The 90th Percentile Volume

Why the 90th?

"Maximized" Water Quality Capture Volume

Guo & Urbonas

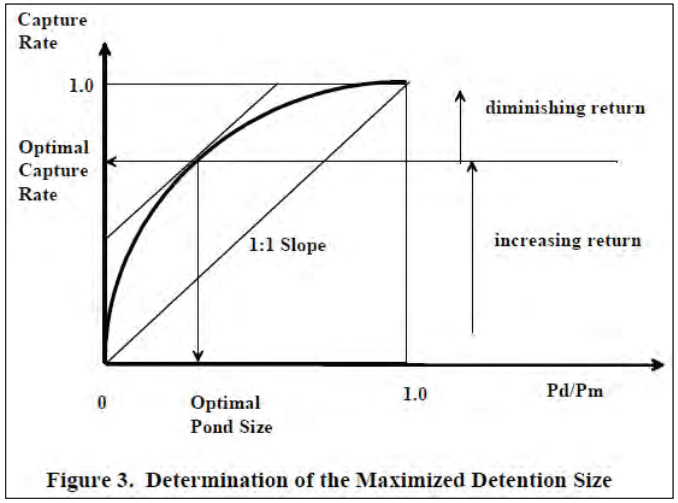
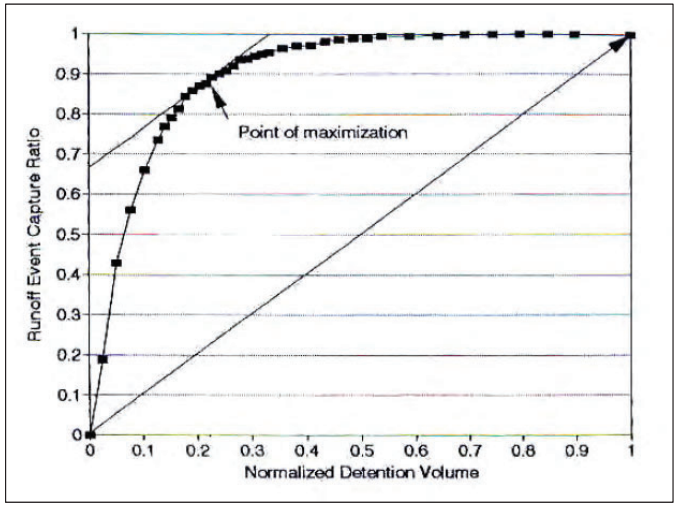


Figure 3. Determination of the Maximized Detention Size



The 90th Percentile Volume

How to Calculate

V_{goal} = 90th Percentile Volume

$V_{goal} = R_V dA$

Step 1	Determine the 90th Percentile Precipitation Depth	→	**d**
Step 2	Determine the project's imperviousness.	→	**imp & A**
Step 3	Volumetric Runoff Coefficient	→	R_V
Step 4	Determine 90th Percentile Volume	→	V_{goal}

The 90th Percentile Volume

Step 1 **Determine the 90th Percentile Precipitation Depth, d**

Obtain long-term reliable rainfall data.

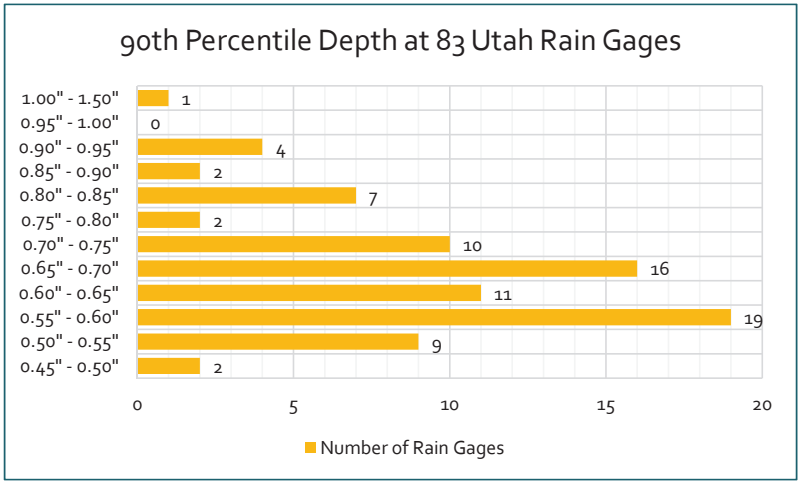
1. Active rain gage
2. 30 years of data
3. 90% data coverage

