FINAL DRAINAGE REPORT FOR

Claremont Business Park 2 Filing No. 1

Comment addressed

EL PASO COUNTY, COLORADO

APRIL 2020

Prepared for:

Hammers Construction, Inc.
1411 Woosley Heights
Colorado Springs, CO 80906
(719) 570-1599
&
Lena Gail Case
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Prepared by:

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Project #44-037

PCD # SF-20-014

Comment addressed

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERCIAL FILING NO.3 EL PASO COUNTY COLORADO

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 master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

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

DEVELOPER'S STATEMENT

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

BY:_____ BY:_____

TITLE:_____ TITLE:_____
DATE:_____ DATE:_____

ADDRESS: Lena Gail Case
2432 Parkview Lane
Colorado Springs, CO 80903

Hammers Construction, Inc.
1411 Woosley Heights
Colorado Springs, CO 80906

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 Irvin, P.E.
County Engineer / ECM Administrator

CONDITIONS:

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERCIAL FILING NO.3 EL PASO COUNTY COLORADO

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APPENDIX

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERCIAL FILING NO.3 EL PASO COUNTY COLORADO

Preliminary Plan

Comment addressed

PURPOSE

This document is intended to serve as the Final Drainage Report for Claremont Commercial Filing No.3 and will effectively supersede the previously approved Preliminary Drainage Report for Claremont Commercial Subdivision Fil No. 2, A Resubdivision of Tract C of Claremont Business Park Filing No. 2, El Paso County, Colorado previously approved in December of 2018. The purpose of this document is to identify and analyze the onsite 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 and City of Colorado Springs Drainage Criteria Manual. The proposed principal use for the site will be neighborhood commercial and light industrial. The parcel is zoned by El Paso County for commercial service as CS. This is a final drainage report; with no significant change from the Preliminary Drainage Report that was submitted previously with the Development plan.

The 13.66 acres that encompasses Claremont Commercial Filing No.3 will be platted as one filing. For construction purposes the south portion (8.33 acres) will be developed and will treat and convey runoff to WQCV Pond 2. The north portion (5.33 acres) will be analyzed in two conditions, undeveloped and future development. In the undeveloped condition, the undeveloped runoff will be routed to a 24" flared end section at southwest corner of the site. In the future developed condition, runoff will be routed to a WQCV Pond 1 at southwest corner of the site. Upon construction of the north portion, a drainage letter will have to be submitted and approved to confirm the ~~preliminary~~ study and design were done in accordance with this report.

Please delete this word.

Comment addressed

GENERAL LOCATION AND DESCRIPTION

3

Comment addressed

Claremont Commercial Subdivision Filing No. 2 is located in the Northeast ¼ of the Northeast ¼ of Section 8, and the Southeast ¼ of the Southeast ¼ of Section 5, Township 14 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The site is bordered to the southeast by U.S. Highway 24 and to the northeast by N. Marksheffel Road, to the north and west by Meadowbrook Parkway, and to the south by a vacant, undeveloped lot. The site lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

The site consists of 13.66 acres which is currently vacant land with a relatively new roadway infrastructure for Meadowbrook Parkway and associated utilities services directly adjacent to the site. Vegetation is sparse, consisting of native grasses and weeds. Existing site terrain generally slopes from north to southwest at grade rates that vary between 1.2% and 2%. A soil retention wall runs along the eastside of the proposed site, next to U.S. Highway 24 and N. Marksheffel Road, and borders a large portion of the back of the proposed lots. The Claremont Commercial site is currently zoned "CS" and the proposed principal use for the site will be neighborhood commercial and light industrial.

Two (2) sand filter basins will provide water quality treatment for the proposed (Pond 2) and future developments (Pond 1). The outlet structures of the proposed and future water quality ponds will tie into an existing storm sewer system near Meadowbrook Parkway, which routes the treated runoff southwest into Sand Creek. See Appendix for details.

SOILS

Soils for this project are delineated by the map in the appendix as Ellicott Loamy Course Sand (28), Blendon Sandy Loam (10) and Blakeland Loamy Sand (8) and have been characterized as Hydrologic Soil Types "A" & "B". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". See Appendix for soils report.

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. 08041C0756G, revised December 7, 2018. No portion of this site is located within the 100 year floodplain. See Appendix.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual. 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 100 acres. See Appendix for calculations.

FOUR STEP PROCESS

Step1 Employ Runoff Reduction Practices –Roof drains will be directed to property lines swales to minimize direct connection of impervious surfaces.

Step 2 Stabilize Drainageways – The site is upstream of an existing 42"/48" RCP storm sewer system that directly discharges to Sand Creek Channel via an outlet structure with wingwalls (privately owned and maintained by the Central Marksheffel Metropolitan District) . The "Final Drainage Report for Claremont Business Park Filing No. 2", dated November 2006, by Matrix Design Group, Inc. (henceforth referred to as "Matrix FDR") has been designed to discharge developed flows via a 48" RCP storm sewer system directly into the East Fork Sand Creek. The Claremont Commercial Filing No. 2 site proposes a two (2) Sand Filter Water Quality Facilities before flows from both WQ facilities are discharged to the existing private 42"/48" RCP system east of Meadowbrook Parkway. The outlet underdrains are designed to drain the ponds in a peak event within 12 hours, therefore it's not anticipated to have negative effects on the downstream drainageways.

Step 3 Provide Water Quality Capture Volume – Two (2) Sand Filter Basin water quality facilities are proposed to provide WQCV.

Step4 Consider Need for Industrial and Commercial BMP's – This submittal provides a Preliminary Grading and Erosion Control plan. A Final GEC plan with BMP's in place shall be required with a Final Plat and Site Development applications. The proposed project will use silt fence, a vehicle tracking control pad, a concrete washout area, mulching and reseeding to mitigate the potential for erosion across the site.

This RCP is not shown on the drainage plan. Will it be utilized by this development? will it be removed? Please address what will happen to this 30" RCP.

Comment addressed called out on draiange plan.

EXISTING DRAINAGE CONDITIONS

The Claremont Commercial Subdivision Filing No. 3 site consists of 13.66 acres and is situated east of the East Fork Reach of the Sand Creek Watershed. This area was previously studied in the "Final Drainage Report for Claremont Business Park Filing No. 2", dated November 2006, by Matrix Design Group, Inc. (henceforth referred to as "Matrix FDR"). The Matrix FDR calculations indicate that, under the fully developed conditions, the total tributary area of Sub-basins B1, B2, and B3 (18.1 acres), with basin B3 including the eastern half of Meadowbrook Parkway, would produce a cumulative runoff of approximately Q5=42.6 cfs and Q100=86.6 cfs (Design Point 2). The Matrix FDR illustrates that the watershed would drain from east to the southwest towards Meadowbrook Parkway. Sub-Basin B2 identifies a future private 30" RCP to be installed and used to drain the sub-basin into the 42"/48" storm system (privately owned and maintained by the Central Marksheffel Metropolitan District). Field locates has confirmed the 30" RCP was installed. Sub-Basin B1 identifies a future private 36" RCP to be installed along Meadowbrook Pkwy and stubbed to the sub-basin and used to drain also into the 42"/48" storm system. Field locates found no evidence that the future private 36" RCP was installed. As stated in the Matrix FDR, overlot grading activities for the entire site have been completed. Per Resolution 16-426 of the BoCC, on-site WQCV is required but on-site stormwater detention is not required per the FDR for Claremont Business Park Fil. 2.

see comment on the drainage plan.

Comment addressed field inspection of manhole.

A 48" public storm sewer runs along Meadowbrook Parkway and is routed directly to the Sand Creek channel. Two 10' Type R at grade inlets exist at the intersection of Woolsey Heights and Meadowbrook Parkway, one on the northwest and the other on the northeast corner of the intersection. Runoff from the site and the two surrounding streets, Meadowbrook Parkway and Woolsey Heights, is intercepted by these inlets and conveyed to the Sand Creek channel via the existing 48" public storm sewer.

Refer to the drainage basin descriptions that follow for additional information as well as the Drainage Map located within the Appendix of this report.

Please provide an existing drainage plan showing the appropriate basins and design points (Q) of the historic/existing drainage flow patterns.

Comment addressed Matrix FDR map DR01 is ex. conditions map.

PROPOSED DRAINAGE CHARACTERIST

General Concept Drainage Discussion

The majority of the site will consist of neighborhood commercial and light industrial, asphalt, curb, two (2) storm water quality sand filter basins (proposed pond 2 and future pond 1), and landscaping. The flows generated by the site will typically sheet flow across asphalt and impermeable surfaces which direct runoff primarily to the south and southwest to proposed private pipe systems which direct runoff to one of two private ponds. The outlet structures of the proposed water quality ponds will release runoff to the existing private 42" RCP storm sewer located at the southwest corner of the site. A survey and inspection of the existing 42" RCP shall be made before use. The existing private 42" storm sewer ties into an existing public 48" storm sewer which will route the treated runoff to Sand Creek. For more information of drainage basins, existing and proposed structures refer to the Proposed Drainage Map located within the Appendix of this report.

The 13.66 acres that encompasses Claremont Commercial Filing No.3 will be platted as one filing. For construction purposes the south portion (8.33 acres) will be developed and will treat and convey runoff to WQCV Pond 2. The north portion (5.33 acres) will be analyzed in two conditions, undeveloped and

when this portion is developed the design will be final not preliminary. Please delete this word.

Comment addressed

future development. In the undeveloped condition, the north portion will remain undisturbed, except for some minor grading around the perimeter which will route undeveloped flows to a 24" flared end section at the southwest corner of the site. In the future developed condition, ~~preliminary~~ drainage patterns, calculations, treatment and conveyance to a WQCV Pond 1 will be addressed. Upon construction of the north portion, a drainage letter will have to be submitted and approved to confirm the drainage study and design were done in accordance with this report.

To assist in the Detailed Drainage Discussion and differentiate between the north portion undeveloped and north portion future developed, a ** before a drainage basin designation label, design point and pipe run will signify the undeveloped condition. A *** before a drainage basin designation label, design point and pipe run will signify the future developed condition.

Assumed? this is something that should be verified. Please revise accordingly.

Comment addressed

Detailed Drainage Discussion

Basin **OS1, 0.19 acres, consists of steep slopes of 32% adjacent to portions of U.S Highway 24 and N. Marksheffel Rd. The roadway embankment within **Basin **OS1** slopes into a soil retention wall that runs along the south east boundary of the site. Runoff for **Basin **OS1** is limited has been calculated to reach peak flow rates of Q5=0.1 cfs and Q100=0.6 cfs. Flows produced within the basin will be conveyed westward into adjacent basin **Basin **OS3** as sheet flow.

Basin **OS2, 0.30 acres, consists of portion of steep slopes of up to 33% that lie adjacent to portions of U.S Highway 24. Similar to **Basin **OS1**, the roadway embankment within **Basin **OS2**, slopes into a soil retention wall that runs along the eastern boundary. Runoff for **Basin **OS2** has been calculated to reach peak flow rates of Q5=0.1 cfs and Q100=1.0 cfs. The limited runoff produced is assumed to be conveyed westward into adjacent **Basin **OS3** as sheet flow.

BasinOS3**, 4.92 acres, consists of the north portion of the undeveloped site. Runoff produced within **Basin **OS3** is anticipated to reach peak runoff rates of Q5=1.6 cfs and Q100=10.7 cfs. Runoff from the **Basins **OS1, **OS2** and ****OS3** shall be conveyed via historic drainage patterns and some minor grading around the perimeter, to a low point at the southwest corner of the site located at **Design Point **4** (Q5=1.8 cfs and Q100=11.8 cfs). A temporary sediment basin will outlet route treated runoff to a proposed private 24" polyethylene storm drain (**Pipe **5, **5.1, **5.2**) and will route the flows south, adjacent to the Meadowbrook ROW to a proposed manhole and existing 42" RCP. The 24" polyethylene storm drain has been sized using the future condition to allow for sufficient capacity.

Basin **OS4, 0.23 acres, consists of a landscaping strip running alongside and adjacent to Meadowbrook Parkway. The landscaping strip consists primarily of trees, bushes/grasses, and decorative ground cover. Low runoff values produced by **Basin **OS4** of Q5=0.1 cfs and Q100=0.7 cfs will travel as sheet flow into Meadowbrook Parkway.

Basin ***A, 0.19 acres, consists of steep slopes of 32% adjacent to portions of U.S Highway 24 and N. Marksheffel Rd. The roadway embankment within **Basin ***A** slopes into a soil retention wall that runs along the south east boundary of the site. Runoff for **Basin ***A** is limited has been calculated to reach peak flow rates of Q5=0.1 cfs and Q100=0.6 cfs. Flows produced within the basin will be conveyed westward into adjacent basin **Basin ***B** as sheet flow.

Basin ***B, 1.39 acres, consists of Lot 10 along the northeast corner of the proposed site. Runoff produced within **Basin ***B** is anticipated to reach peak runoff rates of Q5=5.5 cfs and Q100=10.1 cfs. The cumulative flows of **Basin ***A** and **Basin ***B** will be routed to the southend of **Basin ***B** to **Design Point ***1**(Q5=5.6 cfs and Q100=10.6 cfs). A proposed private 24" polyethylene storm drain (**Pipe ***1**) will be extended to **Design Point ***1** to capture runoff from **Basins ***A** and *****B**.

Comment addressed

Assumed? this is something that should be verified. Please revise accordingly.

Basin ***C, 0.30 acres, consists of portion of steep slopes of up to 33% that lie adjacent to portions of U.S Highway 24. Similar to **Basin ***A**, the roadway embankment within **Basin ***C**, slopes into a soil retention wall that runs along the eastern boundary. Runoff for **Basin ***C** has been calculated to reach peak flow rates of Q5=0.1 cfs and Q100=1.0 cfs. The limited runoff produced is assumed to be conveyed westward into adjacent **Basin ***D** as sheet flow.

Basin*D**, 1.53 acres, consists of Lot 8 along the eastern boundary of the proposed site. Runoff produced within **Basin ***D** is anticipated to reach peak runoff rates of Q5=6.3 cfs and Q100=11.5 cfs. The cumulative flows of **Basin ***C** and **Basin ***D** will be routed to the southwest corner of **Basin ***D** to **Design Point ***2** (Q5=6.4 cfs and Q100=12.4 cfs). A proposed private 24" polyethylene storm drain (**Pipe ***2**) will be extended to **Design Point ***2** to capture runoff from **Basins ***C** and ***D. Runoff collected within **Pipes ***1** and *****2** will be routed to a proposed private sand filter water quality pond via a private 30" polyethylene storm drain (**Pipe ***3**) at peak flow rates of Q5=11.8 cfs and Q100=22.6 cfs. A small riprap pad will be required to reduce velocities prior to entering the pond. A swale/berm shall be constructed along the south line of Lot 8, to ensure flows are conveying easterly to a 24" pipe to the proposed storm system and then conveyed to the proposed Sand Filter WQ pond (**Pond 1**) for the retail center area.

Comment addressed

westerly

Basin ***E, 1.55 acres, consists of Lot 9 and a portion of the planned private access entrance, which is located adjacent to a portion of Meadowbrook Parkway. Runoff produced within **Basin ***E** is anticipated to reach peak runoff rates of Q5=6.5 cfs and Q100=11.8 cfs. A proposed private 24" polyethylene storm drain (**Pipe ***4**) will be extended from the private pond to collect runoff reaching **Design Point ***3** (Q5=6.5 cfs and Q100=11.8 cfs). A small riprap pad will be required to reduce velocities prior to entering the pond.

Basin ***F, 0.36 acres, consists of a land (Tract B) which is dedicated to house a proposed private onsite Sand Filter Basin Water Quality Pond (**Pond 1**) adjacent to existing Meadowbrook Parkway. Runoff produced within **Basin ***F** (Q5=0.2 cfs and Q100=1.0 cfs) will ultimately combine with flows entering the pond via **Pipes ***3** and *****4** at **Design Point ***4**. The total flow anticipated to reach the pond at **Design Point ***4** is calculated by the rational method to be Q5=18.2 cfs and Q100=35.0 cfs. Using the UD-Detention worksheet, flows treated via the Sand Filter Basin are to be discharged through a 6.0' x 2.91' CDOT Modified Type D outlet structure and proposed private 24" polyethylene Storm Sewer (**Pipe Runs ***5, ***5.1, ***5.2**). The proposed pond shall be constructed with 4:1 SS and is anticipated to store 0.0.118, 0.157 and 0.200 ac-ft and discharge 0.1 cfs, 7.2 cfs, and 15.5 cfs in the water quality, 5 year and 100 year events respectively. The 8.5' wide emergency spillway shall be designed to discharge the peak inflow safely to Meadowbrook Parkway in the event that the inlet would become clogged. Runoff conveyed in **Pipe ***5.2** will combine with flows from a second onsite pond, prior to being discharged downstream via an existing 42" RCP storm sewer.

Basin ***G, 0.29 acres, consists of a landscaping strip running alongside and adjacent to Meadowbrook Parkway and a small section of pavement associated with site access. Excluding the small section of street the basin consists primarily of trees, bushes/grasses, and decorative ground cover. Low runoff values produced by **Basin ***G** of Q5=0.5 cfs and Q100=1.3 cfs will travel as sheet flow into Meadowbrook Parkway.

Basin H, 0.71 acres, consists of steep slopes of up to 33% adjacent to portions of U.S Highway 24. The roadway embankment within **Basin H** slopes into a soil retention wall that runs along the south east boundary of the site. Runoff for **Basin H** has been calculated to reach peak flow rates of Q5=0.3 cfs and Q100=2.0 cfs. Flows produced within the basin will be conveyed westward into adjacent basins (**Basin I**) as sheet flow.

Basin I, 2.75 acres, consists of Lots 5 and 6, portions of Lots 2-4 and 7 and section of proposed private street, which is generally located within the center of the proposed site. Runoff produced within **Basin I** is

Comment addressed
No flowby

This the final stage. What is the actual flow that will bypass, if any. Note that the ultimate decision as to whether it is OK for 0.1 cfs to not be treated will be up to the engineering manager.

anticipated to reach peak runoff rates of Q5=9.8 cfs and Q100=17.9 cfs. Runoff from the **Basins H** and **I** shall be conveyed via side lot swales and curb and gutter to a proposed private street and a pair of proposed CDOT Type R at grade inlets (15' and 10') located at **Design Point 5** (Q5=10.1 cfs and Q100=19.8 cfs). Runoff intercepted by the inlets will be conveyed south to a second proposed water quality sand filter pond via proposed private 24" polyethylene **Pipes 6** and **7** at 5 year flow rates of 6.4 cfs and 10.1 cfs and at 100 year flow rates of 10.6 and 16.6 cfs respectively. A small riprap pad will be required to reduce velocities prior to entering the pond. Runoff by passing the inlets will continue west within the street to **Design Point 6.**

Basin J, 1.05 acres, consists of portions of Lots 1, 2 and 7 and a segment of the proposed street, which is located along the western edge of the proposed site. Runoff produced within **Basin J** is anticipated to reach peak runoff rates of Q5=4.4 cfs and Q100=8.0 cfs. Runoff from the **Basins J** and flow-by from **Design Point 5** shall intercepted by a pair of proposed CDOT Type R at grade inlets (15' and 10') located at **Design Point 6** (Q5=4.4 cfs and Q100=11.2 cfs). Runoff intercepted by the proposed inlets will be conveyed south to a second proposed water quality pond via proposed private 18" and 24" polyethylene **Pipes 8** and **9** at 5 year flow rates of 2.8 cfs and 4.4 cfs and at 100 year flow rates of 6.9 and 11.0 cfs respectively. Based upon the preliminary assumptions, approximately 0.1 cfs will bypass **Design Point 6** and will be continue within the curb and gutter to the adjacent street in the 100 year event.

Basin K, 0.42 acres, consists of the rear halves of Lots 1 and 2, which is generally located along the southwest corner of the proposed site. Runoff produced within **Basin K** is anticipated to reach peak runoff rates of Q5=1.8 cfs and Q100=3.2 cfs. Runoff from the **Basins K** can be conveyed to a CDOT Type C grated inlet at the southwest corner of Lot 1. Runoff collected at the local depression would combine with flows in **Pipe 9** and continue to the proposed water quality sand filter pond via pipes 10 and 10.1 at peak flow rates of 6.2 cfs and 14.3 cfs in the 5 and 100 year storm events. A small riprap pad will be required to reduce velocities prior to entering the pond. A small riprap pad will be required to reduce velocities prior to entering the pond.

Basin L, 1.32 acres, consists of steep slopes of 32% adjacent to portions of U.S Highway 24. The roadway embankment within **Basin L** slopes into a soil retention wall that runs along the south east boundary of the site. Runoff for **Basin L** has been calculated to reach peak flow rates of Q5=0.5 cfs and Q100=3.7 cfs. Flows produced within the basin will be conveyed westward into adjacent basins (**Basin M**) as sheet flow.

Basin M, 1.84 acres, consists of a portion of Lots 3 and 4, which is generally located along the south and southeast sides of the proposed site. Runoff produced within **Basin M** is anticipated to reach peak runoff rates of Q5=6.7 cfs and Q100=12.2 cfs. Runoff from the **Basins L** and **M** shall be conveyed to a proposed grassed lined swale which will outfall to proposed Sand Filter WQ Pond 2. Peak runoff reaching **Design Point 8** is anticipated to have peak flow rates of Q5=7.2 cfs and Q100=15.7 cfs. The proposed swale would need to be a minimum of 1.5' deep at 0.5% using a 2' bottom width and 3:1 side slopes. A riprap rundown and pad would need to be provided to arrest flows entering the pond.

