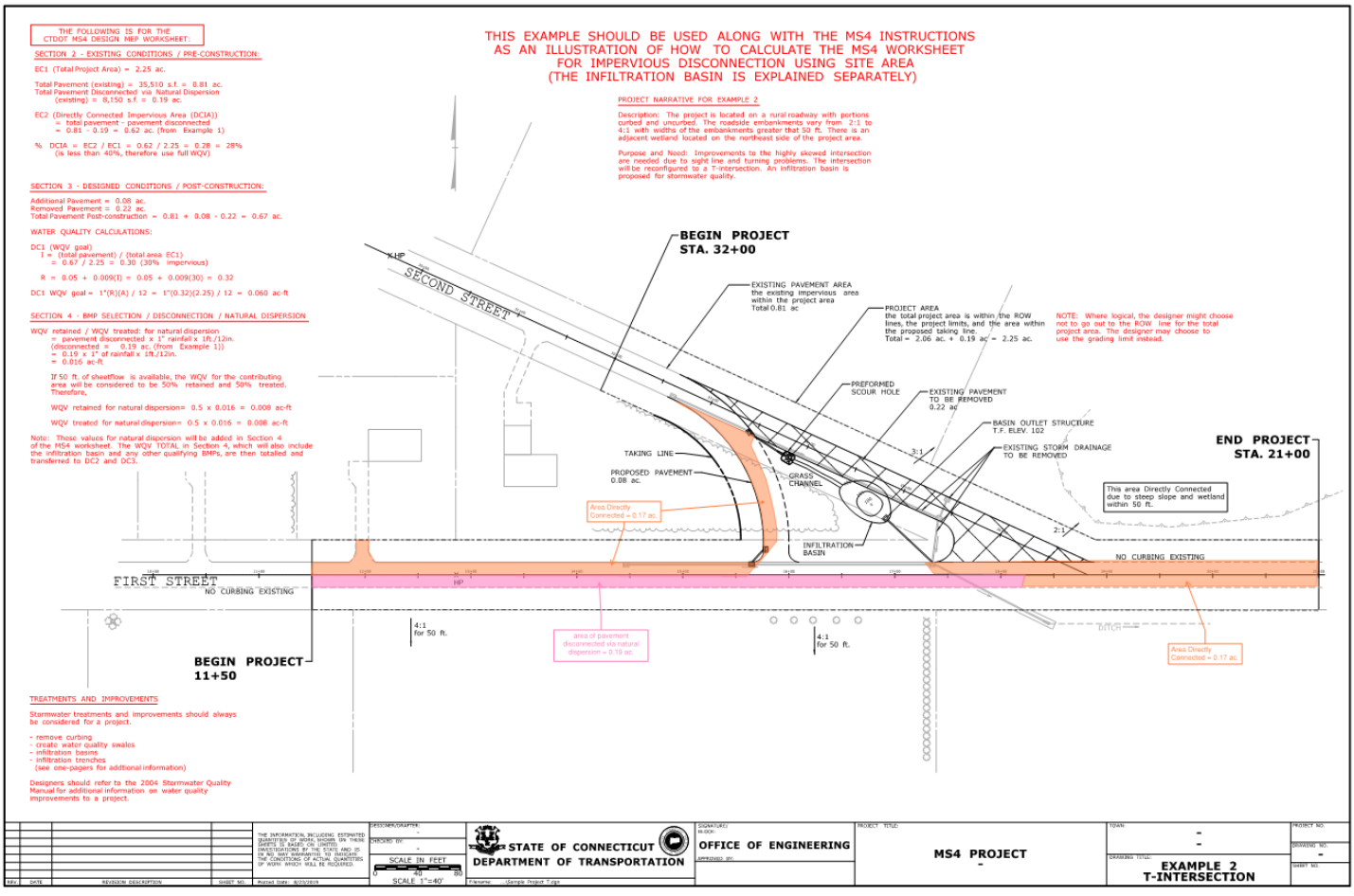
MS4 Example 2 – Infiltration Basin

Rev. 9-19-19

Example 2 improves stormwater quality by taking advantage of an alternative design. Rather than making small improvements to the existing skewed intersection (Example 1), the intersection is proposed to be realigned (Tee'd up.) Doing this will require a partial acquisition from an abutting property; this also creates an area which appears to be suitable for an infiltration basin, depicted on the Site Area/Disconnection Plan below.

