FINAL DRAINAGE REPORT FOR
HCD DRILLING
2601 EAST PLATTE AVENUE
COLORADO SPRINGS, COLORADO 80916

July, 2021
Revised April, 2022

Prepared For:

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DRAINAGE REPORT STATEMENT

Design Engineer's Statement

This 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 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.

_____

L DUCETT, P.E. 32339 Seal

OWNER/DEVELOPER'S STATEMENT:

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

_____ _____

Authorized Signature Date

_____

Printed Name, Title

_____

Business Name

_____

Address

Fill in the blanks in the Developers Statement and provide a signature line.

Unresolved.

Updated.

El Paso County Approval:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 & 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____

~~Jennifer Irvine, P.E.~~ Date

County Engineer / ECM Administrator

Delete

Removed.

Conditions:

Purpose

The purpose of this Final Drainage Report is to identify and analyze the existing and proposed drainage patterns, determine proposed runoff quantities, size drainage structures to safely convey the developed runoff, and present solutions to drainage impacts on-site and off-site resulting from this development.

General Description

This Final Drainage Report is an analysis of the development of "HCD DRILLING" (AKA "TRACT IN NE4NW4 SEC 18-14-65") owned by HCD Properties, LLC. The site is located at 2601 East Platte Avenue, Colorado Springs, CO 80916 in Section 18, Township 14S, Range 65 West of the 6th Principal Meridian in El Paso County. The site is bounded on the west by a landscaping supply business, on the north by E Platte Avenue Frontage Road, on the east by an RV and boat storage business, and on the south by a vacant lot owned by the City of Colorado Springs. The site is currently unplatted.

The site is currently used primarily for the parking and storage of vehicles and heavy equipment with some areas of soil excavation and storage at the southern end.

The proposed development is the addition of a 22,479 square foot building near the centroid of the lot but this project also makes preparations for a future building to be place near the front of the lot with all of the associated drives, utilities, grading, and stormwater features. The proposed building will be used to house a drilling company and includes a front office building with an asphalt parking lot and an attached industrial building with a surrounding gravel lot. The use of the future building will be established at a later time. The access will be from E Platte Avenue Frontage Road via two paved entrances.

The site lies within the Sand Creek Drainage Basin.

Soils Condition

The soil for this project is composed completely of Blakeland Loamy Sand per the "Soils Survey of El Paso County Area, which is in Hydrologic Soil Group A.

Drainage Criteria

Hydrologic and Hydraulic calculations were performed using the El Paso County Storm Drainage Design Criteria Manual Volumes 1 & 2, latest editions. The Rational Method was used to estimate storm water runoff and the design of the FSEDB was performed using UD-Detention v3.07.

Existing (Historic) Drainage Conditions

No previous drainage reports or studies could be found for this site. A drainage map for the existing conditions is included in the Appendix of this report. The site lies within the Sand Creek Basin. The existing topography has a relatively consistent 3% slope from the northeast to

the southwest but drops off more steeply at the western property line. The surface cover is composed of gravel lots and areas of disturbed ground with minimal vegetation.

Drainage ways for this site are poorly defined and runoff primarily sheet flows from the east/northeast to the west/southwest and leaves the site at three locations which are designated as Design Points (DP) for analysis. At the northwest property corner (DP X-1), runoff exits into the public drainage way along E Platte Avenue Frontage Road. At the west property line, about 250 feet south of the northwest property corner (DP X-2), runoff drains into a shallow swale and onto adjacent private property. Along the south side of the proposed development (DP X-3), runoff flows onto the same adjacent private property at a location approximately 500 feet south of DP X-2. Both DP X-2 and DP X-3 eventually release drainage into an existing pond on the west side of the adjacent property. At the southeast property line (DP X-4 & DP X-5), very small areas of runoff sheet flow onto Basin EX-C. There is a ridge that exists at the property line between Basins EX-A and EX-B and the adjacent eastern property which keeps drainage from flowing between sites. Therefore, there is no runoff from the adjacent property flowing onto Basins EX-A or EX-B.

Basin EX-A contributes to DP X-1 and has an area of 1.10 acres consisting of gravel lots and areas of disturbed soil, generating runoff amounts of Q5= 1.83 cfs and Q100= 4.62 cfs.

Basin EX-B contributes to DP X-2 and has an area of 2.10 acres consisting of gravel lots and areas of disturbed soil, generating runoff amounts of Q5= 2.20 cfs and Q100= 7.14 cfs.

Basin EX-C contributes to DP X-3 and has an area of 0.30 acres consisting of areas of disturbed soil, generating runoff amounts of Q5= 0.16 cfs and Q100= 0.88 cfs.

Basin OS-1 contributes to DP X-4 and has an area of 0.05 acres consisting of undeveloped land, generating runoff amounts of Q5= 0.02 cfs and Q100= 0.14 cfs.

Basin OS-2 contributes to DP X-5 and has an area of 0.10 acres consisting of undeveloped land, generating runoff amounts of Q5= 0.03 cfs and Q100= 0.25 cfs.

Developed Drainage Conditions

A drainage map for the proposed condition is included in the appendix of this report.

A Full Spectrum Extended Detention Basin (FSEDB) will be provided for the proposed and future development with a watershed area of 6.05 acres.

The proposed facility is comprised of asphalt parking lots, gravel lots, buildings, and landscaping. The drainage pattern for the site remains generally the same; however, the majority of the proposed developed/impervious areas are routed to the FSEDB. Only proposed Basins I & K will not be conveyed to the pond. Basins I & K total 1.12 acres. The only impervious portion is a 0.01 acre piece of the west access drive that is directed towards the drainage ditch along E Platte Avenue Frontage Road. This 0.01 acre area would qualify for an exclusion (Per ECM App I.7.1.C.1.)

Runoff continues to exit into the public drainage way along E Platte Avenue Frontage Road at the northwest corner (DP 11). The area draining to this location is significantly reduced as compared to existing conditions.

Runoff is no longer discharged at design point X2 as it had been in the existing conditions.

The outlet of the FSEDB (DP 9) is the location at which runoff from the proposed development is discharged after treatment.

Basin A contributes to DP 1 and has an area of 1.36 acres consisting primarily of proposed paved and future building area with a small portion of landscaped area, generating runoff amounts of Q5= 5.26 cfs and Q100= 10.67 cfs. Minor runoff is conveyed under the entrances at E Platte Avenue Frontage Road via 2 ft wide concrete trench drains just to the north of this basin. The runoff is collected by a 8' D-10-R inlet at design point 1 and conveyed to the FSEDB via storm pipe.

Basin B contributes to DP 2 and has an area of 0.71 acres consisting mostly of paved areas and much smaller areas of lawn/landscaping, generating runoff amounts of Q5= 2.58 cfs and Q100= 5.35 cfs. The runoff is collected by a type C inlet at design point 2 and conveyed to the FSEDB via storm pipe.

Basin C contributes to DP 3 and has an area of 0.54 acres consisting of paved area, building, gravel lot, and lawn/landscaping, generating runoff amounts of Q5= 1.59 cfs and Q100= 3.47 cfs. The runoff sheet flows and travels by a 2' concrete pan to a type C inlet at design point 3 and then conveyed to the FSEDB via storm pipe.

Basin D contributes to DP 4 and has an area of 0.26 acres consisting of building, paved area, gravel lot, and lawn/landscaping, generating runoff amounts of Q5= 0.82 cfs and Q100= 1.74 cfs. The runoff is collected by an inlet at design point 4 and conveyed to the FSEDB via storm pipe.

Basin E contributes to DP 5 and has an area of 0.35 acres consisting of building, paved area, and gravel lot, generating runoff amounts of Q5= 1.20 cfs and Q100= 2.48 cfs. The runoff is collected by an inlet at design point 5 and conveyed to the FSEDB via storm pipe.

Basin F contributes to DP 6 and has an area of 0.29 acres consisting of building, paved area, and gravel lot, generating runoff amounts of Q5= 1.03 cfs and Q100= 2.10 cfs. The runoff is collected by an inlet at design point 6 and conveyed to the FSEDB via storm pipe.

Basin G contributes to DP 7 and has an area of 0.35 acres consisting of building, paved area, and gravel lot, generating runoff amounts of Q5= 1.20 cfs and Q100= 2.48 cfs. The runoff is collected by an inlet at design point 7 and conveyed to the FSEDB via storm pipe.

Basin H contributes to DP 8 and has an area of 0.20 acres consisting of building, paved area, and gravel lot, generating runoff amounts of Q5= 0.71 cfs and Q100= 1.46 cfs. The runoff is collected by an inlet at design point 8 and conveyed to the FSEDB via storm pipe.

Basin I contributes to DP 9 and has an area of 0.96 acres consisting of grading needed for the construction of the FSEDB and other landscaped area generating runoff amounts of Q5= 0.26 cfs and Q100= 1.95 cfs. No new impervious area is being added and the ground cover will be improved from gravel and disturbed soil to maintained landscaping. Basin I is excluded from permanent WQ control measures per ECM Appendix I Section I.7.1.B.7 since this area consists of land disturbance to undeveloped land that will remain undeveloped after site construction is complete. Therefore, the area does not require treatment in the FSEDB. The runoff sheet flows onto adjacent property at design point 9 as in the existing conditions.

Basin J contributes to DP 10 and has an area of 1.82 acres consisting of the FSEDB, some paved area, gravel lot, and landscaped area, generating runoff amounts of Q5= 1.81 cfs and Q100= 5.37 cfs. The runoff sheet flows towards the FSEDB located at design point 10.

Basin K is the small area that continues to exit into the public drainage way along E Platte Avenue Frontage Road at the northwest corner (DP 11) as it had previously. The area and runoff of this basin is significantly reduced as compared to existing conditions. Basin K is excluded from permanent WQ control measures per ECM Appendix I Section I.7.1.B.7 since this area consists of land disturbance to undeveloped land that will remain undeveloped after site construction is complete. It generates runoff amounts of Q5= 0.09 cfs and Q100 = 0.45.

Basin L contributes to DP 12 and has an area of 0.06 acres consisting of building, paved area, and gravel lot, generating runoff amounts of Q5= 0.23 cfs and Q100= 0.47 cfs. The runoff is collected by an inlet at design point 12 and conveyed to the FSEDB via storm pipe.

Basin M contributes to DP 13 and has an area of 0.06 acres consisting of building, paved area, and gravel lot, generating runoff amounts of Q5= 0.19 cfs and Q100= 0.41 cfs. The runoff is collected by an inlet at design point 13 and conveyed to the FSEDB via storm pipe.

Basins OS-1 & OS-2 remain as they had previously.

FSEDB

In an effort to protect receiving water and as part of the "four step process to minimize adverse impacts of urbanization" this site was analyzed in the following manner:

Step 1: Employ Runoff Reduction Practices – The nature of the development precludes reducing runoff as most of the site is used for buildings, asphalt lots, and gravel lots.

Step 2: Stabilize Drainageways – There are no existing streams associated with this site.

Step 3: Provide Water Quality Capture Volume – The FSEDB is designed to capture and treat the runoff from the proposed development in the appropriate manner.

Step 4: Consider Need for Industrial and Commercial BMPs – given that the site will be used to house a drilling company, the presence of fuel and other contaminants are likely; therefore, spill kits should be kept on site and any outdoor storage of industrial materials should include the appropriate safeguards.

The runoff from Basins A, B, C, D, E, F, G, H, J, L, M, & OS-1 of the proposed development are routed to the proposed 2.235 ac-ft private FSEDB located at the southern portion of the property at DP 10. The FSEDB treats runoff from a combined watershed area of 6.05 acres with an imperviousness of 65.3%. The elevation of the bottom of the pond is 6243.00 and the top of the berm is at 6252.00. The pond design has a WQCV storage volume of 0.129 ac-ft at a water surface elevation of 6245.20. The EURV storage volume is 0.362 ac-ft at a water surface elevation of 6246.82. The 100-year storage volume of 0.240 ac-ft corresponds to a water surface of 6247.71. The WQCV discharge is less than 0.1 cfs and will be fully released in 40 hours. The EURV discharge is 0.2 cfs and will fully released in 72 hours. The 100 year outflow is 3.5 cfs and is fully released in 73 hours.

The forebay exceeds the size requirement of 2% of the WQCV volume of 0.129 ac-ft. A Trickle channel 2 ft wide and 0.5 ft deep at 0.54% slope runs from the forebay to the micropool at the

FSEDB outlet structure. The outlet structure is a 2.0 ft by 2.0 ft riser box with the inlet invert set at 6243.00 and the top of grate set at elevation 6246.82. A metal orifice plate on the front of the structure regulates the WQCV and EURV via three orifices with 0.7 square inches, 0.7 square inches, and 4 square inches spaced 1.27 ft apart. The invert of 18" outlet pipe is at elevation 6242.75 with a restrictor plate set 4.5 inches higher. The outlet pipe is 82 ft long at a slope of 1.12% with a metal end section at the outlet end with type L riprap protection (D50= 12 in).

An emergency spillway is set at elevation 6249.00. The spillway has a bottom width of 8 ft with 4:1 side slopes and is protected by type VL riprap (D50= 12 in). The 100 year HWL is 1.29 feet below the spillway. In an emergency overflow situation, the runoff will flow onto the property south of the site. Drainage from both the outlet pipe and emergency spillway will discharge from the southwest corner of the site to an existing depression in the land south of the site which is owned by the City of Colorado Springs. If this depression were to overtop, drainage would travel onto the adjacent commercial property to the west and travel over gravel and concrete channel to an existing pond on the western edge of that site in much the same way as in historical conditions.

