AMENDMENT NO. 1

TO THE

FINAL DRAINAGE REPORT

FOR

TIMBERLINE STORAGE YARD
EL PASO COUNTY, COLORADO

SEPTEMBER 2019

Prepared for:

Timberline Landscaping, Inc.
20625 Andalusian View
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(719)-638-1000

Prepared by:

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Project #43-095

PCD Project No. PPR-17-018 /PPR-19-042

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FINAL DRAINAGE REPORT
FOR
TIMBERLINE STORAGE YARD

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was 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 omission on my part in preparing this report.

_____
Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

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

BY:_____

TITLE:_____
DATE:_____

ADDRESS: Timberline Landscaping, Inc.
20625 Andalusian View
Pueblo, CO 81008

EL PASO COUNTY'S STATEMENT

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

BY:_____ DATE:_____
Jennifer Irvine, P.E.
County Engineer

CONDITIONS:

AMENDMENT NO. 1
TO THE
FINAL DRAINAGE REPORT
TIMBERLINE STORAGE YARD

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APPENDIX

TO THE

FINAL DRAINAGE REPORT

FOR

TIMBERLINE STORAGE YARD

PURPOSE

This document is intended to serve as the first amendment to the Final Drainage Report for the Timberline Storage Yard. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual.

The development plan for the site will consist of a storage yard with an office/warehouse building and wash bay, The site will also have roadway drive isles constructed from asphalt and asphalt millings, concrete and asphalt parking areas, landscaping and lighting and a full spectrum extended detention basin as well as underground utilities. The parcel is zoned "M" and the proposed use is permissible within the Industrial zoning criteria. The amendment is required to as the site plan is being expanded to utilize the parcel in its entirety.

GENERAL LOCATION AND DESCRIPTION

Timberline Storage Yard is located in the north and southeast quarter of the southwest quarter of Section 28, Township 13 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The parcel is bound to the north, south, and east by other vacant parcels of land. Adjacent to the southwest corner of the site, is an existing development that consists of a light industrial/storage and a maintenance yard. As shown on the enclosed FIRM panel, a channel known as the East Fork of Sand Creek Sub-tributary flows from east to west along the northern boundary of the site. Due to the presence of an existing railroad embankment, the sub-tributary does not influence the subject site. The site is located with the greater Sand Creek Drainage Basin and is tributary to the Sand Creek Channel via the East Fork Sand Creek Sub-Tributary. A vicinity map showing the location of the proposed development has been provided in the appendix of this report.

In the existing condition, both the parcel and offsite contributing watershed lands are sparsely vegetated, with ground cover consisting primarily of native grasses ranging in density from fair to good. Slopes across the development typically range between 2% to 7% while offsite slopes located to the east of the nearly 38 acres, reach grades of 10:1. Offsite flows reaching development are mainly from small fringe areas located along the north and western boundaries. A ridgeline which bisects the parcel, north to south functions to direct runoff to the southern boundary where it has historically collected.

As discussed, the proposed development will construct an office/warehouse building, a car wash bay, and gravel and asphalt parking areas, lighting, and landscaping, as well as build an access road from existing Capitol Drive. Two temporary modular buildings will be moved onsite until the primarily office building can be completed. The majority of the site will be utilized for the storage of landscaping related

materials such as various types of rock, gravel, boulders and mulch along with other commercial related landscaping products, vehicles and trailers.

Runoff entering the subject site from offsite areas, as well as flows produced within the development will be collected by proposed storm sewer improvements and routed to a proposed full spectrum detention (FSD) pond located along the southern boundary and access roadway into the development. Addition detailed discussion regarding these improvements is discussed in subsequent sections of this report.

SOILS

Soils for this project are delineated by the map in the appendix as Blakeland loamy sand (8) and Blendon Sandy Loam (10) is characterized as Hydrologic Soil Types "A" & "B". Soils in the study area are shown as mapped by Soil Conservation Service in the "Soils Survey of El Paso County Area".

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0543 G, effective date December 7, 2018 no portion of this site is located within the 100- year floodplain.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manual and where applicable the City of Colorado Springs DCM Volume 1 dated May 2014 effective January 2015. Hydrologic calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having areas less than 130 acres (in accordance with Chapter 6 of the City of Colorado Springs

DCM Volume 1). Full spectrum detention facilities have been designed in accordance with Section 3.2.1. of Chapter 13 of the City of Colorado Springs DCM Volume 1, dated May 2014, effective January 31, 2015 and Urban Drainage and Flood Control District Manuals dated January 2016.

FOUR STEP PROCESS

Step 1 Employ Runoff Reduction Practices. – Approx. 1.5 acres of the proposed developed 37.95 Acres of ground within the project is being set aside for a Full Spectrum Detention (FSD) Pond. Whenever possible runoff produced within developable area containing impervious surfaces will be routed through landscaped areas or earthen swales to minimize direct connection of impervious surfaces.

Step 3 Stabilize drainage ways –The Timberline Storage Yard site proposes a Full Spectrum Detention (FSD) pond to control developed runoff that is discharging to the historic drainage way that crosses the vacant parcel located to the south of the subject site. The FSD outlet structure has been designed to drain the water quality event storm in 40 hours, while reducing the 100 year peak discharge to approximately 90% of the predevelopment conditions. The development of this site is not anticipated to have negative effects on downstream drainage ways.

Step 3 Provide water quality capture volume. – A Full Spectrum Detention Basin is proposed to reduce peak discharge rates and provide water quality treatment. The WQCV will be released over a 40 hour period while larger event storms will be released in periods of times between 64-80 hours.

Step4 Consider Need for Industrial and Commercial BMP's – This submittal provides a final grading and erosion control plans with BMPs in place. The proposed project will use silt fence, a vehicle tracking control pad, concrete washout area, mulching and reseeding to mitigate the potential for erosion across the site.

EXISTING DRAINAGE CONDITIONS

The Timberline Storage Yard site consists of 37.95 acres and is situated west of the East Fork Reach of the Sand Creek Watershed. Prior to construction associated with this development there were no existing structures within the planned Timberline Storage Yard site. An existing (historic) conditions hydrologic analysis was performed to determine existing flow quantities entering and exiting the subject site so a comparison to post development discharge rates could be made. As shown on the Existing Drainage Map, located in the appendix of this report, the existing site terrain within the parcel generally slopes from north to south at grades that vary between 2% and 7%. An area east of the proposed site contributes to the overall drainage reaching the discharge point located to the south of the subject site.

Basin EX-1 consists of native grass covered un-platted hillside located to the east of the parcel property boundary. Runoff produced by the 22.9 acre area of land has been calculated to be 7.6 cfs in the 5-year storm event and 51.0 cfs in the 100-year storm event. Runoff from this basin is conveyed as sheet flow to the west towards **Basin EX-2**.

Basin EX-2 consists of grass covered un-platted lands to the east of a ridgeline that bisects the nearly 38 acre parcel. Runoff produced by the 23.6 acre area has been calculated to reach peak flow rates of 4.5 cfs

in the 5-year storm event and 30.4 cfs in the 100-year storm event. Runoff from Basin EX-2 combines with runoff produced within **Basin EX-1** at **Design Point 1** located at the southeast corner of the proposed development boundary. The total calculated surface runoff at **DP1** is 11.5 cfs in the 5-year storm event and 77.3 cfs in the 100-year storm event.

Basin EX-3 consists of native grass covered un-platted lands located within and adjacent to the western half of the parent parcel. Runoff produced by the 24.7 acre area of land has been calculated to be 4.6 cfs in the 5-year storm event and 30.8 cfs in the 100-year storm event. Runoff from **Basin EX-3** combines with runoff from **DP 1** at **Design Point 2**, at a small channelized drainage way located adjacent to the southern boundary of the planned development. The total calculated surface runoff at **DP2** is 13.6 cfs in the 5-year storm event and 91.6 cfs in the 100-year storm event. Runoff reaching this point continues south through the adjacent un-platted offsite parcel.

Basin EX-4 consists of native grass covered un-platted lands located just to the west of the property at the southwest corner of the site. Runoff produced by the offsite 1.27 acre area of land has been calculated to reach 0.4 cfs in the 5-year storm event and 2.7 cfs in the 100-year storm event.

PROPOSED DRAINAGE CHARACTERISTICS

General Proposed Conditions Drainage Discussion

The parcel housing the proposed development is approximately 37.95 acres in size and is currently zoned "M" for industrial. The site is to consist of a large gravel storage yard, an office/warehouse building, a car wash bay, with asphalt and gravel parking areas, lighting, landscaping, and access entryways. Approximately two-thirds of the development will be utilized for the storage of materials and vehicles associated with commercial landscaping.

Runoff produced offsite along the majority of the north and west sides of the proposed site development areas will mimic the historic drainage patterns by sheet flowing to the development boundary lines (see attached proposed drainage map in the appendix) where it will combine with runoff generated onsite within the storage yard and from the east half of the warehouse building. Proposed earthen swales and proposed rip rap lined rundowns will conveyed the collected runoff to a proposed Full Spectrum Detention pond located along the southern boundary of the site. Runoff generated from the proposed landscaping area directly in front of the warehouse building will combine with runoff generated within the adjacent access road where it will collected by a proposed inlet and storm sewer system and routed to the proposed pond. Runoff produced offsite to the east will combine within onsite flows with the eastern half of the development (which is to be utilized for material storage) and directed to a proposed culvert which also convey the collected flows to the FSD pond. The runoff reaching the pond will be detained and discharged via a staged outlet box and proposed RCP storm system to the historic drainage way located south of the site at historic flow rates.

Runoff generated from the west half of the proposed warehouse building and west parking lot and a small portion of the proposed access/entrance roadway will be discharge offsite to a temporary sediment pond located on the adjacent DWIRE Storage Yard until the formal Full Spectrum Detention which is being evaluated by the county concurrently with this project. The proposed discharge from this portion of the

overall?

? See comment letter

site, post construction, is just slightly higher than historic. It should be noted that an shared access and drainage easement has been signed by the adjacent property owner permit access to the west side of the building and to allow for developed discharge onto the site.

Proposed Conditions Detailed Drainage Discussion

Basin OS-1, 1.47 acres, (Q5=0.4cfs, Q100=2.8cfs), consists of undeveloped un-platted offsite lands located along the north boundary of the proposed development. Runoff from **Basin OS-1** is tributary to **Basin A.**
Basin A, 5.87 acres, (Q5=5.8cfs, Q100=17.3cfs), consists primarily of portions of the proposed storage located near the north and west boundaries. Runoff produced within **Basin A** combines with runoff from **Basins OS-1** and enters Basin B.

Basin OS-2, 2.44 acres, (Q5=2.44cfs, Q100=7.5cfs), consists of undeveloped un-platted offsite lands located along the west boundary of the proposed development. Runoff from **Basin OS-2** is tributary to **Basin B.**

Basin C, 2.47 acres, (Q5=2.3cfs, Q100=6.9cfs), consists primarily of portions of the proposed storage yard located adjacent to Basin A and B. Runoff from **Basin C** is tributary to **Basin B**. Describe proposed ground cover.

Basin B, 7.91 acres, (Q5=10.4cfs, Q100=25.9cfs), consists primarily of a proposed gravel storage yard as well as a portion of the proposed office/warehouse building, wash bay, associated concrete aprons, and asphalt parking areas located along the northeast corner of the building. Runoff produced within **Basin B** combines with runoff from **Basins OS-1, OS-2, A and C** at **Design Point 1** (Q5=16.0cfs, Q100=45.3cfs). Runoff reaching DP-1 will be directed to a proposed Full Spectrum Detention Pond at **Design Point 5** via a 4'bw 3:1 SS trapezoidal 25% rundown lined with D50=18" riprap atop a gravel and fabric liner. A pair of 4:1SS, 1' min. deep v-shaped earthen swales graded at a min of 1% are recommended to be constructed along the northern exterior of the pond embankment to intercept runoff that might otherwise erode the pond side slopes. An 18" deep concrete lined forebay is to be constructed at the bottom of the rundown to collect any conveyed sediment.

Basin D, 0.66 acres, (Q5=2.2cfs, Q100=4.5cfs), consists of the southwestern quarter of the proposed office/warehouse building, a portion of the east paved parking lot, landscaping and a portion of the gravel drive isles. Runoff produced within **Basin D** flows east toward a low point located at **Design Point 2** (Q5=2.2cfs, Q100=4.5cfs). Runoff reaching DP-2 will be directed to a proposed Full Spectrum Detention via a 2.5'bw 2:1 SS trapezoidal 25% rundown lined with D50=18" riprap atop a gravel and fabric liner to **Design Point 5.** A 12" deep concrete lined forebay is to be constructed at the bottom of the rundown to collect any conveyed sediment.

Basin E, 1.08 acres, (Q5=3.2cfs, Q100=6.7cfs), consists of a landscaped area, portions of the east paved parking lot, as well as portions of the asphalt millings access roadway planned along the southern boundary line. Runoff generated by this basin are directed eastward via the proposed curb and gutter to the lowpoint at **Design Point 3**.

Basin OS-3, 0.38 acres, (Q5=1.6cfs, Q100=3.0cfs), consists of portions of the asphalt millings access roadway located along the southern boundary of the proposed development. Runoff produced within **Basin E and OS-3** flows to the north toward a low point located at **Design Point 3** (Q5=4.8cfs, Q100=9.6cfs). A

proposed 10' Type R sump inlet will intercept the runoff reaching DP-3 where it will be directed to the proposed Full Spectrum Detention Pond via a Proposed 24" Private Storm Sewer.

Basin OS-4, 3.08 acres, (Q5=0.1cfs, Q100=0.5cfs), consists of undeveloped offsite lands located along the northern boundary of the proposed development. Runoff from **Basin OS-4** is tributary to **Basin G.**

Basin OS-5, 21.36 acres, (Q5=7.6cfs, Q100=50.9cfs), consists of an undeveloped hillside located directly east of the subject site. Runoff from this site will continue to discharge into the subject site as in the historic condition. Runoff from **Basin OS-4** is tributary to **Basin G.**

Basin OS-6, 3.84 acres, (Q5=1.0cfs, Q100=6.4cfs), consists of an undeveloped hillside located directly east of the subject site. Runoff from this site will continue to discharge to the south eastern boundary of the site as in the historic condition. Runoff from **Basin OS-6** is tributary to **Basins OS7 and Basin H.**

Basin OS-7, 0.18 acres, (Q5=0.1cfs, Q100=0.4cfs), consists of a small offsite area located adjacent to the southeast corner of the site. The small area currently acts to funnel offsite runoff in and around the subject site.

doesn't make sense

Basin H, 0.24 acres, (Q5=2.2cfs, Q100=4.4cfs), is a small basin located at the southeast corner of the site. In the proposed condition, a small earthen berm is to be constructed within Basin H and OS7 to redirect the offsite runoff entering the east corner of the site (from **Basins OS6** and **OS7)** into **Basin G** and toward **Design Point 7**. The redirection of runoff will function to protect the proposed improvements and furthermore function to control the offsite runoff that was previously discharge as un-detained sediment laden flows to the property to the south. In the event the roadway is extended with the development of the adjacent property the earthen berm could easily be removed and other storm sewer solutions implemented.

describe how much area, and what the remaining area will be

Basin G, 16.68 acres, (Q5=13.6cfs, Q100=40.9cfs), consists of the eastern half of the development which is planned to be utilized for primarily for storing landscaping materials. Runoff from this basin and the surrounding offsite areas are to be conveyed overland to a low point located at **Design Point 4**. A proposed private 36" culvert will collect and convey the combined runoff reaching the low point of Q5=10.3cfs, Q100=59.5cfs and direct it to a proposed 18" deep concrete lined forebay where it will combine with flwos from **Design Point 3** at a peak flow rate of Q5=13.6cfs, Q100=65.2cfs (**Design Point 5**). The steep slopes adjacent to the culvert entrance shall be lined with riprap or permanent erosion control mat.

Basin F, 1.53 acres, (Q5=1.0cfs, Q100=4.4cfs), consists of a portion of land dedicated to a proposed Full Spectrum Detention (FSD) pond. Runoff from **Design Points 1, 2 &** 5 contribute to the proposed FSD pond at **Design Point 6** at a combined peak flow rate of Q5=31.3cfs, Q100=116.6cfs. The proposed full spectrum detention **FSD Pond 1** was sized utilizing the UDFCD UD-Detention Worksheet, Vol 3.07. Based upon the contributing watershed size, characteristics and planned imperviousness the pond required a minimum of 3.243 acre feet of storage in the 100-year event to limit the discharge to a maximum of 100cfs. A proposed 42" RCP with headwall and wingwalls will convey runoff to offsite down-gradient property. A proposed and riprap outfall stilling basin will be slow and dispersing flows as to not impact the historic drainage way located to the south of the site. The crest of the spillway is set above the 100-year water surface at 6538.5 which allows for positive drainage to the future curb line. The proposed embankment has been set at 6540.5. Should the pond outlet or box and the adjacent inlet become clogged storm water shall overtop the emergency spillway and outfall to the historic channel.

Basin OS-8, 0.68 acres, (Q5=0.2cfs, Q100=1.4cfs), consists of a small offsite area located between the permanent site improvements and the historic drainage channel. The combined runoff from this primarily undeveloped area and the proposed FSD detention pond outlet pipe combines at **Design Point 7** for a 5 and 100-year peak flow rates of 4.2cfs and 100.9cfs. This calculated developed discharge is less than the existing runoff estimated to reaching this location of 15.1cfs and 101.4cfs in the 5 year and 100 year events respectively and therefore is not anticipated to negatively affect downstream facilities or properties.

Basin I, 1.50 acres, (Q5=4.9cfs, Q100=9.8cfs), consists of a portion of the concrete aprons, and gravel and asphalted surfaces for the purpose of parking and driving located along the western side of the planned development as well as the western half of the proposed warehouse building. Runoff from **Basin I** is directed offsite to the adjacent property as sheet flow.

Basin OS-9 consists of native grass covered un-platted lands located just to the west of the property at the southwest corner of the site. Runoff produced by the offsite 1.40 acre area of land has been calculated to reach 0.4 cfs in the 5-year storm event and 2.7cfs in the 100-year storm event. Runoff from **Basin OS-9** and **Basin I** combine at **Design Point 8** at 5 and 100-year peak flow rates of 4.8cfs and 10.0cfs. This calculated developed discharge is slightly higher than the existing runoff estimated to reaching this location of 0.4 and 2.7cfs in the 5-year and 100 year events respectively. The proposed developed flows will be detained and treated within a Full Spectrum Detention Facility that is planned to be constructed with the adjacent DWIRE storage yard that is being concurrently reviewed with this report. Additional discussion regarding the interim collection and discharge of this runoff is anticipated.

to be constructed with this project to meet MS4 permit requirements.

WATER QUALITY PROVISIONS AND MAINTENANCE

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The proposed full spectrum detention (FSD) pond functions to provide detention and water quality for the proposed development as well as all runoff tributary to it. This includes runoff produced onsite, north of the development and parcel, as well as offsite flows adjacent to the east and west boundary of the parcel. This full spectrum detention pond will function to treat approximately 69.22 acres by providing 0.674 acre-feet of storage for the water quality event, 1.436 acre feet of storage at the EURV event storm and 3.243 acre-feet of storage in the 100-year event. The proposed full spectrum detention basin will be private and shall be maintained by the property owner. Access shall be granted to the owner and El Paso County for access and maintenance of the private WQCV facility. A private maintenance agreement document shall accompany this report submittal.

The sizing for the full spectrum detention facility has been determined using the guidelines set forth in the Urban Drainage and Flood Control District Criteria Manual. Refer to the UDFCD UD-Detention Excel Workbook located within the appendix of this report for calculations.

See redlines on spreadsheet.

OFFSITE DOWNSTREAM CHANNEL ANALYSIS

El Paso County Engineering has requested an analysis of the offsite downstream channel. The existing channel runs north to south on unplatted land owned by Weatherford Artificial (Sch. No. 5300000190). The analysis of the existing channel will be begin at the outfall of the proposed Timberline Storage to the

north and will end at the two existing 48" culverts at the southwest end of the property. Runoff reaching the two culverts will ultimately be routed to the East Fork Sand Creek Subtributary. Runoff tributary to the existing channel has been accounted for, as proposed developed flow from the proposed Timberline Storage site (37.95 acres), offsite developed flow from the BLH NO.2 LLC property (22.9 acres), existing undeveloped flow from the offsite BLH NO.2 LLC property (7.7 acres) and existing undeveloped flow from the offsite Weatherford Artificial property (30.2 acres).

Analysis of the existing channel and results provided by the Hydrologic Engineering Center River Analysis System (HEC-RAS) program. Per the results provided (see Appendix), scour (see shear values) and velocities are below the maximum values as stated in the City of Colorado Springs Drainage Criteria Manual Vol.1 (DCM1). Hence erosion of the existing channel is minimal. Let it be noted that with the development of Timberline Storage, the runoff values have been reduced in part to the release rate by the EDB pond. Proposed discharge from the site, post construction, is less than historic and therefore its construction is not anticipated to negatively affect downstream facilities or properties.

Obtain drainage easement and describe.

EROSION CONTROL

It is the policy of the El Paso County that we submit a grading and erosion control plan with the drainage report. Proposed silt fence, vehicle traffic control, and concrete washout area are proposed as erosion control measures. The costs for these measures have been provided on the Grading and Erosion Control plan.