Basin N, 0.47 acres, consists of a land (Tract A) which is dedicated to house a proposed private onsite Sand Filter Basin Water Quality Pond (**Pond 2**) adjacent to existing Meadowbrook Parkway. Runoff produced within **Basin N** (Q5=0.2 cfs and Q100=1.3) cfs will ultimately combine with flows entering the pond via **Pipes 7, 10.1** and from the Swale at **Design Point 8**. The total flow anticipated to reach the pond (**Design Point 9**) is calculated by the rational method to be Q5=23.0 cfs and Q100=46.3 cfs. Using the UD-Detention worksheet, flows treated via the Sand Filter Basin are to be discharged through a 7.0' x 2.91' CDOT Modified Type D outlet structure and proposed private 30" polyethylene Storm Sewer (**Pipe Run 11**). The proposed pond shall be constructed with 4:1 SS and is anticipated to store 0.143, 0.199 and 0.300 ac-ft and discharge 0.1 cfs, 13.2 cfs, and 23.8 cfs in the water quality, 5 year and 100 year events respectively. The 12.5' emergency spillway shall be designed to discharge the peak inflow safely to Meadowbrook Parkway in the event that the inlet would become clogged. Runoff conveyed in **Pipe 11**

Please also provide the total combined flow (this development +Lot2) at the back side of the 10' inlet

Comment addressed. Flows dependent on how Lot 2-1A is developed. Our flows at existing 42" are less than previously stated.

will combine with flows within **Pipe 5.2**, prior to being discharged downstream via an existing 42" RCP storm sewer and into the backside of the existing 10' Type R at grade inlet along existing Woolsey Heights and then to the west via an existing 48" storm sewer.

The Matrix "Final Drainage Report for Claremont Business Park Filing No. 2" calculated that DP 1 combining Sub Basins B1 and B2 generated of (Q5=31.5 cfs and Q100=63.6). The existing 42" RCP pipe with the revised development are expected to be less than that of the Matrix report of Q5=17.6 cfs and Q100=33.8 cfs. These flows will combine downstream in the existing 42" pipe with the flows from Lot 2-1A Claremont Business Park of (Q5=7.5 cfs and Q100=15.4). The original Matrix Report identified flows at the back side of the 10' Type R inlet (Q5=42.6 cfs and Q100=86.6) the combined flows is significantly less that previously reported in the Matrix report. Therefore the proposed development shall not have a negative impact on the downstream storm system and is adequately sized to convey the proposed generated flows.

Please also state the flows of this development at the 42" pipe to compare with the matrix report.

Comment addressed

Basin O, 0.16 acres, consists of a landscaping strip running alongside and adjacent to Meadowbrook Parkway. The basin will most likely be composed of trees, bushes/grasses, and decorative ground cover. Low runoff values produced by **Basin O** of Q5=0.2 cfs and Q100=0.6 cfs will travel as sheet flow into Meadowbrook Parkway.

Basin P, 0.03 acres, consists of steep slopes of up to 33% adjacent to portions of U.S Highway 24. The roadway embankment within **Basin P** slopes into a soil retention wall that runs along the south east boundary of the site. Runoff for **Basin P** has been calculated to reach peak flow rates of Q5=0.0 cfs and Q100=0.1 cfs. Flows produced within the basin will be conveyed westward into adjacent basins (**Basin Q**) as sheet flow.

Basin Q, 0.11 acres, consists of a thin utility corridor alongside the south boundary of the site. The basin will most likely be composed native ground cover. Low runoff values produced by **Basin Q** of Q5=0.0 cfs and Q100=0.3 cfs will combine with flows from **Basin P** and will discharge to adjacent site to the south as sheet flow.

Comment addressed, ownership shared.

There are no planned or required improvements to the Sand Creek Drainage Channel with the development of the CLAREMONT COMMERCIAL.

The preliminary plan that was submitted indicated that the tracts where these ponds are located will be maintained by the Claremont Merchants Association. Please also state who will maintain the proposed storm system (inlets, storm sewers, manholes etc.). Revise accordingly.

WATER QUALITY PROVISIONS AND MAINTENANCE

The subject site was previously analyzed within the Final Drainage Report for Claremont Business Park Filing No. 2 prepared by Matrix Design Group approved April 24, 2006. Per Resolution 16-426 of the BoCC, on-site WQCV is required but on-site stormwater detention is not required per the FDR for Claremont Business Park Fil. 2. The water quality volume required for the site has been determined using the UDFCD UD-Detention workbook per the guidelines set forth in the City of Colorado Springs/El Paso County Drainage Criteria Manual - Volume II.

As previously discussed water quality for the site is provided by two proposed Sand Filter Basins (SFB). Pond 1 is designed to treat runoff from approx 5.33 acres, by providing 0.118 acre-feet of water quality storage, while Pond 2 will treat runoff from approx 8.33acres, by providing 0.143 acre-feet of water quality storage. Per ECM section 1.7.1.C.1, 20% of the project site (not to exceed 1.0 acre) may be excluded from the 100% WQ treatment requirement per El Paso County criteria. This report identifies that Basins G, O, P and Q are unable to reach one of the two proposed WQ ponds. Combined total acreage of the Basins are 0.59 AC, and doesn't exceed the 1.0 acre maximum allowance of acreage runoff.

Flows tributary to the two SFBs are released through outlet structures into an existing storm sewer system located along Meadowbrook Parkway. The water quality basins 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 the final drainage report(s) submittal(s) which construct the two ponds.

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.

CONSTRUCTION COST OPINION

Private Drainage Facilities (NON-Reimbursable) Sand Filter WQ Pond 1 (Future Construction):

Item	Description	Quantity		Unit Cost		Cost
1.	24" PP	352	LF	$48	/LF	$16,896.00
2.	24" FES	1	EA	$520	/EA	$520.00
3.	30" PP	80	LF	$65	/LF	$5,200.00
4.	30” FES	1	EA	$597	/EA	$597.00
5.	Type II Manholes	1	EA	$4,000	/EA	$4,000.00
6.	WQCV Sand Filter Pond	1	EA	$19,000	/EA	$19,000.00
					Total	**$46,213.00**

Private Drainage Facilities (NON-Reimbursable) (WQ Pond 1) Temporary Sediment Basin (TSB-N) (Interim Construction):

Item	Description	Quantity		Unit Cost		Cost
1.	24" PP	475	LF	$48	/LF	$22,800.00
2.	24" FES	1	EA	$520	/EA	$520.00
3.	Type II Manholes	2	EA	$4,000	/EA	$8,000.00
4.	Temporary Sediment Basin (TSB-N)	1	EA	$2500	/EA	$2,500.00
					Total	**$33,820.00**

Private Drainage Facilities (NON-Reimbursable) Sand Filter WQ Pond 2:

Item	Description	Quantity		Unit Cost		Cost
1.	18" PP	47	LF	$40	/LF	$1,880.00
2.	24" PP	479	LF	$48	/LF	$22,992.00
3.	24” FES	2	EA	$520	/EA	$1,040.00
4.	30" PP	40	LF	$65	/LF	$2,600.00
5.	At Grade Inlets (Type R) L=10’	2	EA	$4,700	/EA	$9,400.00
6.	At Grade Inlets (Type R) L=15'	2	EA	$7,200	/EA	$14,400.00
7.	CDOT Type C Grated Inlet	1	EA	$3500	/EA	$3,500.00
8.	Type II Manhole	1	EA	$4,000	/EA	$4,000.00
9.	Type I Manhole	1	EA	$6,500	/EA	$6,500.00
10.	Type H Riprap	9	CY	$80	/CY	$720.00
11.	Type L Riprap	11	CY	$50	/CY	$550.00
12.	WQCV Sand Filter Pond	1	EA	$19,000	/EA	$19,000.00
					Total	**$86,582.00**

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 is only an estimate of the facility cost in 2020.

10

DRAINAGE & BRIDGE FEES

Comment addressed

This site is in the Sand Creek Drainage Basin. The site is proposed to be subdivided into sixteen commercial lots. Drainage fees were paid at the time of the previous platting as Tract C of Claremont Business Park Filing No. 2 (Reception No. 207712506), therefore no additional Drainage Bridge and/or Pond fees are. See Appendix of the "Final Drainage Report for Claremont Business Park Filing No. 2", Revised November 2006, by Matrix Design Group, Inc, for previously paid drainage and bridge fees.

SUMMARY

Development of Claremont Commercial Subdivision Filing No. 3 will not adversely affect the surrounding development. The proposed drainage facilities will adequately convey, detain and route runoff from the onsite & offsite flows to existing facilities. All drainage facilities described herein and shown on the included Proposed Drainage Map (See Appendix) are subject to change being dependent upon individual lot development. Care will be taken to accommodate overland emergency flow routes on site and temporary drainage conditions.

Please revise or remove this statement as the individual lot owners are subject to comply with this final drainage report.

Comment addressed

Although fees where paid with the previous platting, per ECM appendix L section 3.13a drainage fees may still be applicable if there is an increase in impervious acreage. Please include what the previous impervious that this site was designed for compared to your proposed impervious to demonstrate/prove that this development (the total 13.7 acres) does not have an increase in impervious acreage and therefore does not owe any fees.

Comment addressed, imperviousness less than Matrix report.

As discussed in the conference call with staff and M&S, please discuss in your narrative the reduced drainage easement and provide justification for having such small drainage easements at the side lot lines. It was indicated in the meeting that a channel will be provided within these reduced drainage easements. Provide the slope, grading, flow etc. at these locations along with specifications/characteristics of the proposed channel.

Comment addressed Drainage Easement paragraph included.

REFERENCES

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

2.) "Urban Storm Drainage Criteria Manual"

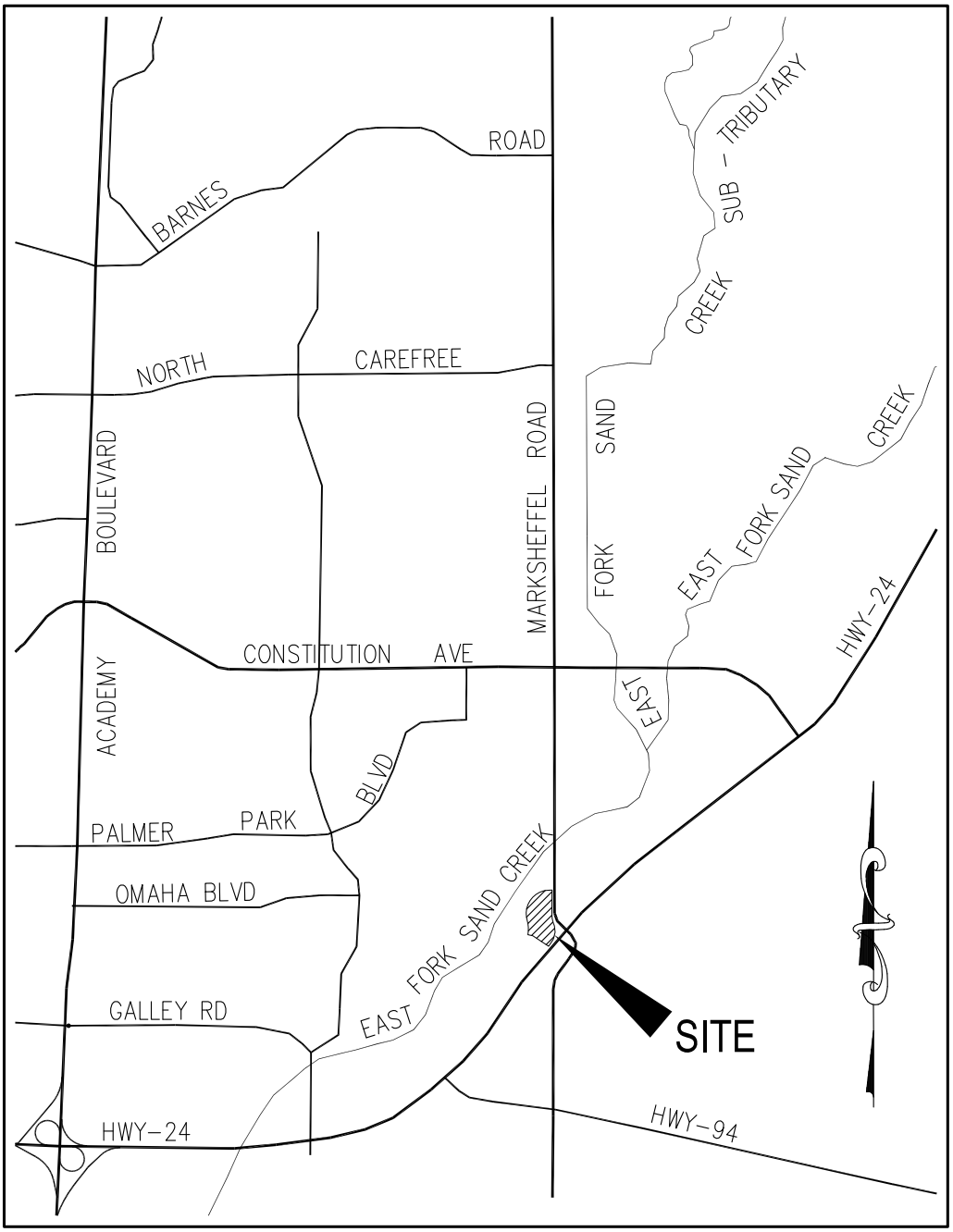
3.) SCS Soils Map for El Paso County.

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

5.) "Final Drainage Report for Claremont Business Park Filing No. 2", dated November 2006, by Matrix Design Group, Inc.

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

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
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A

CLAREMONT COMMERCIAL FILING NO. 2

HYDROLOGIC TYPE A SOILS

HYDROLOGIC TYPE B SOILS

SITE BOUNDARY

NOT TO SCALE

SOILS MAP

M&S CIVIL CONSULTANTS, INC.

O:\44037A-CBP F2-Lots 1-8\44037A-CBP F2-Lots 1-8\dwg\Eng Exhibits\44037-Soils Map Claremont.dwg 11/22/2019 11:22 AM

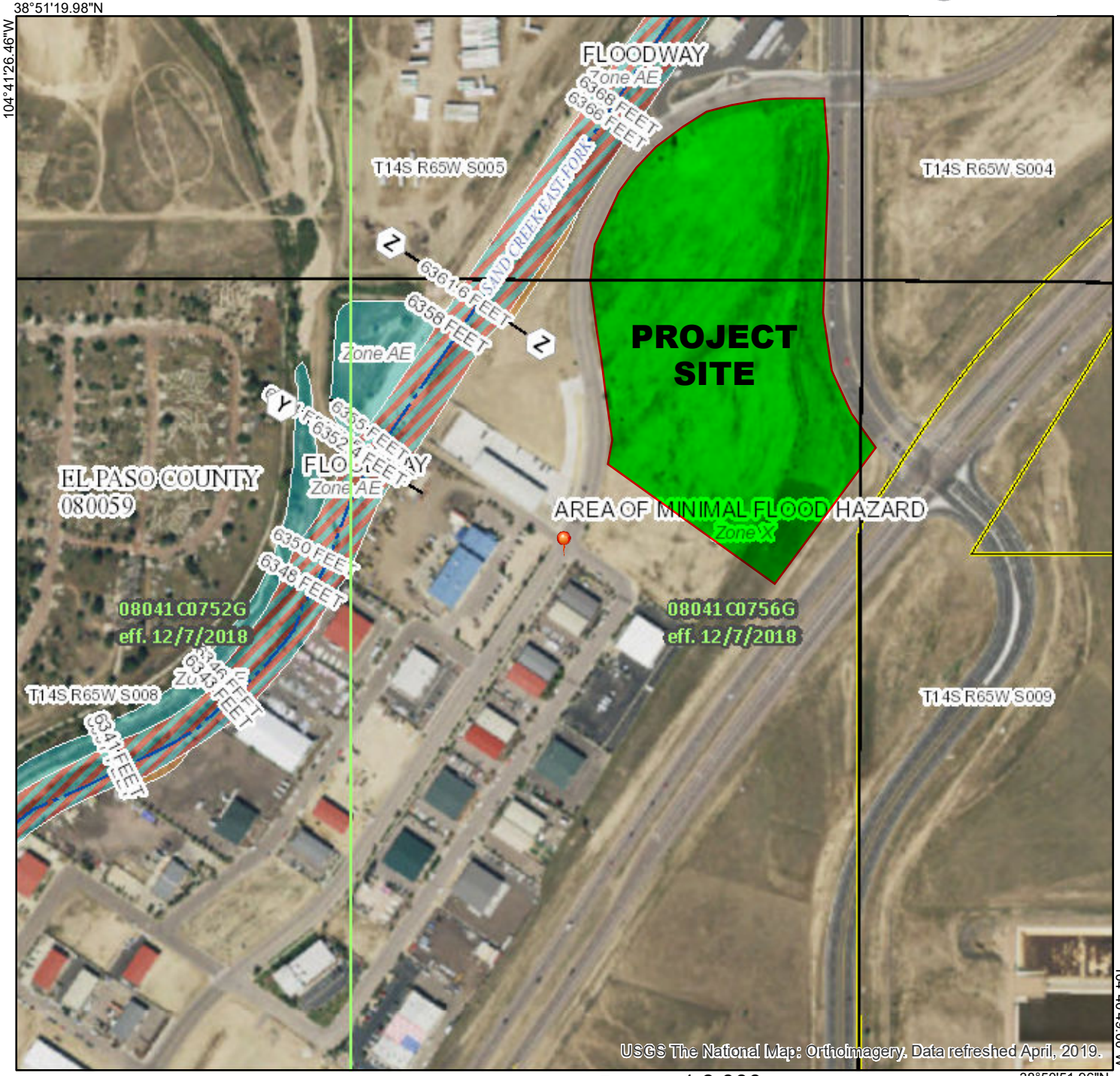
FEMA FIRM PANEL

National Flood Hazard Layer FIRMette

FEMA

38°51'19.98"N

104°41'26.46"W



104°40'49.00"W

38°50'51.96"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Legend

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

SPECIAL FLOOD HAZARD AREAS

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

OTHER AREAS OF FLOOD HAZARD

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

OTHER AREAS

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

GENERAL STRUCTURES

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

OTHER FEATURES

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

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/13/2020 at 12:07:22 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

HYDROLOGIC CALCULATIONS

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERICAL FILING NO. 3
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}
*****OS1***	*8359.6*	**0.19**	0.00	0.73	0.81	0.00	0.30	0.50	0.19	0.09	0.36	***0.09***	***0.36***
*****OS2***	*13279.8*	**0.30**	0.00	0.81	0.88	0.00	0.59	0.70	0.30	0.09	0.36	***0.09***	***0.36***
*****OS3***	*214320.8*	**4.92**	0.00	0.81	0.88	0.00	0.59	0.70	4.92	0.09	0.36	***0.09***	***0.36***
*****OS4***	*9938.1*	**0.23**	0.00	0.90	0.96	0.00	0.16	0.41	0.23	0.09	0.36	***0.09***	***0.36***
******A***	*8359.6*	**0.19**	0.00	0.90	0.96	0.00	0.16	0.41	0.19	0.09	0.36	***0.09***	***0.36***
******B***	*60660.5*	**1.39**	1.39	0.81	0.88	0.00	0.30	0.50	0.00	0.12	0.39	***0.81***	***0.88***
******C***	*13279.8*	**0.30**	0.00	0.90	0.96	0.00	0.16	0.41	0.30	0.09	0.36	***0.09***	***0.36***
******D***	*66703.6*	**1.53**	1.53	0.81	0.88	0.00	0.30	0.50	0.00	0.12	0.39	***0.81***	***0.88***
******E***	*67533.9*	**1.55**	1.55	0.81	0.88	0.00	0.30	0.50	0.00	0.12	0.39	***0.81***	***0.88***
******F***	*15781.4*	**0.36**	0.00	0.73	0.81	0.00	0.30	0.50	0.36	0.12	0.39	***0.12***	***0.39***
******G***	*12722.3*	**0.29**	0.06	0.90	0.96	0.23	0.16	0.41	0.00	0.12	0.39	***0.32***	***0.53***
H	*31099.0*	**0.71**	0.00	0.90	0.96	0.00	0.16	0.41	0.71	0.09	0.36	***0.09***	***0.36***
I	*119584.6*	**2.75**	2.75	0.81	0.88	0.00	0.30	0.50	0.00	0.12	0.39	***0.81***	***0.88***
J	*45863.7*	**1.05**	1.05	0.81	0.88	0.00	0.30	0.50	0.00	0.09	0.36	***0.81***	***0.88***
K	*18476.1*	**0.42**	0.42	0.81	0.88	0.00	0.30	0.50	0.00	0.09	0.36	***0.81***	***0.88***
L	*57315.2*	**1.32**	0.00	0.81	0.88	0.00	0.30	0.50	1.32	0.09	0.36	***0.09***	***0.36***
M	*80126.1*	**1.84**	1.84	0.81	0.88	0.00	0.30	0.50	0.00	0.09	0.36	***0.81***	***0.88***
N	*20642.4*	**0.47**	0.00	0.81	0.88	0.00	0.16	0.41	0.47	0.12	0.39	***0.12***	***0.39***
O	*6997.2*	**0.16**	0.02	0.90	0.96	0.00	0.30	0.50	0.14	0.12	0.41	***0.22***	***0.48***
P	*1393.0*	**0.03**	0.00	0.81	0.88	0.00	0.30	0.50	0.03	0.09	0.36	***0.09***	***0.36***
Q	*4961.4*	**0.11**	0.00	0.90	0.96	0.00	0.30	0.50	0.11	0.09	0.36	***0.09***	***0.36***