Before including the effect of the infiltration basin in the worksheet, follow the worksheet calculations on the left hand side of the figure below to determine the following for Example 2:

- Total Project Area (EC1)
- Directly Connected Impervious Area (EC2)
- WQV Retention Goal (DC1)
- The portions of Section 4 of the worksheet attributed to the basin disconnection and natural dispersion

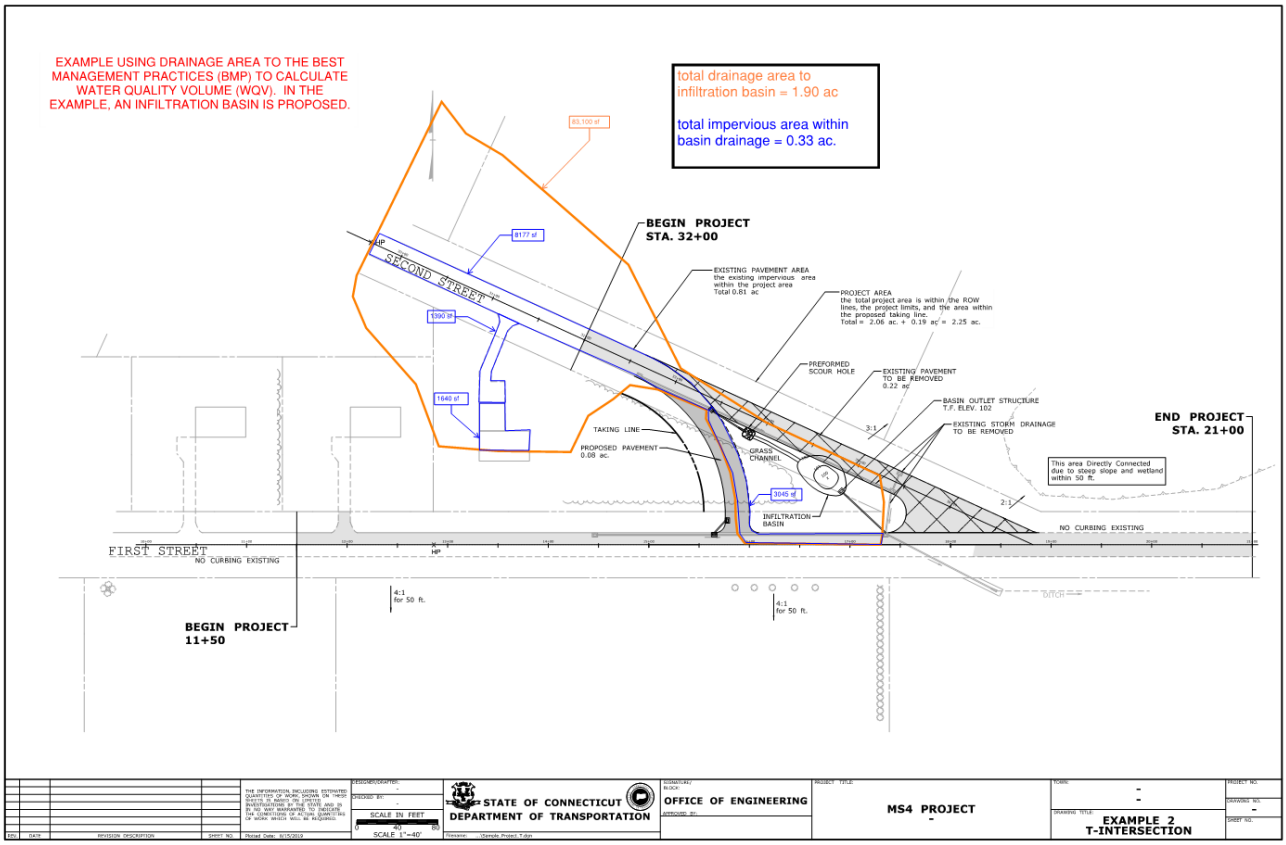


Inclusion of Infiltration Basin BMP

Overview: Infiltration basins may be used in various locations, such as in a natural or constructed depression (wide median, gore area, excess property...) Stormwater may flow overland into the infiltration basin or piped in via a small diameter pipe.

Note: To utilize an infiltration basin for retention (also see Infiltration Basin One-Pager):

- Water Depth should generally be less than 3 feet deep.
- Groundwater minimum 2 feet below the infiltration basin bottom.
- Soils must be sandy and suitable for infiltration.
- A pre-treatment measure should be installed to capture sediment before it enters the infiltration basin. A Type 2 Preformed Scour Hole is acceptable.
- The infiltration basin should be designed in accordance with the DOT Drainage Manual and capable of safely storing and routing the expected design storm.
- Grass should be established in the infiltration basin.



For this example, the infiltration basin is located in the excess property created by the roadway realignment. The bottom of the infiltration basin is 2 feet below the inlet elevation of the outlet structure so it will provide a two foot depth for water quality purposes. A Type 2 preformed scour hole (18' long) will be installed at the drainage system outlet to serve as pretreatment.

Determine the contributing drainage area and amount of impervious surface to the infiltration basin. (Shown in the preceding figure)

After determining the contributing drainage area, determine the Water Quality Volume (WQV) for the drainage area contributing to the infiltration basin.

Since the percentage of DCIA for the total project was <40%, retaining the full WQV is our goal.

