

Attachment 1: Analysis of Current Conditions and Projected Development in Clarksburg Stage 4

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A. MASTER PLAN RECOMMENDATIONS

The **Ten Mile Creek watershed** includes part of the Town Center District and all of the Ten Mile Creek Area in the 1994 Clarksburg Master Plan.

The plan envisioned the **Town Center District** as a strong central focus for the entire master plan area, while also recognizing that a portion of the district was in the headwaters of Ten Mile Creek. The plan included reduced densities relative to the other parts of the Town Center District for parcels closest to the headwaters of Ten Mile Creek. Even with the density reduction, the MXP and PD-4 zoning can produce relatively high levels of imperviousness and most of the Ten Mile Creek area was placed in the last implementation stage to allow evaluation of protection measures and consideration of additional water quality measures and land use actions.

West of I-270, the master plan provisions for the **Ten Mile Creek Area** recommended a balance of environmental concerns, housing needs and employment uses in the high-technology employment corridor. The provisions included:

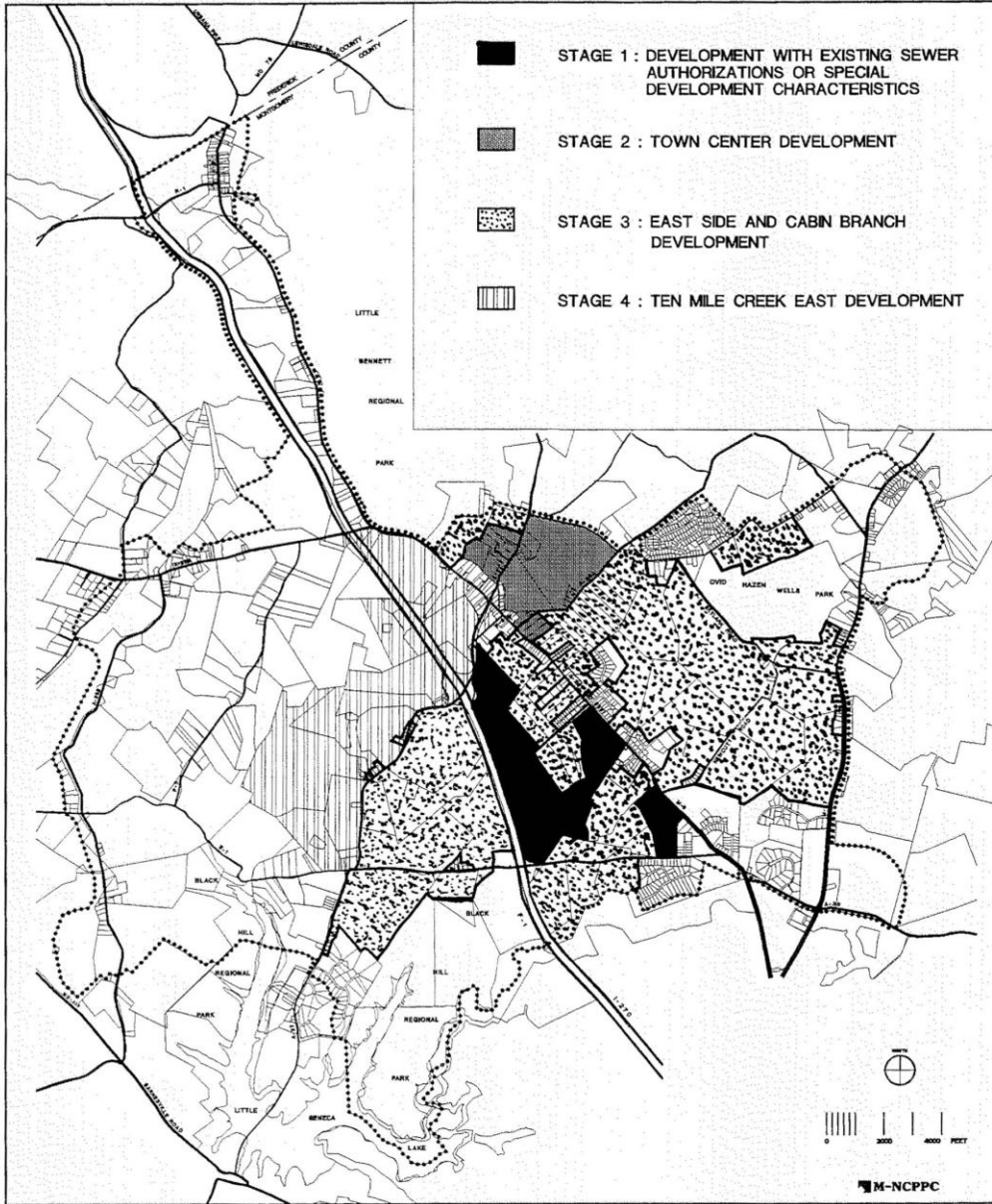
- employment sites with development criteria to help address environmental concerns
- low density residential use for land west of MD 121
- low density residential (2-4 units per acre) between the mainstem of the creek and Shiloh Church Road with a substantial area of private conservation area and parkland, and
- the remaining area in the watershed in rural residential (1 unit per 5 acres) and agricultural reserve.

The R&D land in the Ten Mile Creek Area is limited to 15% imperviousness and with uses tightly clustered close to I-270. The residential area west of MD 121 is approximately 600 acres and is limited to a maximum of 900 units, with any units beyond the base density requiring the purchase of TDRs. The plan specifies that at least 70% must be single family dwellings with the open space and conservation areas being undeveloped and forested.

Detailed summaries of the master plan provisions for both the Town Center District and Ten Mile Creek Area are included in **Attachment A**.

Clarksburg: Staging of Development

Figure 54



The 1994 Clarksburg Master Plan addresses considerations of environmentally sensitive areas and water quality, and in response outlines provisions for staged implementation of development. The Plan defines four major implementation areas. Development in Clarksburg is currently in Stage 3. Stage 3 includes areas east of I-270 and the Cabin Branch area west of I-270 and southeast of Clarksburg Road. Stage 4 includes the environmentally sensitive Ten Mile Creek Area on both sides of I-270, and is designated as Ten Mile Creek East. The Stage 4 triggers have been met (except sewer funding which

will be provided by the developers), but Council action is necessary to allow development to go forward.

Many sections of the master plan relate to the Ten Mile Creek implementation area and the following list highlights the most important planning considerations for the Ten Mile Creek East area (see Staging Principles, p. 187 -192 of the 1994 Clarksburg Master Plan). The staging principles state that:

- Sewage treatment and conveyance capacity will limit new development in Clarksburg
- No new development should proceed until wastewater solutions are programmed
- Land development should be coordinated with capital improvement, such as sewerage and transportation
- Timing and sequence of development should reinforce the plan’s community design and identity goals
- Staging should respond to the (near term) demand for single family housing and (long term demand) for employment
- Timing and sequence of development should respond to the unique environmental qualities of the area and help mitigate, in particular, development impacts in the Ten Mile Creek watershed
- DEP to conduct the necessary baseline stream monitoring and test the effectiveness of Best Managements Practices (BMP’s)
- Delaying development in the Ten Mile Creek Watershed will provide property owners the opportunity to pursue voluntary measures to protect water quality.

The staging plan was crafted by the County Council to hold development in the Ten Mile Creek watershed until they could be assured that such development could adequately protect the special qualities of Ten Mile Creek. The following summary was drawn from the staging plan, with checks indicating those triggers that have been completed.

Stage 4 Implementation (MP pages, 197 -205)

Status	Implementation Triggers
✓	Pass enabling legislation for development districts, or infrastructure financing
✓	Establish a new Water Quality Review Process
*	Allocate CIP funding for wastewater facilities for all approved development in Germantown and Stage 4 areas of Clarksburg
✓	Conduct baseline monitoring of ecosystems of Little Seneca and Ten Mile Creek watersheds for minimum of 3 years
✓	A minimum of 2,000 housing building permits have been issued for Town Center and Newcut Road areas
✓	Release the first annual report on water quality for Town Center and Newcut Road areas

*This trigger has not been met, because developer-funded infrastructure is not put in the CIP until a feasibility study has been completed by the developer.

Implementation Mechanisms (requirements for development in Stage 4 to proceed)

- When all above triggers must be met, then County Council considers whether to proceed with water and sewer plan amendments to permit development in Ten Mile Creek,
- Ongoing water quality and BMP monitoring by DEP,
- Individual properties are subject to AGP and APFO approvals,

- Infrastructure facilities are provided in accord with APFO, and added local determinations by Council are implemented.

For required water and sewer category changes Council will:

- Review demands on the CIP program for necessary infrastructure,
- Evaluate the water quality results associated with the Newcut Road and Town Center development, and other similar developments,
“Council will draw upon standards established by federal, state, and local laws and regulations and determine if the methods, facilities, and practices being utilized are sufficient to protect Ten Mile Creek.”
- Assess voluntary measures taken by property owners in the Ten Mile Creek watershed to protect water quality.

Council Options in Considering Stage 4
<ol style="list-style-type: none"> 1. Grant water and sewer changes without placing limiting conditions. 2. Grant water and sewer changes, subject to property owners’ commitments to take additional water quality measures. 3. Defer action on water and sewer category changes pending further study or actions. 4. Consider such other land use actions as are deemed necessary.

B. WATER QUALITY CONSIDERATIONS

With the January 2009 County release of the “Special Protection Area Program and Annual Report for 2007,” countywide attention has been given to the Clarksburg Ten Mile Creek Special Protection Area. The report documents a deterioration of water quality in the Clarksburg Special Protection Area and also presents initial recommendations for methods that could be considered to address the 2007 SPA findings.