Floodplain Statement

According to FEMA's FIRM No. 08041CO754G (eff. 12/7/2018), the proposed development is within an area designated as Zone X, having minimal flood hazard.

Construction Cost Opinion

Private Drainage Facilities Improvements (Non-Reimbursable)

Description	Quantity	Unit Price	Cost
4 ft Concrete Drain Pan	735 LF	$42	$30,870
2 ft Conc. Trench Drain	56 LF	$230	$12,880
		Total	**$43,750**

Private Permanent BMP (Non-Reimbursable) – 1 FSEDB

Description	Quantity	Unit Price	Cost
Earthwork	3607 Cu Yd	$12	$43284
Forebays	1 EA	$1500	$1500
Trickle Channel	92 LF	$32	$2944
Outlet Structure (box riser, micropool, pipe, headwall, and riprap)	1 EA	$5000	$5000
Emergency Spillway	1 EA	$1500	$1500
Maintenance Access Rd	1 EA	$500	$500
Stabilization	1 EA	$5000	$5000
		Subtotal	*$59,728*
		10% Contingency	*$5973*
		Total	**$65,701**

Drainage And Bridge Fees

This currently unplatted site is in the Sand Creek Drainage Basin. The site is 7.13 acres. The combined Drainage Fees (2021) are due prior to final plat recordation.

Fee Type	% Imp.	Parcel Area (acre)	Imp. Area (acre)	Fee per Imp Acre	Mod %	Fee Cost
Drainage	65.3	7.13	4.66	$20,387	100	$95,003.42
Bridge	65.3	7.13	4.66	$8,339	100	$38,859.74
				Total		$133,863.16

Maintenance

The proposed FSEDB will be privately maintained by the lot owner and is accessible via a 12' wide aggregate base maintenance access road. The proposed entrance trench drains and proposed concrete drain pans will be privately maintained by the lot owner.

Summary

This Final Drainage Report analyzed the development of HCD Drilling owned by HCD Properties, LLC, located at 2601 East Platte Avenue, Colorado Springs, CO 80916. Runoff from the development will not adversely affect the surrounding or downstream developments. Proposed flows, as detailed in this report, will follow existing drainage patterns and will be safely routed downstream. Water quality and detention are provided on-site using a FSEDB. No public storm drainage modifications or design changes are necessary as a result of the development.

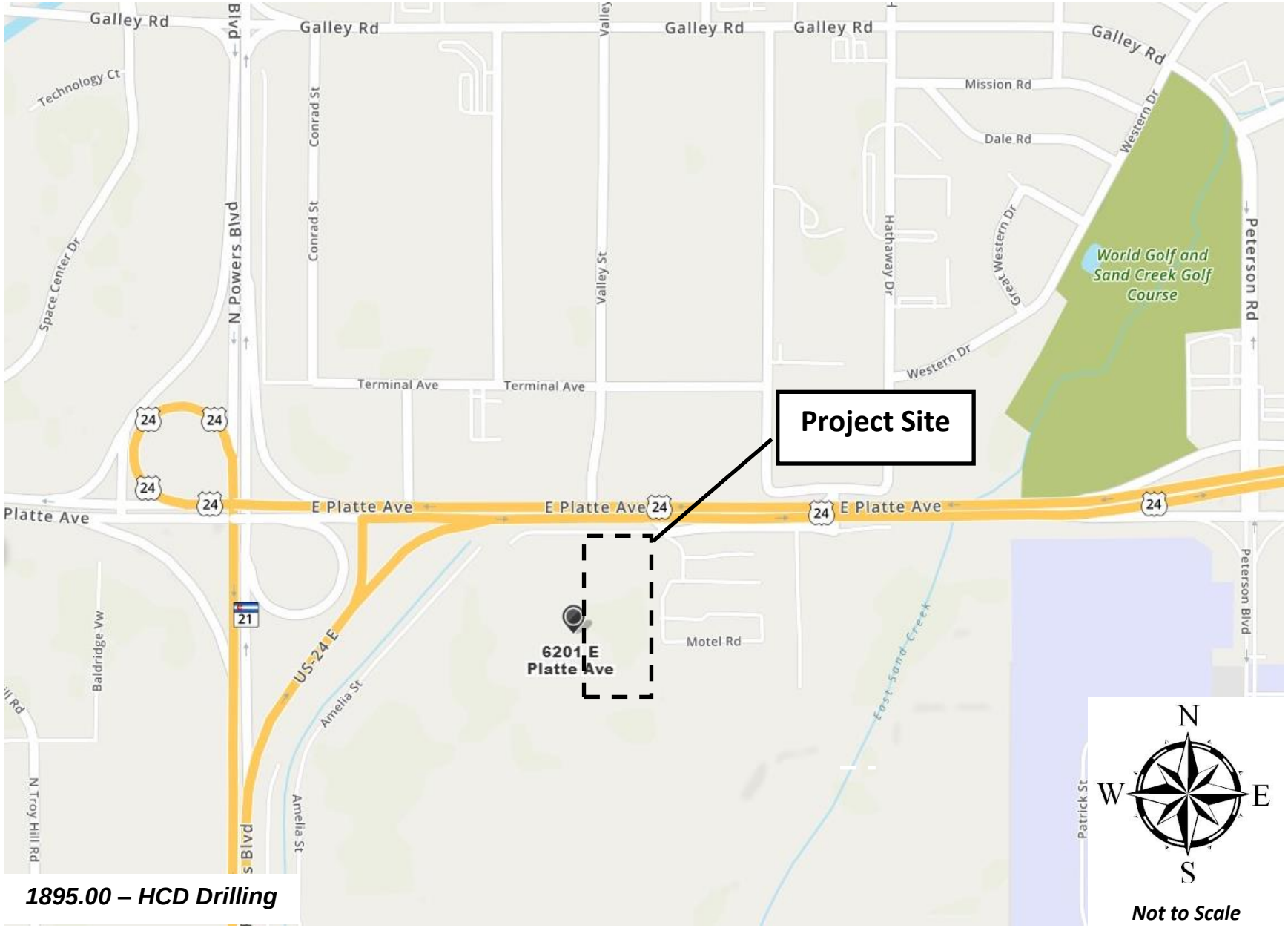
An Erosion Control Plan will be submitted separately.

References

1) *City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated May 2014.*
2) *Soil survey of El Paso County Area, Colorado, Prepared by United States Department of Agriculture Soil Conservation Service*, dated June 1981.
3) *Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Number 08041CO754G.*

APPENDICES

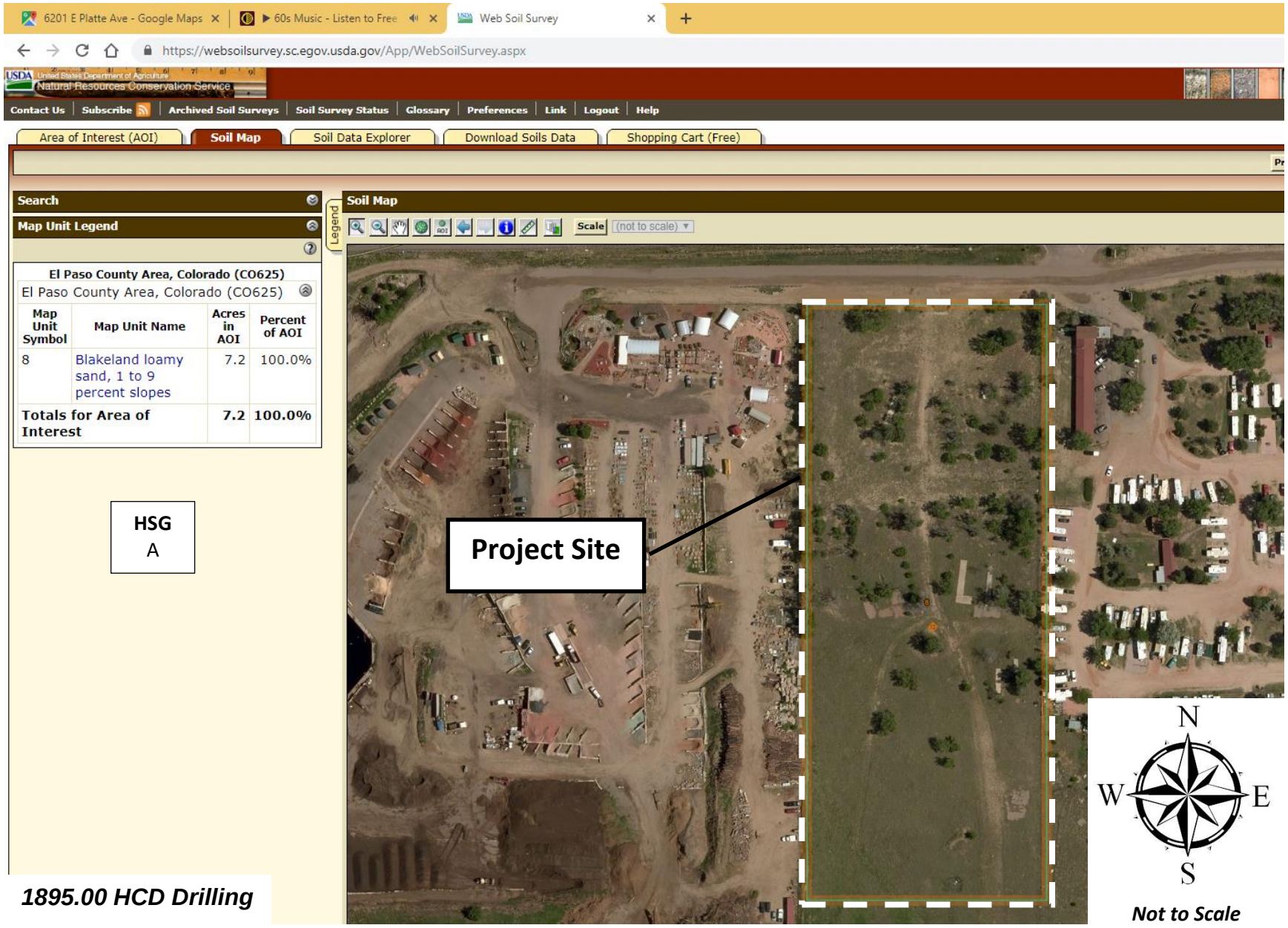
VICINITY MAP



1895.00 – HCD Drilling

Not to Scale

SOILS MAP



1895.00 HCD Drilling

Not to Scale

FEMA FLOODPLAIN MAP

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/24/2019 at 5:22:04 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

HYDROLOGIC CALCULATIONS

1895.00 HCD DRILLING
Area Runoff Coefficient (C) Summary

HSG - A

EXISTING

		GRAVEL LOT			DISTURBED AREA			LAWN/LANDSCAPING			WEIGHTED		WEIGHTED CA	
BASIN	TOTAL AREA	AREA	C5	C100	AREA	C5	C100	AREA	C5	C100	C5	C100	CA5	CA100
	(Acres)	(Acres)			(Acres)			(Acres)						
EX-A	1.1	0.7	0.59	0.70	0.4	0.15	0.50	0.0	0.08	0.35	0.43	0.63	0.47	0.69
EX-B	2.1	0.7	0.59	0.70	1.4	0.15	0.50	0.0	0.08	0.35	0.30	0.57	0.62	1.19
EX-C	0.3	0.0	0.59	0.70	0.3	0.15	0.50	0.0	0.08	0.35	0.15	0.50	0.05	0.15
OS-1	0.1	0.0	0.59	0.70	0.0	0.15	0.50	0.1	0.08	0.35	0.08	0.35	0.00	0.02
OS-2	0.1	0.0	0.59	0.70	0.0	0.15	0.50	0.1	0.08	0.35	0.08	0.35	0.01	0.04
	3.7													

Fixed.

