INNOVATIVE DESIGN. CLASSIC RESULTS.

Engineering Review

07/06/2021 8:29:48 PM
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EPC Planning & Community Development Department

See comment letter also

PCD-ENGINEERING REVIEW COMMENTS IN BLUE BOXES WITH BLUE TEXT

CCES Responses in Red

FINAL DRAINAGE REPORT FOR RETREAT AT TIMBERRIDGE FILING NO. 2

Prepared for:
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Job No. 1185.20

PCD Project No. SF-21-XXX

FINAL DRAINAGE REPORT FOR
RETREAT AT TIMBERRIDGE FILING NO. 2

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

_____ _____

Marc A. Whorton Colorado P.E. #37155 Date

OWNER'S/DEVELOPER'S STATEMENT:
I, the owner/developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: TIMBERRIDGE DEVELOPMENT GROUP, LLC

By: _____

Title: _____

Address: 2138 Flying Horse Club Drive

Colorado Springs, CO 80921

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

_____ _____

For County Engineer, / ECM Administrator Date

Conditions:

FINAL DRAINAGE REPORT FOR
RETREAT AT TIMBERRIDGE FILING NO. 2

TABLE OF CONTENTS:

PURPOSE	Page 1
GENERAL DESCRIPTION	Page 1
EXISTING DRAINAGE CONDITIONS	Page 1
PROPOSED DRAINAGE CONDITIONS	Page 5
DETENTION/SWQ FACILITIES	Page 16
SAND CREEK CHANNEL IMPROVEMENTS	Page 16
DRAINAGE CRITERIA	Page 22
FLOODPLAIN STATEMENT	Page 24
DRAINAGE AND BRIDGE FEES	Page 24
SUMMARY	Page 26
REFERENCES	Page 28

APPENDICES

VICINITY MAP

SOILS MAP (WEB SOIL SURVEY)

F.E.M.A. MAP / LOMR (08-08-0541P)

RECOMMENDATIONS PER SAND CREEK DBPS

HYDROLOGIC / HYDRAULIC CALCULATIONS

STORMWATER QUALITY / DETENTION POND CALCULATIONS

HEC-RAS CALCULATIONS

DRAINAGE MAPS

SECTION 404 PERMITTING / WETLAND IMPACT MAP (CORE Consultants)

PURPOSE

The purpose of this Final Drainage Report is to address on-site and off-site drainage patterns and identify specific drainage improvements and facilities required to minimize impacts to the adjacent properties.

GENERAL DESCRIPTION

The Retreat at TimberRidge Filing No. 2 is 75.829-acre site located in portions sections 27 and 28, township 12 south, range 65 west of the sixth principal meridian. The site is bounded on the north by future development phases within the TimberRidge property, to the south, east and west by Sterling Ranch property (zoned for future urban development), TimberRidge Filing No. 1 and Vollmer Road. The site is in the upper portion of the Sand Creek Drainage Basin. Both large lot rural single family residential and urban single family residential are proposed in this Filing.

The average soil condition reflects Hydrologic Group "B" (Pring coarse sandy loam and Kettle gravelly loamy sand) as determined by the "Web Soil Survey of El Paso County Area," prepared by the Natural Resources Conservation Service (see map in Appendix).

EXISTING DRAINAGE CONDITIONS

The Retreat at TimberRidge Filing No. 2 property is located in the upper portion of the Sand Creek drainage basin on the south edge of Black Forest. Nearly the entire site, other than the Sand Creek corridor, is mainly covered with native grasses with few or no pine trees. The Sand Creek channel bisects the site in a north-south direction. A wetlands delineation was prepared by CORE Consultants, Inc., which included the entire TimberRidge property and submitted along with Filing No. 1. (See Appendix) This document reflects some wetlands throughout the Sand Creek channel. Any effect on these wetlands within jurisdictional waters will be described later in this report along with the appropriate permitting.

