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Special Protection Area Program Annual Report 2004

PREPARED BY THE MONTGOMERY COUNTY DEPARTMENT OF ENVIRONMENTAL PROTECTION IN COOPERATION WITH THE DEPARTMENT OF PERMITTING SERVICES

SPA Annual Report for the 2004 Monitoring Period

I. Purpose of the Report:

The Special Protection Area (SPA) Program was established in 1994 by Montgomery County Code Chapter 19, Article V (Water Quality Review-Special Protection Areas, Section 19-67) and the program implemented through Executive Regulation 29-95, "Water Quality Review for Development in Designated Special Protection Areas". The law and regulations require an Annual Report be prepared that summarizes available monitoring results of stream and best management practices (BMP) collected within SPA's. This report is submitted annually to the County Executive and County Council with a copy to the Planning Board.

The County Council has designated four areas within Montgomery County as Special Protection Areas (Figure 1). The designated areas are: the Clarksburg Master Plan SPA,

Figure 1. Montgomery County Special Protection Areas.

the Upper Paint Branch Watershed SPA, the Piney Branch Watershed SPA and the Upper Rock Creek SPA. Upper Rock Creek was designated as an SPA on February 24, 2004 with the adoption of the Upper Rock Creek Master Plan. These SPA's have existing water resources or other environmental features directly relating to those water resources that are of high quality or unusually sensitive; and where proposed land uses would threaten the quality of preservation of those resources or features in the absence of special water quality protection measures which are closely coordinated with appropriate land use controls. Appropriate land use controls are those that help ensure that the impacts from master planned development activities are mitigated to greatest extent practicable. Examples of these controls include reducing imperviousness, minimizing grading, and saving natural features such as forested stream buffers. Special water quality protection measures include sediment control and stormwater management structures that go beyond current minimum standards.

II. Summary of Principal Findings:

Presented below are highlights of principal findings from the 2004 SPA data and from ten years of prior experience with the SPA program.

Monitoring of Best Management Practices (BMPs) in SPA's

- Sediment and erosion (S&E) control efficiencies: Monitoring results show S&E control devices are generally effective, with sediment removal rates ranging from 56% - 94% and with a median value of 78%, when properly installed and regularly maintained. However, S&E Controls can become a significant contributing source of sediments when not regularly maintained and/or in very large storm events (larger than the design storm), causing substantial releases of previously captured sediments with detrimental downstream impacts. Inadequate maintenance of sediment control structures also limits their effectiveness as interim measures to slow the erosive force of captured and discharged stormwater runoff.

  Stormwater Management Structures (SWM): Twelve SPA developments have started submitting post-construction monitoring data. These developments provided data on the temperature, nitrogen, metals, or sediment impacts completed projects have had on the receiving stream and on changes to groundwater levels. As the postconstruction monitoring continues, the data will provide needed information on the effectiveness of the SPA program in minimizing impacts to the stream resources. Results of S&E Control or SWM BMP monitoring received thus far are for the following development projects: Briarcliff Manor West, Fairland Community Center, and Parrs Ridge (Paint Branch SPA), Clarksburg Detention Center, Gateway 270, and Running Brook Acres (Clarksburg Masterplan SPA), and Shady Grove Road, Bruck Property, Cavanaugh Property, Boverman Property, Snider Property and Peters Property (Piney Branch SPA). Temperature and embeddedness (sedimentation of riffle stream areas) data showed no impacts detected at any of the projects submitting information. Five projects had groundwater monitoring. Data submitted for three of the five projects showed no impacts to groundwater levels. Data submitted for the other two projects were inconclusive. The one project submitting nitrogen and metals data showed levels returning to pre-construction levels.

  Thermal impacts: have not been observed to be permanent. Sediment control traps are designed to retain a permanent pool of water. Between storm events the permanent pool warms up. During larger rain events the warm pool of water is flushed out through the riser structure and to the receiving stream. The result is a brief sharp increase of water temperature in the stream.

Stream Monitoring Results

- Piney Branch SPA: Monitoring shows that there has been a decline in the aquatic insect and fish community condition, particularly evident during the construction phase, but that there has been some recent partial recovery of these biological communities since the stabilization and completion of most development projects with final stormwater management (SWM) controls in place.
- Paint Branch SPA: The tributaries have exhibited some decline in the fish community, particularly brown trout, most likely caused by a combination of gradual changes over time in watershed development, increases in impervious area, and two years drought conditions (1999, 2002) that impacted stream flows and temperatures. The headwater areas of these tributaries have consistently supported fewer fish because of limited habitat availability. However, 2004 and preliminary 2005 fish monitoring data is showing a small, gradual recovery to brown trout populations and a good overall fish community. Recent development in the upper Right Fork tributary has caused some decline in benthic community. Capital stream restoration projects installed by DEP in the Upper Paint Branch appear to be working well. Several new and retrofitted stormwater controls installed in the Good Hope tributary have dramatically improved control of storm runoff by reducing peak runoff flow discharges by about 2/3rds. A bypass of storm flows from a wet stormwater pond has reduced thermal impacts in the Gum Springs tributary by about 5 degrees F during storm flows and 2.5 degrees F during base flows.
- Clarksburg Master Plan SPA: There has been a decline in the aquatic insect community of headwater streams draining areas of development in and around the Town Center and Village areas that indicates an increasing degree of impairment in these streams. Impacts observed after 2002 reflect the scope and intensity of mass grading, development activity, accompanying increases in impervious area, a water main break impacting the Town Center Tributary in April 2003, and some inadequately maintained sediment and erosion controls or controls installed out-of-sequence to sufficiently manage sediment loadings from areas under construction. Some recovery to the stream system is anticipated once development projects are stabilized with permanent stormwater control in place. However, there is insufficient data to determine whether large increases in watershed imperviousness area and related sedimentation, stream erosion, thermal, groundwater and pollutant impacts on stream biology will be transient or permanent in nature.
- Upper Rock Creek SPA: SPA Monitoring in this newly designated SPA commenced in 2004. There is presently insufficient data available to define initial baseline SPA conditions in the vicinity of the large parcels that make up most of the undeveloped lands within this SPA. These large parcels drain to small headwater tributaries that did not have baseline monitoring stations on them before this area received SPA designation.

Interpreting Findings on the Effectiveness of Sediment and Erosion Controls

The findings highlighted above are preliminary in nature. Most development projects being monitored are still in a construction phase. Data has not been collected over a long enough period to assess final impacts once all project construction and sediment control phases have been completed, the development site fully stabilized with final stormwater controls in place, and 3-5 years of follow up monitoring data collected to evaluate impacts under a range of typically varying weather conditions.

It should also be noted, particularly for the Clarksburg SPA, that the intensity and scale of development planned for the surrounding landscape has made water quality protection particularly challenging. The rolling nature of affected topography has required extensive mass grading to balance cut and fill quantities needed to achieve approved development densities while also meeting currently required maximum road grade specifications. This reshaping of the landscape is dramatically altering natural drainage pathways and exposing, at one time, hundreds of acres of soils. These piedmont soils are of a fine texture, characterized by small particle sizes that easily float and resuspend. This fine soil types have always proven to be the most difficult to remove by typical sediment controls which are primarily reliant upon gravity settling for sediment capture.

DPS has received local delegation authority for sediment and erosion control and has an approved NPDES stormwater management program from the Maryland Department of the Environment (MDE). DPS indicates that all operative MDE, federal, and local permitting requirements are generally being met or exceeded. DPS has more inspectors and plan reviewers than any other agency which has received MDE's approval for local program delegation and is meeting MDE's established maintenance frequencies and enforcement targets for sediment control. In carrying out sediment control permit compliance, DPS regularly reviews the on-site sediment control logs, which MDE requires developers to maintain on their development sites. DPS holds pre-construction meetings with the developers of every project to review on-site sediment control requirements and expectations. DPS also meets frequently with the site managers of development projects to address day-to-day sediment control facility construction and maintenance issues. Recognizing these program commitments, many of the sediment impacts currently being observed may be largely unavoidable, short-term results of project construction phases. Given the scale of present development activity in Clarksburg, DPS believes observed impacts primarily reflect the 20% of disturbed sediments which, most research indicates, discharge from even the most efficient sediment control practices.

Impervious area changes and BMP effectiveness in mitigating stream impacts
Recent research (Center for Watershed Protection, 2003) has shown that most stream quality indicators will decline when watershed impervious areas exceeds ten percent, with severe impairment occurring when imperviousness exceeds 25 percent. A preliminary regression model developed from Montgomery County stream data predicted similar results, suggesting that the biological integrity of aquatic insect communities would decline to a "fair" condition when watershed impervious area exceeded eight percent, and to a "poor" condition when it exceeded 21 percent (CSPS update 2003). Some limited prior monitoring research (Maxted 1999, ERM, ERM 2000, CWP 2003) has suggested that modern SWM controls can help reduce, but not eliminate, the impacts of land development on streams. However, due to the relative scarcity of data which

directly links impervious areas and BMP effectiveness to stream quality, most researchers have derived their conclusions by lumping together runoff monitoring information from all impervious areas, whether or not they were accompanied by modern stormwater controls. Now that more SPA development projects are finally completing their construction phase, stream and BMP monitoring data being collected under the SPA program will produce sufficient data to enable assessment of impervious area impacts accompanied by modern, linked stormwater controls. Over time, results from SPA monitoring will provide additional insights on what the most effective BMP's are and how successful they can be, in combination with improved site planning, and other pollution source controls, in mitigating impervious area impacts.

Improvements needed in SPA Plan Review Process

Project developers within SPA's are required to participate in a pre-application meeting to identify critical natural resource parameters that need to be maintained in order to protect existing high quality stream conditions. Protection of these natural resource parameters is guided by performance goals developed for each development project as part of a Water Quality Plan. Successful incorporation of the performance goals into the Water Quality Plan and the site design process requires continuing innovation and close coordination between the project's design team and environmental, regulatory and planning agencies.

Ideally, the goals and objectives agreed upon through participation in these early pre-application meetings are incorporated into the development site design plans. This review process has been somewhat successful in encouraging interagency collaboration to identify and protect to the greatest extent possible critical and sensitive natural resource parameters. However, when protection of identified critical natural resources is not considered in the early stages of preparing a development plan, opportunities for protection are not fully achieved and resources may not be fully protected. DPS and DEP have encountered problems with site planning decisions that have greatly complicated arriving at cost-effective and practical siting decisions for sediment and erosion control structures and stormwater management facilities. In some cases, for example, these decisions have required locating sediment structures and stormwater facilities in areas with high water tables or without proper maintenance access.

There are also continuing conflicts between SPA goals for environmentally sensitive developments and road code and other requirements that, sometimes, unnecessarily foster increased impervious areas, excessive use of cut and fill to minimize road grade changes, and use of curb and gutter drainage systems which speeds the delivery of increased and erosive runoff flows to streams. All of these changes from watershed development complicate the protection of natural stream systems.

Proposed SPA Program Changes

- BMP monitoring: DEP is proposing to take over the responsibility for monitoring BMP's from SPA project developers. It is proposed that these costs be funded through a BMP monitoring fee assessed to project developers. DEP is also focusing future BMP monitoring in the Clarksburg SPA, where the level of development activity is greatest, the suite of representative BMP's to monitor is the most diverse, and available interagency monitoring resources enable the most intensive and effective monitoring. Results of this data will be used to evaluate the relative effectiveness of various types of sediment and erosion control and stormwater management and target the most effective BMP's to new development activities in the other SPA's and throughout the County.

