

MEMORANDUM

To: El Paso County - Stormwater

From: Scott Maier, PE (Ayres Associates)

Date: July 20, 2023

EPC Project No.: PPR2315

Re: Super Star Carwash – Claremont Business Park 2 – Drainage Compliance Letter

Background

Super Star Carwash is planning to construct a carwash located within the Claremont Business Park 2 located at the southwest corner of Marksheffel Road and Meadowbrook Parkway. The site is currently vacant and is 1.5+/- acres.

The proposed development will consist of a 5,000+/- square foot carwash building with access drives, parking areas with vacuum bays, patio areas, and landscaping. This lot was initially contemplated for development as part of the overall development of the Claremont Business Park 2, Filing No. 2 VR 233. The overall development will construct the storm sewer system and detention pond for the overall development. The purpose of this letter is to demonstrate that the proposed development of the Super Star Carwash is in compliance with the assumptions of Claremont Business Park 2 Filing No. 2. Water quantity and that proposed development will meet water quality standards as required by El Paso County. The proposed development will discharge to an 18" RCP storm sewer system along El Jefe Heights that will be constructed as part of the overall development.

Explain where the site flow will go to a suitable outfall.

Runoff Comparison

The proposed development for the Super Star Carwash is part of Basin B within the Claremont Business Park 2 Filing No. 2 prepared by MS Civil Consultants, dated 6/11/23 as shown in the supporting documents. Below is a summary of the anticipated runoff from the overall drainage report.

Please update report in accordance with ECM 4.5
The FDR for VR233 has not been approved yet.
Please include drainage map showing basins for the lot

discuss existing and proposed basins in the text. including flows, impervious areas, WQ treatment for each basin, and how flows will be directed to the WQ facility. Discuss the existing detention facility and show location on a figure.

Engineer must confirm in the Drainage Report that the existing offsite or onsite PBMPs that the site is tributary to are functioning as intended.

Comparison Studies	Basin Area (acres)	Time of Concentration (min.)	Design Runoff Coefficient 5-yr	Design Runoff Coefficient 100-yr	Runoff (5 year) (CFS)	Runoff (100 year) (CFS)
Claremont Business Park 2 Filing No. 2 – Lot 1 Basin B	1.50	5.0	0.81	0.88	6.0	10.9
Super Star Carwash	1.78	5.0	C=0.49	C=0.68	3.34	10.77

The proposed development for the Super Star Carwash will have less designed runoff than those contemplated in the Claremont Business Park 2 Filing No. 2 drainage studies even after adding in the offsite areas along Marksheffel Rd and Meadowbrook Parkway.

Unresolved form Submittal 1 - The Final Drainage Study proposed a WQ pond to treat the runoff from Lot 1. Please add a statement clarifying the change and that the rain garden will still provide adequate water quality for the site.

Water Quality

Water Quality was not included as part of the improvements for the Claremont Business Park 2 Filing No. 2 overall development and is required to be constructed upon development. The Super Star Carwash proposes to construct a rain garden to serve the water quality requirements for it's development.

	WQCV Required	WQCV Provided	Method
Super Star Carwash Parking Lot and Building	0.027 Ac-Ft	0.027	Rain Garden

The rain garden is designed to have an underdrain system and an outfall to the west. As part of the proposed improvements, the site will drain a rain garden in the southern portion of the site. After treatment the rain garden will enter the overall development storm sewer system to the west and ultimately discharge into the water quantity pond southwest of the site.

Super Star Carwash will follow the “Four-Step Process” as defined below:

Step 1: Employ Runoff Reduction Practices

The proposed development utilizes reduced pavement areas with the implementation of landscaped islands in the parking lot and around the building.

Step 2: Stabilize Drainage Ways

Proposed drainage ways have been stabilized through the implementation of a concrete drainage pan for water entering the rain garden. A grass drainage swale is located along the east side of the property to capture offsite runoff that enters the property.

Provide backup for how the WQCV was calculated.

Step 3: Provide Water Quality Capture Volume (WQCV)

WQCV is achieved through a rain garden that treats onsite runoff. The rain garden is located at the southern portion of the property and treats building and parking lot runoff as well as offsite runoff that enters the site from the east.

Step 4: Consider Need for Industrial and Commercial BMP's

The proposed site will implement silt fence, construction entrance, concrete washout area and inlet protection to limit erosion and sediment runoff across the site.

Low Impact Development

This development will propose to construct a rain garden as part of the development. The rain garden will provide water quality benefits by providing filtration and some infiltration. The engineered media within the rain garden will provide filtration of the runoff from the site. In addition to the filtration for smaller rain events infiltration will also be a benefit of the rain garden.

Conclusion

The proposed Super Star Carwash development complies with the Claremont Business Park 2 overall drainage study. The regional drainage facility for the Claremont Business Park 2 Filing No. 2 provides the water quantity for the Super Star Carwash. The Super Star Carwash development will install the proposed rain garden to meet the water quality requirements of the onsite development.

In summary, the Super Star Carwash is in general compliance with the original development assumptions and no additional improvements to the storm sewer system beyond those noted is necessary.

If you should have any questions, please feel free to contact me at 262-522-4901.

Sincerely,

Scott Maier

There is no regional drainage facility.

Design Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

[Scott Maier, P.E. # _____]

Date

Owner/Developer Statement:

I, the Owner/Developer had read and will comply with all of the requirements specific in the is drainage report and Plan

[Name, Title]

Date

Business Name

Address

El Paso County:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volume 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as ammended