**Existing undeveloped

***Ulitmate build out, developed. Used to size future pond 1 and storm sewer.

Calculated by: GT
Date: 4/1/2020
Checked by: VAS

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERICAL FILING NO. 3
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.)*
*****OS1***	0.19	0.09	0.36	0.09	40	5.0	5.0	0	0.0%	0.0	0.0	5.0	10.2	5.2	8.7	***0.1***	***0.6***
*****OS2***	0.30	0.09	0.36	0.09	40	8.0	4.3	0	0.0%	0.0	0.0	4.3	10.2	5.2	8.7	***0.1***	***1.0***
*****OS3***	4.92	0.09	0.36	0.09	100	2.0	14.5	637	1.7%	0.6	16.5	31.0	14.1	3.6	6.1	***1.6***	***10.7***
*****OS4***	0.23	0.09	0.36	0.09	20	0.5	6.0	0	0.0%	0.0	0.0	6.0	10.1	4.9	8.2	***0.1***	***0.7***
******A***	0.19	0.09	0.36	0.09	40	5.0	5.0	0	0.0%	0.0	0.0	5.0	10.2	5.2	8.7	***0.1***	***0.6***
******B***	1.39	0.81	0.88	0.81	80	1.0	4.4	250	1.6%	2.5	1.7	6.0	11.8	4.9	8.2	***5.5***	***10.1***
******C***	0.30	0.09	0.36	0.09	40	8.0	4.3	0	0.0%	0.0	0.0	4.3	10.2	5.2	8.7	***0.1***	***1.0***
******D***	1.53	0.81	0.88	0.81	60	1.2	3.2	350	2.0%	2.8	2.1	5.3	12.3	5.1	8.5	***6.3***	***11.5***
******E***	1.55	0.81	0.88	0.81	60	1.2	3.2	167	2.0%	2.8	1.0	4.2	11.3	5.2	8.7	***6.5***	***11.8***
******F***	0.36	0.12	0.39	0.12	60	1.2	10.9	30	33.0%	11.5	0.0	10.9	10.5	4.1	6.8	***0.2***	***1.0***
******G***	0.29	0.32	0.53	0.32	25	0.5	5.6	0	0.0%	0.0	0.0	5.6	10.1	5.0	8.4	***0.5***	***1.3***
H	0.71	0.09	0.36	0.09	100	17.0	7.2	0	0.0%	0.0	0.0	7.2	10.6	4.6	7.8	***0.3***	***2.0***
I	2.75	0.81	0.88	0.81	60	1.2	3.2	425	2.0%	1.4	5.0	8.2	12.7	4.4	7.4	***9.8***	***17.9***
J	1.05	0.81	0.88	0.81	60	1.2	3.2	200	2.0%	2.8	1.2	4.4	11.4	5.2	8.7	***4.4***	***8.0***
K	0.42	0.81	0.88	0.81	60	1.2	3.2	175	2.0%	2.8	1.0	4.3	11.3	5.2	8.7	***1.8***	***3.2***
L	1.32	0.09	0.36	0.09	100	17.0	7.2	0	0.0%	0.0	0.0	7.2	10.6	4.6	7.8	***0.5***	***3.7***
M	1.84	0.81	0.88	0.81	100	1.0	5.2	400	1.5%	2.4	2.7	8.0	12.8	4.5	7.5	***6.7***	***12.2***
N	0.47	0.12	0.39	0.12	60	1.2	10.9	30	33.0%	11.5	0.0	10.9	10.5	4.1	6.8	***0.2***	***1.3***
O	0.16	0.22	0.48	0.22	25	0.5	6.3	0	0.0%	0.0	0.0	6.3	10.1	4.8	8.1	***0.2***	***0.6***
P	0.03	0.09	0.36	0.09	100	17.0	7.2	0	0.0%	0.0	0.0	7.2	10.6	4.6	7.8	***0.0***	***0.1***
Q	0.11	0.09	0.36	0.09	25	0.5	7.1	0	0.0%	0.0	0.0	7.1	10.1	4.6	7.8	***0.0***	***0.3***

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

**Existing undeveloped

***Ulitmate build out, developed. Used to size future pond 1 and storm sewer.

Calculated by: GT
Date: 4/1/2020
Checked by: VAS

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERICAL FILING NO. 3
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*	*****A, ***B OFFSITE DEVELOPED**	1.15	1.29		TAKEN FROM BASIN B							6.0	4.9	8.2	***5.6***	***10.6***	Proposed PVT 24" Storm Sewer
***2*	*****C, ***D OFFSITE DEVELOPED**	1.27	1.46		TAKEN FROM BASIN D							5.3	5.1	8.5	***6.4***	***12.4***	Proposed PVT 24" Storm Sewer
***3*	*****E OFFSITE DEVELOPED**	1.26	1.36		TAKEN FROM BASIN E (ADJ MIN Tc)							5.0	5.2	8.7	***6.5***	***11.8***	Proposed PVT 24" Storm Sewer
***4*	*****F, ***PR3 & ***PR4 OFFSITE DEVELOPED**	3.71	4.26		TAKEN FROM DESIGN POINT 1							6.0	4.9	8.2	***18.2***	***35.0***	PVT Sand Filter Basin FSD Pond 1
***4*	****OS1, **OS2, **OS3 OFFSITE UNDEVELOPED**	0.49	1.95		TAKEN FROM DESIGN POINT 4							14.1	3.6	6.1	***1.8***	***11.8***	24" PP & FES
5	**H, I**	2.29	2.67		TAKEN FROM BASIN I							8.2	4.4	7.4	***10.1***	***19.8***	10' and 15' Type R Inlets (assumed split flows)
6	**J, FB DP5**	0.85	1.29		TAKEN FROM BASIN J (Adj to Min Tc)							5.0	5.2	8.7	***4.4***	***11.2***	10' and 15' Type R Inlets (assumed split flows)
7	**K**	0.34	0.37		TAKEN FROM BASIN K (Adj to Min Tc)							5.0	5.2	8.7	***1.8***	***3.2***	Manhole w/ Grate
8	**L, M**	1.61	2.09		TAKEN FROM BASIN M							8.0	4.5	7.5	***7.2***	***15.7***	PVT Swale or PVT 24" Storm Sewer
9	**N, DP8, PR7 & PR10.1**	5.15	6.16		TAKEN FROM DESIGN POINT 8							8.0	4.5	7.5	***23.0***	***46.3***	PVT Sand Filter Basin FSD Pond 2

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

**Existing undeveloped

***Ulitmate build out, developed. Used to size future pond 1 and storm sewer.

Calculated by: GT
Date: 4/1/2020
Checked by: VAS

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERICAL FILING NO. 3
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	***DP1	1.15	1.29	6.0	4.9	8.2	5.6	10.6	PROP 24" PP
***2	***DP2	1.27	1.46	5.3	5.1	8.5	6.4	12.4	PROP 24" PP
***3	***PR1, ***PR2	2.41	2.75	6.0	4.9	8.2	11.8	22.6	PROP 30" PP
***4	***DP3	1.26	1.36	5.0	5.2	8.7	6.5	11.8	PROP 24" PP
***5	POND 1 OUTFALL DEVELOPED	1.48	1.89	6.0	4.9	8.2	7.2	15.5	PROP 24" PP
**5	**DP4 OFFSITE UNDEVELOPED	0.49	1.95	14.1	3.6	6.1	1.8	11.8	PROP 24" PP
***5.1	***PR5	1.48	1.89	6.0	4.9	8.2	7.2	15.5	PROP 24" PP
***5.2	***PR5.1	1.48	1.89	6.0	4.9	8.2	7.2	15.5	PROP 24" PP
6	INLET 1	1.44	1.43	8.2	4.4	7.4	6.4	10.6	PROP 24" PP
7	PR6, INLET 2	2.28	2.24	8.2	4.4	7.4	10.1	16.6	PROP 30" PP
8	INLET 3	0.55	0.80	5.0	5.2	8.7	2.8	6.9	PROP 18" PP
9	PR8, INLET 4	0.86	1.27	5.0	5.2	8.7	4.4	11.0	PROP 24" PP
10	PR9, DP7	1.20	1.64	5.0	5.2	8.7	6.2	14.3	PROP 24" PP
10.1	PR10	1.20	1.64	5.0	5.2	8.7	6.2	14.3	PROP 24" PP
11	POND 2 OUTFALL	2.95	3.17	8.0	4.5	7.5	13.2	23.8	PROP 30" PP
12	***PR5.2, PR11		FROM UD-DET SHEETS CUMMALATIVE FLOW				20.4	39.3	EX 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: GT
Date: 4/1/2020
Checked by: VAS

**Existing undeveloped

***Ulitmate build out, developed. Used to size future pond 1 and storm sewer.

HYDRAULIC CALCULATIONS / SFB WQCV CALCULATIONS

Rating Table for 3' wide 6" deep Rectangular Channel

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.003 ft/ft
Normal Depth	6.0 in
Bottom Width	3.00 ft

Channel Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.003	4.46	2.97	1.5	4.0	3.00
0.005	6.30	4.20	1.5	4.0	3.00
0.008	7.72	5.15	1.5	4.0	3.00
0.010	8.92	5.94	1.5	4.0	3.00
0.013	9.97	6.65	1.5	4.0	3.00
0.015	10.92	7.28	1.5	4.0	3.00
0.018	11.79	7.86	1.5	4.0	3.00
0.020	12.61	8.41	1.5	4.0	3.00
0.023	13.37	8.92	1.5	4.0	3.00
0.025	14.10	9.40	1.5	4.0	3.00
0.028	14.79	9.86	1.5	4.0	3.00
0.030	15.44	10.30	1.5	4.0	3.00

Claremont Commercial Filing No. 3
DRAINAGE PLAN CALCULATIONS
(Pond Volume Calculation)

WQCV POND 1

Elevation	SF	CF	Storage AF	Storage Sum
6373.00	3,690.00	0.00	0.00	0.00
6374.00	4,280.00	3,985.00	0.09	0.09
6375.00	6,051.00	5,165.50	0.12	0.21
6376.00	7,382.00	6,716.50	0.15	0.36
6376.50	8,085.00	3,866.75	0.09	0.45

Total = 19,734 CF

Total = 0.5 Ac-ft

Calculated by: DLM

Date: 11/20/2019

Checked by:

CLAREMONT COMMERICAL FILING NO. **3** *(PROPOSED CONDITIONS)*

Weighted Percent Imperviousness of Proposed WQ Sand Filter Pond 1				
Contributing Basins	***Area (Acres)***	***C_5***	***Impervious % (I)***	***(Acres)*(I)***
A	0.19	0.09	2	0.38
B	1.39	0.81	95	132.29
C	0.30	0.09	2	0.61
D	1.53	0.81	95	145.47
E	1.55	0.81	95	147.28
F	0.36	0.12	7	2.54
Totals	***5.33***			***428.58***
Imperviousness % to FSD	***80.4***			

1.77	A soils	33%
3.57	B soils	67%
5.33	total area	

Claremont Commercial Filing No. 3

EMERGENCY SPILLWAY CALCULATIONS POND 1

Horizontal Broad-Crested Weir (Eqn 12-20 UDFCD)						
Variable				*Solve For*		
C	3.00			L (ft)	H (ft)	Q (cfs)
L	8.50	ft		0.0	0.0	25.5
H	1.00	ft				
Q		cfs				

Sloping Broad-Crested Weir (Eqn 12-21 UDFCD)						
Variable				*Solve For*		
C	3.00			Z (ft)	H (ft)	Q (cfs)
Z	4.00	ft		0.0	0.0	4.8
H	1.00	ft				
Q		cfs				

Total Q	35.10

Equation 12-20

$$Q = C_{BCW} L H^{1.5}$$

Equation 12-21

$$Q = \left(\frac{2}{5}\right) C_{BCW} Z H^{2.5}$$

Where:

Q = discharge (cfs)

C_{BCW} = broad-crested weir coefficient (This ranges from 2.6 to 3.0. A value of 3.0 is often used in practice.) See Hydraulic Engineering Circular No. 22 for additional information.

L = broad-crested weir length (ft)

H = head above weir crest (ft)

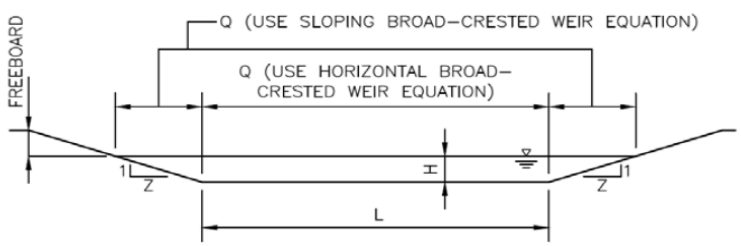
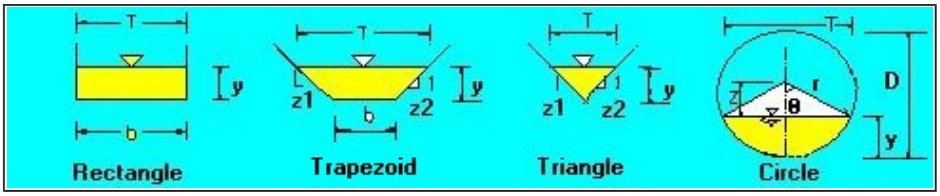


Figure 12-20. Sloping broad-crest weir

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.1 ft/ft	Water depth(y): 0.19 ft	Bottom width(b) 10 ft
Flow velocity 5.9764 ft/s	LeftSlope (Z1): 3 to 1 (H:V	RightSlope (Z2): 3 to 1 (H:V
Flow discharge 12.0025 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 11.2 ft	Flow area 2.01 ft^2	Top width(T) 11.14 ft
Specific energy 0.74 ft	Froude number 2.48	Flow status Supercritical flow
Critical depth 0.34 ft	Critical slope 0.0136 ft/ft	Velocity head 0.55 ft

DP 4 SWALE/COLLECTION POINT

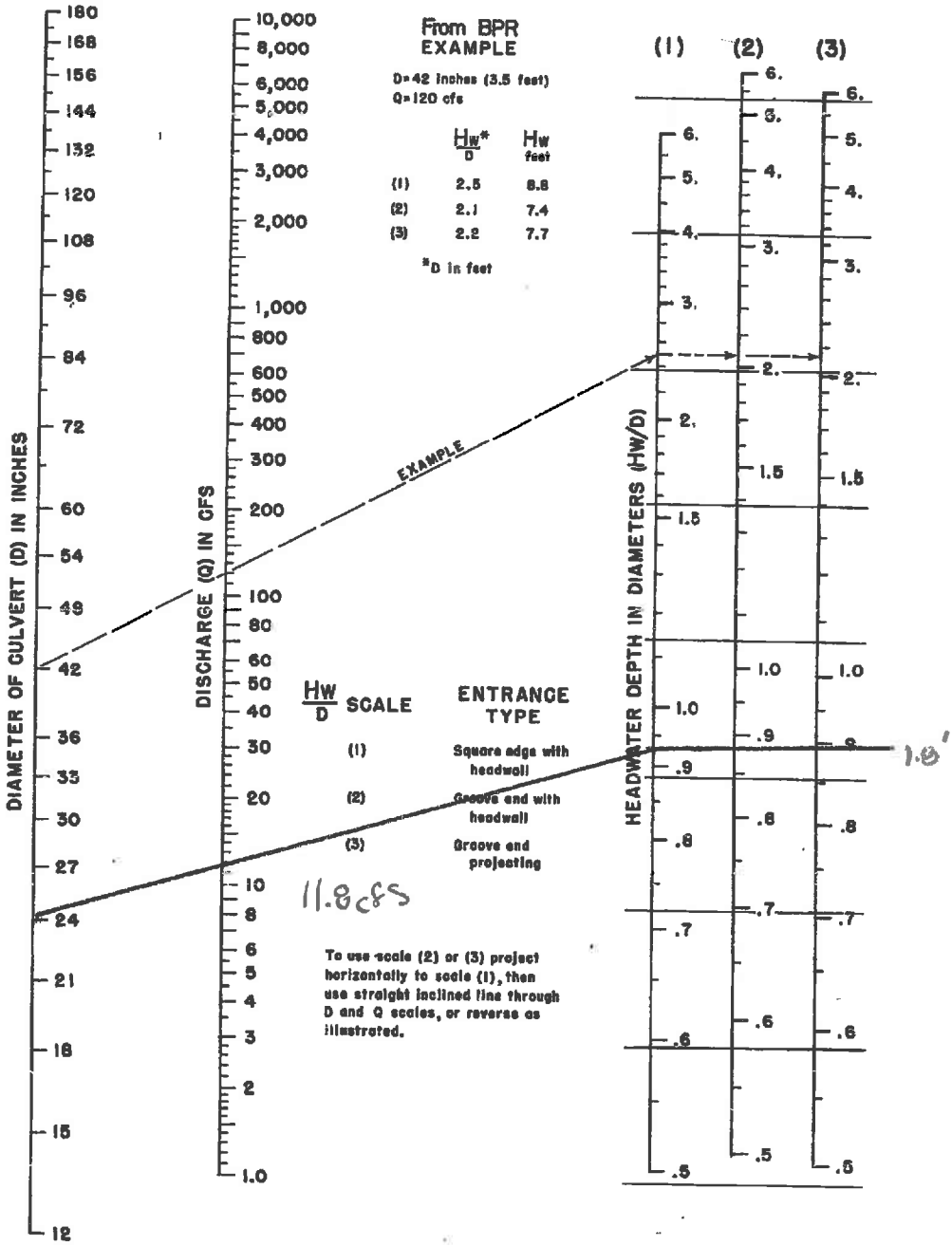


Figure 11-9. Inlet control nomograph—example

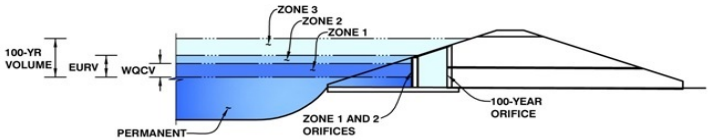
DP5 INLET CONTROL NOMOGRAPH

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: **CLAREMONT COMMERCIAL FILING NO. 3**

Basin ID: **WQCV POND 1**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	5.33	acres
Watershed Length =	735	ft
Watershed Length to Centroid =	325	ft
Watershed Slope =	0.016	ft/ft
Watershed Imperviousness =	80.40%	percent
Percentage Hydrologic Soil Group A =	33.0%	percent
Percentage Hydrologic Soil Group B =	67.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.118	acre-feet	0.118	acre-feet
Excess Urban Runoff Volume (EURV) =	0.505	acre-feet	0.505	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.399	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.525	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.629	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.749	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.860	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.989	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 2.53 in.) =	0.994	acre-feet	2.53	inches
Approximate 2-yr Detention Volume =	0.375	acre-feet		
Approximate 5-yr Detention Volume =	0.492	acre-feet		
Approximate 10-yr Detention Volume =	0.603	acre-feet		
Approximate 25-yr Detention Volume =	0.668	acre-feet		
Approximate 50-yr Detention Volume =	0.706	acre-feet		
Approximate 100-yr Detention Volume =	0.749	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.118	acre-feet
Zone 2 Volume (100-year - Zone 1) =	0.631	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.749	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

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)
6373	**Media Surface**	--	0.00	--	--	--	3,690	0.085		
	6374	--	1.00	--	--	--	4,280	0.098	3,985	0.091
	6375	--	2.00	--	--	--	6,048	0.139	9,149	0.210
	6376	--	3.00	--	--	--	7,348	0.169	15,847	0.364
	6376.5	--	3.50	--	--	--	8,082	0.186	19,704	0.452

Will be provided with WQ Pond 1 Final Drainage Report.

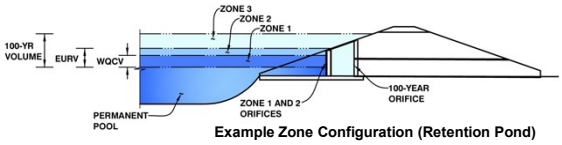
FYI: outlet structure design was not reviewed as pond 1 details have not been provided

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: CLAREMONT COMMERCIAL FILING NO. 3

Basin ID: WQCV POND 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.26	0.118	Filtration Media
Zone 2 (100-year)	#VALUE!	0.631	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		0.749	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	2.50	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Diameter =	1.63	inches	Underdrain Orifice Centroid =	0.07	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)

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

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

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

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

	Zone 2 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.27		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	1.27		feet
Overflow Weir Front Edge Length =	6.00		feet	Overflow Weir Slope Length =	2.91		feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =	7.70		
Horiz. Length of Weir Sides =	2.91		feet	Overflow Grate Open Area w/o Debris =	12.22		ft^2
Overflow Grate Open Area % =	70%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	6.11		ft^2
Debris Clogging % =	50%		%				

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

	Zone 2 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.75		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.59		ft^2
Outlet Pipe Diameter =	24.00		inches	Outlet Orifice Centroid =	0.58		feet
Restrictor Plate Height Above Pipe Invert =	12.10		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.58	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	2.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.67	feet
Spillway Crest Length =	8.50	feet	Stage at Top of Freeboard =	3.67	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.19	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.45	acre-ft

Routed Hydrograph Results

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

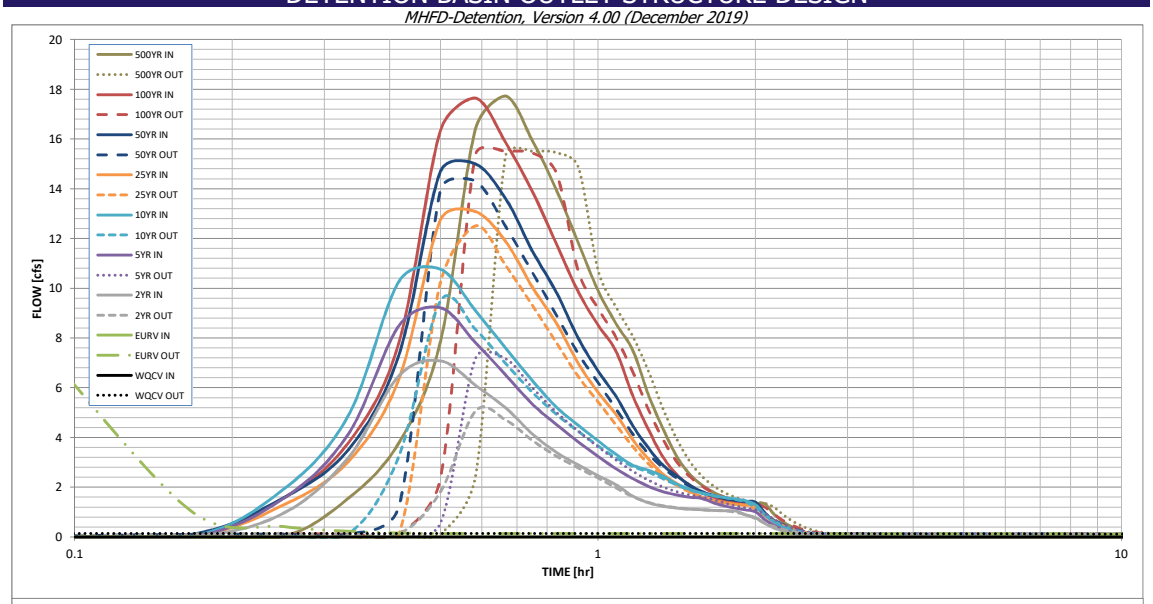
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	2.53
CUHP Runoff Volume (acre-ft) =	0.118	0.505	0.399	0.525	0.629	0.749	0.860	0.989	0.994
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.399	0.525	0.629	0.749	0.860	0.989	0.994
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.9	1.6	3.4	4.5	5.9	5.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.16	0.31	0.64	0.84	1.11	1.12
Peak Inflow Q (cfs) =	N/A	N/A	7.1	9.2	10.8	13.1	15.0	17.6	17.7
Peak Outflow Q (cfs) =	0.1	46.1	5.1	7.2	9.5	12.5	14.3	15.5	15.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	8.2	5.8	3.7	3.2	2.6	2.6
Structure Controlling Flow =	Filtration Media	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.65	0.39	0.6	0.8	1.0	1.1	1.3	1.3
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) =	11	11	13	13	13	12	12	11	11
Time to Drain 99% of Inflow Volume (hours) =	**12**	12	14	14	14	14	14	13	13
Maximum Ponding Depth (ft) =	1.26	1.62	1.52	1.59	1.66	1.74	1.78	1.94	1.94
Area at Maximum Ponding Depth (acres) =	0.11	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14
Maximum Volume Stored (acre-ft) =	0.118	0.159	0.148	0.157	0.164	0.174	0.180	0.200	0.202