The monitoring data supports the designation of Ten Mile Creek as an “extremely environmentally sensitive area of county-wide significance” in the Clarksburg Master Plan. Base-flows continue to be low in the summer months and the creek is susceptible to low flows from lack of rain. However, even in the driest years, tributaries have continued to flow and provide cool clean water as a refuge for the fish and aquatic insects.

There are few watersheds that can compare to the Ten Mile Creek watershed’s rich and diverse ecosystem within Montgomery County. These watersheds are primarily in the far north and west of the County and include Little Bennett Creek, Bennett Creek and the Upper Patuxent River. Ten Mile Creek’s tributaries continue to provide cool clean water to the stream system. These tributaries begin at springs such as the King Spring, Hancock Spring, and an unnamed spring along Frederick Road on the MXPDP-zoned property. These springs have provided cool clean water for a long time as evidenced by the use of native rock by early settlers to protect the spring head. Trout and other sensitive aquatic species rely on this source of cool, clean water. In 2007, fisheries biologists discovered three adult brown trout some distance above the West Old Baltimore Road ford. Two adult brown trout were found again in 2008 above the West Old Baltimore Road ford.

The Ten Mile Creek floodplain contains mature forest and healthy wetland areas. Beaver have developed a series of dams in the upper reaches that provide areas of deep, cool water as refuge for fish, amphibians and reptiles during the drier summer months. In the winter, this same habitat provides for wintering waterfowl and area wildlife. This series of beaver dams with flowing stream segments in between provides an example of how our streams looked before the area was first settled.

The benthic macroinvertebrate community contains sensitive species with very specialized habitat needs that indicate extremely healthy water quality conditions. Some of the species are found in few other watersheds within Montgomery County. The Ten Mile Creek and associated tributaries have large areas of forested and herbaceous wetlands, vernal pools, and seeps that provide high quality amphibian and reptile habitat. The streams provide habitat for amphibian species that require stable stream habitat to survive.

The watershed contains many areas of upland and riparian interior forest habitat. Bird surveys in 2009 observed or heard 12 migratory nesting forest interior bird species in the Stage 4 forest interior areas of Ten Mile Creek.

In addition to the sensitivity of the stream system itself, it is important to note that it forms a significant portion (about 25%) of the watershed that drains to Seneca Lake, an emergency water supply reservoir. While the reservoir is currently used to supplement flow in the Potomac River in times of drought, the quality of the water is important for this use as well as to Seneca Creek, which flows from the lake.

The stream conditions in the far eastern headwater area of Ten Mile Creek (near the Correctional Center and I-270) declined from *good* to *fair* since 1998. New development in this area since that time includes parts of new residential areas east of 355 in Stage 3 as well as portions of the entrance and perimeter roads for the County Correctional Center. Runoff from the most of the Correctional Center is diverted from this tributary to an adjacent one. Even this small amount of new development has had a noticeable adverse effect on Ten Mile Creek. This, in addition to other contributing factors, has had a noticeable and cumulative adverse effect on the eastern headwater of Ten Mile Creek. The watershed remains a very fragile system dependent on the contribution of cool, clean water from its tributaries to maintain healthy stream conditions.

Montgomery County Department of Environmental Protection (DEP) staff has recently collected data to estimate the environmental buffers for the Stage 4 area. While definitive buffers can only be established when a Natural Resources Inventory/Forest Stand Delineation is submitted by the property owner for each property, it is clear that there are more potential environmental constraints than are shown in the master plan. In particular, the developable area in the Stage 4 headwaters areas will probably be reduced.

Impacts of Stages 1, 2 and 3 on Stream Conditions

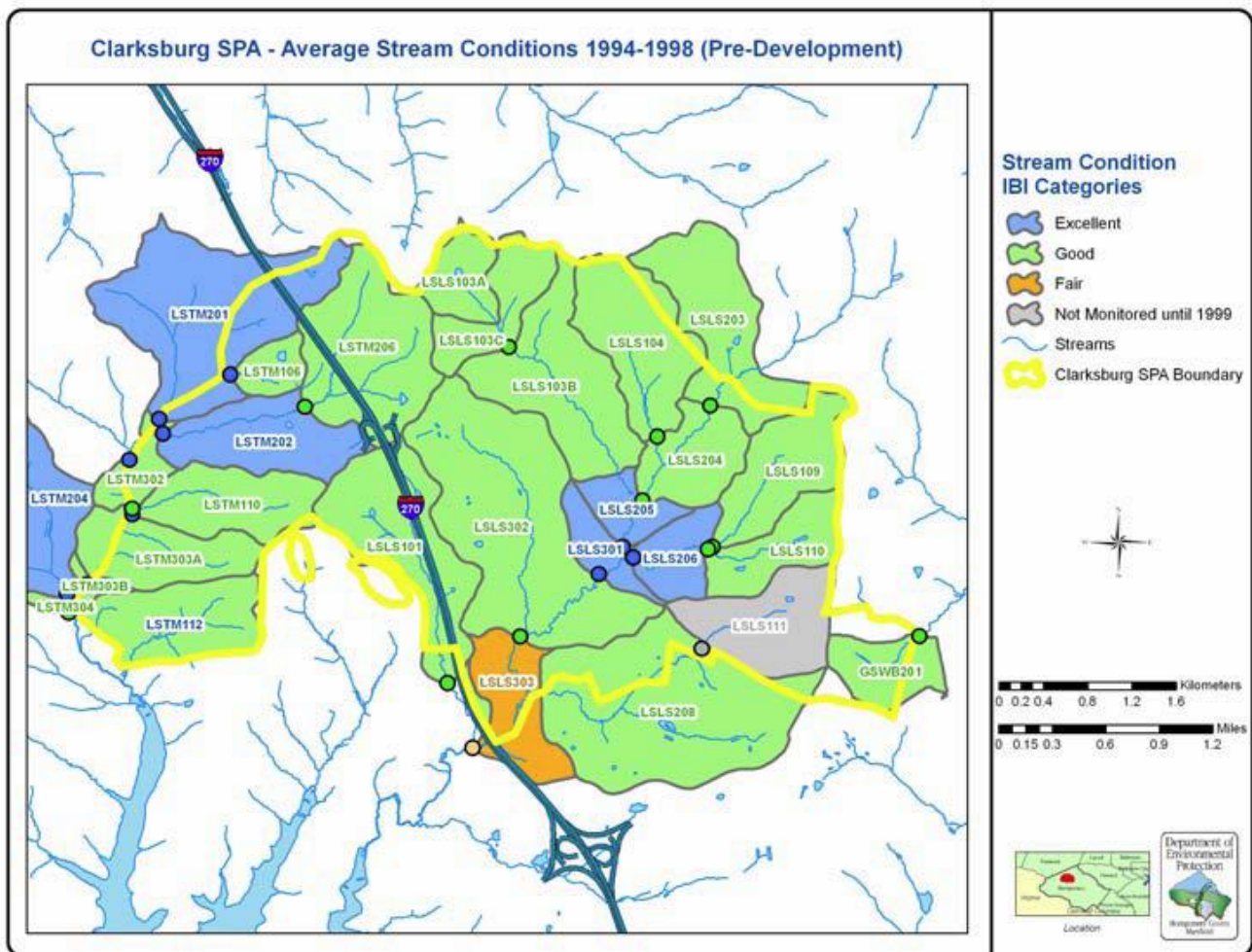
In Little Seneca Creek which drains most of Clarksburg east of I-270 and south of Clarksburg Road (121), the stream conditions were predominantly *good* to *excellent* before development occurred. Currently, stream conditions have dropped into the *fair* category primarily in the Clarksburg Town Center and Newcut Road development areas (see maps on the following page). Detrimental impacts to the biological health of the streams in Clarksburg have been observed due to:

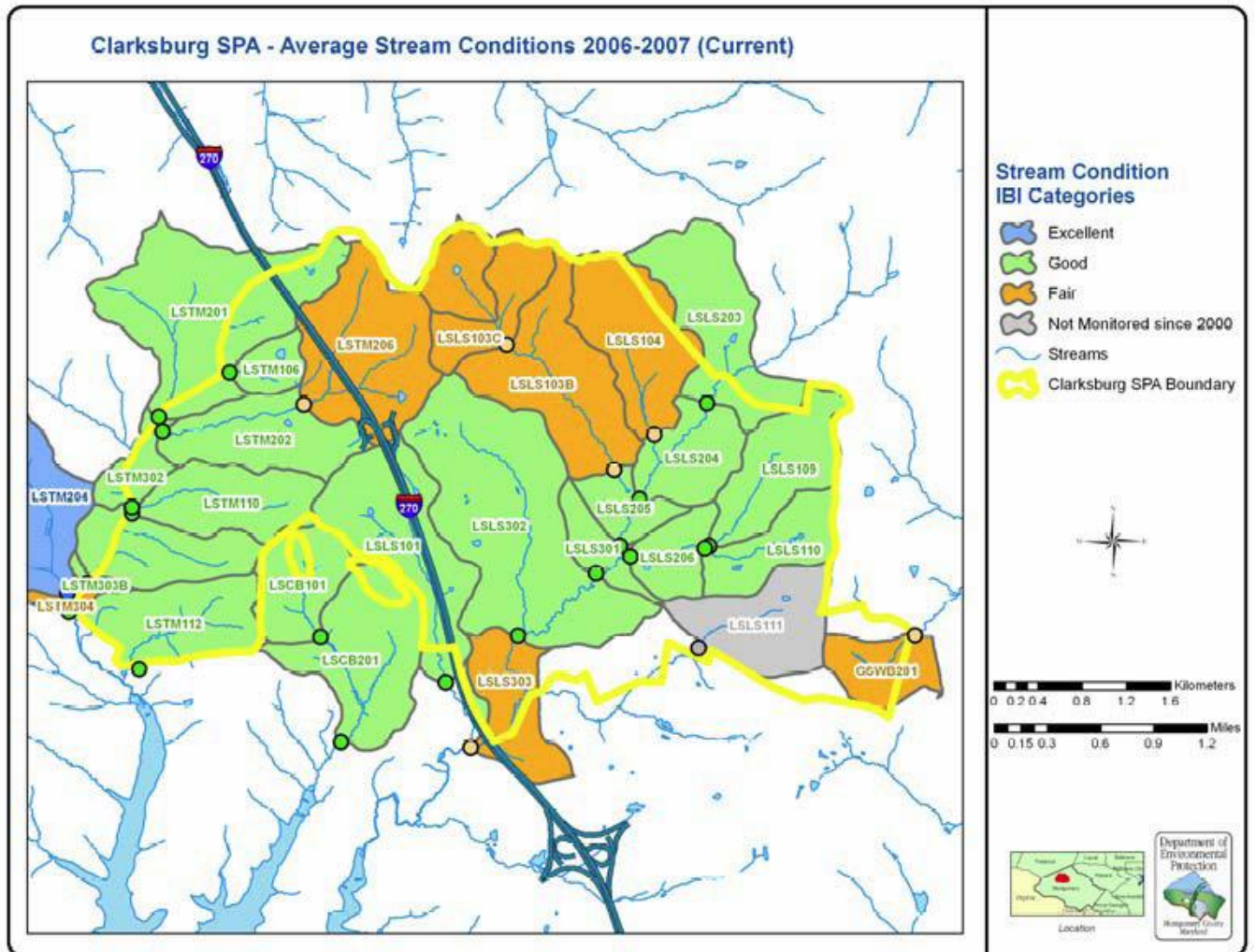
- the unexpected downturn in the construction economy and its consequences on the landscape (rapid start of construction followed by delays, leaving large areas of land with sediment and erosion control only),
- the fact that most BMPs have not been converted from sediment and erosion control (S&EC) to stormwater management (SWM),
- the amount of land disturbance and hydrologic modification,
- the increases of imperviousness associated with the development, and

- impacts associated with the installation of utility lines to service this area.

The current land use development process permanently changes the character of the landscape. These changes are cumulative and influence the receiving streams in ways that require an understanding of processes that go beyond BMP effectiveness. The overall topography, natural drainage patterns, and natural infiltration are altered due to the cut and fill requirements necessary to meet the density requirements of these neighborhoods and the diversion of most of the surface runoff into stormwater inlets and drains. These changes to the landscape alter hydrology and can permanently affect water quality.

Thus far, SPA monitoring results show that BMPs are performing as expected. However, the efficiency of the BMPs is not correlating to the monitored results of the biological health of the stream downstream of the BMPs. As imperviousness increases in the watershed, the streams health declines drastically. There is insufficient data at this point in the development process to evaluate if the watershed will recover from the negative effects documented during construction. However, dependence on structural solutions alone to maintain healthy stream systems has not worked to date. Stream conditions in SPA watersheds with lower imperviousness have changed less than those with higher imperviousness. The streams in lower density watersheds are expected to have a fuller recovery because the biological community, water quality conditions and habitat are still intact. Springs and seeps, necessary to maintain base flows in headwater streams, may not be adequately protected by the current wetland buffers.

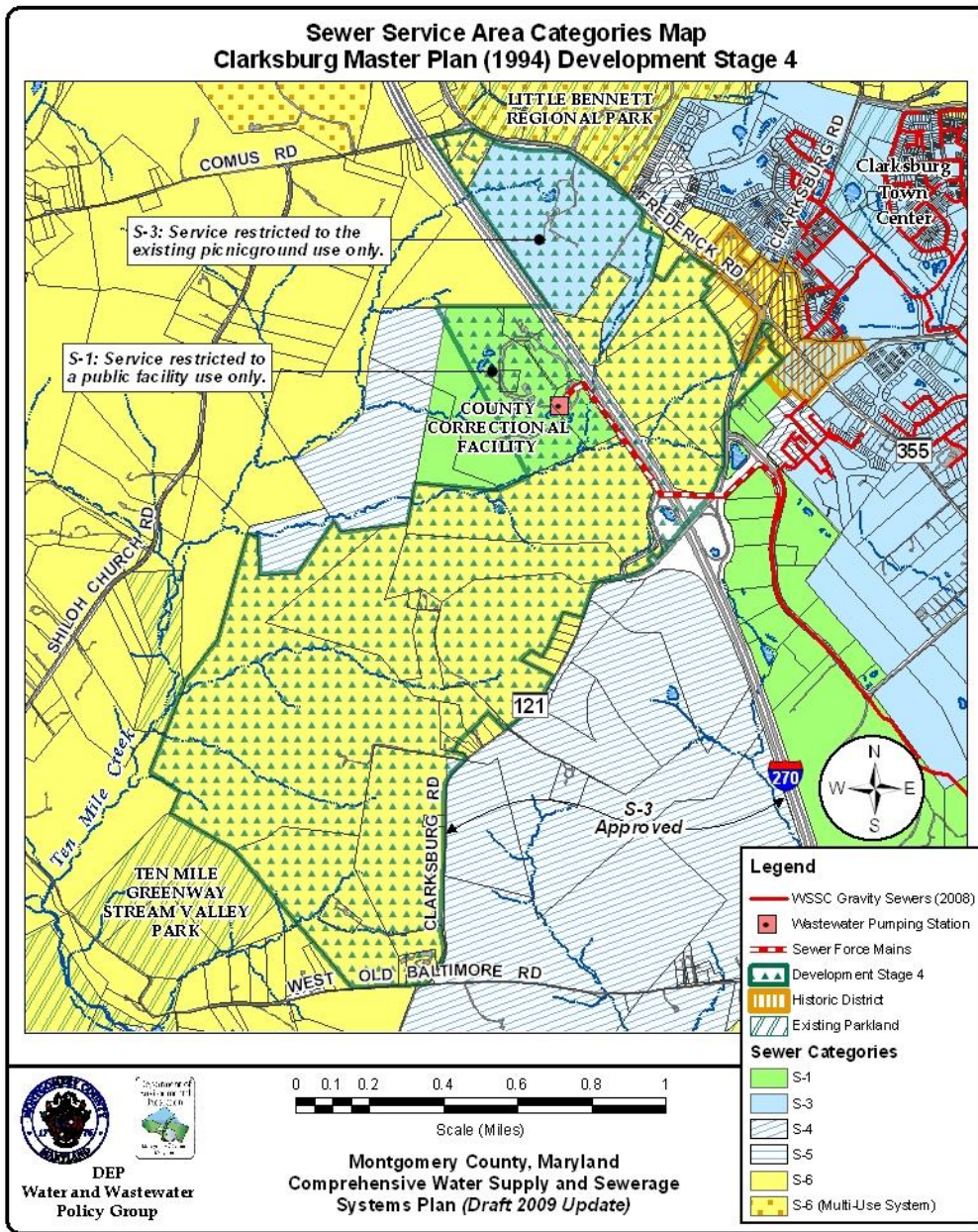




Source: *Special Protection Area Annual Report 2007*.

Current Status of Sewer and Water Service

Town Center: Properties in the Town Center outside of Stage 4 are all approved for public sewer service as part of the general category map amendments approved for Development Stages 2 and 3. This area is served by gravity extensions from the Little Seneca Trunk Sewer. Some nearby projects in the Town Center District—primarily those across Clarksburg Rd. in Little Bennett Creek—use grinder pressure systems to pump over into the town center gravity mains. Properties in the Ten Mile Creek watershed in Stage 3—including those in the Historic District and the proposed fire station site—generally have conditional approval for sewer service, as established under the general category map amendment for Stage 3. Final approval depends on confirmation that WSSC can provide sewer service using only CIP-approved capital projects. The Egan’s BBQ site has sewer service approval, but has not yet connected to the public sewer system, according to WSSC. The County approved public sewer service restricted to the existing picnic/catering operation.



Historic District: Only a few properties currently receive sewer service, some adjacent to the Town Center and a few west of Route 355. As noted above, many Historic District properties and some properties along 355 have conditional approval for public sewer service.

Ten Mile Creek: The bulk of Stage 4 areas in this watershed is in categories W-6 and S-6 (no planned service), pending resolution of the staging action by County Council.

Depending on those decisions, any category changes needed for this area would be addressed under a general category map amendment initiated by DEP. Two sites in Ten Mile Creek Stage 4 have received restricted sewer service approval: The County Correctional Center and Egan’s BBQ (see above). The County Correctional Center is served by a dedicated line and pumping station that cannot serve other development.

C. POTENTIAL BUILDOUT OF MASTER PLAN STAGE 4 AREAS

Remaining Development in the Town Center District

The 1994 Master Plan (page 40) includes an end state development level of 2,600 units and 770,000 square feet of employment for the 635-acre Town Center subarea. The Town Center subarea includes implementation segments of Stage 2 and 3 areas in the northeast portions. The Compliance Plan for the

Town Center is located in the eastern portion and was approved in December 2008. The east Town Center area currently includes significant development with 1,213 residential units and 194,720 square feet of retail space approved to date.

Using the guidance provided by the master plan and deducting development approved to date for the Town Center subarea, the remaining development potential is approximately 1,387 residential units and 575,280 square feet of employment area.