Portions of this site have been previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Engineering Corporation, March 1996. The portion of Sand Creek that traverses the site is defined as Reach SC-9 in the DBPS. 1000+ acres north of this property is tributary to this reach of the channel. (See Off-site Drainage Map in Appendix)

According to the DBPS, this reach of Sand Creek all contained within the channel has the following flow characteristics: Q_{10} = 630 cfs Q_{100} = 2170 cfs. However, the 100 yr. flow recognized by FEMA in the LOMR 08-08-0541P with effective date of July 23, 2009, equals nearly Q_{100} = 2600 cfs. Also, Sterling Ranch has finalized their MDDP which includes modeling of this property as well as the large acreage north up to the top of the Sand Creek Basin. The MDDP proposes developed flows within Sand Creek that are significantly lower than both the DBPS and FEMA currently show. These flows are as follows: At Arroya Lane crossing Q_{10} = 430 cfs Q_{100} = 1487 cfs and TimberRidge south property line Q_{10} = 452 cfs Q_{100} = 1523 cfs. Even with the County approval of the MDDP and these adjusted flows, a CLOMR/LOMR will be required to be prepared, submitted and approved by FEMA prior to utilizing these flows in any Final Drainage Reports within this development. Based on the anticipated 12-18 month timing of the CLOMR/LOMR process, this development will continue to utilize the much larger FEMA recognized flows for all proposed channel improvements through this property, including the culvert crossing at Poco Road. This is how Filing No. 1 was developed as well.

The majority of these off-site flows enter the property at the north end of the site conveying flows from the northwest (Black Forest area) and the off-site stock ponds to the north (both tributary to hundreds of acres of property in Black Forest). There are multiple existing culvert crossings of Vollmer Rd. just north of Arroya Lane to facilitate these historic flow patterns. The following are the few key culverts that directly feed the Sand Creek channel north of Arroya Lane: Approximately 1,000 feet north of Arroya Lane, an existing 36" CMP crosses Vollmer Road (Basin SC-1 on Off-site Drainage Map). A small basin and natural ravine just west of Vollmer feeds this facility. From a recent field visit, this small facility seems to be in good working condition, however, not labeled in the DBPS. Another 700 feet+ north along Vollmer a much larger basin exists west of the roadway. This off-site basin is approximately 350+ acres northwest of Vollmer Road (Basin SC-2 on Off-site Drainage Map). As shown within the DBPS, this existing crossing is a 60" CMP with some very dense and tall vegetation at both the entrance and exit of this facility. But, based on a recent field visit this facility seems to be in good working condition. The DBPS

depicts this facility and recommends an additional 60" CMP at this location. However, there are no signs of erosion or over topping the road at this location at this time based on the current development within the tributary area to this facility. Based on the existing surrounding topography and roadway configuration, the 100 yr. historic flows at this location would appear to spill over the roadway and continue in their historic drainage pattern downstream within the upper reach of Sand Creek.

The following descriptions represent the pre-development flow design points for the property excluding the major off-site flows within Sand Creek just described:

EX DP-1 (Q_2 = 1 cfs, Q_5 = 3 cfs, Q_{100} = 18 cfs) consists of small portion of the property at the SE corner that currently sheet flows in a southwesterly direction. These pre-development flows travel off-site directly onto Sterling Ranch property prior to eventually entering the Sand Creek channel.

Basin EX-2 (Q_2 = 2 cfs, Q_5 = 7 cfs, Q_{100} = 44 cfs) consists of approximately 50% off-site and 50% on-site property. The off-site property is part of the future Sterling Ranch development and is conveyed in a southwesterly direction directly on-site via a natural ravine. Portions of the on-site property were graded along with Filing No. 1 to allow for this area to be captured in two temporary sediment basins and away from the Filing No. 1 lot development. These two facilities will be removed along with Filing No. 2 construction.

Basin EX-3 (Q_2 = 1 cfs, Q_5 = 2 cfs, Q_{100} = 16 cfs) consists of again both off-site and on-site property. These flows are conveyed in a southwesterly direction and captured in a graded ditch and routed towards another temporary sediment basin constructed with Filing No. 1. This facility will remain during Filing No. 2 construction as it captures undeveloped flows further north.

Basin EX-4 (Q_2 = 4 cfs, Q_5 = 13 cfs, Q_{100} = 90 cfs) consists of the remaining portion of the yet undeveloped TimberRidge property along with off-site future Sterling Ranch property. This entire area sheet flows in a southwesterly direction towards Sand Creek. Along with the development of Filing No. 1 and the secondary emergency access road up to Arroya Lane, several storm system were installed to convey portions of these flows under the access road. The existing on-site stock pond will continue to remain as it captures much of the off-site tributary area.

EX DP-5 (Q_2 = 3 cfs, Q_5 = 11 cfs, Q_{100} = 69 cfs) consists of combined flows from basins EX-5 and EX-7. Basin EX-5 is the northwest portion of the TimberRidge property with some spruce trees and a very defined natural ravine that conveys flows in a southeast direction towards Sand Creek. Vollmer Road is the westerly boundary of this basin. Basin EX-7 (Q_2 = 3 cfs Q_5 = 8 cfs, Q_{100} = 42 cfs) consists of an off-site basin west of Vollmer Road (not a part of this development) that drains under Vollmer into the TimberRidge property via an existing 48" CMP culvert. These off-site flows enter Basin EX-5 and then travel within the on-site ravine towards Sand Creek. Dual 30" culverts were installed along with Filing No. 1 where the future road crosses this ravine. This condition will remain with the development of Filing 2 and these off-site flows will be accounted for in downstream design.