BMP - WQF / WQF Calculations

PROJECT	Example 2 Infiltration Basin Drainage Area	PREPARED BY
DATE		CHECKED BY
SUBJECT		

WATER QUALITY VOLUME (WQV) CALCULATION

Drainage Area to BMP (A) =	1.90	acres
=	0.00297	square miles

BMP DRAINAGE AREA

Drainage Area	Impervious Area
Subcatchment-1	0.33
Subcatchment-2	0.00
Subcatchment-3	0.00
Total Impervious	0.33

Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	17	
Volumetric Runoff Coefficient (R) =	0.206	

WQV =	**0.033**	**ac-ft**
	1423	**cu-ft**

1/2 WQV=	**0.016**	**ac-ft**
=	**711**	**cu-ft**

Determining an appropriate size of the Infiltration basin by average end area:

This will be the desired WQV retained by the infiltration basin.

Storage Volume needed for infiltration = 1423 cu-ft

Elevation	area (cf)	volume
100	0	
		260
101	520	
		1170
102	1820	
total volume (cu-ft) =		1430
(ac-ft) =		0.033

Note: This average end area calculation table was used to determine storage volume for infiltration. This calculates the volume stored below the top of the outlet structure. Additional infiltration basin depth may be necessary above the elevation of the outlet for various reasons (such as the depth of the contributing drainage system). Elevations are an assumed datum for this example.

Enter WQV Retained by the Infiltration Basin in Section 4 of the worksheet.

Section 4: Stormwater BMP Selection Summary			
Design Phase ☐30% ☐60% ☐90% ☐FDP	WQV Retained (ac-ft)	WQV Treated (ac-ft)	Site Constraints
Disconnection			
No curb / natural dispersion	0.008	0.008	Choose an Item.
Vegetative filter strip			Choose an Item.
Other			Choose an Item.
Conveyance & Disconnection			
Grass channel			Choose an Item.
Water quality swale (dry)			Choose an Item.
Other			Choose an Item.
Infiltration / Retention			
Infiltration basin	0.033		Choose an Item.
Infiltration trench			Choose an Item.
Underground infiltration system			Choose an Item.
Dry well			Choose an Item.
Other			Choose an Item.
Treatment			
Wet basin / wetland system			Choose an Item.
Extended dry detention basin			Choose an Item.
Hydrodynamic-oil/grit sys.			Choose an Item.
Bioretention with underdrain			Choose an Item.
Other			Choose an Item.
TOTAL	0.041	0.008	
Notes: Infiltration Basin added: 1430 cu-ft storage available for infiltration (WQV)			

Enter the WQV Retained and WQV Treated into DC2 and DC3 in Section 3 of the worksheet to obtain a Total WQV for retained and treated (automatically calculated in DC4) that now includes both natural dispersion and the infiltration basin.

For Example 2, the impervious portion of the drainage area the infiltration basin was determined to be 0.33 acres. Since the infiltration basin retains 100% of the WQV of its contributing drainage area, this whole contributing impervious area is now considered to be disconnected. Note: 0.33 acres exceeds the impervious area to the infiltration basin contained in the chosen project area, therefore there will be compensation for other remaining on-site post-construction DCIA areas.

Since individual BMPs typically have drainage areas that extend beyond the chosen site project area, it is likely to have retention/treatment that results in disconnection that include off-site impervious areas. When this is the case, credit may be taken – compensating for on-site impervious areas. (In rare cases, it could be that more impervious area is disconnected due to retention/treatment of off-site areas than was in the original project area.)

Calculating DC5 (Post-construction DCIA):

0.67 (Total Pavement Post Construction)

- 0.19 (Area Disconnected via Natural Dispersion) (On-site area)

- 0.33 (Impervious Area to Infiltration Basin) (On-site & off-site areas)

0.15 acres (Entered into DC5 - Post Construction DCIA)

Section 3: Designed Conditions

	Water Quality Calculations	30% Design		60% Design	90% Design	FDP
DC1	WQV retention design goal ☑ Full ☐ 1/2"-WQV	ac-ft	☑ TBD	0.060 ac-ft	ac-ft	ac-ft
DC2	WQV goal ***retained*** (refer to page 2)	ac-ft		0.041 ac-ft	ac-ft	ac-ft
DC3	WQV goal ***treated*** (refer to page 2)	ac-ft		0.008 ac-ft	ac-ft	ac-ft
DC4	Total WQV *retained and treated*	0 ac-ft		0.049 ac-ft	0 ac-ft	0 ac-ft
DC5	Post-construction DCIA(acres)	ac.	☑ TBD	0.15 ac.	ac.	ac.
DC6	Pre-construction DCIA (refer to EC2 above)	ac.		0.62 ac.	ac.	ac.
DC7	Change in DCIA from pre- to post-construction *Can be positive (DCIA gained) or negative (DCIA lost)*	0 ac.	☑ TBD	-0.47 ac.	0 ac.	0 ac.

CONCLUSION

The worksheet calculates the change in DCIA to be -0.47 ac-ft.

The infiltration basin provides a significant reduction in directly connected impervious area.