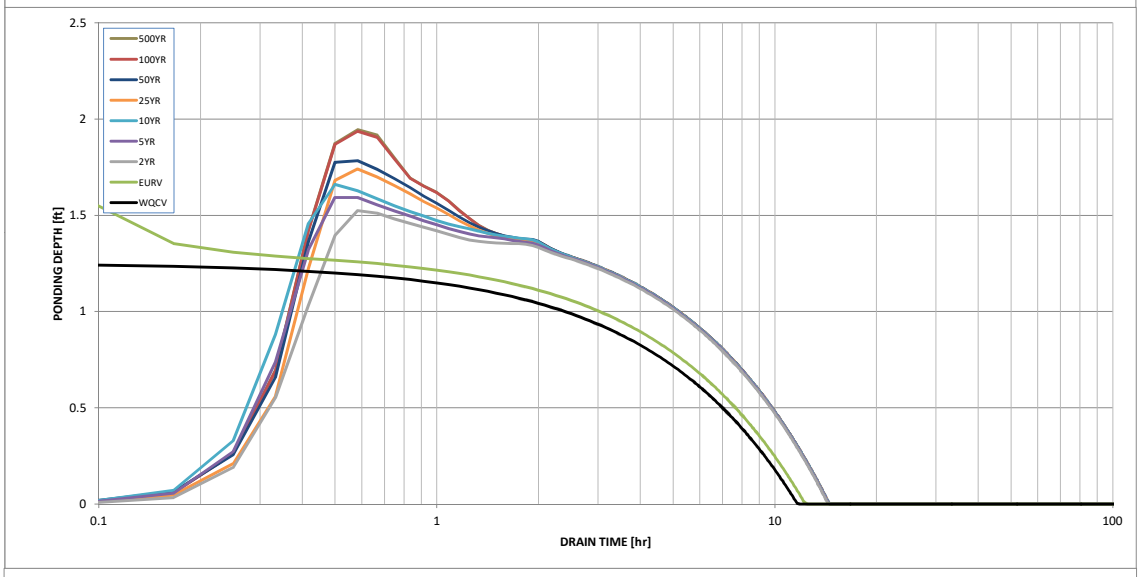
Provide a note as done in the preliminary plan and other claremont business park projects regarding detention not being required. The previous note indicated something along the lines of: **Per resolution 16-426 of the BoCC, on-site WQCV is required but on-site stormwater detention is not required per the FDR for Claremont Business Park Filing No. 2.**

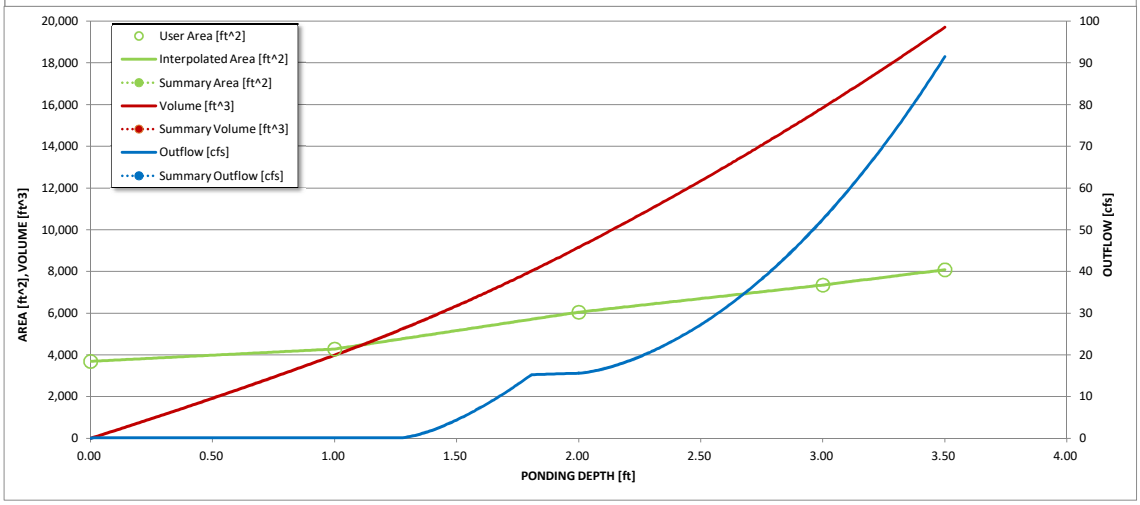
Comment addressed

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

Claremont Commercial Filing No. 3
DRAINAGE REPORT DRAINAGE CALCULATIONS
(Pond Volume Calculation)

WQCV POND 2

			Storage	
Elevation	SF	CF	AF	Sum
6364.45	2,957.00	0.00	0.00	0.00
6365.00	3,660.00	1,819.68	0.04	0.04
6366.00	4,942.00	4,301.00	0.10	0.14
6367.00	6,327.00	5,634.50	0.13	0.27
6368.00	7,808.00	7,067.50	0.16	0.43

Total = 18,823 CF

Total = 0.4 Ac-ft

Calculated by: GT

Date: 4/27/2020

Checked by:

CLAREMONT COMMERICAL FILING NO. **3** *(PROPOSED CONDITIONS)*

Weighted Percent Imperviousness of Proposed WQ Sand Filter Pond 2				
Contributing Basins	***Area (Acres)***	***C_5***	***Impervious % (I)***	***(Acres)*(I)***
H	0.71	0.09	2	1.43
I	2.75	0.81	95	260.80
J	1.05	0.81	95	100.02
K	0.42	0.81	2	0.85
L	1.32	0.09	2	2.63
M	1.84	0.81	95	174.75
N	0.47	0.12	7	3.32
Totals	***8.57***			***543.80***
Imperviousness of WQ Pond 2	***63.5***			

8.57 B soils
8.57 total area

Claremont Commercial Filing No. 3

EMERGENCY SPILLWAY CALCULATIONS POND 2

Horizontal Broad-Crested Weir (Eqn 12-20 UDFCD)						
Variable				*Solve For*		
C	3.00			L (ft)	H (ft)	Q (cfs)
L	12.50	ft		0.0	0.0	37.5
H	1.00	ft				
Q		cfs				

Total Q	47.10

Equation 12-20

$$Q = C_{BCW} L H^{1.5}$$

Sloping Broad-Crested Weir (Eqn 12-21 UDFCD)						
Variable				*Solve For*		
C	3.00			Z (ft)	H (ft)	Q (cfs)
Z	4.00	ft		0.0	0.0	4.8
H	1.00	ft				
Q		cfs				

Equation 12-21

$$Q = \left(\frac{2}{5}\right) C_{BCW} Z H^{2.5}$$

Where:

Q = discharge (cfs)

C_{BCW} = broad-crested weir coefficient (This ranges from 2.6 to 3.0. A value of 3.0 is often used in practice.) See Hydraulic Engineering Circular No. 22 for additional information.

L = broad-crested weir length (ft)

H = head above weir crest (ft)

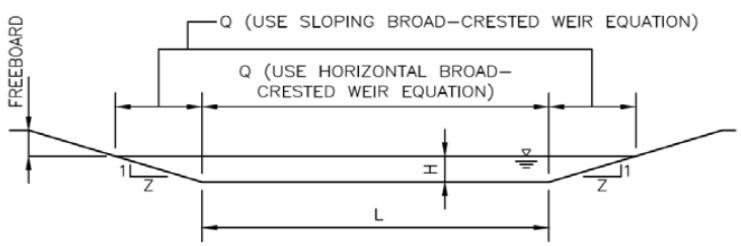


Figure 12-20. Sloping broad-crest weir

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

PROJECT: CLAREMONT BUSINESS PARK 2 FIL. 1

DATE: 4-21-20

STORM 10 OUTFALL LOW TAILWATER BASIN.
RIPRAP SIZING FIG. 9-38 (UDFCD)

$Q_{100} = 14.3$ cfs 24" ADS

$Q/D^{2.5} \leq 6.0$ $14.3/2^{2.5} = \underline{2.53} \leq 6.0$ OK

$Q/D^{1.5} = 14.3/2^{1.5} = \underline{5.06}$ ASSUME $\underline{0.4} = Y_t/D$

FROM FIG 9-38 USE TYPE L RIPRAP $T = 2D_{50} = \underline{2(9") = 18"}$

STORM 7 OUTFALL LOW TAILWATER BASIN
RIPRAP SIZING FIG 9-38 (UDFCD)

$Q_{100} = 16.6$ cfs 24" ADS

$Q/D^{2.5} \leq 6.0$ $16.6/2^{2.5} = \underline{2.93} \leq 6.0$ OK

$Q/D^{1.5} = 16.6/2^{1.5} = \underline{5.87}$ ASSUME $\underline{0.4} = Y_t/D$

FROM FIG 9-38 USE TYPE L RIPRAP $T = 2D_{50} = 2(9") = \underline{18"}$

DP 8 4:1 RUNDOWN OUTFALL
RIP RAP SIZING FIG 12-21 EMBANKMENT PROTECTION

$Q_{100} = 16.7$ cfs 3' WIDTH

UNIT DISCHARGE (cfs/ft) $= 15.7/3 = \underline{5.23}$ 4:1 = 25% LONGITUDINAL SLOPE

FROM FIG 12-21 USE TYPE H RIPRAP $D_{50} = 18"$

$$H_a = \frac{(H + Y_n)}{2}$$ Equation 9-19

Where the maximum value of H_a shall not exceed H, and:

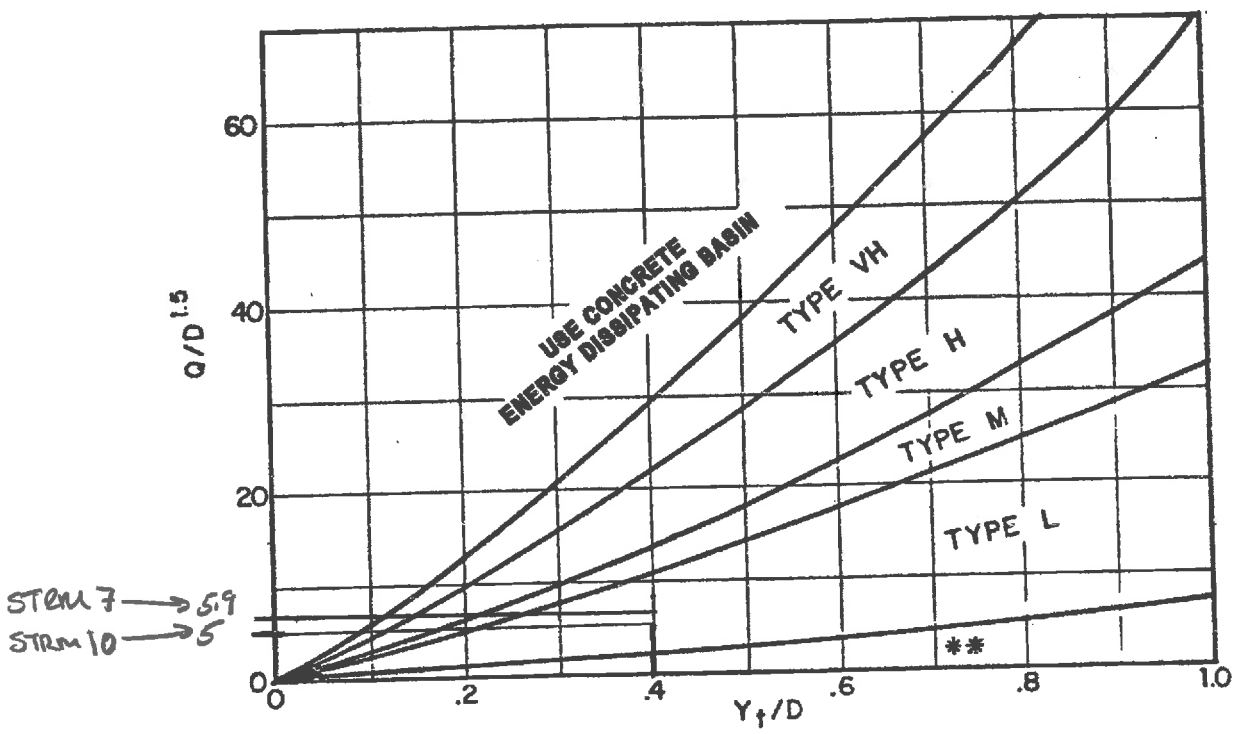
D_a = parameter to use in place of D in Figure 9-38 when flow is supercritical (ft)

D_c = diameter of circular culvert (ft)

H_a = parameter to use in place of H in Figure 9-39 when flow is supercritical (ft)

H = height of rectangular culvert (ft)

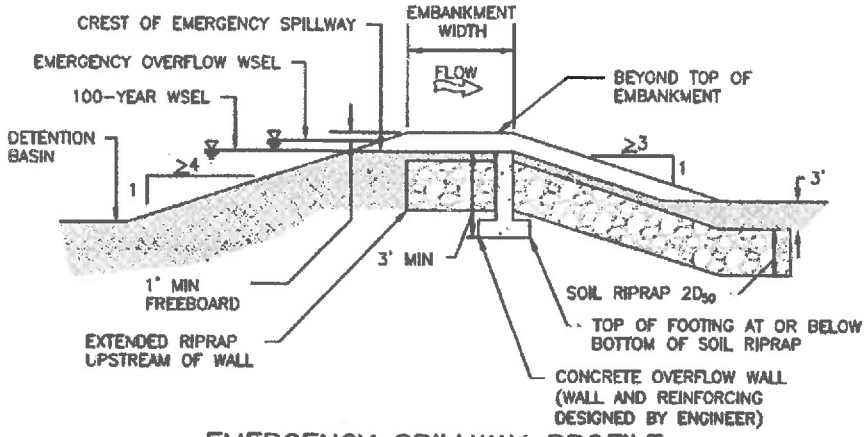
Y_n = normal depth of supercritical flow in the culvert (ft)



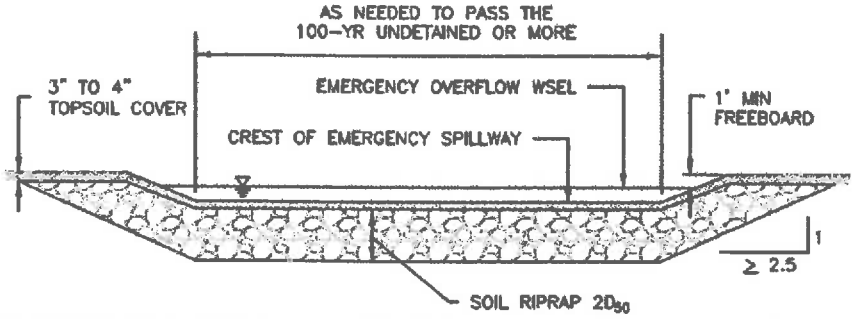
Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

RIPRAP SIZING FOR LOW TAILWATER BASINS POND 2

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



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

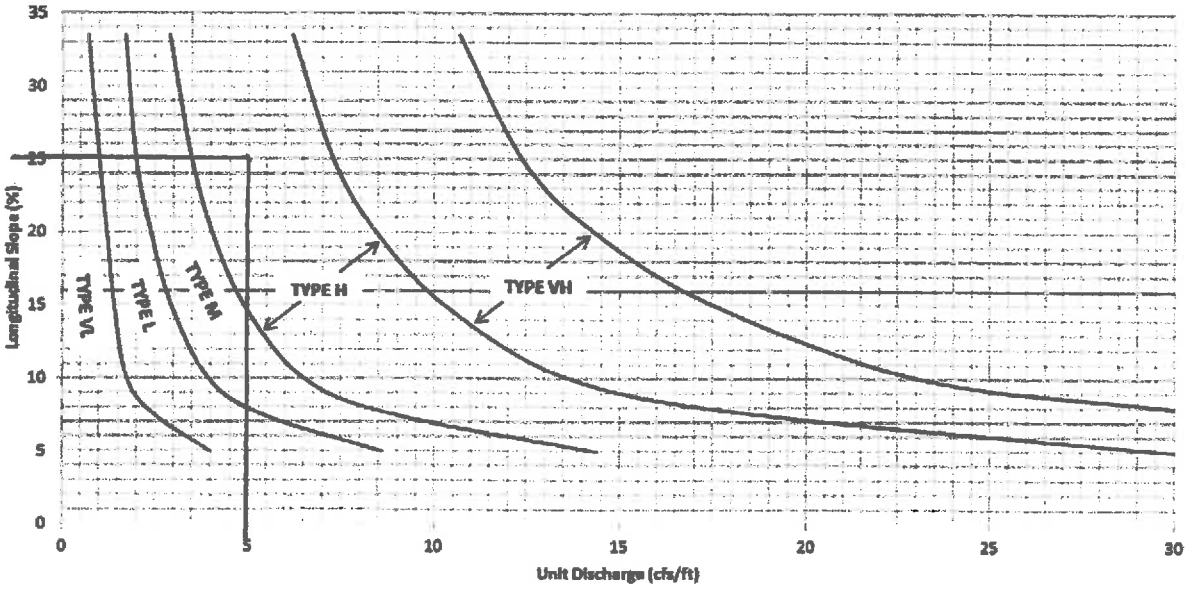
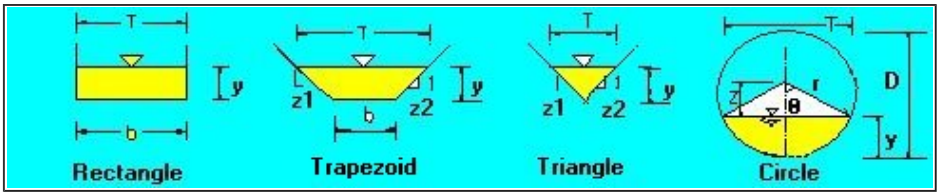


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

RIPRAP SIZING FOR RUNDOWN POND 2

The open channel flow calculator

Select Channel Type: Triangle



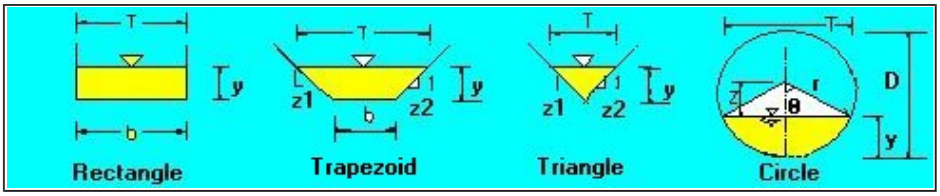
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.12 ft/ft	Water depth(y): 0.4 ft	Bottom W(b) 0 ft
Flow velocity 6.7989 ft/s	LeftSlope (Z1): 3 to 1 (H:V	RightSlope (Z2): 3 to 1 (H:V
Flow discharge 3.2635 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.53 ft	Flow area 0.48 ft^2	Top width(T) 2.4 ft
Specific energy 1.12 ft	Froude number 2.68	Flow status Supercritical flow
Critical depth 0.59 ft	Critical slope 0.0146 ft/ft	Velocity head 0.72 ft

DP 7 SWALE TO CDOT TYPE C INLET

The open channel flow calculator

Select Channel Type: Trapezoid



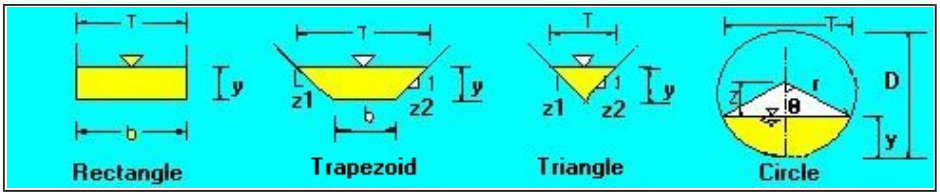
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.005 ft/ft	Water depth(y): 1.02 ft	Bottom width(b) 2 ft
Flow velocity 3.0255 ft/s	LeftSlope (Z1): 3 to 1 (H:V	RightSlope (Z2): 3 to 1 (H:V
Flow discharge 15.615 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.45 ft	Flow area 5.16 ft^2	Top width(T) 8.12 ft
Specific energy 1.16 ft	Froude number 0.67	Flow status Subcritical flow
Critical depth 0.84 ft	Critical slope 0.0116 ft/ft	Velocity head 0.14 ft

DP8 SWALE
Q_{100}=15.7 cfs

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .25 ft/ft	Water depth(y): .41 ft	Bottom width(b) 3 ft
Flow velocity 10.0147 ft/s	LeftSlope (Z1): 2 to 1 (H:V	RightSlope (Z2): 2 to 1 (H:V
Flow discharge 15.6851 ft^3/s	Input n value 0.035 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.83 ft	Flow area 1.57 ft^2	Top width(T) 4.64 ft
Specific energy 1.97 ft	Froude number 3.04	Flow status Supercritical flow
Critical depth 0.79 ft	Critical slope 0.023 ft/ft	Velocity head 1.56 ft

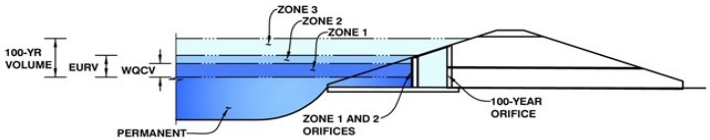
RUNDOWN POND 2

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: **CLAREMONT COMMERCIAL FILING NO.** 3