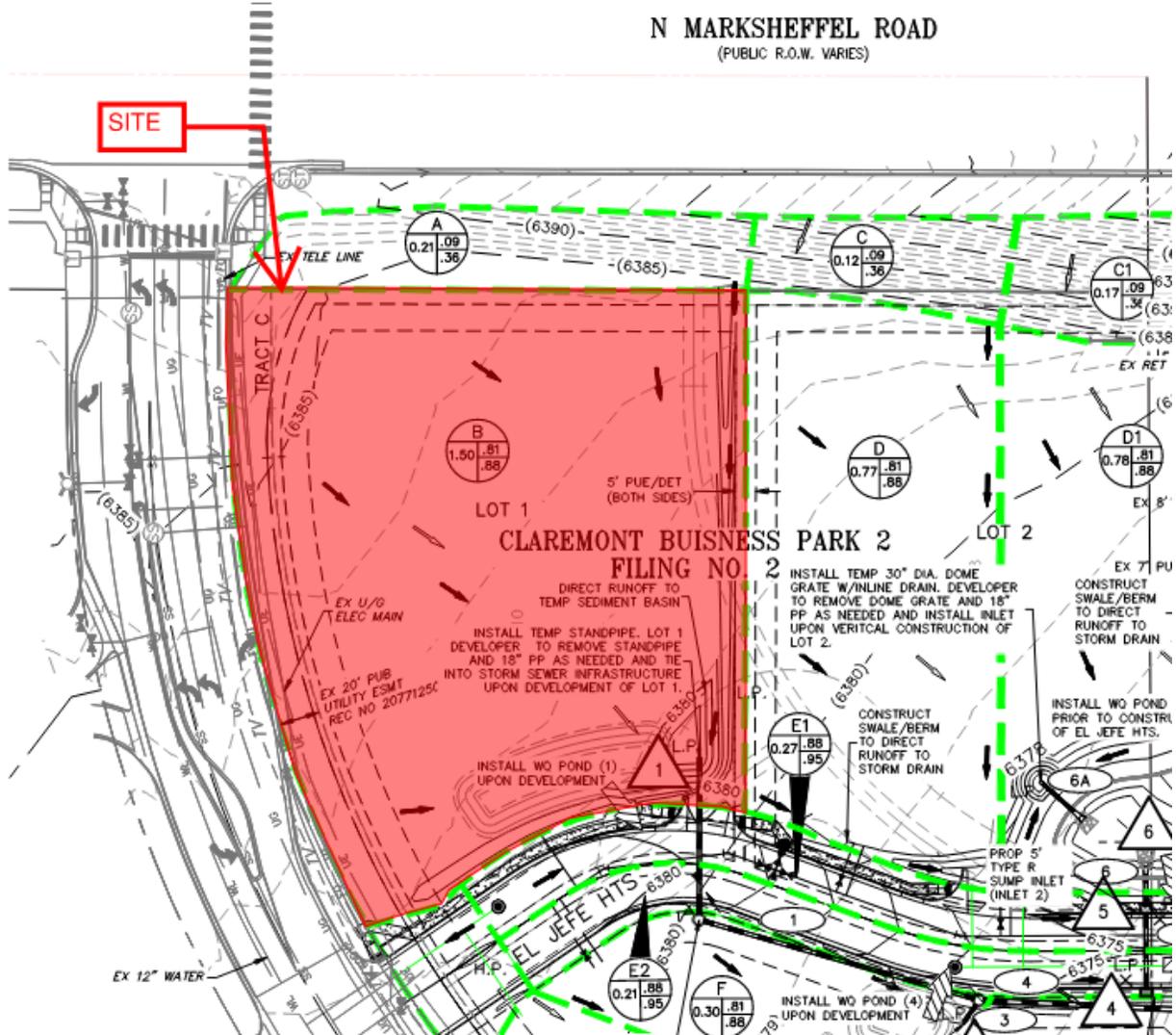
County Engineer/ECM Administrator

Date

Conditions:

Bromley Park Filing 5 – Supporting Documents

provide a figure for existing and proposed basins.



(EXHIBIT ABOVE IS PORTION OF Claremont Business Park 2 Filing No. 2 DRAINAGE PLAN)

FINAL DRAINAGE REPORT FOR CLAREMONT BUSINESS PARK 2 FILING NO.2
PROPOSED DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

BASIN	TOTAL AREA (SF)	TOTAL AREA (Acres)	ROOFS 0.73-0.81 0.81-0.88 ASPHALT DRIVES 0.90-0.96				LANDSCAPED AREAS 0.16-0.41 GRAVEL STORAGE YARD 0.30-0.50 LIGHT INDUST AREAS 0.39-0.70				PARKS 0.12-0.39 GREENBELTS/AGRI. 0.09-0.36				WEIGHTED			
			AREA (Acres)	C ₁	C ₃	C ₁₀₀	AREA (Acres)	C ₃	C ₅	C ₁₀₀	AREA (Acres)	C ₂	C ₅	C ₁₀₀	C ₂	C ₅	C ₁₀₀	
A	9300.8	0.21	0.10	0.89	0.00	0.00	0.00	0.41	0.16	0.16	0.03	0.21	0.09	0.09	0.36	0.09		
B	65264.4	1.50	1.30	0.79	0.81	0.33	0.34	0.30	0.34	0.34	0.05	0.10	0.12	0.39	0.39	0.39		
C	5372.3	0.12	0.00	0.89	0.90	0.00	0.16	0.41	0.16	0.16	0.03	0.12	0.09	0.09	0.36	0.09		
CT	7457.3	0.17	0.00	0.89	0.90	0.00	0.16	0.41	0.16	0.16	0.03	0.17	0.09	0.09	0.36	0.09		
Σ	184463.4	4.00	0.77	0.70	0.83	0.00	0.33	0.33	0.33	0.33	0.05	0.00	0.15	0.70	0.83	0.83		

(EXHIBIT ABOVE IS PORTION OF Claremont Business Park 2 Filing No. 2 Proposed Drainage Calculations-Area Runoff Coefficient Summary)

**FINAL DRAINAGE REPORT FOR CLAREMONT BUSINESS PARK 2 FILING NO.2
PROPOSED DRAINAGE CALCULATIONS
(Area Drainage Summary)**