Updat EX-C. Area does not match the existing drainage map (3.92 ac)

ELOPED

		GRA			OOF			LAWN/LANDSCAPING			WEIGHTED		WEIGHTED CA	
BASIN	TOTAL AREA	AREA	C5	C100	AREA	C5	C100	AREA	C5	C100	C5	C100	CA5	CA100
	(Acres)	(Acres)			(Acres)			(Acres)						
A	1.36	0.00	0.59	0.70	1.15	0.90	0.96	0.21	0.08	0.35	0.77	0.87	1.05	1.18
B	0.71	0.00	0.59	0.70	0.56	0.90	0.96	0.15	0.08	0.35	0.73	0.83	0.52	0.59
C	0.54	0.12	0.59	0.70	0.27	0.90	0.96	0.15	0.08	0.35	0.60	0.73	0.33	0.40
D	0.26	0.15	0.59	0.70	0.08	0.90	0.96	0.03	0.08	0.35	0.63	0.74	0.16	0.19
E	0.35	0.24	0.59	0.70	0.11	0.90	0.96	0.00	0.08	0.35	0.69	0.78	0.24	0.27
F	0.29	0.18	0.59	0.70	0.11	0.90	0.96	0.00	0.08	0.35	0.71	0.80	0.21	0.23
G	0.35	0.24	0.59	0.70	0.11	0.90	0.96	0.00	0.08	0.35	0.69	0.78	0.24	0.27
H	0.20	0.12	0.59	0.70	0.08	0.90	0.96	0.00	0.08	0.35	0.71	0.80	0.14	0.16
I	0.96	0.00	0.59	0.70	0.00	0.90	0.96	0.96	0.08	0.35	0.08	0.35	0.08	0.34
J	1.82	0.62	0.59	0.70	0.06	0.90	0.96	1.14	0.08	0.35	0.28	0.49	0.51	0.89
K	0.16	0.00	0.59	0.70	0.01	0.90	0.96	0.15	0.08	0.35	0.13	0.39	0.02	0.06
L	0.06	0.00	0.59	0.70	0.05	0.90	0.96	0.01	0.08	0.35	0.76	0.86	0.05	0.05
M	0.06	0.00	0.59	0.70	0.04	0.90	0.96	0.02	0.08	0.35	0.63	0.76	0.04	0.05
OS-1	0.05	0.00	0.59	0.70	0.00	0.90	0.96	0.05	0.08	0.35	0.08	0.35	0.00	0.02
OS-2	0.10	0.00	0.59	0.70	0.00	0.90	0.96	0.10	0.08	0.35	0.08	0.35	0.01	0.04

Date: 7/20/2021 Checked by: _____

1895.00 HCD DRILLING
Runoff Summary

EXISTING

		WEIGHTED		*OVERLAND*				*SHALLOW CONCENTRATED FLOW*				T_C	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Slope** *(ft/ft)*	T_t *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
EX-A	1.10	0.43	0.63	0.43	150	0.029	10.4	180	4.4%	3.2	0.9	11.4	3.9	6.7	1.83	4.62
EX-B	2.10	0.30	0.57	0.30	150	0.027	12.8	276	3.6%	2.8	1.6	14.4	3.5	6.0	2.20	7.14
EX-C	0.30	0.15	0.50	0.15	150	0.033	14.2	176	3.5%	2.8	1.0	15.2	3.4	5.9	0.16	0.88
OS-1	0.05	0.08	0.35	0.08	35	0.029	7.7	0	3.5%	2.8	0.0	7.7	4.4	7.9	0.02	0.14
OS-2	0.10	0.08	0.35	0.08	75	0.040	10.1	0	3.5%	2.8	0.0	10.1	4.1	7.0	0.03	0.25

DEVELOPED

		WEIGHTED		*OVERLAND*				*SHALLOW CONCENTRATED FLOW*				T_C	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Slope** *(ft/ft)*	T_t *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
A	1.36	0.77	0.87	0.77	55	0.02	3.4	255	3.0%	3.5	1.2	5.0	5.0	9.1	5.26	10.67
B	0.71	0.73	0.83	0.73	0	0.04	0.0	260	1.3%	2.2	2.0	5.0	5.0	9.1	2.58	5.35
C	0.54	0.60	0.73	0.60	45	0.02	4.8	95	1.0%	2.0	0.8	5.6	4.9	8.8	1.59	3.47
D	0.26	0.63	0.74	0.63	0	0.04	0.0	160	2.5%	3.2	0.8	5.0	5.0	9.1	0.82	1.74
E	0.35	0.69	0.78	0.69	0	0.33	0.0	180	4.0%	2.0	1.5	5.0	5.0	9.1	1.20	2.48
F	0.29	0.71	0.80	0.71	0	0.10	0.0	160	4.0%	2.0	1.3	5.0	5.0	9.1	1.03	2.10
G	0.35	0.69	0.78	0.69	0	0.10	0.0	180	4.0%	2.0	1.5	5.0	5.0	9.1	1.20	2.48
H	0.20	0.71	0.80	0.71	0	0.10	0.0	160	4.0%	2.0	1.3	5.0	5.0	9.1	0.71	1.46
I	0.96	0.08	0.35	0.08	100	0.03	12.8	310	4.0%	2.0	2.6	15.4	3.4	5.8	0.26	1.95
J	1.82	0.28	0.49	0.28	100	0.03	10.3	240	4.2%	1.0	4.0	14.3	3.5	6.0	1.81	5.37
K	0.16	0.13	0.39	0.13	100	0.07	9.4	0	1.0%	1.0	0.0	9.4	4.1	7.2	0.09	0.45
L	0.06	0.76	0.86	0.76	0	0.07	0.0	65	3.0%	1.5	0.7	5.0	5.0	9.1	0.23	0.47
M	0.06	0.63	0.76	0.63	0	0.07	0.0	90	3.0%	1.5	1.0	5.0	5.0	9.1	0.19	0.41
OS-1	0.05	0.08	0.35	0.08	50	0.02	10.4	0	1.0%	1.0	0.0	10.4	4.0	7.0	0.02	0.12
OS-2	0.10	0.08	0.35	0.08	90	0.03	11.8	0	1.0%	1.0	0.0	11.8	3.8	6.6	0.03	0.23

1895.00 HCD DRILLING
Surface Routing

EXISTING CONDITIONS									
Design Point(s)	***Contributing Basins***	***Area (Acres)***	***Equivalent CA_5***	***Equivalent CA_{100}***	***Maximum T_C***	***Intensity***		***Flow***	
						I_5	***I_{100}***	***Q_5***	***Q_{100}***
X1	EX-A	1.10	0.47	0.69	11.4	3.9	6.7	1.83	4.62
X2	EX-B	2.10	0.62	1.19	14.4	3.5	6.0	2.20	7.14
X3	EX-C, OS-1, OS-2	4.07	0.05	0.15	15.2	3.4	5.9	0.21	1.27
X4	OS-1	0.05	0.00	0.02	7.7	4.4	7.9	0.02	0.14
X5	OS-2	0.10	0.01	0.04	10.1	4.1	7.0	0.03	0.25

PROPOSED CONDITIONS									
Design Point(s)	***Contributing Basins***	***Area (Acres)***	***Equivalent CA_5***	***Equivalent CA_{100}***	***Maximum T_C***	***Intensity***		***Flow***	
						I_5	***I_{100}***	***Q_5***	***Q_{100}***
1	A	1.36	1.05	1.18	5.0	5.0	9.1	5.26	10.67
2	B	0.71	0.52	0.59	5.0	5.0	9.1	2.58	5.35
3	C	0.54	0.33	0.40	5.6	4.9	8.8	1.59	3.47
4	D	0.26	0.16	0.19	5.0	5.0	9.1	0.82	1.74
5	E	0.35	0.24	0.27	5.0	5.0	9.1	1.20	2.48
6	F	0.29	0.21	0.23	5.0	5.0	9.1	1.03	2.10
7	G	0.35	0.24	0.27	5.0	5.0	9.1	1.20	2.48
8	H	0.20	0.14	0.16	5.0	5.0	9.1	0.71	1.46
9	I, OS-2, Pond	7.11	0.08	0.37	27.2	2.6	4.3	0.42	5.09
10	J, OS-1	1.87	0.52	0.91	24.7	2.7	4.5	1.42	4.12
11	K	0.16	0.02	0.06	9.4	4.1	7.2	0.09	0.45
12	L	0.06	0.05	0.05	5.0	5.0	9.1	0.23	0.47
13	M	0.06	0.04	0.05	5.0	5.0	9.1	0.19	0.41
14	OS-1	0.05	0.00	0.02	10.4	4.0	7.0	0.02	0.12
15	OS-2	0.10	0.01	0.04	11.8	3.8	6.6	0.03	0.23

DEVELOPED CONDITIONS

Pipe Run(s)	*Contributing Design Points/Pipe Runs*	*Area (Acres)*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity*		*Flow*	
						I_5	*I_{100}*	*Q_5*	*Q_{100}*
1	DP 1	1.36	1.05	1.18	5.0	5.0	9.1	5.3	10.7
2	DP 12	0.06	0.05	0.05	5.0	5.0	9.1	0.2	0.5
3	DP 13, PR 2	0.12	0.08	0.10	5.0	5.0	9.1	0.4	0.9
4	DP 3, PR 3, PR 1	2.02	1.46	1.67	5.0	5.0	9.1	7.3	15.1
5	DP 5, PR 4	2.37	1.70	1.94	5.0	5.0	9.1	8.5	17.6
6	DP 7, PR 5	2.72	1.94	2.22	5.0	5.0	9.1	9.7	20.1
7	DP 2	0.71	0.52	0.59	5.0	5.0	9.1	2.6	5.3
8	DP 4, PR 7	0.97	0.68	0.78	5.0	5.0	9.1	3.4	7.1
9	DP 6, PR 8	1.26	0.88	1.01	5.0	5.0	9.1	4.4	9.2
10	DP 8, PR 9	1.46	1.03	1.17	5.0	5.0	9.1	5.1	10.6
11	POND OUTLET							0.2	3.5

Calculated by: JF

Date: 7/21/2021

Checked by: _____

HYDRAULIC CALCULATIONS

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 1

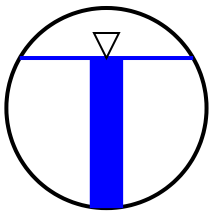
24" RCP

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	20.6269	cfs
Velocity, v	2.4877	m/s
Velocity head, h_v	0.3155	m H2O
Flow area	0.2348	m^2
Wetted perimeter	1.2767	m
Hydraulic radius	0.1839	m
Top width, T	0.5279	m
Froude number, F	1.19	
Shear stress (tractive force), tau	18.0341	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 2

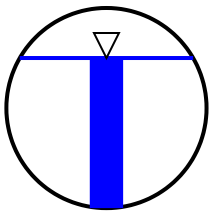
12" HDPE

Inputs

Pipe diameter, d_0	12	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	3.2485	cfs
Velocity, v	1.5671	m/s
Velocity head, h_v	0.1252	m H2O
Flow area	0.0587	m^2
Wetted perimeter	0.6384	m
Hydraulic radius	0.0920	m
Top width, T	0.2640	m
Froude number, F	1.06	
Shear stress (tractive force), tau	9.0170	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 3

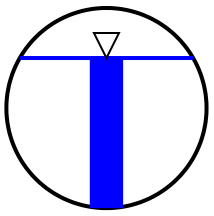
12" HDPE

Inputs

Pipe diameter, d_0	12	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	3.2485	cfs
Velocity, v	1.5671	m/s
Velocity head, h_v	0.1252	m H2O
Flow area	0.0587	m^2
Wetted perimeter	0.6384	m
Hydraulic radius	0.0920	m
Top width, T	0.2640	m
Froude number, F	1.06	
Shear stress (tractive force), tau	9.0170	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 4

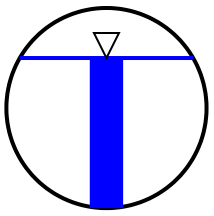
24" RCP

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	20.6269	cfs
Velocity, v	2.4877	m/s
Velocity head, h_v	0.3155	m H2O
Flow area	0.2348	m^2
Wetted perimeter	1.2767	m
Hydraulic radius	0.1839	m
Top width, T	0.5279	m
Froude number, F	1.19	
Shear stress (tractive force), tau	18.0341	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 5

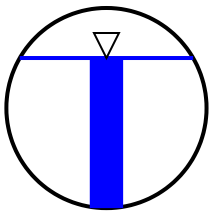
24" RCP

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	20.6269	cfs
Velocity, v	2.4877	m/s
Velocity head, h_v	0.3155	m H2O
Flow area	0.2348	m^2
Wetted perimeter	1.2767	m
Hydraulic radius	0.1839	m
Top width, T	0.5279	m
Froude number, F	1.19	
Shear stress (tractive force), tau	18.0341	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 6

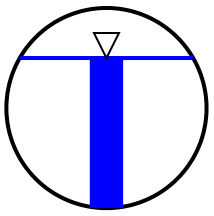
24" RCP

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	20.6269	cfs
Velocity, v	2.4877	m/s
Velocity head, h_v	0.3155	m H2O
Flow area	0.2348	m^2
Wetted perimeter	1.2767	m
Hydraulic radius	0.1839	m
Top width, T	0.5279	m
Froude number, F	1.19	
Shear stress (tractive force), tau	18.0341	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 7

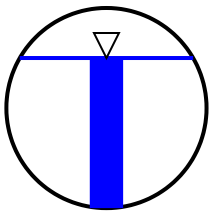
15" HDPE

Inputs

Pipe diameter, d_0	15	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	5.8900	cfs
Velocity, v	1.8185	m/s
Velocity head, h_v	0.1686	m H2O
Flow area	0.0917	m^2
Wetted perimeter	0.7980	m
Hydraulic radius	0.1149	m
Top width, T	0.3300	m
Froude number, F	1.10	
Shear stress (tractive force), tau	11.2713	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 8

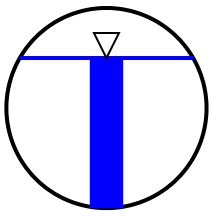
18" RCP

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	9.5777	cfs
Velocity, v	2.0535	m/s
Velocity head, h_v	0.2150	m H2O
Flow area	0.1321	m^2
Wetted perimeter	0.9576	m
Hydraulic radius	0.1379	m
Top width, T	0.3959	m
Froude number, F	1.14	
Shear stress (tractive force), tau	13.5256	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 9

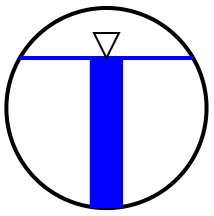
18" RCP

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	9.5777	cfs
Velocity, v	2.0535	m/s
Velocity head, h_v	0.2150	m H2O
Flow area	0.1321	m^2
Wetted perimeter	0.9576	m
Hydraulic radius	0.1379	m
Top width, T	0.3959	m
Froude number, F	1.14	
Shear stress (tractive force), tau	13.5256	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe Run 10

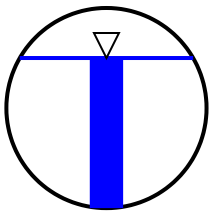
24" RCP

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.01	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	.75	fraction

Results

Flow, Q (See notes)	20.6269	cfs
Velocity, v	2.4877	m/s
Velocity head, h_v	0.3155	m H2O
Flow area	0.2348	m^2
Wetted perimeter	1.2767	m
Hydraulic radius	0.1839	m
Top width, T	0.5279	m
Froude number, F	1.19	
Shear stress (tractive force), tau	18.0341	N/m^2



Notes:

This is the flow and depth *inside* the pipe.
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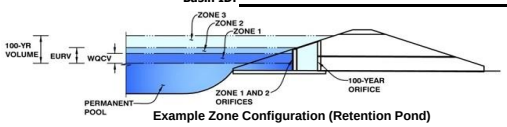
FSEDB CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

No override used.