CONSTRUCTION COST OPINION

Private Drainage Facilities (**NON-Reimbursable**):

Item	Description	Quantity		Unit Cost		Cost
1.	24" RCP	100	LF	$104	/LF	$10,400.00
2.	24" RCP FES	1	EA	$1,046	/EA	$1,046.00
3.	36" RCP	92	LF	$155	/LF	$14,260.00
4.	36" RCP FES	2	EA	$1,845	/EA	$3,690.00
5.	42" RCP	97	LF	$181	/LF	$17,557.00
6.	10' Type R Inlet	1	EA	$5,741	/EA	$5,741.00
7.	HW/WW Outlet Struct.	1	LS	$8,000	/LF	$8,000.00
4.	2.5'w,2:1SS Rundown	18	CY	$80	/CY	$7,750.00
5.	4.0'w, 3:1SS Rundown	29	CY	$80	/CY	$2,320.00
5.	D50=12" Riprap	40	CY	$65	/CY	$2,600.00
5.	Concrete Forebays	1	LS	$14,376	/LS	$14,376.00
6.	Full Spectrum Det Pond	1	EA	$10,000	/EA	$10,665.00
7.	Modified Type D Outlet	1	EA	$20,500	/EA	$20,500.00
					Total $	$118,905.00

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above and below is only an estimate of the facility cost amounts in 2019. This parcel is not being platted, thus no drainage basin fees are required with this development.

SUMMARY

The proposed drainage facilities recommended within this report will adequately convey, detain and route runoff from the planned development to the historic drainage ways at peak flow rates which are in line with historic rates.

Provide no significant impact statement. Address downstream and offsite improvements and drainage easements.

REFERENCES

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manuals".

2.) "Urban Storm Drainage Criteria Manual"

3.) SCS Soils Map for El Paso County.

4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date December 7, 2018.

REFERENCES

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manuals".

2.) "Urban Storm Drainage Criteria Manual"

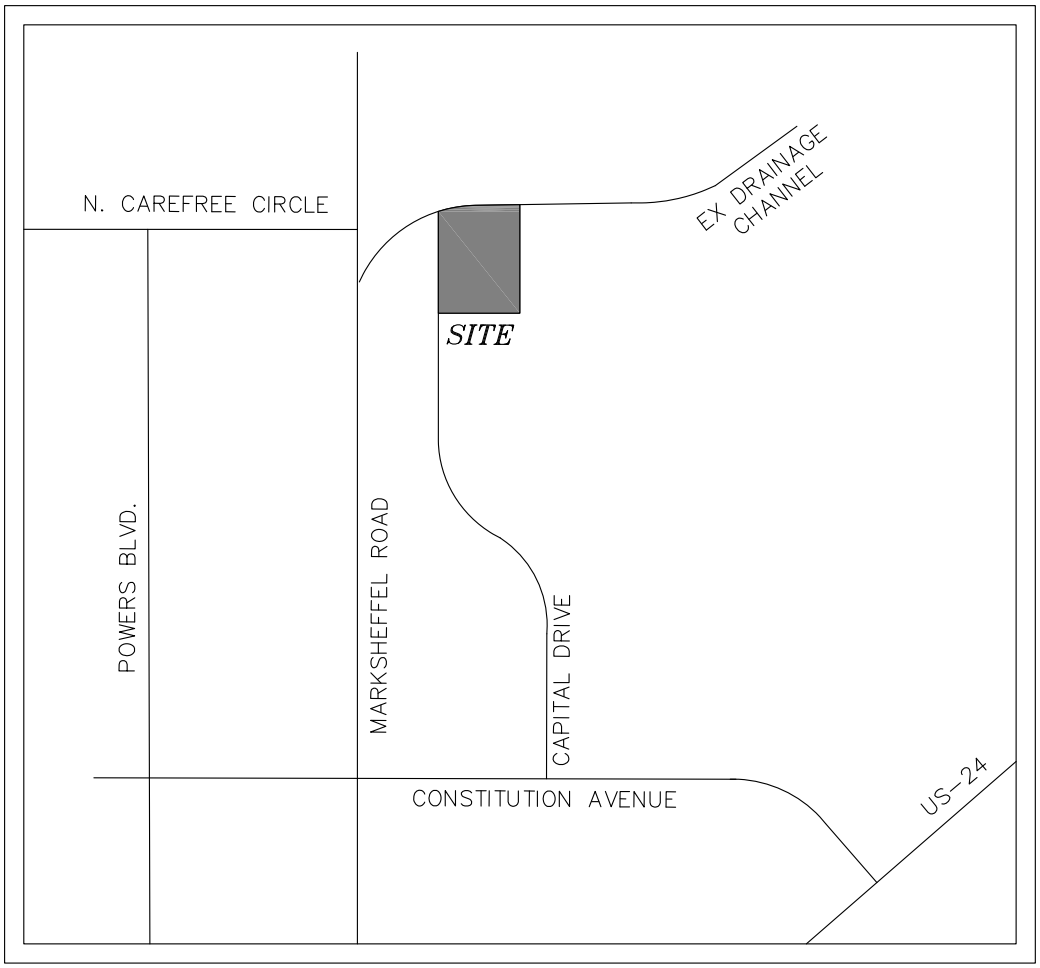
3.) SCS Soils Map for El Paso County.

4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date March 17, 1997.

Duplicate?

APPENDIX

VICINITY MAP

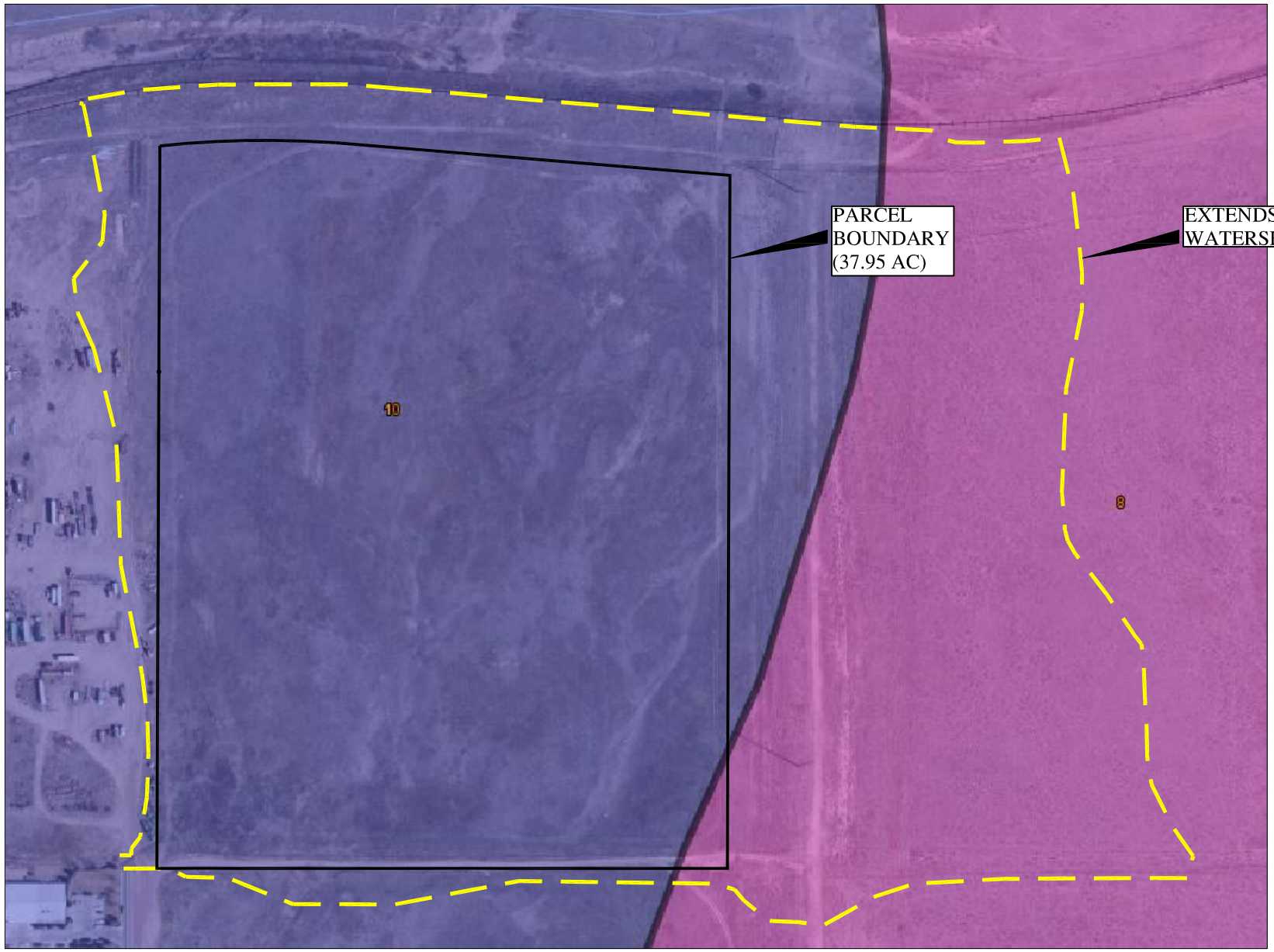


VICINITY MAP

N.T.S.

M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

SOILS MAP



NOT TO SCALE

Summary by Map Unit — El Paso County Area, Colorado (CO625)		
Map unit symbol	Map unit name	Rating
8	Blakeland loamy sand, 1 to 9 percent slopes	A
10	Blendon sandy loam, 0 to 3 percent slopes	B

HYDROLOGIC TYPE A SOILS

HYDROLOGIC TYPE B SOILS

SITE BOUNDARY

ANALYZED WATERSHED BOUNDARY

TIMBERLINE STORAGE YARD

SOILS MAP

M&S CIVIL CONSULTANTS, INC.

FIRM PANEL

HYDROLOGIC CALCULATIONS

TIMBERLINE STORAGE
EXISTING DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			STREETS / DEVELOPED			*OVERLAND / DEVELOPED*			*OVERLAND / UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
EX-1	*998724.7*	**22.93**	0.00	0.81	0.88	0.00	0.30	0.50	22.93	0.09	0.36	***0.09***	***0.36***
EX-2	*1029448.0*	**23.63**	0.00	0.81	0.88	0.00	0.30	0.50	23.63	0.09	0.36	***0.09***	***0.36***
EX-3	*1074435.8*	**24.67**	0.00	0.81	0.88	0.00	0.30	0.50	24.67	0.09	0.36	***0.09***	***0.36***
EX-4	***55409.0***	**1.27**	0.00	0.81	0.88	0.00	0.30	0.50	1.27	0.09	0.36	***0.09***	***0.36***

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

TIMBERLINE STORAGE
EXISTING DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
EX-1	22.93	0.09	0.36	0.09	100	4.0	11.5	325	8.0%	2.8	1.9	13.5	3.7	6.2	***7.6***	***51.0***
EX-2	23.63	0.09	0.36	0.09	100	4.0	11.5	1600	1.6%	1.3	21.1	32.6	2.4	4.0	***5.0***	***33.6***
EX-3	24.67	0.09	0.36	0.09	90	3.8	10.8	1750	1.6%	1.3	23.1	33.8	2.3	3.9	***5.1***	***34.3***
EX-4	1.27	0.09	0.36	0.09	100	5.0	10.7	330	2.1%	1.4	3.8	14.5	3.6	6.0	***0.4***	***2.7***

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

TIMBERLINE STORAGE
EXISTING DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(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.)*
1	**EX1, EX2**	4.19	16.76	TAKEN FROM BASIN EX1			13.5	1300	1.5%	1.9	11.6	25.1	2.7	4.6	***11.5***	***77.3***
2	**DP1, EX3**	6.41	25.64	TAKEN FROM BASIN EX2								32.6	2.4	4.0	***15.1***	***101.4***
3	**EX4**	0.11	0.46	TAKEN FROM BASIN EX4								14.5	3.6	6.0	***0.4***	***2.7***

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

Not checked this review

TIMBERLINE STORAGE
PROPOSED DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			ROOFS 0.73-0.81 COMMERCIAL AREAS 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 0.59-0.70			PARKS 0.12-0.39 GREENBELTS/AGRI. 0.09-0.36			WEIGHTED	
BASIN	TOTAL AREA (SF)	TOTAL AREA (Acres)	AREA (Acres)	C_5	C_{100}	AREA (Acres)	C_5	C_{100}	AREA (Acres)	C_5	C_{100}	C_5	C_{100}
A	255817.4	5.87	0.00	0.73	0.81	4.99	0.30	0.50	0.88	0.09	0.36	0.27	0.48
B	344618.1	7.91	0.44	0.90	0.96	1.14	0.59	0.70	6.33	0.30	0.50	0.38	0.55
C	107689.3	2.47	0.00	0.73	0.81	2.10	0.30	0.50	0.37	0.09	0.36	0.27	0.48
D	28919.2	0.66	0.41	0.90	0.96	0.18	0.30	0.50	0.07	0.09	0.36	0.65	0.77
E	47161.5	1.08	0.56	0.90	0.96	0.31	0.16	0.41	0.21	0.30	0.50	0.57	0.71
F	66782.6	1.53	0.00	0.90	0.96	0.28	0.30	0.50	1.25	0.12	0.39	0.15	0.41
G	726383.5	16.68	0.00	0.90	0.96	14.17	0.30	0.50	2.50	0.09	0.36	0.27	0.48
H	10390.9	0.24	0.17	0.90	0.96	0.00	0.73	0.81	0.07	0.16	0.41	0.69	0.80
I	65383.5	1.50	0.85	0.90	0.96	0.54	0.30	0.50	0.11	0.16	0.41	0.63	0.75
OS1	64029.9	1.47	0.00	0.81	0.88	0.00	0.30	0.50	1.47	0.09	0.36	0.09	0.36
OS2	106418.5	2.44	0.00	0.81	0.88	1.90	0.30	0.50	0.54	0.09	0.36	0.25	0.47
OS3	16592.9	0.38	0.34	0.90	0.96	0.05	0.16	0.41	0.00	0.09	0.36	0.81	0.89
OS4	134326.7	3.08	0.00	0.90	0.96	0.00	0.30	0.50	3.08	0.09	0.36	0.09	0.36
OS5	930571.9	21.36	0.00	0.81	0.88	0.00	0.30	0.50	21.36	0.09	0.36	0.09	0.36
OS6	167403.3	3.84	0.00	0.81	0.88	0.00	0.30	0.50	3.84	0.09	0.36	0.09	0.36
OS7	7983.7	0.18	0.00	0.81	0.88	0.00	0.30	0.50	0.18	0.09	0.36	0.09	0.36
OS8	20171.5	0.46	0.00	0.81	0.88	0.00	0.30	0.50	0.46	0.09	0.36	0.09	0.36
OS9	66441.3	1.53	0.08	0.90	0.96	0.00	0.30	0.50	1.44	0.09	0.36	0.13	0.39

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

TIMBERLINE STORAGE
PROPOSED DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
A	5.87	0.27	0.48	0.27	90	2.0	10.9	575	1.9%	1.0	9.9	20.8	13.7	3.7	6.1	***5.8***	***17.3***
B	7.91	0.38	0.55	0.38	100	1.0	13.1	810	1.4%	1.2	11.6	24.7	15.1	3.5	5.9	***10.4***	***25.9***
C	2.47	0.27	0.48	0.27	100	2.0	11.9	850	2.5%	1.1	12.9	24.8	15.3	3.5	5.9	***2.3***	***6.9***
D	0.66	0.65	0.77	0.65	50	6.0	2.5	50	1.0%	2.0	0.4	2.9	10.6	5.2	8.7	***2.2***	***4.5***
E	1.08	0.57	0.71	0.57	33	6.0	2.1	275	1.6%	2.6	1.8	3.9	11.7	5.2	8.7	***3.2***	***6.7***
F	1.53	0.15	0.41	0.15	50	1.0	9.6	50	25.0%	5.0	0.2	9.8	10.6	4.2	7.0	***1.0***	***4.4***
G	16.68	0.27	0.48	0.27	100	2.5	11.1	1800	1.1%	0.7	41.7	52.8	20.6	3.0	5.1	***13.6***	***40.9***
H	0.24	0.69	0.80	0.69	50	1.0	4.2	200	3.3%	3.6	0.9	5.1	11.4	5.1	8.6	***0.8***	***1.6***
I	1.50	0.63	0.75	0.63	50	1.0	4.8	50	4.0%	4.0	0.2	5.0	10.6	5.2	8.7	***4.9***	***9.8***
OS1	1.47	0.09	0.36	0.09	100	4.0	11.5	315	1.1%	0.7	7.1	18.7	12.3	3.2	5.4	***0.4***	***2.8***
OS2	2.44	0.25	0.47	0.25	100	1.0	15.3	200	2.0%	1.0	3.4	18.7	11.7	3.9	6.5	***2.4***	***7.5***
OS3	0.38	0.81	0.89	0.81	50	1	2.9					2.9	10.3	5.2	8.7	***1.6***	***3.0***
OS4	3.08	0.09	0.36	0.09	50	1	10.3	200	1.0%	0.7	4.8	15.0	11.4	3.5	5.9	***1.0***	***6.6***
OS5	21.36	0.09	0.36	0.09	100	4	11.5	600	5.5%	2.3	4.3	15.8	13.9	3.4	5.8	***6.6***	***44.4***
OS6	3.84	0.09	0.36	0.09	100	3	12.7	1000	3.8%	1.4	12.2	24.9	16.1	2.8	4.6	***1.0***	***6.4***
OS7	0.18	0.09	0.36	0.09	50	1	10.3	200	3.3%	3.6	0.9	11.2	11.4	4.0	6.7	***0.1***	***0.4***
OS8	0.46	0.09	0.36	0.09	100	2	14.5	300	2.0%	2.8	1.8	16.3	12.2	3.4	5.7	***0.1***	***1.0***
OS9	1.53	0.13	0.39	0.13	100	5	10.3	330	2.1%	2.9	1.9	12.2	12.4	3.8	6.4	***0.8***	***3.9***

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

TIMBERLINE STORAGE
PROPOSED DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS** *DPS AND/OR PIPES*	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(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.)*	COMMENTS
1	**OS1, OS2, A, B, C**	5.96	10.06	TAKEN FROM BASIN A			13.7	900	1.4%	1.2	12.5	26.2	2.7	4.5	***16.0***	***45.3***	DRAINAGE SWALE INTO FSD (N Forebay)
2	**D**	0.43	0.51		TAKEN FROM BASIN D (MIN Tc)							5.0	5.2	8.7	***2.2***	***4.5***	2'W RIPRAP RUNDOWN (SW Forebay)
3	**E, OS3**	0.92	1.11		TAKEN FROM BASIN E (MIN Tc)							5.0	5.2	8.7	***4.8***	***9.6***	8' TYPE R SUMP INLET
4	**G, OS4, OS5, OS6 OS7, H**	3.21 0.18	11.37 0.26		TAKEN FROM BASIN G							20.6	3.0	5.1	***10.3***	***59.5***	36" RCP CULVERT
		3.39	11.63									20.6	3.0	5.1	***10.3***	***59.5***	
5	**DP3, DP4**	4.31	12.74	TAKEN FROM BASIN G								20.6	3.0	5.1	***13.2***	***65.2***	PROPOSED FSD POND 1 (SE Forebay)
6	**DP1-DP4, F**	10.28	22.79	TAKEN FROM BASIN G								20.6	3.0	5.1	***31.3***	***116.6***	PROPOSED FSD POND 1
7	**PIPE 3 OS8**	1.41	19.72	TAKEN FROM DESIGN POINT 6								20.6	3.0	5.1	***4.3***	***100.9***	EXISTING SWALE
8	**BASIN I OS9**	1.11	1.37	AVERAGE OF BASIN I AND OS9								8.6	4.4	7.3	***4.8***	***10.0***	PROPOSED FSD POND 1

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

TIMBERLINE STORAGE
PROPOSED DRAINAGE CALCULATIONS
(Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design Points*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity**		*Flow*		*Pipe Size*
					I_5	*I_{100}*	*Q_5*	*Q_{100}*	
1	**DP3**	0.92	1.11	5.0	5.2	8.7	***4.8***	***9.6***	**PROP 24" RCP**
2	**DP4**	3.39	11.63	20.6	3.0	5.1	***10.3***	***59.5***	**PROP 36" RCP**
3	**POND 1 OUTLET (DP6)**		TAKEN FROM UD-DETENTION WORKSHEET				***4.2***	***100.0***	**PROP 42" RCP**

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point
PR - Pipe Run

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: DLM
Date: 9/12/2019
Checked by: VAS

HYDRAULIC CALCULATIONS / EDB WQCV CALCULATIONS

TIMBERLINE STORAGE
DRAINAGE REPORT DRAINAGE CALCULATIONS
(Pond Volume Calculation)

FSD POND 1

	Elevation	SF	CF	Storage AF	Storage Sum
WQCV	6530.00	0.00	0.00	0.00	0.00
	6530.33	40.00	6.60	0.00	0.00
	6531.00	900.00	314.90	0.01	0.01
	6532.00	12,619.00	6,759.50	0.16	0.16
	6533.00	23,386.00	18,002.50	0.41	0.58
	6534.00	28,078.00	25,732.00	0.59	1.17
	6535.00	30,840.00	29,459.00	0.68	1.84
	6536.00	33,750.00	32,295.00	0.74	2.58
	6537.00	36,764.00	35,257.00	0.81	3.39
	6538.00	39,875.00	38,319.50	0.88	4.27
	6539.00	43,185.00	41,530.00	0.95	5.23
	6540.00	47,351.00	45,268.00	1.04	6.27

Total = 272,944 CF

Total = 6.3 Ac-ft

100 Year Spillway Elevation = 6538.5

Calculated by: DLM

Date: 9/12/2017

Checked by:

Weighted Percent Imperviousness of WQ Pond 1				
Contributing Basins	***Area (Acres)***	***C_5***	***Impervious % (I)***	***(Acres)*(I)***
A	5.87	0.27	34	199.67
B	7.91	0.38	53	419.30
C	2.47	0.27	34	84.06
D	0.66	0.65	84	55.77
E	1.08	0.57	78	84.45
F	1.53	0.15	11	16.86
G	16.68	0.27	34	566.97
H	0.24	0.69	87	20.75
OS1	1.47	0.09	0	0.00
OS2	2.44	0.25	30	73.29
OS3	0.38	0.81	95	36.19
OS4	3.08	0.09	0	0.00
OS5	21.36	0.09	0	0.00
OS6	3.84	0.09	0	0.00
OS7	0.18	0.09	0	0.00
Totals	***69.22***			***1557.31***
Imperviousness of WQ Pond 2	**22.5**			

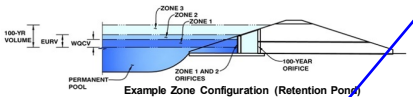
soil groups A and B?