PROPOSED DRAINAGE CONDITIONS

Proposed development within the Retreat at TimberRidge Filing No. 2 will consist of a variety of different residential lot sizes ranging from 1.0 – 2.5 acre large rural lots to 12,000 SF min. urban lots. The rural lots will have paved streets and roadside ditches while the urban lots paved streets with County standard curb, gutter and sidewalk. Development of the urban lots proposed will consist of overlot grading for the planned roadways and lots. Development of rural lots proposed within the site will be limited to roadways and building pads, conserving the natural feature areas. Individual home sites on these lots are to be left generally in their natural condition with minimal disturbance to existing conditions per individual lot construction. Per the El Paso County

ECM, Section I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide Water Quality Capture Volume (WQCV). However, based on the current County/Urban Drainage stormwater quality standards, a WQCV component is automatically built into the UD Detention spreadsheet utilized in the detention basin design. Thus, the proposed facilities within both the rural and urban portions of this development will provide WQCV along with an Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume with an outlet control device. Frequent and infrequent inflows are released at rates approximating undeveloped conditions. This concept provides some mitigation of increased runoff volume by releasing a portion of the increased runoff at a low rate over an extended period of time, up to 72 hours. This means that frequent storms, smaller than the 2-year event, will be reduced to very low flows near or below the sediment carrying threshold value for downstream drainage ways. Also, by incorporating an outlet structure that limits the 100-year runoff to the undeveloped condition rate, the discharge hydrograph for storms between the 2 year and the 100-year event will approximate the hydrograph for the undeveloped conditions and will help effectively mitigate the effects of development. To the greatest extent possible, WQCV will be provided for all new roads and urban lots. The following describes how this development proposes to handle both the off-site and on-site drainage conditions:

As reasonably

Is this correct with areas draining offsite?

As mentioned previously, the majority of the off-site flows are already within the Sand Creek channel prior to entering the property. However, the few off-site basins that must travel through the proposed site development areas prior to entering Sand Creek have been accounted for.

The following represent the basins and design points west of Sand Creek:

Basins OS-1 (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 9 cfs) and OS-2 (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 7 cfs) represent off-site flows from future TimberRidge development adjacent to Vollmer Rd. and Arroya Lane. These flows calculated as future development flows will continue to travel in a southerly direction within the existing natural ravine and enter Basin B. As mentioned

previously, Basin Ex-7 (Q_2 = 3 cfs Q_5 = 8 cfs, Q_{100} = 42 cfs) consists of the off-site basin west of Vollmer Road (not a part of this development) that drains under Vollmer into the TimberRidge property via an existing 48" CMP culvert. These flows are then combined with the flows from basins OS-1 and OS-2. **Design Point 1 (Q_5 = 12 cfs, Q_{100} = 57 cfs)** represents this combined total where the existing dual 30" RCP culverts crossing Aspen Valley Rd. will convey the flows under the road and towards Design Point 3. (See Appendix for culvert and rip-rap calculations) The natural ravine within lots 4 and 5 is contained within a drainage esmt. as shown on the drainage map and final plat.

Basin D (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 6 cfs) represents a portion of the proposed 2.5 ac. rural lots adjacent to Aspen Valley Road. Developed flows from this basin will continue to sheet flow in a southeasterly direction towards Design Point 3 and combine with the upstream flows. **Design Point 3 (Q_5 = 13 cfs, Q_{100} = 60 cfs)** represents this combined flow total where proposed dual 30" RCP culverts will convey the developed flows under Falcon Nest Court towards Pond 3. (See Appendix for culvert and rip-rap calculations) The natural ravine within lot 7 is contained within a drainage esmt. as shown on the drainage map and final plat. Basin C (Q_2 = 2 cfs Q_5 = 3 cfs, Q_{100} = 8 cfs) represents a portion of the proposed 2.5 ac. rural lots with developed flows that sheet flow in a southeasterly direction towards Design Point 4. At this location a proposed 24" RCP culvert will convey these flows under Falcon Nest Court and combine with the previously mentioned developed flows.

