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To: Jason Papacosma, Watershed Planner
Arlington County Department of Environmental Services

From: Gregory Hoffmann, P.E., Program Director
Center for Watershed Protection, Inc.

Re: Little Pimmit Run Watershed Retrofit Plan
Final Report

The Center for Watershed Protection, Inc. (CWP) is pleased to present this final report for the Little Pimmit Run Watershed Retrofit Plan. In addition to an explanation of CWP's work on this project, this report includes the following information:

Attachment 1: Stormwater Retrofit Objectives, Specific Goals and Preliminary Screening Rules
Attachment 2: Stormwater Retrofit Drainage Areas
Attachment 3: Example Scoring Sheet, Site Ranking Summary, and Master Spreadsheet
Attachment 4: Photographs, and Field Forms for Each Site.
Attachment 5: Pollutant Removal Values
Attachment 6: Concept Designs

This project included six key aspects, each of which is described further below:

- Office Assessment
- Public Involvement
- Field Work and Compilation of Potential Retrofit Sites
- Development of Ranking Factors
- Treatment Volume and Pollutant Removal Calculations
- Concept Designs

Office Assessment

This project began with an office assessment of potential retrofit sites, based upon procedures outlined in Urban Stormwater Retrofit Practices (Shueler, et. al). The office assessment was guided by the Stormwater Retrofit Objectives and the Specific Goals and Preliminary Screening Rules (Attachment 1), which were developed jointly by CWP and Arlington County.

While these rules were not necessarily strictly adhered to during the field assessment and concept development stage of the project, they were used to determine the suitable sites to visit when reviewing the watershed during the office assessment, and as a general guide in the field.

Public Involvement

Following the office assessment, a public stakeholder meeting was held on November 12, 2008 to introduce the project to the public and collect ideas for additional retrofit locations. The connection between this retrofit project and the stream modeling and culvert replacement underway in the watershed was discussed. Several potential retrofit locations were also identified during the meeting and added to the list of sites to visit.

Field Work and Compilation of Potential Retrofit Sites

Field work was conducted on November 13, and December 1-2, to assess the existing conditions and retrofit suitability of all of the sites highlighted during the office assessment and stakeholder meeting (64 sites).

Of the 64 sites initially identified, 40 showed retrofit potential, based on site visits. At each site where a stormwater retrofit appeared feasible, photographs were taken, and field forms were filled out with the information necessary to develop concept designs. All of the information gathered in the field was then reviewed for accuracy and consistency, and organized into a site catalog. A summary map of all the potential retrofit sites, and their respective drainage areas is included as Attachment 2.

Development of Ranking Factors

Following the compilation of the potential retrofit sites, a scoring system was developed as a means of ranking and prioritizing them. Taking pertinent information from the field forms, points were awarded for each of ten weighted ranking factors, resulting in potential retrofit rankings from 0 - 100. The ten factors include seven “primary” factors, and three “secondary” factors (See Attachment 3).

Primary Ranking Factors

<u>Percent of water quality volume treated</u>

In accordance with the most current version of the Virginia Department of Conservation and Recreation’s bioretention standards and specifications, the water quality volume treated, in most cases is equal to the ponding volume plus the soil storage volume. Ponding volume is calculated as the average surface area x ponding depth. For bioretention areas, a maximum ponding depth of one foot was used.

Ponding Volume = (Top Area + Bottom Area)/2 x Ponding Depth

Soil storage volume is calculated as the total void space volume in the filter material (both the gravel layer and the soil media). A gravel layer depth of 0.75 feet was used, and a maximum filter layer of 2.25 feet was assumed for these calculations. Where head space was limited, the total depth of the filter media was reduced as needed to the minimum depth of 1.5 feet. Void space ratio is 0.4 for the gravel layer, and 0.25 for the soil media.

Soil Storage = Average Surface Area x (Gravel Depth x 0.4 + Soil Media Depth x 0.25)

The water quality volume treated by the retrofit is compared to the water quality volume produced by the site’s contributing drainage area (the volume of runoff produced by a 1” rain event). The percent of the water quality volume treated is then converted to a 0-10 scale score (0% of water quality volume treated = 0 points; 100% (or greater) of water quality volume treated = 10 points), and this score is given a weight of 1.5.

