CHAPTER 8

WATER QUALITY
BEST MANAGEMENT PRACTICES

8.2 Water Quality Performance Criteria

Total suspended solids (TSS) is a key pollutant associated with sediment. It also serves as a "carrier" of other pollutants such as organics and metals, and is often used as a key parameter for sizing BMPs for protecting water quality. Therefore, control of TSS may be used as a surrogate for the most important pollutants that need to be controlled in order to meet the designated use and water quality standards in the stream.

The City has developed a TSS performance criterion for new development to minimize additional impacts to the city's watersheds. This criterion represents a TSS loading rate from a developed site of 850 lb/ac/yr as computed using the protocol in the tool described below.

8.2.1 Performance Criterion Tool

An automated spreadsheet tool was developed to facilitate evaluation of developments in accordance with the TSS performance criterion (Figure 8.2.1-1). The tool was developed with the strategy of providing disincentives for installation of impervious surfaces, and incentives for leaving key areas (particularly riparian buffers) undisturbed.

The review protocol identifies four distinct types of land area on each site:

- **Impervious Area** –e. g., driveways, rooftops, parking lots, roads, sidewalks, etc.
- **Disturbed Pervious Area** – e.g., lawns, gardens, landscaped areas, any area that was cleared, grubbed or graded. Porous pavement will be treated as a land use BMP and should be included in the disturbed pervious areas.
- **Undisturbed Upland Area** –e.g., upland woods, meadows, and other areas not cleared, grubbed or graded.
- **Undisturbed Stream Buffers** – e.g., undisturbed riparian buffers contiguous to streams, lakes, and wetlands. Undisturbed buffers are areas that are not cleared, grubbed, or graded. The area of land that can be used as a stream buffer to receive credit for TSS removal rates (see Table 8.2.1-1) is limited to the larger of 1) the stream buffer as determined by any state, city, or other regulation/ordinance or 2) the 100 year floodplain.

The tool estimates TSS loadings commensurate with potential contributions from land types (Table 8.2.1-1). The sum of the products of the areas and their corresponding TSS loading rates represent the total load from the site that is not managed or routed through a BMP. The approach is simple to use and

encourages site design that takes advantage of the natural site amenities and minimizes impervious surfaces.

Table 8.2.1-1 Land Use Types and Their Respective TSS Removal Rates

Land Type	TSS Rate (lb/ac/yr)
Impervious Area (driveways, rooftops, parking lots, etc)	4000
Disturbed Pervious Area (lawns, garden, porous pavement, etc)	1200
Undisturbed Upland Area (woods, preserves, etc)	500
Undisturbed Stream Buffers	125

The computerized spreadsheet form automatically calculates and graphs the loading value, and provides options for implementing BMPs on the site and designating the tributary drainage area to each BMP. BMPs available in the spreadsheet tool and the respective TSS removal efficiencies are listed in Table 8.2.1-2. The form compares loading rates that are managed with and without BMPs to the TSS criterion. This tool can be used iteratively in the site design process.

Instructions for using the automated spreadsheet tool are attached to this document and the electronic copy of the tool is available on the website. The address to the website is: http://www.gcwshed.org/SQPRF-4000.xls. When opening the tool from the website, the user should enable all macros (click "YES" when prompted by Microsoft Excel.

Table 8.2.1-2 BMPs and Their Respective TSS Removal Efficiencies

BMP	TSS Removal (%)
Wet and Dry Extended Detention Pond	80
Dry Detention Pond	50
Constructed Wetland	80
Vegetated Filter Strips	50
Sand Filters	80
Infiltration Trenches	80
Oil/Grit Separator	60
Grassed Swales (2% slope. Dam)	15

Figure 8.2.1-1
Storm Water Quality Performance Review Form

***DRAFT* Gwinnett County Department of Public Utilities**

Stormwater Quality Performance Review Form

Name of Developer:	John Johnson	Name of Engineer:	Joe Black, PE
Development Name:	Spring Trails	Tracking #:	12345
Development Type:	Single Family Residential	Date Submitted:	12/12/2000
Area of Development (ac):	40.00		