Remove the optional User override for WQCV and EURV.

Unresolved.

Depth Increment = ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	6.05	acres
Watershed Length =	800	ft
Watershed Length to Centroid =	340	ft
Watershed Slope =	0.022	ft/ft
Watershed Imperviousness =	65.30%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.129	acre-feet	0.129	acre-feet
Excess Urban Runoff Volume (EURV) =	0.491	acre-feet	0.491	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.346	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.454	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.540	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.653	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.763	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.898	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	1.123	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.319	acre-feet		
Approximate 5-yr Detention Volume =	0.418	acre-feet		
Approximate 10-yr Detention Volume =	0.503	acre-feet		
Approximate 25-yr Detention Volume =	0.605	acre-feet		
Approximate 50-yr Detention Volume =	0.667	acre-feet		
Approximate 100-yr Detention Volume =	0.731	acre-feet		

Define Zones and Basin Geometry

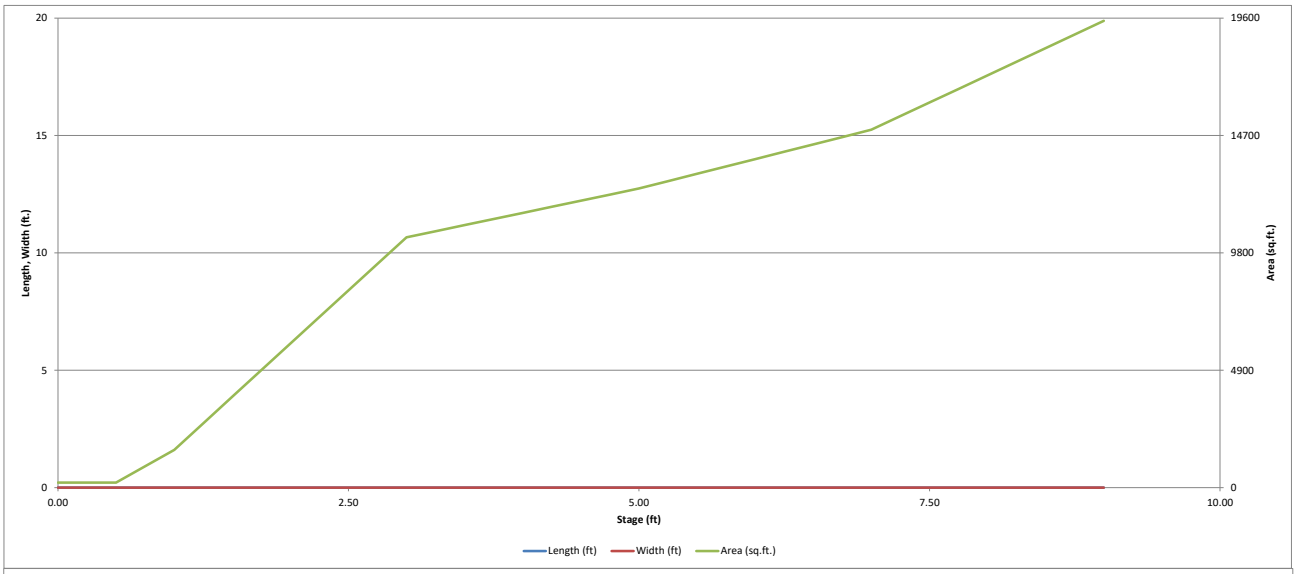
Zone 1 Volume (WQCV) =	0.129	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.362	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.240	acre-feet
Total Detention Basin Volume =	0.731	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

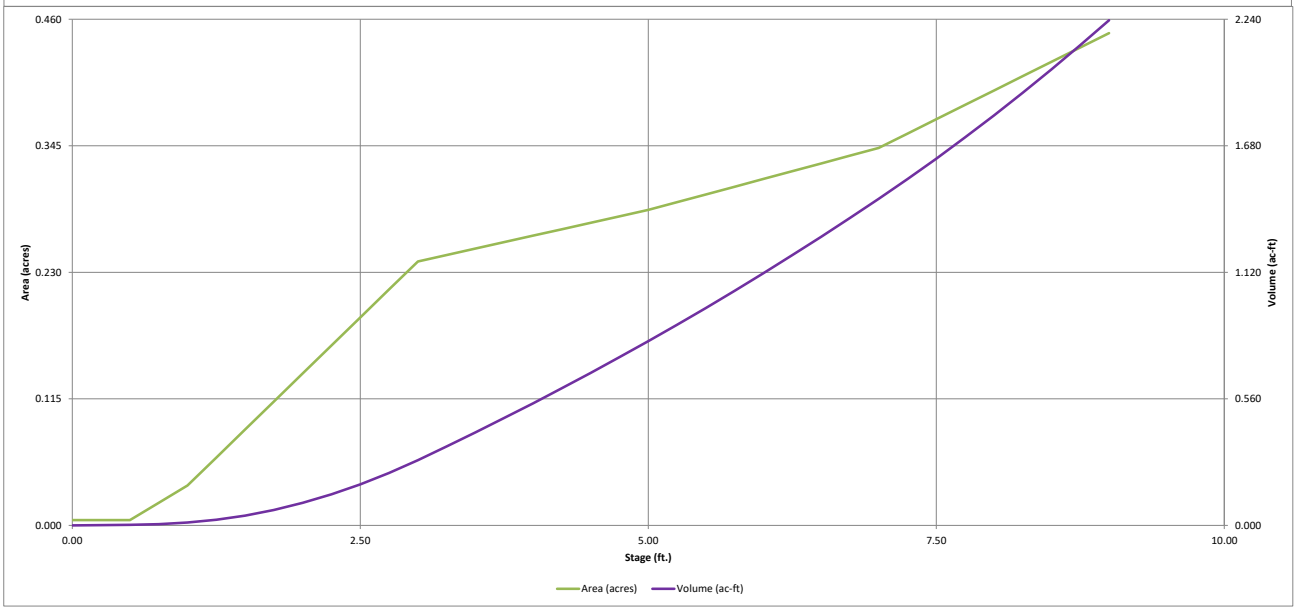
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Sta								Volume (ft^3)	Volume (ac-ft)
Top									
								53	0.001
								105	0.002
								243	0.006
								552	0.013
								1,085	0.025
	--	1.50	--	--	--	3,796	0.087	1,895	0.044
	--	1.75	--	--	--	4,905	0.113	2,983	0.068
6245	--	2.00	--	--	--	6,014	0.138	4,348	0.100
	--	2.25	--	--	--	7,123	0.164	5,990	0.138
	--	2.50	--	--	--	8,232	0.189	7,909	0.182
	--	2.75	--	--	--	9,341	0.214	10,106	0.232
6246	--	3.00	--	--	--	10,450	0.240	12,580	0.289
	--	3.25	--	--	--	10,705	0.246	15,224	0.350
	--	3.50	--	--	--	10,960	0.252	17,932	0.412
	--	3.75	--	--	--	11,215	0.257	20,704	0.475
6247	--	4.00	--	--	--	11,470	0.263	23,540	0.540
	--	4.25	--	--	--	11,724	0.269	26,439	0.607
	--	4.50	--	--	--	11,979	0.275	29,402	0.675
	--	4.75	--	--	--	12,234	0.281	32,429	0.744
6248	--	5.00	--	--	--	12,489	0.287	35,519	0.815
	--	5.25	--	--	--	12,796	0.294	38,680	0.888
	--	5.50	--	--	--	13,102	0.301	41,917	0.962
	--	5.75	--	--	--	13,409	0.308	45,231	1.038
6249	--	6.00	--	--	--	13,715	0.315	48,621	1.116
	--	6.25	--	--	--	14,022	0.322	52,088	1.196
	--	6.50	--	--	--	14,328	0.329	55,632	1.277
	--	6.75	--	--	--	14,635	0.336	59,252	1.360
6250	--	7.00	--	--	--	14,941	0.343	62,949	1.445
	--	7.25	--	--	--	15,509	0.356	66,755	1.532
	--	7.50	--	--	--	16,078	0.369	70,704	1.623
	--	7.75	--	--	--	16,646	0.382	74,794	1.717
6251	--	8.00	--	--	--	17,215	0.395	79,027	1.814
	--	8.25	--	--	--	17,783	0.408	83,401	1.915
	--	8.50	--	--	--	18,351	0.421	87,918	2.018
	--	8.75	--	--	--	18,920	0.434	92,577	2.125
6252	--	9.00	--	--	--	19,488	0.447	97,378	2.235

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



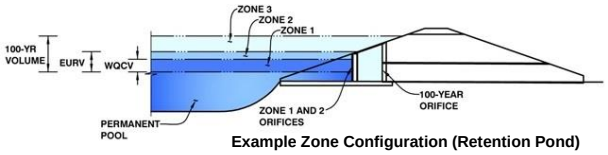


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.20	0.129	Orifice Plate
Zone 2 (EURV)	3.82	0.362	Orifice Plate
Zone 3 (100-year)	4.71	0.240	Weir&Pipe (Restrict)
Total (all zones)		0.731	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.82	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	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)	0.00	1.27	2.55					
Orifice Area (sq. inches)	0.70	0.70	4.00					

	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)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.82	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.82	N/A	feet
Overflow Weir Front Edge Length =	2.00	N/A	feet	Overflow Weir Slope Length =	2.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	9.16	N/A	
Horiz. Length of Weir Sides =	2.00	N/A	feet	Overflow Grate Open Area w/o Debris =	3.16	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	1.58	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.35	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.22	N/A	feet
Restrictor Plate Height Above Pipe Invert =	4.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.05	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.65	feet
Spillway Crest Length =	8.00	feet	Stage at Top of Freeboard =	7.65	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.38	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.68	acre-ft

Calculated Parameters for Spillway

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).

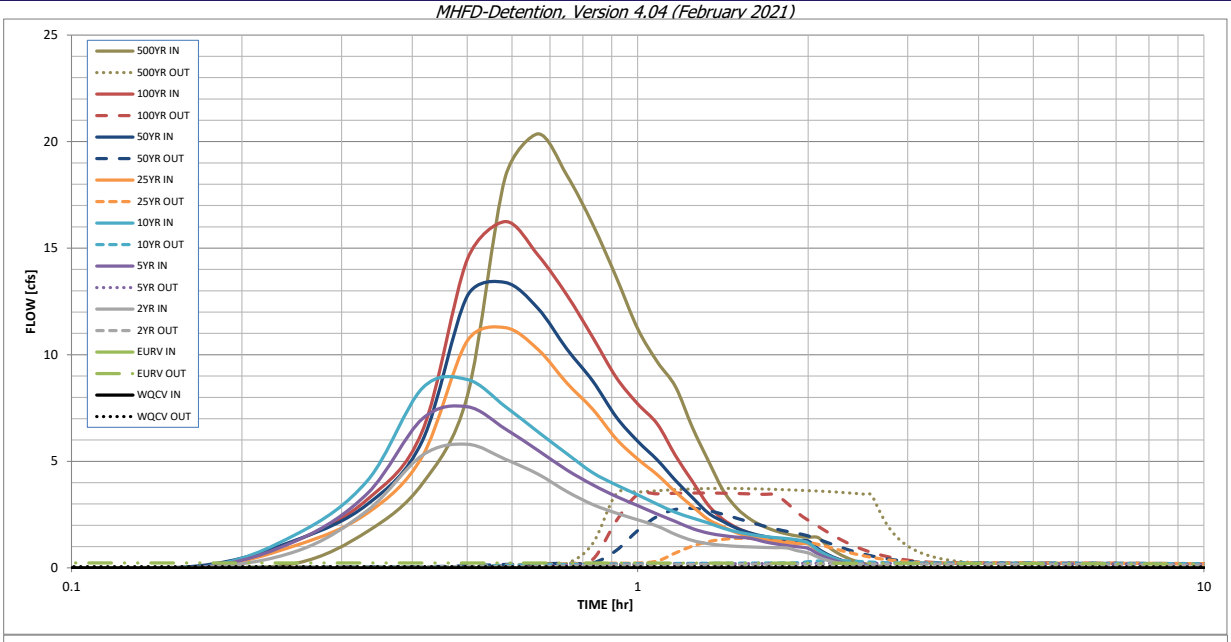
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.129	0.491	0.346	0.454	0.540	0.653	0.763	0.898	1.123
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.346	0.454	0.540	0.653	0.763	0.898	1.123
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	1.1	2.3	3.7	6.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.19	0.38	0.62	0.99
Peak Inflow Q (cfs) =	N/A	N/A	5.8	7.6	8.8	11.3	13.4	16.2	20.4
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.3	1.4	2.8	3.5	3.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.3	2.7	1.2	1.2	0.9	0.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.5	0.8	1.0	1.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	67	61	66	69	68	66	64	62
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	65	71	75	74	74	73	72
Maximum Ponding Depth (ft) =	2.20	3.82	3.14	3.55	3.86	4.01	4.15	4.43	5.00
Area at Maximum Ponding Depth (acres) =	0.16	0.26	0.24	0.25	0.26	0.26	0.27	0.27	0.29
Maximum Volume Stored (acre-ft) =	0.129	0.493	0.320	0.422	0.501	0.543	0.580	0.653	0.813