BASIN	Flow Area Based Coefficient Summary			OVERLAND			STREET / CHANNEL FLOW				Time of Travel (T _t)			INTENSITY *			TOTAL FLOWS		
	AREA TOTAL (Acres)	C ₁	C ₂	C ₃	C ₁₀₀	Length (ft)	Height (ft)	T _c (min)	Slope (%)	Velocity (ft/s)	T ₁ (min)	CHECK (min)	I ₁ (ft/hr)	I ₂ (ft/hr)	I ₃ (ft/hr)	I ₁₀₀ (ft/hr)	Q ₁ (cfs)	Q ₂ (cfs)	Q ₁₀₀ (cfs)
A	0.21	0.03	0.79	0.09	0.36	40	5.0	5.0	0.0%	0.0	0.0	10.2	4.1	5.2	8.7	0.0	0.0	0.0	
B	1.50	0.79	0.81	0.81	0.88	80	1.0	4.4	1.7%	2.6	1.5	5.0	3.3	4.9	8.3	4.4	6.0	10.9	
C	0.12	0.03	0.09	0.09	0.36	40	16.0	3.4	0.0%	0.0	0.0	5.0	4.1	5.2	8.7	0.0	0.0	0.0	
C1	0.17	0.03	0.09	0.09	0.36	60	22.6	4.3	0.0%	0.0	0.0	5.0	10.3	5.2	8.7	0.0	0.0	0.0	
D	0.77	0.79	0.81	0.81	0.88	60	1.2	3.2	1.6%	2.5	1.6	5.0	11.7	4.1	5.2	2.5	2.5	5.9	
D1	0.78	0.79	0.81	0.81	0.88	60	1.2	3.2	1.6%	2.5	1.6	5.0	11.7	4.1	5.2	2.5	2.5	6.0	
E1	0.27	0.87	0.88	0.88	0.95	30	0.6	1.7	2.0%	2.8	1.7	5.0	11.7	4.1	5.2	8.7	2.0	2.2	
E2	0.21	0.87	0.88	0.88	0.95	30	0.6	1.7	2.0%	2.8	1.7	5.0	11.7	4.1	5.2	8.7	2.0	2.2	
F	0.30	0.79	0.81	0.81	0.88	60	1.2	3.2	1.3%	2.3	1.1	5.0	11.2	4.1	5.2	8.7	1.6	1.7	
G1	0.27	0.87	0.88	0.88	0.95	30	1.0	5.3	0.0%	0.0	0.0	5.3	10.2	4.1	5.1	8.5	0.4	0.4	
G2	1.15	0.79	0.81	0.81	0.88	60	0.6	4.1	1.0%	2.0	3.3	7.4	12.6	3.7	4.6	7.7	2.3	2.3	
H1	0.16	0.03	0.09	0.09	0.36	76	20.0	5.4	0.0%	0.0	0.0	5.4	10.4	4.0	5.1	8.5	0.0	0.0	
H2	0.40	0.03	0.09	0.09	0.36	100	17.0	7.2	0.0%	0.0	0.0	7.2	10.6	3.7	4.6	7.8	0.0	0.0	
H3	0.04	0.03	0.09	0.09	0.36	100	17.0	7.2	0.0%	1.4	0.0	7.2	10.6	3.7	4.6	7.8	0.0	0.0	
H4	0.10	0.03	0.09	0.09	0.36	100	17.0	7.2	0.0%	0.0	0.0	7.2	10.6	3.7	4.6	7.8	0.0	0.0	
H5	0.56	0.82	0.83	0.83	0.90	100	3.0	3.4	2.5%	3.2	1.1	5.0	11.8	4.1	5.2	8.7	1.0	2.1	
I1	0.48	0.77	0.78	0.78	0.87	60	7.0	5.5	1.0%	5.0	5.3	5.0	11.7	4.1	5.3	8.7	1.4	3.0	

(EXHIBIT ABOVE IS PORTION OF Claremont Business Park 2 Filing No. 2 Proposed Drainage Calculations-Area Drainage Summary)

Super Star Carwash Onsite Drainage Calculations

provide drainage calculations. this section only contains a table of runoff coefficients.

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

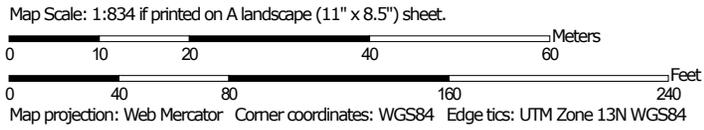
Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries													
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks													
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Super Star Carwash Soil Information

Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



MAP LEGEND

- Area of Interest (AOI)**
 -  Area of Interest (AOI)
- Soils**
 - Soil Rating Polygons**
 -  A
 -  A/D
 -  B
 -  B/D
 -  C
 -  C/D
 -  D
 -  Not rated or not available
 - Soil Rating Lines**
 -  A
 -  A/D
 -  B
 -  B/D
 -  C
 -  C/D
 -  D
 -  Not rated or not available
 - Soil Rating Points**
 -  A
 -  A/D
 -  B
 -  B/D
- Water Features**
 -  Streams and Canals
- Transportation**
 -  Rails
 -  Interstate Highways
 -  US Routes
 -  Major Roads
 -  Local Roads
- Background**
 -  Aerial Photography
- Other**
 -  C
 -  C/D
 -  D
 -  Not rated or not available

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.
 Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 20, Sep 2, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	0.0	0.5%
10	Blendon sandy loam, 0 to 3 percent slopes	B	1.4	58.1%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	1.0	41.3%
Totals for Area of Interest			2.4	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

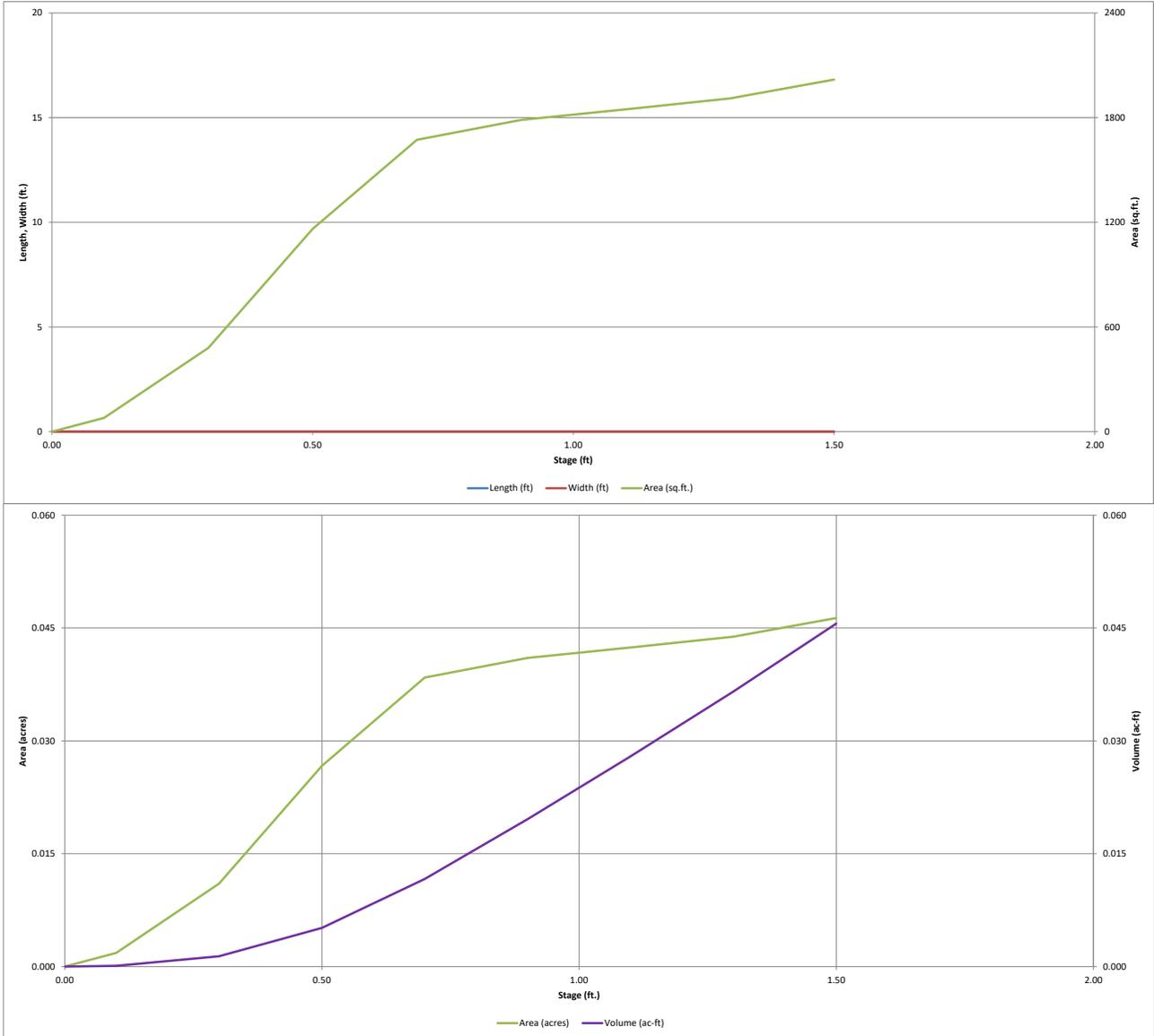
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Super Star Carwash Onsite Water Quality Basin Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