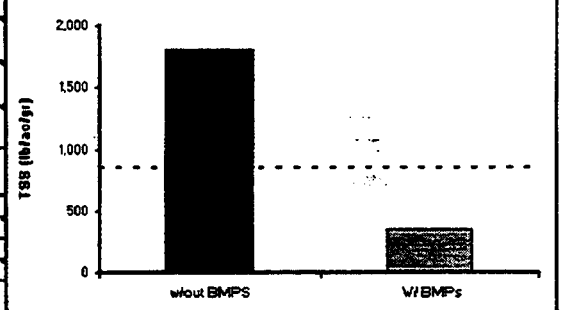
BMP Distribution | BMP Efficiencies

Land Use Distribution & Pollutant Loads:

Land Use Category	Area (acres)	TSS Rate (lb/ac/yr)	Avg Annual TSS Load (lbs)
Impervious Area (driveways, rooftops, parkinglots,etc)	10.00	4,000	40,000
Disturbed Pervious Area (lawns, gardens, porous pavement, etc)	25.00	1,200	30,000
Undisturbed Upland Area (woods, preserves, etc)	5.00	500	2,500
Undisturbed Stream Buffers	0.00	125	0
Totals	**40.00**		**72,500**

TSS Loading Rate w/out BMPs (lb/ac/yr):	1,813
TSS Loading Rate w/ BMPs (lb/ac/yr) :	352
TSS Criterion for New Development(lb/ac/yr):	850

LEGEND FOR GRAPH:
- TSS Load W/out BMPs
- TSS Load W/BMPs
- TSS Criterion for New Development



Reviewed By:	Phil Wright, PE
Date Approved:	02/12/2001
Conditions of Approval:	

BMPs Chosen:

- ☑ Extended Detention Pond (Wet/Dry)
- ☐ Dry Detention Pond
- ☑ Constructed Wetland
- ☐ Sand Filters
- ☐ Vegetated Filter Strips
- ☐ Infiltration Trenches
- ☑ Grassed Swales (2% slope, dam)
- ☐ Oil/Grit Separator

8.2.2 Draft Storm Water Quality Performance Review Form – Instruction Guide

8.2.2.1 Main Form

The Main form has 4 sections that are discussed in detail below (see Figure 8.2.2.1-1).

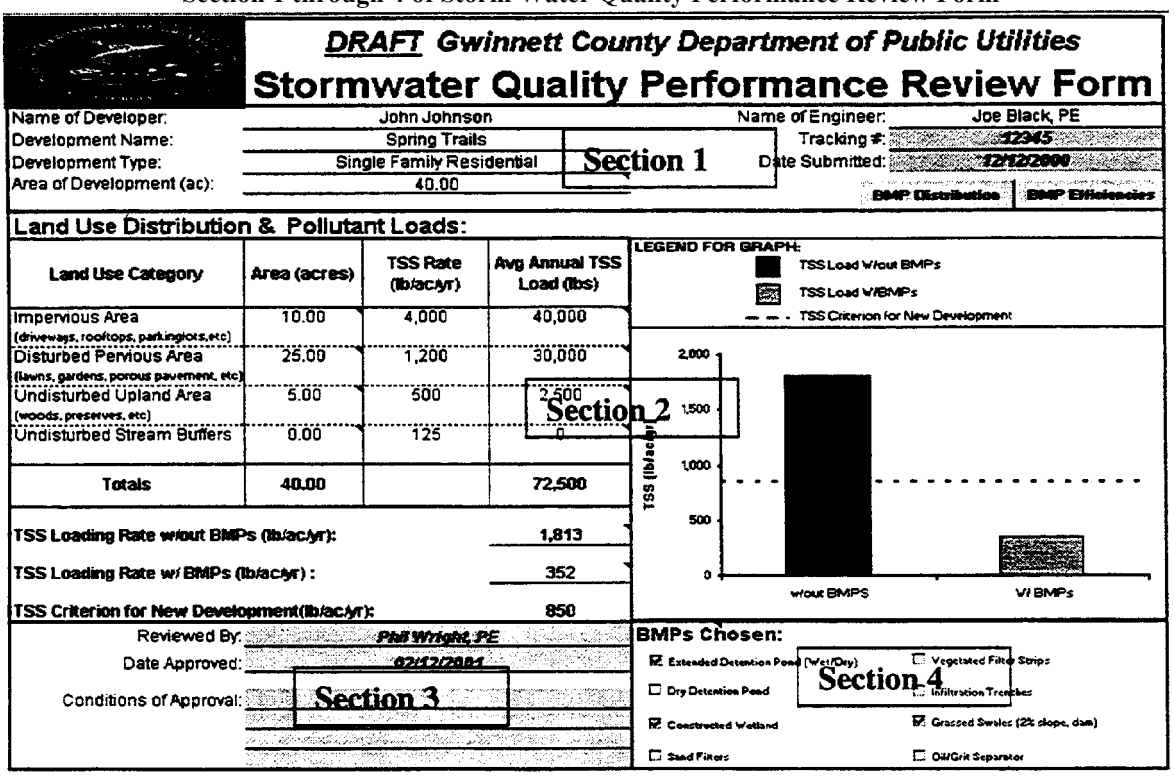
1) The first section requires user to fill out general information of the site. Inputs include: Name of Developer, Name of Development, Type of Development, Area of Development, and Name of Engineer.