Size of contributing drainage area

The size of the contributing drainage area is credited with 0 acres = 0 points, and 5 acres = 10 points. It is possible, although rare, for a site to earn more than 10 points for this factor, if the contributing drainage area is greater than 5 acres. The score for the contributing drainage area is given a weight of 1.5.

Cost/cubic foot of runoff treated

Scoring for this factor was determined using the general cost data available in Urban Stormwater Retrofit Practices. Costs of greater than $40/cubic foot treated receive a score of 0. Costs between $20 and $40/cubic foot treated are given a score of 5, and costs less than $20/cubic foot treated are given a score of 10. The score is then given a weight of 1.5.

As most of the potential retrofits were bioretention areas, most sites received a score of 10, and differences in scoring for this factor depended mainly upon drainage area, as smaller projects are typically more expensive on a cost/cubic foot treated basis.

Percent impervious cover in contributing drainage area

The percent impervious cover of the contributing drainage area is credited with 0% = 0 points, and 100% = 10 points. The score for impervious cover is given a weight of 1.0.

Property ownership

Since public land is generally easier for installation and maintenance of stormwater retrofits, public land is given a higher score than private land. Private land is given a score of 0; school properties receive a score of 4; road right-of-ways receive a score of 7; and park or government land receive a score of 10. The score for property ownership is given a weight of 1.0.

Potential for quick implementation

Retrofits that have the potential for quick implementation are given a higher score because they can lead to more immediate water quality results, or, in some cases, are time-dependent, and construction plans must be completed quickly. Two types of projects were considered to have potential for quick implementation: 1. Projects that coincide with planned construction in the area, and 2. Projects that have no road cuts, new curbing, or other road changes; include no major structural work (beyond curb cuts, underdrains, and overflows), and are located on public property. These projects are given a score of 10. Projects that do not fit either category are given a score of 0 for this factor. The score for quick implementation potential is given a weight of 1.0.

County maintenance burden

Potential retrofits that are expected to have a high maintenance burden for Arlington County are given a lower score for this factor. High maintenance burden projects include those that are located in a road right-of-way or include high pervious cover in their contributing drainage area with potential for significant leaf accumulation. These projects are given a score of 0. Retrofits in parks are considered to have a medium maintenance burden and are given a score of 5. Retrofits on school properties or private land are considered to have a low maintenance burden for Arlington County, and are given a score of 10. The score for County maintenance burden is given a weight of 1.0.

Secondary Ranking Factors

Potential utility or site constraints
As certain site constraints can greatly affect retrofit construction, potential retrofits with an identifiable site constraint, including existing utilities, busy roads, difficult slopes, or the need for significant excavation were given a score of 0, and sites without any identifiable constraints were given a score of 10. The score for the utility or site constraint factor is given a weight of 0.5.

Treatment of an existing drainage problem
Occasionally, potential retrofit sites are located where a drainage problem already exists, and the retrofit will help solve the problem. Projects that will address an existing drainage problem receive a score of 10, while projects that do not receive a score of 0. This factor is given a weight of 0.5.

Educational opportunity
Potential retrofits that represent good educational opportunities are given a higher score for this factor. Retrofits that can include educational signage receive a score of 5, retrofits in parks receive a score of 8, and retrofits at schools receive a score of 10. This factor is given a weight of 0.5.

An example scoring sheet that includes all of the screening factors as well as a summary of each site's score and rank and the "master spreadsheet," that contains all of the scoring calculations for each potential retrofit is included in Attachment 3. Attachment 4 contains a compilation of photographs, scoring sheets, and field forms for each of the potential retrofit sites visited in the field.

Treatment Volume and Pollutant Removal Calculations
Once all of the potential retrofit sites were compiled, calculations were made regarding the treatment volume and pollutant removal benefits provided by the retrofits, individually, and in aggregate. Considered all together, the retrofits will treat approximately 9% of the land area in the west branch (11.4% of the impervious area) of the Little Pimmit Run watershed, and 5% of the land area in the east branch (5.2% of the impervious area). CWP calculated the treatment volume numbers for each potential retrofit, including both ponding storage and soil storage, as described above. These values were then used by VHB in their efforts to model stormwater runoff in the watershed and flow depths in Little Pimmit Run.