Planning Subarea	Acres (Approx.)	Residential Dwelling Units	Employment and Retail (square feet)
Town Center District Master Plan, Page 40	635	2,600	770,000
Development Approved As of May 2009		1,213	194,720
Allowable End State Development Potential Remaining		1,387	575,280

Potential Buildout of the MXPDP and PD-4 Headwaters Area

Approximately 370 acres of the Ten Mile Creek watershed is east of I-270 in the Town Center analysis subarea. Planning staff prepared a preliminary study of potential density for the Stage 4 portion, which consists of approximately 223 acres. Refined studies will be necessary to verify the feasibility of these projections.

The most significant finding is that the zoning envelope for the R&D designated land within the MXPDP area, with an allowed .75 FAR can **potentially accommodate much more development than the available remaining Town Center employment balance**. Use of all of this remaining balance within the headwaters areas would preclude future allocations elsewhere in the Town Center District.

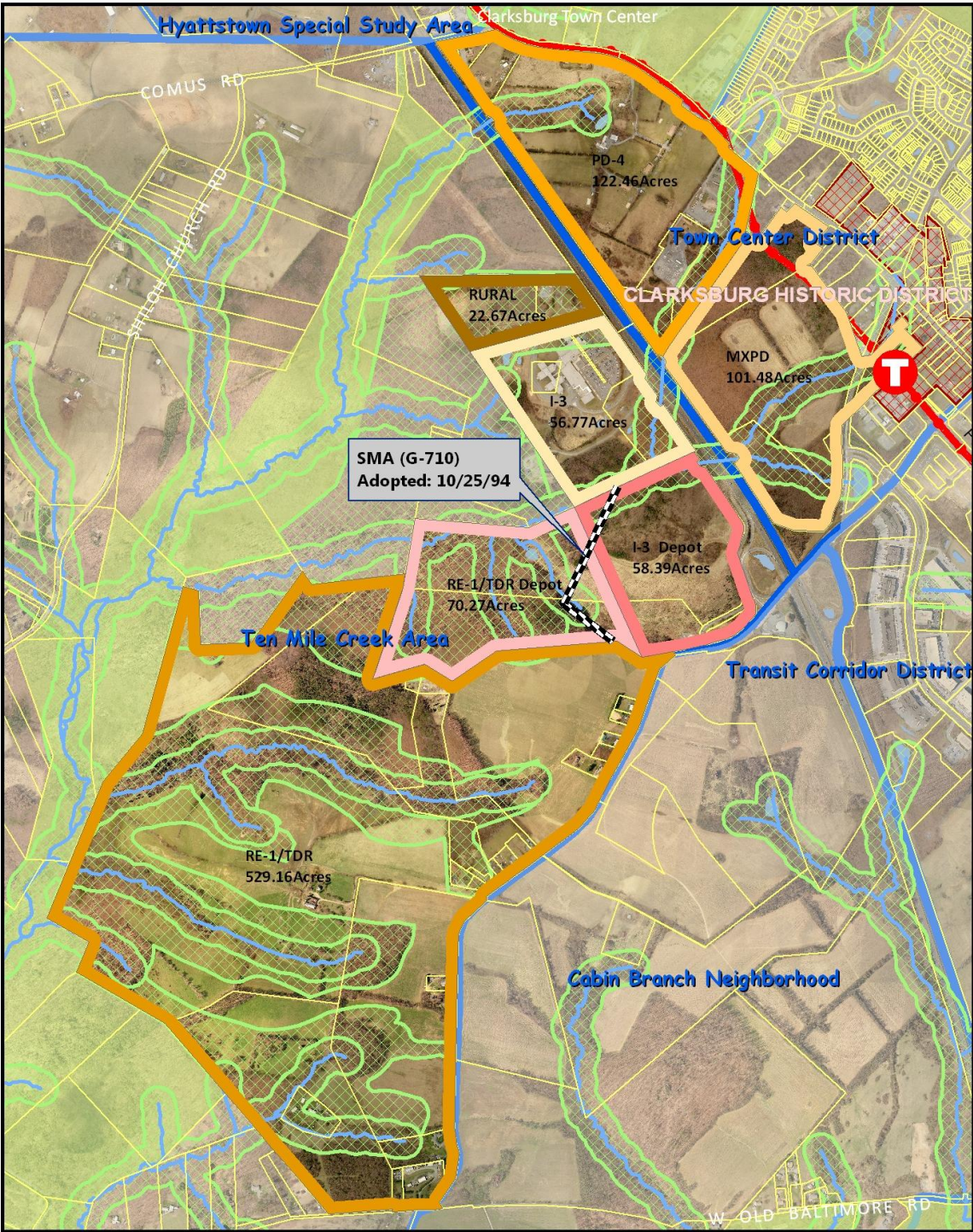
- The entire **575,280 square feet employment and retail area Town Center remaining balance could be accommodated** within the two MXPDP, R&D designated zoned areas.
- The initial study projects that **over half of the available Town Center residential balance** of 1,387 units could potentially be accommodated within the PD-4 and MXPDP headwaters areas.
- A **potential residential density of 743 units** could be realized using the study scenario. For the entire Town Center Analysis area 2,600 residential units are allowed by the Master Plan. The potential residential balance could be allocated as future Town Center area infill and possibly to the remaining parcels adjacent to the Town Center Corridor Cities Transit (CCT) station.
- The master plan projects 470,000 square feet of employment and up to 300,000 square feet of retail within the Town Center allocation of 770,000 square feet. With 194,720 square feet of retail approved, the **balance remaining is 105,280 square feet of retail**.

Current studies of the CCT by the Maryland Transit Administration project a Town Center Station to occur after 2025.

As set forth in the master plan, the level of development in these areas must result from a very careful balance between environmental constraints and the potential allowable development density. The actual development level for the PD-4 and MXPDP areas must be determined through further refined studies. A wide range of factors will influence planning and will limit the ultimate development density:

- development programs, preliminary planning and engineering input, and additional considerations from landowners
- land assembly needed for some of the parcels to develop
- the potential level of imperviousness resulting from certain land uses and densities

Clarksburg Stage 4 Master Plan Guidance



- roadway access considerations including the timing of roadway and transit infrastructure
- the application of the new refined environmental constraints criteria during future planning and development review
- the appropriate relatively low density of the PD-4 zone, and the significant density allowed under the MXPDP zone
- parking facility needs together with open space requirements

- master plan height provisions of 4 floors or less in areas except those within walking distance of the Town Center transit station
- the upper limits of the PD density ranges (only achieved through maximum use of the MPDU provisions)
- the southernmost R&D parcel located outside the designated 6 to 8 floor height allowance for areas within transit walking distances
- very constrained developable areas for the southernmost MXPDP, R&D and PD 7-9 parcels

Preliminary Development Concept Study for Stage 4 MXPDP and PD-4 Headwaters Areas

Planning Subarea	Acres (Approx.)	Residential Dwelling Units	Employment and Retail (sq. ft.)
Town Center District Total Master Plan, Page 40	635	2,600	770,000
Development Approved As of May 2009		1,213	194,720
Allowable End State <i>Development Potential Remaining</i>		1,387	575,280
Concept Study for Potential Buildout in Headwaters Areas			
MXPDP Area (Excludes areas adjacent to TC CCT Station)	101	314	575,280
PD-4 Area	122	429	---
<i>Density Allocations with Concept Study</i>		743	575,280
Impact Summary – Remaining Development if Concept Study is realized for Headwaters Areas			
644 Units remaining as future allowable development	223	644 Units remaining	No Employment area remaining
R&D Parcels in the MXPDP Area could allow over 1,000,000 sq. ft. of employment			

Ten Mile Creek Area (West of I-270)

The entire Ten Mile Creek Area (approx. 3,588 acres) includes, within its eastern segment, the remainder of properties in the Stage 4 implementation area. For the entire Ten Mile Creek area the 1994 master plan projects an end state development potential of 1,240 residential units and 960,000 square feet of employment and retail. Within this eastern **Stage 4 subarea** the master plan includes:

- approximately 600 acres of the RE-1/TDR-2 zoned properties
- approximately 116 acres of I-3 zoned land
- approximately 23 acres of Rural zoned land, north of the I-3 areas (within County Owned Site 30)

Development Potential for the Ten Mile Creek Area, Including Stage 4 (West of I-270)

The development potential for the Ten Mile Creek watershed can be summarized using guidance from the 1994 Clarksburg Master Plan, Attachment A. The master plan guidance for the three separately zoned land segments and property areas -

- **RE-1/TDR-2** zoned properties - approximately 600 acres has a master plan designated limit of 900 units total and assigning this density to 593 acres (as shown in MP Table 3, page 101) the resulting calculations are -
 - 593 units as a base density
 - 113 minimum MPDU's
 - 194 TDRs (maximum)
 - 900 units total
- **I-3 zoned** area (part of CLV property and Site 30, approximately 116 acres)
 - 400, 000 square feet of employment area on the I-3, 59 acre east portion of the **CLV Site** (currently proposed for the North County Maintenance Depot to park 250 buses and accommodates associated offices and facilities)
 - 400, 000 square feet of total employment area on the I-3, 57 acre east portion of **Site 30**, (occupied now by the County Correctional Facility)
- **Rural and RDT** zoned land-up to 125 units on approximately 1380 acres outside of Stage 4 in the Ten Mile Creek watershed.