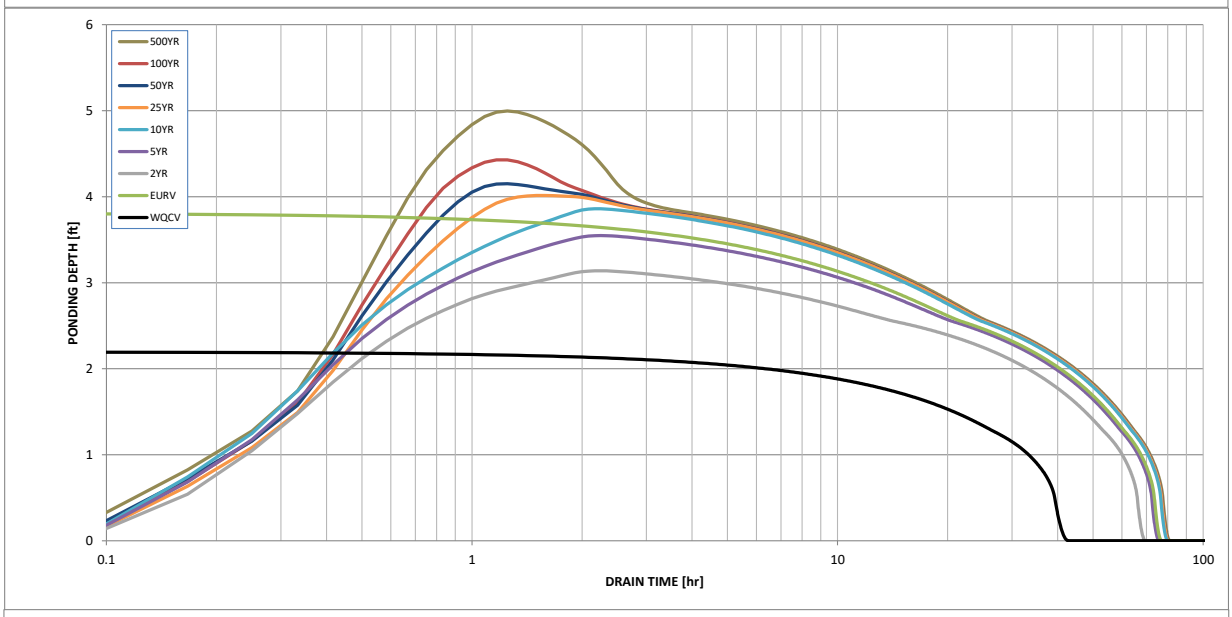
Update outlet structure design. For full spectrum design these must be equal to or less than predevelopment flows.
Unresolved

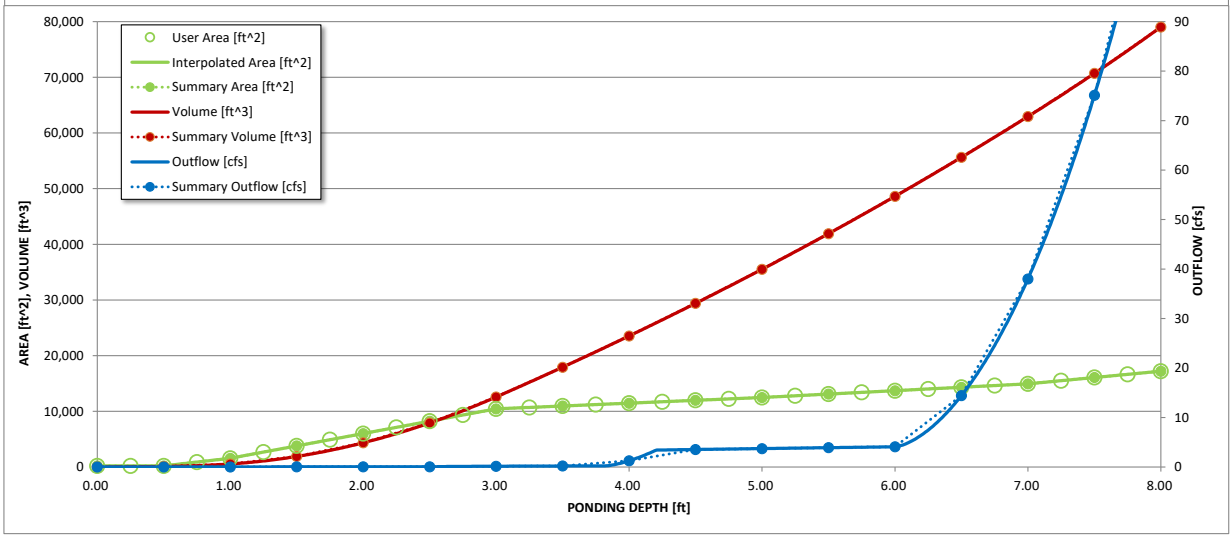
We keep to the standards for the 100-year flow, but the only way I was able to get these numbers below 1.0 was to violate the 97% drain times.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01	0.22
	0:15:00	0.00	0.00	0.79	1.28	1.59	1.07	1.32	1.30	1.71
	0:20:00	0.00	0.00	2.69	3.50	4.10	2.58	2.99	3.22	3.95
	0:25:00	0.00	0.00	5.29	7.00	8.43	5.24	5.96	6.42	8.05
	0:30:00	0.00	0.00	5.80	7.56	8.84	10.65	12.75	14.46	18.31
	0:35:00	0.00	0.00	5.10	6.53	7.58	11.27	13.39	16.25	20.36
	0:40:00	0.00	0.00	4.40	5.51	6.38	10.25	12.18	14.68	18.41
	0:45:00	0.00	0.00	3.58	4.59	5.35	8.67	10.26	12.80	16.11
	0:50:00	0.00	0.00	2.97	3.90	4.46	7.44	8.76	10.81	13.64
	0:55:00	0.00	0.00	2.57	3.35	3.89	6.05	7.08	8.93	11.23
	1:00:00	0.00	0.00	2.26	2.92	3.43	5.11	5.94	7.70	9.67
	1:05:00	0.00	0.00	1.96	2.52	2.99	4.37	5.06	6.75	8.49
	1:10:00	0.00	0.00	1.57	2.17	2.61	3.56	4.10	5.26	6.57
	1:15:00	0.00	0.00	1.28	1.84	2.34	2.88	3.30	4.05	5.02
	1:20:00	0.00	0.00	1.13	1.63	2.11	2.27	2.57	2.94	3.62
	1:25:00	0.00	0.00	1.06	1.52	1.86	1.92	2.17	2.27	2.78
	1:30:00	0.00	0.00	1.01	1.44	1.69	1.64	1.84	1.87	2.27
	1:35:00	0.00	0.00	0.98	1.39	1.57	1.45	1.63	1.62	1.95
	1:40:00	0.00	0.00	0.96	1.24	1.48	1.32	1.49	1.45	1.74
	1:45:00	0.00	0.00	0.95	1.13	1.42	1.24	1.40	1.33	1.59
	1:50:00	0.00	0.00	0.94	1.05	1.38	1.18	1.33	1.25	1.49
	1:55:00	0.00	0.00	0.80	0.99	1.31	1.15	1.29	1.21	1.44
	2:00:00	0.00	0.00	0.70	0.92	1.18	1.12	1.26	1.19	1.42
	2:05:00	0.00	0.00	0.50	0.65	0.83	0.80	0.89	0.85	1.01
	2:10:00	0.00	0.00	0.35	0.46	0.58	0.56	0.63	0.60	0.71
	2:15:00	0.00	0.00	0.24	0.31	0.40	0.39	0.44	0.42	0.50
	2:20:00	0.00	0.00	0.16	0.21	0.27	0.26	0.29	0.28	0.33
	2:25:00	0.00	0.00	0.10	0.13	0.18	0.17	0.19	0.19	0.22
	2:30:00	0.00	0.00	0.06	0.09	0.11	0.11	0.13	0.12	0.14
	2:35:00	0.00	0.00	0.03	0.05	0.06	0.07	0.07	0.07	0.08
	2:40:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.03	0.04
	2:45:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	210	0.005	0	0.000	0.00
	0.50	210	0.005	105	0.002	0.02
	1.00	1,578	0.036	552	0.013	0.02
	1.50	3,796	0.087	1,895	0.044	0.04
	2.00	6,014	0.138	4,348	0.100	0.05
	2.50	8,232	0.189	7,909	0.182	0.06
	3.00	10,450	0.240	12,580	0.289	0.16
	3.50	10,960	0.252	17,932	0.412	0.21
	4.00	11,470	0.263	23,540	0.540	1.26
	4.50	11,979	0.275	29,402	0.675	3.54
	5.00	12,489	0.287	35,519	0.815	3.73
	5.50	13,102	0.301	41,917	0.962	3.91
	6.00	13,715	0.315	48,621	1.116	4.08
	6.50	14,328	0.329	55,632	1.277	14.43
	7.00	14,941	0.343	62,949	1.445	38.01
	7.50	16,078	0.369	70,704	1.623	75.11
	8.00	17,215	0.395	79,027	1.814	126.90
	8.50	18,351	0.421	87,918	2.018	194.59
	9.00	19,488	0.447	97,378	2.235	279.36

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

FORBAY VOLUMES

FORBAY VOLUME

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6244.00	200				
		200	1.5	300	
6245.50	200				300

End Area Method: 300 C.F.
0.007 A.F.

Required Forbay Volume = 3% of WQCV

WQCV =	0.129	ac-ft
WQCV =	5,619	cu-ft
3% of WQCV =	168.58	cu-ft

PROPOSED MICROPOOL VOLUME

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6240.50	12				
		111	3	333	
6243.50	210				333

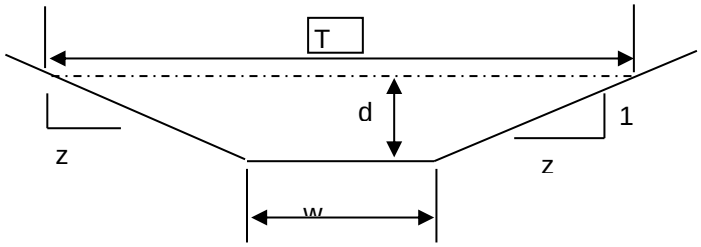
End Area Method: 333 C.F.
0.008 A.F.