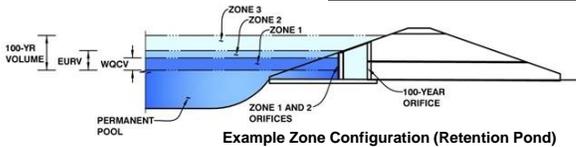


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.05 (January 2022)*

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1	#N/A		Filtration Media
Zone 2			
Zone 3			
Total (all zones)			

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	<input style="width: 100px;" type="text"/>							
Orifice Area (sq. inches)	<input style="width: 100px;" type="text"/>							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	<input style="width: 100px;" type="text"/>							
Orifice Area (sq. inches)	<input style="width: 100px;" type="text"/>							

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = ft²
 Vertical Orifice Centroid = feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, Ho = ft (relative to basin bottom at Stage = 0 ft)
 Overflow Weir Front Edge Length = feet
 Overflow Weir Grate Slope = H:V
 Horiz. Length of Weir Sides = feet
 Overflow Grate Type =
 Debris Clogging % = %

Calculated Parameters for Overflow Weir

Height of Grate Upper Edge, H_g = ft
 Overflow Weir Slope Length = feet
 Grate Open Area / 100-yr Orifice Area =
 Overflow Grate Open Area w/o Debris = ft²
 Overflow Grate Open Area w/ Debris = ft²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
 Circular Orifice Diameter = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = ft²
 Outlet Orifice Centroid =
 Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	N/A	N/A	0.82	1.10	1.34	1.69	1.98	2.29	3.08
CUHP Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =									
CUHP Predevelopment Peak Q (cfs) =									
OPTIONAL Override Predevelopment Peak Q (cfs) =									
Predevelopment Unit Peak Flow, q (cfs/acre) =									
Peak Inflow Q (cfs) =									
Peak Outflow Q (cfs) =									
Ratio Peak Outflow to Predevelopment Q =									
Structure Controlling Flow =									
Max Velocity through Gate 1 (fps) =									
Max Velocity through Gate 2 (fps) =									
Time to Drain 97% of Inflow Volume (hours) =									
Time to Drain 99% of Inflow Volume (hours) =									
Maximum Ponding Depth (ft) =									
Area at Maximum Ponding Depth (acres) =									
Maximum Volume Stored (acre-ft) =									

Super Star Carwash Onsite Runoff Calculations

Calculation of Peak Runoff using Rational Method

Designer: Scott Maier
 Company: Ayres Associates
 Date: 6/23/2023
 Project: SUPER STAR CAR WASH
 Location: MEADOWBROOK, Mesa County

Version 2.00 released May 2017

Cells of this color are for required user-input
 Cells of this color are for optional override values
 Cells of this color are for calculated results based on overrides

$$t_t = \frac{0.395(1.1 - C_s)\sqrt{L_t}}{S^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_t + t_r$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{\text{minimum}} = 5$ (urban)
 $t_{\text{minimum}} = 10$ (non-urban)

Selected $t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

1-hour rainfall depth, P1 (in) =

2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
0.83	1.11	1.38	1.69	2.17	2.58	3.14

Rainfall Intensity Equation Coefficients =

a	b	c
28.50	10.00	0.786

$I(\text{in/hr}) = \frac{a + P_1}{(b + t_c)^c}$

$Q(\text{cfs}) = CIA$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				Channelized (Travel) Flow Time					Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)									
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S _i (ft/ft)	Overland Flow Time t _i (min)	Channelized Flow Length L _c (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S _c (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V _c (ft/sec)	Channelized Flow Time t _c (min)	Computed t _c (min)	Regional t _c (min)	Selected t _c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin A1	0.03	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90	10.00			0.250	0.48	50.00			0.010	20	2.00	0.42	0.90	9.36	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	0.07	0.10	0.12	0.15	0.20	0.23	0.29
Basin A2	0.97	B	74.0	0.59	0.62	0.65	0.71	0.74	0.77	0.81	100.00			0.250	3.01	200.00			0.010	20	2.00	1.67	4.68	15.14	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	1.59	2.26	2.97	3.97	5.29	6.54	8.34
Basin A3	0.29	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	10.00			0.020	5.00	100.00			0.010	15	1.50	1.11	6.11	27.85	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.00	0.00	0.06	0.33	0.56	0.86	1.32
Basin A4	0.11	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	10.00			0.020	4.91	20.00			0.020	20	2.83	0.12	5.11	26.26	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.00	0.00	0.02	0.13	0.21	0.33	0.50
Basin A5	0.12	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	20.00			0.250	3.07	50.00			0.030	20	3.46	0.24	3.31	26.53	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.00	0.00	0.03	0.14	0.23	0.36	0.55
Basin B1	0.11	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90	120.00			0.043	2.97	120.00			0.043	20	4.15	0.48	3.45	9.42	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	0.26	0.35	0.44	0.55	0.72	0.86	1.06
Basin Off	0.18	B	65.0	0.50	0.54	0.58	0.66	0.69	0.73	0.77					0.59										5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	0.25	0.40	0.49	0.68	0.92	1.18	1.48
Rain Garden	1.63	B	47.0	0.35	0.38	0.44	0.54	0.59	0.64	0.71					0.43										5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	1.58	2.64	3.33	5.08	7.08	8.56	12.29
Total Site	1.81	B	54.0	0.41	0.44	0.49	0.59	0.63	0.68	0.73					0.49										5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	2.06	3.34	4.17	6.10	8.38	10.77	14.14

Provide the drainage and basin map the goes with this in the report.

All comments from submittal 1 should be addressed with the included basin map.