- Resolving Constraints on Siting Which Impact Practicality, Costs, and Effectiveness of Sediment Control and Stormwater Facilities: Closer coordination is needed between the environmental, permitting, and planning agencies and SPA project design teams to assure that planning and subdivision decisions on lot siting decisions, lot coverage, and road code requirements do not preempt locations for practical, cost-effective sediment control and stormwater management facilities. Decisions on lot siting, location and on roads need to be made with a fuller appreciation of implications these decisions have on natural drainage patterns, stream systems, sediment control and stormwater facility options. These decisions must also better understand and accommodate maintenance access requirements, costs and maintainability of stormwater management facilities.

III. SPA Development Review Process:

The SPA program requires the Montgomery County Department of Permitting Services (DPS), the Department of Environmental Protection (DEP) and the Maryland-National Capital Park and Planning Commission (M-NCPPC) to work closely with project developers from the outset of the regulatory review process to minimize impacts to SPA stream conditions. SPA permitting requirements guide the development of concept plans for site imperviousness, site layout, environmental buffers, forest conservation, sediment control and stormwater management. Applicant requirements to carry out monitoring of sediment/SWM best management practices (BMPs) are also defined through this process. A pre-application meeting presents the project developer with the critical natural resource parameters that need to be maintained in order to protect existing high quality stream conditions. Protection of these natural resource parameters is guided by performance goals developed for each development project. Achievement of the performance goals through the site plan design process and accompanying permitting requirements for sediment, erosion and stormwater management controls requires close coordination between the project's design team and environmental, regulatory and planning agencies.

IV. SPA Stream and BMP Monitoring Requirements:

DEP conducts stream monitoring within and downstream of development projects to assess baseline stream conditions before development projects are started, conditions during project construction, and conditions after projects have been completed and stabilized with permanent stormwater management controls. Monitoring the biological community provides information on the degree of cumulative impacts occurring in the streams and allows a comparison to minimally impaired streams elsewhere in the county. This activity is supported through fees collected by DPS from developers of SPA projects. Developers are also required to monitor selected sediment and erosion controls and stormwater BMP's installed within SPA projects and to provide data from this activity for analysis. This information is used to evaluate the efficacy of various types of BMP's so that DPS can continuously assess and optimize the effectiveness of permitted facility design and maintenance requirements. This monitoring requirement may also include groundwater sampling, to track potential changes in water table levels, replenishment of stream flows during low flow conditions and groundwater quality in response to watershed development. The period of required BMP monitoring typically includes pre, during and post-construction.

V. Review of SPA Program Results:

This is the ninth report on the SPA program. It covers stream and BMP monitoring results from 2004. In 1995, DEP initiated SPA stream monitoring work. Project developers began SPA BMP monitoring for a few projects in 1998 before most development had begun within the three originally designated SPA areas. This report summarizes monitoring results to date, what aspects of the SPA program seem to be working well and what do not, and indicates program improvements are being pursued to address identified program deficiencies.

Stream monitoring results continue to produce a broad range of trend data that will help assess how effective water quality plan development and review process, performance goal setting, improved site planning and intensive BMP's are in mitigating development impacts in SPA's to receiving streams. Key stream indicators used in these evaluations are measures of biological resource diversity and quality, physical stream channel and habitat conditions, and water chemistry. As new development projects within SPA's and new SPA's have been added, the program has added new monitoring stations to provide a measure of baseline stream conditions. Stream monitoring methods used are comparable with those of the Maryland Biological Stream Survey, enabling use of the state's data to help supplement the coverage provided through county monitoring.

Thus far, stream monitoring in SPA's has produced 10 years of consistent and comparable trend data that has been used to define pre-construction conditions and evaluate construction impacts as new development projects have come on line over time. Until the past few years, the level of development activity which proceeded through the SPA review process and into project construction has been relatively small, as has the size of each project. (Note: This does not include the subdivisions developed in the upper reaches of the Piney Branch SPA, where actual plan review and related BMP permitting requirements actually preceded the SPA requirements). This has now changed. The scope and intensity of development activity has increased dramatically in recent years in the Clarksburg SPA. While this activity is providing a wealth of new information on construction phase impacts, only a few large development projects within SPA's have been fully completed and stabilized with sediment controls removed and replaced by permanent stormwater control structures. However, more development projects are now being completed. For these projects, collected monitoring data will be able to begin assessing post development conditions and the long-term recovery of biological communities from construction phase impacts.

Data is needed on more permanent storm water controls to evaluate how well the SPA program will be able to limit final development impacts on the receiving streams, however sufficient data has been collected to describe observed effectiveness of S&E controls and downstream impacts being observed during project construction. Thus far, data from the Piney Branch and Clarksburg SPA monitoring sites have shown some temperature and sedimentation impacts accompanying new development. Especially when construction and land disturbance on large amounts of land is occurring at the same time. While the sediment pulses during construction may be transitory and short term, the temperature impacts related to runoff from heated road surfaces, rooftops, and other impervious surfaces may not.

BMP Monitoring

The goals of the BMP monitoring program are to assess the effectiveness of selected, representative SPA sediment and erosion control devices during a development's construction phase and the effectiveness of different types of permanently installed SWM BMP's in mitigating long-term development impacts on streams after projects have been completed. Consultants are contracted by individual project developers who are responsible to monitor BMP's as may be required in the water quality plan. Each consultant is to follow county methods and procedures in monitoring various selected, representative BMP practices. Recognizing practical siting, feasibility and cost considerations, BMP monitoring is not required for all SPA development projects.

DEP has now received enough initial limited BMP monitoring data from developer consultants to begin evaluating effectiveness of sediment and erosion control devices. The Regulation for Water Quality Review – Special Protection Areas, (29-95, Section 12, B. 6. (i)), requires the county to dewater all sediment and erosion control structures to draw down the water before it warms up and further that dewatering devices must be designed to remove fine particulate matter such as clay from runoff. DEP's monitoring of these devices sought to understand how effective they were in removing fine total suspended sediments and to record what kind of thermal impacts they had on the receiving stream. Relatively few SPA development projects have been built out to the stage where sediment and erosion control devices have been converted over to SWM BMP's to enable completion of SWM BMP monitoring evaluations.

Data Analysis of Sediment and Erosion Control Effectiveness

Sediment control structures had a median value of 78% efficiency in removing fine suspended material from runoff. About twenty per cent of these fines can leave the site, in addition sediment is tracked onto road surfaces as truck traffic leaves a development site, is transported as wind blown dust, and is deposited into streams as a result of precipitation events that exceed what the control structures were designed to contain. Solely depending on engineered solutions to prevent impacts to a receiving stream is not often the best solution. Rolling topography and existing road minimum grade requirements can require extensive amounts of cut and fill to occur. Without a grading ordinance in place, extensive mass grading can occur on a development site. Adoption of a grading ordinance with requirements for phased development and stabilization may be a way of achieving more control over mass grading impacts. Frequently, the densities and complexities of the approved site plans, utility installation and road construction make sediment control sequencing extremely difficult to properly install and maintain. In short, some damage to a receiving stream is expected, the SPA program is designed to minimize that damage but some impacts will inevitably occur.

The 2003 SPA Report (November, 2004) was one of the first where sufficient monitoring data had become available to enable some very preliminary assessments on the effectiveness of SPA BMP's. This report provides additional information on Sediment and Erosion control device effectiveness that builds upon that prior report. Monitoring results, to date, have been reported as inflow and discharge concentration data due to the costs and difficulty associated with monitoring storm flows. Other nationally prominent investigators have also evaluated sediment and erosion control device effectiveness using similar concentration data for the same reasons. Grab samples are collected during, and/or within a 24 hour period immediately after, a storm. The data seems to be reliable and consistent. However, without flow data, grab samples cannot represent the total load of sediment moving through a structure. In the coming year DEP expects to begin receiving data collected by automated samplers throughout entire storms that can be used to more confidently evaluate the effectiveness of BMPs. This data, because it is collected through an entire event, will certainly be representative of the entire storm and not a brief point in time. It will be possible to evaluate structure efficiency in retaining sediment loads using that data.

Monitored sediment and erosion control multi-cell structures generally performed well in removing fine sediments when they functioned as designed (Figure 3). DEP analyzed the results from 34 grab samples for Total Suspended Solids (TSS) taken at different sediment structures. Taken together, the median efficiency in TSS concentration reductions between the inlet to the sediment forebays and the outlet of the measured structures was 78%. However, 6 of the sample results were far outside the range of the other samples, these are called outliers or extremes depending on their distance from the rest of the data (Figure 2). They were used to calculate the median.

DEP staff examined the 6 outliers or extremes shown on the table to further assess whether the sampled sediment control structures were operating as designed when the samples were taken. For the six outliers or extremes observations (Table 1), TSS values increased 160% on average between the forebays and outfalls of the structures. Three possible reasons were hypothesized for this: 1) Lack of maintenance of the structure over time; 2) The amount of the rainfall was greater then the structure was designed to treat; or, 3) The runoff entering the structure was already so low in TSS, that even a modest TSS concentration at the outlet results in a large percentage increase value.

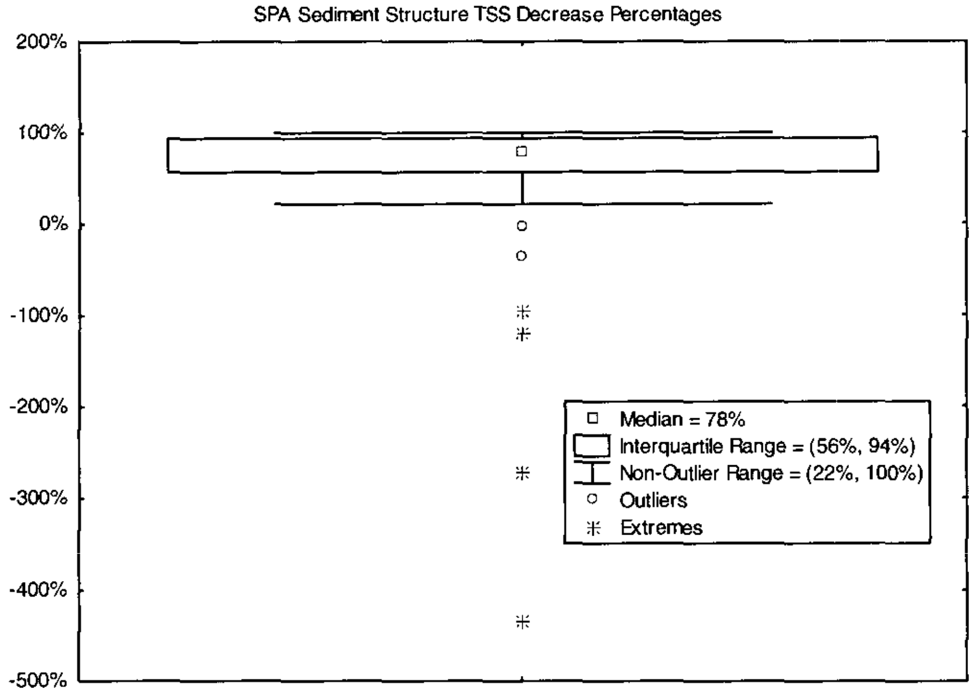

Figure 2. Sediment Structure and Structure TSS Removal Efficiencies (N = 34).

