Retention Method Discussion
Community Development Department
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Major Development and *Major Redevelopment* projects will have significant impact on stormwater runoff patterns and water quality. *Major Development* projects must provide facilities for the entire site. *Major Redevelopment* projects must provide facilities for the disturbed and any increased impervious area. The Retention Method includes both the flood attenuation and water quality management.

To use the Retention Method, please complete the Retention Method Worksheet in order to determine the two options for meeting requirements for your project. The calculations need to be submitted with your application. Additionally, you must include on your site plan the location of the required facility with the volume information.

Option 1 – Full Retention with No Discharge

A pond with full retention with no discharge is designed to retain all of the runoff from the site. This often creates a somewhat permanent pool of water depending on the amount of runoff and the time between storms. Figure 13-2 shows the required retention volume based on lot size and amount of impervious area for a retention pond that does not have an outlet.

Option 2 – Retention with Discharge

A pond with a combination of retention and detention is designed to retain the runoff that exceeds the pre-developed amount and detain, or release slowly at the pre-developed rates, the remainder. Figures 13-3 and 13-4 show the required volumes based on lot size and amount of impervious area for a retention pond that has an outlet. Figure 13-5 shows the width of the outlet weir depending upon the depth of the detention portion of the pond.

The Retention Method is based on the following assumptions:

1) All runoff calculations are based on impervious area and total lot size.
2) Stormwater flows are not separated into multiple downstream drainage basins.
3) The stormwater retention volume requirement is based on 1.5 times the volume of runoff generated by a 24-hour, 100-year storm event using Type II (clay loam) soils.
4) The stormwater detention volume requirements are based on the Equation Detention Method (Table 13-1) for Type II (clay loam) soils.

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5) The 60% phosphorus removal can be achieved by the retention of the runoff.

The construction of a swimming pool may or may not increase the effective impervious area on a site. If the pool is covered in such a way that it sheds runoff, the pool acts as if it was a new impervious surface and will increase the runoff from the site. If the pool is not covered, it will reduce runoff from the site. Because of the variation in the design of pool covers and the likelihood that a pool cover will be replaced with a different design sometime during the life of the pool, it is impractical to assign a specific permanent impervious area to a pool. Therefore, it shall be assumed that the surface area of the pool will not create a change in the impervious area for the site. However, the impervious area created by the pool deck area shall be considered as new impervious area for the site.

(clarification added by PMB on 1/7/08)

Retention Plan Worksheet
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(A)   Lot Size =   (A) _____ ft^2

(B)   Existing Impervious (Paved or Roofed) Area =   (B) _____ ft^2

(C)   Removed Impervious Area =   (C) _____ ft^2

(D)   Proposed (New) Impervious Area =   (D) _____ ft^2

(E)   Increased Impervious Area: (D) – (C) =   (E) _____ ft^2

(F)   Total Impervious Area: (B) + (E) =   (F) _____ ft^2

(G)   Total Impervious Area Divided by Lot Size: 100 x (F) / (A) =   (G) _____ %

Option 1 - Full Retention with No Discharge*

(H)   Full Retention Volume with No Discharge (G): _____% =   (H) _____ ft^3
      (Based on Figure 13-2)

Option 2 - Retention with Discharge**

(I)   Retention Volume with Discharge (G): _____% =   (I) _____ ft^3
      (Based on the attached Figure 13-3)

(J)   Detention Volume for Total Impervious Area (G): _____% =   (J) _____ ft^3
      (Based on the attached Figure 13-4)

(K)   Weir Width for Detention Volume =   (K) _____ in.
      (Based on attached Figure 13-5)

(L)   Total Volume of Retention and Detention: (I) + (J) =   (L) _____ ft^3

*   This section gives the volume of a pond that does not have a discharge and retains all of the
     runoff from the site.

**   This section gives the volume of a pond that combines detention with retention. This option
     reduces the size of the facility and the potential amount of long-term stored runoff.

Retention Volume (cubic feet) (y-axis)

Lot Size (square feet) (x-axis)

Legend:
- 60% Impervious Area
- 50% Impervious Area
- 40% Impervious Area
- 30% Impervious Area
- 20% Impervious Area
- 10% Impervious Area
- 5% Impervious Area
- 2.5% and Less Impervious Area

Greenwood Village
October 2003

24-Hour Storms Fig 13-2 to Fig 13-5 - Figure 13-2

Figure 13-2
Retention Method - Full Retention with No Discharge

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Figure 13-3
Retention Method - Retention Volume with Discharge

24-Hour Storms Fig 13-2 to Fig 13-5 - Figure 13-3

Figure 13-4

Retention plus Detention Method - Detention Volume

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24-Hour Storms Fig 13-2 to Fig 13-5 - Figure 13-4

Figure 13-5
Retention Method - Detention Weir Sizing

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24-Hour Storms Fig 13-2 to Fig 13-5 - Figure 13-5 Orifice