Basin ID: **WQCV POND 2**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type = **SF**
Watershed Area = 8.57 acres
Watershed Length = 665 ft
Watershed Length to Centroid = 325 ft
Watershed Slope = 0.018 ft/ft
Watershed Imperviousness = 63.50% percent
Percentage Hydrologic Soil Group A = 0.0% percent
Percentage Hydrologic Soil Group B = 100.0% percent
Percentage Hydrologic Soil Groups C/D = 0.0% percent
Target WQCV Drain Time = 12.0 hours
Location for 1-hr Rainfall Depths = User Input

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.142	acre-feet	0.142	acre-feet
Excess Urban Runoff Volume (EURV) =	0.593	acre-feet	0.593	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.521	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.713	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.877	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.080	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.254	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.466	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 2.53 in.) =	1.473	acre-feet	2.53	inches
Approximate 2-yr Detention Volume =	0.459	acre-feet		
Approximate 5-yr Detention Volume =	0.616	acre-feet		
Approximate 10-yr Detention Volume =	0.788	acre-feet		
Approximate 25-yr Detention Volume =	0.850	acre-feet		
Approximate 50-yr Detention Volume =	0.885	acre-feet		
Approximate 100-yr Detention Volume =	0.960	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) = 0.142 acre-feet
Zone 2 Volume (100-year - Zone 1) = 0.818 acre-feet
Select Zone 3 Storage Volume (Optional) = acre-feet
Total Detention Basin Volume = 0.960 acre-feet
Initial Surcharge Volume (ISV) = N/A ft^3
Initial Surcharge Depth (ISD) = N/A ft
Total Available Detention Depth (H_{total}) = user ft
Depth of Trickle Channel (H_{TC}) = N/A ft
Slope of Trickle Channel (S_{TC}) = N/A ft/ft
Slopes of Main Basin Sides (S_{main}) = user H:V
Basin Length-to-Width Ratio ($R_{L/W}$) = user

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)
6364.45	**Media Surface**	--	0.00	--	--	--	2,957	0.068		
	6365	--	0.55	--	--	--	3,660	0.084	1,820	0.042
	6366	--	1.55	--	--	--	4,942	0.113	6,121	0.141
	6367	--	2.55	--	--	--	6,327	0.145	11,755	0.270
	6368	--	3.55	--	--	--	7,808	0.179	18,823	0.432
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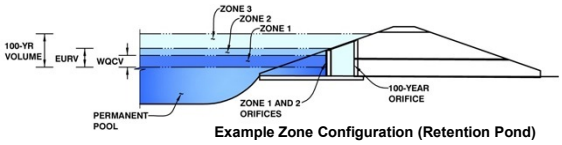
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: **CLAREMONT COMMERCIAL FILING NO. 3**

Basin ID: **WQCV POND 2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.57	0.142	Filtration Media
Zone 2 (100-year)	#VALUE!	0.818	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		0.960	

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

Underdrain Orifice Invert Depth =	2.50	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Diameter =	1.60	inches	Underdrain Orifice Centroid =	0.07	feet

Calculated Parameters for Underdrain

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

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

Calculated Parameters for Plate

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 2 Weir	Not Selected			Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.58		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	1.58		feet
Overflow Weir Front Edge Length =	7.00		feet	Overflow Weir Slope Length =	2.91		feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =	6.35		
Horiz. Length of Weir Sides =	2.91		feet	Overflow Grate Open Area w/o Debris =	14.26		ft^2
Overflow Grate Open Area % =	70%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	7.13		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

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

	Zone 2 Restrictor	Not Selected			Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.75		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.25		ft^2
Outlet Pipe Diameter =	30.00		inches	Outlet Orifice Centroid =	0.67		feet
Restrictor Plate Height Above Pipe Invert =	14.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.50	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.78	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.75	feet
Spillway Crest Length =	12.50	feet	Stage at Top of Freeboard =	4.53	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.18	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.43	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

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

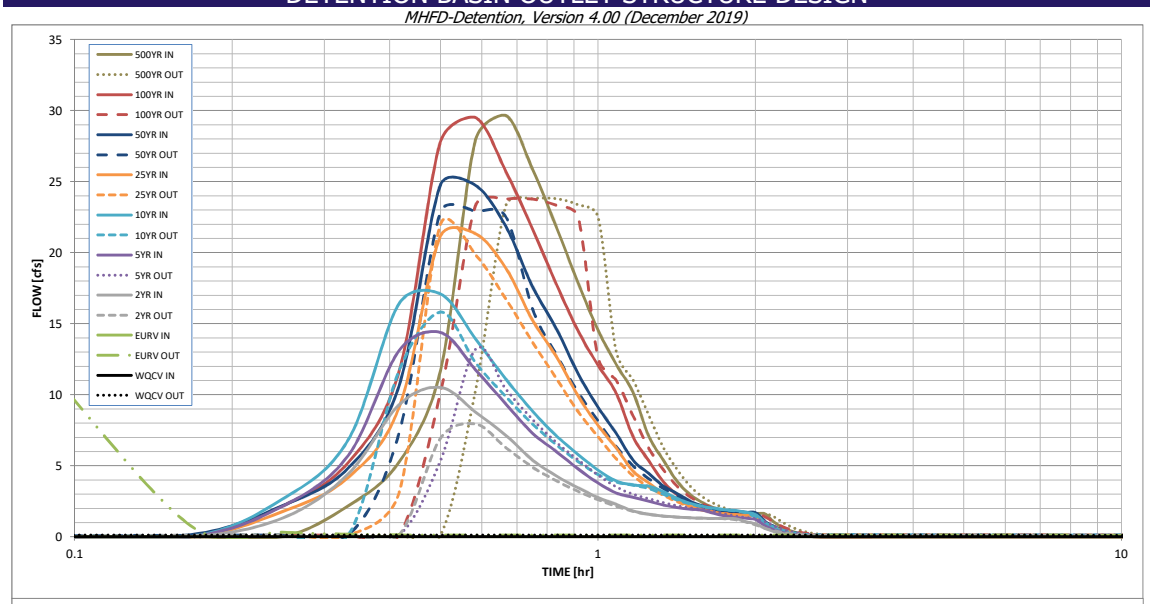
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	2.53
CUHP Runoff Volume (acre-ft) =	0.142	0.593	0.521	0.713	0.877	1.080	1.254	1.466	1.473
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.521	0.713	0.877	1.080	1.254	1.466	1.473
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.2	3.2	4.8	8.5	10.7	13.3	13.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.38	0.56	0.99	1.24	1.56	1.57
Peak Inflow Q (cfs) =	N/A	N/A	10.5	14.4	17.1	21.3	24.8	29.5	29.6
Peak Outflow Q (cfs) =	0.1	50.8	7.9	13.2	15.8	22.0	22.9	23.8	23.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	4.1	3.3	2.6	2.1	1.8	1.8
Structure Controlling Flow =	Filtration Media	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.90	0.54	0.9	1.1	1.5	1.6	1.7	1.7
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) =	14	13	15	15	14	13	13	12	12
Time to Drain 99% of Inflow Volume (hours) =	**14**	14	16	16	16	16	16	15	15
Maximum Ponding Depth (ft) =	1.57	2.03	1.90	2.03	2.09	2.22	2.41	2.75	2.76
Area at Maximum Ponding Depth (acres) =	0.11	0.13	0.12	0.13	0.13	0.13	0.14	0.15	0.15
Maximum Volume Stored (acre-ft) =	0.143	0.197	0.182	0.199	0.206	0.222	0.248	0.300	0.301

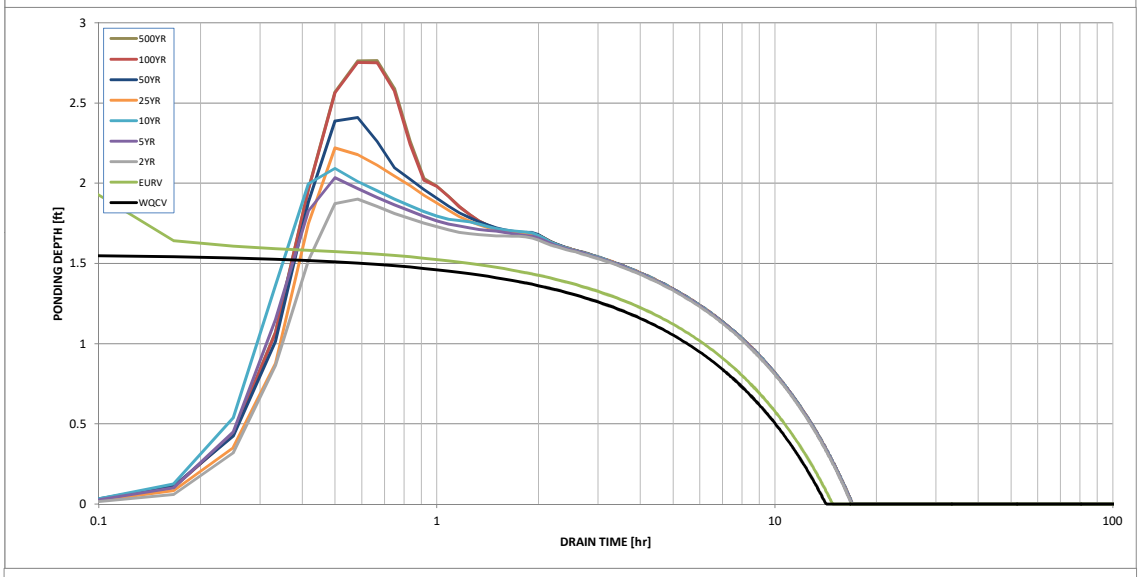
Provide a note as done in the preliminary plan and other claremont business park projects regarding detention not being required. The previous note indicated something along the lines of: **Per resolution 16-426 of the BoCC, on-site WQCV is required but on-site stormwater detention is not required per the FDR for Claremont Business Park Filing No. 2.**

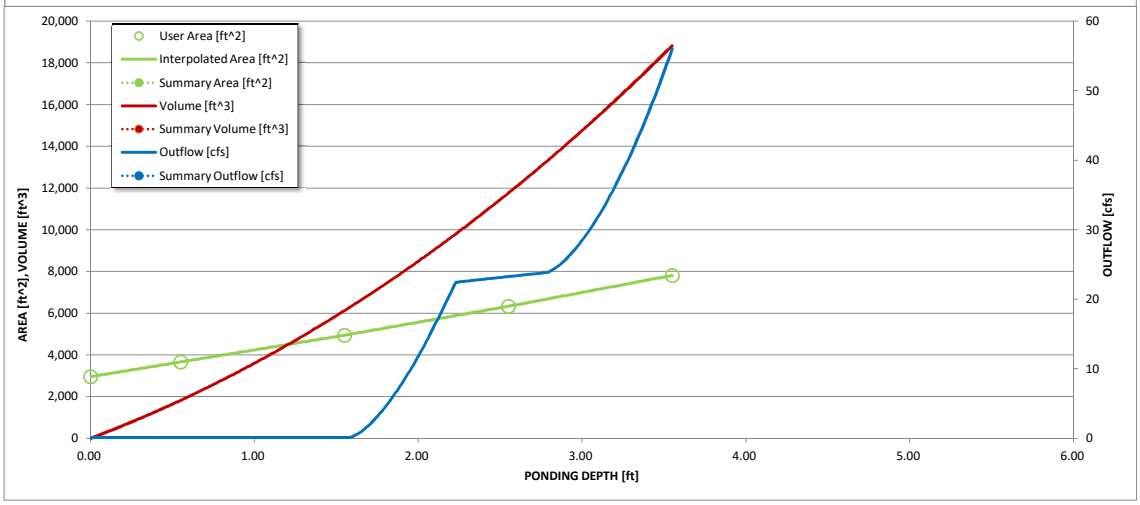
Comment addressed

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

CIVIL CONSULTANTS, INC.

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

PROJECT: CLAREMONT BUSINESS PARK 2 FIL.1

DATE: 4-17-2020

CONTROL ORIFICE FOR WQCV

EQN. SF-3 UDFCD Vol 3 SAND FILTER

$$D_{12\,HOUR\ DRAIN\ TIME} = \sqrt{\frac{V}{144\,y^{0.41}}}$$

$$y = 2.5' - \left(\frac{4'' - 2''}{12\ in/ft}\right) = \underline{2.33'}$$

$$V = 0.143\ AC\text{-}ft \times \frac{43560\ ft^3}{1\ AC\text{-}ft} = \underline{6229\ ft^3}$$

FROM MHFD-DETENTION SHEET

$$D = \sqrt{\frac{6229\ ft^3}{144\,(2.33^{0.41})}} = 1.76\ in\ DIA \qquad \pi r^2 = A = \pi\,(0.88)^2 = 2.44\ in^2$$

$$2.44\ in^2 \cong 0.017\ ft^2$$

Fluid Flow Table of Contents
Hydraulic and Pneumatic Knowledge
Fluid Power Equipment

This engineering calculator determines the Flow within a partially full pipe (&e1/2 fullusing the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V
for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, **D** =	4	in
Depth of flow, **y** =	1.25	in

(must have y ≥ D/2)

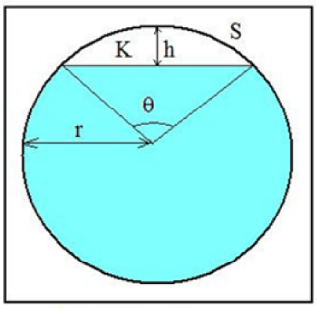
Full Pipe Manning roughness, n_{full} =	0.013	
Channel bottom slope, **S** =	0.005	ft/ft

Calculations

n/n_{full} =	1.34375	
Partially Full Manning roughness, **n** =	0.017	

Calculations

Pipe Diameter, **D** =	0.333333	ft
Pipe Radius, **r** =	0.166666	ft
Circ. Segment Height, **h** =	0.229	ft
Central Angle, **q** =	3.91	radians
Cross-Sect. Area, **A** =	0.02	ft^2
Wetted Perimeter, **P** =	0.4	ft
Hydraulic Radius, **R** =	0.06	ft
Discharge, **Q** =	0.02	cfs
Ave. Velocity, **V** =	0.91	ft/sec
pipe % full [(A/A_{full})*100%] =	26.7%	



Partially Full Pipe Flow Parameters
(More Than Half Full)

r = D/2

h = 2r - y

(hydraulic radius)

R = A/P

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

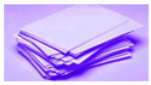
V = Q/A P

$$\theta = 2\arccos\left(\frac{r-h}{r}\right)$$

$$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = 2\pi r - r*\theta$$

Equation used for n/n_{full}: $\mathbf{n/n_{full} = 1.25 - (y/D - 0.5)*0.5}$ (for $0.5 \le y/D \le 1$)



DEPTH OF FLOW FOR 12 HR DRAIN TIME 4" PVC

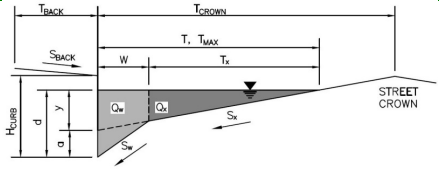
Version 4.05 Released March 2017

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

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

Project: CLAREMONT COMMERCIAL FILING NO. 3

Inlet ID: Inlet 1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.012	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} =	15.8	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**6.5**	**12.7**	**cfs**

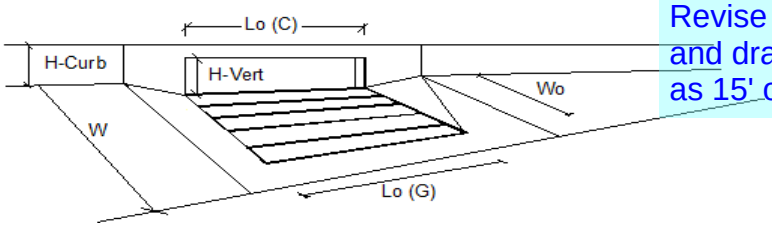
WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

Revise so that it matches the CD's and drainage plan. Inlet 1 is indicated as 15' on the CD's.



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	N_o =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.5**	**10.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**86**	**%**

Unit length is 5'. # of units is 3.

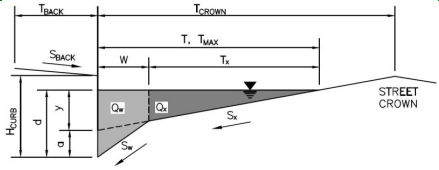
Version 4.05 Released March 2017

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

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

Project: CLAREMONT COMMERCIAL FILING NO. 3

Inlet ID: Inlet 2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

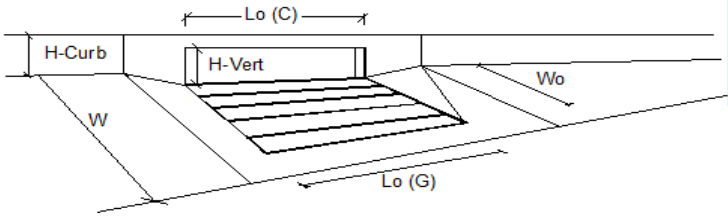
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**11.3**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Revise so that it matches the CD's and drainage plan. Inlet 2 is indicated as 10' on the CD's.

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.7**	**6.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

Unit length is 5'. # of units is 3. Changed to 15'.

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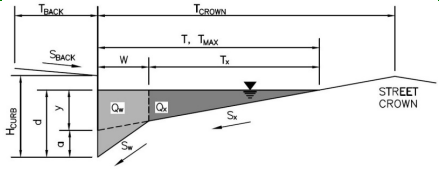
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: CLAREMONT COMMERCIAL FILING NO. 3

Inlet ID: Inlet 3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.010	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} =	15.8	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

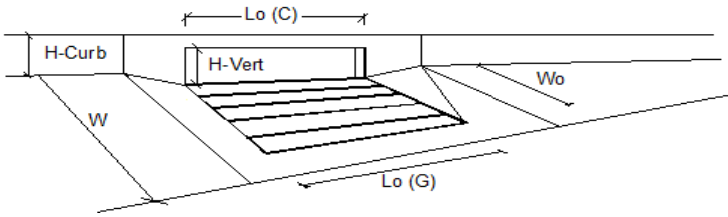
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.9**	**11.6**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Revise so that it matches the CD's and drainage plan. Inlet 3 is indicated as 15' on the CD's.

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.0**	**8.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**95**	**%**

Unit length is 5'. # of units is 3.

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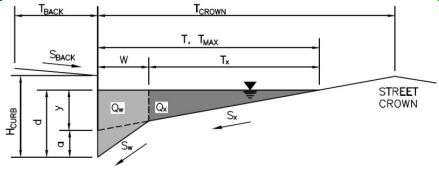
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: CLAREMONT COMMERCIAL FILING NO. 3

Inlet ID: Inlet 4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.8	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

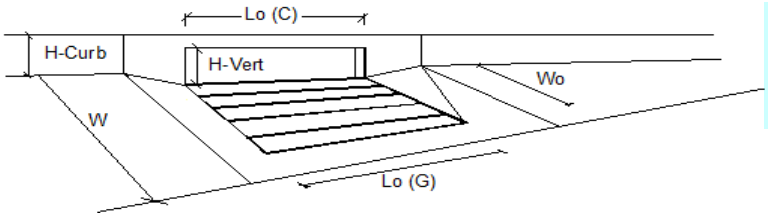
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.5**	**10.9**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Revise so that it matches the CD's and drainage plan. Inlet 4 is indicated as 10' on the CD's.

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**5.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**92**	**%**

Unit length is 5'. # of units is 3. Changed to 15'.

It appears that the CD's label this as inlet 6. Revise accordingly.