Table 1. Information on the 6 Sampling Events Identified as Outliers or Extremes.

Project	Sample day	Inflow TSS Concentration (mg/l)	*Outfall* TSS Discharge (mg/l)	Structure Age in Months	Rain-fall (in.)	Overall % TSS Increase	Hypothesized Cause
Martens Structures 1&3	12/10/04	15.00	80.00	18.00	0.98	+433.3%	Low TSS in Forebay
Running Brook	10/11/02	100.00	104.00	8.13	1.6	+4.0%	May Have Needed Maintenance
Fairland Farms	04/13/04	60.00	82.00	9.26	1.37	+6.7%	
Martens Structures 1&3	09/29/04	80.00	156.00	15.68	2.05	+95.0%	Large Storm
Clarksburg Village - Structure 'A'	09/18/04	96.67	213.33	6.48	1.82	+120.7%	Cited by DPS 18 days later for Poor Maintenance
Running Brook	05/16/03	110.00	410.00	15.13	0.85	+272.7%	May Have Needed Maintenance
Mean		89.33	193.07	10.94	1.54	+105.8%	

Results from the Running Brook outfall indicated TSS levels steadily increased over time. This suggests that an inadequate frequency of maintenance to clean out the structure probably was a contributing factor inhibiting adequate structure performance. In addition, the 9/04 sample from the Clarksburg Village Structure A showed higher TSS at the outfall than the inlet and a relatively high outfall TSS concentration. DPS issued a notice of violation directing the developer to clean out the forebay and to replace filter fabric and stone on the forebay and main cell dewatering devices. Maintenance was a factor leading to poor structure performance in this event as well. Samples from other sites showed low outfall TSS values and good percent decreases in TSS even for large storms. Storm size acts together with maintenance practices to affect structure performance.

SPA sediment control structures vary but are generally sized to control storms up to about 1.25 inches in size if maintained. Larger storms may be able to overwhelm structures and wash accumulated sediment out.

Another reason that TSS may increase in older structures may be that cleaner water is entering structures as sites become more stabilized. Water entering the structure may approach the maximum attainable level of TSS removal. In these instances, even though the data do not indicate that the structure decreased TSS, the absolute TSS concentration leaving the structure may still be relatively low. Data collected at the Martens project on 12/10/04 is an example of this. The forebay TSS level was only 15 mg/L which is a value that sediment control BMPs generally cannot improve on.

Based upon the data now available, the increased size of SPA sediment control structures now being required appears to result in significant sediment capture rates for most storms (median is 78%, Figure 2). This median value also compares very well with published data for sediment control structures. In a 1990 study Schueler and Lugbill found an average removal of 65% of TSS at Maryland construction sites (Schueler and Holland 2000). However, sediment control efforts are less effective during larger, more intense, storms which can overwhelm sediment structures and greatly reduce their effectiveness. BMP monitoring has also found the ability of structures to control sediment during larger storms can substantially diminish with the age of the structure if it is not regularly and sufficiently maintained. Use of larger structures and more stringent maintenance standards could improve effectiveness. Future monitoring will provide more information on long term effects and post-construction impacts.

Stormwater Management BMP Monitoring

Twelve SPA developments have started submitting post-construction monitoring data. These developments provided data on the temperature, nitrogen, metals, or sediment impacts the completed project have had on the receiving stream or monitored changes to groundwater levels. As the postconstruction monitoring continues, the data will provide needed information on the effectiveness of the SPA program in minimizing impacts to the stream resources. Results of sediment and erosion control or SWM BMP monitoring received thus far are for the following development projects: Briarcliff Manor West, Fairland Community Center, and Parrs Ridge (Paint Branch SPA), Clarksburg Detention Center, Gateway 270, and Running Brook Acres (Clarksburg Masterplan SPA), and

Shady Grove Road, Bruck Property, Cavanaugh Property, Boverman Property, Snider Property and Peters Property (Piney Branch SPA).

Seven of the twelve projects that are currently in the post-construction monitoring phase provided temperature data from receiving streams. Temperature impacts have not been detected at any of the seven projects.

Six projects provided post-construction monitoring data on the degree of receiving stream channels embeddedness – a measure of the extent that sediment has covered stream bottom riffle cobble and rock habitat. No impact was observed from five of the six projects. One project (Shady Grove Road) had embeddedness impacts during construction, but post-construction monitoring data indicated embeddedness has been reduced to pre-construction levels.

Five projects had submitted groundwater monitoring data. Three of the five projects had no impacts to groundwater levels. Data from the other two projects were inconclusive.

Monitoring of some quality control SWM structures have yielded some preliminary results indicating they work to minimize the release of pollutants to receiving streams. The monitored pollutants include nitrogen, cadmium, lead, copper and zinc. For example, DEP has received some preliminary data on a StormCeptor water quality BMP that indicates slight reductions in pollutant concentrations. The water entering the structure has not generally contained high concentrations of pollutants and it can be difficult to measure the removal of pollutants that are only present at very low concentrations. Monitoring during the next three years will provide more conclusive information on the performance of the Stormceptor structure.

Two years of post-construction data (2003, 2003) from the Gateway 270 West project in the Clarksburg SPA indicates that levels of nitrogen and metals have returned to pre-construction levels (Figure 3). The 24.5 acre I-3 site is a light industrial complex with closed section roads and parking areas. Stormwater management is provided by vegetated swales and two sand filters draining 4.5 acres (84% imperviousness area) and 5.3 acres (90% imperviousness area) respectively. The two sand filters drain independently to a wet pond that provides quantity control and additional quality treatment for the stormwater runoff. The outfall from the wet pond has been sampled for nutrients and metals. This approach does not provide information on pollutant removal or the function of any individual BMP but instead focuses on the site's impact on nearby streams.

BMP Effects in Mitigating Runoff Temperature Impacts

Stream water temperature is one of the most important factors in maintaining the biological health of streams. Minimizing thermal impacts to streams is therefore frequently selected as one of several performance goals for new development projects in SPA's. SPA BMP design features that help minimize temperature impacts include: 1) use of dry ponds for runoff quantity control that minimize standing pools that soak up excessive heat; 2) routing storm water through

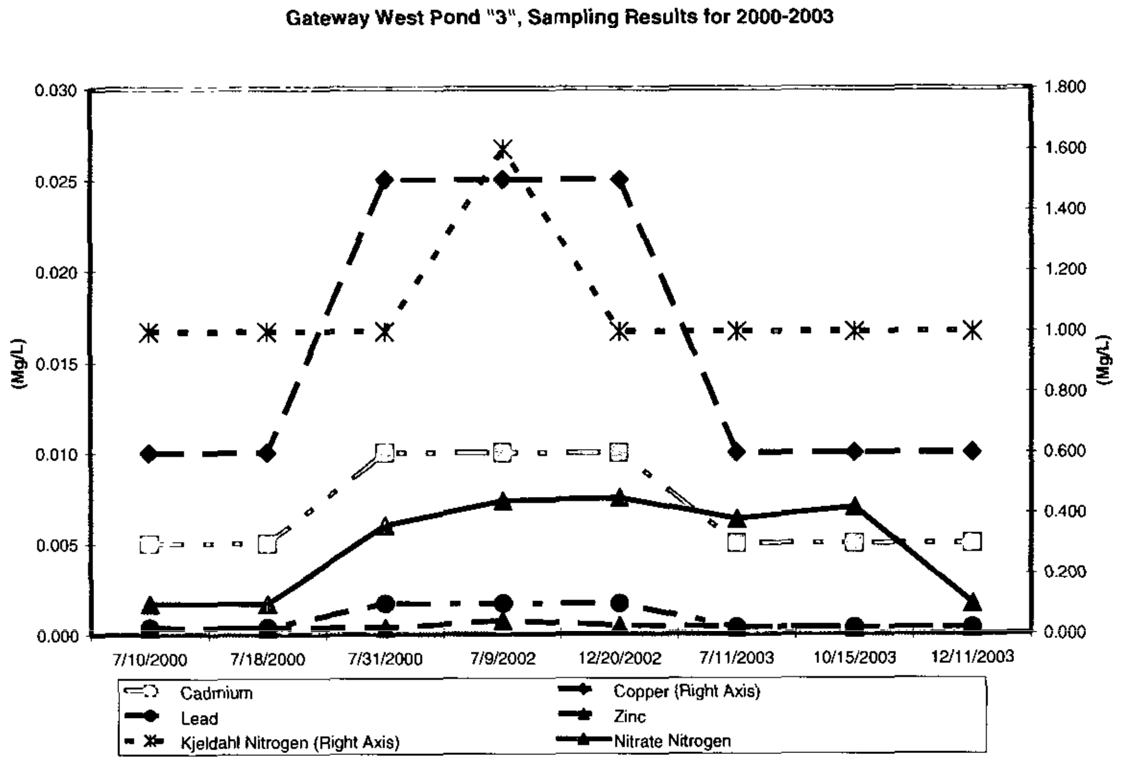

Figure 3. Pre and Post-construction data (2003, 2003) from the Gateway 270 West Project.

roadside swales slows conveyance and provides an opportunity for the warmest runoff (first flush) to infiltrate into the soil; 3) sand filters and bio-filtration cells provide a cooling effect as warm storm water passes through cooler underground soil and sand matrices.

Data available for this report continues to support findings on thermal impacts originally cited in the November 2004 SPA report. Seventeen projects in the SPA's are monitoring water temperature in nearby or downstream streams to determine if thermal impacts occur as a result of the development. Eleven of the development projects are still under construction and six have been completed. Monitoring data from thirteen projects show no thermal impact on receiving streams. Post-construction data from the six completed projects all show no thermal impacts to receiving streams. Data from four projects, still under construction, do show thermal impacts. In all four cases thermal impact is caused by the release of warm water from sediment control structures. Sediment control structures are designed to retain a permanent pool of water. Between storm events the permanent pool warms up. During larger rain events the warm pool of water is flushed out through the riser structure and to the receiving stream. The result is a brief sharp increase of water temperature in the stream. Temporary elevated thermal discharges could occur when S&E controls have become clogged due to inadequate maintenance or have topped over from heavy periods of precipitation.

Although brief, these temperature spikes can raise the water temperature as much as ten degrees (F). Biological monitoring results from Wildcat Branch, one of the locations where temperature spikes have occurred, indicate no impairment to the benthic macroinvertebrate community.

Post-construction temperature monitoring has been completed at six projects. Results show no thermal impact, indicating that the goal of minimizing temperature impact has been achieved on these six projects. Four of the six projects release stormwater to second order streams where dilution effects from stream flows likely hampered the detection of thermal impacts. As more projects are completed in headwater areas of streams data will become available on temperature impacts in these more sensitive streams.