CWP also used the data gathered for each potential retrofit to estimate the average annual pollutant removal benefits that could be achieved by each retrofit. CWP followed the same procedures for pollutant removal calculation as are used in the current draft of the State of Virginia stormwater regulations. Using an average annual rainfall of 43 inches, and an event mean pollutant concentration of 0.26 mg/L for phosphorous and 2.67 mg/L for nitrogen, the pollutant load for each contributing drainage area was calculated. Pollutant removal values for bioretention areas and other practices from CWP's Runoff Reduction Method were then applied to calculate the expected annual phosphorous and nitrogen removal benefits for each of these potential retrofits.

For projects that did not treat the entire water quality volume, adjustments were made to calculate pollutant removal figures for these smaller practices, using an analysis of rainfall data to correlate the volume treated by the retrofit to the corresponding % of annual rainfall. A practice that treats the entire water quality volume, or 1" of rainfall, will treat 90% of the rain events. Correspondingly, a practice that treats 0.6" of rainfall, for example, would treat 67.7% of the rain events. It is then assumed that the pollutant removal credit should be adjusted in this case to 75% of the published value: 67.7% / 90% = 75%. See Table 1 below for more examples.

Table 1. Weighting Factor based on rainfall depth treated		
Rainfall Depth Treated (in)	%Annual Rainfall	Pollutant Removal Credit Adjustment (%) = %Annual Rainfall/90%
1.0	90%	100
0.8	79.2%	88
0.6	67.7%	75
0.4	50.9%	57
0.2	22.4%	25

Attachment 5 includes annual pollutant removal values for all of the potential retrofits.

Given that the potential retrofits will treat only 9% of the west branch and 5 % of the east branch, phosphorous and nitrogen removal at the watershed scale is somewhat limited. The potential retrofits will reduce phosphorous and nitrogen loads in the watershed by about 4%. Other pollutants, including petroleum products and metals, are expected to be reduced by similar proportions.

The storage volume provided by the 40 retrofits (including both ponding storage and soil storage) totals 146,500 cubic feet, or 3.4 acre-feet.

For the storm events modeled in the Little Pimmit Run stream corridor study by Vanasse Hangen, Brustlin, Inc. (VHB), peak flow reductions from the potential retrofits range from 0% to 5% along the corridor. The maximum peak flow reduction is 5% for the June 2009 event at County line. Overall stormwater volume reductions relative to 2008 watershed conditions are -1% for the June 2006 event, -2% for the September 2008 event, and -5% for the June 2009 event.

Concept Designs

Development of concept designs was the final step of the Little Pimmit Watershed Retrofit Plan. Seven of the top fifteen potential retrofits were selected for further concept development. After ranking was complete it became clear that land ownership was one of the most important factors in determining which projects can most quickly proceed to construction , therefore the top County-owned projects were selected, rather than simply the projects ranked highest overall. The concepts are included in Attachment 6. For each concept, aspects of the design were fleshed out, with both existing and proposed conditions described in detail. The concept designs also included a hand-drawn diagram to further illustrate the retrofit, where appropriate. Since many of the proposed retrofits were curb extension bioretention areas in the parking lane of wider roads, a standard detail for these retrofits was developed. Appendices describing the suggested filter media, plant selection, and maintenance plans were also provided.

With submittal of this final report, CWP has completed the Little Pimmit Run Watershed Retrofit Plan. However, should it be necessary, CWP is available to assist with any of these retrofit projects as Arlington County moves from planning to implementation.

References

Schueler, T., Hirschman, D., Novotney, M., and J. Zielinski. 2007. *Urban Stormwater Retrofit Practices Version 1.0*. Center for Watershed Protection. Ellicott City, MD.

Attachment 1:
Stormwater Retrofit Objectives, Specific Goals and Preliminary Screening Rules

Attachment 2:
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Attachment 5:
Pollutant Removal Values

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