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Timberline Storage (Amended)

Basin ID: FSD Pond 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	69.22	acres		
Watershed Length =	1,880	ft		
Watershed Slope =	0.014	ft/ft		
Watershed Imperviousness =	22.50%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	70.0%	percent		
Percentage Hydrologic Soil Groups C/D =	30.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.725	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	1.508	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	1.189	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.855	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.002	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.469	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	7.093	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	9.201	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	1.110	acre-feet		
Approximate 5-yr Detention Volume =	1.745	acre-feet		
Approximate 10-yr Detention Volume =	2.493	acre-feet		
Approximate 25-yr Detention Volume =	2.977	acre-feet		
Approximate 50-yr Detention Volume =	3.137	acre-feet		
Approximate 100-yr Detention Volume =	3.865	acre-feet		

Stage-Storage Calculation

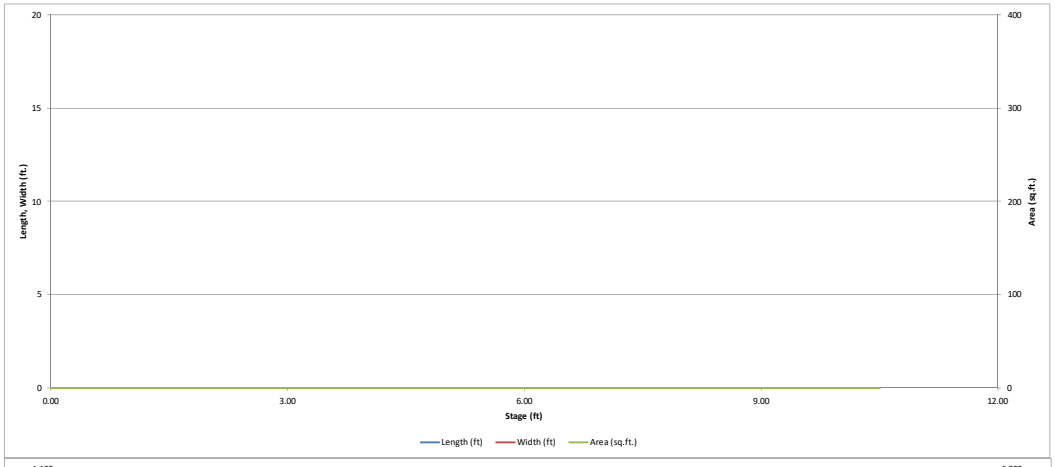
Zone 1 Volume (WQCV) =	0.725	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.783	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.357	acre-feet
Total Detention Basin Volume =	3.865	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

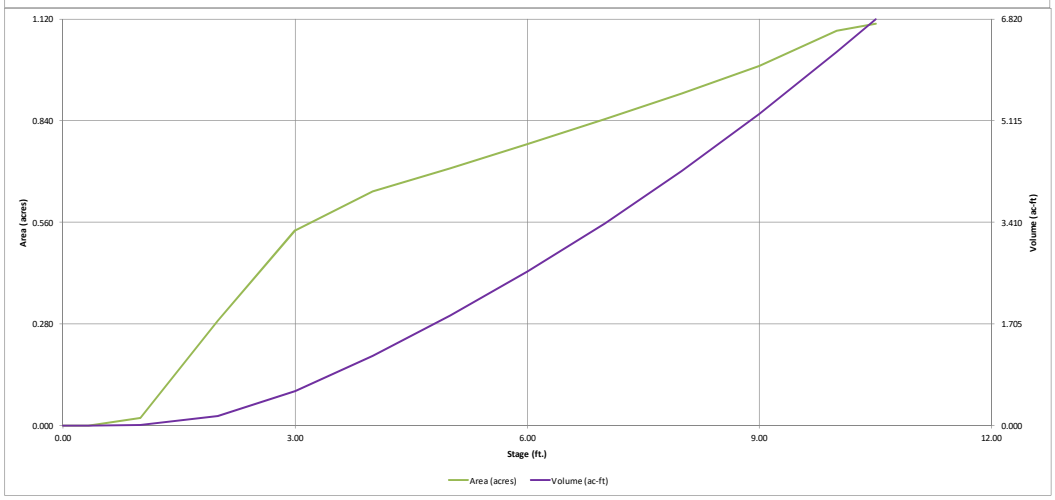
Depth Increment = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
30	**Top of Micropool**	--	0.00	--	--	--	0	0.000		
	30.33	--	0.33	--	--	--	40	0.001	6	0.000
	31	--	1.00	--	--	--	900	0.021	313	0.007
	32	--	2.00	--	--	--	12,619	0.290	6,955	0.160
	33	--	3.00	--	--	--	23,386	0.537	25,083	0.576
	34	--	4.00	--	--	--	28,078	0.645	50,815	1.167
	35	--	5.00	--	--	--	30,840	0.708	80,274	1.843
	36	--	6.00	--	--	--	33,750	0.775	112,569	2.584
	37	--	7.00	--	--	--	36,764	0.844	147,826	3.394
	38	--	8.00	--	--	--	39,875	0.915	186,146	4.273
	39	--	9.00	--	--	--	43,185	0.991	227,676	5.227
	40	--	10.00	--	--	--	47,351	1.087	272,944	6.266
	40.5	--	10.50	--	--	--	48,250	1.108	296,844	6.815

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



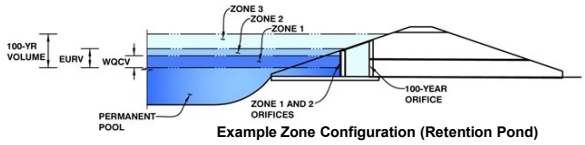


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Timberline Storage (Amended)

Basin ID: FSD Pond 1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.27	0.725	Orifice Plate
Zone 2 (EURV)	4.52	0.783	Orifice Plate
Zone 3 (100-year)	7.55	2.357	Weir&Pipe (Restrict)
		3.865	Total

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 Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.60	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	19.60	inches
Orifice Plate: Orifice Area per Row =	2.85	sq. inches (diameter = 1-7/8 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.979E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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	1.53	3.07					
Orifice Area (sq. inches)	2.85	2.85	2.85					

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	17.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.60	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.40	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	47.60	N/A	ft^2
Overflow Grate Open Area w/ Debris =	23.80	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	36.20		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	8.82	N/A	ft^2
Outlet Orifice Centroid =	1.62	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.38	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	72.50	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	10.46	feet
Basin Area at Top of Freeboard =	1.11	acres

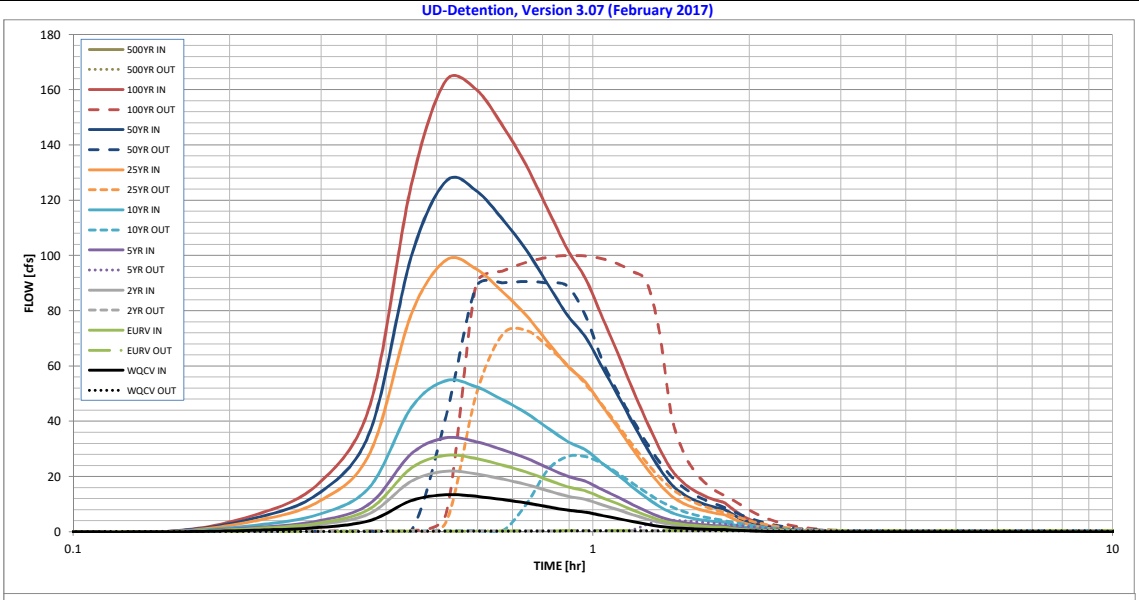
Routed Hydrograph Results

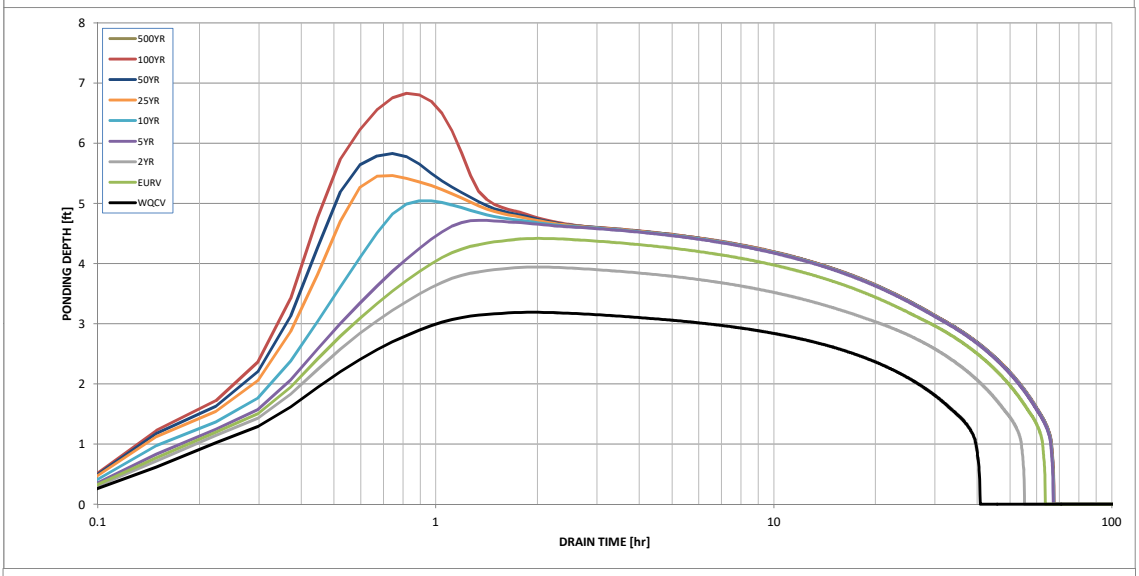
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.725	1.508	1.189	1.855	3.002	5.469	7.093	9.201	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.724	1.507	1.188	1.854	3.002	5.461	7.090	9.193	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.06	0.28	0.80	1.09	1.45	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.0	4.2	19.6	55.6	75.6	100.1	0.0
Peak Inflow Q (cfs) =	13.4	27.7	21.9	34.0	54.7	98.4	126.9	163.3	#N/A
Peak Outflow Q (cfs) =	0.3	0.5	0.4	4.2	27.2	72.8	90.5	100.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.4	1.3	1.2	1.0	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.6	1.5	1.9	2.1	#N/A
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	58	51	61	58	53	51	47	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	62	54	65	64	61	60	58	#N/A
Maximum Ponding Depth (ft) =	3.19	4.42	3.94	4.72	5.04	5.46	5.83	6.83	#N/A
Area at Maximum Ponding Depth (acres) =	0.56	0.67	0.64	0.69	0.71	0.74	0.76	0.83	#N/A
Maximum Volume Stored (acre-ft) =	0.674	1.436	1.128	1.640	1.871	2.176	2.446	3.243	#N/A

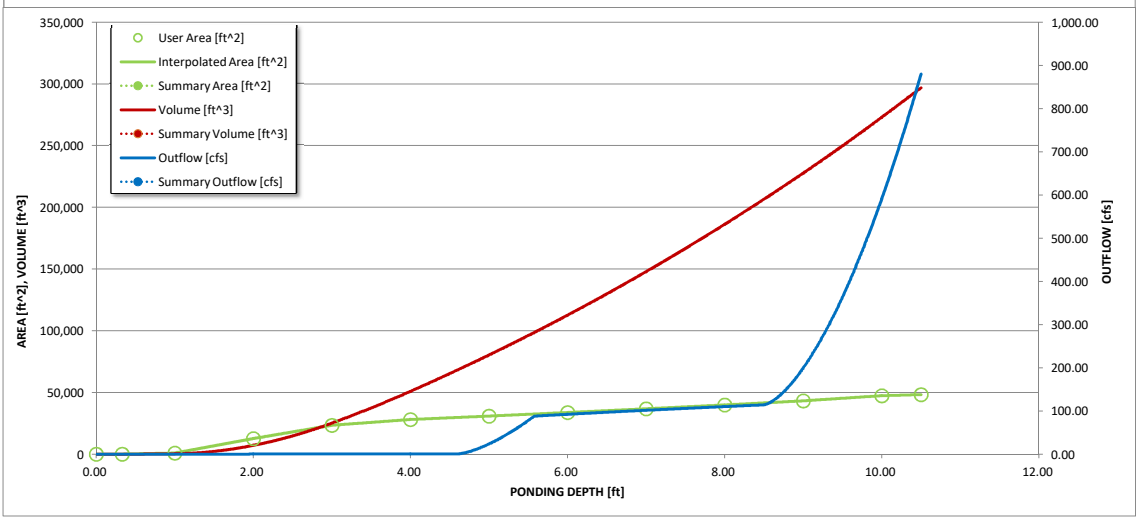
fix

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
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]
4.47 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:08:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:13:25	0.59	1.20	0.96	1.47	2.32	3.97	4.95	6.10	#N/A
1.118	0:17:53	1.60	3.27	2.59	4.00	6.38	11.19	14.17	17.83	#N/A
	0:22:21	4.11	8.40	6.66	10.27	16.37	28.72	36.39	45.81	#N/A
	0:26:49	11.29	23.06	18.30	28.19	44.91	78.69	99.61	125.25	#N/A
	0:31:17	13.43	27.72	21.91	34.01	54.70	98.38	126.92	163.33	#N/A
	0:35:46	12.82	26.52	20.95	32.56	52.47	95.12	123.46	160.12	#N/A
	0:40:14	11.67	24.14	19.07	29.64	47.75	86.82	112.96	146.91	#N/A
	0:44:42	10.43	21.65	17.09	26.60	42.96	78.25	101.87	132.55	#N/A
	0:49:10	9.01	18.79	14.81	23.11	37.48	68.59	89.47	116.65	#N/A
	0:53:38	7.85	16.33	12.88	20.07	32.66	59.95	78.27	102.13	#N/A
	0:58:07	7.11	14.81	11.68	18.20	29.54	54.00	70.35	91.58	#N/A
	1:02:35	5.87	12.32	9.69	15.17	24.69	45.41	59.37	77.61	#N/A
	1:07:03	4.80	10.14	7.96	12.51	20.42	37.68	49.33	64.56	#N/A
	1:11:31	3.71	7.91	6.19	9.79	16.10	29.98	39.41	51.79	#N/A
	1:15:59	2.76	6.00	4.66	7.45	12.37	23.25	30.66	40.41	#N/A
	1:20:28	2.00	4.38	3.39	5.47	9.18	17.45	23.11	30.57	#N/A
	1:24:56	1.55	3.34	2.60	4.16	6.92	13.03	17.18	22.63	#N/A
	1:29:24	1.27	2.73	2.13	3.39	5.59	10.43	13.70	17.97	#N/A
	1:33:52	1.08	2.31	1.80	2.86	4.71	8.77	11.50	15.06	#N/A
	1:38:20	0.95	2.02	1.58	2.50	4.11	7.61	9.97	13.03	#N/A
	1:42:49	0.85	1.81	1.42	2.24	3.68	6.80	8.89	11.61	#N/A
	1:47:17	0.79	1.67	1.31	2.06	3.37	6.22	8.12	10.59	#N/A
	1:51:45	0.58	1.23	0.96	1.52	2.50	4.67	6.16	8.11	#N/A
	1:56:13	0.42	0.90	0.70	1.11	1.82	3.38	4.44	5.85	#N/A
	2:00:41	0.31	0.66	0.52	0.82	1.34	2.50	3.29	4.34	#N/A
	2:05:10	0.23	0.49	0.38	0.60	1.00	1.86	2.45	3.22	#N/A
	2:09:38	0.16	0.35	0.27	0.44	0.73	1.37	1.80	2.38	#N/A
	2:14:06	0.12	0.25	0.20	0.31	0.52	0.98	1.30	1.72	#N/A
	2:18:34	0.08	0.18	0.14	0.23	0.38	0.71	0.94	1.25	#N/A
	2:23:02	0.05	0.12	0.09	0.15	0.26	0.50	0.67	0.89	#N/A
	2:27:31	0.03	0.08	0.06	0.10	0.17	0.33	0.44	0.59	#N/A
	2:31:59	0.02	0.04	0.03	0.05	0.09	0.19	0.26	0.35	#N/A
	2:36:27	0.01	0.02	0.01	0.02	0.04	0.09	0.12	0.17	#N/A
	2:40:55	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.05	#N/A
	2:45:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:49:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:54:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:03:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:07:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:12:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:16:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:21:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:25:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:30:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:34:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:39:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:43:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:47:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:52:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:56:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:01:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:05:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:10:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:14:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:19:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:23:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:28:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:32:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:37:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:41:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:46:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:50:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:55:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:59:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:03:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:08:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:12:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:17:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:21:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

soil groups A and B?