Groundwater Monitoring Results

DEP requires some project developers to install and monitor wells on project sites to evaluate changes in groundwater levels as development occurs. As discussed in last year's SPA report (November, 2004), collected groundwater level data has, thus far, covered only pre-construction and during-construction conditions phases of development. Several years of groundwater monitoring will be required after development projects have been completed before evaluation to assess permanent impacts on groundwater levels or groundwater quality can be made. When sufficient well data becomes available, DEP hopes to be able to assess how well stormwater infiltration devices are working to help support groundwater replenishment and stream base flows from the impacts of increased watershed impervious area. The hydrological monitoring ongoing in the Clarksburg SPA will allow assessment of changes in groundwater quality and quantity related to changes in stream flows as the SPA builds out. DEP and its interagency monitoring partners (USGS, EPA, UMD) are only able to do this type of monitoring in the Clarksburg area because of costs and staffing required to adequately maintain the groundwater and surface water gaging stations.

Problems Encountered With Reliance on BMP Monitoring by Project Developers

The SPA BMP monitoring requirements for developers that are now in place were originally designed to replicate the self-monitoring approach imposed by state regulatory agencies on operators of wastewater discharge facilities. When SPA monitoring program requirements were originally conceived, DEP had presumed a similar approach would be successful in monitoring BMP's. However, maintaining the quality and consistency of the BMP monitoring data has proven to be much more challenging than DEP originally anticipated. Monitoring of inflows and discharges from BMP's covering multiple sites during unpredictable storm events has proven to be much more difficult than monitoring relatively constant wastewater discharges under controlled site conditions. At least seven different consultant firms are currently involved in monitoring BMP's at 28 different SPA sites. Developers from the building industry, who are usually not familiar with the technical requirements for this type of monitoring, oversee and manage the monitoring contracts. The multiple parties involved has led to a host of problems in maintaining adequacy of monitoring equipment installations and calibration, in observing proper field and lab methods and quality assurance/quality control procedures, and in the development of timely, informative data reporting on results.

DEP's two monitoring staff funded under the SPA program have tried to maintain a level of quality assurance/quality control (QA/QC) on the different BMP field monitoring projects, but have been overwhelmed by their other SPA responsibilities to perform the stream monitoring and participate in the review of SPA water quality plans. Consequently, staff often cannot be present when monitoring equipment is being installed or monitoring performed to assure that these functions are carried out correctly. DEP thus often receives QA/QC information from project developers after the fact and encounters unavoidable losses in storm data when the standard QA/QC information indicates field or analytical problems. It has also been difficult to maintain consistency in having many consultants follow standardized field methods. Results have been difficult to interpret and apply due to different analytical methods used by the consultants to summarize the data. Required annual BMP monitoring reports are often submitted months late by project developers and report quality differs greatly.

Practically, there is little DEP can do to ensure more timely submissions of BMP monitoring reports. The report requirements are specified as conditions within the DPS sediment control permit. Project developers seek DPS signoff on the sediment control plan and release for bonding requirements immediately after all permanent stormwater facilities have been installed, but long before the required post-development monitoring is completed. The DPS sediment control inspectors lack the technical familiarity with storm event and/or groundwater monitoring requirements to evaluate whether project developers are following acceptable QA/QC procedures or analytical and data reporting protocols. Consequently much SPA staff time is spent tracking late report submissions and in reviewing these reports.

Operating within the limit of the existing law and regulation, DEP has tried several approaches to resolve these problems. DEP established a BMP monitoring work group to define through technical consensus and seek consultant adherence to standardized methods. Through this work group, DEP has produced standardized field methods and procedures for the different monitoring tasks. DEP also developed and provided a standardized reporting outline and checklist for consultants to follow in preparing the annual BMP monitoring reports. A database is being established to allow the BMP monitoring data to be easily retrieved for use in assessing the effectiveness of the SPA BMP's.

Changes Proposed for BMP Monitoring

Unfortunately the above changes have not been fully successful in achieving the desired result of receiving consistent, timely, and easily retrievable and interpretable BMP monitoring information. Consequently, DEP is proposing an SPA program change to have developers pay a fee to support further BMP monitoring rather than continuing to conduct this monitoring themselves. DEP would use collected fees to manage a monitoring contract to conduct all BMP monitoring required on SPA projects. This would give DEP direct control over the QA/QC requirements and data submission requirements that have proven to be a problem. DEP's other annual stream monitoring activities within SPA's would not change. All other SPA water quality plan review and reporting aspects of the SPA program would also remain the same.

DEP is also focusing future BMP monitoring on the Clarksburg SPA where the level of development activity is greatest, the suite of representative BMP's to monitor is the most diverse, and available interagency monitoring resources enable the most intensive and effective monitoring to evaluate streamflow and groundwater impacts. Results of this data will be used to by DPS to evaluate which BMP types are the most and least effective and then to target the most effective BMP's to new development activities in the other SPA's and elsewhere throughout the County. DEP will continue to annually monitor and report upon trends in stream conditions in all SPA's.

DEP and DPS are working with the County attorney to draft changes to Chapter 19 and accompanying regulations to accommodate these desired changes. Changes to the existing SPA regulations would follow Method 2. Changes to the existing SPA fees would follow Method 3. Fee changes would involve changes to the fee for stream monitoring, and add a fee for new BMP monitoring. This new fee would include adjustments for existing permittees who want to discontinue their present BMP monitoring and participate in the new BMP monitoring approach

Status of Stream Monitoring Program
DEP began stream monitoring within the three original Special Protection Areas (Clarksburg, Piney Branch and Paint Branch) in 1995 and within the newly designated Upper Rock Creek SPA in 2004. Stream monitoring consists of biological sampling of benthic macroinvertebrate and fish communities, habitat assessment, stream channel measurements, and water quality readings (dissolved oxygen, temperature, pH, and conductivity). Presently, there are fifty seven (57) fixed monitoring stations throughout the four SPA's, twenty seven (27) in Clarksburg, fourteen (14) in Upper Paint Branch, ten (10) in Piney Branch and six (6) in the Upper Rock Creek SPA. Because of staff constraints not all fifty seven stations can be monitored each year. In 2004, forty nine stations were monitored.

General Comparison of Observed Stream Impacts Among SPA's
DEP has compared changes in SPA stream conditions relative to the intensity of changes in land uses that occurred. As anticipated, water quality conditions have generally decreased as the level of watershed development increased. For example, benthic macroinvertebrate monitoring results show Piney Branch, the most developed SPA tributary, has the lowest rated stream condition, while Ten Mile Creek, the least developed SPA tributary within the Clarksburg SPA , has the highest rated stream condition (Figure 4).

Watersheds where little or no development has occurred thus far have the highest quality stream conditions. Changes observed in these watersheds are due to natural variability or from existing land uses. Ten Mile Creek and Cabin Branch have consistently had higher quality stream conditions. These are also watersheds that have had very little development.

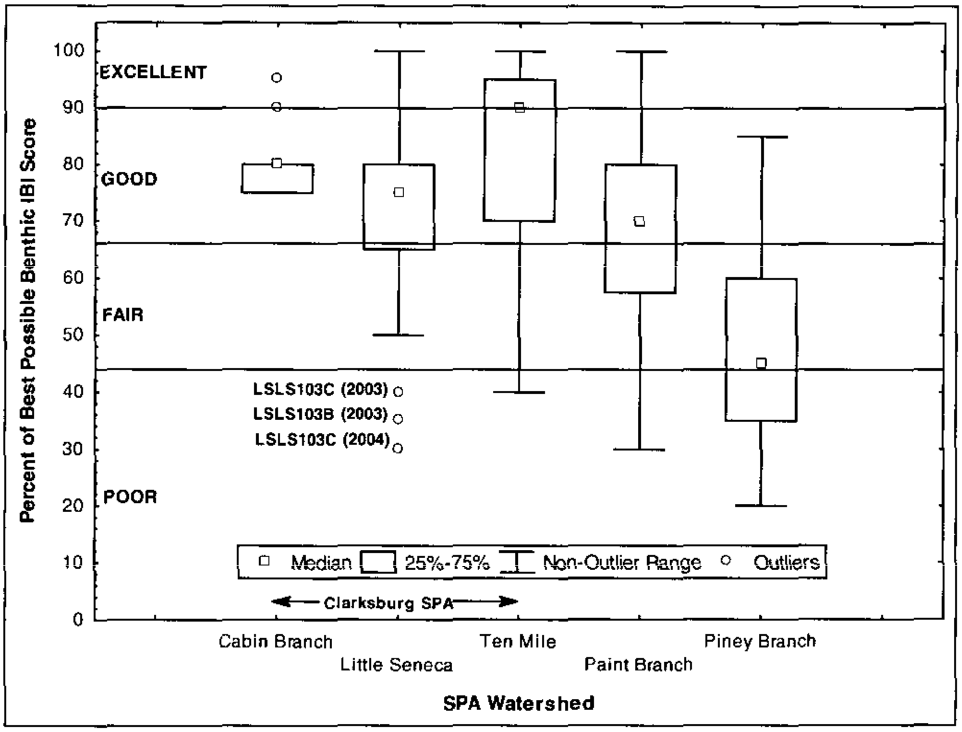

Figure 4. Results of all benthic macroinvertebrate monitoring in SPA watersheds (1995 - 2004)

Streams in sub-watersheds where massive grading and filling is occurring as part of the development process are showing greater decline in biological health. In the Clarksburg SPA, for example, the Town Center tributary receives runoff from moderate to high intensity development within the new Clarksburg Town Center. Stream conditions declined sharply in this tributary from levels indicative of 'good' condition (sustained during a six year period, 1997 – 2002) to 'poor' condition in 2003 and 2004. Several observed stream impacts were initially responsible for decline in this area, including: severe drought, high rates of algae growth, a water main break and associated sedimentation. Stream flows in the region were near or above average during 2003 and 2004 providing favorable conditions for biological communities to recover from severely stressful drought conditions that existed during 2002. However, the continued presence of fine sediment coating the stream bottom, primarily the result of discharge from construction sites, appears to be hindering the recovery of biological health. Even with sediment control structures and structures functioning at high levels (80% removal of suspended sediment, on average) some of the uncaptured fine sediment discharges still reach and impact stream channel habitat and resident aquatic life (Figure 5).

Observed Stream Impacts - Piney Branch SPA

The Piney Branch SPA is close to maximum build-out allowed under the master plan. Much of the development in the upper portions of Piney Branch (Willows of Potomac and Piney Glen Village) predates SPA law and therefore was not subject to SPA level

Figure 5. Fine Sediments in Town Center Tributary

plan review. However, these development projects did include "the best available" stormwater management practices at the time. These practices provide quality and quantity treatment of runoff from all impervious surfaces.

All development on the Traville property has gone through the SPA process. Most of this development has been completed and sediment control is now being converted to stormwater management facilities.

Stream monitoring results show biological health has deteriorated since 1996 along the mainstem of Piney Branch. Results from a monitoring station in the Western Tributary, a relatively undeveloped control station for the Piney Branch mainstem, show biological health continually rated in the good range through the period 1996 - 2004. This suggests that additional impacts other than drought are causing the deterioration of biological health in the mainstem of Piney Branch. DEP has identified several factors thought to be contributing to poor biological conditions in Piney Branch. These include: a) high rates of algae growth in the stream causing stressful water quality conditions; b) continued presence of fine sediments in the stream bed; and possibly c) the use of mosquito larvicide's on the Willows of Potomac development and in some cases directly in the stream.

Monitoring results from 2004 (Figure 6) show benthic macroinvertebrate community health remains poor along the Piney Branch mainstem. However, there are some signs of a partial recovery in both the fish and benthic macroinvertebrate communities.