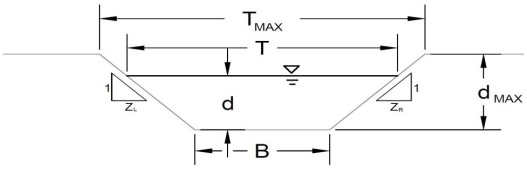
Version 4.05 Released March 2017

AREA INLET IN A SWALE

Comment addressed

CLAREMONT COMMERCIAL FILING NO. 3

Inlet 5



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.025	
Channel Invert Slope	S_O =	0.1200	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

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

Choose One:
- ☐ **Non-Cohesive**
- ☒ **Cohesive**
- ☐ **Paved**

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**1.92**	**2.40**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.32**	**0.40**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**1.8**	**3.3**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.32**	**0.40**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.8**	**3.2**	**cfs**
Water Depth	d =	**0.32**	**0.40**	**feet**

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

Version 4.05 Released March 2017

AREA INLET IN A SWALE

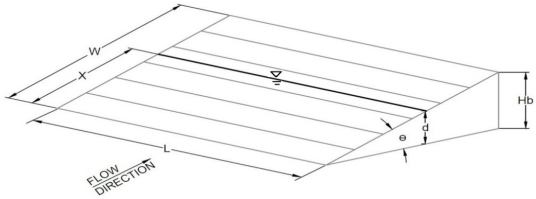
CLAREMONT COMMERCIAL FILING NO. 2

Inlet 5

Inlet Design Information (Input)

Type of Inlet: CDOT Type C (Depressed)

Inlet Type = CDOT Type C (Depressed)

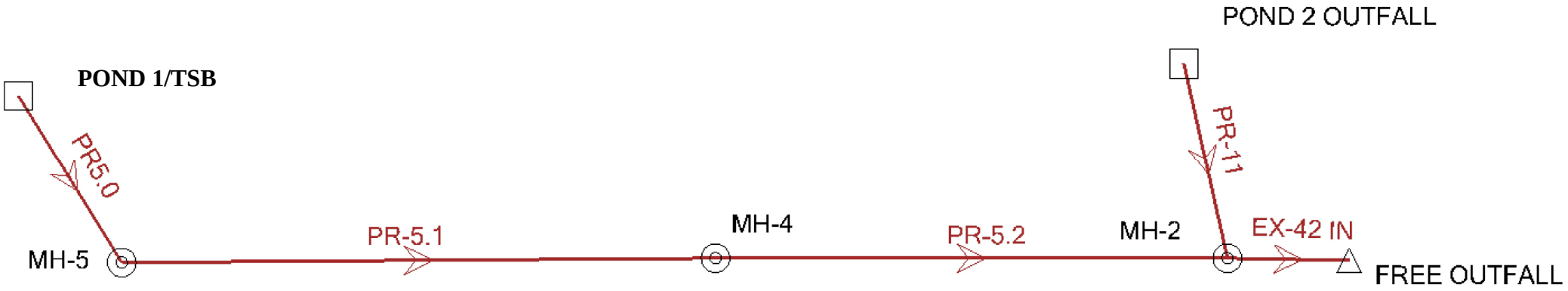


Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	feet
Length of Grate	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.84	
Orifice Coefficient	C_o =	0.56	
Weir Coefficient	C_w =	1.81	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.32	1.40	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**16.3**	**16.8**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

POND 1/TSB & POND 2 INDEX MAP

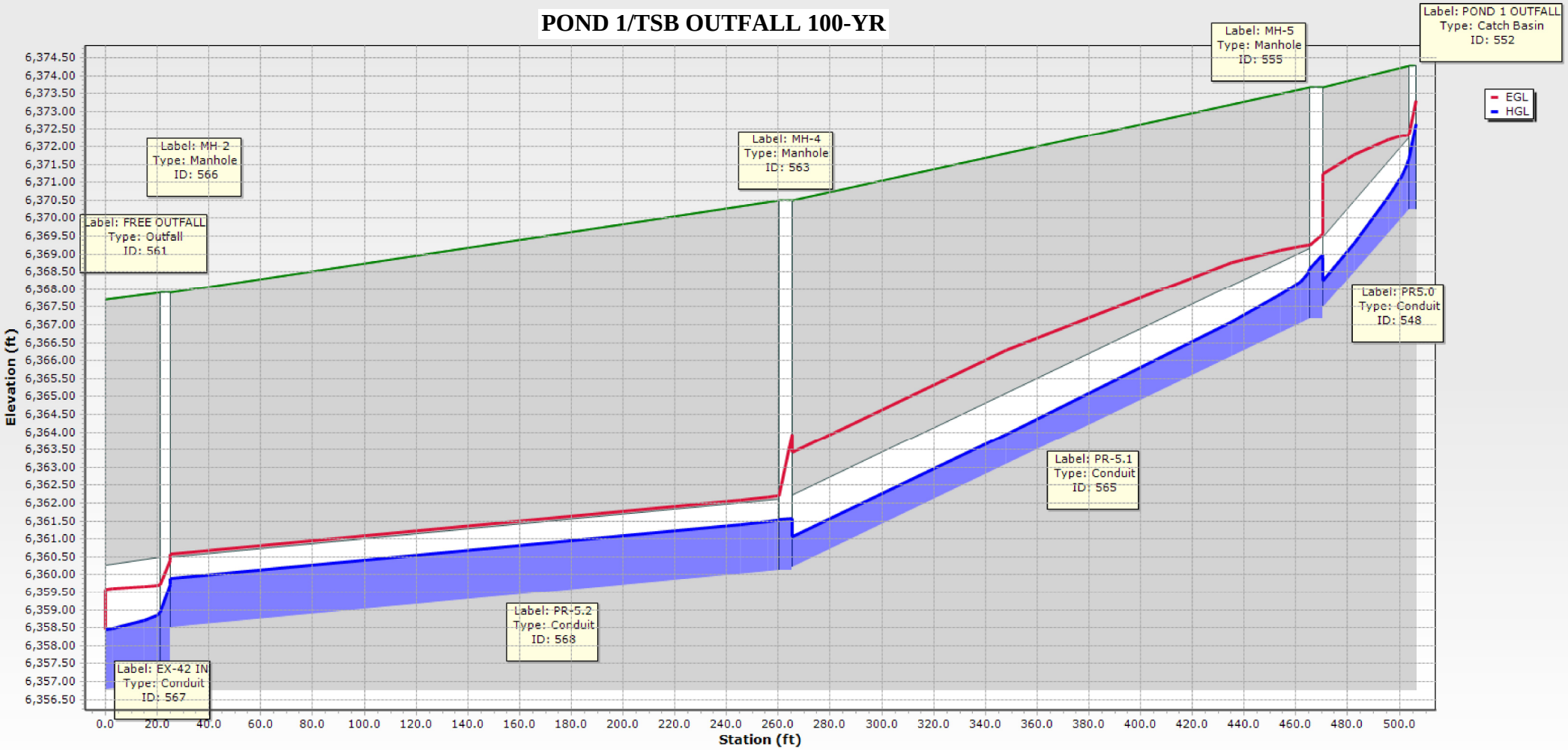


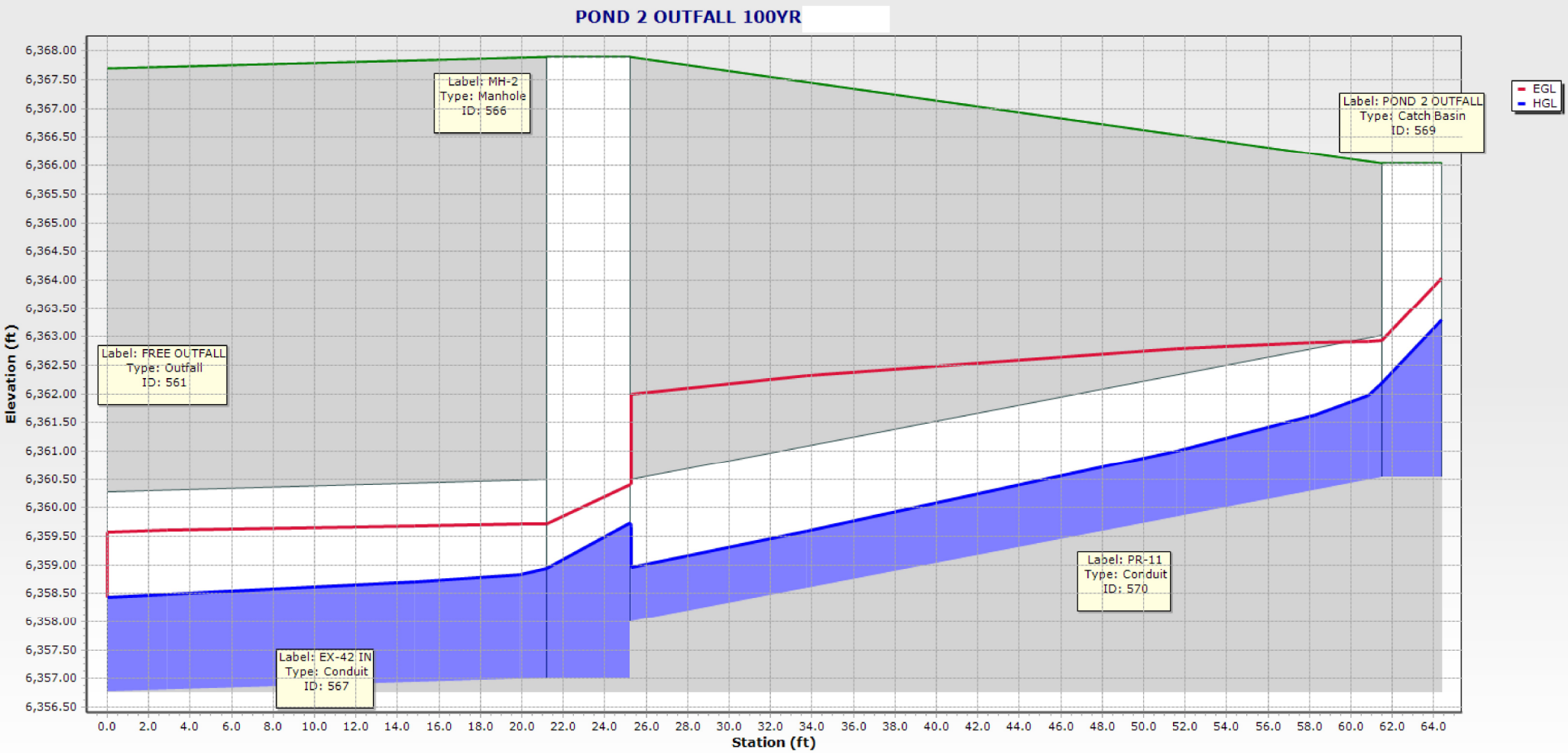
Conduit FlexTable: POND 1-2 OUTFALL 100-YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	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)
PR5.0	548	POND 1 OUTFALL	15.50	25.0	37.0	16.40	4.096	0.68	1.42	6,372.33	6,369.56	6,371.67	6,368.99	2.68	6,372.65
PR-5.1	565	MH-5	15.50	37.2	205.1	12.28	2.709	0.85	1.42	6,369.25	6,362.30	6,368.59	6,361.70	6.89	6,368.99
EX-42 IN	567	MH-2	39.30	39.2	23.2	9.78	1.603	1.52	1.95	6,360.24	6,360.10	6,359.45	6,358.95	0.50	6,360.26
PR-5.2	568	MH-4	15.50	94.9	239.6	5.92	0.832	1.55	1.42	6,362.22	6,360.95	6,361.67	6,360.29	1.38	6,361.70
PR-11	570	POND 2 OUTFALL	23.80	25.7	39.7	15.82	3.505	0.86	1.66	6,362.92	6,360.90	6,362.19	6,360.26	1.93	6,363.29

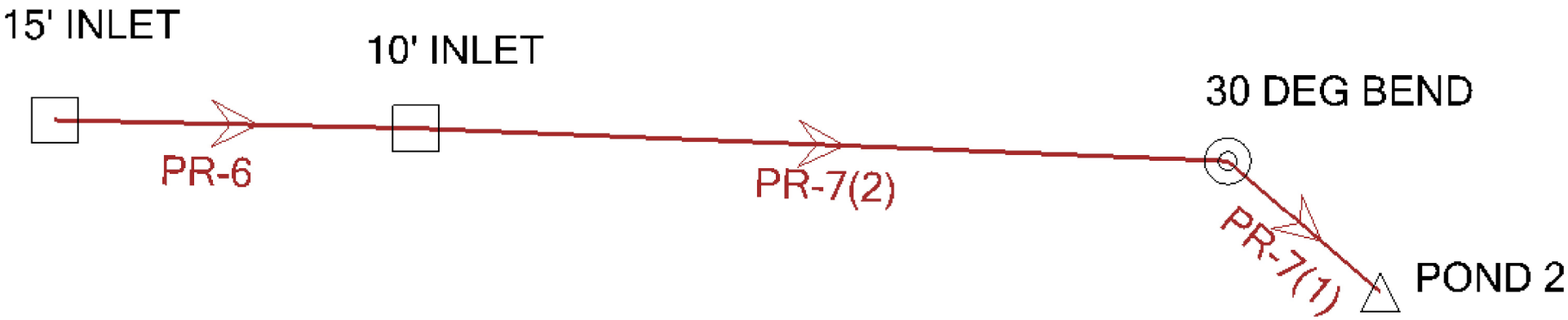
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
6.50	1.500	0.98	6,373.66	6,374.27	6,367.47	6,370.25	Circle - 24.0 in
6.05	1.000	0.40	6,370.50	6,373.66	6,360.22	6,367.17	Circle - 24.0 in
6.46	1.020	0.81	6,367.70	6,367.90	6,357.27	6,357.50	Circle - 42.0 in
6.21	0.050	0.03	6,367.90	6,370.50	6,358.87	6,360.12	Circle - 24.0 in
6.87	1.500	1.10	6,366.03	6,367.90	6,360.53	6,358.50	Circle - 30.0 in

POND 1/TSB OUTFALL 100-YR




POND 2 OUTFALL 100YR
Elevation (ft)
Station (ft)
EGL
HGL
Label: MH-2
Type: Manhole
ID: 566
Label: POND 2 OUTFALL
Type: Catch Basin
ID: 569
Label: FREE OUTFALL
Type: Outfall
ID: 561
Label: PR-11
Type: Conduit
ID: 570
Label: EX-42 IN
Type: Conduit
ID: 567

STORM 7 INDEX MAP



The flow is greater than the capacity. Revise accordingly.

Comment addressed. Note added to drainage report and construction plans for pressurized pipe requirements.

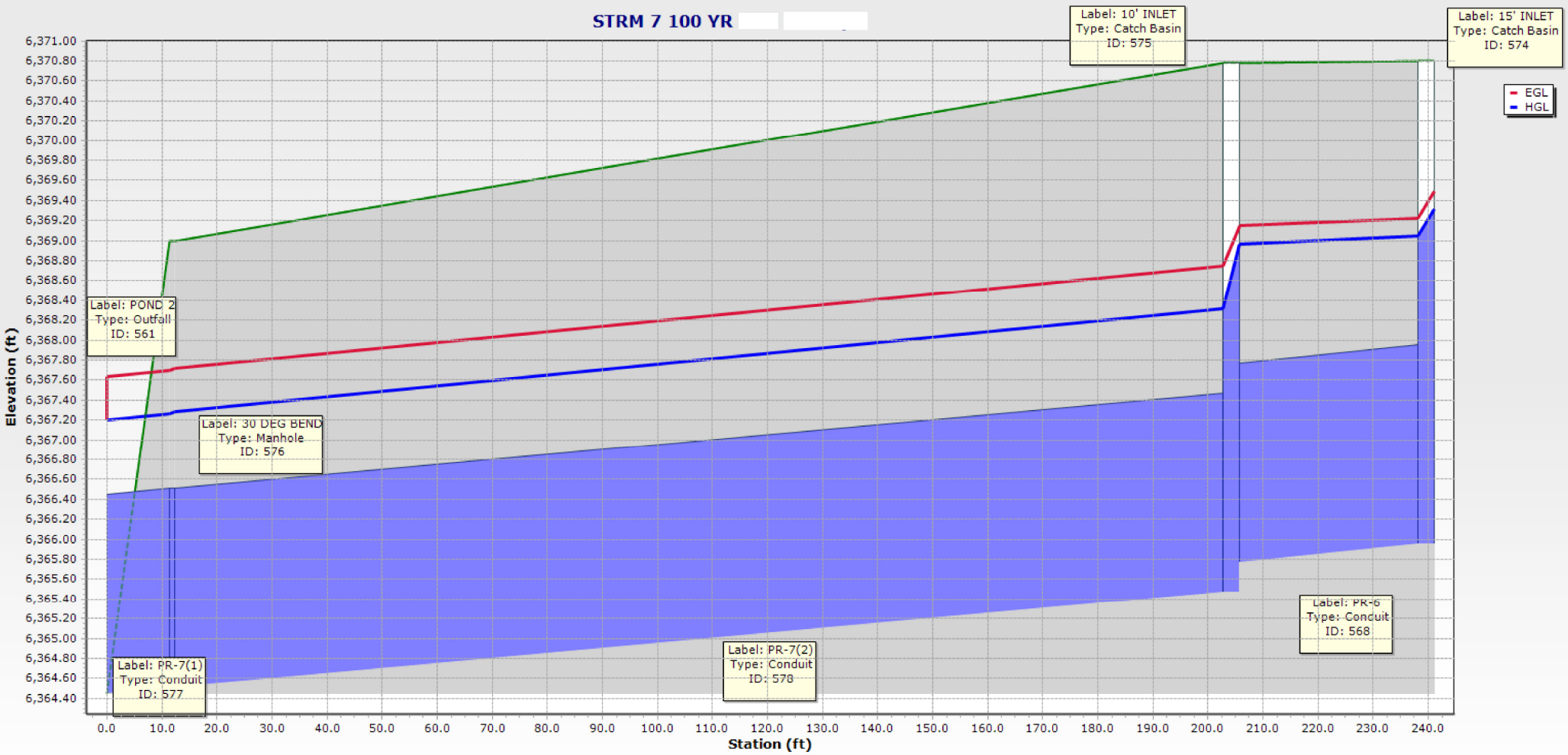
Conduit FlexTable: STRM 7 100-YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	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)
PR-6	568	15' INLET	10.60	38.3	35.3	3.37	1.798	0.86	1.17	6,369.22	6,369.15	6,369.05	6,368.97	0.08	6,369.31
PR-7(1)	577	30 DEG BEND	16.60	103.8	12.0	5.28	0.711	1.72	1.47	6,367.70	6,367.63	6,367.26	6,367.20	0.06	6,367.28
PR-7(2)	578	10' INLET	16.60	103.9	192.5	5.28	0.708	1.72	1.47	6,368.75	6,367.72	6,368.32	6,367.28	1.04	6,368.97

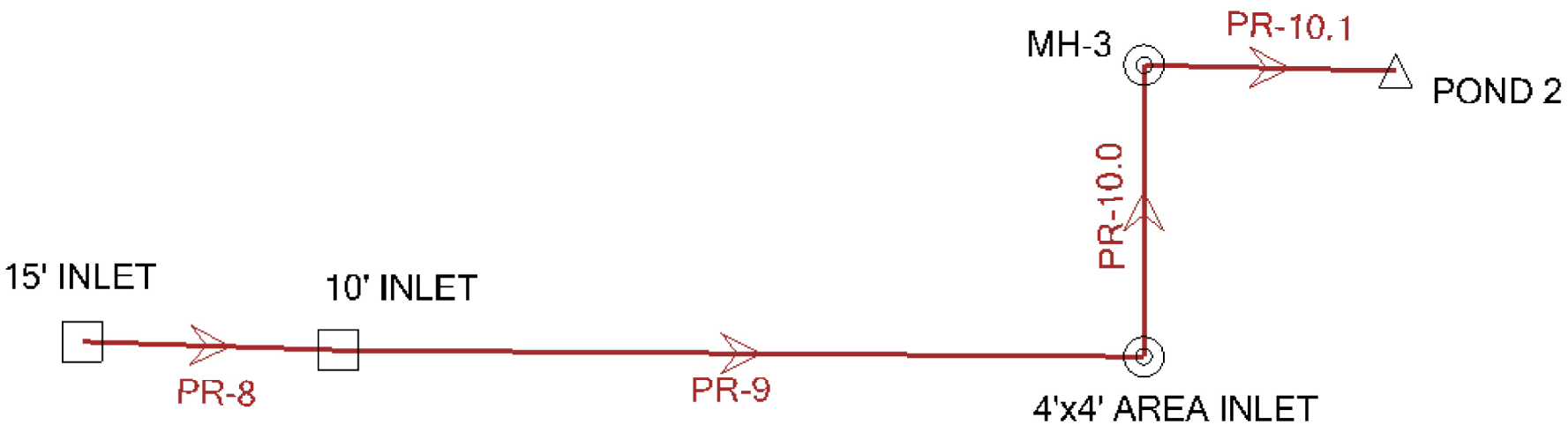
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
3.37	1.500	0.27	6,370.78	6,370.80	6,365.77	6,366.30	Circle - 24.0 in
5.28	0.040	0.02	6,364.45	6,369.00	6,364.45	6,364.51	Circle - 24.0 in
3.37	1.500	0.65	6,369.00	6,370.78	6,364.51	6,365.47	Circle - 24.0 in

Comment addressed. Pipe is 24", drainage plan revised.

Revise to match the drainage plan which shows pipe run 7 as 30"


STRM 7 100 YR
Label: 10' INLET
Type: Catch Basin
ID: 575
Label: 15' INLET
Type: Catch Basin
ID: 574
EGL
HGL
Label: POND 2
Type: Outfall
ID: 561
Label: 30 DEG BEND
Type: Manhole
ID: 576
Label: PR-7(1)
Type: Conduit
ID: 577
Label: PR-7(2)
Type: Conduit
ID: 578
Label: PR-6
Type: Conduit
ID: 568
Elevation (ft)
Station (ft)

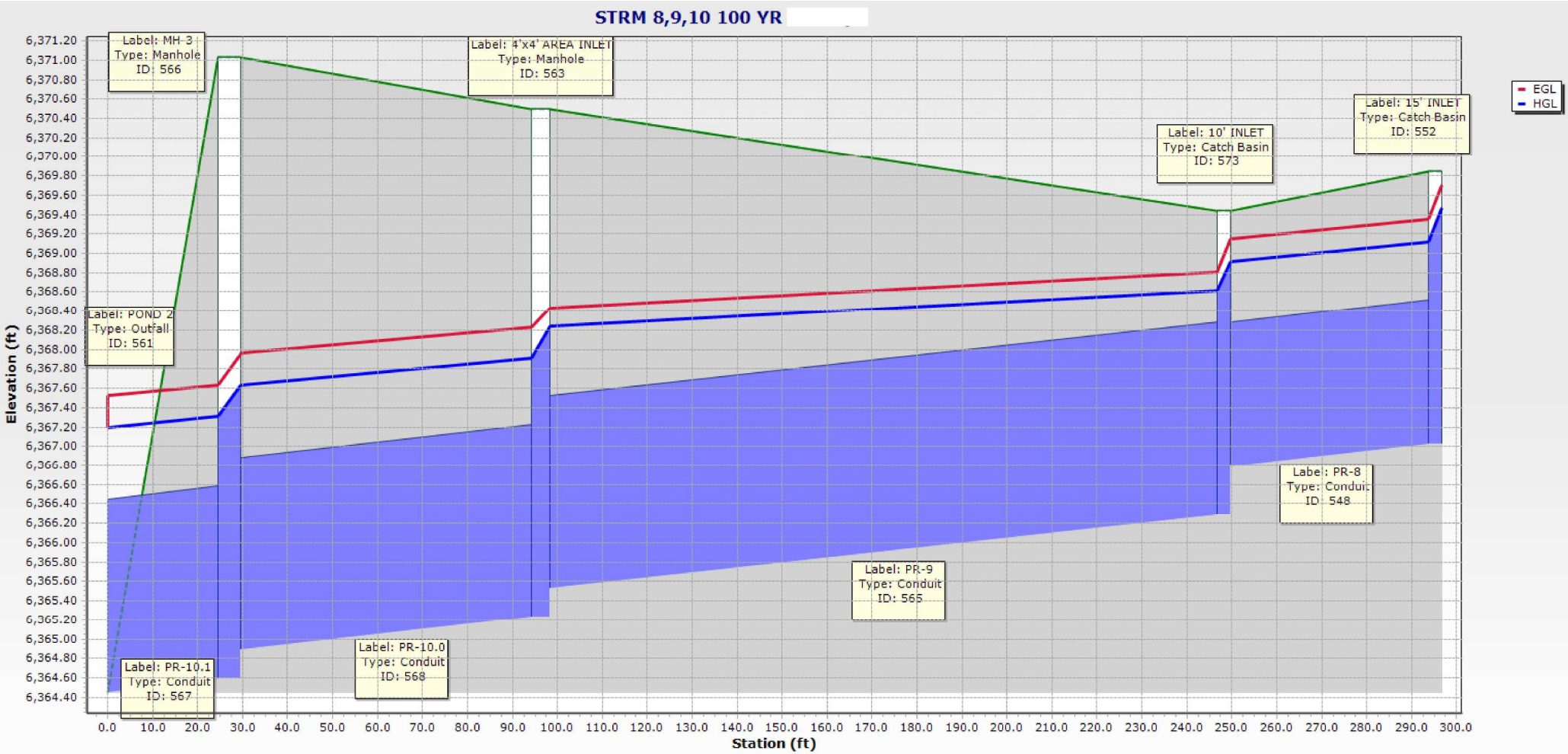
STORM 8, 9, 10 INDEX MAP



Conduit FlexTable: STRM 8,9,10 100-YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	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)
PR-8	548	15' INLET	6.90	93.9	47.0	3.90	0.776	1.15	1.02	6,369.35	6,369.15	6,369.11	6,368.91	0.20	6,369.47
PR-9	565	10' INLET	11.20	70.0	151.9	3.57	0.950	1.23	1.20	6,368.81	6,368.44	6,368.61	6,368.24	0.37	6,368.91
PR-10.1	567	MH-3	14.30	88.0	27.1	4.55	0.877	1.46	1.36	6,367.63	6,367.52	6,367.31	6,367.20	0.11	6,367.64
PR-10.0	568	4'x4' AREA INLET	14.30	90.2	69.2	4.55	0.842	1.49	1.36	6,368.24	6,367.96	6,367.91	6,367.64	0.28	6,368.24

Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
3.90	1.500	0.36	6,369.44	6,369.84	6,366.79	6,367.02	Circle - 18.0 in
3.90	1.500	0.30	6,370.50	6,369.44	6,365.53	6,366.29	Circle - 24.0 in
4.55	1.020	0.33	6,364.45	6,371.03	6,364.45	6,364.59	Circle - 24.0 in
3.57	1.020	0.33	6,371.03	6,370.50	6,364.89	6,365.23	Circle - 24.0 in


STRM 8,9,10 100 YR
Label: MH-3
Type: Manhole
ID: 566
Label: 4'x4' AREA INLET
Type: Manhole
ID: 563
Label: 10' INLET
Type: Catch Basin
ID: 573
Label: 15' INLET
Type: Catch Basin
ID: 552
Label: POND 2
Type: Outfall
ID: 561
Label: PR-10.1
Type: Conduit
ID: 567
Label: PR-10.0
Type: Conduit
ID: 568
Label: PR-9
Type: Conduit
ID: 565
Label: PR-8
Type: Conduit
ID: 548
EGL
HGL
Elevation (ft)
Station (ft)

BOCC RESOLUTION 16-426

BOCC

Chuck Broerman
11/28/2016 11:50:04 AM
Doc $0.00 2
Rec $0.00 Pages
El Paso County, CO
216137149

RESOLUTION NO. 16- 426

BOARD OF COUNTY COMMISSIONERS
COUNTY OF EL PASO, STATE OF COLORADO

Resolution Denying an Appeal by Hammers Construction LLC (APP-16-002) of the Administrative Determination made by the Planning and Community Development Department Executive Director regarding the requirement for permanent/post construction Water Quality (permanent stormwater quality best management practices or BMP's).