Stormwater Facility Name: **Pond 1**

Facility Location & Jurisdiction: **Timberline Storage Yard, El Paso County / El Paso County**

User Input: Watershed Characteristics

Watershed Slope =	0.014	ft/ft
Watershed Length =	1880	ft
Watershed Area =	69.22	acres
Watershed Imperviousness =	22.5%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	70.0%	percent
Percentage Hydrologic Soil Groups C/D =	30.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

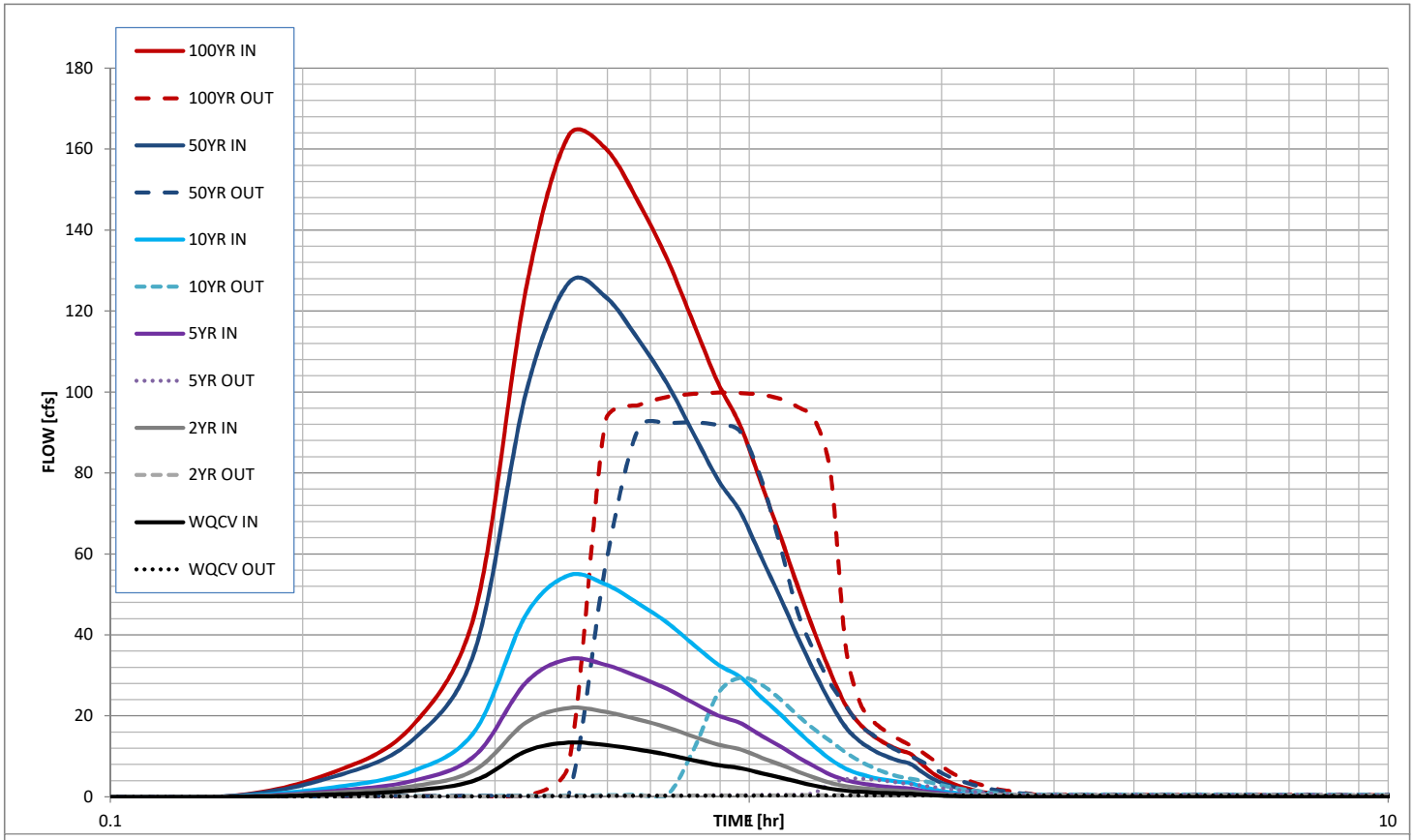
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.33	40	0.30	0.06
1.00	900	1.00	0.10
2.00	12,619	2.00	0.20
3.00	23,386	3.00	0.28
4.00	28,078	4.00	0.43
4.60	29,735	4.60	0.55
4.65	29,873	4.65	1.99
4.71	30,039	4.71	4.85
4.81	30,315	4.81	11.40
4.90	30,563	4.90	17.90
4.99	30,812	4.99	29.22
5.20	31,422	5.20	72.69
5.46	32,179	5.46	90.61
5.84	33,284	5.84	94.19
6.20	34,353	6.20	96.91
6.49	35,227	6.49	98.77
6.80	36,161	6.80	99.96
6.83	36,252	6.83	100.00

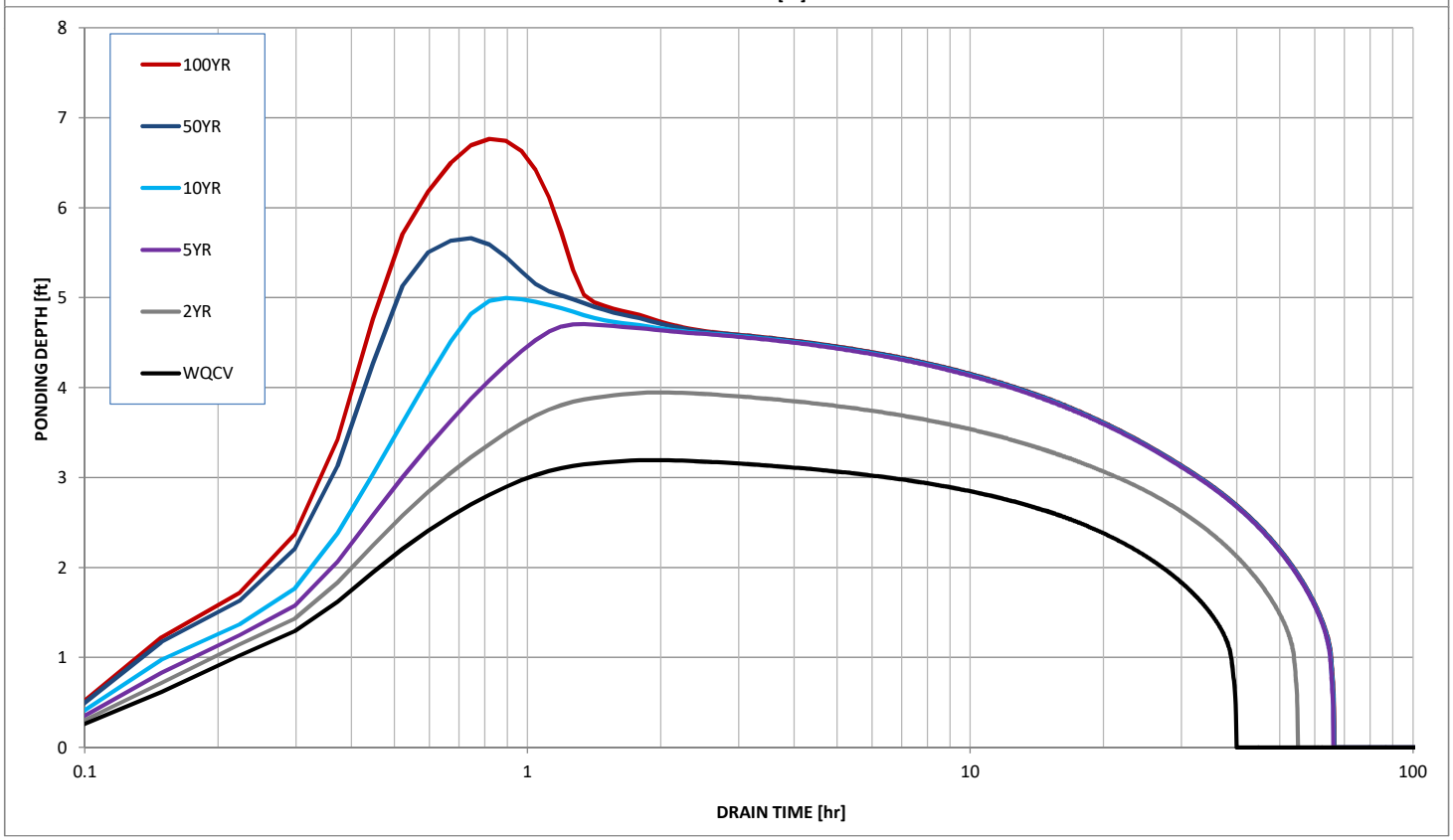
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.725	1.189	1.855	3.002	7.093	9.201	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.724	1.188	1.854	3.002	7.091	9.194	acre-ft
Time to Drain 97% of Inflow Volume =	37.4	51.1	**60.6**	58.1	50.7	47.2	hours
Time to Drain 99% of Inflow Volume =	38.9	53.4	63.9	62.9	59.7	**58.3**	hours
Maximum Ponding Depth =	3.19	3.95	4.71	5.00	5.66	6.77	ft
Maximum Ponded Area =	0.56	0.64	0.69	0.71	0.75	**0.83**	acres
Maximum Volume Stored =	0.680	1.130	1.633	1.837	2.321	3.191	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





MS CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, STE 110
COLORADO SPRINGS, CO 80903
(719) 955-5485

PROJECT: Timberline Storage Yard

DATE:

Forebay Volumes Req'd

Size of Contributing Area = 69.22 ac.

Min. Forebays = 3% of WQCV (UDFCD T5-EDB-12)

WQCV Pond 1 = .740 (UD-Det V. 3.07)

Total Volume Req'd = 0.03 x 0.740 = 0.022 ac

x $\frac{43560 \text{ sq-ft}}{1 \text{ ac}}$ = 967.03 cf

Total # of Forebays = 3

Divide Volume based upon Contributing area flows

Q100 @ Pond = 45.7 + 4.5 + 9.6 + 58.3 = 118.1 cfs

N = 45.7 / 118.1 = 0.387 = 38.7%

SW = 4.5 / 118.1 = 0.038 = 3.8%

SE = 100% - 38.7 - 3.8 = 57.5%

Req'd Forebay Volumes

N = 0.387 x 967.0 = 374 cf / 1.5ft = 249.3 sf (min)

SW = 0.038 / x 967.0 37 cf / 1.0ft = 37.0 sq ft

SE = 0.575 x 967.0 = 556 cf / 1.5ft = 370.7 sf (min.)

MS CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, STE 110
COLORADO SPRINGS, CO 80903
(719) 955-5485

PROJECT: Timberline Storage Yard

DATE:

Size notch for N Forebay

2% of undetained 100-yr Flow Reaching Forebay

$Q_{100} = 45.3$ cfs

$Q_{LF} = 45.3 \text{ cfs} \times 0.02 = 0.906$ cfs

Size notch using weir eqn (Rect Weir)

$$Q = \frac{3.247\, L \cdot H^{1.48} - 0.566\, L^{1.9}}{1 + 2L^{1.87}} \cdot H^{1.9} \qquad H = 1.5'$$

$L = 1.9''$

Size notch for SE Forebay

2% of undetained 100-yr Flow Reaching Forebay

$Q_{100} = 65.2$ cfs

$Q_{LF} = 65.2 \times 0.02 = 1.304$ cfs

Size notch using weir eqn (Rect Weir)

$$Q = \frac{3.247\, L \cdot H^{1.48} - 0.566\, L^{1.9}}{1 + 2L^{1.87}} \cdot H^{1.9} \qquad H = 1.5'$$

$L = 2.8''$

CIVIL CONSULTANTS, INC.

20 BOULDER CRESCENT, STE 110
COLORADO SPRINGS, CO 80903
(719) 955-5485

PROJECT: _____

DATE: _____

Size notch for SW forebay

2% of unattained 100-yr Flow Remaining Forebay

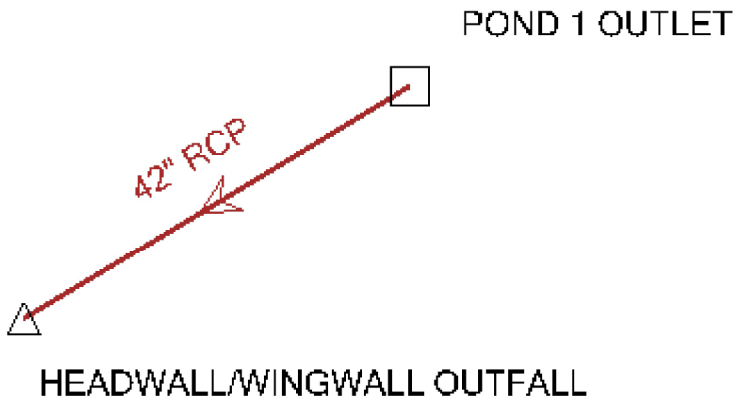
$Q_{100} = 4.5 cfs$

$Q_{2\%} = 4.5 \times 0.02 = 0.09 cfs$

$$Q = \frac{3.247\, L \cdot H^{1.4} - 0.5066\, L^{1.9}}{1 + 2L^{1.8}} H^{1.9} \qquad H = 10$$

$L = 0.33''$ use a min of 3/8" wide

POND 1 OUTFALL INDEX MAP

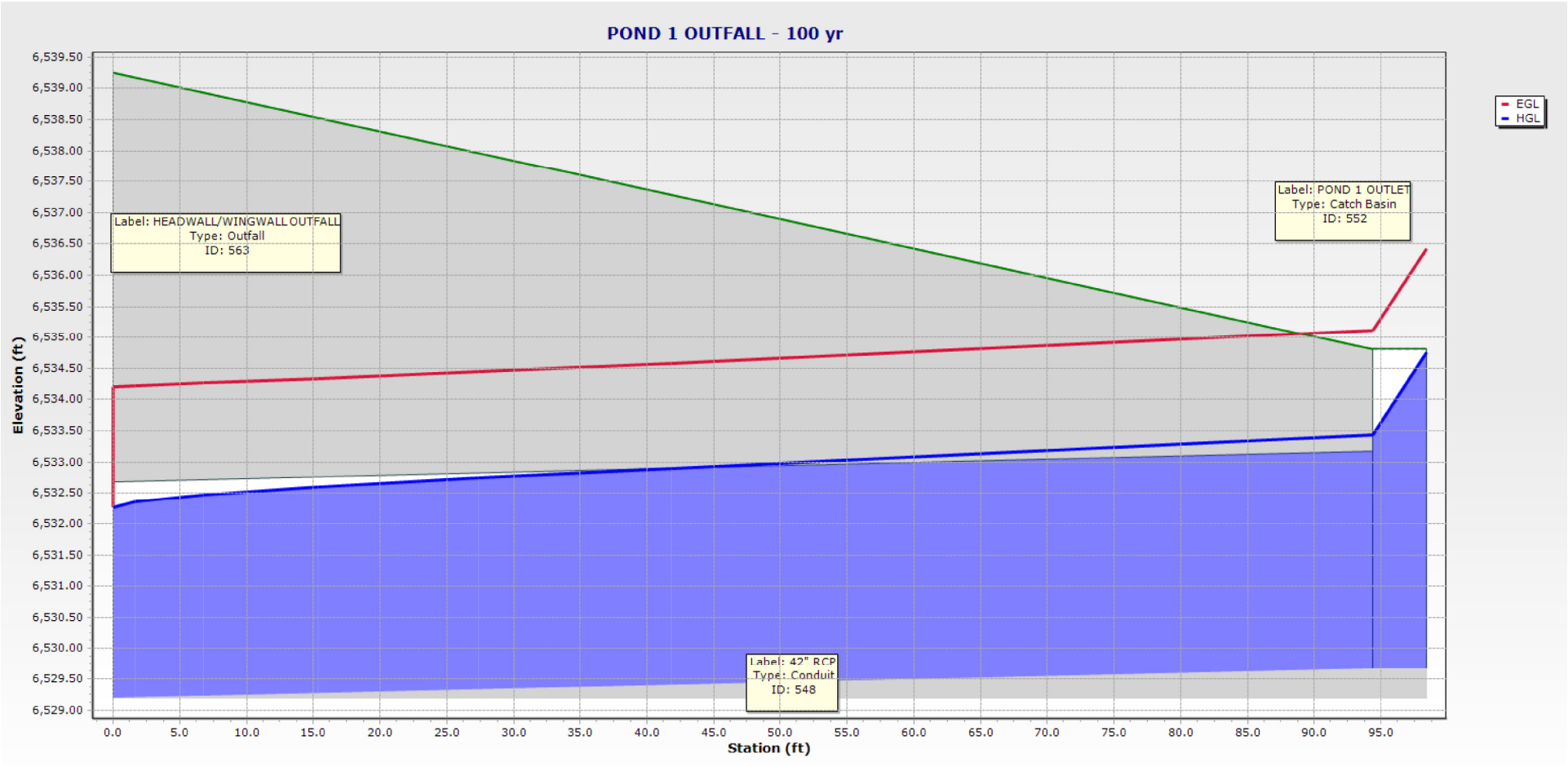


Conduit FlexTable: POND 1 OUTFALL

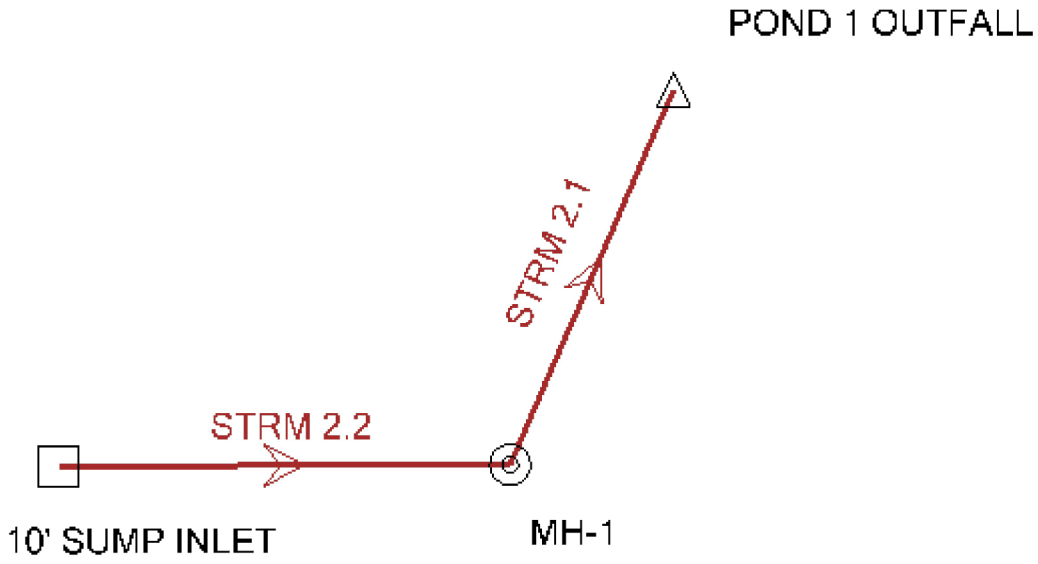
Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)
42" RCP	548	POND 1 OUTLET	100.00	140.9	96.4	10.39	0.979	(N/A)	3.07

Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)
6,535.11	6,534.20	6,533.43	6,532.26	1.17	6,534.75	10.39	1.000	1.32	6,539.25

Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)
6,534.81	6,529.19	6,529.67


POND 1 OUTFALL - 100 yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: HEADWALL/WINGWALL OUTFALL
Type: Outfall
ID: 563
Label: POND 1 OUTLET
Type: Catch Basin
ID: 552
Label: 42" RCP
Type: Conduit
ID: 548
6,539.50
6,539.00
6,538.50
6,538.00
6,537.50
6,537.00
6,536.50
6,536.00
6,535.50
6,535.00
6,534.50
6,534.00
6,533.50
6,533.00
6,532.50
6,532.00
6,531.50
6,531.00
6,530.50
6,530.00
6,529.50
6,529.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0

STRM 2 INDEX MAP

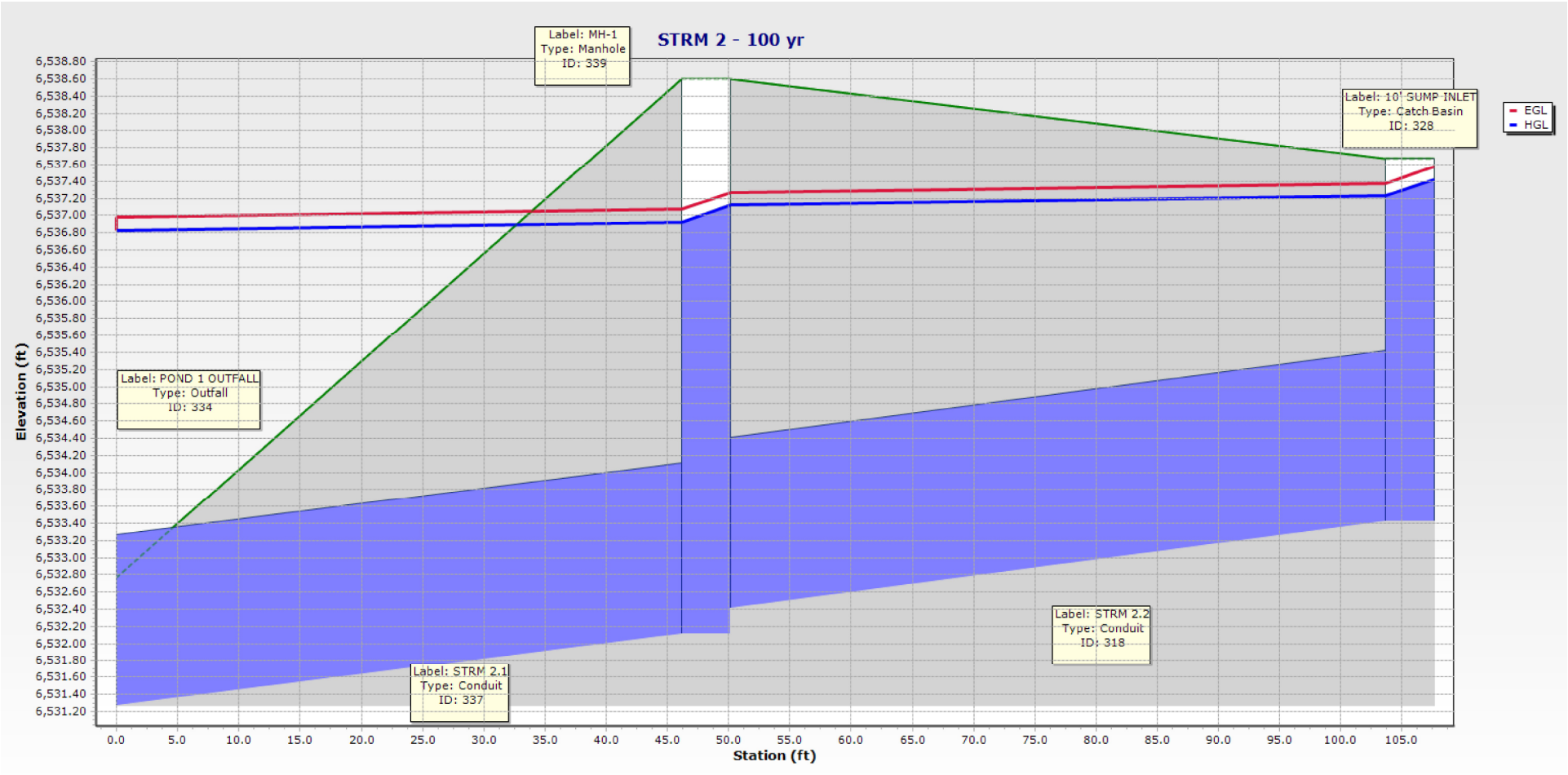


Conduit FlexTable: STRM 2

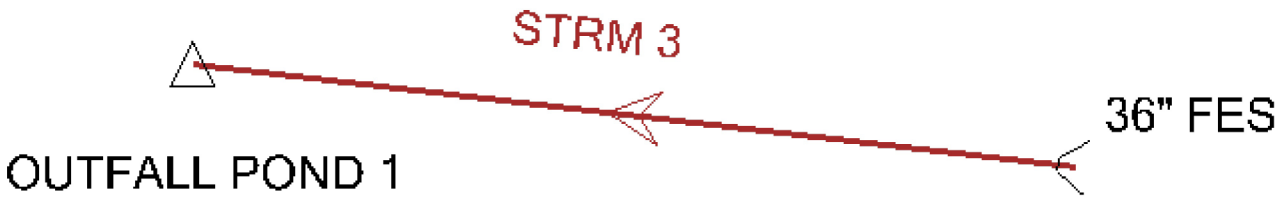
Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)
STRM 2.2	318	10' SUMP INLET	9.80	32.7	57.5	3.12	1.965	0.79	1.12
STRM 2.1	337	MH-1	9.80	32.8	48.2	3.12	1.957	0.79	1.12

Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)
6,537.38	6,537.27	6,537.23	6,537.12	0.11	6,537.43	3.12	1.320	0.20	6,537.67
6,537.07	6,536.98	6,536.92	6,536.83	0.09	6,537.12	3.12	1.320	0.20	6,538.60

Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)
6,538.60	6,533.42	6,532.41
6,532.77	6,532.11	6,531.27


STRM 2 - 100 yr
Label: MH-1
Type: Manhole
ID: 339
Label: 10' SUMP INLET
Type: Catch Basin
ID: 328
EGL
HGL
Label: POND 1 OUTFALL
Type: Outfall
ID: 334
Label: STRM 2.1
Type: Conduit
ID: 337
Label: STRM 2.2
Type: Conduit
ID: 318
Elevation (ft)
Station (ft)
6,538.80
6,538.60
6,538.40
6,538.20
6,538.00
6,537.80
6,537.60
6,537.40
6,537.20
6,537.00
6,536.80
6,536.60
6,536.40
6,536.20
6,536.00
6,535.80
6,535.60
6,535.40
6,535.20
6,535.00
6,534.80
6,534.60
6,534.40
6,534.20
6,534.00
6,533.80
6,533.60
6,533.40
6,533.20
6,533.00
6,532.80
6,532.60
6,532.40
6,532.20
6,532.00
6,531.80
6,531.60
6,531.40
6,531.20
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0

STORM 3 INDEX MAP

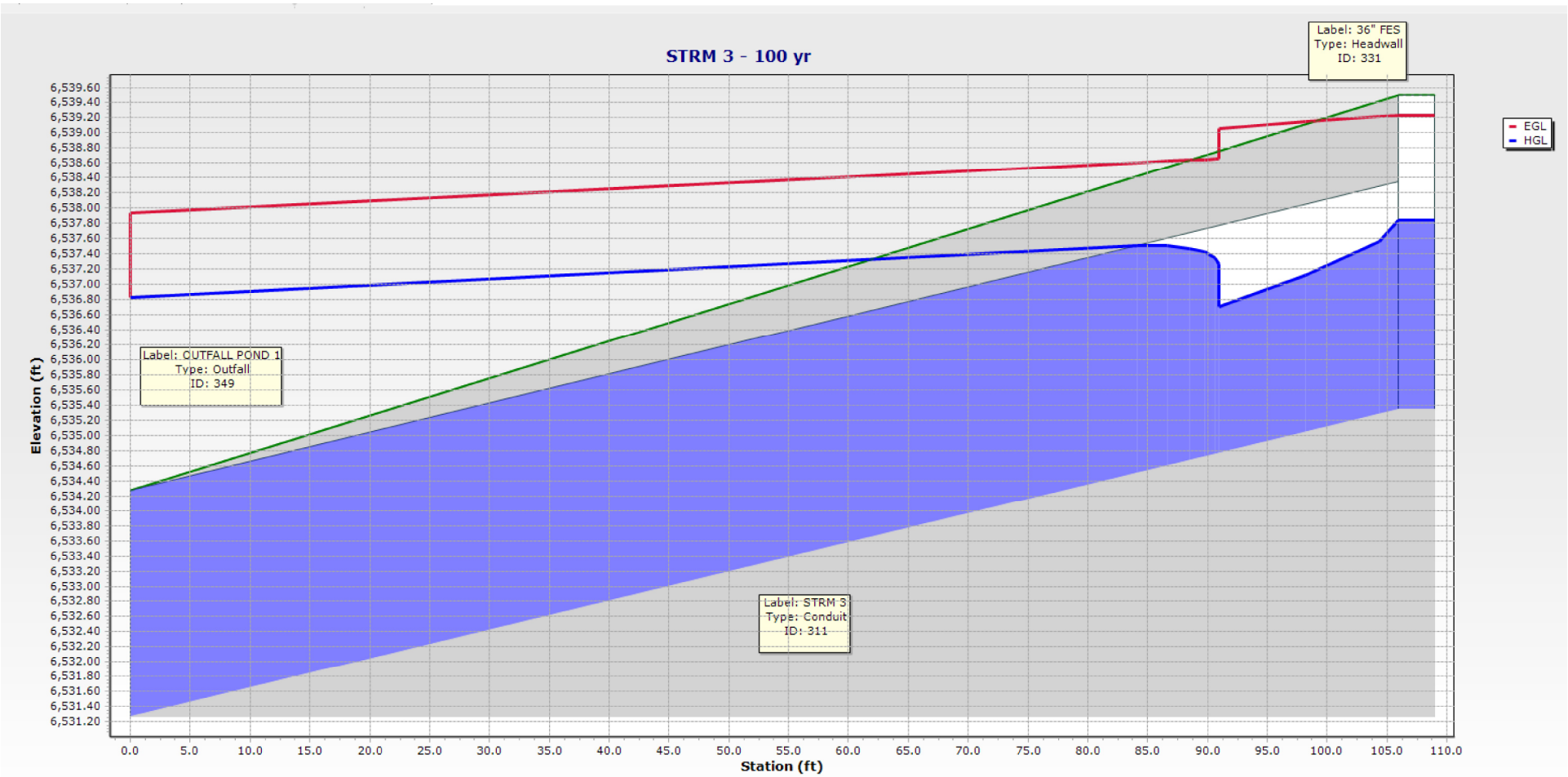


Conduit FlexTable: STRM 3

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)
STRM 3	311	36" FES	59.50	45.8	107.5	17.98	3.017	1.42	2.49

Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)
6,539.24	6,537.93	6,537.84	6,536.83	1.01	6,537.84	9.48	1.000	0.00	6,539.50

Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)
6,531.27	6,535.35	6,531.27


STRM 3 - 100 yr
Label: 36" FES
Type: Headwall
ID: 331
EGL
HGL
Label: OUTFALL POND 1
Type: Outfall
ID: 349
Label: STRM 3
Type: Conduit
ID: 311
Elevation (ft)
Station (ft)

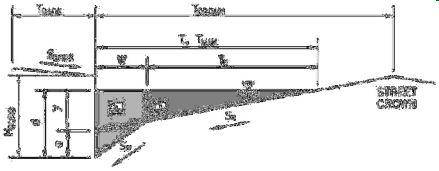
Version 4.05 Released March 2017

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

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

Project: Enter Your Project Name Here

Inlet ID: Inlet 1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	46.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.010	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	46.0	46.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

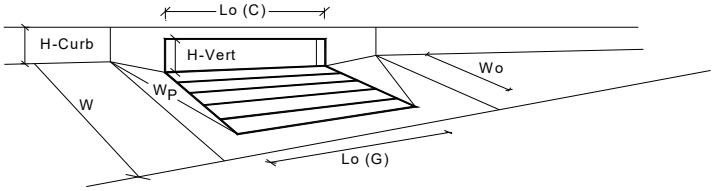
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	5.52	5.52	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.75	1.75	inches
Water Depth at Gutter Flowline	d =	7.27	7.27	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	44.0	44.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.140	0.140	
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_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	35.4	85.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	33.4	83.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.189	0.070	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.3	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.69	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**8.3**	**13.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	4.8	9.6	cfs

```
                    HEC-RAS HEC-RAS 5.0.3 September 2016
                      U.S. Army Corps of Engineers
                     Hydrologic Engineering Center
                           609 Second Street
                           Davis, California


          X     X  XXXXXX    XXXX        XXXX       XX      XXXX
          X     X  X        X    X       X   X     X  X    X
          X     X  X        X            X   X    X    X   X
          XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
          X     X  X        X            X  X     X    X        X
          X     X  X        X    X       X   X    X    X        X
          X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: existingswale
Project File : existingswale.prj
Run Date and Time: 12/4/2017 3:05:07 PM

Project in English units

PLAN DATA

Plan Title: swale analysis
Plan File : o:\43095A\Tim Emick\Documents\Reports\Drainage\HEC-RAS\existingswale.p01

Geometry Title: existingswale
Geometry File : o:\43095A\Tim Emick\Documents\Reports\Drainage\HEC-RAS\existingswale.g01

Flow Title : ex flow w timberline
Flow File : o:\43095A\Tim Emick\Documents\Reports\Drainage\HEC-RAS\existingswale.f01

Plan Summary Information:

Number of:	Cross Sections	= 7	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: ex flow w timberline
Flow File : o:\43095A\Tim Emick\Documents\Reports\Drainage\HEC-RAS\existingswale.f01

Flow Data (cfs)

River	Reach	RS	5YR	100YR
existing swale	existing swale	1074.48	5.2	84.2
existing swale	existing swale	620.87	11.6	126.9
existing swale	existing swale	400	12.1	130.6
existing swale	existing swale	175.88	13.5	139.7

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
existing swale	existing swale	5YR	Normal S = 0.022	Normal S = 0.02

GEOMETRY DATA

Geometry Title: existingswale
Geometry File : o:\43095A\Tim Emick\Documents\Reports\Drainage\HEC-RAS\existingswale.g01

```
CROSS SECTION


RIVER: existing swale
REACH: existing swale     RS: 1074.48

INPUT
Description:
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6530.367.099998 6530.27   15.57 6530.18    39.4 6530.13   43.03 6529.97
   51.38 6526.41   52.96 6526.23      60 6526.81   61.75 6526.94   62.19 6526.94
   65.05 6527.42   69.31  6528.1   92.52 6528.97   97.37 6529.07  108.59 6529.46
     120 6529.84

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03     120    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0     120           171.67  171.67  171.67             .1       .3

CROSS SECTION


RIVER: existing swale
REACH: existing swale     RS: 902.81

INPUT
Description:
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6527.85   13.59 6527.47   16.76 6527.42   41.75 6526.87   46.77 6526.29
      60  6525.4    61.9 6525.27    68.4 6525.78    74.5 6525.91    81.3 6526.18
   88.72 6527.19   94.11 6528.08  112.71 6528.74  119.25 6529.01     120 6529.03

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03     120    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0     120           113.78  113.78  113.78             .1       .3

CROSS SECTION


RIVER: existing swale
REACH: existing swale     RS: 789.03

INPUT
Description:
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6527.76   23.05 6526.62   32.69 6526.3162.39999 6524.94   75.97 6524.47
   80.31 6524.36   80.54 6524.36   89.43  6524.3   98.67 6525.33  108.83 6526.49
  138.32 6527.86  155.36 6528.39  165.31 6529.02

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03  165.31    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0  165.31           168.16  168.16  168.16             .1       .3

CROSS SECTION


RIVER: existing swale
REACH: existing swale     RS: 620.87

INPUT
Description:
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6527.58.9100037 6527.56   29.14 6526.6337.42999 6526.2761.32001 6523.27
62.03999 6523.1362.46001 6523.1367.78999 6523.29      80 6523.59   92.41 6523.94
    94.9 6523.98   99.08 6524.02  135.86 6524.35  139.15 6524.37  146.21 6524.49
  196.17 6525.18     220 6525.61

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03     220    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0     220           220.87  220.87  220.87             .1       .3

CROSS SECTION
```

```
RIVER: existing swale
REACH: existing swale     RS: 400

INPUT
Description:
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6522.564.610001 6522.47   22.67 6522.23   33.53 6521.75   52.72 6521.63
      60 6521.57    64.2 6521.54   82.04 6521.4492.49001 6521.58  141.05 6521.75
  142.01 6521.75  142.24 6521.82     145 6522.82

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03     145    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0     145           224.12  224.12  224.12             .1       .3

CROSS SECTION


RIVER: existing swale
REACH: existing swale     RS: 175.88

INPUT
Description:
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6521.1930.50999 6520.75   32.22 6520.7132.78999 6520.7134.03999 6520.69
   35.09 6520.67  102.35 6519.63  112.29 6519.49     130 6519.57   137.9 6519.62
  140.38 6519.68  167.91 6519.68  168.26 6519.65   168.7 6519.66     170 6519.67
   172.6 6519.69  199.67 6519.87  210.95 6519.98  228.11 6520.84  235.11 6522.39
  243.44 6522.22     245 6522.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03     245    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0     245           147.52  147.52  147.52             .1       .3

CROSS SECTION


RIVER: existing swale
REACH: existing swale     RS: 28.36

INPUT
Description:
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 6521.5232.07001 6521.08   36.97 6521.01   45.59 6520.75   61.39 6520.37
   86.45 6519.71   95.58 6519.39  102.08 6519.42  106.63    6519  119.68  6518.2
  124.79 6518.04  125.48 6518.02  136.36 6518.56  140.39 6518.81  149.97 6518.72

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .035       0     .03  149.97    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0  149.97             .1       .3



SUMMARY OF MANNING'S N VALUES

River:existing swale

      Reach          River Sta.       n1        n2        n3

 existing swale       1074.48          .035       .03       .035
 existing swale       902.81           .035       .03       .035
 existing swale       789.03           .035       .03       .035
 existing swale       620.87           .035       .03       .035
 existing swale       400              .035       .03       .035
 existing swale       175.88           .035       .03       .035
 existing swale       28.36            .035       .03       .035