For example, using an indirect indicator of density, the average abundance of benthic macroinvertebrates found in representative samples of the Piney Branch macroinvertebrate community has increased by 93% from 2003 when the overall numbers of individuals found in samples reached an all-

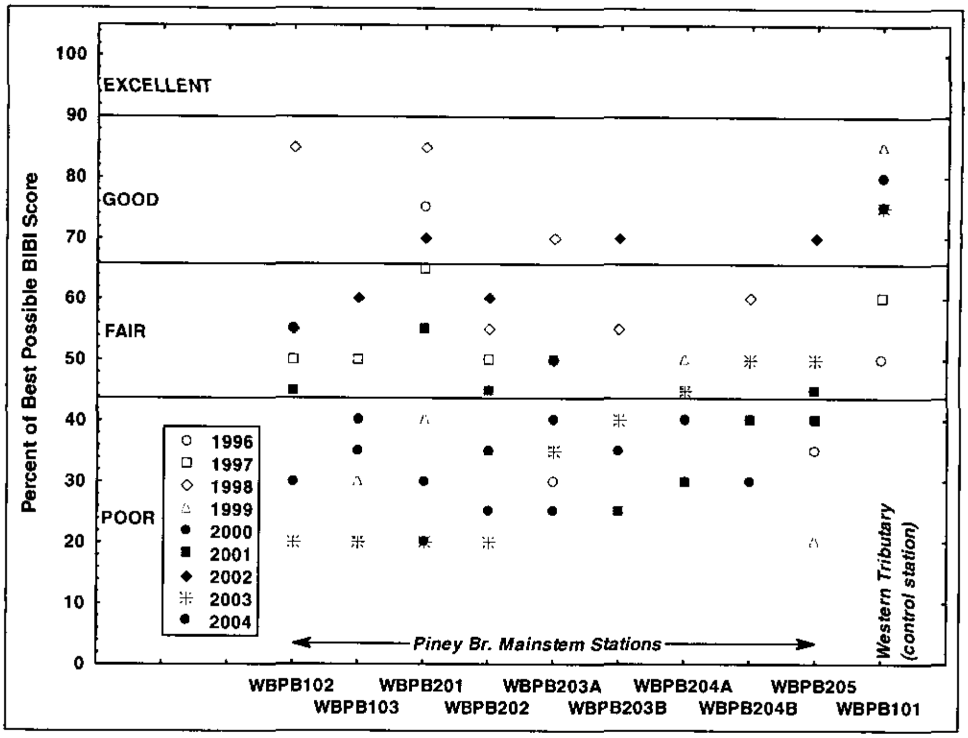

Figure 6. Benthic Macroinvertebrate Results From Piney Branch

time low (Figure 7). The drought of 2002 along with impacts listed above resulted in the low numbers observed in 2003.

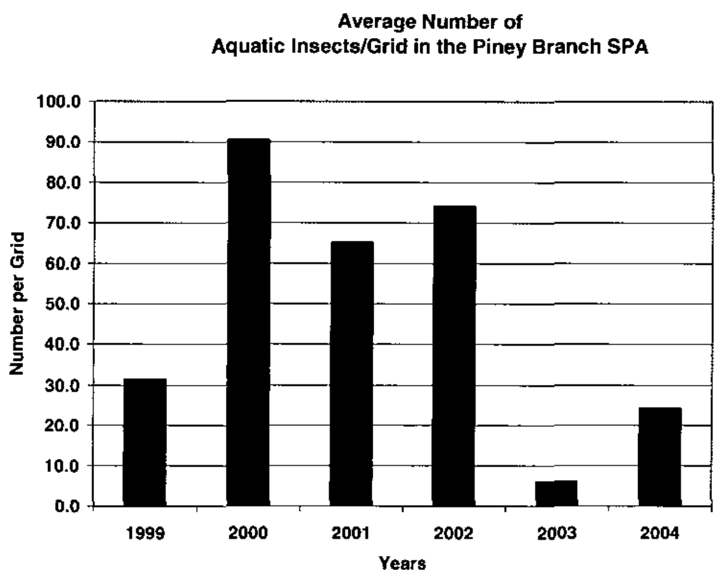

Figure 7. Estimated number of individuals per sample collected from the mainstem of Piney Branch

Additionally, the abundance of Sculpins, a sensitive fish species, has increased throughout Piney Branch. Stream flow during 2003 and 2004 was favorable to biological communities and is likely the primary reason for these improvements. With construction now complete on the Traville Property, the ground stabilized and permanent stormwater controls in place, it is hoped that continued monitoring will show further improvement in biological condition in Piney Branch over the next several years

Observed Stream Impacts – Upper Paint Branch SPA

New development projects in the Paint Branch SPA have mostly been in the Right Fork sub-watershed (Figure 8). Five projects, on a total of 336 acres (approximately one third of the total drainage area in the Right Fork), are currently either under construction, planned for, or have been built. One project, Peach/Orchard Allnut, was halted and the land purchased by the Maryland State Highway Administration as needed for an alternative route for the ICC. This property (141 acres) is located within the headwaters of the Right Fork. Now that the SHA has selected a different ICC alignment, the MNCPPC is seeking a donation of this land as part of a parkland mitigation package for parkland losses elsewhere due the planned ICC construction.

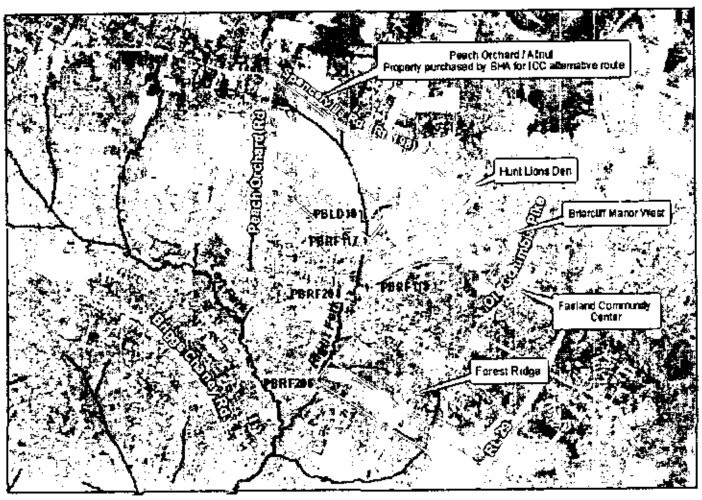

Figure 8. Aerial photo (2004) of Upper Paint Branch Watershed

Results of stream monitoring in the Paint Branch SPA show the fish community has remained rated in the excellent / good range throughout most of the SPA (Figure 9). Those monitoring stations rating in the fair range are located in the headwater portions of tributaries where small stream size and habitat limitations are the cause of lower IBI scores for fish.

The brown trout population was impacted to a greater degree than the rest of the fish community by two droughts occurring over a relatively short time span (1999 and 2002). Numbers of brown trout reached a new low in 2003. Encouragingly, monitoring results from 2004 show higher numbers of young-of-year brown trout which suggests that higher stream flows in 2003 and 2004 have provided favorable conditions for successful spawning. However, the numbers are still very low in comparison with historic DNR averages. Good Hope and Gum Springs Tributaries are strongholds for the trout

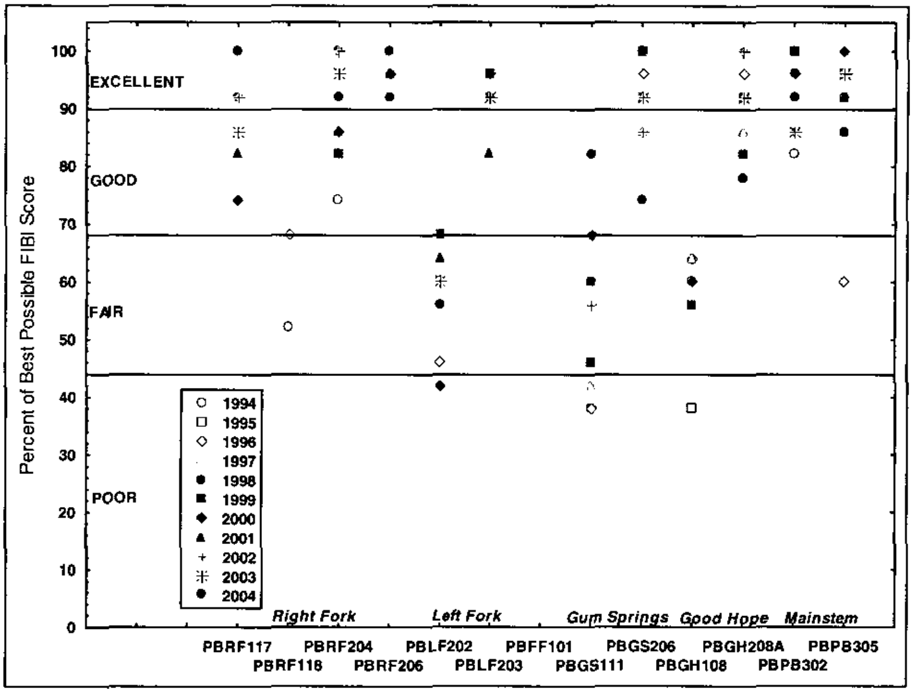

Figure 9. Fish monitoring results from Paint Branch

population because of favorable habitat. Habitat condition in these areas has continued to decline in recent years due to high storm flows causing stream bank erosion and associated sedimentation of the stream bottom. This habitat degradation is the result of uncontrolled stormwater from older development that predates SPA law. DEP has installed several new stormwater management ponds to correct this situation (discussed further below). It is expected that the numbers of brown trout will continue to improve as stream flows have remained favorable into 2005. Preliminary 2005 fish data collected by DEP in the mainstem of Paint Branch at Fairland road shows numbers of brown trout, both young-of-year and adults have increased.

The results of 2004 benthic macroinvertebrate monitoring show continued decline in stream condition in the Right Fork (Figures 10 and 11). Additionally, decline was observed along the Paint Branch Mainstem between Briggs Chaney Road and Fairland Road. There has been some improvement in benthic macroinvertebrate community health within the Good Hope Tributary since 2003.