Design Point 2 (Q_5 = 5 cfs, Q_{100} = 20 cfs) represents developed flows from Basin A. At this location a proposed 24" RCP culvert crossing Aspen Valley Rd. will convey the flows under the road into the side road ditch towards Pond 3. (See Appendix for culvert and rip-rap calculations) Basin E (Q_2 = 2 cfs Q_5 = 5 cfs, Q_{100} = 18 cfs) represents a portion of the proposed 2.5 ac. rural lots that sheet flow in a southerly direction and combine with the upstream developed flows. Basin OS-3 (Q_2 = 0.1 cfs Q_5 = 0.4 cfs, Q_{100} = 2 cfs) represents a small portion of the proposed lot 12 that continues to sheet flow towards Sand Creek as originally anticipated.

See comment letter regarding location of the pond

Pond relocated outside of wetlands

Design Point 5 (Q_5 = 20 cfs, Q_{100} = 83 cfs) represents the total developed flows entering the proposed **Pond 3.** A proposed full-spectrum EDB is proposed at this location to release less than the pre-development flows currently seen. The following describes the design of this facility. (See Appendix for MHFD-Detention pond design sheets):

Detention Pond 3 (Full Spectrum EDB – see multiple storm release data below)

0.44 Ac.-ft. WQCV required

0.35 Ac.-ft. EURV required with 4:1 max. slopes

1.88 Ac.-ft. 100-yr. Storage

2.68 Ac.-ft. Total

Total In-flow:	**Q_2 = 11.3 cfs,**	**Q_5 = 22.7 cfs,**	**Q_{100} = 80.8 cfs**
Pond Design Release:	**Q_2 = 1.1 cfs,**	**Q_5 = 11.1 cfs,**	**Q_{100} = 66.8 cfs**
Pre-development Release:	**Q_2 = 6.0 cfs,**	**Q_5 = 16.9 cfs,**	**Q_{100} = 74.9 cfs**

(Ownership and maintenance by the Retreat at TimberRidge Metro District)

At this proposed outfall location, the overall channel flows will not significantly change based on Detention Pond 3 release of Q_{100} = 66.8 cfs which is less than the predevelopment flows at this location of Q_{100} = 74.9 cfs. (See Appendix for culvert outlet and rip-rap calculations)

The following represent the basins east of Sand Creek:

Design Point 6 (Q_5 = 3 cfs, Q_{100} = 8 cfs) represents developed flows from on-site Basin G (Q_2 = 1.7 cfs Q_5 = 2.4 cfs, Q_{100} = 5 cfs) and off-site Basin OS-9 (Q_2 = 0.5 cfs Q_5 = 0.9 cfs, Q_{100} = 3 cfs). These flows remain consistent with the previous Filing No. 1 report where an existing 10' Type R at-grade inlet was installed with Filing No. 1. This facility continues to intercept 100% of the 5 yr. and 79% of the 100 yr. developed flows. The flow-by that will continue down the west side of the street into Filing No. 1 remains consistent with the previous report and equals Q_5 = 0 cfs, Q_{100} = 1.7 cfs. (See Appendix for calculations) Basins H1 (Q_2 = 0.6 cfs Q_5 = 0.9 cfs, Q_{100} = 2 cfs),

H2 (Q_2 = 0.6 cfs Q_5 = 0.8 cfs, Q_{100} = 2 cfs) and I (Q_2 = 0.2 cfs Q_5 = 0.3 cfs, Q_{100} = 0.8 cfs) represents the rear lots of proposed lots 13-16. As previously accounted for in the Filing No. 1 report, these developed flows will sheet flow directly off-site and into the open space tract in Filing No. 1.

rear yards

Design Point 7 (Q_5 = 9 cfs, Q_{100} = 39 cfs) represents developed flows from on-site Basin J (Q_2 = 4 cfs Q_5 = 7 cfs, Q_{100} = 18 cfs), off-site Basin OS-4 (Q_2 = 0.2 cfs Q_5 = 0.7 cfs, Q_{100} = 5 cfs) and a 70% portion of the anticipated future Sterling Ranch development within off-site Basin OS-5 (Q_2 = 1 cfs Q_5 = 4 cfs, Q_{100} = 26 cfs). These flows will combine and travel in a southerly direction to Design Point 7 where a proposed 15' Type R sump inlet will completely intercept both the 5 yr. and 100 yr. developed flows. The emergency overflow will be 12" and then down the street to the west within Elk Antler Lane.

In the interim the off-site flows will be captured in temp. sed. basin

How will this flow get to the inlet - is gutter capacity adequate? If developed flow is detained to this value a pipe is needed.