2) The second section consists of the Land Use Distribution and Pollutant Loads. It is a summary of information from the different drainage areas in the BMP Distribution Component. Each computed cell in this section has popup notes that enable the user to understand the processing of data. This component provides a summary of the TSS loading rates (with and without BMPs) produced by the site. It then generates a graph to compare the two TSS loading rates with the New Development Criterion.

3) The third section functions as a tool to track the review process for all new developments.

4) The fourth section of the Main Form is a summary of all the different BMPs chosen for the given site. It summarizes the BMP information by drainage area from the BMP Distribution Sheet and displays them.

Figure 8.2.2.1-1
Section 1 through 4 of Storm Water Quality Performance Review Form



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Stormwater Quality Performance Review Form

Name of Developer:	John Johnson	Name of Engineer:	Joe Black, PE
Development Name:	Spring Trails	Tracking #:	12345
Development Type:	Single Family Residential	Date Submitted:	12/12/2000
Area of Development (ac):	40.00		

Section 1

BMP Distribution | BMP Efficiencies

Land Use Distribution & Pollutant Loads:

Land Use Category	Area (acres)	TSS Rate (lb/ac/yr)	Avg Annual TSS Load (lbs)
Impervious Area (driveways, rooftops, parkinglots, etc)	10.00	4,000	40,000
Disturbed Pervious Area (lawns, gardens, porous pavement, etc)	25.00	1,200	30,000
Undisturbed Upland Area (woods, preserves, etc)	5.00	500	2,500
Undisturbed Stream Buffers	0.00	125	0
Totals	**40.00**		**72,500**

Section 2

TSS Loading Rate w/out BMPs (lb/ac/yr):	1,813
TSS Loading Rate w/ BMPs (lb/ac/yr) :	352
TSS Criterion for New Development(lb/ac/yr):	850

LEGEND FOR GRAPH:
TSS Load W/out BMPs
TSS Load W/BMPs
TSS Criterion for New Development

Reviewed By: Phil Wright, PE
Date Approved: 02/12/2001
Conditions of Approval:

Section 3

BMPs Chosen:
- [x] Extended Detention Pond (Wet/Dry)
- [ ] Dry Detention Pond
- [x] Constructed Wetland
- [ ] Sand Filters
- [ ] Vegetated Filter Strips
- [ ] Infiltration Trenches
- [x] Grassed Swales (2% slope, dam)
- [ ] Oil/Grit Separator

Section 4

8.2.2.2 BMP Distribution

In most developments, it is not physically possible to treat the entire site with one BMP. The BMP Distribution Component aids in dividing up the development into several different drainage areas (Figure 8.2.2.2-1). For example, a particular development of 40 acres may have 30 acres treated by a constructed wetland while 10 acres treated by grassed swales. The reduction efficiencies for the two BMPs are different (80% and 15% respectively). Hence the two areas should be entered into the BMP Distribution Component as Drainage Area 1 (30 acres) and Drainage Area 2 (10 acres), the BMPs in each drainage area should be chosen in the BMP Matrix section. The tool then computes the TSS loading rates for each drainage area. A weighted average is then computed to five an overall post treatment loading rate for the development and presented in the Main Form Component of this tool. Currently the BMP Distribution Component allows a particular development to be split into 20 drainage areas. There are three sections in the BMP Distribution Component (see Figure 8.2.2.2-1).