Fine sediment washed off construction projects within the Right Fork subwatershed may be the cause of degraded biological health in the Right Fork and mainstem portions of Paint Branch. The stream is often very turbid after rain events and a light coating of fine sediment is present on the stream substrate. It is hoped that after construction projects are complete the land stabilized and permanent stormwater controls are in place, impacts to the Right Fork will diminish and the biological health of the stream will recover to pre-construction levels

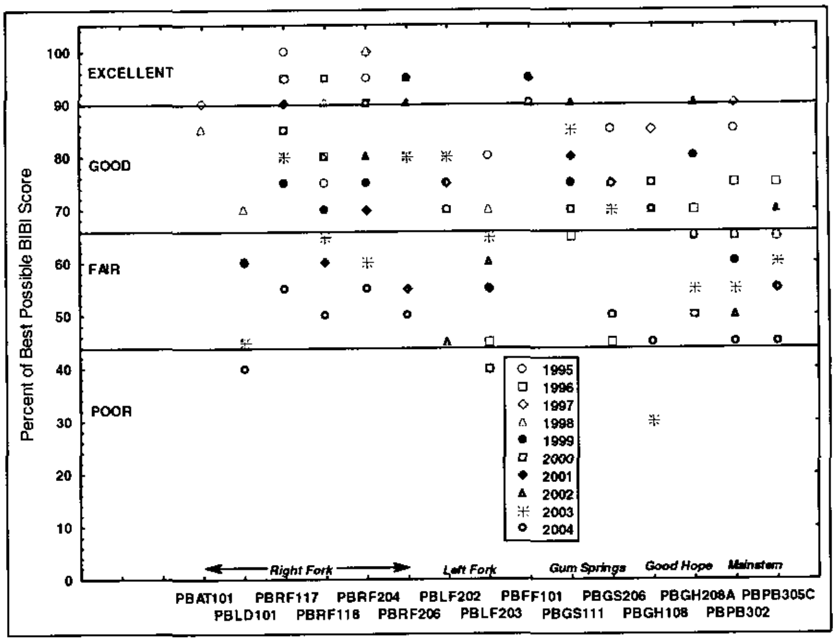

Figure 10. Aquatic Insect monitoring results from Paint Branch

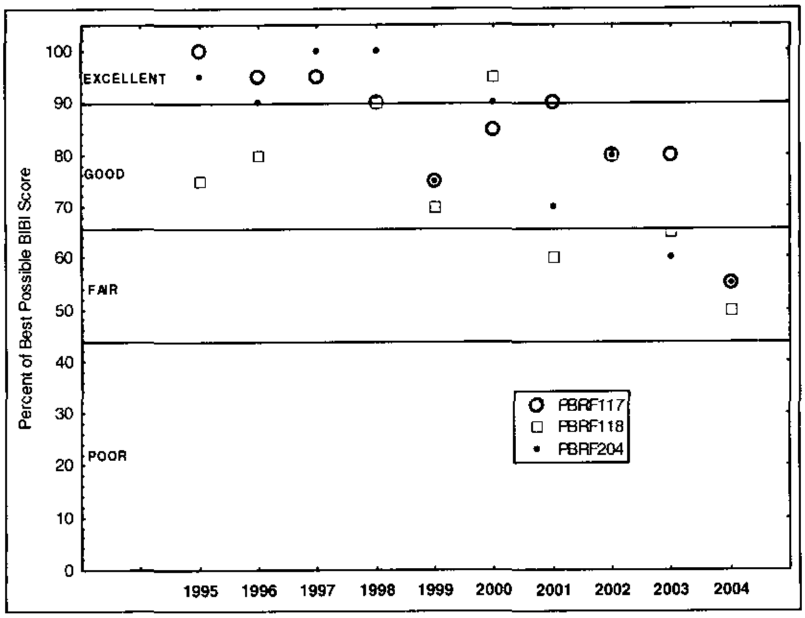

Figure 11. Results of Benthic Macroinvertebrate Monitoring From the Right Fork of Paint Branch

Habitat Restoration and Stormwater Retrofit Measures in Paint Branch

DEP is also pursuing separate stream restoration and SWM retrofit initiatives in the Upper Paint Branch SPA. These projects are being pursued to improve the management of runoff from previously developed areas and mitigate areas of habitat damage caused by development impacts that occurred before the SPA program was established. DEP, in cooperation with DPS, the M-NCPPC and other agencies, have worked closely to inventory 75 potential stream habitat restoration, wetlands creation, and stormwater retrofit project opportunities. Some of these are capital projects. Others involve small habitat restoration, wetlands creation and tree planting that can be partially implemented by volunteers.

As of March 2005, DEP had completed installation of nine watershed restoration projects in the Upper Paint Branch SPA. Eight projects are in the Good Hope subwatershed and one is in the Gum Springs subwatershed. Another six projects are under design, one in the Good Hope subwatershed, three in the Gum Springs subwatershed, one in the Right Fork subwatershed and one in the Left Fork subwatershed. Another project in the Right Fork, previously under design, has been placed on hold due to property acquisition issues.

Immediately downstream of the Special Protection Area an additional 2.25 miles of stream restoration has been completed on the Paint Branch mainstem between Fairland Road and Route 29. Stream restoration along this stretch of Paint Branch includes: bank stabilization, tree planting, lunkers and woody debris placement (for fish habitat), grade control, and channel relocation to protect a historical site. This restoration is expected to significantly improve the quality, variety, and availability of habitat for brown trout and other species. This project was installed by the U.S. Army Corps of Engineers in fulfillment of a cooperative cost share agreement with the county.

DEP is also completing a new watershed study, primarily for the Lower Paint Branch, which will also include some further evaluation on additional project opportunities for reducing stormwater impacts within the Upper Paint Branch SPA.

The following sections describe measurable benefits that these projects have provided to the Upper Paint Branch watershed thus far.

Stormwater Retrofits in the Good Hope Tributary

The Good Hope tributary now provides most of the spawning habitat for the brown trout population in Paint Branch. Good Hope tributary has many water quality and habitat attributes that make it suitable for trout spawning. These include: cool water temperature during stressful summer months, clean gravel and cobble substrate on the stream bottom, forested stream buffer, and good base flow during dry periods. Stability of the stream bottom is important to successful trout spawning as nests, called redds, are built in the riffle portions of the stream. Eggs are deposited and fertilized there during the fall season. Active stream channel erosion is evident throughout the length of Good Hope and has had an impact on trout spawning habitat. Much of the development within the watershed was completed prior to modern SWM regulations.

DEP constructed three projects to add stormwater management controls within the upper Good Hope sub-watershed to help reduce the erosive storm flows from previously developed areas. Combined, these three projects add stormwater management for 209 acres of older development (approximately one-third of the upper Good Hope sub-watershed) where none had previously existed. The last of these three projects was completed in February 2002. The projects were designed to reduce peak storm flows in Good Hope by retaining runoff from impervious surfaces (roads, rooftops, etc.) in new and retrofitted stormwater management ponds and releasing it at a slower rate.

Data from a stream flow gage in Good Hope and rainfall data from a nearby rain gage (approximately 2 miles away) (Table 2) was used to analyze stream flows before the new

Table 2. Summary Data From Eight Storms

Storm Date	Pre- or Post - SWM Pond Installation	Duration of Storm (hours)	Rainfall (inches)	Peak Flow (CFS)
4/9/98	Pre	10.5	1.02	31.39
6/23/98	Pre	3.25	1.15	41.36
3/15/99	Pre	3.75	0.76	20.60
6/18/00	pre	2.25	0.72	12.02
Average Peak Flow From Four Pre-Pond Storms				**26.34**
7/14/02	Post	8.00	1.33	6.16
7/22/04	Post	2.25	1.43	6.35
8/17/03	Post	3.75	0.71	6.75
7/23/02	Post	2.25	0.90	4.13
Average Peak Flow From Four Post-Pond Storms				**5.85**

Flow Data is From Good Hope Tributary Approximately 0.5 Miles Downstream of Good Hope Road, Rainfall Data For Pre-Pond Period 1999 - 2000 is From Colesville Maintenance Depot, Post-Pond Period 2002 - 2004 is From WSSC Lab on Tech Road (~2 miles away).

SWM ponds were built and after. Four storms were found in the pre-pond data set that matched up closely with four storms in the post-pond data set. Comparisons in Table 2 show that new stormwater management has reduced peak stormwater runoff flow by 77.8% on average during comparable storm events.

The shape of storm hydrographs has also changed as a result of new stormwater management in upper Good Hope. For example, the hydrograph for a storm that occurred on 3/15/1999 (Figure 12) shows the stream flow rising to peak flow and returning to baseflow in a relatively short period of time. Conversely, the hydrograph from a storm of similar intensity and duration that occurred on 8/17/03 (Figure 13), after the new SWM ponds were built, shows the stream flow rising to a much lower peak flow and receding at a slower rate back to baseflow.

The reductions in peak storm flow will help slow the rate of stream bank erosion and reduce sediment deposition on the stream bottom. The result will be stream habitat that is more favorable for successful trout spawning. Lower peak flows will decrease the likelihood of trout redds being washed away by erosive high stream flows.

Forester Farm Pond Removal

The Forester Pond is an old farm pond located on a small tributary to Good Hope. The tributary originates near the Colesville Maintenance Depot. A temperature study conducted by DEP in the Colesville Depot Tributary during 1995 identified the Forester Pond, rather than the Colesville Depot as a significant source of thermal impact to the stream. Follow-up monitoring in 1999 and 2000 showed that the discharge from the pond increased average stream temperature by 6.0^0 F (1999 mean) and 3.1^0 F (2000 mean) respectively. In 2000 DEP implemented a restoration project designed to reduce or eliminate this thermal impact. The project lowered the surface elevation of the pond by partially breaching the dam. Because the pond is spring fed water is continuously flowing through. By lowering the ponds water surface, the time water is retained and warmed by ambient air temperature and solar radiation is reduced. The reduced pond elevation is sufficient for maintaining amphibian and fish habitat. The area around the pond was planted with various wetland trees, shrubs and grasses to increase shade cover.

During the summer of 2004 temperature loggers were again deployed upstream and downstream of the Forester Pond. Results show mean stream temperature was 0.9^0 F warmer, on average, downstream. This was the smallest difference between upstream and downstream ever observed and suggests that thermal impacts have been reduced. Ambient air temperature during the summer of 2004 was 72.2^0 F which is near the historic average of 72.1^0 F (for period of June 1 – Sept. 30 at Dulles National Airport).

Gum Springs By-Pass Pipe

A temperature study of the Gum Springs tributary was conducted during the summer of 1999. Results show that water temperature in the Oak Springs tributary was 5 ^{0}(F) warmer, on average, than the Gum Springs tributary (1999 SPA annual report, pg 46). Continuous discharge of warm water from Oak Springs pond was identified as the cause of elevated stream temperature in Oak Springs tributary.

Warmer water from Oak Springs tributary caused water temperature in lower Gum Springs to increase by 1.5 ^{0}(F) on average. Gum Springs tributary has, historically, been an important brown trout spawning area. Elevated water temperature in lower Gum Springs has had a negative effect on trout spawning.

The Gum Springs by-pass pipe, a joint project between the U.S. Army Corps of Engineers, DEP and M-NCPPC, was completed in July of 2000. The by-pass pipe was designed to divert warm discharge from Oak Springs pond 1,900 feet to the Paint Branch Mainstem. Benefits of the by-pass pipe which have a direct influence on stream condition in Gum Springs include: 1) elimination of thermal barrier which may have hindered the migration of brown trout up the Gum Springs tributary. 2) reduction in peak storm flows in lower Gum Springs as some stormwater is now diverted through the by-pass pipe to the Paint Branch mainstem.

After completion of the Gum Springs by-pass pipe temperature loggers were placed in Gum Springs, upstream and downstream of the confluence with Oak Springs tributary.