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **HCD Drilling** Location: EDB Forebay Notch - Q=16.2 cfs * 2% = 0.32 cfs

By: John Fornander Date: 7/21/2021

Chk By: Date: version 12-2004



Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient

$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	0.25
d (depth, ft)=	1.5
S (slope, ft/ft)	0.005
n_{low} =	0.013
n_{high} =	0.013

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
1.5	0.38	3.25	0.12	1.91555431	0.71833	1.915554	0.71833	T =	0.25
								Dm =	1.500
				Sc low =	0.0657	Sc high =	0.0657		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0460	0.0854	0.0460	0.0854		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **HCD Drilling** Location: EDB Trickle Channels (need Q= 0.49 cfs)

By: John Fornander Date: 7/21/2021

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

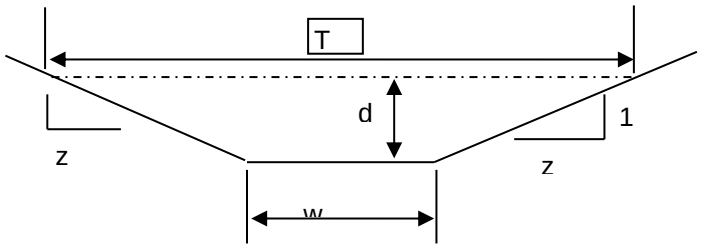
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	1
d (depth, ft)=	0.5
S (slope, ft/ft)	0.0054
n_{low} =	0.013
n_{high} =	0.013

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	0.50	2.00	0.25	3.33333483	1.66667	3.333335	1.66667	T =	1
								Dm =	0.500
				Sc low =	0.0078	Sc high =	0.0078		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0055	0.0102	0.0055	0.0102		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

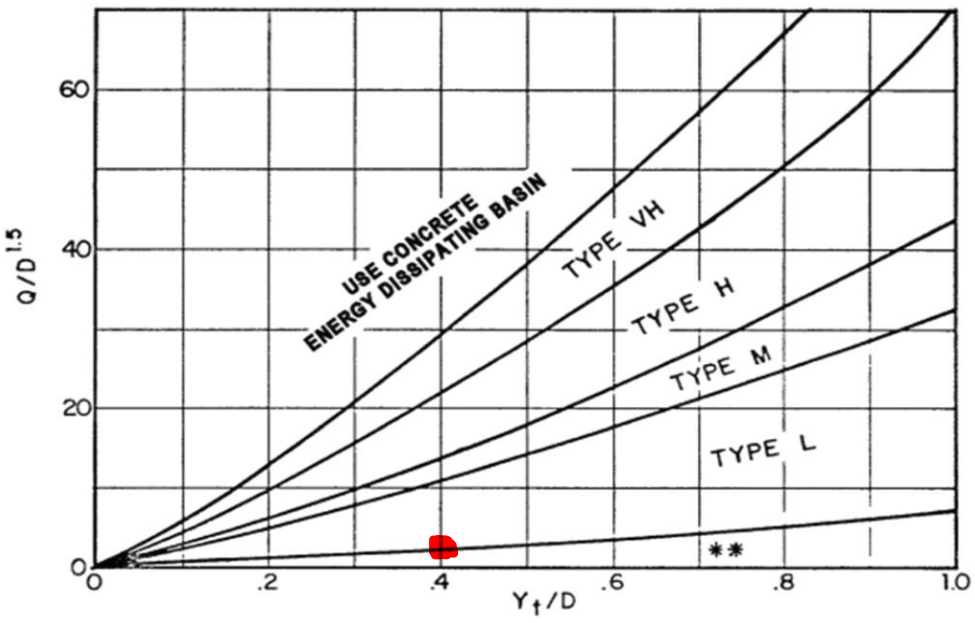
Created by: Mike O'Shea

1895.00 HCD Drilling

Riprap Protection for FSEDB Outlet Pipe[1]

Q100=	3.5	cfs	$Q/D^{2.5}$ =	1.27
D=	1.5	ft	$Q/D^{1.5}$ =	1.91
Yt=	0.25	ft	Yt/D =	0.4

Minimum Riprap d_{50} Required = d_{50} = 9 in ==> use d_{50} = 12 in



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for Q/D2.5 ≤ 6.0)

[1] see USDCM Chapter 9 Section Section 3.2.3

Figure 13-12c. Emergency Spillway Protection

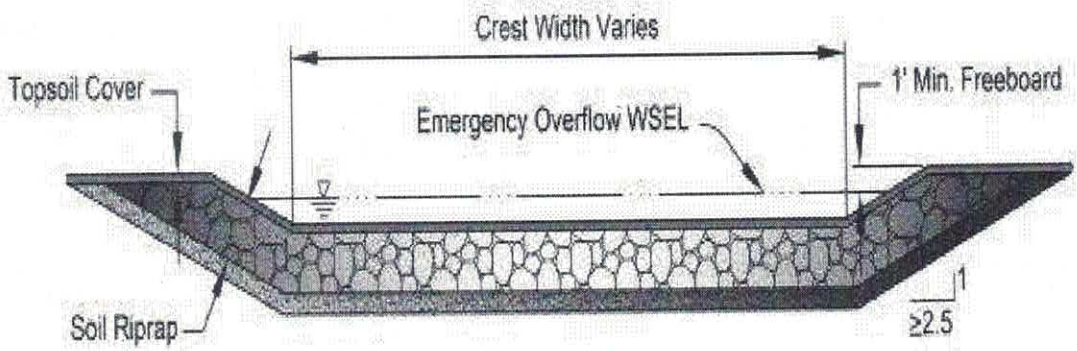
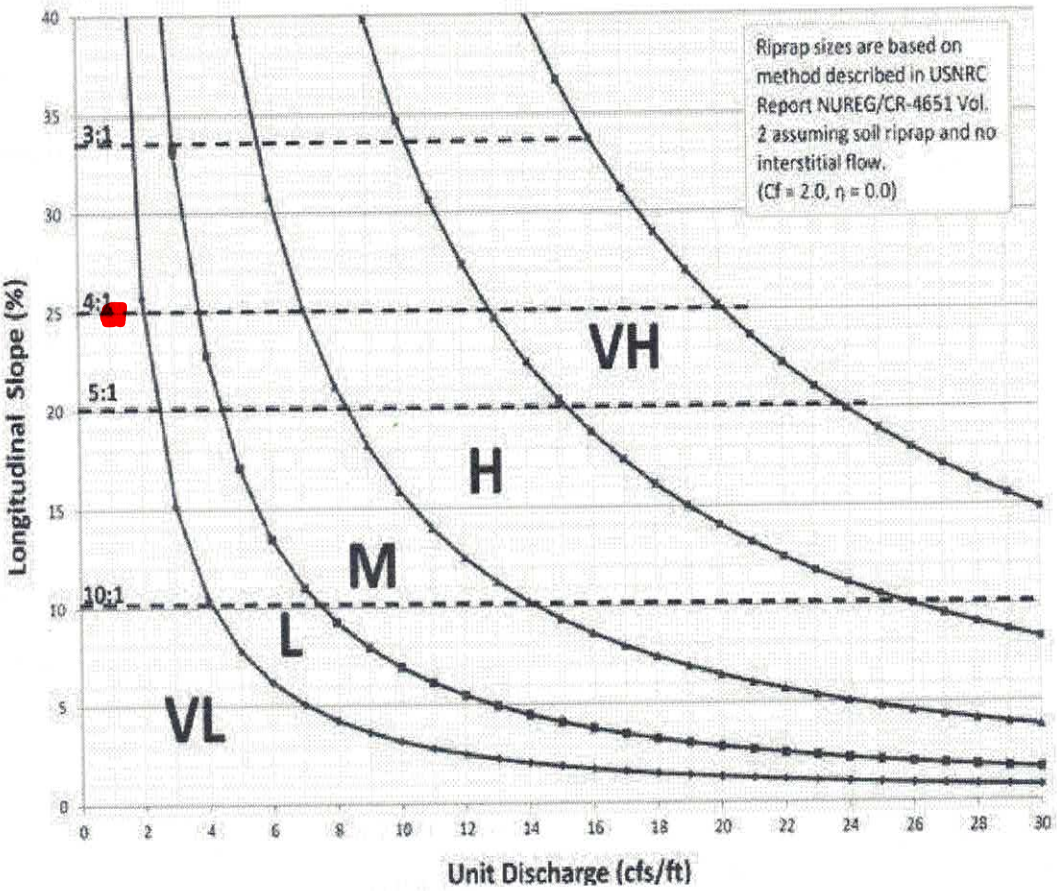


Figure 13-12d. Riprap Types for Emergency Spillway Protection

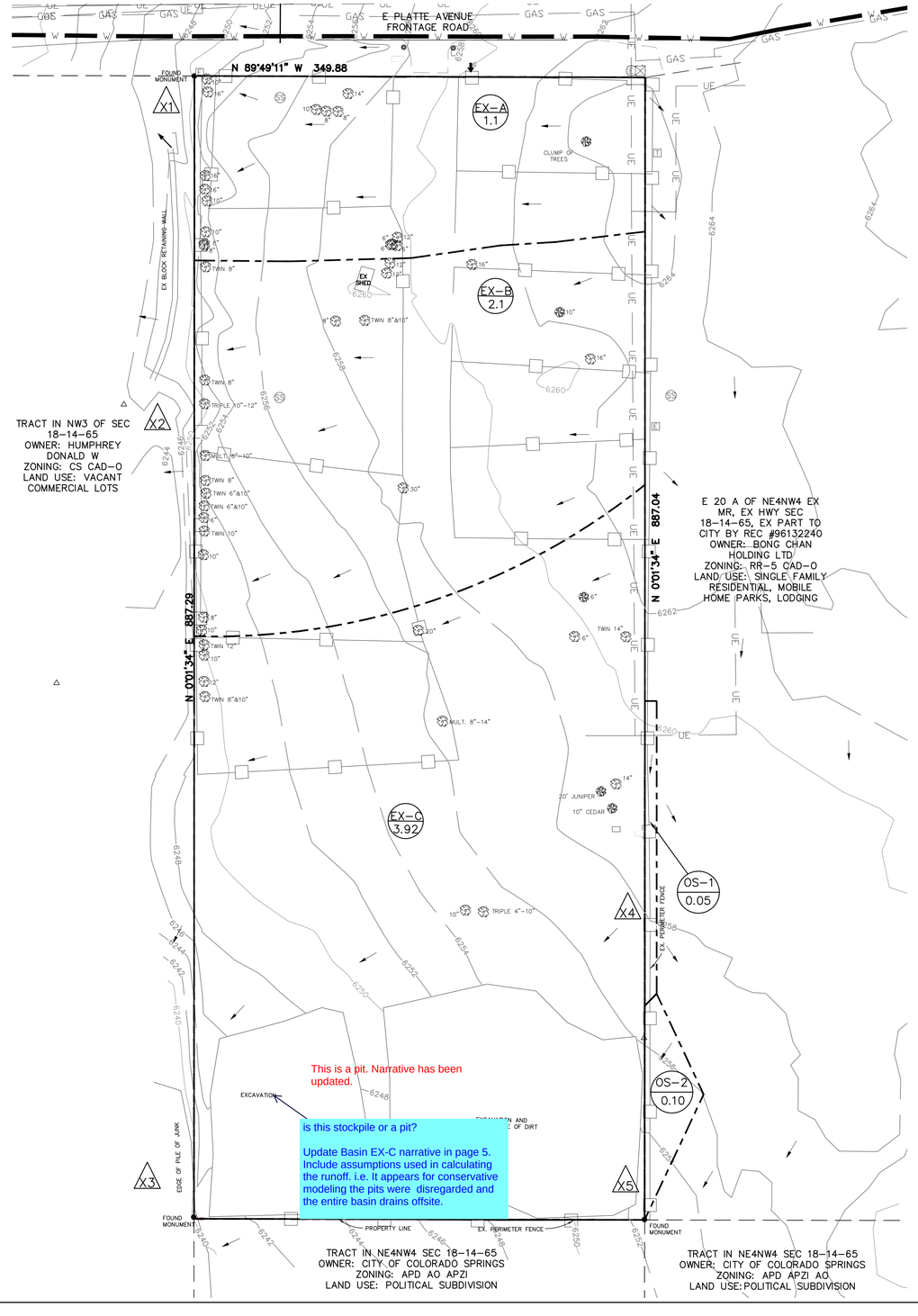


DRAINAGE MAPS

HCD DRILLING MINOR SUBDIVISION

6201 EAST PLATTE AVE

EXISTING DRAINAGE MAP



DRAINAGE SUMMARY

BASIN NAME	AREA (ACRES)	FLOW 5 YR (cfs)	FLOW 100 YR (cfs)
EX-A	1.10	1.83	4.62
EX-B	2.10	2.20	7.14
EX-C	3.92	0.16	0.88
OS-1	0.05	0.02	0.14
OS-2	0.10	0.03	0.25
TOTAL	7.27		

DESIGN POINT SUMMARY

DP	CONTRIBUTING BASINS	AREA AC.	Q5 CFS	Q100 CFS
X1	EX-A	1.10	1.83	4.62
X2	EX-B	2.10	2.20	7.14
X3	EX-C, OS-1, OS-2	4.07	0.21	1.27
X4	OS-1	0.05	0.02	0.14
X5	OS-2	0.10	0.03	0.25

N

0 25' 50' 100'
SCALE: 1"= 50'

LEGEND

- EX-B / 12.22 — BASIN DESIGNATION / AREA IN BASIN (AC)
- 1 — PIPE RUN
- 2 — DESIGN POINT
- BASIN BOUNDARY
- 6132 — EXISTING MINOR CONTOUR
- 6130 — EXISTING MAJOR CONTOUR
- GROUND SURFACE FLOW DIRECTION

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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OFFICE: 719-635-6422
FAX: 719-635-6426
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HCD PROPERTIES MINOR SUBDIVISION
6201 E. PLATTE AVE.