SUMMARY OF REACH LENGTHS

River: existing swale

      Reach          River Sta.      Left     Channel    Right
```

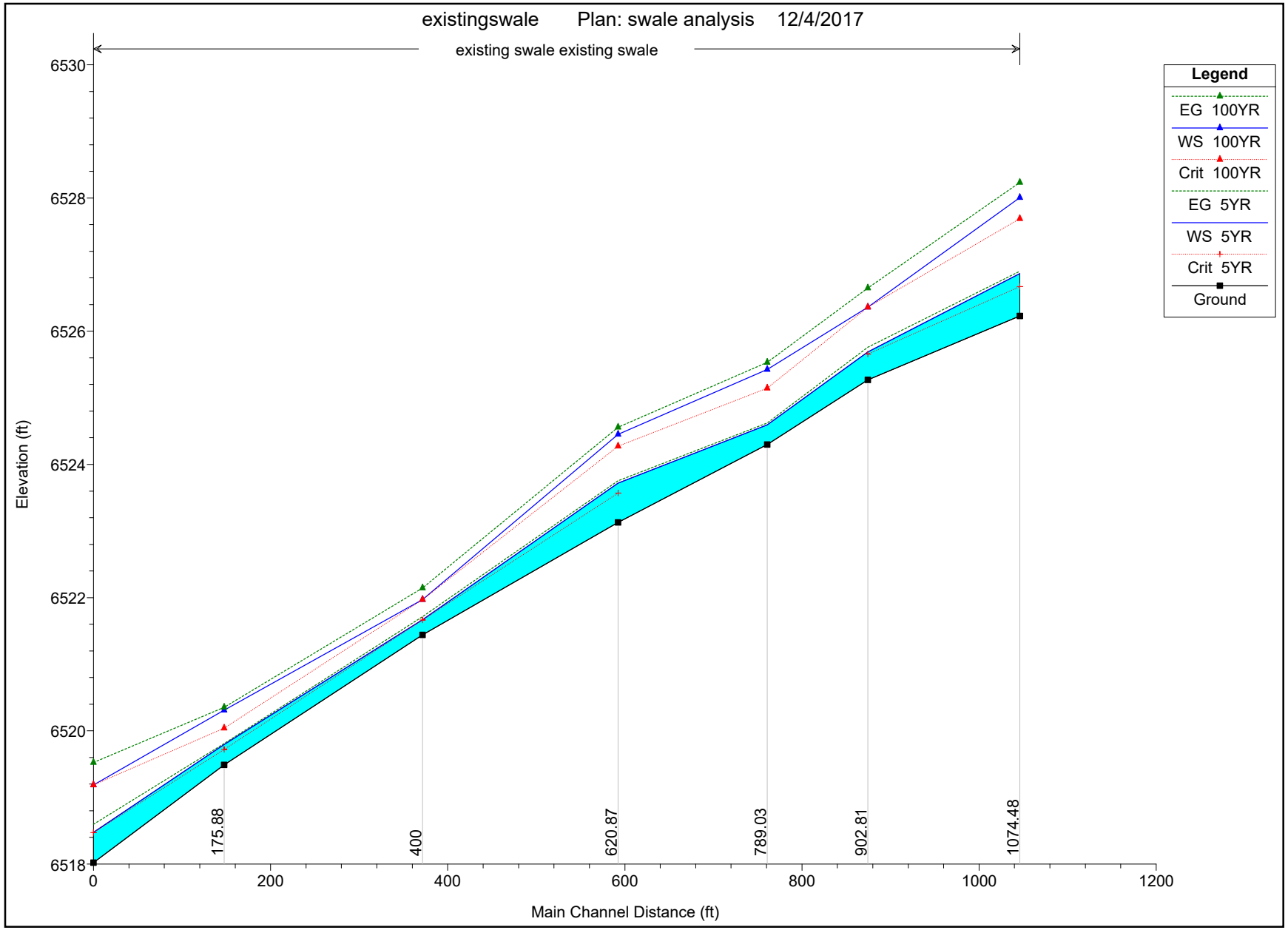
existing swale	1074.48	171.67	171.67	171.67
existing swale	902.81	113.78	113.78	113.78
existing swale	789.03	168.16	168.16	168.16
existing swale	620.87	220.87	220.87	220.87
existing swale	400	224.12	224.12	224.12
existing swale	175.88	147.52	147.52	147.52
existing swale	28.36			

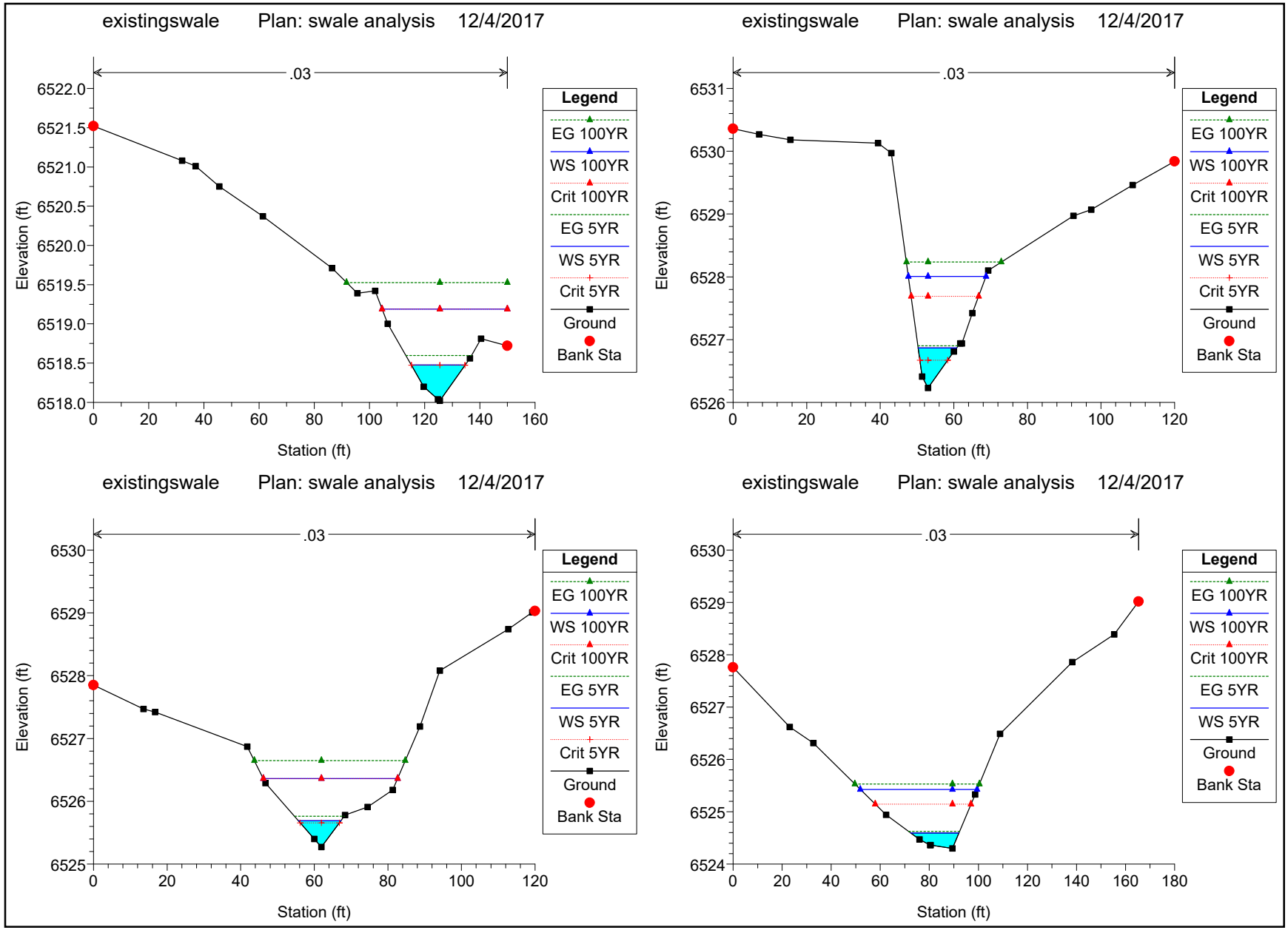
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: existing swale

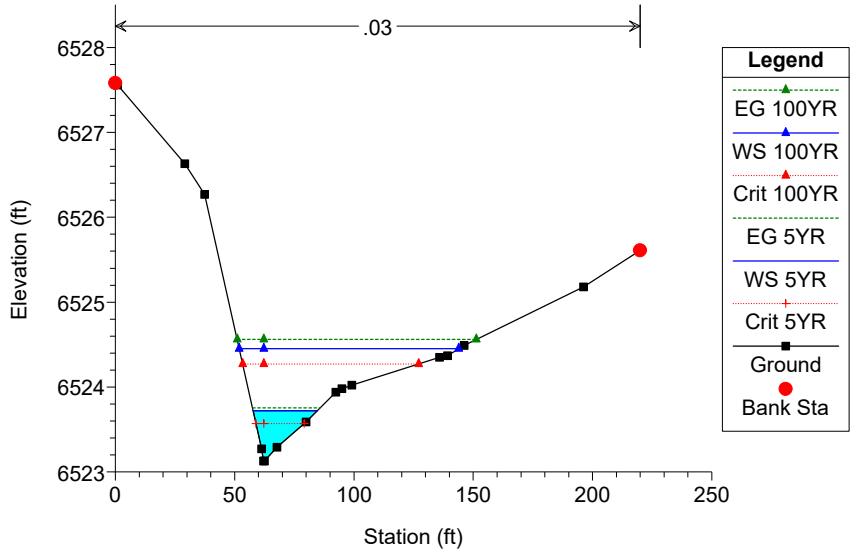
Reach	River Sta.	Contr.	Expan.
existing swale	1074.48	.1	.3
existing swale	902.81	.1	.3
existing swale	789.03	.1	.3
existing swale	620.87	.1	.3
existing swale	400	.1	.3
existing swale	175.88	.1	.3
existing swale	28.36	.1	.3

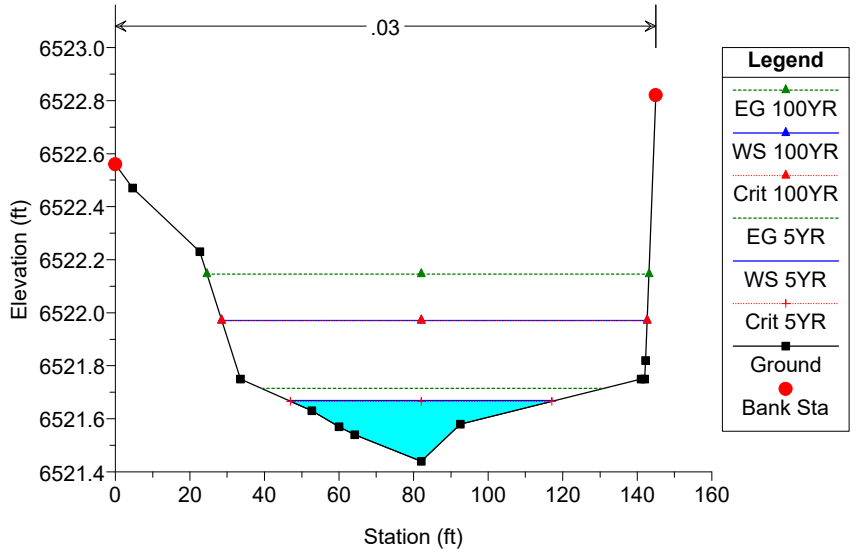
HEC-RAS Plan: exsw River: existing swale Reach: existing swale

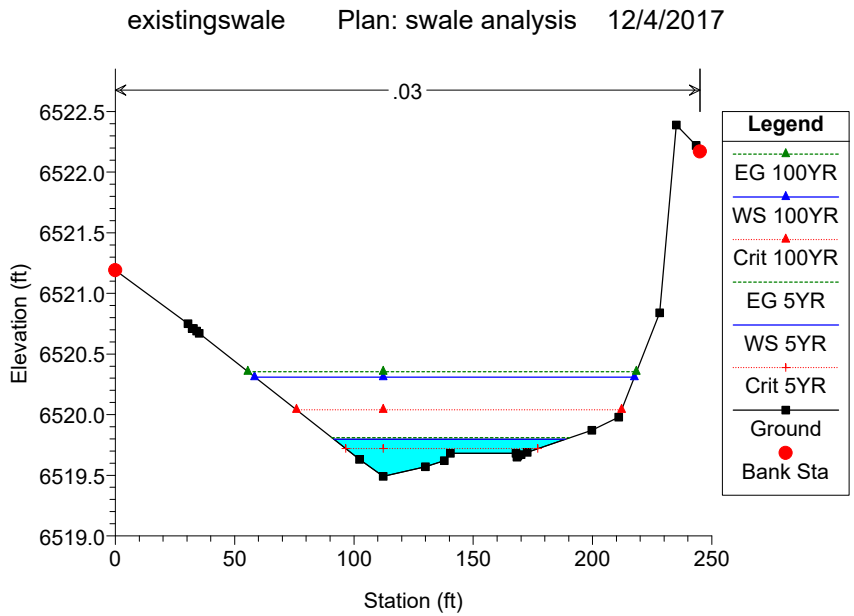
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Max Chl Dpth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Shear Chan	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	(lb/sq ft)	
existing swale	1074.48	5YR	5.20	6526.23	6526.87	0.64	6526.67	6526.90	0.003696	1.46	3.57	10.45	0.08	0.44
existing swale	1074.48	100YR	84.20	6526.23	6528.01	1.78	6527.69	6528.23	0.005784	3.82	22.03	21.10	0.37	0.66
existing swale	902.81	5YR	5.20	6525.27	6525.69	0.42	6525.66	6525.76	0.015218	2.15	2.42	11.55	0.20	0.83
existing swale	902.81	100YR	84.20	6525.27	6526.36	1.09	6526.36	6526.65	0.017093	4.28	19.66	36.48	0.57	1.03
existing swale	789.03	5YR	5.20	6524.30	6524.59	0.29		6524.62	0.006992	1.38	3.77	19.65	0.08	0.55
existing swale	789.03	100YR	84.20	6524.30	6525.43	1.13	6525.14	6525.53	0.004633	2.60	32.35	47.61	0.20	0.56
existing swale	620.87	5YR	11.60	6523.13	6523.72	0.59	6523.57	6523.75	0.004583	1.48	7.86	26.87	0.08	0.48
existing swale	620.87	100YR	126.90	6523.13	6524.45	1.32	6524.27	6524.56	0.006887	2.66	47.79	91.93	0.22	0.65
existing swale	400	5YR	12.10	6521.44	6521.67	0.23	6521.67	6521.71	0.025559	1.70	7.12	71.62	0.16	0.95
existing swale	400	100YR	130.60	6521.44	6521.97	0.53	6521.97	6522.15	0.019209	3.35	38.96	114.13	0.41	1.01
existing swale	175.88	5YR	13.50	6519.49	6519.80	0.31	6519.72	6519.81	0.004447	0.93	14.50	96.91	0.04	0.42
existing swale	175.88	100YR	139.70	6519.49	6520.31	0.82	6520.04	6520.35	0.002691	1.67	83.55	159.13	0.09	0.41
existing swale	28.36	5YR	13.50	6518.02	6518.48	0.46	6518.47	6518.60	0.019987	2.77	4.87	19.54	0.31	0.98
existing swale	28.36	100YR	139.70	6518.02	6519.19	1.17	6519.19	6519.53	0.015570	4.65	30.01	45.39	0.64	1.01


existingswale Plan: swale analysis 12/4/2017
existing swale existing swale
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Elevation (ft)
6530
6528
6526
6524
6522
6520
6518
0
200
400
600
800
1000
1200
Main Channel Distance (ft)
175.88
400
620.87
789.03
902.81
1074.48

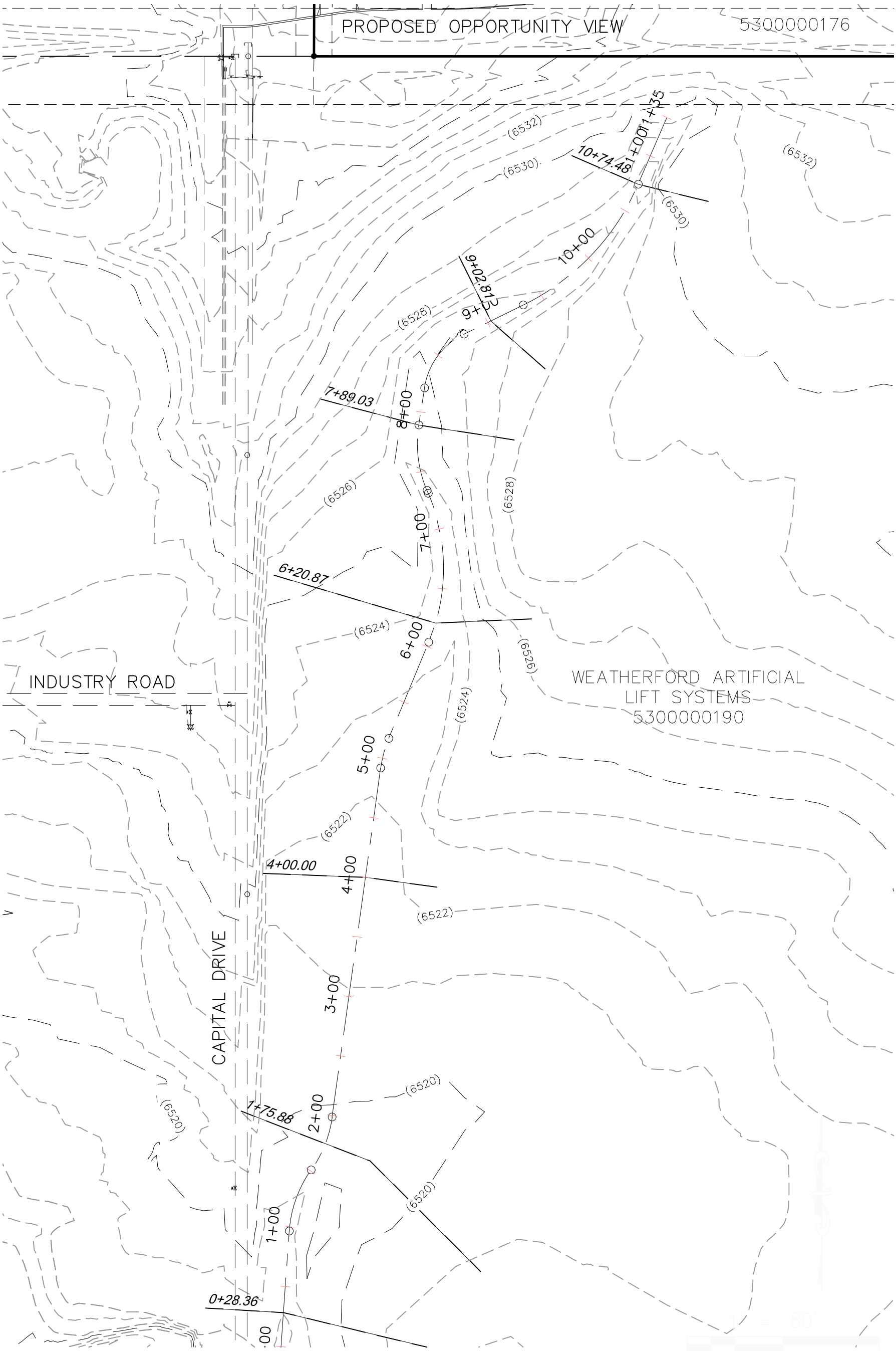

existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Bank Sta
existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Bank Sta
existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Bank Sta
existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Ground
Bank Sta


existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Bank Sta


existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Bank Sta


existingswale Plan: swale analysis 12/4/2017
.03
Elevation (ft)
Station (ft)
Legend
EG 100YR
WS 100YR
Crit 100YR
EG 5YR
WS 5YR
Crit 5YR
Ground
Bank Sta

OFF-SITE SWALE HEC-RAS WORK MAP



5YR EVENT / 100YR EVENT

CROSS SECTION ID	FLOW CFS	DEPTH FT	VELOCITY FT/S	SHEAR LB/SF		FLOW CFS	DEPTH FT	VELOCITY FT/S	SHEAR LB/SF
10+74.48	5.2	0.6	1.5	0.1		84.2	1.8	3.8	0.4
9+02.81	5.2	0.4	2.2	0.2		84.2	1.1	4.3	0.6
7+89.03	5.2	0.3	1.4	<0.1		84.2	1.1	2.6	0.2
6+20.87	11.6	0.6	1.5	<0.1		126.9	1.3	2.7	0.2
4+00.00	12.1	0.2	1.7	0.2		130.6	0.5	3.4	0.4
1+75.88	13.5	0.3	0.9	<0.1		139.7	0.8	1.7	0.1
0+28.36	13.5	0.4	2.8	0.3		139.7	1.2	4.7	0.6

M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

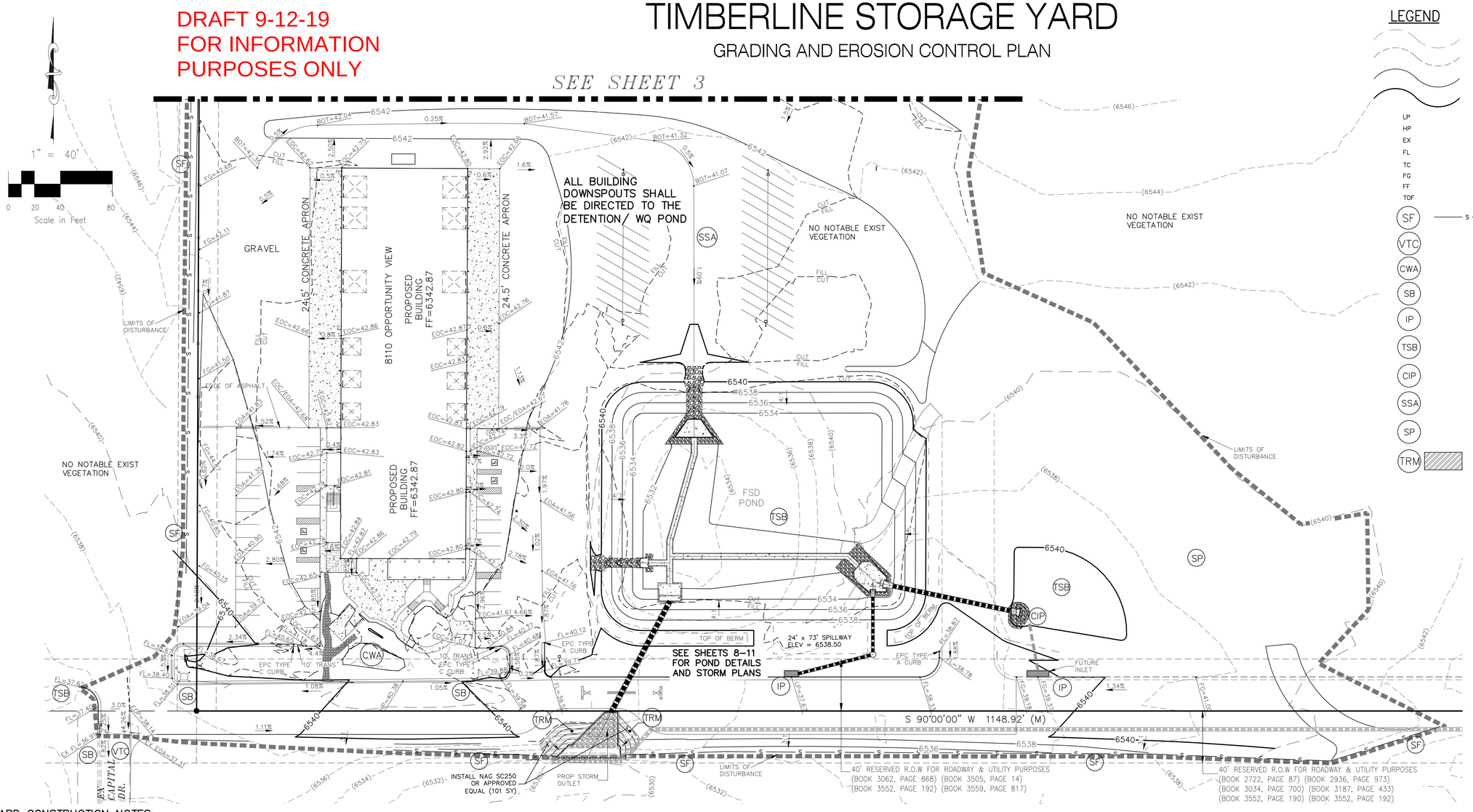
File: O:\43095A\Tim Emick\dwg\Eng Exhibits\RAS model XS.dwg Plotstamp: 12/5/2017 8:28 AM

GRADING AND EROSION CONTROL PLAN

DRAFT 9-12-19
FOR INFORMATION
PURPOSES ONLY

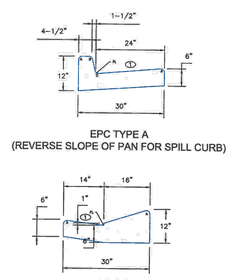
TIMBERLINE STORAGE YARD

GRADING AND EROSION CONTROL PLAN



LEGEND

	EX MAJ CONT
	EX MIN CONT
	PROP MAJ CONT
	PROP MIN CONT
LP	LOW POINT
HP	HIGH POINT
EX	EXISTING
FL	FLOWLINE
TC	TOP OF CURB
FG	FINISH GRADE
FF	FINISH FLOOR
TOF	TOP OF FOOTING
SF — S —	SILT FENCE – INITIAL
VTC	VEHICLE TRACKING CONTROL – INITIAL
CWA	CONCRETE WASH-OUT BASIN – INITIAL
SB	STRAW BALE – INITIAL
IP	INLET PROTECTION – INITIAL
TSB	TEMPORARY SEDIMENT BASIN – INTERIM
CIP	CULVERT INLET PROTECTION – INITIAL
SSA	CULVERT INLET PROTECTION – INITIAL
SP	TEMPORARY STOCK PILE AREA – INITIAL
TRM	NORTH AMERICAN GREEN SC250 PERMANENT EROSION CONTROL BLANKET (OR APPROVED EQUAL) – PERM



STANDARD CONSTRUCTION NOTES:

1. ALL DRAINAGE AND ROADWAY CONSTRUCTION SHALL MEET THE STANDARDS AND SPECIFICATIONS OF THE CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL VOLUMES 1 AND 2, AND THE EL PASO COUNTY ENGINEERING CRITERIA MANUAL.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE NOTIFICATION AND FIELD LOCATION OF ALL EXISTING UTILITIES, WHETHER SHOWN ON THE PLANS OR NOT, BEFORE BEGINNING CONSTRUCTION. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CALL 811 TO CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO SPRINGS.
3. CONTRACTOR SHALL KEEP A COPY OF THESE APPROVED PLANS, THE GRADING AND EROSION CONTROL PLAN, THE STORMWATER MANAGEMENT PLAN (SWMP), THE SOILS AND GEOTECHNICAL REPORT AND THE APPROPRIATE DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS AT THE JOB SITE AT ALL TIME INCLUDING THE FOLLOWING:
   3.1 EL PASO COUNTY ENGINEERING CRITERIA MANUAL (ECM)
   3.2 CITY OF COLORADO SPRINGS/EL PASO COUNTY ENGINEERING CRITERIA MANUAL VOLUMES 1 AND 2.
   3.3 COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) STANDARDS SPECIFICATION FOR ROAD AND BRIDGE CONSTRUCTION.
   3.4 CDOT M&S STANDARDS.
4. IT IS THE DESIGN ENGINEERS RESPONSIBILITY TO ACCURACY SHOW EXISTING CONDITION BOTH ONSITE AND OFFSITE ON THE CONSTRUCTION PLANS. ANY MODIFICATION NECESSARY DUE TO CONFLICT OMISSIONS OR CHANGED CONDITIONS WILL BE ENTIRELY THE DEVELOPERS RESPONSIBILITY TO RECTIFY.
5. ONCE THE ESQCP HAS BEEN ISSUED, THE CONTRACTOR MAY INSTALL THE INITIAL STAGE EROSION AND SEDIMENT CONTROL BMPS AS INDICATED ON THE GEC. A PRECONSTRUCTION MEETING BETWEEN THE CONTRACTOR, ENGINEER, AND EL PASO COUNTY WILL BE HELD PRIOR TO ANY CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE APPLICANT TO COORDINATE THE MEETING TIME AND PLACE WITH COUNTY PCD INSPECTIONS STAFF.
6. IT IS THE CONTRACTORS RESPONSIBILITY TO UNDERSTAND THE REQUIREMENTS OF ALL JURISDICTIONAL AGENCIES AND TO OBTAIN ALL REQUIRED PERMITS, INCLUDING BUT NOT LIMITED TO EL PASO COUNTY EROSION AND STORM WATER QUALITY CONTROL PERMIT (ESQCP), US ARMY CORPS OF ENGINEER ISSUED 401 AND/OR 404 PERMITS AND COUNTY AND STATE FUGITIVE DUST PERMITS.
7. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE CONSTRUCTION SITE AT APPROVED CONSTRUCTION ACCESS POINTS.
8. ANY TEMPORARY SIGNAGE AND STRIPING SHALL COMPLY WITH EL PASO COUNTY DOW AND MUTCD CRITERIA.
9. CONTRACTOR SHALL OBTAIN ANY PERMITS REQUIRE BY EL PASO COUNTY DOT INCLUDING WORK WITHIN THE RIGHT-OF-WAY AND SPECIAL TRANSPORT PERMITS.
10. THE LIMITS OF CONSTRUCTION SHALL REMAIN WITHIN THE PROPERTY LINE UNLESS OTHERWISE NOTED. THE OWNER/DEVELOPER SHALL OBTAIN WRITTEN PERMISSION AND EASEMENTS, WHERE REQUIRED, FROM ADJOINING PROPERTY OWNER(S) PRIOR TO ANY OFFSITE DISTURBANCE GRADING, OR CONSTRUCTION.

GRADING AND EROSION CONTROL NOTES:

1. STORMWATER DISCHARGES FROM CONSTRUCTION SITES SHALL NOT CAUSE OR THREATEN TO CAUSE POLLUTION, CONTAMINATION, OR DEGRADATION OF STATE WATERS. ALL WORK AND EARTH DISTURBANCE SHALL BE DONE IN A MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF-SITE WATERS, INCLUDING WETLANDS.
2. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS FROM REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING.
3. A SEPARATE STORMWATER MANAGEMENT PLAN (SMWP) FOR THIS PROJECT SHALL BE COMPLETED AND AN EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP) ISSUED PRIOR TO COMMENCING CONSTRUCTION. MANAGEMENT OF THE SWMP DURING CONSTRUCTION IS THE RESPONSIBILITY OF THE DESIGNATED QUALIFIED STORMWATER MANAGER OR CERTIFIED EROSION CONTROL INSPECTOR. THE SWMP SHALL BE LOCATED ON SITE AT ALL TIMES DURING CONSTRUCTION AND SHALL BE KEPT UP TO DATE WITH WORK PROGRESS AND CHANGES IN THE FIELD.
4. ONCE THE ESQCP IS APPROVED AND A "NOTICE TO PROCEED" HAS BEEN ISSUED, THE CONTRACTOR MAY INSTALL THE INITIAL STAGE EROSION AND SEDIMENT CONTROL MEASURES AS INDICATED ON THE APPROVED GEC. A PRECONSTRUCTION MEETING BETWEEN THE CONTRACTOR, ENGINEER, AND EL PASO COUNTY WILL BE HELD PRIOR TO ANY CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE APPLICANT TO COORDINATE THE MEETING TIME AND PLACE WITH COUNTY STAFF.