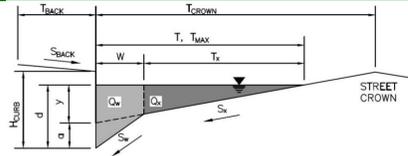
Unresolved from Submittal 1: Provide storm drain and swale calculations as well as inlet calcs

Super Star Carwash Onsite Inlet Calculations

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Super Star Car Wash - Meadowbrook
Inlet ID: Basin A1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

T _{BACK} =	10.0	ft
S _{BACK} =		ft/ft
n _{BACK} =	0.013	

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

H _{CURB} =	6.00	inches
T _{CROWN} =	10.0	ft
W =	1.00	ft
S _X =	0.048	ft/ft
S _W =	0.083	ft/ft
S _O =	0.007	ft/ft
n _{STREET} =	0.013	

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T _{MAX} =	10.0	10.0	ft
d _{MAX} =	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Maximum Capacity for 1/2 Street based On Allowable Spread

Water Depth without Gutter Depression (Eq. ST-2)
 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")
 Gutter Depression (d_c - (W * S_x * 12))
 Water Depth at Gutter Flowline
 Allowable Spread for Discharge outside the Gutter Section W (T - W)
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Discharge outside the Gutter Section W, carried in Section T_X
 Discharge within the Gutter Section W (Q_T - Q_X)
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Maximum Flow Based On Allowable Spread
 Flow Velocity within the Gutter Section
 V*d Product: Flow Velocity times Gutter Flowline Depth

	Minor Storm	Major Storm	
y =	5.76	5.76	inches
d _c =	1.0	1.0	inches
a =	0.42	0.42	inches
d =	6.18	6.18	inches
T _X =	9.0	9.0	ft
E _O =	0.257	0.257	
Q _X =	8.0	8.0	cfs
Q _W =	2.8	2.8	cfs
Q _{BACK} =	0.0	0.0	cfs
Q_T =	10.8	10.8	cfs
V =	1.5	1.5	fps
V*d =	0.8	0.8	

Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread
 Theoretical Spread for Discharge outside the Gutter Section W (T - W)
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Theoretical Discharge outside the Gutter Section W, carried in Section T_{X,TH}
 Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})
 Discharge within the Gutter Section W (Q_d - Q_X)
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Total Discharge for Major & Minor Storm (Pre-Safety Factor)
 Average Flow Velocity Within the Gutter Section
 V*d Product: Flow Velocity Times Gutter Flowline Depth
 Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm
 Max Flow Based on Allowable Depth (Safety Factor Applied)
 Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
 Resultant Flow Depth at Street Crown (Safety Factor Applied)

	Minor Storm	Major Storm	
T _{TH} =	9.7	9.7	ft
T _{X,TH} =	8.7	8.7	ft
E _O =	0.265	0.265	
Q _{X,TH} =	7.3	7.3	cfs
Q _X =	7.3	7.3	cfs
Q _W =	2.6	2.6	cfs
Q _{BACK} =	0.0	0.0	cfs
Q =	9.9	9.9	cfs
V =	1.4	1.4	fps
V*d =	0.7	0.7	
R =	1.00	1.00	
Q_d =	9.9	9.9	cfs
d =	6.00	6.00	inches
d _{CROWN} =	0.00	0.00	inches

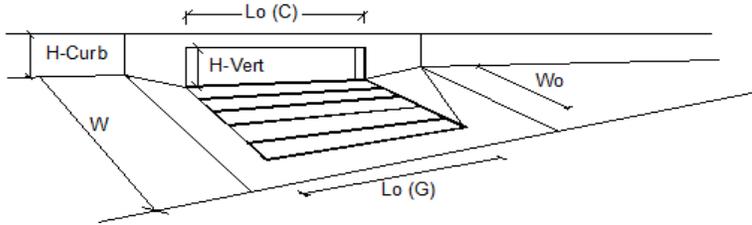
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	9.9	9.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

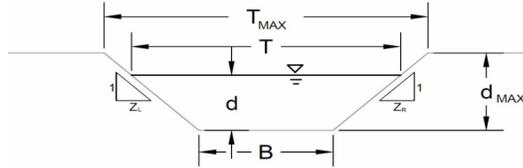


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type C Grate		
Local Depression (additional to continuous gutter depression 'a')	a _{LOCAL} = 0.0	0.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No = 1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o = 2.92	2.92	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W _o = 2.92	2.92	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _{r-G} = 0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _{r-C} = N/A	N/A	
Street Hydraulics: OK - Q < Allowable Street Capacity'			
Design Discharge for Half of Street (from <i>Inlet Management</i>)	Q _o = 0.1	0.3	cfs
Water Spread Width	T = 1.6	2.2	ft
Water Depth at Flowline (outside of local depression)	d = 1.3	1.7	inches
Water Depth at Street Crown (or at T _{MAX})	d _{CROWN} = 0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E _o = 0.968	0.849	
Discharge outside the Gutter Section W, carried in Section T _x	Q _x = 0.0	0.0	cfs
Discharge within the Gutter Section W	Q _w = 0.1	0.2	cfs
Discharge Behind the Curb Face	Q _{BACK} = 0.0	0.0	cfs
Flow Area within the Gutter Section W	A _w = 0.07	0.10	sq ft
Velocity within the Gutter Section W	V _w = 1.7	2.1	fps
Water Depth for Design Condition	d _{LOCAL} = 1.3	1.7	Inches
Grate Analysis (Calculated)			
Total Length of Inlet Grate Opening	L = 2.92	2.92	ft
Ratio of Grate Flow to Design Flow	E _{o-GRATE} = -0.487	0.496	
Under No-Clogging Condition			
Minimum Velocity Where Grate Splash-Over Begins	V _o = 9.94	9.94	fps
Interception Rate of Frontal Flow	R _f = 1.00	1.00	
Interception Rate of Side Flow	R _s = 0.61	0.55	
Interception Capacity	Q _i = 0.1	0.2	cfs
Under Clogging Condition			
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef = 1.00	1.00	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog = 0.50	0.50	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L _e = 1.46	1.46	ft
Minimum Velocity Where Grate Splash-Over Begins	V _o = 6.91	6.91	fps
Interception Rate of Frontal Flow	R _f = 1.00	1.00	
Interception Rate of Side Flow	R _s = 0.24	0.20	
Actual Interception Capacity	Q _a = 0.0	0.1	cfs
Carry-Over Flow = Q _o - Q _a (to be applied to curb opening or next d/s inlet)	Q _b = 0.1	0.1	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			
Equivalent Slope S _e (based on grate carry-over)	S _e = N/A	N/A	ft/ft
Required Length L _T to Have 100% Interception	L _T = N/A	N/A	ft
Under No-Clogging Condition			
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _T)	L = N/A	N/A	ft
Interception Capacity	Q _i = N/A	N/A	cfs
Under Clogging Condition			
Clogging Coefficient	CurbCoef = N/A	N/A	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog = N/A	N/A	
Effective (Unclogged) Length	L _e = N/A	N/A	ft
Actual Interception Capacity	Q _a = N/A	N/A	cfs
Carry-Over Flow = Q _{o(GRATE)} - Q _a	Q _b = N/A	N/A	cfs
Summary			
Total Inlet Interception Capacity	Q = 0.0	0.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.1	0.1	cfs
Capture Percentage = Q _a /Q _o =	C% = -12	60	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Rain Garden Outlet Structure

adjust swale side slopes to meet MHFD requirements. A minimum of 4:1 slopes are preferred.