EXISTING DRAINAGE MAP

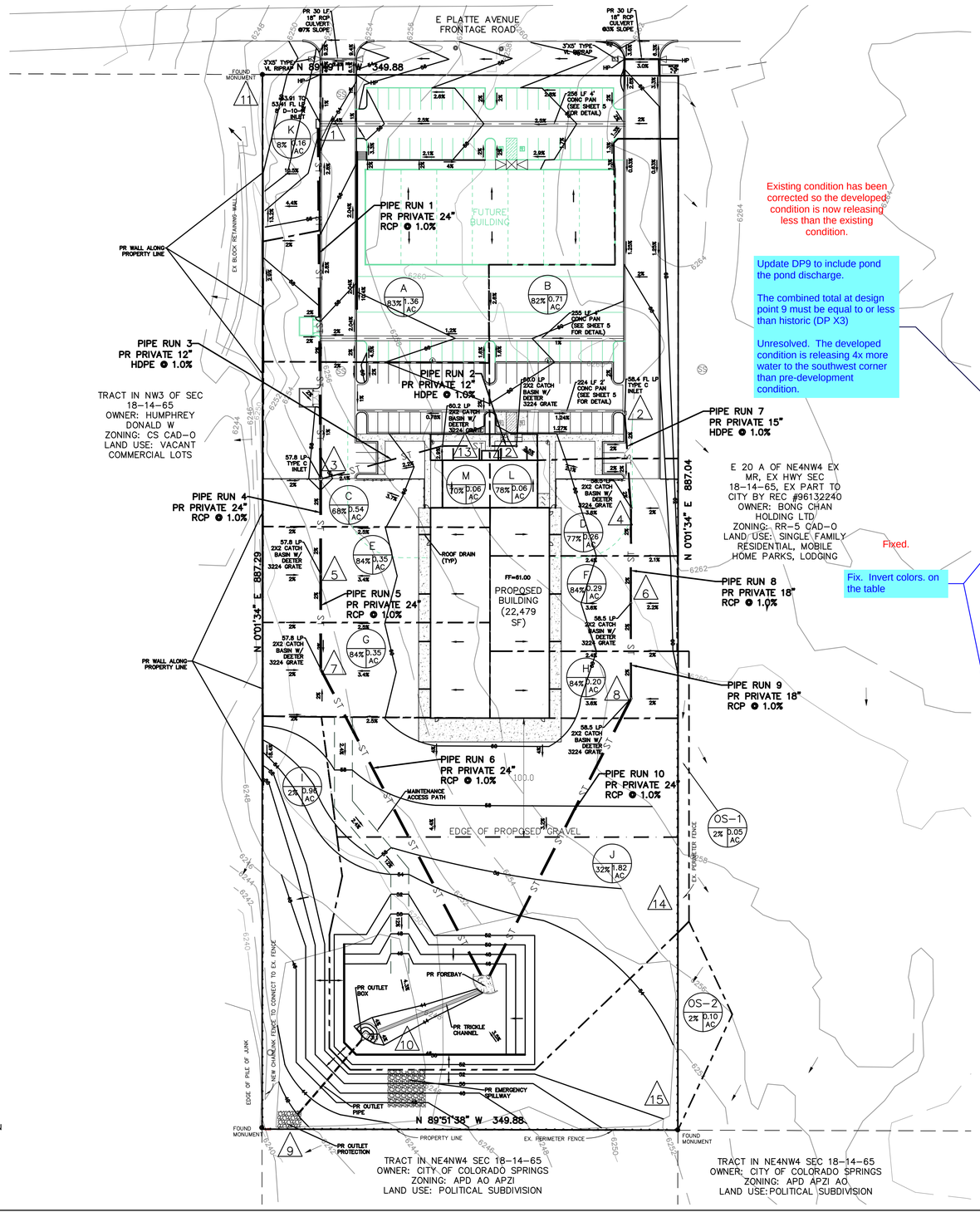
DESIGNED BY JF
DRAWN BY JF
CHECKED BY LD
H-SCALE AS NOTED
V-SCALE N/A
JOB NO. 1895.00
DATE ISSUED 4/15/22
SHEET NO. 1 OF 2

N:\jobs\1895.00\Drawings\189500 DRAINAGE MAPS.dwg, 5/3/2022 8:05:22 AM, DWG To PDF.pc3

HCD DRILLING MINOR SUBDIVISION

6201 EAST PLATTE AVE

PROPOSED DRAINAGE MAP



NOTE: All drainage structures are PRIVATE unless otherwise labeled.

N

0 15' 30' 60'

SCALE: 1" = 30'

LEGEND

- OS-2 / 2% / 0.10 AC — BASIN DESIGNATION / PERCENT IMPERVIOUSNESS / AREA IN BASIN
- 1 — PIPE RUN
- 2 — DESIGN POINT
- BASIN BOUNDARY
- 6132 — EXISTING MINOR CONTOUR
- 6130 — EXISTING MAJOR CONTOUR
- GROUND SURFACE FLOW DIRECTION

Existing condition has been corrected so the developed condition is now releasing less than the existing condition.

Update DP9 to include pond the pond discharge.

The combined total at design point 9 must be equal to or less than historic (DP X3)

Unresolved. The developed condition is releasing 4x more water to the southwest corner than pre-development condition.

Fixed.

Fix. Invert colors. on the table

DRAINAGE SUMMARY

BASIN NAME	AREA (ACRES)	FLOW 5 YR (cfs)	FLOW 100 YR (cfs)
A	1.36	5.26	10.67
B	0.71	2.58	5.35
C	0.54	1.59	3.47
D	0.26	0.82	1.74
E	0.35	1.20	2.48
F	0.29	1.03	2.10
G	0.35	1.20	2.48
H	0.20	0.71	1.46
I	0.96	0.26	1.95
J	1.82	1.81	5.37
K	0.16	0.09	0.45
L	0.06	0.23	0.47
M	0.06	0.19	0.41
OS-1	0.05	0.02	0.12
OS-2	0.10	0.03	0.23

PROPOSED CONDITIONS

Design Point(s)	*Contributing Basins*	*Area (Acres)*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity I_5*	*Intensity I_{100}*	*Flow Q_5*	*Flow Q_{100}*
1	A	1.36	1.05	1.18	5.0	5.0	9.1	5.26	10.67
2	B	0.71	0.52	0.59	5.0	5.0	9.1	2.58	5.35
3	C	0.54	0.33	0.40	5.6	4.9	8.8	1.59	3.47
4	D	0.26	0.16	0.19	5.0	5.0	9.1	0.82	1.74
5	E	0.35	0.24	0.27	5.0	5.0	9.1	1.20	2.48
6	F	0.29	0.21	0.23	5.0	5.0	9.1	1.03	2.10
7	G	0.35	0.24	0.27	5.0	5.0	9.1	1.20	2.48
8	H	0.20	0.14	0.16	5.0	5.0	9.1	0.71	1.46
9	I, OS-2, Pond	7.11	0.08	0.37	27.2	2.6	4.3	0.42	5.09
10	J, OS-1	1.87	0.52	0.91	24.7	2.7	4.5	1.42	4.12
11	K	0.16	0.02	0.06	9.4	4.1	7.2	0.09	0.45
12	L	0.06	0.05	0.05	5.0	5.0	9.1	0.23	0.47
13	M	0.06	0.04	0.05	5.0	5.0	9.1	0.19	0.41
14	OS-1	0.05	0.00	0.02	10.4	4.0	7.0	0.02	0.12
15	OS-2	0.10	0.01	0.04	11.8	3.8	6.6	0.03	0.23

DEVELOPED CONDITIONS

Pipe Run(s)	*Contributing Design Points/Pipe Runs*	*Area (Acres)*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity I_5*	*Intensity I_{100}*	*Flow Q_5*	*Flow Q_{100}*		
1	DP 1	1.36	1.05	1.18	5.0	5.0	9.1	5.3	10.7	24" RCP	PRIVATE
2	DP 12	0.06	0.05	0.05	5.0	5.0	9.1	0.2	0.5	12" HDPE	PRIVATE
3	DP 13, PR 2	0.12	0.08	0.10	5.0	5.0	9.1	0.4	0.9	12" HDPE	PRIVATE
4	DP 3, PR 3, PR 1	2.02	1.46	1.67	5.0	5.0	9.1	7.3	15.1	24" RCP	PRIVATE
5	DP 5, PR 4	2.37	1.70	1.94	5.0	5.0	9.1	8.5	17.6	24" RCP	PRIVATE
6	DP 7, PR 5	2.72	1.94	2.22	5.0	5.0	9.1	9.7	20.1	24" RCP	PRIVATE
7	DP 2	0.71	0.52	0.59	5.0	5.0	9.1	2.6	5.3	15" HDPE	PRIVATE
8	DP 4, PR 7	0.97	0.68	0.78	5.0	5.0	9.1	3.4	7.1	18" RCP	PRIVATE
9	DP 6, PR 8	1.26	0.88	1.01	5.0	5.0	9.1	4.4	9.2	18" RCP	PRIVATE
10	DP 8, PR 9	1.46	1.03	1.17	5.0	5.0	9.1	5.1	10.6	24" RCP	PRIVATE
11	POND OUTLET							0.2	3.5	18" RCP	PRIVATE

REVISIONS

NO.	DESCRIPTION	DATE

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Creative Civil Engineering Solutions
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FAX: 719-635-6426
www.tnesinc.com

HCD PROPERTIES MINOR SUBDIVISION
6201 E PLATTE AVE.

PROPOSED DRAINAGE MAP

DESIGNED BY JF
DRAWN BY JF
CHECKED BY LD

H-SCALE AS NOTED
V-SCALE N/A

JOB NO. 1895.00
DATE ISSUED 4/15/22
SHEET NO. 2 OF 2

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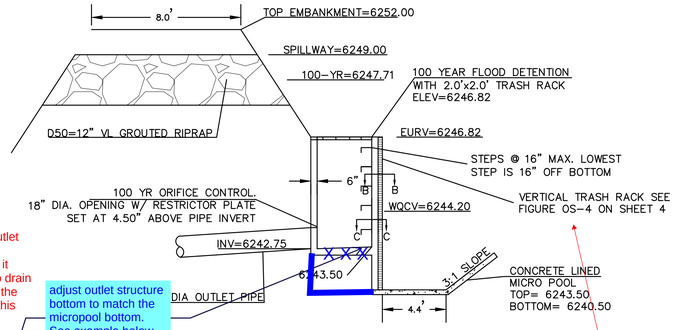
HCD DRILLING MINOR SUBDIVISION
CONSTRUCTION DRAWINGS

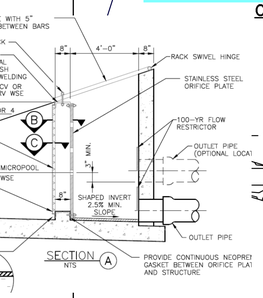
Need to place outlet structure at this elevation to give it enough height to drain out. I was under the impression that this was allowed.

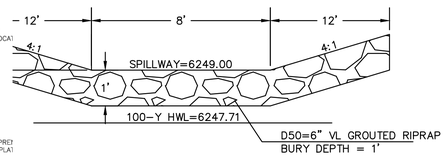
adjust outlet structure bottom to match the micropool bottom. See example below. Unresolved.



OUTLET STRUCTURE & MICROPOOL SIDE VIEW

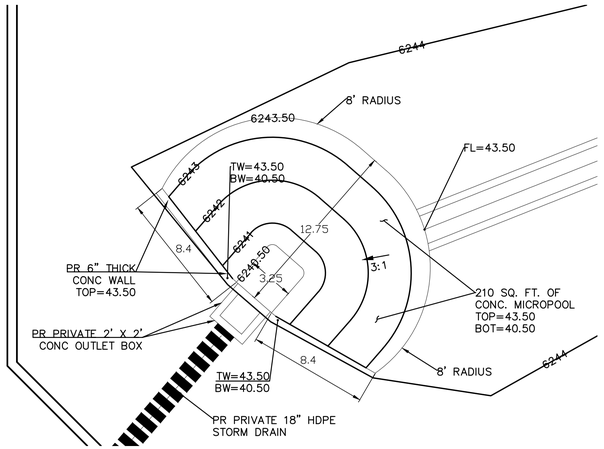
NOT TO SCALE





EDB EMERGENCY SPILLWAY

NOT TO SCALE



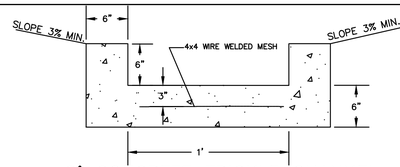
OUTLET STRUCTURE & MICROPOOL PLAN VIEW

Remove Sheet.

Redline comments are cursory comments. Detailed comments will be provided to the construction drawings as part of the review of the site development plan application.

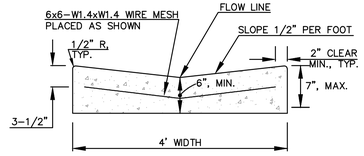
Unresolved.

Removed.