D. IMPERVIOUSNESS PROJECTIONS

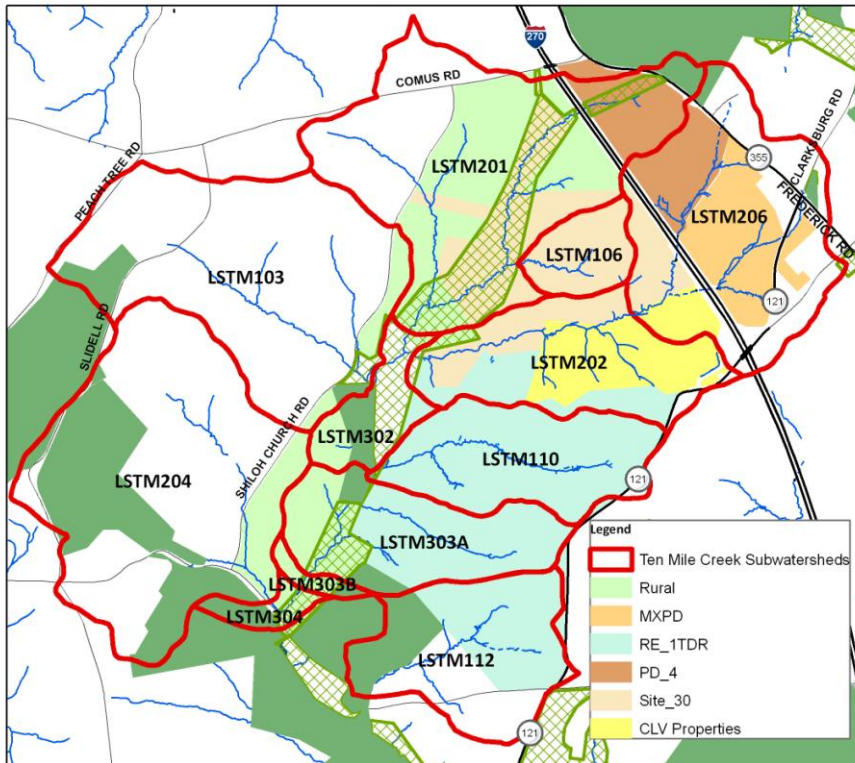
Imperviousness, or the percentage of the watershed or drainage area that is covered in paving or buildings, has been shown to be highly correlated with sensitivity and number of aquatic invertebrates that indicate the overall health of a particular stream. The 2007 SPA Annual Report (pages 1-9 through 1-14, attached as **Attachment B**) summarized key findings of research on the effect of impervious surfaces:

- stream segments with less than 10% impervious coverage in their contributing drainage area are generally able to retain their good to excellent ratings
- stream segments with 10% - 25% impervious coverage show clear signs of declining stream health with most falling in the fair range
- stream segments that range between 25% - 60% impervious coverage can no longer support a healthy stream and cannot attain pre-development conditions even with restoration efforts.

In addition, studies of Montgomery County streams indicate that degradation can occur at even lower levels (8-10%).

The Planning Department has been using estimates of imperviousness to estimate the potential effects of zoning and land use scenarios in master plans since the early 1990's.

Ten Mile Creek Subwatersheds and Stage 4 Properties



Imperviousness projections were made as part of the 1994 plan. That work assumed a voluntary imperviousness cap of 15% on the RE1/TDR2 areas and research at that time showed good water quality could still be achieved with up to 15% imperviousness. We can no longer assume voluntary limitations on imperviousness and monitoring shows degradation is already occurring in Ten Mile Creek.

Planning staff prepared new estimates for

imperviousness by determining the imperviousness of existing and permitted development, and adding the typical imperviousness (or actual, if known) for land development and transportation improvements associated with a particular set of assumptions. These estimates are subject to further refinement. Planning Department staff made projections based on four sets of assumptions for purposes of comparison between the existing master plan and other potential approaches for the drainage areas shown below.

The following table shows the estimates for the individual drainage areas in Ten Mile Creek under various imperviousness assumptions. **Yellow shaded drainage areas indicate projections above 8% impervious surface.** The modeling assumptions include:

- 1994 Plan assumes buildout of the densities using standard impervious factors for each zone, with all TDRs used for the RE-1/TDR properties
- 15% cap assumes that all properties are held to 15% imperviousness
- 25% limit in Headwaters and RNC assumes a 25% cap for MXPD and PD-4 with RNC zoning replacing the RE-1/TDR zoning
- 25% limit in Headwaters retains the RE-1/TDR zoning.

Imperviousness Assumptions

Property	Acres			1994 Plan	15% Cap	25% Limit in Headwaters + RNC	25% Limit in Headwaters
MXPD	171			35	15	25	25
PD-4	121			35	15	25	25
Site 30	295			15	15	15	15
NCMD Proposal	129			15	15	15	15
RE-1/TDR2 (not including part of NCMD)	563			26	15	9	26
Rural	451			6	6	6	6
Proposed Transportation Improvements	15						

Projected Imperviousness Estimates

Drainage Area	Acres	Stream Quality	Current Imperviousness	1994 Plan	15% Cap	25% Limit in Headwaters + RNC	25% Limit in Headwaters
LSTM201	540.6	Good	2.6%	11.0%	8.9%	8.4%	8.4%
LSTM206	386.7	Fair	12.6%	22.1%	16.6%	19.3%	19.3%
LSTM106	67.8	Good	7.6%	11.7%	11.7%	11.7%	11.7%
LSTM202	242.5	Good	1.4%	14.7%	12.6%	11.5%	14.7%
LSTM110	212.9	Good	1.0%	26.3%	15.5%	9.7%	25.6%
LSTM103	487.7	Good	2.0%	2.2%	2.2%	2.2%	2.2%
LSTM302	78.3	Good	0.1%	3.5%	2.6%	2.1%	3.5%
LSTM204	560.7	Good	2.2%	2.6%	2.6%	2.6%	2.6%
LSTM303A	209.8	Good	0.5%	16.5%	9.7%	5.6%	16.5%
LSTM303B	16.0	Fair	1.7%	4.7%	4.7%	4.7%	4.7%
LSTM304	27.4	Good	1.2%	3.1%	3.1%	3.1%	3.1%
LSTM112	228.5		1.0%	12.1%	7.0%	4.2%	12.1%
Total TMC Imperviousness	3059		3.3%	11%	8.1%	7.4%	10.1%

The staff analysis of potential density indicates that, for the headwaters area -

- the potential for impervious surfaces can be expected in the range of **20%** at a minimum, and up to **50% or higher** for the larger of the two MXPD, R&D properties
- the resulting net developable areas will have higher effective percentages of imperviousness (the impervious percentage of the land outside of environmental buffers) with a range of approximately **25%** and **up to approximately 70% or higher** for the MXPD, PD 7-9 area (two parcels) nearest the Town Center transit station.

Staff believes that **the imperviousness that would likely result from the land use and zoning recommendations of the 1994 master plan pose a threat to the health of Ten Mile Creek**, even with improvements in stormwater management techniques that will be required. The sensitivity of this stream and the high imperviousness predicted will result in severe degradation in many of the tributaries, and raise the overall imperviousness above 10% in the watershed. Buildout of the master plan densities would put enormous pressure on the headwaters and affect the whole length of the stream. Given experience to date in Ten Mile Creek, even small changes have resulted in degradation. Local information and national studies indicate that even the lower imperviousness that might result from limiting imperviousness to 15 or 25 % in selected areas may yet endanger many of the tributaries.

E. POTENTIAL ADDITIONAL WATER QUALITY MEASURES AND VOLUNTARY ACTIONS

At a minimum, stormwater management requirements for Ten Mile Creek will be in accordance with the Stormwater Management Act of 2007, which are based on Montgomery County's existing requirements and experiences. The County is in the process of adoption and refinement of stormwater management requirements to meet the state standards to require a comprehensive standard or strategy for maintaining predevelopment runoff characteristics and protecting natural resources. The strategy has been termed "Environmental Site Design" or ESD.

ESD relies on the integration of site design, natural hydrology, and smaller controls to capture and treat runoff. Some of the components include optimizing the conservation of natural features; minimizing impervious surfaces; slowing down runoff; increasing infiltration and evapotranspiration; a greater use of smaller stormwater management structures and non structural control methods; and, constant improvements to innovative technologies. Recent modifications to the County's Road Code to require more vegetative stormwater management practices within the public right of way fall in line with ESD. The more traditional approaches for stormwater management may still be needed at times. However, ESD and its associated components are to be use "to the maximum extent practicable."

Many ESD components, especially small biofilters and recharge areas, are planned and have been used in much of the Clarksburg Special Protection Area already. This is especially true for development projects that have been approved since 2000. However, an even more comprehensive approach will be needed for the Ten Mile Creek area. As stated before, some traditional stormwater management structures will be needed, especially for areas where large amounts of impervious surface are planned. By using ESD, the use of these types of structures should be reduced significantly. The goal is still to maintain or enhance the runoff characteristics of Ten Mile Creek and its tributaries.

The 2007 SPA Report recommends the following improvement to the process for stormwater management:

- Environmental site design should have a high priority in development projects, so that the minimization and mitigation of runoff impacts is integrated into the overall design, rather than added at the end
- Monitoring for Best Management Practices would be more consistent if developers were given the option to have DEP do the monitoring for a fee
- Sediment and erosion controls should be upgraded and converted more quickly to stormwater management
- A grading ordinance should be adopted to limit the area of mass grading during construction.

Even with the best development controls on sediment and stormwater, no facilities (even with maximum ESD) will offset fully the effects of imperviousness. The most successful protection strategies rely on a combination of limiting imperviousness, protecting existing forest (particularly in stream buffers) ESD techniques and redundant stormwater management features.

Planning Department, DEP and DPS staff representatives met with the majority of the property owners in Stage 4 to assess voluntary measures they might undertake. They are willing to work with staff to consider environmental protection first before preparing a development plan, to stage construction of their development, to incorporate Environmentally Sensitive Design and Best Management Practices, and to consider any other mitigation measures suggested. They have prepared only the very beginnings of conceptual plans for stormwater management, and have no proposed development layouts. They are opposed to limits on impervious surface, and if such limits are considered or imposed, they want to have pervious paving materials counted as partially pervious in that calculation.