This worksheet uses the NRCS vegetative retardance method to determine Manning's n.
 For more information see Section 7.2.3 of the USDCM.

Warning 01
Warning 01

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E) A, B, C, D, or E = **B**
 Manning's n (Leave cell D16 blank to manually enter an n value) n = **see details below**
 Channel Invert Slope S₀ = **0.0050** ft/ft
 Bottom Width B = **10.00** ft
 Left Side Slope Z₁ = **0.50** ft/ft
 Right Side Slope Z₂ = **0.50** ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V _{MAX})	Max Froude No. (F _{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:

Non-Cohesive
 Cohesive
 Paved

	Minor Storm	Major Storm	
T _{MAX} =	12.20	13.00	ft
d _{MAX} =	1.10	1.50	ft

Maximum Channel Capacity Based On Allowable Top Width

	Minor Storm	Major Storm	
T _{MAX} =	12.20	13.00	ft
d =	2.20	3.00	ft
A =	24.42	34.50	sq ft
P =	14.92	16.71	ft
R =	1.64	2.06	ft
n =	0.080	0.057	
V =	1.82	3.02	fps
VR =	2.99	6.24	ft ² /s
D =	2.00	2.65	ft
Fr =	0.23	0.33	
Q _T =	44.5	104.3	cfs

Maximum Channel Capacity Based On Allowable Water Depth

	Minor Storm	Major Storm	
d _{MAX} =	1.10	1.50	ft
T =	11.10	11.50	ft
A =	11.61	16.13	sq ft
P =	12.46	13.35	ft
R =	0.93	1.21	ft
n =	0.315	0.170	
V =	0.32	0.70	fps
VR =	0.30	0.85	ft ² /s
D =	1.05	1.40	ft
Fr =	0.05	0.10	
Q _d =	3.7	11.3	cfs

Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q _{allow} =	3.7	11.3	cfs
d _{allow} =	1.10	1.50	ft

Water Depth in Channel Based On Design Peak Flow

	Minor Storm	Major Storm	
Q _o =	2.6	8.6	cfs
d =	0.91	1.45	ft
T =	10.91	11.45	ft
A =	9.46	15.52	sq ft
P =	12.02	13.24	ft
R =	0.79	1.17	ft
n =	0.322	0.213	
V =	0.28	0.55	fps
VR =	0.22	0.65	ft ² /s
D =	0.87	1.36	ft
Fr =	0.05	0.08	

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
 Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

MHFD-Inlet, Version 5.01 (April 2021)
AREA INLET IN A SWALE

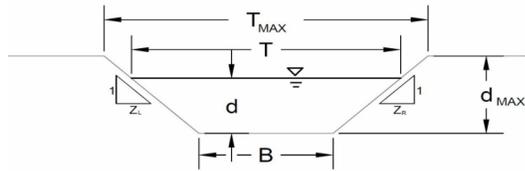
Super Star Car Wash - Meadowbrook
Rain Garden Outlet Structure

Inlet Design Information (Input)							
Type of Inlet	CDOT Type C (Depressed)						
Inlet Type =	CDOT Type C (Depressed)						
Angle of Inclined Grate (must be <= 30 degrees)	$\theta = 0.00$ degrees						
Width of Grate	$W = 3.00$ ft						
Length of Grate	$L = 3.00$ ft						
Open Area Ratio	$A_{RATIO} = 0.70$						
Height of Inclined Grate	$H_B = 0.00$ ft						
Clogging Factor	$C_f = 0.50$						
Grate Discharge Coefficient	$C_d = 0.84$						
Orifice Coefficient	$C_o = 0.56$						
Weir Coefficient	$C_w = 1.81$						
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	<table border="1"> <thead> <tr> <th></th> <th>MINOR</th> <th>MAJOR</th> </tr> </thead> <tbody> <tr> <td>$d =$</td> <td>1.91</td> <td>2.45</td> </tr> </tbody> </table>		MINOR	MAJOR	$d =$	1.91	2.45
	MINOR	MAJOR					
$d =$	1.91	2.45					
Grate Capacity as a Weir							
Submerged Side Weir Length	$X = 3.00$ ft						
Inclined Side Weir Flow	$Q_{ws} = 24.9$ cfs						
Base Weir Flow	$Q_{wb} = 35.6$ cfs						
Interception Without Clogging	$Q_{wi} = 85.5$ cfs						
Interception With Clogging	$Q_{wa} = 42.7$ cfs						
Grate Capacity as an Orifice							
Interception Without Clogging	$Q_{oi} = 39.3$ cfs						
Interception With Clogging	$Q_{oa} = 19.6$ cfs						
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a = 19.6$ cfs						
Bypassed Flow	$Q_b = 0.0$ cfs						
Capture Percentage = Q_a/Q_o	$C\% = 100$ %						

Warning 01: Sideslope steepness exceeds USDCM Volume I recommendation.