5. CONTROL MEASURES MUST BE INSTALLED PRIOR TO COMMENCEMENT OF ACTIVITIES THAT COULD CONTRIBUTE POLLUTANTS TO STORMWATER. CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, AND DISTURBED LAND AREAS SHALL BE INSTALLED IMMEDIATELY UPON COMPLETION OF THE DISTURBANCE.
6. ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE MAINTAINED AND REMAIN IN EFFECTIVE OPERATING CONDITION UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED AND FINAL STABILIZATION IS ESTABLISHED. ALL PERSONS ENGAGED IN LAND DISTURBANCE ACTIVITIES SHALL ASSESS THE ADEQUACY OF CONTROL MEASURES AT THE SITE AND IDENTIFY IF CHANGES TO THOSE CONTROL MEASURES ARE NEEDED TO ENSURE THE CONTINUED EFFECTIVE PERFORMANCE OF THE CONTROL MEASURES. ALL CHANGES TO TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES MUST BE INCORPORATED INTO THE STORMWATER MANAGEMENT PLAN.
7. TEMPORARY STABILIZATION SHALL BE IMPLEMENTED ON DISTURBED AREAS AND STOCKPILES WHERE GROUND DISTURBING CONSTRUCTION ACTIVITY HAS PERMANENTLY CEASED OR TEMPORARILY CEASED FOR LONGER THAN 14 DAYS.
8. FINAL STABILIZATION MUST BE IMPLEMENTED AT ALL APPLICABLE CONSTRUCTION SITES. FINAL STABILIZATION IS ACHIEVED WHEN ALL GROUND DISTURBING ACTIVITIES ARE COMPLETE AND ALL DISTURBED AREAS EITHER HAVE A UNIFORM VEGETATIVE COVER WITH INDIVIDUAL PLANT DENSITY OF 70 PERCENT OF PRE-DISTURBANCE LEVELS ESTABLISHED OR EQUIVALENT PERMANENT ALTERNATIVE STABILIZATION METHOD IS IMPLEMENTED. ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE REMOVED UPON FINAL STABILIZATION AND BEFORE PERMIT CLOSURE.
9. ALL PERMANENT STORMWATER MANAGEMENT FACILITIES SHALL BE INSTALLED AS DESIGNED IN THE APPROVED PLANS. ANY PROPOSED CHANGES THAT EFFECT THE DESIGN OR FUNCTION OF PERMANENT STORMWATER MANAGEMENT STRUCTURES MUST BE APPROVED BY THE ECM ADMINISTRATOR PRIOR TO IMPLEMENTATION.
10. EARTH DISTURBANCES SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY MINIMIZE ACCELERATED SOIL EROSION AND RESULTING SEDIMENTATION. ALL DISTURBANCES SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME. PRE-EXISTING VEGETATION SHALL BE PROTECTED AND MAINTAINED WITHIN 50 HORIZONTAL FEET OF A WATERS OF THE STATE UNLESS SHOWN TO BE INFEASIBLE AND SPECIFICALLY REQUESTED AND APPROVED.
11. COMPACTION OF SOIL MUST BE PREVENTED IN AREAS DESIGNATED FOR INFILTRATION CONTROL MEASURES OR WHERE FINAL STABILIZATION WILL BE ACHIEVED BY VEGETATIVE COVER. AREAS DESIGNATED FOR INFILTRATION CONTROL MEASURES SHALL ALSO BE PROTECTED FROM SEDIMENTATION DURING CONSTRUCTION UNTIL FINAL STABILIZATION IS ACHIEVED. IF COMPACTION PREVENTION IS NOT FEASIBLE DUE TO SITE CONSTRAINTS, ALL AREAS DESIGNATED FOR INFILTRATION AREA VEGETATION CONTROL MEASURES MUST BE LOOSENED PRIOR TO INSTALLATION OF THE CONTROL MEASURE(S).
12. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED AND CONSTRUCTED FOR THE CONVEYANCE OF STORMWATER AROUND, THROUGH, OR FROM THE EARTH DISTURBANCE AREA SHALL BE A STABILIZED CONVEYANCE DESIGNED TO MINIMIZE EROSION AND THE DISCHARGE OF SEDIMENT OFF SITE.
13. CONCRETE WASH WATER SHALL BE CONTAINED AND DISPOSED OF IN ACCORDANCE WITH THE SWMP. NO WASH WATER SHALL BE DISCHARGED TO OR ALLOWED TO ENTER STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES. CONCRETE WASHOUTS SHALL NOT BE LOCATED IN AN AREA WHERE SHALLOW GROUNDWATER MAY BE PRESENT, OR WITHIN 50 FEET OF A SURFACE WATER BODY, CREEK OR STREAM.
14. DURING DEWATERING OPERATIONS OF UNCONTAMINATED GROUND WATER MAY BE DISCHARGED ON SITE, BUT SHALL NOT LEAVE THE SITE IN THE FORM OF SURFACE RUNOFF UNLESS AN APPROVED STATE DEWATERING PERMIT IS IN PLACE.
15. EROSION CONTROL BLANKETING OR OTHER PROTECTIVE COVERING SHALL BE USED ON SLOPES STEEPER THAN 3:1.
16. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL WASTES FROM THE CONSTRUCTION SITE FOR DISPOSAL IN ACCORDANCE WITH LOCAL AND STATE REGULATORY REQUIREMENTS. NO CONSTRUCTION DEBRIS, TREE SLASH, BUILDING MATERIAL WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURIED, DUMPED, OR DISCHARGED AT THE SITE.
17. WASTE MATERIALS SHALL NOT BE TEMPORARILY PLACED OR STORED IN THE STREET, ALLEY, OR OTHER PUBLIC WAY, UNLESS IN ACCORDANCE WITH AN APPROVED TRAFFIC CONTROL PLAN. CONTROL MEASURES MAY BE REQUIRED BY EL PASO COUNTY ENGINEERING IF DEEMED NECESSARY, BASED ON SPECIFIC CONDITIONS AND CIRCUMSTANCES.
18. TRACKING OF SOILS AND CONSTRUCTION DEBRIS OFF-SITE SHALL BE MINIMIZED. MATERIALS TRACKED OFF-SITE SHALL BE CLEANED UP AND PROPERLY DISPOSED OF IMMEDIATELY.
19. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL CONSTRUCTION DEBRIS, DIRT, TRASH, ROCK, SEDIMENT, SOIL, AND SAND THAT MAY ACCUMULATE IN ROADS, STORM DRAINS AND OTHER DRAINAGE CONVEYANCE SYSTEMS AND STORMWATER APPURTENANCES AS A RESULT OF SITE DEVELOPMENT.
20. THE QUANTITY OF MATERIALS STORED ON THE PROJECT SITE SHALL BE LIMITED, AS MUCH AS PRACTICAL, TO THAT QUANTITY REQUIRED TO PERFORM THE WORK IN AN ORDERLY SEQUENCE. ALL MATERIALS STORED ON-SITE SHALL BE STORED IN A NEAT, ORDERLY MANNER, IN THEIR ORIGINAL CONTAINERS, WITH ORIGINAL MANUFACTURER'S LABELS.
21. NO CHEMICAL(S) HAVING THE POTENTIAL TO BE RELEASED IN STORMWATER ARE TO BE STORED OR USED ONSITE UNLESS PERMISSION FOR THE USE OF SUCH CHEMICAL(S) IS GRANTED IN WRITING BY THE ECM ADMINISTRATOR. IN GRANTING APPROVAL FOR THE USE OF SUCH CHEMICAL(S), SPECIAL CONDITIONS AND MONITORING MAY BE REQUIRED.
22. BULK STORAGE OF ALLOWED PETROLEUM PRODUCTS OR OTHER ALLOWED LIQUID CHEMICALS IN EXCESS OF 55 GALLONS SHALL REQUIRE ADEQUATE SECONDARY CONTAINMENT PROTECTION TO CONTAIN ALL SPILLS ONSITE AND TO PREVENT ANY SPILLED MATERIALS FROM ENTERING STATE WATERS, ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR OTHER FACILITIES.
23. NO PERSON SHALL CAUSE THE IMPEDIMENT OF STORMWATER FLOW IN THE CURB AND GUTTER OR DITCH EXCEPT WITH APPROVED SEDIMENT CONTROL MEASURES.
24. OWNER/DEVELOPER AND THEIR AGENTS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33 USC 1344), IN ADDITION TO THE REQUIREMENTS OF THE LAND DEVELOPMENT CODE, DCM VOLUME II AND THE ECM APPENDIX I. ALL APPROPRIATE PERMITS MUST BE OBTAINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION (1041, NPDES, FLOODPLAIN, 404, FUGITIVE DUST, ETC.). IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS AND OTHER LAWS, RULES, OR REGULATIONS OF OTHER FEDERAL, STATE, LOCAL, OR COUNTY AGENCIES, THE MOST RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.
25. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE ONLY AT APPROVED CONSTRUCTION ACCESS POINTS.
26. PRIOR TO CONSTRUCTION THE PERMITTEE SHALL VERIFY THE LOCATION OF EXISTING UTILITIES.
27. A WATER SOURCE SHALL BE AVAILABLE ON SITE DURING EARTHWORK OPERATIONS AND SHALL BE UTILIZED AS REQUIRED TO MINIMIZE DUST FROM EARTHWORK EQUIPMENT AND WIND.
28. THE SOILS REPORT FOR THIS SITE HAS BEEN PREPARED BY ENTECH ENGINEERING, INC., ENTITLED GEOLOGIC HAZARD/LAND STUDY AND PRELIMINARY SUBSURFACE SOIL INVESTIGATION STERLING RANCH, DATED OCTOBER 31, 2006, AND SHALL BE CONSIDERED A PART OF THESE PLANS.
29. AT LEAST TEN (10) DAYS PRIOR TO THE ANTICIPATED START OF CONSTRUCTION, FOR PROJECTS THAT WILL DISTURB ONE (1) ACRE OR MORE, THE OWNER OR OPERATOR OF CONSTRUCTION ACTIVITY SHALL SUBMIT A PERMIT APPLICATION FOR STORMWATER DISCHARGE TO THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WATER QUALITY DIVISION. THE APPLICATION CONTAINS CERTIFICATION OF COMPLETION OF A STORMWATER MANAGEMENT PLAN (SWMP), OF WHICH THIS GRADING AND EROSION CONTROL PLAN MAY BE A PART. FOR INFORMATION OR APPLICATION MATERIALS CONTACT:

   COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
   WATER QUALITY CONTROL DIVISION
   WQCD – PERMITS
   4300 CHERRY CREEK DRIVE SOUTH
   DENVER, CO 80246–1530
   ATTN: PERMITS UNIT

ADDITIONAL NOTES:

STAGING AREA TO BE DETERMINED BY CONTRACTOR IN THE FIELD. THE LOCATIONS SHALL BE DELINEATED ON THIS PLAN BY THE CONTRACTOR.

THE EROSION CONTROL DELINEATED ON THIS PLAN SHALL BE REGULARLY UPDATED BY THE CONTRACTOR.

NO PORTION OF THIS PROPERTY IS LOCATED WITHIN A DESIGNATED FEMA FLOODPLAIN IN ACCORDANCE WITH FLOOD INSURANCE RATE MAPS (FIRM) 08041C0543G, EFFECTIVE DATE MARCH 17, 1997.

EL PASO COUNTY FILE NO. PPR 17–018

TIMBERLINE STORAGE YARD	
GRADING AND EROSION CONTROL PLAN	
PROJECT NO. 43-095	DATE: 9/11/2019
DESIGNED BY: GW	SCALE: HORIZONTAL: 1"=40'
DRAWN BY: GW	VERTICAL: N/A
CHECKED BY: VAS	SHEET 2 OF 15
	GR02

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF MVE & ASSOCIATES, CONSULTANTS, INC.
VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

REVISIONS:				APRV'D.	BY:	DATE:
NO.	DATE:	BY:	DESCRIPTION:			

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

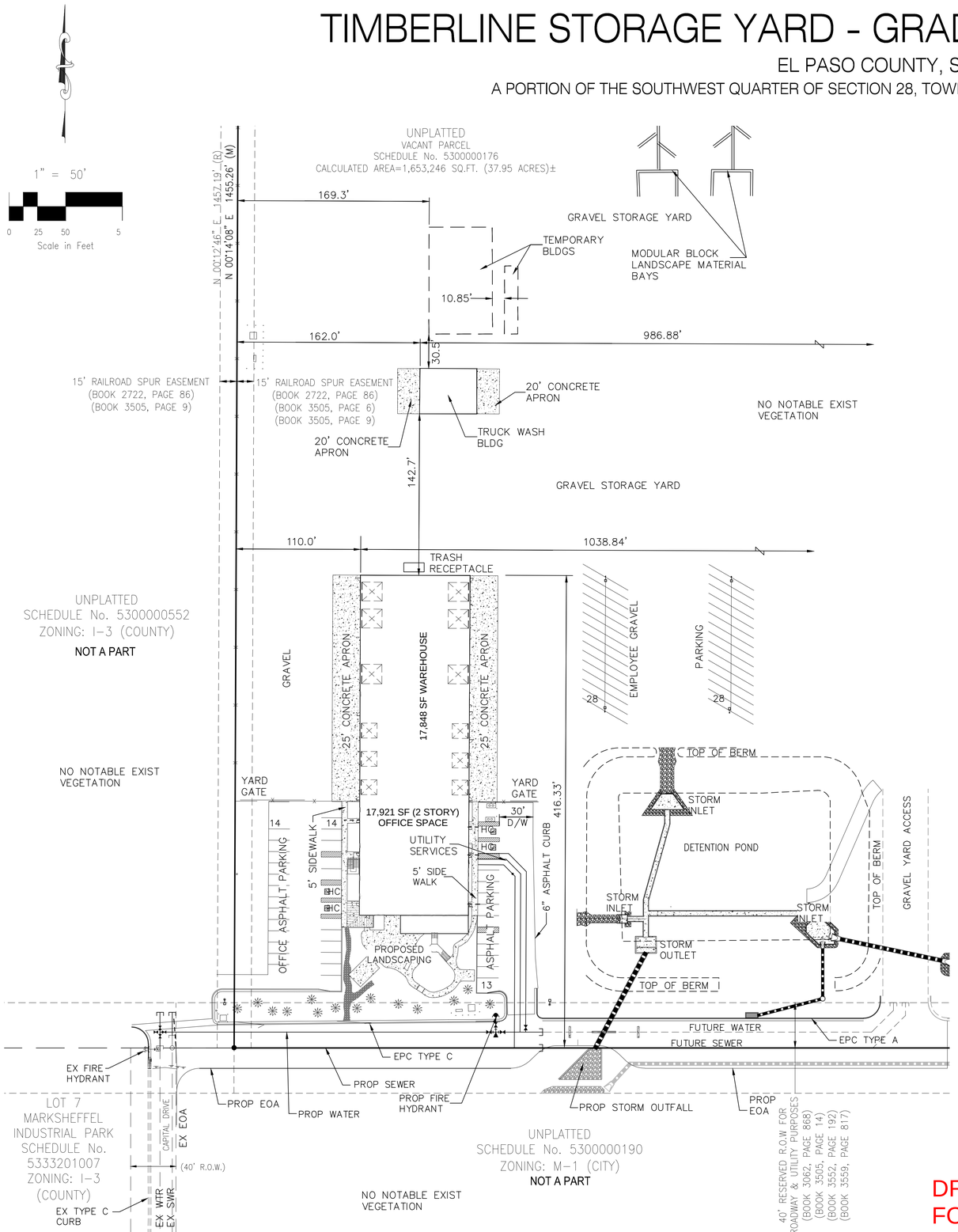
CAUTION

File: O:\43095A\Tim Ennis\dwg\Dev Plan\43095 Grading Plan.dwg Plotstamp: 9/12/2019 12:35 PM

