Appendix 3:
Analysis Of The Proposed Stormwater Standard For Sites In Bradfordville

The proposed standard requires that the volume of runoff calculated as 4.0 inches times the total impervious area of a site be retained onsite with full recovery within 72 hours. This standard presents a challenge to the engineers to develop methods to comply with this requirement. The most important challenge is to determine how to recover the required volume in 72 hours, since historically, the soils in the Bradfordville area have lower percolation rates in comparison to sandy soils located in the southern portion of the county.

Staff believes that the best way to accomplish this recovery is by designing shallow stormwater ponds between 12 inches to 24 inches below the existing natural ground. In general, percolation rates in the shallow soils are better. Staff contracted with Alpha Geotechnical and Testing Services to perform double ring stabilized percolation tests and borings in three different soil types within the proposed commercial areas in Bradfordville to determine whether the proposed standard would provide limitations on the allowable impervious area. The lowest infiltration test in existing (non-excavated) soils from 12 inches to 18 inches deep was 0.35 inches/hour.

The data from the testing was used on a simulated 1 acre site plan with grades similar to those in the Bradfordville corners area (see attached summary). It was assumed that an 8500 sf commercial building would be placed on site with the necessary infrastructure, parking, sidewalks, interconnection, dumpster, and loading zone for a maximum impervious area of 40%. The site was designed with 25% natural area. The remaining 33% of the site, typically used for landscaping and stormwater, was assumed to all be available for stormwater percolation to meet the 4" retention standard proposed, since the proposed standard allows landscape credit for shallow stormwater facilities.

The retention design was considered two ways. The first design assumed the 4" retention volume was stored in the landscaped portion of the site and a factor of safety of 2 was applied. This showed that the 4 inches could be recovered in 27.5 hours which is much less than the required 72 hours. The second consideration was to determine the smallest amount of area for percolation. With a factor of safety of 2, and the required retention volume being recovered in 72 hours, only 13% of the site would be required for the percolation area. This analysis shows that up to 40% impervious can be designed on a site and meet the proposed standard.

Although the infiltration tests had results from 0.35 in/hour to 3.1 in/hour, if the 4" retention volume was spread over the area available(33%), then a percolation rate of 0.067 in/hour would be needed to recover this volume within 72 hours. As with any good design some factor of safety would need to be assumed making the rate higher.

Accomplishing the stormwater design standard on some sites may require creative stormwater design and site layout which may cost additional money. The steeper sites may have to terrace the stormwater for cascading ponds. However, several options are available that have not been utilized on the site such as irrigation, pervious pavement, site design alternative, over excavation with backfill, and over retention for similar results. Additional testing was being performed by a Consultant in soils three feet deep in other areas within Bradfordville. We are awaiting the results of these studies to further support this analysis.

June 1, 2000 Bradfordville Site Analysis

The following analysis assumes a Commercial Site on one acre which equals 43,560 square feet (sf).
Parking was calculated at 1 space per 1000 sf of building area for a total of 8 parking spaces and 1 handicap space.
The building size was estimated at 8,500 sf per acre.
The total impervious area was assumed to be 40%, including building, parking, drive aisles and sidewalks.
Natural area and landscaping was included as required by code.

The following summarizes a typical site layout. Each site will be different depending on its unique site conditions.

Impervious Area:				
	Building	8500 sf		20%
	Parking	1710 sf		4%
	Drive Aisles	5166 sf		12%
	Loading/Dumpster	388 sf		1%
	Sidewalks	1660 sf		4%
	Total Impervious area:		17424 sf	40%
Natural Area			10890 sf	25%
Interior Landscape Islands			800 sf	2%
Area left for stormwater pond / landscape			14447 sf	33%
	Total area		43560 sf	100%

Assume 25% for Stormwater facility / percolation
10890 sf Area for Stormwater facility / percolation

Assume Pecolation within 18" of surface with safety factor
5807.83 cf required for retention (17,424 sf impervious area x 4 inches/12 inches/foot)
6.40 inches Pond Depth required for Retention Volume (5808 cf required/10890 sf area x 12 inches/foot)

0.09 in/hr (Inches per hour) Percolation required within 12" of the surface
0.35 in/hr Lowest measured stabilized double ring infiltration test
0.23 in/hr Apply a factor of safety of 1.5
0.18 in/hr Or Apply a factor of safety of 2

*** Based on the above percolation rate, the 40% impervious site could be designed with a shallow stormwater pond footprint of 13% of the site or 5,808 sf with a 12 inch pond depth.**