F. INFRASTRUCTURE AND STAGE 4 WATER/SEWER CATEGORY ISSUES

As currently envisioned in the 1994 master plan, implementation of the development densities proposed for the Stage 4 area will require public water and sewer service. The majority of properties included in Stage 4 are currently designated as categories W-6 and S-6. The provision of public service in Stage 4 will require the approval of category changes through the County's Water and Sewer Plan. The master plan also envisioned that this recommendation process would proceed to the Council as part of a proposed comprehensive category change amendment for Stage 4 and nearby properties. In the process of preparing the recommendations included in this report, the contributing agencies agreed that preparing a comprehensive Stage 4 category change proposal would be premature; and that the County should address the master plan's procedural options for Stage 4 without the pressure of a pending category change amendment.

With the exception of the County Correctional Facility, there are no receiving sewers in the Stage 4 area, so sewer service within the basin will require a completely new system with pumping systems to move the flow to the Little Seneca basin. The Correctional Facility already pumps over to Gateway Center Drive. In preliminary discussions with developers of the MXPZ-zoned properties, WSSC has agreed in concept with a proposal that would use two WSSC pumping stations to serve Stage 4. One station, possibly located near the proposed North County Maintenance Depot (CLV) site, would serve the "upper" Stage 4 sites. The second station, located to the south closer to West Old Baltimore Rd., would serve "lower" Stage 4. This concept avoids construction of a lengthy gravity main extension along Ten Mile Creek and provides some additional flexibility in timing for development of Stage 4 projects. The master plan ties development staging closely to sewer infrastructure planning. All capital sewerage system projects needed to serve Development Stage 4 must be approved and fully funded in the first four years of the WSSC CIP in order to move properties forward to category S-3. The master plan envisions this occurring as part of a Stage 4 general water/sewer category change amendment initiated by DEP, as was done for the earlier Clarksburg development stages.

The North County Maintenance Depot is planned for the CLV site in the Stage 4 area. From an **infrastructure standpoint**, the Depot would have to pump its wastewater out of the Ten Mile Creek watershed to mains that drain to the Little Seneca Trunk Sewer, as would the rest of the Stage 4 properties. If the Depot project proceeds ahead of other Stage 4 projects, the facility will need its own—perhaps interim—pumping station. The concept for the upper Stage 4 area would be to have its wastewater flows pumped southeast across Route 121 into sewers in the Clarksburg Triangle project (Stage 3) that would feed into the Little Seneca sewerage system. This would depend on the progress of the Clarksburg Triangle project and its sewer construction. If Clarksburg Triangle sewers aren't available, then the County would need to study alternative pump-over destinations and alignments. From the **standpoint of service area approvals**, the Depot would require approval of a water/sewer category change request, most likely under the "public facilities" policy, as was done for the County Correctional Facility site. If it precedes decisions or timing of Stage 4 it would need its own category change, separate from the planned Stage 4 general amendment.

The Historic District is outside of Stage 4; however most of it is in the Ten Mile Creek watershed. A few properties in the Historic District have access to sewer service via sewers in the Little Seneca watershed: some adjacent to the town center and a few west of Route 355. WSSC indicates that historic district properties north of Clarksburg Road will need service provided via a future Stage 4 (Ten Mile Creek) sewerage system. DGS has proposed a site for the Clarksburg Fire Station opposite historic district properties north of Clarksburg Road. If built before service the extension of public sewer to the upper portion of Stage 4, service to this facility may require a grinder pressure extension to existing mains in the Town Center. It will also need a separate category change request addressed through the Water and Sewer Plan's "public facilities" policy.

Details of Guidance from the 1994 Clarksburg Master Plan

MXPD and PD-4, Stage 4 portion of the Town Center District (Ten Mile Creek Headwaters) (MP pages, 42 -53)

- historic district as focal point
- mixed use, office and residential neighborhoods
- blend old and new
- environmental concern at headwaters, with reduced densities
- town center transit station, adjacent to MXPD headwaters area
- town center as focus of entire plan
- patterns of small blocks with access to transit
- selective, compatible infill in historic district
- high tech employment up to 470,000 square feet in MXPD area visible from I-270
- 2,600 residential units total with mix- 25-45% multi-family, 30-50% attached, 10-20% detached
- 20% increase of residential total with carriage homes (in PD and RMX zones, as non MPDU's)
- apartment buildings up to 6- 8 floors if within walking distance of transit station and compatible with historic district; and 4 floors or less elsewhere
- 153,000 to 300,000 square feet of commercial allowed in entire TC, with 150,000 in retail center, and 70,000 to 105,000 added office and commercial throughout the TC
- town center as the “civic” center of the study area, 0.5 acre public space at the transit station
- transit oriented pattern with bus loops, bikeways, and pedestrian oriented streets
- land use pattern responsive to environmental concerns, noise, and protective of headwaters
- R&D and PD 7-9 densities at transit station and reduced densities PD 2-4 in the headwaters
- interconnected streets as found in older towns
- roadway network guidelines, MP pg. 52 and 53
- special character for Redgrave Place
- variety of open space features, including forest conservation areas along streams

The headwaters MXPD and PD-4 portions of the Town Center are identified by the master plan as “As Areas Proposed for Zones Requiring Future County Council Actions”, and (MP pages, 98 -99). The following summary items provide additional guidance from the master plan and primary provisions of these zones -

- where there is a range in the PD density, the higher density may be achieved only through max. use of the MPDU provisions
- end state densities cannot occur without more detailed review than is typically required by the subdivision or site plan process

MXPD

- intended for multi-use centers, outside of transit areas
- open space and non-vehicular networks encouraged
- retail not to exceed 20% of R&D
- residential density per MP
- commercial density not to exceed .75 FAR
- 20% increase with carriage homes in PD areas
- 100 ft. and no less than building height as setback from any residential
- not less than 50% of total residential area as green

- not less than 40% of total commercial area as green except for provision of amenity areas for community

PD 7-9

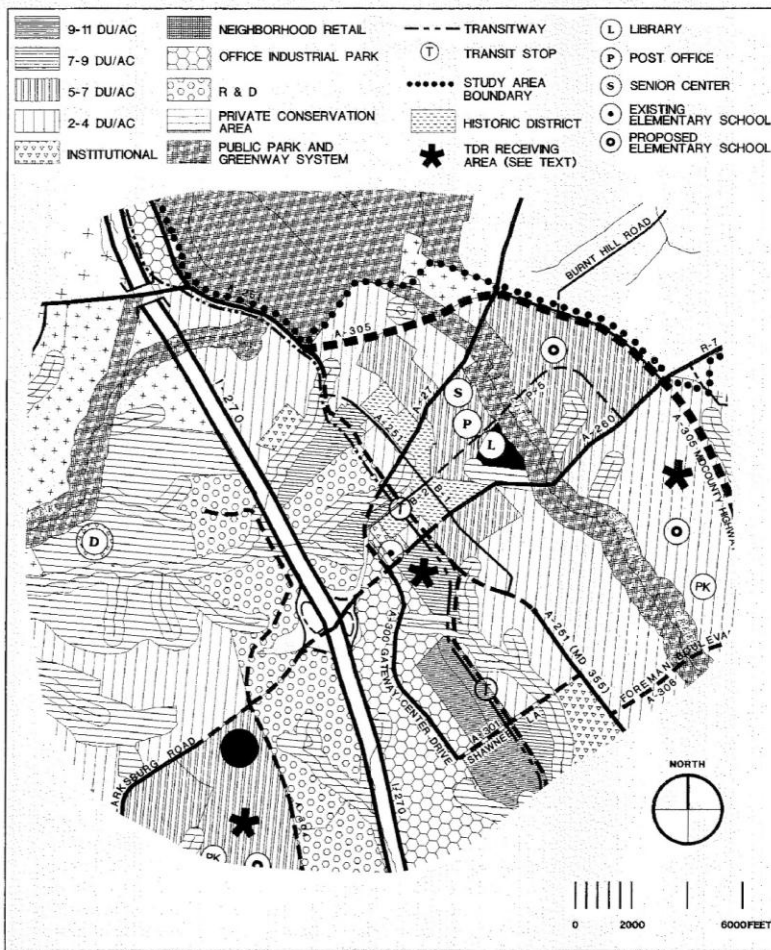
- 7-9 residential units/ac.
- residential unit mix requirements per 59-C-7.131
- 40% green area min.