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Basin A4

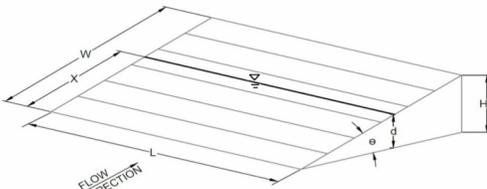


This worksheet uses the NRCS vegetative retardance method to determine Manning's n.
 For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method			A, B, C, D, or E = <input style="width: 50px;" type="text" value="B"/>									
NRCS Vegetal Retardance (A, B, C, D, or E)			n = <input style="width: 50px;" type="text" value="see details below"/>									
Manning's n (Leave cell D16 blank to manually enter an n value)			S ₀ = <input style="width: 50px;" type="text" value="0.0200"/> ft/ft									
Channel Invert Slope			B = <input style="width: 50px;" type="text" value="4.00"/> ft									
Bottom Width			Z1 = <input style="width: 50px;" type="text" value="10.00"/> ft/ft									
Left Side Slope			Z2 = <input style="width: 50px;" type="text" value="20.00"/> ft/ft									
Right Side Slope			Choose One: <input type="checkbox"/> Non-Cohesive <input type="checkbox"/> Cohesive <input type="checkbox"/> Paved									
Check one of the following soil types:												
Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})										
Non-Cohesive	5.0 fps	0.60										
Cohesive	7.0 fps	0.80										
Paved	N/A	N/A										
Maximum Allowable Top Width of Channel for Minor & Major Storm			<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">Minor Storm</td> <td style="width: 20%; text-align: center;">Major Storm</td> <td style="width: 10%;"></td> </tr> <tr> <td>T_{MAX} =</td> <td style="text-align: center;">15.00</td> <td style="text-align: center;">15.00</td> <td style="text-align: center;">ft</td> </tr> </table>			Minor Storm	Major Storm		T _{MAX} =	15.00	15.00	ft
	Minor Storm	Major Storm										
T _{MAX} =	15.00	15.00	ft									
Maximum Allowable Water Depth in Channel for Minor & Major Storm			<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">Minor Storm</td> <td style="width: 20%; text-align: center;">Major Storm</td> <td style="width: 10%;"></td> </tr> <tr> <td>d_{MAX} =</td> <td style="text-align: center;">0.50</td> <td style="text-align: center;">0.50</td> <td style="text-align: center;">ft</td> </tr> </table>			Minor Storm	Major Storm		d _{MAX} =	0.50	0.50	ft
	Minor Storm	Major Storm										
d _{MAX} =	0.50	0.50	ft									
Allowable Channel Capacity Based On Channel Geometry												
MINOR STORM Allowable Capacity is based on Top Width Criterion			<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">Minor Storm</td> <td style="width: 20%; text-align: center;">Major Storm</td> <td style="width: 10%;"></td> </tr> <tr> <td>Q_{allow} =</td> <td style="text-align: center;">0.9</td> <td style="text-align: center;">0.9</td> <td style="text-align: center;">cfs</td> </tr> </table>			Minor Storm	Major Storm		Q _{allow} =	0.9	0.9	cfs
	Minor Storm	Major Storm										
Q _{allow} =	0.9	0.9	cfs									
MAJOR STORM Allowable Capacity is based on Top Width Criterion			<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">Minor Storm</td> <td style="width: 20%; text-align: center;">Major Storm</td> <td style="width: 10%;"></td> </tr> <tr> <td>d_{allow} =</td> <td style="text-align: center;">0.37</td> <td style="text-align: center;">0.37</td> <td style="text-align: center;">ft</td> </tr> </table>			Minor Storm	Major Storm		d _{allow} =	0.37	0.37	ft
	Minor Storm	Major Storm										
d _{allow} =	0.37	0.37	ft									
Water Depth in Channel Based On Design Peak Flow												
Design Peak Flow			<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">Minor Storm</td> <td style="width: 20%; text-align: center;">Major Storm</td> <td style="width: 10%;"></td> </tr> <tr> <td>Q_o =</td> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.3</td> <td style="text-align: center;">cfs</td> </tr> </table>			Minor Storm	Major Storm		Q _o =	0.0	0.3	cfs
	Minor Storm	Major Storm										
Q _o =	0.0	0.3	cfs									
Water Depth			<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 20%; text-align: center;">Minor Storm</td> <td style="width: 20%; text-align: center;">Major Storm</td> <td style="width: 10%;"></td> </tr> <tr> <td>d =</td> <td style="text-align: center;">0.03</td> <td style="text-align: center;">0.21</td> <td style="text-align: center;">ft</td> </tr> </table>			Minor Storm	Major Storm		d =	0.03	0.21	ft
	Minor Storm	Major Storm										
d =	0.03	0.21	ft									
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management' Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'												

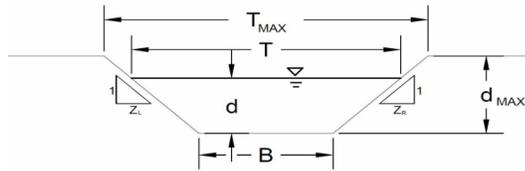
AREA INLET IN A SWALE

**Super Star Car Wash - Meadowbrook
Basin A4**

Inlet Design Information (Input)																					
Type of Inlet	Inlet Type =																				
<input type="text" value="CDOT Type C (Depressed)"/>	<input type="text" value="CDOT Type C (Depressed)"/>																				
Angle of Inclined Grate (must be <= 30 degrees)	$\theta =$ <input type="text" value="0.00"/> degrees																				
Width of Grate	$W =$ <input type="text" value="3.00"/> ft																				
Length of Grate	$L =$ <input type="text" value="3.00"/> ft																				
Open Area Ratio	$A_{RATIO} =$ <input type="text" value="0.70"/>																				
Height of Inclined Grate	$H_B =$ <input type="text" value="0.00"/> ft																				
Clogging Factor	$C_f =$ <input type="text" value="0.50"/>																				
Grate Discharge Coefficient	$C_d =$ <input type="text" value="0.84"/>																				
Orifice Coefficient	$C_o =$ <input type="text" value="0.56"/>																				
Weir Coefficient	$C_w =$ <input type="text" value="1.81"/>																				
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">MINOR</th> <th style="text-align: center;">MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">$d =$</td> <td style="text-align: center; padding: 2px;">1.03</td> <td style="text-align: center; padding: 2px;">1.21</td> <td></td> </tr> <tr> <td style="padding: 2px;">$Q_a =$</td> <td style="text-align: center; padding: 2px;">14.5</td> <td style="text-align: center; padding: 2px;">15.6</td> <td style="padding: 2px;">cfs</td> </tr> <tr> <td style="padding: 2px;">$Q_b =$</td> <td style="text-align: center; padding: 2px;">0.0</td> <td style="text-align: center; padding: 2px;">0.0</td> <td style="padding: 2px;">cfs</td> </tr> <tr> <td style="padding: 2px;">$C\% =$</td> <td style="text-align: center; padding: 2px;">100</td> <td style="text-align: center; padding: 2px;">100</td> <td style="padding: 2px;">%</td> </tr> </tbody> </table>		MINOR	MAJOR		$d =$	1.03	1.21		$Q_a =$	14.5	15.6	cfs	$Q_b =$	0.0	0.0	cfs	$C\% =$	100	100	%
	MINOR	MAJOR																			
$d =$	1.03	1.21																			
$Q_a =$	14.5	15.6	cfs																		
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$C\% =$	100	100	%																		
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)																					
Total Inlet Interception Capacity (assumes clogged condition)																					
Bypassed Flow																					
Capture Percentage = Q_a/Q_o																					

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Basin A5



This worksheet uses the NRCS vegetative retardance method to determine Manning's n.
 For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E) A, B, C, D, or E = **B**

Manning's n (Leave cell D16 blank to manually enter an n value) n = **see details below**

Channel Invert Slope S₀ = **0.0200** ft/ft

Bottom Width B = **4.00** ft

Left Side Slope Z₁ = **10.00** ft/ft

Right Side Slope Z₂ = **10.00** ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V _{MAX})	Max Froude No. (F _{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:

Non-Cohesive

Cohesive

Paved

	Minor Storm	Major Storm	
T _{MAX} =	10.00	10.00	ft
d _{MAX} =	0.50	0.50	ft

Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Top Width Criterion Minor Storm