WHEREAS, pursuant to §§30-11-101(1)(e) and 30-11-107(1)(e), C.R.S., the Board of County Commissioners of El Paso County, Colorado (hereinafter "Board) has the legislative authority to manage the concerns of El Paso County when deemed by the Board to be in the best interests of the County and its inhabitants; and

WHEREAS, after consultation with the County Attorney's Office, the Executive Director of Planning and Community Development on August 4, 2016 issued an administrative determination finding made an administrative determination that all undeveloped lots within the Claremont Business Park are subject to installation of permanent stormwater management best management practices (BMP's) associated with development, and that the terms of a 2008 approved deviation relieving the developer of the requirements have not been met.; and

WHEREAS, an appeal of the administrative determination was filed by Hammers Construction on August 10, 2016, and a hearing date was set for September 27, 2016 to hear the appeal; and

WHEREAS, the hearing was continued to a date certain of November 22, 2016; and

WHEREAS, at the Applicant's appeal hearing on November 22, 2016, testimony from the Applicant and the Applicant's representatives was heard by the Board in favor of the appeal, testimony from representatives of Planning and Community Development Department and was presented, and such testimony and associated evidence was weighed by the Board; and

WHEREAS, the Board, having reviewed the testimony and evidence, hereby finds and determines that the requested appeal of the administrative determination by the Planning and Community Development Executive Director by the Applicant did not satisfy the criteria of approval to overturn the administrative determination.

NOW, THEREFORE, BE IT RESOLVED that the Board of County Commissioners of El Paso County, Colorado, hereby denies the appeal of the administrative determination by Hammers Construction and determines that permanent stormwater management best management practices (BMP's) are required with new development within the Claremont Business Park: and

BE IT FURTHER RESOLVED that Sallie Clark, duly elected, qualified member and Chair of the Board of County Commissioners, or Darryl Glenn, duly elected, qualified member and Vice Chair of the Board of County Commissioners, be and is hereby authorized on behalf of the Board to execute any and all documents necessary to carry out the intent of the Board as described herein.

DONE THIS 22nd day of November, 2016, at Colorado Springs Colorado.

BOARD OF COUNTY COMMISSIONERS
EL PASO COUNTY, COLORADO

By: _____
Chair of the Board

ATTEST: _____
County Clerk & Recorder

PROPOSED DRAINAGE MAP

Please place the drainage maps at the end of your report.

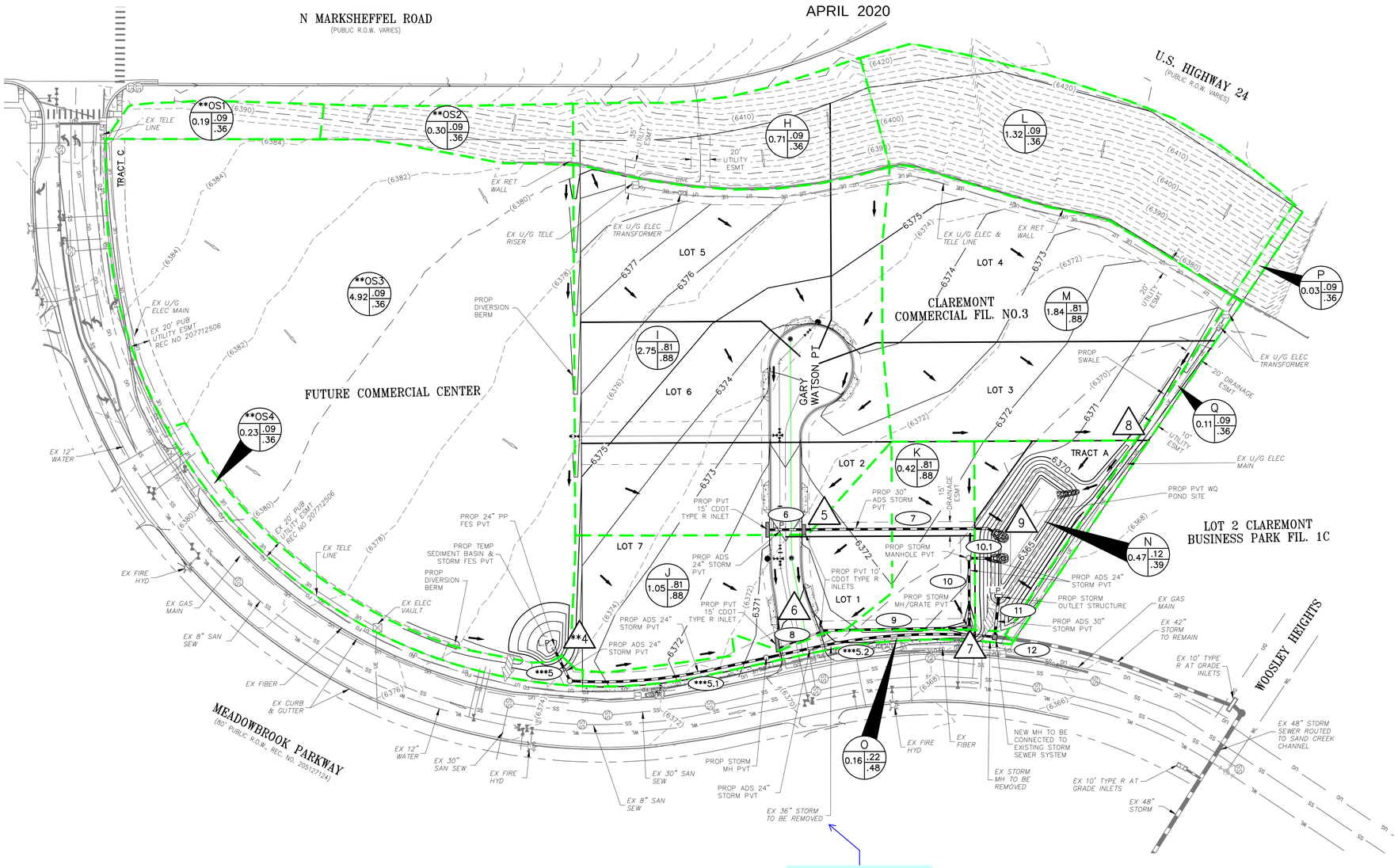
Comment addressed. At end of report.

FINAL DRAINAGE REPORT FOR
CLAREMONT COMMERCIAL FILING NO. 3

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

APRIL 2020



The narrative indicates that there is no evidence that the 36" RCP was installed. This plan indicates that there is an existing 36" storm sewer. Which is it? Please revise your narrative/plan accordingly.

Comment addressed. Narrative revised.

1" = 60'

0 30 60 120

Scale in Feet

LEGEND

- BASIN DESIGNATION — Z; 25 .25 .35; C5; ACRES; C100
- 4 — PIPE RUN REFERENCE LABEL
- 6 — SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6920 — PROP CONTOUR
- UGE — UNDERGROUND ELECTRICAL
- EXISTING GAS LINE
- STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- CROSSPAN
- INLET
- EXISTING FLOW DIRECTION ARROW
- EMERGENCY OVERFLOW DIRECTION
- FLOW DIRECTION
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
**OS1	0.19	0.1	0.6
**OS2	0.3	0.1	1.0
**OS3	4.92	1.6	10.7
**OS4	0.23	0.1	0.7
H	0.71	0.3	2.0
I	2.75	9.8	17.9
J	1.05	4.4	8.0
K	0.42	1.8	3.2
L	1.32	0.5	3.7
M	1.84	6.7	12.2
N	0.47	0.2	1.3
O	0.16	0.2	0.6
P	0.03	0.0	0.1
Q	0.11	0.0	0.3

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
**4	1.8	11.8	**OS1,**OS2,**OS3	24" PP & FES
5	10.1	19.8	H, I	10'/15' INLETS
6	4.4	11.2	J, FBDP5	10'/15' INLETS
7	1.8	3.2	K	CDOT TYPE C INLET W/GRATE
8	7.2	15.7	L, M	24" PP OR SWALE
9	23.0	46.3	DP8, 7,10.1, N	POND 2

STORM SEWER SUMMARY				
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING DP/BASIN/PIPES
***5	7.2	15.5	24"	**DP4
***5.1	7.2	15.5	24"	***PR5
***5.2	7.2	15.5	24"	***PR5.1
6	6.4	10.6	24"	INLET 1
7	10.1	16.6	24"	PR6, INLET 2
8	2.8	6.9	18"	INLET 3
9	4.4	11.0	24"	PR8, INLET 4
10	6.2	14.3	24"	PR9, DP7
10.1	6.2	14.3	24"	PR10
11	13.2	23.8	30"	POND 2 OUTFALL
12	20.4	39.3	EX42"	***PR5.2, PR11

**EXISTING UNDEVELOPED
***ULTIMATE BUILD OUT, DEVELOPED. USED TO SIZE FUTURE POND 1 AND STORM SEWER.

SF WQCV POND 2 SUMMARY	
EPC/URBAN DRAINAGE SAND FILTER BASIN–SEE STD. DET.	
AREA REQUIRED	2,962 SF
AREA PROVIDED	3,040 SF

SF ELEV = 6364.45
WQCV WSE = 6366.02
100 YR SPILLWAY ELEV = 6367.74
100 YR WSE = 6367.20

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.
102 E. PIKES PEAK AVE., 5TH FLOOR
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

CLAREMONT COMMERCIAL FIL. NO. 3

PROP. DRAINAGE W/OFFSITE UNDEVELOPED

PROJECT NO. 44-037A | FILE: \dwg\Eng Exhibits\44037-FDRM-1.dwg

DESIGNED BY: ET | DRAWN BY: CLP | CHECKED BY: VAS | SCALE HORIZ: 1"=60' VERT: N/A | DATE: 05-05-2020 | SHEET 1 OF 2 | FDM01

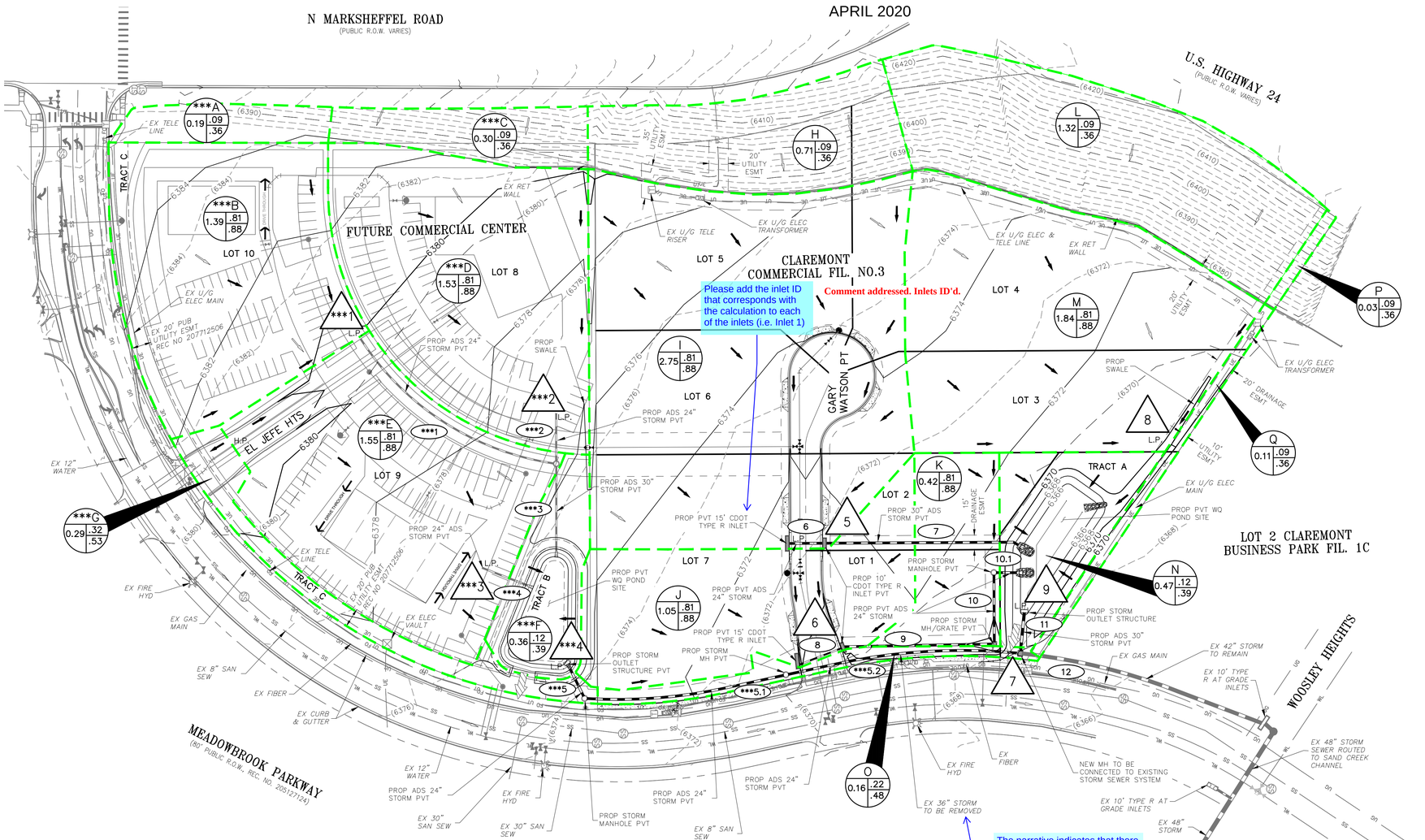
File: G:\44037A-CDP F2-Lots 1-8\44037A-CDP F2-Lots 1-8\dwg\Eng Exhibits\FDR MAP 3-30-20\44037-FDRM-1.dwg Plotstamp: 5/5/2020 4:11 PM

FINAL DRAINAGE REPORT FOR CLAREMONT COMMERCIAL FILING NO. 2

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

APRIL 2020



Please add the inlet ID that corresponds with the calculation to each of the inlets (i.e. Inlet 1)

Comment addressed. Inlets ID'd.

The narrative indicates that there is no evidence that the 36" RCP was installed. This plan indicates that there is an existing 36" storm sewer. Which is it? Please revise your narrative/plan accordingly.

Comment addressed. Narrative revised. Also ex. 30" to be removed.

FYI: Pushing infrastructure such as Pond 1 and the associated drainage facilities on the northern portion of the site to a future site development as opposed to the final plat stage is not typically allowed. We will discuss with the Director and Engineering manager as to whether or not this will be allowed. You will be informed of the decision that is made.

Comment addressed. This issue has been resolved.

LEGEND

- BASIN DESIGNATION — Z; 25 (ACRES); .25 (C5); .35 (C100)
- 4 / 6 — PIPE RUN REFERENCE LABEL / SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6920 — PROP CONTOUR
- UGE — UNDERGROUND ELECTRICAL
- EXISTING GAS LINE
- STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- CROSSPAN
- INLET
- EXISTING FLOW DIRECTION ARROW
- EMERGENCY OVERFLOW DIRECTION
- FLOW DIRECTION
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
***A	0.19	0.1	0.6
***B	1.39	5.5	10.1
***C	0.3	0.1	1.0
***D	1.53	6.3	11.5
***E	1.55	6.5	11.8
***F	0.36	0.2	1.0
***G	0.29	0.5	1.3
H	0.71	0.3	2.0
I	2.75	9.8	17.9
J	1.05	4.4	8.0
K	0.42	1.8	3.2
L	1.32	0.5	3.7
M	1.84	6.7	12.2
N	0.47	0.2	1.3
O	0.16	0.2	0.6
P	0.03	0.0	0.1
Q	0.11	0.0	0.3

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
***1	5.6	10.6	***A, ***B	24" PP
***2	6.4	12.4	***C, ***D	24" PP
***3	6.5	11.8	***E	24" PP
***4	18.2	35.0	***F, ***3, ***4	POND 1
5	10.1	19.8	H, I	10'/15' INLETS
6	4.4	11.2	J, FBDP5	10'/15' INLETS
7	1.8	3.2	K	MH W/GRATE
8	7.2	15.7	L, M	24" PP OR SWALE
9	23.0	46.3	DP8, 7,10.1, N	POND 2

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING DP/BASIN/PIPES
***1	5.6	10.6	24"	***DP1
***2	6.4	12.4	24"	***DP2
***3	11.8	22.6	30"	***PR1, ***PR2
***4	6.5	11.8	24"	***DP3
***5	7.2	15.5	24"	POND 1 OUTFALL
***5.1	7.2	15.5	24"	***PR5
***5.2	7.2	15.5	24"	***PR5.1
6	6.4	10.6	24"	INLET 1
7	10.1	16.6	30"	PR6, INLET 2
8	2.8	6.9	18"	INLET 3
9	4.4	11.0	24"	PR8, INLET 4
10	6.2	14.3	24"	PR9, DP7
10.1	6.2	14.3	24"	PIPE 10
11	13.2	23.8	30"	POND 2 OUTFALL
12	20.4	39.3	EX42"	***PR5.2, PR11

***ULTIMATE BUILD OUT, DEVELOPED, DESIGNED TO SIZE FUTURE POND 1 AND STORM SEWER.

SF WQCV POND 1 SUMMARY

EPC/URBAN DRAINAGE SAND FILTER BASIN–SEE STD. DET.	
AREA REQUIRED	2,335 SF
AREA PROVIDED	3,690 SF

SF ELEV = 6373.00
WQCV WSE = 6374.26
100 YR SPILLWAY ELEV = 6375.00
100 YR WSE = 6374.94

SF WQCV POND 2 SUMMARY

EPC/URBAN DRAINAGE SAND FILTER BASIN–SEE STD. DET.	
AREA REQUIRED	2,962 SF
AREA PROVIDED	3,040 SF

SF ELEV = 6364.45
WQCV WSE = 6366.02
100 YR SPILLWAY ELEV = 6367.74
100 YR WSE = 6367.20

1" = 60'

0 30 60 120
Scale in Feet

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
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M&S CIVIL CONSULTANTS, INC.
102 E. PIKES PEAK AVE., 5TH FLOOR
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

CLAREMONT COMMERCIAL FIL. NO. 2

PROP. DRAINAGE OFFSITE DEVELOPED

PROJECT NO. 44-037A	FILE: \dwg\Eng Exhibits\44037-FDRM-2.dwg		
DESIGNED BY: ET	SCALE	DATE: 05-05-2020	
DRAWN BY: CLP	HORIZ: 1"=60'	SHEET 2 OF 2	FDM02
CHECKED BY: VAS	VERT: N/A		

File: O:\44037A-CBP F2-Lots 1-8\44037A-CBP F2-Lots 1-8\dwg\Eng Exhibits\FDR MAP 3-30-20\44037-FDRM-2.dwg Plotstamp: 5/6/2020 4:21 PM

EXCERPT OF "FINAL DRAINAGE REPORT FOR CLAREMONT BUSINESS PARK FIL NO. 2 ", BY MATRIX DESIGN DATED NOVEMBER 2006

&

EXISTING DRAINAGE MAP

NEW DOC

FINAL DRAINAGE REPORT

For

"Claremont Business Park Filing No. 2"

Prepared for:
El Paso County
Department of Public Works
Engineering Division

On Behalf of:
Claremont Development, Inc.