Rainfall data sources

Daily rainfall summaries

Other sources that meet criteria

Usually between 0.50" and 0.85"



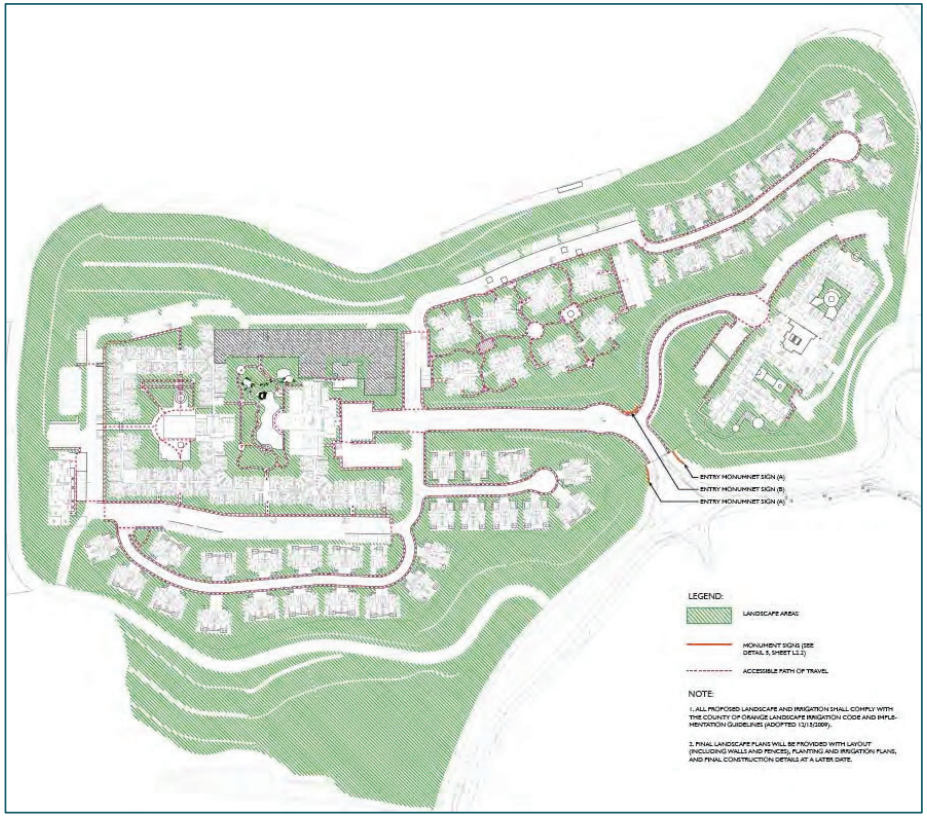
Appendix A

STATION	NAME	LATITUDE	LONGITUDE	ELEVATION (FT)	90TH PERCENTILE DEPTH (IN)
USC00420074	ALTAMONT, UT US	40.3670	-110.2986	6456	0.53
USC00420086	ALTON, UT US	37.4402	-112.4819	7098	0.81
USC00420168	ANGLE, UT US	38.2486	-111.9608	6410	0.53
USC00420336	ARCHES NATIONAL PARK HQS, UT US	38.6163	-109.6191	4093	0.56
USC00420527	BEAVER CANYON POWER HOUSE, UT US	38.2682	-112.4818	7275	0.74
USS0011J46S	BEAVER DIVIDE, UT US	40.6100	-111.1000	8280	0.70
USS0011H08S	BEN LOMOND PEAK, UT US	41.3800	-111.9400	8000	1.50
USS0012L07S	BIG FLAT, UT US	38.3000	-112.3600	10349	0.90