PD-4

- 2-4 residential units/ ac.
- flexibility of design, with efficiency, convenience and amenity
- mix of residential, convenience comm., and other uses
- range of housing types
- community interaction and open space networks
- residential unit mix requirements per 59-C-7.131
- senior housing permitted
- pedestrian, neighborhood commercial permitted
- green area minimum: PD-2 and 3 - 30%, PD-4 - 40%

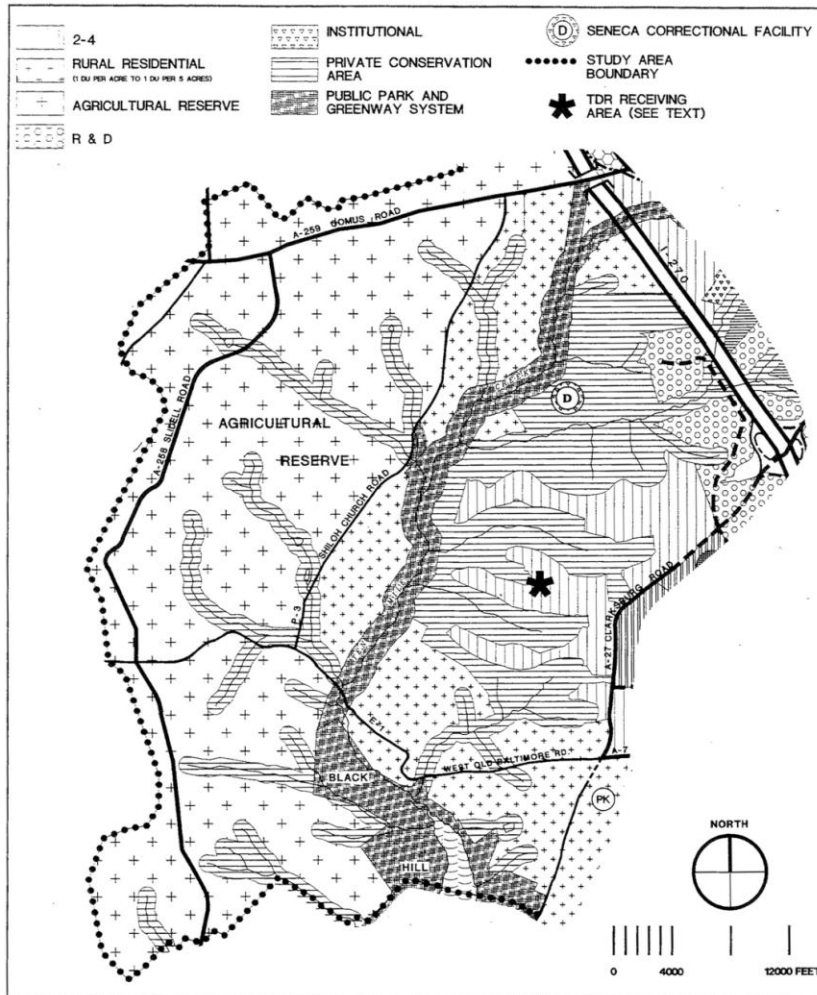
Town Center District Land Use Plan

Figure 19



Ten Mile Creek Area Land Use Plan

Figure 34



Clarksburg Master Plan and Hyattstown Special Study Area
APPROVED AND ADOPTED JUNE 1994

MARYLAND-NATIONAL CAPITAL
PARK & PLANNING
COMMISSION

Ten Mile Creek Area

(MP pages, 87 -93)

- the land west of Ten Mile Creek is designated as supportive of the Agricultural Reserve
- land use east of Ten Mile Creek to balance environmental concerns, County housing needs, and the importance of I-270 as a high technology employment corridor
- Ten Mile Creek, as a fragile stream, merits special consideration
- two employment sites are recommended along I-270, with the character of development very important given their location in the Ten Mile Creek watershed
- guidelines for the two employment sites to foster environmentally sensitive site plans
 - no more than 400,000 square feet for each of the two I-270 employment sites
 - an impervious limit of 15% for the entirety of the two employment sites (the CLV property, currently sought by the County for the North County Maintenance Depot (approximately 128 acres), and the County Site 30 property (approximately 300 acres).
 - clustered development close to I-270, with improved access from MD 121
- recommended land use west of MD 121 Clarksburg Road to address environmental concerns and assure a predominance of single family detached units

- approximately 600 acres as RE-1/TDR-2 with base density of 1 unit/ acre, with 900 units total, and with a minimum of 70% single family detached units

Environmental Plan section of the Master Plan

(MP pages, 137 -153)

Overview

- land use proposals of the plan reflect a difficult balancing of community development objectives with environmental preservation concerns
- the plan relies on many mitigation strategies to help protect natural features
 - forested conservation along all stream buffers
 - key areas subject to more rigorous development review
 - mainstems of all streams to be acquired by the public (M-NCPPC)
 - extraordinary mitigation for land uses near sensitive headwater areas
- Ten Mile Creek has the greatest constraints for development
- the plan recommends clustering development and stringent environmental objectives in some areas

Watershed Analysis

- plan studies resulted in the 1994 determination that, with continuously forested stream buffers, water quality standards probably could be achieved
- Ten Mile Creek water quality in 1994 was good to excellent
- protection and improvements of wetland systems are critical to maintaining water quality
- Ten Mile Creek is most prone to environmental degradation
- the greatest level of environmental constraints are in the stream valley areas

Recommendations relating to Watersheds and Sensitive Area Protection

- low density land use and best management practices (BMP's) for maintaining water quality
 - lower residential densities in Town Center areas beyond transit
 - 15% impervious limit and square footage limit for employment areas west of I-270
 - extensive forested green space beyond stream buffers
 - public parkland dedication for Ten Mile Creek stream buffers, and possibly for buffers for first and second order tributaries
 - employment and impervious limits County Site 30
- the plan strongly encourages buffers of 175 ft. from the streams
- protection of tree cover, including preserving large contiguous areas west of I-270
 - avoid tree clearing
 - minimize trees lost
 - replace trees that are unavoidably cleared
 - tree saving and tree planting (reforestation, afforestation)
 - off site planting within the same watershed
 - fees to a tree fund when necessary
- a “no net loss of wetlands” policy
- modifications to M-NCPPC “Environmental Guidelines” for review of subdivisions
- maintain the environmental qualities of headwaters streams
 - headwaters should receive the highest degree of protection possible
- endorse agricultural BMP's

Relation to the 1992 Maryland Planning Act

- the plan included a “sensitive areas” element

Areawide Environmental Concerns

- it is critical to protect “recharge” areas, in permeable uplands, where surface water percolates into the ground
- well abandonments must follow County requirements

Solid and Hazardous Waste

- maximize recycling efforts
- reduce illegal dumping of hazardous materials

Air Quality

- the plan encourages land development and transportation planning that aids in achieving standards of the 1990 Clean Air Act
 - higher density development near transit corridors
 - reduction of single occupancy auto usage
 - inclusion of the regional transitway

Noise

The plan avoids locating residential and other sensitive land uses where attenuated noise levels from the roadway are likely to exceed designated limits

Streams and Imperviousness Excerpt from the 2007 Special Protection Area Program

There are a number of studies documenting the effects of imperviousness on stream water quality in Maryland (Klein 1979; May 1998; Boward et al. 1999; M-NCPPC 2000; Fairfax Co 2001; Angermeier et al. 2004; Kazyak et al. 2005). All of these studies found that impervious cover between 5% and 15% produce significant declines in water quality.

The strong relationship between increasing imperviousness levels and declining stream health is also supported in regional and national studies, such as Arnold and Gibbons (1996). There are also indications that highly compacted soils like those typically found on residential lawns and sports fields act similarly to impervious area preventing *infiltration* of precipitation into the ground.

Increasing impervious surface in a watershed affects streams by intercepting rainwater and eliminating the natural functions of the soil. In an undisturbed environment, most rainwater percolates through soil prior to discharging into a stream. The functions of soil and infiltration include: 1) filtering contaminants such as pesticides, road salt, nutrients from fertilizer, and *hydrocarbons* found in oil and grease, 2) cooling water temperature, and 3) slowing the rate of discharge into the stream. Increased levels of impervious surface reduces these functions, and streams typically experience increased temperatures during storms, increased contaminants and sediments in surface water, and wider flow fluctuations during floods and droughts. These changes cause streams to degrade.

One of the most widely used predictors of the effects of imperviousness on water quality in streams is the Impervious Cover Model (ICM) (Fig. 1.4) created by the Center for Watershed Protection (CWP 2003) and updated by the Chesapeake Stormwater Network (CSN 2008). The ICM defines four categories of urban streams based on how much impervious cover exists in their subwatershed: *high quality streams*, *impacted streams*, *non-supporting streams*, and *urban drainage*. The ICM can be used to develop specific quantitative or narrative predictions for stream indicators within each stream category.

These predictions define the severity of stream impacts with respect to changes in stream hydrology, alteration of the stream corridor, stream habitat degradation, declining water quality and loss of aquatic diversity.

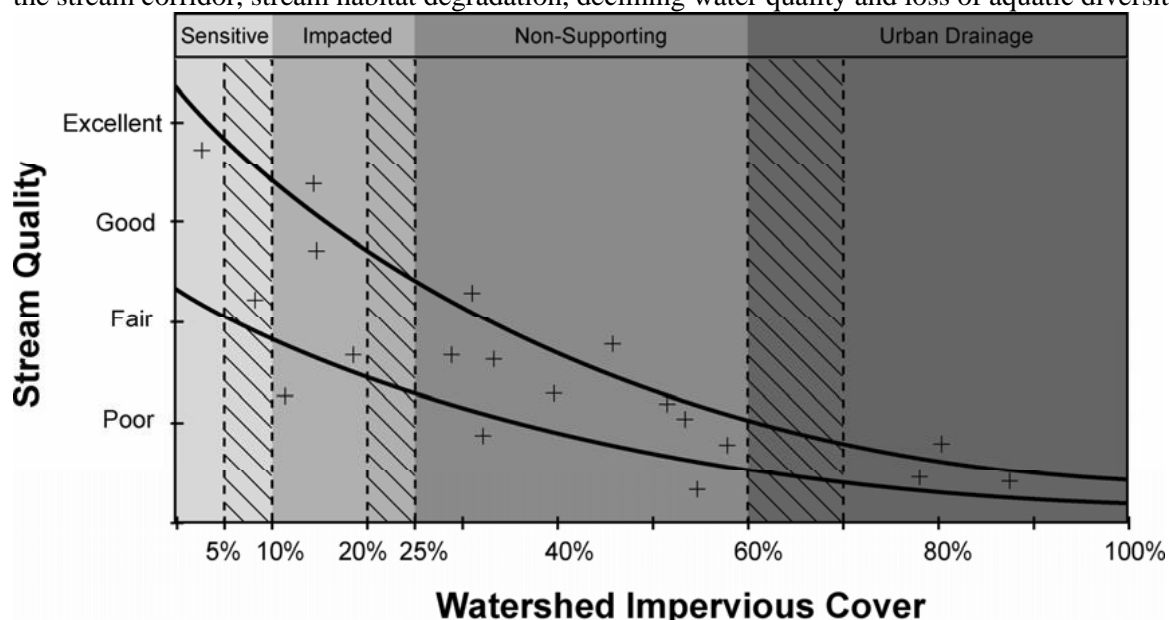


Figure 1.4. The Reformulated Impervious Cover Model

The general predictions of the ICM are as follows:

- Stream segments with less than 10% impervious cover (IC) in their contributing drainage area continue to function as high quality streams, and are generally able to retain their hydrologic function and support *good to excellent* aquatic diversity.
- Stream segments that have 10 to 25% IC in their contributing drainage area behave as impacted streams and show clear signs of declining stream health. Most indicators of stream health will fall in the *fair* range, although some segments may range from *fair to good* as *riparian* cover improves. The decline in stream quality is greatest towards the higher end of the IC range.
- Stream segments that range between 25 and 60% subwatershed impervious cover are classified as non-supporting streams (i.e., no longer supporting their designated uses in terms of hydrology, channel stability habitat, water quality, or biological diversity). These stream segments become so degraded that any future stream restoration or riparian cover improvements are insufficient to fully recover stream function and diversity (i.e., the streams are so dominated by subwatershed IC that they cannot attain pre-development conditions).

The impervious cover of the Newcut Road and Town Center areas is over 25%, classifying those subwatersheds as non-supporting streams according to the ICM. The impervious cover for the Whelan Lane I-3 area in the Stage 4 Ten Mile Creek watershed has a 15% imperviousness cap for each of the two properties. The impervious cover of the MXPD zoned land in the Stage 4 Ten Mile Creek headwaters east of I-270 and west of Frederick Road would be over 25% and classified as non-supporting. The remaining developable land in the Stage 4 Ten Mile Creek area is zoned RE-1/TDR-2 with an estimated 20% to 25% imperviousness cover. This area would be described as impacted/non-supporting according to the ICM.

The ICM has been extensively tested in ecoregions around the United States and elsewhere, with more than 200 different studies confirming the basic model for single stream indicators or groups of stream indicators (CWP 2003). Two recent academic research studies have specifically explored the impervious cover stream quality relationship in *headwater streams* located in Montgomery County. The first, by Goetz et al. (2003), looked at stream quality and detailed subwatershed land cover data for 245 streams in Montgomery County and concluded:

“We found a stream health rating of *excellent* required no more than 6% impervious cover in the watershed and at least 65% tree cover in the *riparian zone*. A rating of good required less than 10% impervious cover and 60% tree cover in the riparian zone.”

The authors also present data that indicate a shift to *poor* stream health occurring when watershed impervious cover exceeded 20% in Montgomery County streams. The second study by Moore and Palmer (2005), investigated 29 urban and agricultural headwater streams in Montgomery County. They found: “*Taxa* richness was related negatively and linearly with the amount of impervious cover” with a pronounced shift to poor richness values at around 20 to 25% subwatershed impervious cover. Considered together, these research studies strongly reinforce the validity of the ICM as it pertains to rural and urbanizing streams within Montgomery County.

The 2003 (MCDEP) update to the Countywide Stream Protection Strategy (CSPS) observed that impervious and highly compacted surfaces covering the landscape affect how much water infiltrates and how much runs off. A regression model developed by DEP, and based solely on available county stream quality and watershed impervious area data, predicts that aquatic insect IBIs (Section 5) decline to the *fair* category when imperviousness exceeds 8%. When imperviousness exceeds 21%, the model predicts that aquatic insect IBIs shift to the *poor* category (Fig. 1.5).

Additional research, such as that being conducted in the SPAs, is needed to assess the extent to which the combined effect of modern stormwater controls, stream buffers, and forest reforestation, can help mitigate the effects of increasing imperviousness and compacted soil conditions in urban and suburban watersheds. The Center for Watershed Protection Study (CWP 2003) further notes that it is premature to presume that SWM controls are of limited value in maintaining biological diversity in small streams. Most SWM control structures studied to date were designed using now obsolete design standards to control certain types of storms, and were not specifically designed to protect stream habitat or to optimize prevention of downstream channel erosion. Forest retention and buffers may also provide benefits that have not been well quantified (CWP 2003).

Few studies have actually followed a small watershed from pre-construction through to the build-out of projects to evaluate the ability of various combinations of SWM controls, along with stream buffers, forest conservation, and other stormwater pollutant controls in mitigating watershed development impacts. As the S&EC BMPs are converted to SWM BMPs in the Clarksburg Special Protection Area, DEP will be able to better quantify how redundant and modern best management practices can help mitigate the effects of imperviousness on the biological communities in our streams. The data to date suggests that although SWM controls and other management techniques like forest buffer can mitigate some impacts to water quality, these techniques cannot prevent stream degradation from increased imperviousness.

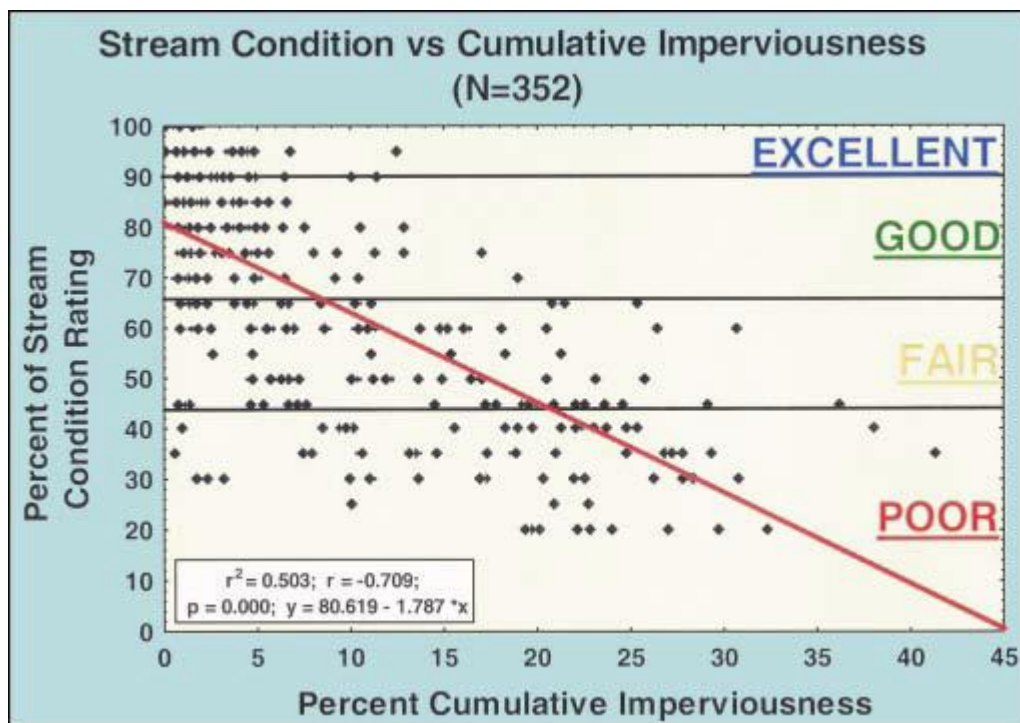


Figure 1.5. Preliminary Relationship Between Imperviousness and Stream Condition Ratings in Montgomery County, MD (MCDEP 2003).

1.6 Development and Imperviousness

There are continuing conflicts between SPA goals for environmentally sensitive developments and other development requirements that sometimes foster increased impervious areas including: Master Plan-designated *transferable development right (TDR)* receiving areas, zoning density, construction sequence, and road grade requirements that require extensive *cut and fill*. These increased development pressures compete with the protection of natural stream systems.

Using an impervious area limit is one of the methods used to minimize the effects of development on natural resources. The Piney Branch SPA and the Clarksburg SPA were created with very limited or no imperviousness cap for new development (in the Clarksburg Master Plan, there is a 15% impervious limit recommended for specific sites on the west side of I-270). As the importance of minimizing imperviousness levels in order to maintain healthy stream conditions became better understood, Upper Paint Branch was designated as an SPA by County Council resolution in 1995 with an accompanying *Environmental Overlay Zone*, adopted in July 1997, that included a 10% impervious cap on new development, as well as restrictions on specific land uses that typically have significant adverse environmental impacts on sensitive natural resources. This Overlay Zone was amended in 2007 to revise the imperviousness limit for new development downwards to 8%.

The Upper Rock Creek SPA was designated as an SPA by the County Council with the approval of the Upper Rock Creek Master Plan by resolution on February 24, 2004. The Environmental Overlay Zone for this SPA was adopted on October 26, 2004, and it designates an 8% imperviousness limit only on private development or subdivisions that are served by community sewer.

1.7 Landscape Changes and Streams

In addition to imperviousness, stream water quality can also be affected by landscape changes. The clearing of vegetation and the surface grading and compaction of native soils for site preparation, road and utility installation alters the original topography and hydrology. The rolling topography like Clarksburg must be flattened to meet maximum slope requirements for roads and the tops of hills are cut and valleys are filled in to create a landscape suitable for development. This process creates major changes to the surface (topography) and, as a result, the surface and subsurface water patterns are permanently altered.

Stream buffers are used to minimize impacts to hydrology; however, the development process allows for cutting and filling up to the limits of disturbance along the stream buffer. This can result in altered hydrology and impacts to local springs and seeps.