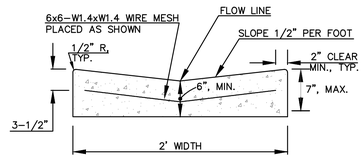
2' CONCRETE TRICKLE CHANNEL

NOT TO SCALE



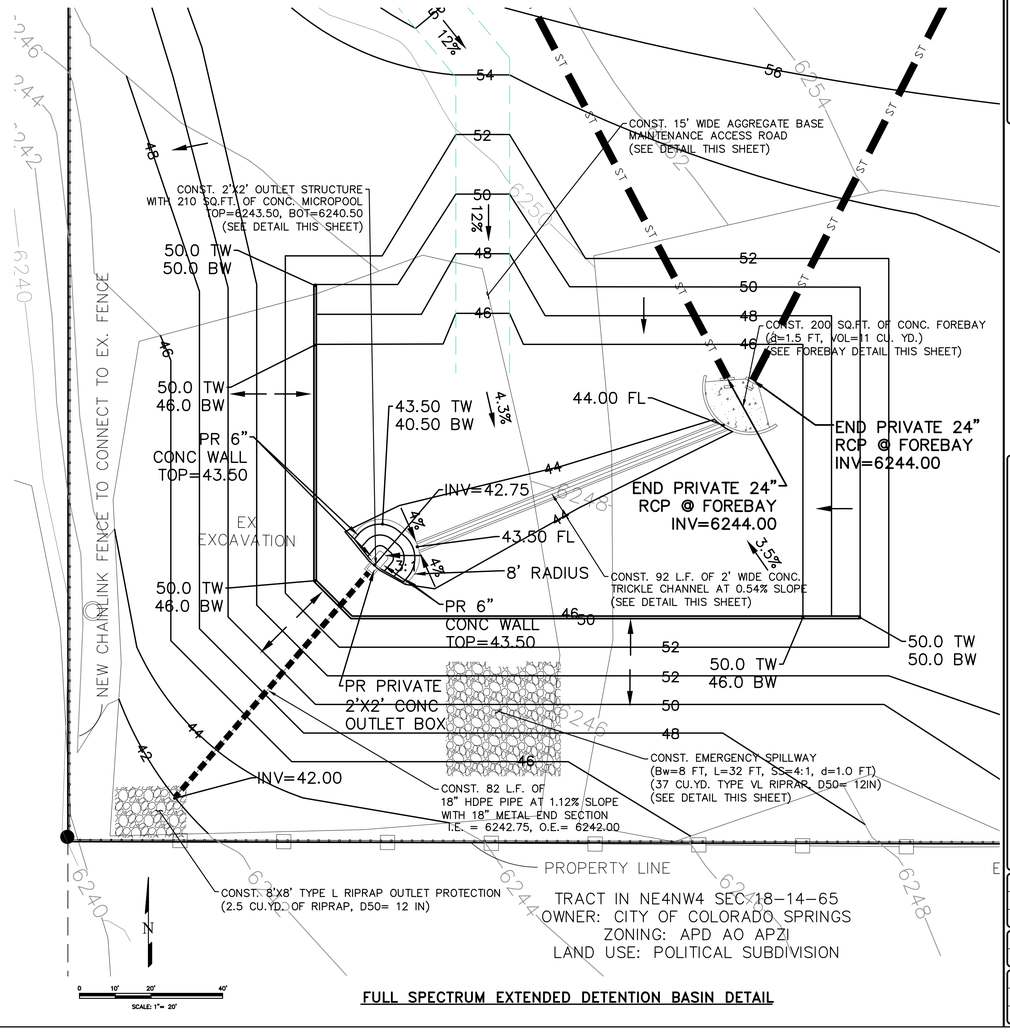
4' CONCRETE PAN

NOT TO SCALE

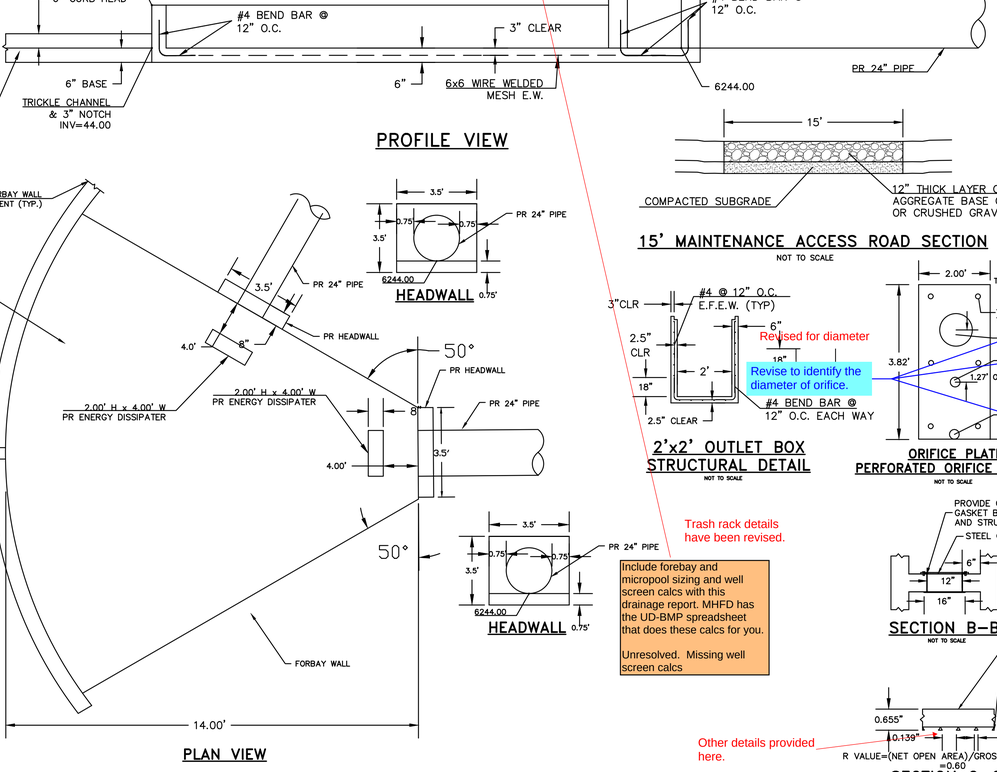


2' CONCRETE PAN

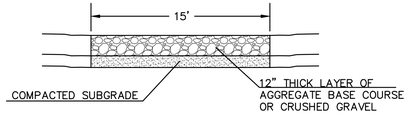
NOT TO SCALE



FULL SPECTRUM EXTENDED DETENTION BASIN DETAIL

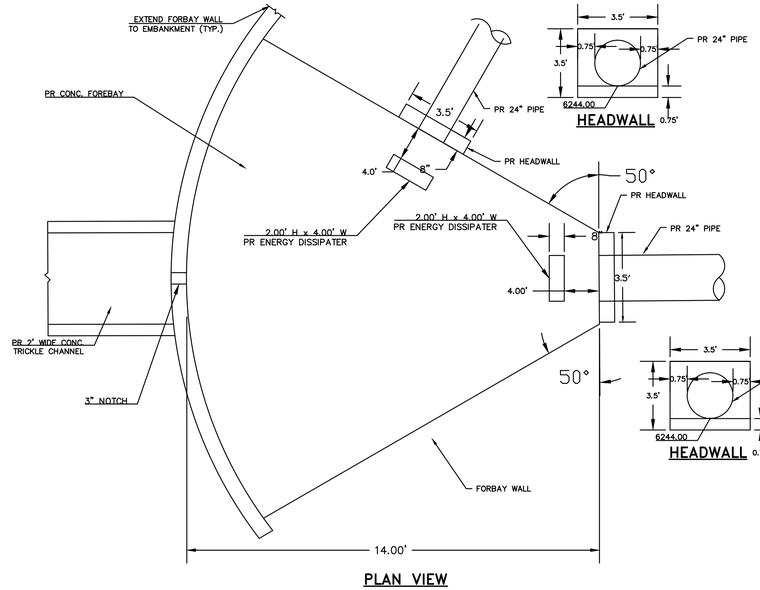


PROFILE VIEW

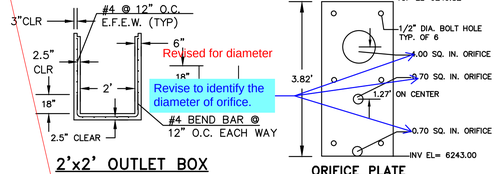


15' MAINTENANCE ACCESS ROAD SECTION

NOT TO SCALE

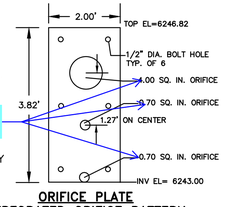


CONCRETE FOREBAY DETAIL



2'x2' OUTLET BOX STRUCTURAL DETAIL

NOT TO SCALE



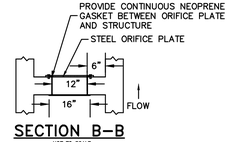
ORIFICE PLATE PERFORATED ORIFICE PATTERN

NOT TO SCALE

Trash rack details have been revised.

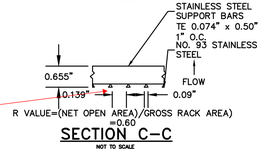
Include forebay and micropool sizing and well screen calcs with this drainage report. MHFD has the UD-BMP spreadsheet that does these calcs for you.

Unresolved. Missing well screen calcs



SECTION B-B

NOT TO SCALE



Other details provided here.

SECTION C-C

NOT TO SCALE

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD ST
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tneainc.com

NO.	DESCRIPTION	DATE
REVISIONS		

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE FOR PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
T-BONE CONSTRUCTION
ATTN: FORD STREET
1310 FORD STREET
COLORADO SPRINGS, CO 80915
(719) 570-1456

HCD DRILLING MINOR SUBDIVISION
6201 E. PLATTE AVE.

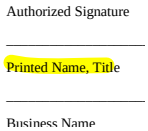
CONSTRUCTION DRAWINGS
DETAIL SHEET

DESIGNED BY	JF
DRAWN BY	JF
CHECKED BY	LD
H-SCALE	
V-SCALE	
JOB NO.	1895.00
DATE ISSUED	4/22/22
SHEET NO.	5 OF 8

N:\jobs\1895.00\Drawings\CD\189500 GEC.dwg, 5/2/2022 3:53:01 PM, DWG To PDF.pc3

Drainage Report - Final_V2 redline.pdf Markup Summary

dsdlaforce (19)



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Page Label: 3
Author: dsdlaforce
Date: 6/29/2022 10:21:53 AM
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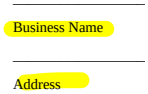

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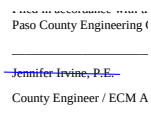
Subject: Text Box
Page Label: 3
Author: dsdlaforce
Date: 6/29/2022 10:22:02 AM
Status:
Color:
Layer:
Space:

Fill in the blanks in the Developers Statement and provide a signature line.

Unresolved.



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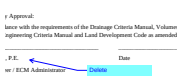

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Author: dsdlaforce
Date: 6/29/2022 10:22:25 AM
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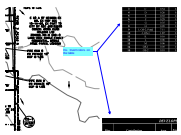
Delete



Subject: Callout
Page Label: [1] PR DRN MAP
Author: dsdlaforce
Date: 6/29/2022 10:24:02 AM
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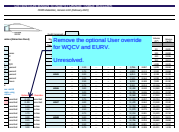
Fix. Invert colors. on the table



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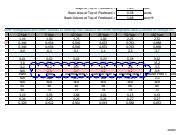
Remove the optional User override for WQCV and EURV.

Unresolved.



Subject: Cloud
Page Label: 36
Author: dsdlaforce
Date: 6/29/2022 10:40:12 AM
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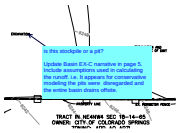
Subject: Callout
Page Label: 36
Author: dsdlaforce
Date: 6/29/2022 10:40:19 AM
Status:
Color:
Layer:
Space:

Update outlet structure design. For full spectrum design these must be equal to or less than predevelopment flows.
Unresolved



Subject: Callout
Page Label: [1] EX DRN MAP
Author: dsdlaforce
Date: 6/29/2022 11:02:35 AM
Status:
Color:
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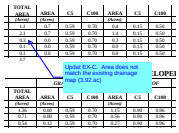
Space:

is this stockpile or a pit?

Update Basin EX-C narrative in page 5. Include assumptions used in calculating the runoff. i.e. It appears for conservative modeling the pits were disregarded and the entire basin drains offsite.



Subject: Callout
Page Label: 18
Author: dsdlaforce
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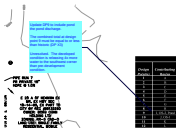
Updat EX-C. Area does not match the existing drainage map (3.92 ac)



Subject: Callout
Page Label: [1] PR DRN MAP
Author: dsdlaforce
Date: 6/29/2022 11:20:19 AM
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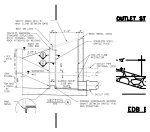
Update DP9 to include pond the pond discharge.

The combined total at design point 9 must be equal to or less than historic (DP X3)

Unresolved. The developed condition is releasing 4x more water to the southwest corner than pre-development condition.



Subject: Image
Page Label: [1] DETAIL SHEET
Author: dsdlaforce
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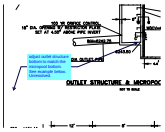

Subject: Callout
Page Label: [1] DETAIL SHEET
Author: dsdlaforce
Date: 6/29/2022 11:22:44 AM
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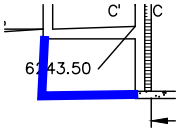
adjust outlet structure bottom to match the micropool bottom. See example below.
Unresolved.



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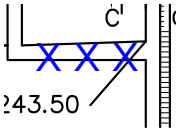

Subject: Text Box
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Author: dsdlaforce
Date: 6/29/2022 11:24:20 AM
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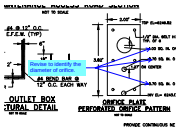
X X X



Subject: Callout
Page Label: [1] DETAIL SHEET
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Date: 6/29/2022 11:31:14 AM
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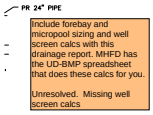
Revise to identify the diameter of orifice.



Subject: Contractor
Page Label: [1] DETAIL SHEET
Author: dsdlaforce
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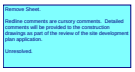
Include forebay and micropool sizing and well screen calcs with this drainage report. MHFD has the UD-BMP spreadsheet that does these calcs for you.

Unresolved. Missing well screen calcs



Subject: Text Box
Page Label: [1] DETAIL SHEET
Author: dsdlaforce
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Remove Sheet.

Redline comments are cursory comments. Detailed comments will be provided to the construction drawings as part of the review of the site development plan application.

Unresolved.