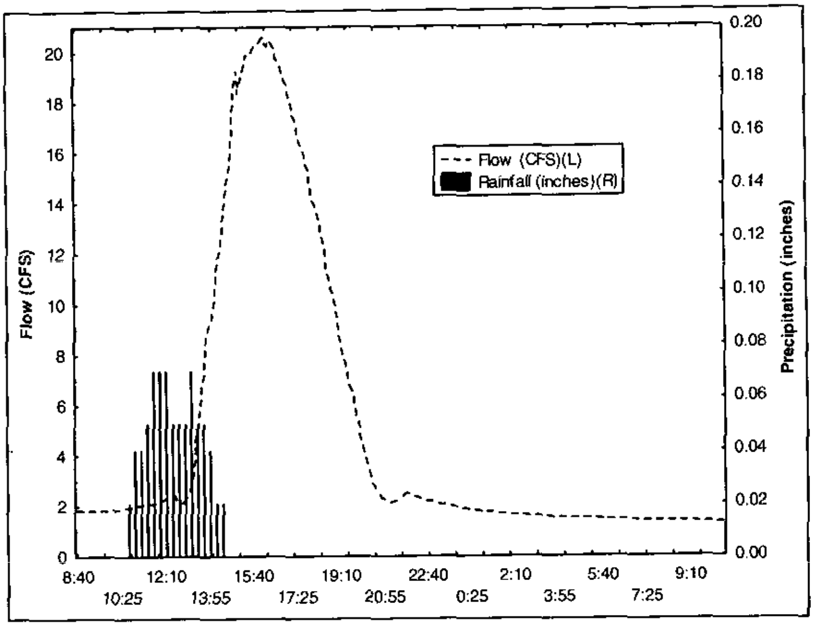

Figure 12. Storm hydrograph from Good Hope Tributary on 3/15/99, before new SWM ponds were built

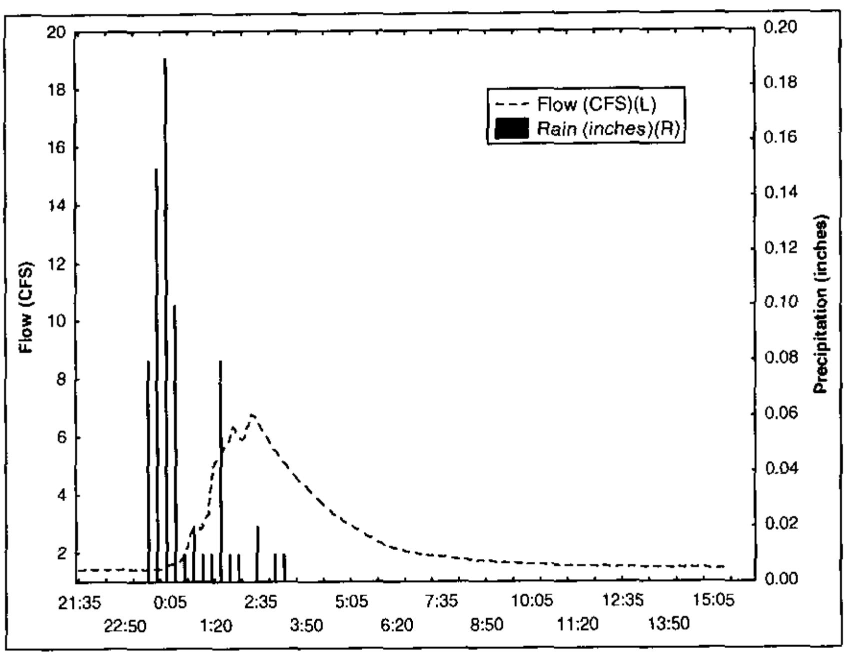

Figure 13. Storm hydrograph from Good Hope Tributary on 8/17/03, after new SWM ponds were built

Results indicated that average water temperature was equal at the two locations. Thermal impacts that had existed prior to installation of the by-pass pipe are no longer present in lower Gum Springs. Additionally, warm water entering the by-pass pipe is cooled by 2.5^0 F on average and by 5^0 F to 6^0 F during storm events as warm pond water, flushed out, flows 1,900 feet in an under ground pipe (Figure 14).

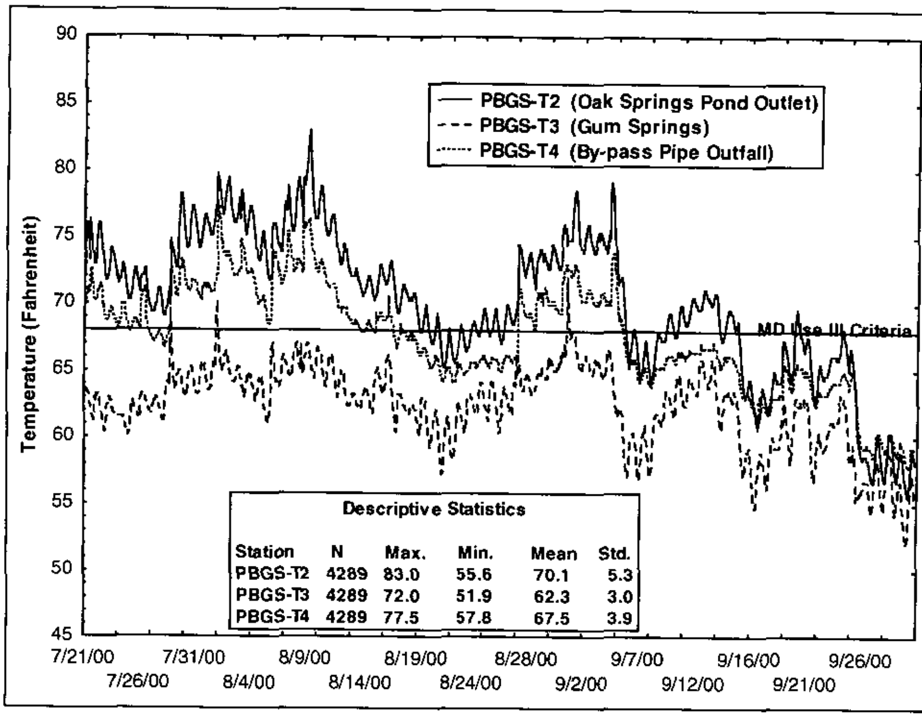

Figure 14. Water Temperature Data From Gum Springs Parallel Pipe System

Fish monitoring during the summer of 2001 revealed a relatively high number of brown trout young-of-year in lower Gum Springs indicating that spawning had occurred in this area. Presumably the elimination of warm water discharge from Oak Springs Pond has had a positive effect on trout spawning in lower Gum Springs tributary.

Temperature loggers were also placed in the mainstem of Paint Branch at locations immediately upstream and downstream of the by-pass pipe outfall to determine if the by-pass pipe is causing thermal impact in the mainstem. Results indicated no thermal impact in Paint Branch mainstem.

Observed Stream Impacts - Clarksburg SPA

Ongoing and planned land use changes in the Clarksburg SPA have been far greater in scope and intensity than the other three SPA's. The Clarksburg master plan calls for very dense development which will result in high levels of imperviousness. In addition, many parcels in the Clarksburg Master Plan area were designated as additional TDR receiving areas after the original master plan adoption which contributed to the high levels of imperviousness here. During 2004 most of the construction activity was in the Town Center area (between Stringtown Rd, Clarksburg Rd. and Rt. 355) and Greenway Village (Skylark Rd.) development projects (Figure 15).

Results of stream monitoring show that stream conditions were somewhat stressed throughout all areas of the Clarksburg SPA in response to drought conditions during 1999 and 2002. Monitoring results from 2004 show biological health had begun to recover in most streams due to improved stream flow conditions. However, the tributaries receiving runoff from large construction projects, (i.e. the Town Center tributary, and tributaries draining headwaters of Little Seneca Creek west of Skylark Road) had not recovered and in some cases degraded further.

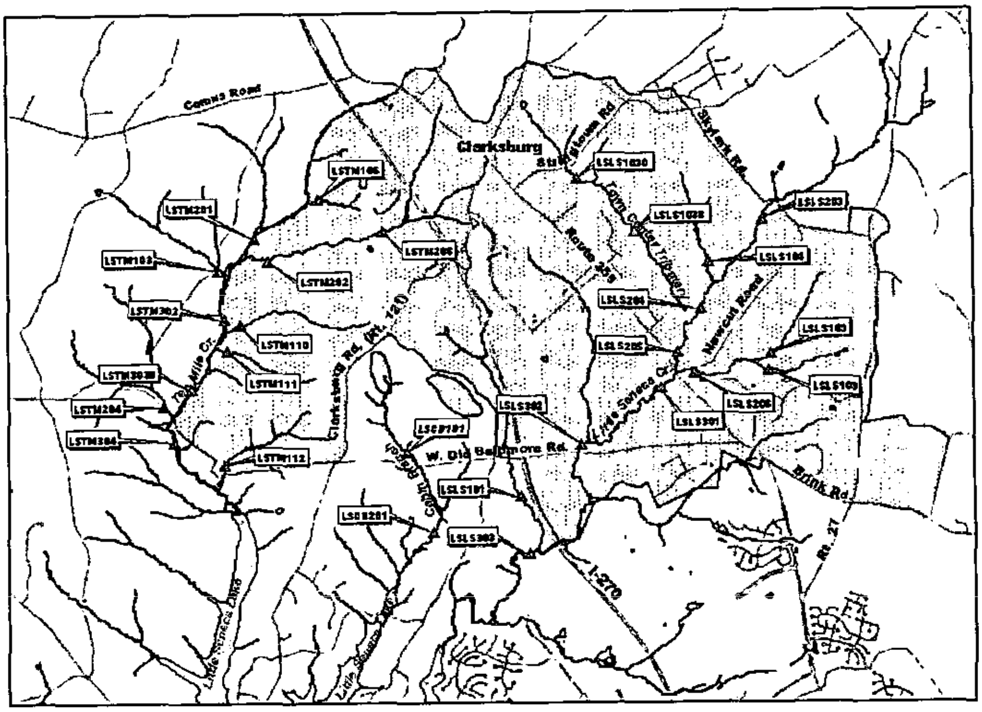

Figure 15. Clarksburg SPA with Monitoring Station Locations

For example, stream conditions in the Town Center tributary degraded sharply in 2003 in response to several possible factors including: a) a water main break in April 2003 and associated sedimentation, b) drought of 1999 and 2002, c) thermal impacts from water released from sediment ponds and d) sediment deposition on the stream bottom, apparently related to ongoing construction activity upstream. Monitoring results from 2004 show biological health has degraded further in the upper portion of Town Center tributary (LSLS103C). Additionally, some biological degradation has occurred in an unnamed tributary (Greenway Tributary in this report) which receives storm runoff from the now developed Greenway Village and the Clarksburg Village development project now under construction (Figure 16). This tributary was not affected by the 2003 water main break. The decline has not been as great (Figure 16).

The lack of any recovery of biological health in the Town Center tributary, and the degradation in Greenway tributary which receives runoff from the Clarksburg Village and Greenway Village development projects, appears primarily due to the presence of fine sediment on the stream bottom.