The 90th Percentile Volume

Step 2 **Determine the Project's Imperviousness**

$$\text{Imperviousness} = \frac{\text{Impervious Area within Project Limits}}{\text{Total Project Area}}$$



The 90th Percentile Volume

Step 3 **Determine the Volumetric Runoff Coefficient, R_V**

What is R_V?

$$R_V = \frac{\text{Monitored Runoff Volume}}{\text{Total Precipitation Volume}}$$

- Not the same as the Rational Method C
- R_V is more appropriate for smaller, more frequent storms
- Typically smaller values than C

Methods Used in the Manual

Method 1 – Reese
Applicable for urban development
$R_V = 0.91 \times imp - 0.0204$

Method 2 – Hydrologic Soil Groups
$R_{V\text{-}A} = 0.84 \times imp^{1.302}$
$R_{V\text{-}B} = 0.84 \times imp^{1.169}$
$R_{V\text{-}C/D} = 0.83 \times imp^{1.122}$

Method 3 – Granato Method
Applicable for highways
$R_V = 0.225 \times imp + 0.05$; when $imp < 0.55$
$R_V = 1.14 \times imp - 0.371$; when $imp \geq 0.55$

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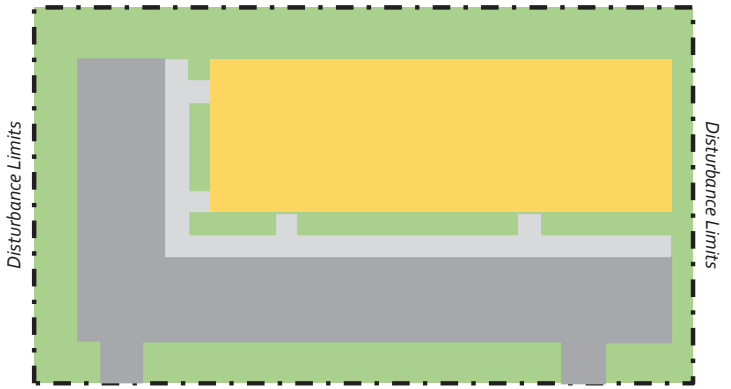
Step 3	Volumetric Runoff Coefficient	→	**R_V**
Step 4	Determine 90th Percentile Volume	→	**V_{goal}**

The 90th Percentile Volume

V_{goal} vs Water Quality Volume (WQV)

V_{goal}



V_{goal} calculated from:

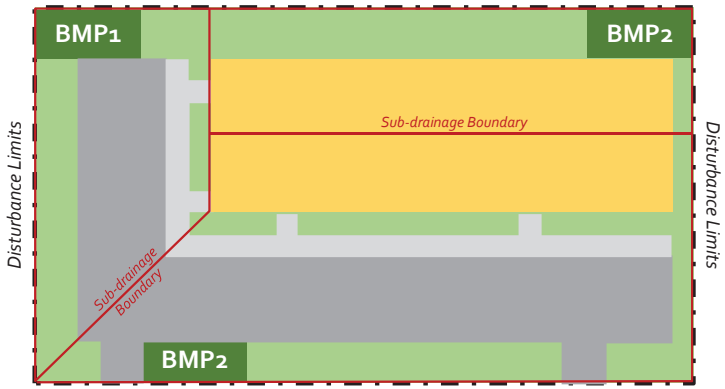
Project disturbance limits

Project imperviousness

90th Percentile Storm Depth

$V_{goal} = R_V dA$

WQV



WQV calculated from:

BMP's drainage area

Imperviousness of BMP's drainage area

90th Percentile Storm Depth

$WQV = R_V dA$

$$V_{goal} = \sum WQV$$