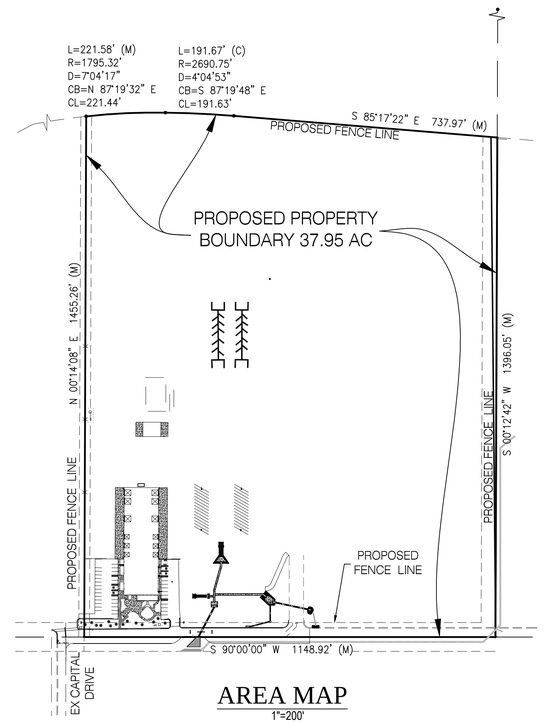
TIMBERLINE STORAGE YARD - GRADING AND EROSION CONTROL PLAN

EL PASO COUNTY, STATE OF COLORADO

A PORTION OF THE SOUTHWEST QUARTER OF SECTION 28, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN,

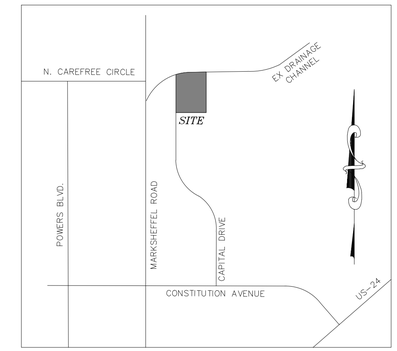


SITE MAP



AREA MAP

1"=200'



VICINITY MAP

N.T.S.

DESIGN ENGINEER'S STATEMENT

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED ROADWAY, DRAINAGE, GRADING AND EROSION CONTROL PLANS AND SPECIFICATIONS, AND SAID PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH APPLICABLE MASTER DRAINAGE PLANS AND MASTER TRANSPORTATION PLANS. SAID PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR ROADWAY AND DRAINAGE FACILITIES ARE DESIGNED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS.

VIRGIL A. SANCHEZ, COLORADO P.E. #37160 DATE
FOR AND ON BEHALF OF M & S CIVIL CONSULTANTS, INC.

OWNER/DEVELOPER'S STATEMENT:

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN AND ALL OF THE REQUIREMENTS SPECIFIED IN THESE DETAILED PLANS AND SPECIFICATIONS.

OWNER SIGNATURE: DATE

EL PASO COUNTY:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

IN ACCORDANCE WITH ECM SECTION 1.12, THESE CONSTRUCTION DOCUMENTS WILL BE VALID FOR CONSTRUCTION FOR A PERIOD OF 2 YEARS FROM THE DATE SIGNED BY THE EL PASO COUNTY ENGINEER. IF CONSTRUCTION HAS NOT STARTED WITHIN THOSE 2 YEARS, THE PLANS WILL NEED TO BE RESUBMITTED FOR APPROVAL, INCLUDING PAYMENT OF REVIEW FEES AT THE PLANNING AND COMMUNITY DEVELOPMENT DIRECTOR'S DISCRETION.

JENNIFER IRVINE, P.E. DATE
COUNTY PROJECT ENGINEER SIGNATURE

LEGAL DESCRIPTION:

THAT PORTION OF THE SOUTHWEST QUARTER OF SECTION 28, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO, DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID SOUTHWEST QUARTER; THENCE ON THE WEST LINE OF SAID SOUTHWEST QUARTER, NORTH 00 DEGREES 02 MINUTES 12 SECONDS WEST A DISTANCE OF 298.20 FEET TO INTERSECT THE SOUTHEASTERLY RIGHT-OF-WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD; THENCE NORTHEASTERLY AND EASTERLY ON SAID RIGHT-OF-WAY LINE ON A CURVE TO THE RIGHT WHOSE RADIUS IS 1,795.32 FEET, THROUGH A CENTRAL ANGLE OF 63 DEGREES 33 MINUTES 20 SECONDS AN ARC DISTANCE OF 1,991.47 FEET FOR THE POINT OF BEGINNING OF THE TRACT TO BE DESCRIBED HEREBY; THENCE CONTINUE ON THE LAST MENTIONED CURVE, WHOSE RADIUS IS 1,795.32 FEET, THROUGH A CENTRAL ANGLE OF 06 DEGREES 56 MINUTES 39 SECONDS AN ARC DISTANCE OF 217.59 FEET; THENCE ON A SPIRAL CURVE, WHOSE LONG CHORD BEARS SOUTH 86 DEGREES 25 MINUTES 49 SECONDS EAST A DISTANCE OF 195.23 FEET TO A POINT OF TANGENCY; THENCE SOUTH 85 DEGREES 25 MINUTES 17 SECONDS EAST A DISTANCE OF 738.04 FEET MORE OF LESS TO INTERSECT THE EAST LINE OF SAID SOUTHWEST QUARTER; THENCE ON SAID EAST LINE SOUTH 00 DEGREES 12 MINUTES 46 SECONDS WEST A DISTANCE OF 1,395.80 FEET TO THE SOUTHEAST CORNER OF SAID SOUTHWEST QUARTER; THENCE ON THE SOUTH LINE OF SAID SOUTHWEST QUARTER, SOUTH 90 DEGREES 00 MINUTES 00 SECONDS WEST A DISTANCE OF 1,148.00 FEET; THENCE NORTH 00 DEGREES 12 MINUTES 46 SECONDS EAST A DISTANCE OF 1,457.19 FEET MORE OR LESS TO THE POINT OF BEGINNING.

CALCULATED AREA=1,653,246 SQ.FT. (37.95 ACRES)±

CONTACTS

OWNER	TIMBERLINE LANDSCAPING, INC. 3499 CAPITAL DRIVE COLORADO SPRINGS, CO 80939
CIVIL ENGINEER	MS CIVIL CONSULTANTS, INC 102 E. PIKES PEAK AVE. STE 306 COLORADO SPRINGS, CO 80903 VIRGIL A. SANCHEZ, P.E. 719-491-0818
WATER AND WASTEWATER	CHEROKEE METROPOLITAN DISTRICT 6250 PALMER PARK BOULEVARD COLORADO SPRINGS, CO 80915-1721 JONATHAN SMITH 719-597-5080
COUNTY ENGINEER	EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT 2880 INTERNATIONAL CIRCLE, SUITE 110 COLORADO SPRINGS, COLORADO 80910 GILBERT LAFORCE, P.E. 719-520-7945
FIRE DEPARTMENT	CIMARRON HILLS FIRE DEPARTMENT 1835 TUSKEGEE PLACE COLORADO SPRINGS, CO 80915 719-591-0960
TELEPHONE COMPANY	U.S. WEST COMMUNICATIONS (LOCATORS) 800-922-1987 AT&T (LOCATORS) 719-635-3674

DRAFT 9-12-19
FOR INFORMATION PURPOSES ONLY

EL PASO COUNTY FILE NO. PPR 17-018

TIMBERLINE STORAGE YARD
GRADING AND EROSION CONTROL PLAN

PROJECT NO. 43-095 | DATE: 09/11/2019 | SHEET 1 OF 15 | GR01

DESIGNED BY: DLM | DRAWN BY: GW | CHECKED BY: VAS | SCALE: HORIZONTAL: N/A VERTICAL: N/A

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160
FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

REVISIONS: NO. | DATE: | BY: | DESCRIPTION: | APRV'D: | BY: | DATE:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

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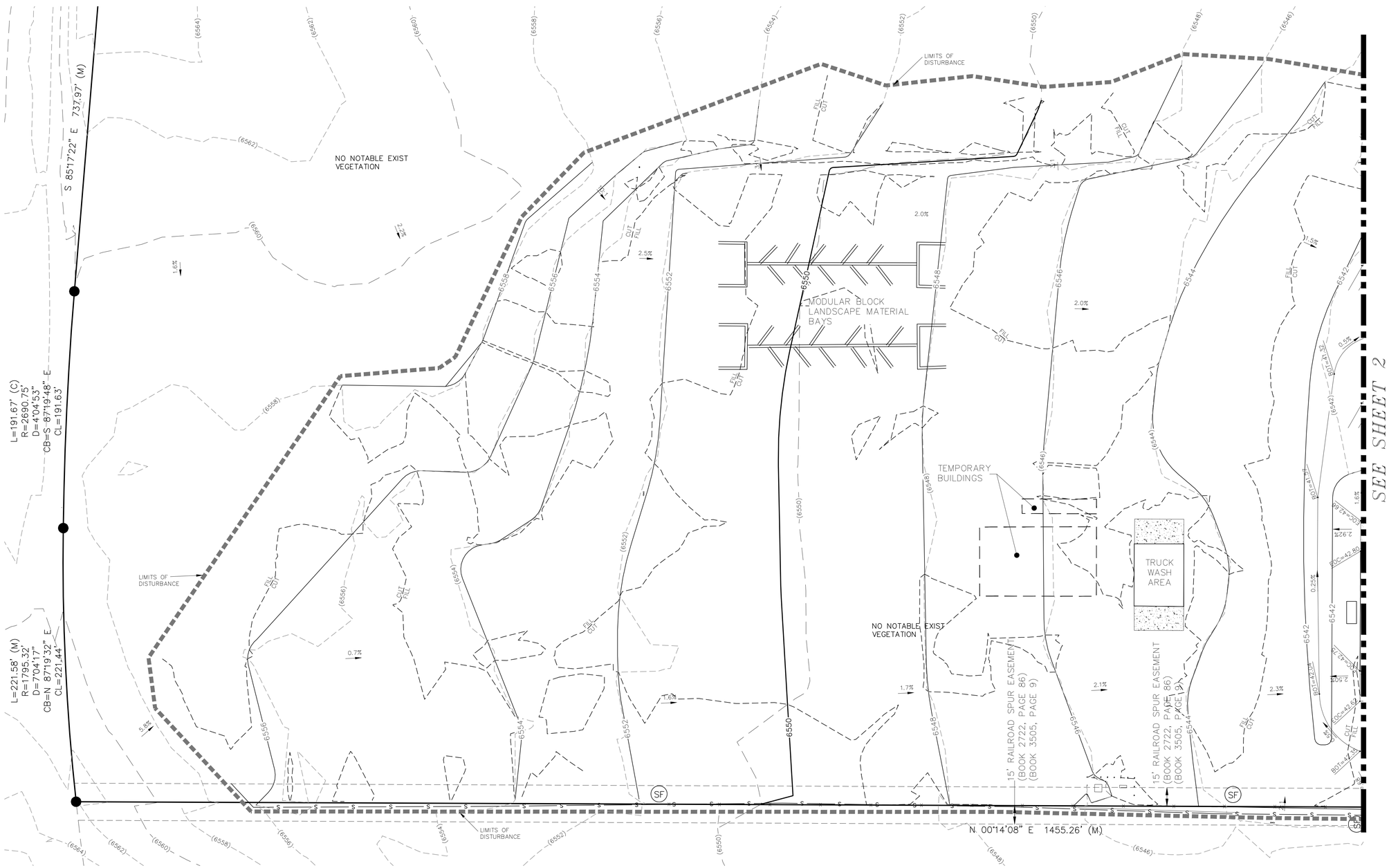
TIMBERLINE STORAGE YARD

GRADING AND EROSION CONTROL PLAN



LEGEND

	EX MAJ CONT	TOF	TOP OF FOOTING
	EX MIN CONT	SF	SILT FENCE – INITIAL
	PROP MAJ CONT	VTC	VEHICLE TRACKING CONTROL – INITIAL
	PROP MIN CONT	CWA	CONCRETE WASH-OUT BASIN – INITIAL
LP	LOW POINT	SB	STRAW BALE – INITIAL
HP	HIGH POINT	IP	INLET PROTECTION – INITIAL
EX	EXISTING	CIP	CULVERT INLET PROTECTION – INITIAL
FL	FLOWLINE		
TC	TOP OF CURB		
FG	FINISH GRADE		
FF	FINISH FLOOR		

DRAFT 9-12-19
FOR INFORMATION
PURPOSES ONLY

EL PASO COUNTY FILE NO. PPR 17–018

TIMBERLINE STORAGE YARD
GRADING AND EROSION CONTROL PLAN

PROJECT NO. 43-095 | SCALE: HORIZONTAL: 1"=40' VERTICAL: N/A | DATE: 9/11/2019 | SHEET 3 OF 15 | GR03

DESIGNED BY: GW
DRAWN BY: GW
CHECKED BY: VAS

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

FOR AND ON BEHALF OF MACK CIVIL CONSULTANTS, INC.

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APR/D.	BY:	DATE:

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CAUTION

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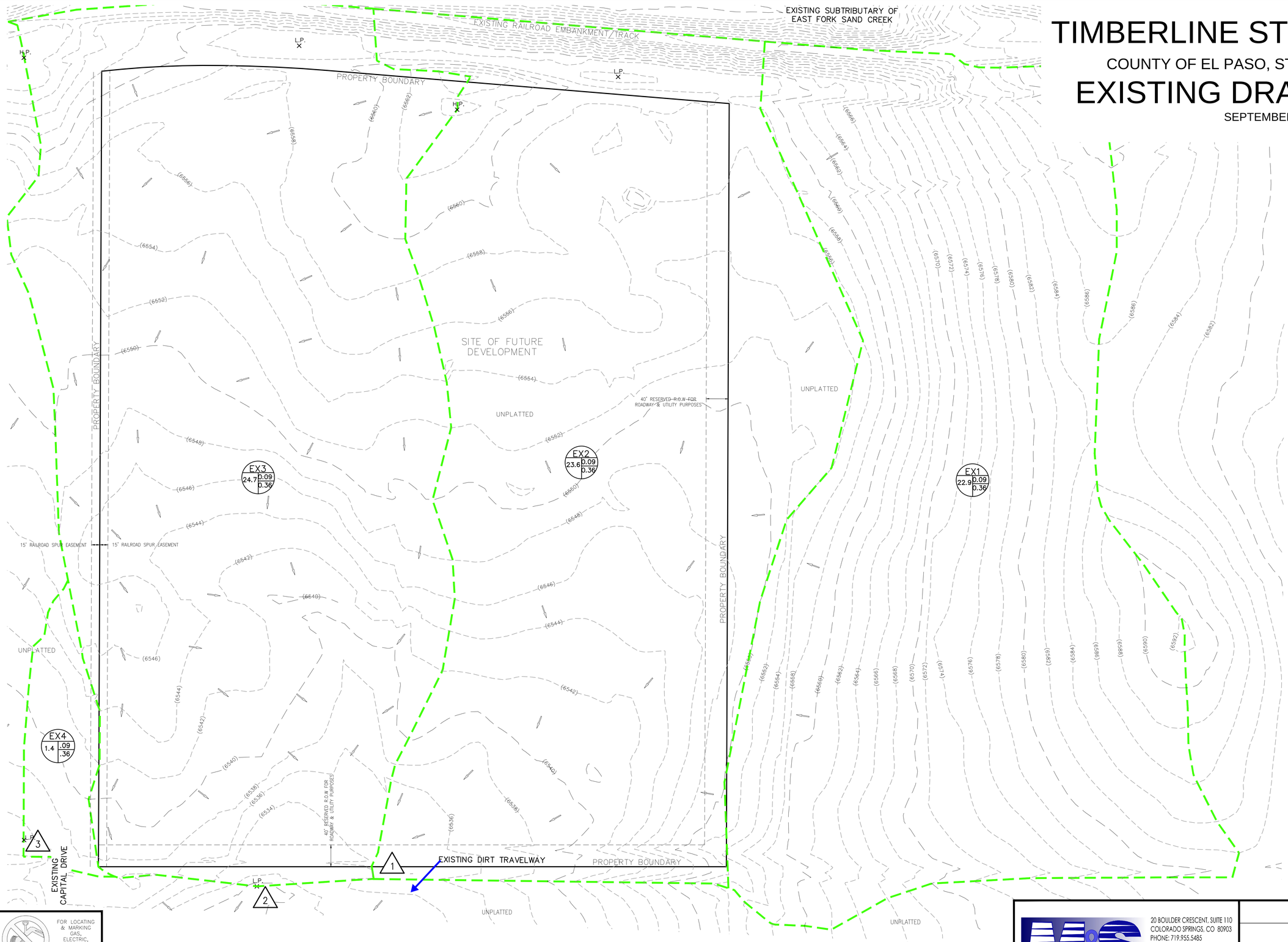
PROPOSED/EXISTING DRAINAGE MAP

TIMBERLINE STORAGE YARD

COUNTY OF EL PASO, STATE OF COLORADO

EXISTING DRAINAGE MAP

SEPTEMBER 2019



LEGEND

BASIN DESIGNATION — Z; 25 (ACRES); .25 (C5); .35 (C100)

- 6 — SURFACE DESIGN POINT (DP)
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- PARCEL BOUNDARY
- EXISTING FLOW DIRECTION ARROW
- H.P. — HIGH POINT
- L.P. — LOW POINT

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
EX1	22.93	7.6	51.0
EX2	23.63	5.0	33.6
EX3	24.67	5.1	34.3
EX4	1.27	0.4	2.7

DESIGN POINT SUMMARY			
DESIGN POINT	Q_5	Q_{100}	BASIN & DES. PTS
1	11.5	77.3	EX1,EX2
2	15.1	101.4	DP1,EX3
3	0.4	2.7	EX4

1" = 80'

0 40 80 160

Scale in Feet

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

TIMBERLINE STORAGE YARD

EXISTING DRAINAGE MAP

PROJECT NO. 43-095	SCALE: HORIZONTAL: 1"=80' VERTICAL: N/A	DATE: 9/12/2019	
DESIGNED BY: CMN DRAWN BY: CMN CHECKED BY: VAS		SHEET 1 OF 1	EDM

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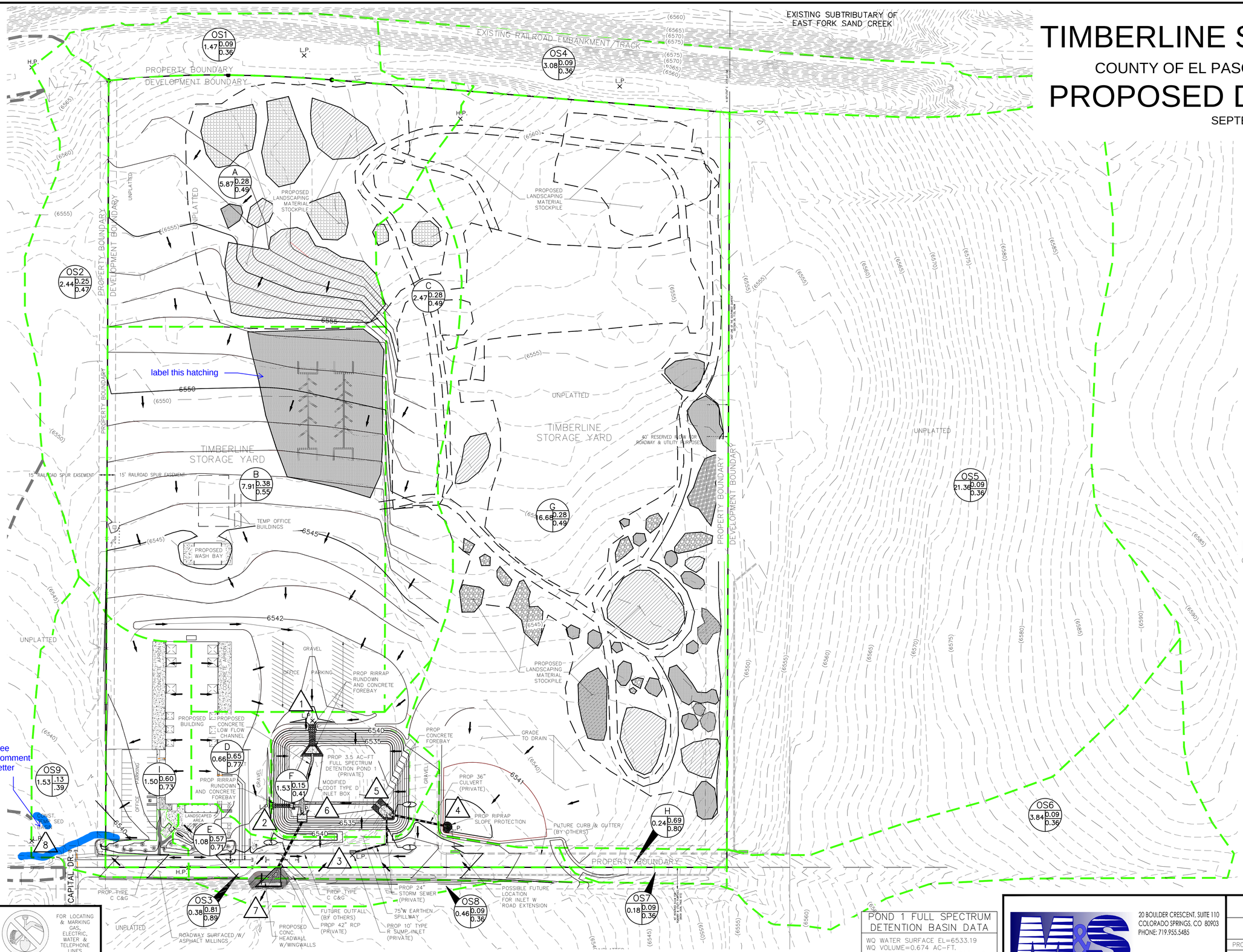
TIMBERLINE STORAGE YARD

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

SEPTEMBER 2019



LEGEND

- BASIN DESIGNATION: Z; 25 (ACRES); .25 (C5); .35 (C100)
- 4 — PIPE RUN (PR) REFERENCE LABEL
- 6 — SURFACE DESIGN POINT (DP)
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6538 — PROP CONTOUR
- PARCEL BOUNDARY
- TIMBERLINE STORAGE YARD SITE BOUNDARY
- STORM SEWER PIPE
- FUTURE STORM SEWER PIPE
- INLET
- FUTURE INLET
- EXISTING FLOW DIRECTION ARROW
- EMERGENCY OVERFLOW DIRECTION
- FLOW DIRECTION
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT
- CROSSPAN

1" = 80'

0 40 80 160

Scale in Feet

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
A	5.87	5.8	17.3
B	7.91	10.4	25.9
C	2.47	2.3	6.9
D	0.66	2.2	4.5
E	1.08	3.2	6.7
F	1.53	1.0	4.4
G	16.68	13.6	40.9
H	0.24	0.8	1.6
I	1.50	4.9	9.8
OS1	1.47	0.4	2.8
OS2	2.44	2.4	7.5
OS3	0.38	1.6	3.0
OS4	3.08	1.0	6.6
OS5	21.36	6.6	44.4
OS6	3.84	1.0	6.4
OS7	0.18	0.1	0.4
OS8	0.46	0.1	1.0
OS9	1.53	0.8	3.9

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	16.0	45.3	OS1, OS2, A, B, C	RIPRAP RUNDOWN INTO FULL-SPECTRUM DETENTION POND
2	2.2	4.5	D	RIPRAP RUNDOWN INTO FSD POND
3	4.8	9.6	E, OS3	10' SUMP TYPE R INLET
4	10.3	59.5	OS4, OS5, OS6, OS7, G, H	36" CULVERT
5	13.2	65.2	DP3, DP4	SE FOREBAY
6	31.3	116.6	DP1-DP4, F	TOTAL FLOW TO FSD
7	4.3	100.9	PIPE 3, OS8	EXIST SWALE
8	4.8	10.0	I, OS9	TO TEMP SED. POND

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING BASIN/DP/STR
1	4.8	9.6	24" RCP	DP3
2	10.3	59.5	36" RCP	DP4
3	4.2	100.0	42" RCP	POND OUTFALL

POND 1 FULL SPECTRUM DETENTION BASIN DATA

SPILLWAY CREST EL=6538.50
TOP OF EMBANKMENT EL=6540.50
100-YR VOLUME=3.243 AC-FT
100-YR INFLOW=116.6 CFS
100-YR RELEASE=100.0 CFS

POND 1 FULL SPECTRUM DETENTION BASIN DATA

WQ WATER SURFACE EL=6533.19
WQ VOLUME=0.674 AC-FT.
EURV WATER SURFACE EL=6534.60
EURV VOLUME=1.436 AC-FT
100-YR WATER SURFACE EL=6536.83

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

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M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

TIMBERLINE STORAGE YARD

PROPOSED DRAINAGE MAP

PROJECT NO. 43-095	SCALE: HORIZONTAL: 1"=80' VERTICAL: N/A	DATE: 9/12/2019	
DESIGNED BY: CMN DRAWN BY: CMN CHECKED BY: VAS		SHEET 1 OF 1	PDM