Prepared by:

Matrix Design Group, Inc.
Integrated Design Solutions
Infrastructure Engineering
Community Development
Program Management

2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
(719) 575-0100
fax (719) 572-0208

Revised November 2006

05.151.006

Engineer's Statement:

The *revisions* (changes made to the base Final Drainage Report since July, 2006) to the attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. The revisions encompassed adding additional right of way to the study area at the County's request, the handling of offsite drainage due to the additional right of way, a breakdown of private drainage within lot numbers 10 through 25 of Filing No. 2 due to cross-lot drainage (contrary to note # 25 on the recorded plat), profiling additional inlets along the channel edge, and rip-rap sizing for outlet structures along the channel. The Final Drainage Report dated July, 2006 was prepared under the direct supervision of Richard G. Gallegos, Jr. in July, 2006 and stamped (see next sheet).

The Final Drainage Report was prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing the *revisions* to this report.

Brady A. Shyrock
Registered Professional Engineer
State of Colorado
No. 38164

SEAL

Engineer's Statement:

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

SEAL

Richard G. Gallegos, Jr.
Registered Professional Engineer
State of Colorado
No. 36247

Developer's Statement:

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

Claremont Development, Inc.
Business Name

By: _____

Title: _____
Address: 3460 Capital Drive
Colorado Springs, CO 80915

El Paso County:

Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

For Mr. John McCarty, County Engineer/Director — Date 4/23/07

Conditions:

D. Drainage and Bridge Fees

Claremont Business Park Filing No. 2 has not been previously platted. The drainage basin and bridge fees have been determined per the El Paso County Drainage Basin Fees Sheet, dated February 3, 2006, Resolution No. 06-31. The site is located entirely within the Sand Creek Drainage Basin. The fees are based upon the percent impervious of the development, which have been included within the appendix of this report. The fees due have been calculated as follows.

Claremont Business Park Filing No. 2
Final Drainage Report
Drainage and Bridge Fees

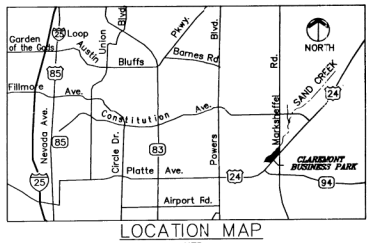
	Area (ac.)	Fee/Imp. Acre	% Imp.	Fee Due	Reimbursable Const. Costs	Fee Credit	Fee Due at Platting	Fee Credit Remaining
Drainage Fee	62.967	$15,000.00	80%	$755,604.00	$0.00	$1,225,355.45	$0.00	$469,751.45
Bridge Fee	62.967	$1,503.00	80%	$75,711.52	$75,711.52	$0.00	$0.00	$0.00
						Total Fee Due at Platting	***$0.00***	

The developer of Claremont Business Park is completing the construction of the channel improvements on behalf of the Central Marksheffel Metropolitan District. The construction costs for both Filing 1 and Filing 2 combined exceed the drainage fees due for the site. No drainage fees will be required at the time of platting.

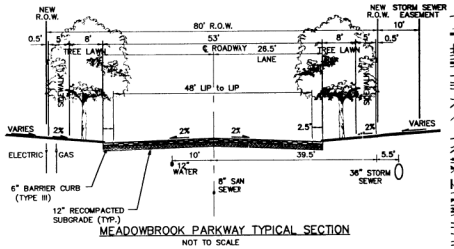
It should be noted that the Central Marksheffel Business District is reimbursing the developer of Claremont Business Park Filing 2 for the construction costs of the channel minus the drainage fees due for the site. The District has $1,225,355.45 of drainage credits available within the Sand Creek Basin. This credit amount is based upon the construction cost estimate for the channel minus the drainage fees assessed for Claremont Business Park Filing No. 1. The District will use an additional $755,604.00 of the drainage credits for the platting of Claremont Business Park Filing No. 2. The District will have $469,751.45 of drainage credits left within the Sand Creek Fee basin.

The Central Marksheffel Business District has also constructed the Marksheffel Road Bridge over East Fork Sand Creek. This structure has been identified as a needed public improvement within the Drainage Basin Planning Study for Sand Creek and is eligible for reimbursement. Since the construction of the Marksheffel Bridge is in excess of the $75,711.52 in bridge fees due for this site, no bridge fees are required at the time of platting. The fee will be deducted from the eligible reimbursable construction costs of the bridge and the remaining credits will be utilized or reimbursement applied for by the Central Marksheffel Business District.

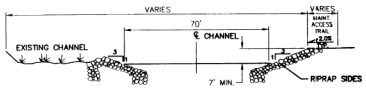
DRAINAGE PLAN
CLAREMONT BUSINESS PARK FILING NO. 2



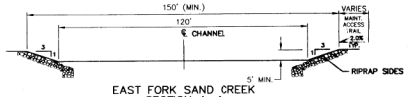
LOCATION MAP
NTS



MEADOWBROOK PARKWAY TYPICAL SECTION
NOT TO SCALE

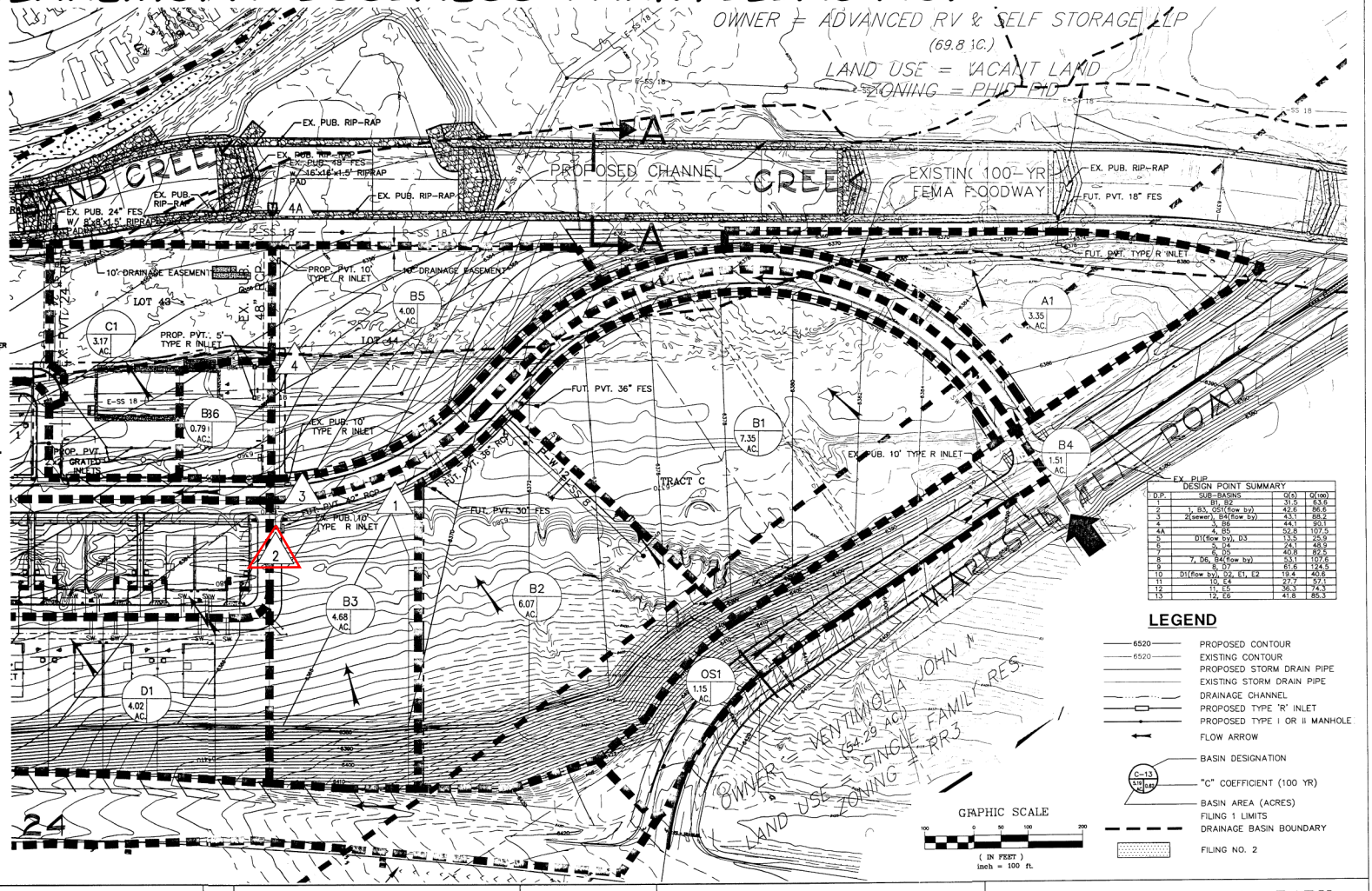


EAST FORK SAND CREEK
SECTION B-B
N.T.S.
FOR INFORMATION ONLY



EAST FORK SAND CREEK
SECTION A-A
N.T.S.
FOR INFORMATION ONLY

NOTE:
CONSTRUCTION OF THE EAST FORK SAND CREEK CHANNEL IMPROVEMENTS WILL BE REQUIRED TO REMOVE A PORTION OF CLAREMONT BUSINESS PARK FILING No. 1 FROM THE EXISTING 100-YEAR FLOODPLAIN (PER FEMA FLOOD INSURANCE RATE MAPS 752F AND 756F)



DESIGN POINT SUMMARY			
D.P.	SUB-BASINS	Q(5)	Q(100)
1	B1, B2	31.5	63.6
2	1, B3, OS1(flow by)	42.6	86.6
3	2(sewer), B4(flow by)	43.1	88.2
4	3, B6	44.1	90.1
4A	4, B5	52.8	107.5
5	D1(flow by), D3	12.5	25.5
6	5, D4	24.1	48.9
7	6, D5	40.8	82.5
8	7, D6, B4(flow by)	53.1	107.6
9	8, D7	61.6	124.5
10	D1(flow by), D2, E1, E2	19.4	40.6
11	10, E4	27.7	57.1
12	11, E5	36.3	74.3
13	12, E6	41.8	85.3

LEGEND

- 6520 — PROPOSED CONTOUR
- 6520 — EXISTING CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- DRAINAGE CHANNEL
- PROPOSED TYPE 'R' INLET
- PROPOSED TYPE I OR II MANHOLE
- FLOW ARROW
- BASIN DESIGNATION
- "C" COEFFICIENT (100 YR)
- BASIN AREA (ACRES)
- FILING 1 LIMITS
- DRAINAGE BASIN BOUNDARY
- FILING NO. 2

REFERENCE DRAWINGS
X-BASE-04 052.001
x-util
X-TOPO
X-ROAD
X-BASE
X-TOPO-09-01-05-bas

NO.	DATE	DESCRIPTION	BY
		REVISIONS	

BENCHMARK DATA(ELEV.)
(DATUM)
(DESCRIPTION/LOCATION)

C:\Documents and Settings\rich_gallegos\My Documents\05.151.036(FILING 2)\Matrix Resources\302-FDR\DR01-02.dwg
PLOT DATE: Mar 02, 2007 9:29am

SUBDIVIDER
HAMMERS CONSTRUCTION INC.
3460 CAPITAL DRIVE
COLORADO SPRINGS, CO 80915-9710

FOR AND ON BEHALF OF
MATRIX DESIGN GROUP, INC.

Matrix Design Group, Inc.
Integrated Design Solutions 2435 Research Parkway, Suite 30
Colorado Springs, CO 80920
Phone 719-575-030
Fax 719-575-028

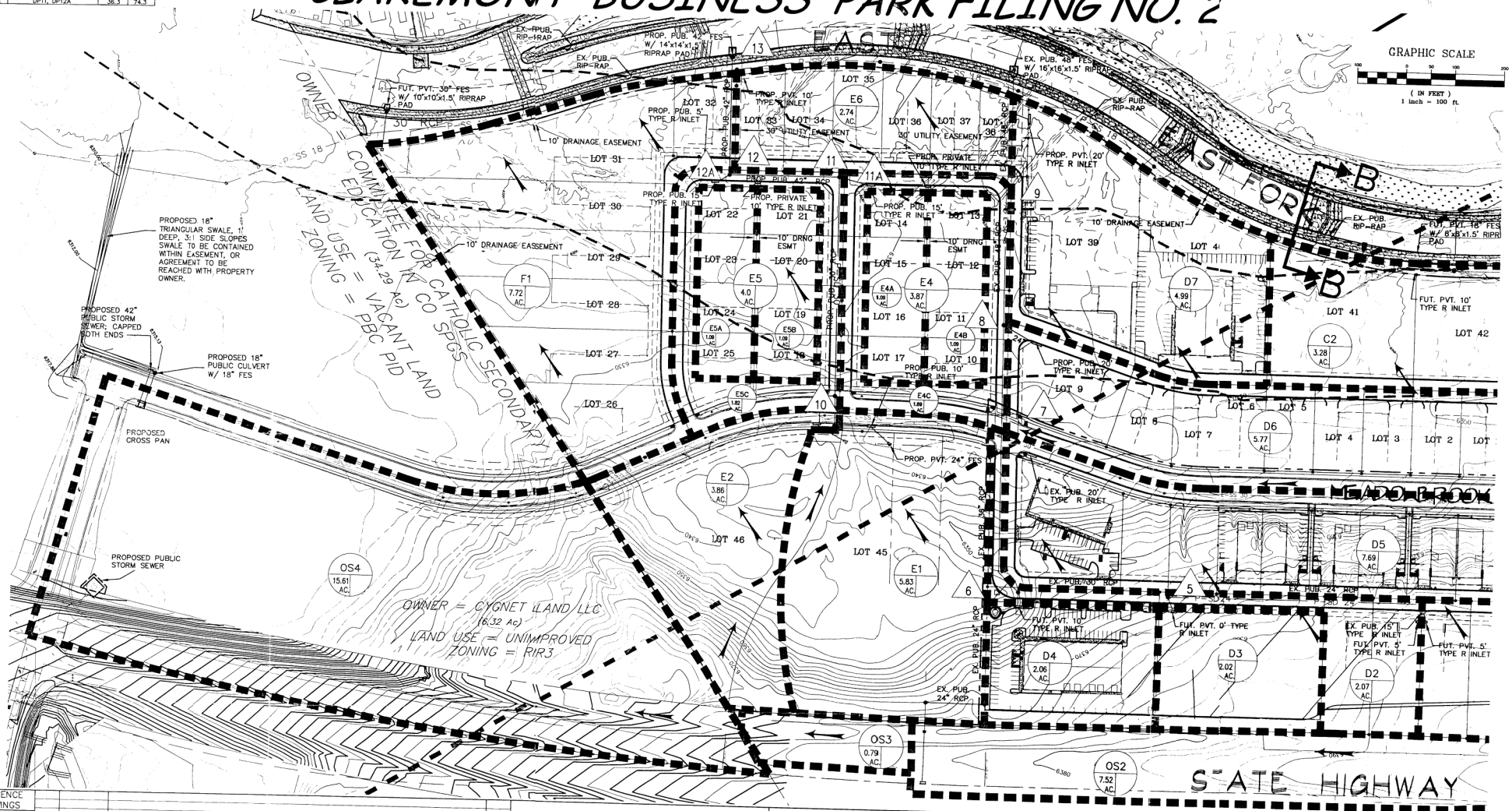
CLAREMONT BUSINESS PARK
FINAL DRAINAGE PLAN
MASTER DEVELOPMENT DRAINAGE PLAN
FINAL DRAINAGE PLAN
FILING NO. 2

DESIGNED BY: RGG	SCALE	DATE ISSUED: SEPTEMBER 2006	DR01
DRAWN BY: GES	HORIZ: 1"= 100'		
CHECKED BY: JPL	VERT: N/A	SHEET NO. 1 OF 2 SHEETS	

DRAINAGE PLAN
CLAREMONT BUSINESS PARK FILING NO. 2

1

DESIGN POINT SUMMARY			
D.P.	SUB-BASINS	Q(5)	Q(100)
11A	E4A, E4B, E4C	11.5	23.0
11	DP10, DP11A	27.7	57.1
12A	E5A, E5B, E5C	11.7	23.5
12	DP11, DP12A	36.3	74.3



REFERENCE DRAWINGS
X-BASE-04.052.001
x-util
X-TOPO
X-ROAD
X-BASE
X-TOPO-09-01-05-bas

NO.	DATE	DESCRIPTION	BY

REVISIONS

C:\Documents and Settings\rich_gallegos\My Documents\05.151.006(FILIN:22 Resources\302-FDR\
DR02-revised-02-19-07.dwg
PLOT DATE: Mar 02, 2007 8:44am

BENCHMARK DATA(ELEV.) _____
(DATUM) _____
(DESCRIPTION/LOCATION) _____

SUBDIVIDER

HAMMERS CONSTRUCTION INC.
3460 CAPITAL DRIVE
COLORADO SPRINGS, CO 80915-9710

FOR AND ON BEHALF OF
MATRIX DESIGN GROUP, INC.

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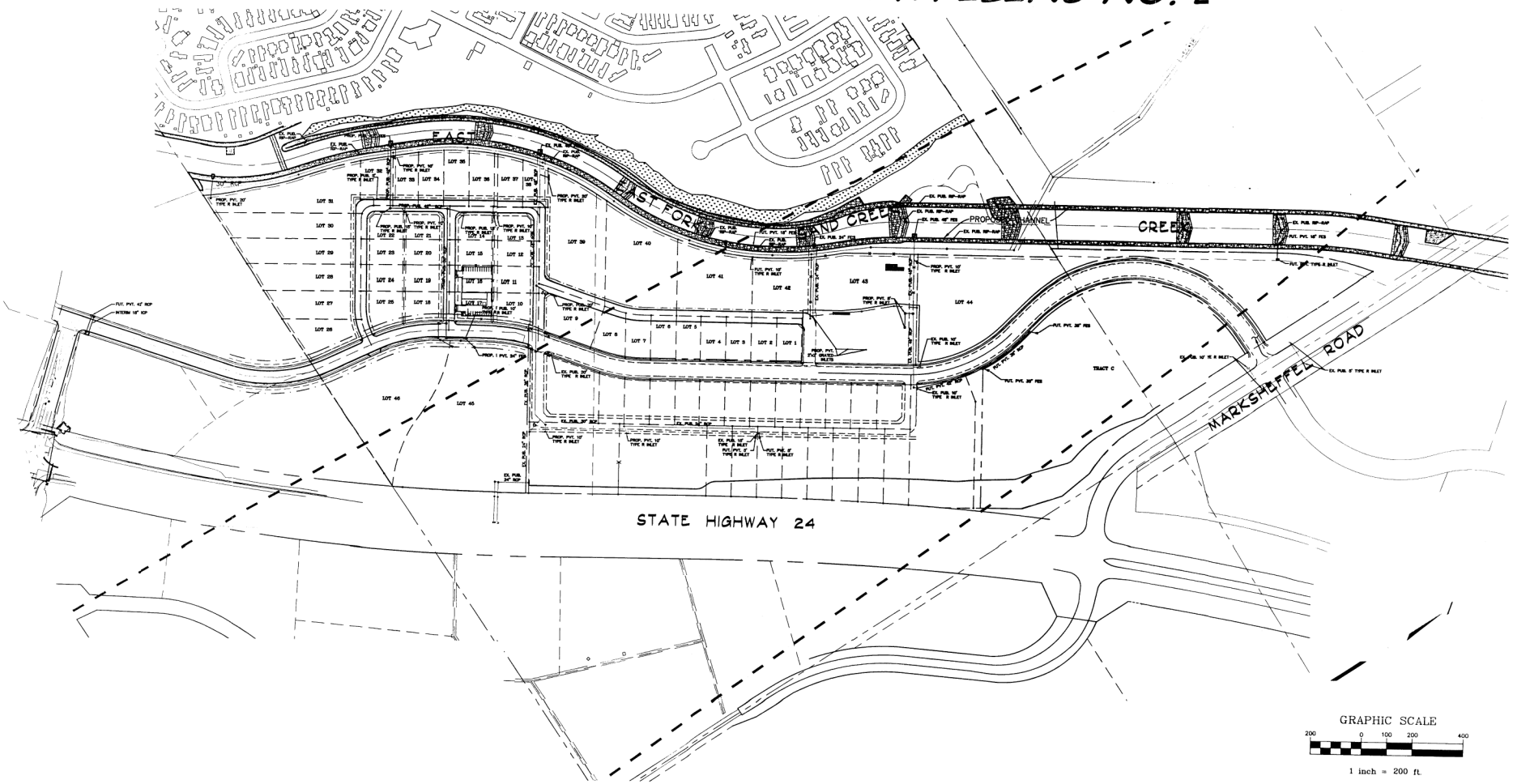
CLAREMONT BUSINESS PARK

REVISED FINAL DRAINAGE PLAN

MASTER DEVELOPMENT DRAINAGE PLAN
REVISED FINAL DRAINAGE PLAN
FILING NO. 2

DESIGNED BY: RGG	SCALE	DATE ISSUED: FEBRUARY 2007	
DRAWN BY: BAS	HORIZ: 1" = 100'		
CHECKED BY: JPL	VERT: N/A	SHEET NO. 1 OF 1 SHEETS	DR02

STORM DRAINAGE DESIGNATION PLAN
CLAREMONT BUSINESS PARK FILING NO. 2



REFERENCE DRAWINGS	NO.	DATE	DESCRIPTION	BY
x-title x-util X-BASE			REVISIONS	

NAME: C:\Documents and Settings\rich_gallegos\My Documents\05.151.006 (Claremont) Water Resources\302-FDR\SD-EXHIBIT.dwg
PCP: Matrix.ctb
PLOT DATE: Mar 07, 2007 8:19am

BENCHMARK DATA(ELEV.) _____
(DATUM) _____
(DESCRIPTION/LOCATION) _____

SUBDIVIDER:
HAMMERS CONSTRUCTION, INC.
3460 CAPITIAL DRIVE
COLORADO SPRINGS, CO 80915

FOR AND ON BEHALF OF
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CLAREMONT BUSINESS PARK FILING NO. 2

STORM DRAINAGE DESIGNATION PLAN
FILING NO. 2

DESIGNED BY: BAS	SCALE	DATE ISSUED: JANUARY, 2007	EXH01
DRAWN BY: BAS	HORIZ. 1 = 200'	SHEET NO. 1 OF 1 SHEETS	
CHECKED BY: RGG	VERT. N/A		