As more construction begins in the Clarksburg SPA it is likely that some biological degradation will continue to occur, at least over the period until development stages are fully stabilized and permanent stormwater controls become operational. It appears that, even with the most effective sediment controls, some level of sediment discharge from construction activity will reach and impact stream channel habitat at least over the short

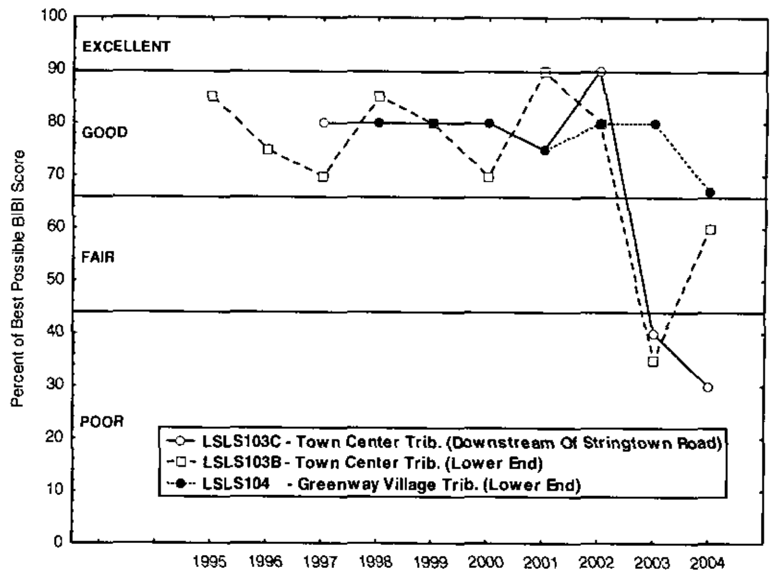

Figure 16. Benthic Macroinvertebrate Monitoring Results from Town Center and Greenway Village Tributary.

term. Monitoring results in the SPA's continue to illustrate the importance to continue efforts to limit these discharges. More care and attention appears needed to assure proper installation and timely scheduled maintenance of sediment control measures, recognizing that even the best sediment control devices are about 80% effective, with 20% of the sediment reaching the stream. Once development has been completed, it now appears that the level of imperviousness planned for Clarksburg will also cause long term impacts to the streams beyond which the SPA SWM controls can mitigate.

Staging of Future Clarksburg Development

The Clarksburg Master Plan established four staging mechanisms to phase in implementation of planned development. These stages were intended to: 1) guide the timing and sequence of development; 2) coordinate completion of public infrastructure; and 3) use stream and BMP monitoring results from areas in stages I – III to help guide decisions on development density in the stage IV area (much of the Clarksburg SPA west of I-270 draining to Ten Mile Creek).

One of the defined triggering mechanisms for the analysis of stage IV occurs when 2,000 building permits have been issued for housing units in the Newcut Road and Town Center sub-areas of Clarksburg. As of August 2005 1,574 building permits have been issued. The master plan calls for a review of all BMP and stream data in the next SPA annual report following the issuance of 2,000 building permits. DEP is anticipating this and plans to include a comprehensive review of all data collected through the SPA program in next year's annual report.

Observed Stream Impacts - Upper Rock Creek SPA

In February of 2004 the County Council designated a portion of the Upper Rock Creek watershed as a new Special Protection Area (SPA). The Upper Rock Creek SPA includes the entire Upper Rock Creek watershed north of Muncaster Mill Road and west of Rock Creek North Branch (Figure 17).

Prior to Upper Rock Creek's designation as an SPA, DEP had established sixteen (16) baseline monitoring stations throughout the Upper Rock Creek watershed to assess stream condition as part of the Countywide Stream Protection Strategy (CSPS). Biological sampling (fish and benthic macroinvertebrates) was first completed at these stations in 1995. Most were sampled again in 2002 for the CSPS update. Results from this sampling indicate that most streams in the SPA portion of the Upper Rock Creek watershed are in good to excellent condition. These sixteen monitoring stations are scheduled to be sampled by DEP once every five years. With the designation of Upper Rock Creek as an SPA, DEP established six new monitoring stations (figure 15) from which biological sampling (benthic macroinvertebrates only), habitat assessment and water quality measurements will be done annually. These six stations are located in small tributaries that drain parcels of land slated for development. Because of the small stream size, fish sampling is not appropriate at any of the six new monitoring stations.

Benthic macroinvertebrate sampling was completed at all six SPA monitoring stations in 2004. Results show that biological health in all of these streams is in the good/excellent range (Figure 18). The biological community is indicative of good habitat and water quality conditions. Slightly lower IBI score at URRC104 is likely due to problems with the stream habitat such as poor stream substrate due to high amounts of sediment in the stream. The sediment is likely from years of agricultural land use within this sub-watershed.

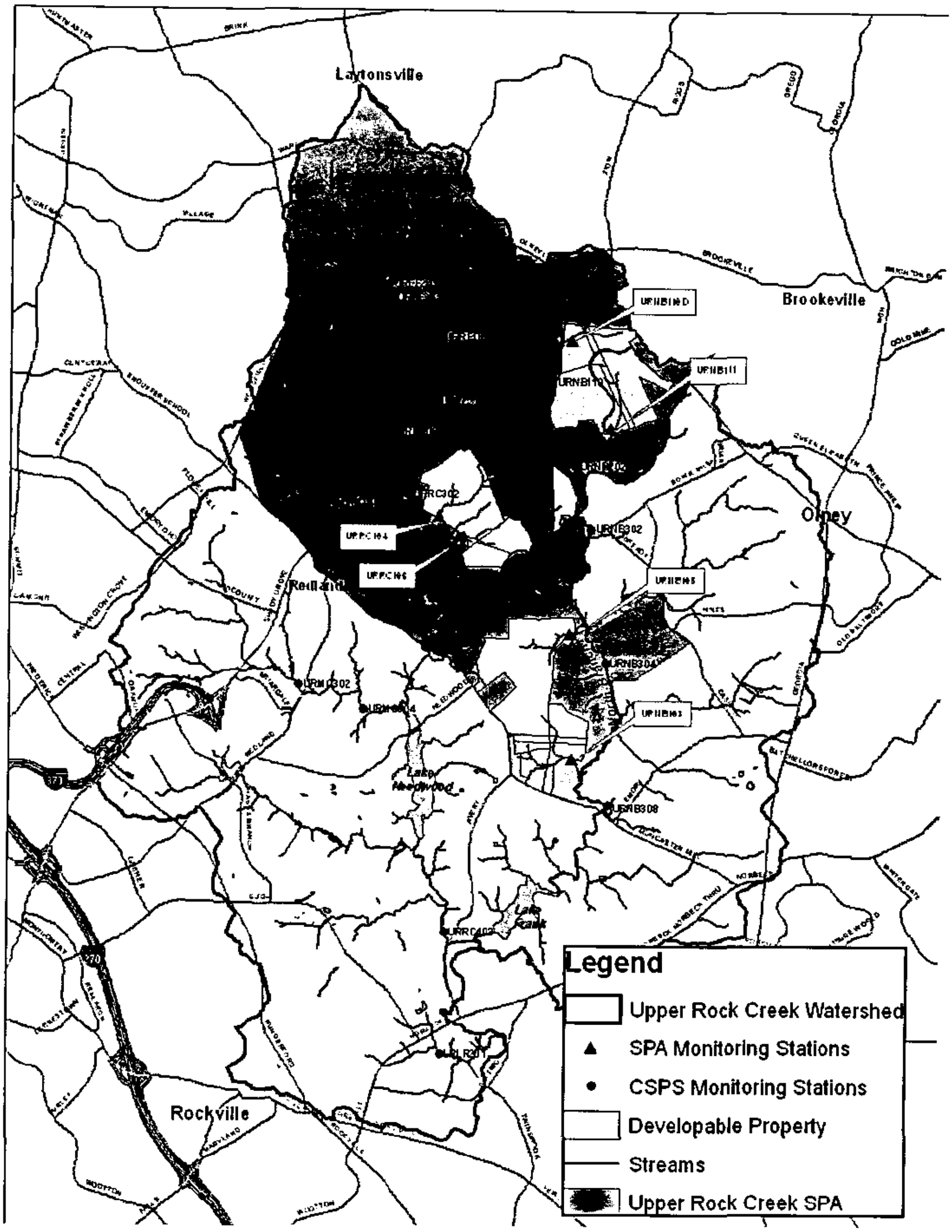

Figure 17. Upper Rock Creek Special Protection Area.

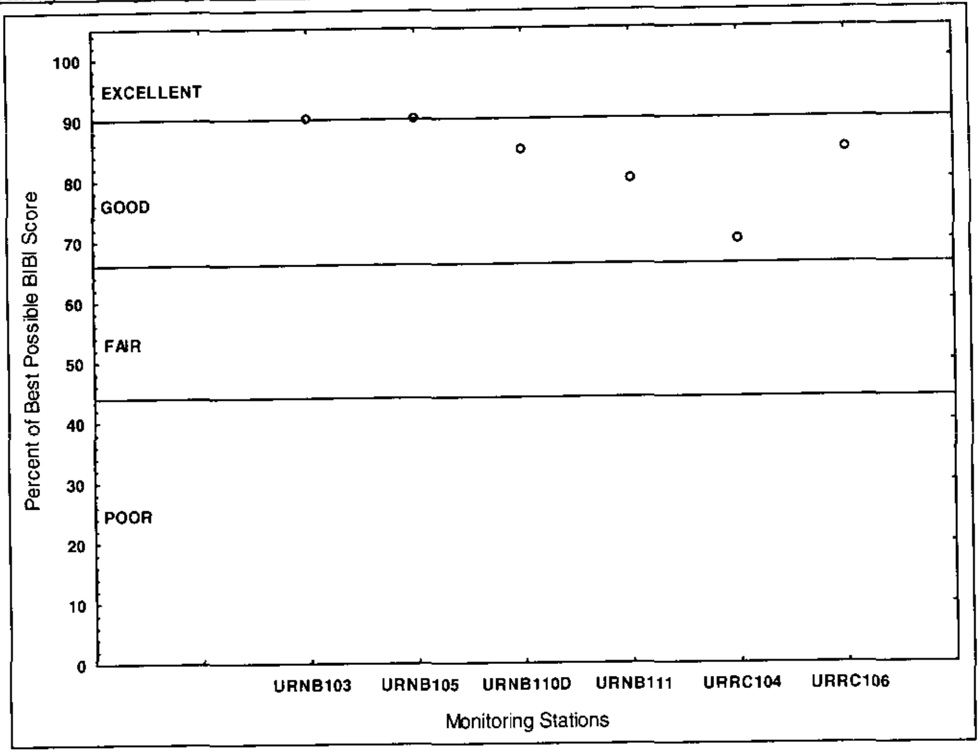

Figure 18. 2004 Benthic Macroinvertebrate Monitoring Results from Upper Rock Creek SPA.

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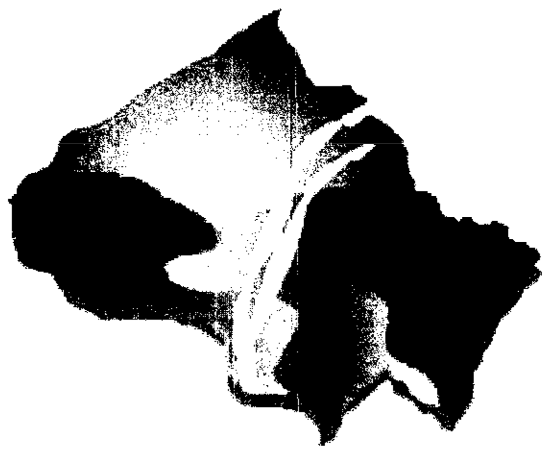
- Clarksburg Conservation Plan
- Piney Branch Conservation Plan
- Upper Paint Branch Conservation Plan



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Department of Environmental Protection / Montgomery County, Maryland
255 Rockville Pike, Suite 120, Rockville, MD 20850
240.777.7770 fax: 240.777.7765
e-mail: help@askDEP.com

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