MAJOR STORM Allowable Capacity is based on Top Width Criterion Major Storm

	Minor Storm	Major Storm	
Q _{allow} =	0.5	0.5	cfs
d _{allow} =	0.30	0.30	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow Q_o =

Water Depth d =

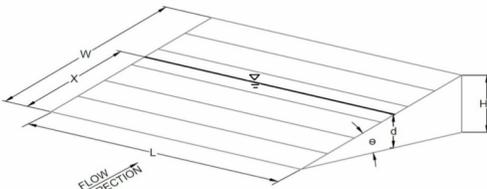
	Minor Storm	Major Storm	
Q _o =	0.0	0.3	cfs
d =	0.03	0.23	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
 Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Basin A5

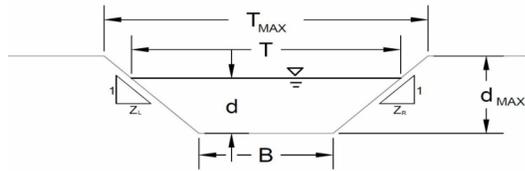
Inlet Design Information (Input)		
Type of Inlet	<input style="width: 90%;" type="text" value="CDOT Type C"/>	Inlet Type = <input style="width: 90%;" type="text" value="CDOT Type C"/>
Angle of Inclined Grate (must be <= 30 degrees)		$\theta =$ <input style="width: 50px;" type="text" value="0.00"/> degrees
Width of Grate		$W =$ <input style="width: 50px;" type="text" value="3.00"/> ft
Length of Grate		$L =$ <input style="width: 50px;" type="text" value="3.00"/> ft
Open Area Ratio		$A_{RATIO} =$ <input style="width: 50px;" type="text" value="0.70"/>
Height of Inclined Grate		$H_B =$ <input style="width: 50px;" type="text" value="0.00"/> ft
Clogging Factor		$C_f =$ <input style="width: 50px;" type="text" value="0.50"/>
Grate Discharge Coefficient		$C_d =$ <input style="width: 50px;" type="text" value="0.96"/>
Orifice Coefficient		$C_o =$ <input style="width: 50px;" type="text" value="0.64"/>
Weir Coefficient		$C_w =$ <input style="width: 50px;" type="text" value="2.05"/>
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)		
Total Inlet Interception Capacity (assumes clogged condition)		
Bypassed Flow		
Capture Percentage = Q_a/Q_o		



	MINOR	MAJOR	
$d =$	0.03	0.23	
$Q_a =$	0.1	2.0	cfs
$Q_b =$	0.0	0.0	cfs
$C\% =$	100	100	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Basin A3



This worksheet uses the NRCS vegetative retardance method to determine Manning's n.
 For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method			A, B, C, D, or E = <input style="width: 50px;" type="text" value="B"/>																									
NRCS Vegetal Retardance (A, B, C, D, or E)			n = <input style="width: 50px;" type="text" value="see details below"/>																									
Manning's n (Leave cell D16 blank to manually enter an n value)			S ₀ = <input style="width: 50px;" type="text" value="0.0200"/> ft/ft																									
Channel Invert Slope			B = <input style="width: 50px;" type="text" value="4.00"/> ft																									
Bottom Width			Z ₁ = <input style="width: 50px;" type="text" value="5.00"/> ft/ft																									
Left Side Slope			Z ₂ = <input style="width: 50px;" type="text" value="5.00"/> ft/ft																									
Right Side Slope			Choose One: <input checked="" type="checkbox"/> Non-Cohesive <input type="checkbox"/> Cohesive <input type="checkbox"/> Paved																									
Check one of the following soil types: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="text-align: left;">Soil Type:</th> <th style="text-align: left;">Max. Velocity (V_{MAX})</th> <th style="text-align: left;">Max Froude No. (F_{MAX})</th> </tr> </thead> <tbody> <tr> <td>Non-Cohesive</td> <td>5.0 fps</td> <td>0.60</td> </tr> <tr> <td>Cohesive</td> <td>7.0 fps</td> <td>0.80</td> </tr> <tr> <td>Paved</td> <td>N/A</td> <td>N/A</td> </tr> </tbody> </table>			Soil Type:	Max. Velocity (V _{MAX})	Max Froude No. (F _{MAX})	Non-Cohesive	5.0 fps	0.60	Cohesive	7.0 fps	0.80	Paved	N/A	N/A	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th style="width: 50px;">Minor Storm</th> <th style="width: 50px;">Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>T_{MAX} =</td> <td><input style="width: 50px;" type="text" value="10.00"/></td> <td><input style="width: 50px;" type="text" value="10.00"/></td> <td>ft</td> </tr> <tr> <td>d_{MAX} =</td> <td><input style="width: 50px;" type="text" value="0.50"/></td> <td><input style="width: 50px;" type="text" value="0.50"/></td> <td>ft</td> </tr> </tbody> </table>			Minor Storm	Major Storm		T _{MAX} =	<input style="width: 50px;" type="text" value="10.00"/>	<input style="width: 50px;" type="text" value="10.00"/>	ft	d _{MAX} =	<input style="width: 50px;" type="text" value="0.50"/>	<input style="width: 50px;" type="text" value="0.50"/>	ft
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<p style="color: red; margin: 0;">Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</p> <p style="color: red; margin: 0;">Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</p>																												

AREA INLET IN A SWALE

**Super Star Car Wash - Meadowbrook
Basin A3**

Inlet Design Information (Input)																												
Type of Inlet ▼	Inlet Type = ▼																											
Angle of Inclined Grate (must be ≤ 30 degrees) Width of Grate Length of Grate Open Area Ratio Height of Inclined Grate Clogging Factor Grate Discharge Coefficient Orifice Coefficient Weir Coefficient	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>$\theta =$</td><td style="text-align: center;">0.00</td><td>degrees</td></tr> <tr><td>$W =$</td><td style="text-align: center;">3.00</td><td>ft</td></tr> <tr><td>$L =$</td><td style="text-align: center;">3.00</td><td>ft</td></tr> <tr><td>$A_{RATIO} =$</td><td style="text-align: center;">0.70</td><td></td></tr> <tr><td>$H_B =$</td><td style="text-align: center;">0.00</td><td>ft</td></tr> <tr><td>$C_f =$</td><td style="text-align: center;">0.50</td><td></td></tr> <tr><td>$C_d =$</td><td style="text-align: center;">0.84</td><td></td></tr> <tr><td>$C_o =$</td><td style="text-align: center;">0.56</td><td></td></tr> <tr><td>$C_w =$</td><td style="text-align: center;">1.81</td><td></td></tr> </table>	$\theta =$	0.00	degrees	$W =$	3.00	ft	$L =$	3.00	ft	$A_{RATIO} =$	0.70		$H_B =$	0.00	ft	$C_f =$	0.50		$C_d =$	0.84		$C_o =$	0.56		$C_w =$	1.81	
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