Figure 8.2.2.2-1
Sections 1 through 3 of the BMP Distribution Component of the Storm Water Quality Performance Review Form.

Drainage Area 2			BMP MATRIX	
	Section 1		BMP 1	Constructed Wetland (80%)
Area (acres)	Enter Impervious Area:	3.00	Section 2	
	Enter Disturbed Pervious Area:	5.00	BMP 2	Grassed Swales (2% slope,dam) (15%
	Enter Undisturbed Pervious Area:	2.00		
	Enter Undisturbed Pervious Buffer Area:			
	Total Area	10.00		
Pollutant Loads			BMP 3	None
	TSS Load w/out BMP (lbs)	19,000		
	TSS Loading Rate w/out BMP (lb/ac/yr)	1,900		
	TSS Load w/ BMP (lbs)	3,686	BMP 4	None
	TSS Loading Rate w/ BMP (lb/ac/yr)	369		
Section 3			BMP 5	None

The BMP distribution component of the tool has 3 main sections that are discussed in detail below.

1) Section 1 requires the user to input the different land area types within a given drainage area. Figure 8.2.2.2-1 provides an example for Drainage Area 2.

2) Section 2 is the BMP Matrix. The drop down menus in the BMP Matrix present the types of BMPs and their removal efficiencies. This section requires the user to input the BMP that treats the given drainage area. The BMP Matrix allows the user to pick multiple combinations of BMPs or BMPs in sequence, i.e. if 10 acres of a given site are drained by a Constructed Wetland which in turn is drained by Grassed Swales, the 10 acres are being treated by a combination of two BMPs. The user should indicate this scenario by picking the Constructed Wetland as BMP1 and the Grassed Swales as BMP2 in the BMP Matrix. However, one should note that if this scenario arises, the removal efficiency of the second BMP will be lower than its highest potential (i.e. the efficiency listed in the BMP Efficiency Component). The reason for the reduction is that most of the heavy (easily removed) solid matter will be reduced by the first BMP, and the smaller particles (which are much harder to treat) will be treated by the second BMP. These smaller particles would reduce the potential of the BMP to remove TSS at its utmost efficiency.

When BMPs are in a series, the equation used to estimate the removal efficiency of the second BMP is as follows:

Example Site: 10 acres drained by a Constructed Wetland followed by Grassed Swales

BMP1:	Constructed Wetland	Removal Efficiency:	80%
BMP2:	Grassed Swales	Removal Efficiency:	15%

Adjusted removal efficiency for BMP2:
= Removal Efficiency BMP2 X (1 – Removal Efficiency BMP1)
= 15% X (1 – 80%)
= 3%

Another important note to keep in mind when the scenario of BMPs in series arises is that the tool recognizes the BMP w/ the highest removal efficiency as the first in series For example, there are 10 acres in a site being treated in the following order:

BMP1:	Grassed Swales	Removal Efficiency:	15%
BMP2:	Constructed Wetland	Removal Efficiency:	80%
BMP3:	Vegetated Filter Strip	Removal Efficiency:	50%

The tool recognizes the sequence in the following order:

BMP1:	Constructed Wetland	Removal Efficiency:	80%
BMP2;	Vegetated Filter Strip	Removal Efficiency:	50%
BMP3:	Grassed Swales	Removal Efficiency:	15%

The adjusted removal efficiencies can be estimated as follows:

Adjusted removal efficiency for BMP2 (Vegetated Filter Strip):

= Removal Efficiency BMP2 X (1 – Removal Efficiency BMP1)
= 50% X (1 – 80%)
= 10%

Adjusted removal efficiency for BMP3 (Grassed Swales):

= Removal Efficiency BMP3 X [1 – (Removal Efficiency BMP1 + Adjusted Removal Efficiency BMP3)]
= 50% X [1- (80% + 10%)]
= 1.5 %

3) Section 3 summarizes the TSS loading rates (with and without BMPs) for the drainage area. Popup notes are inserted in each cell to inform the user about the equations being used.

8.2.2.3 BMP Efficiencies

The last component of the tool lists the types of BMPs that can be used for the New Development Review Protocol. It presents the BMP reduction efficiencies for TSS for each BMP type (see Table 8.2.1-2). It has links to the literature used in developing the removal effectiveness for each of the BMP types in this study.

END OF SECTION 8.2