8

Design Point 8 (Q_5 = 2 cfs, Q_{100} = 10 cfs) represents developed flows from on-site Basin N (Q_2 = 0.7 cfs Q_5 = 1 cfs, Q_{100} = 2 cfs) and a 30% portion of the anticipated future Sterling Ranch development within off-site Basin OS-5 (Q_2 = 1 cfs Q_5 = 4 cfs, Q_{100} = 26 cfs). These flows will combine at Design Point 7 where a proposed 10' Type R sump inlet will completely intercept both the 5 yr. and 100 yr. developed flows. The emergency overflow will be 12" and then down the street to the west within Elk Antler Lane. However, prior to the development of this portion of the Sterling Ranch development, a temporary sediment basin is proposed off-site just east of Elk Antler Lane. This facility sizing is based on the 13.7 ac. off-site basin OS-5 and is shown on the grading and erosion control plan. Both the overflow spillway and outlet pipe will be routed into the proposed curb line of Elk Antler Lane. Appropriate temporary grading and drainage easements will be acquired from the adjacent property owner prior to construction.

2 pipe is provided and now better described

Basin K (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 5 cfs) represents a portion of the rear yards of proposed lots 21-26. These developed flows will continue to sheet flow in a westerly direction towards a temporary sediment basin constructed with Filing No. 1. Basin L (Q_2 = 0.3 cfs Q_5 = 0.6 cfs, Q_{100} =

permanent WQ is required

See Revised and Runoff Reduction sheet now included

2 cfs) represents the rear yard of the proposed lot 27. These minor developed flows will continue to sheet flow in a westerly direction towards another temporary sediment basin constructed with Filing No. 1. Basin M (Q_2 = 0.9 cfs Q_5 = 1.2 cfs, Q_{100} = 3 cfs) represents the developed flows from proposed lots 19-20. These developed flows were accounted for in the Filing No. 1 report and will continue to sheet flow in a southwesterly direction directly into the north side of Elk Antler Lane. The existing downstream 15' Type R At-grade Inlet will continue to adequately collect these flows.

south of Elk Antler Lane (?)

Already accounted for w/ Filing 1 design.

Design Point 9 (Q_5 = 4 cfs, Q_{100} = 14 cfs) represents the developed flows from Basins OS-8 (Q_2 = 2 cfs Q_5 = 3 cfs, Q_{100} = 10 cfs) and Q (Q_2 = 0.4 cfs Q_5 = 1.2 cfs, Q_{100} = 6 cfs). At this location, an existing 10' Type R Sump Inlet was installed with Filing No. 1 to completely intercept both the 5 yr. and 100 yr. developed flows. These flows remain consistent with the Filing No. 1 report as anticipated as Q_5 = 5 cfs, Q_{100} = 15 cfs.

Design Point 10 (Q_5 = 3 cfs, Q_{100} = 11 cfs) represents developed flows from Basins O (Q_2 = 2 cfs Q_5 = 3 cfs, Q_{100} = 9 cfs) and OS-6 (Q_2 = 0.1 cfs Q_5 = 0.4 cfs, Q_{100} = 3 cfs). These developed flows sheet flow in a southwesterly direction towards Design Point 10 where a proposed 10' Type R Sump Inlet will be installed to completely intercept both the 5 yr. and 100 yr. developed flows. The emergency overflow will be 12" and then south over the highpoint. It is planned with this report that with the future development of this portion of Sterling Ranch (Basin OS-6) developed flows equal to pre-development quantities are accounted for downstream in the existing on-site Pond 2. These future flows quantities will be treated and detained within Pond 2. Any developed flows above these quantities will need to be routed further downstream within the Sterling Ranch development.

Design Point 11 (Q_5 = 2 cfs, Q_{100} = 4 cfs) represents developed flows from Basin P. At this location, a proposed 5' Type R Sump Inlet will be installed to completely intercept both the 5 yr. and 100 yr. developed flows. The emergency overflow will be 12" and then southerly over the highpoint.

of Owl Perch Loop

Design Point 12 (Q_5 = 4 cfs, Q_{100} = 9 cfs) represents the developed flows from Basin R. At this location, a proposed 10' Type R At-grade Inlet will be installed to intercept 99% of the 5 yr. and 75% of the 100 yr. developed flows. The flow-by (Q_5 = 0 cfs, Q_{100} = 2.3 cfs) will then continue down the street towards Design Point 13. (See Appendix for calculations)

to the west

Design Point 13 (Q_5 = 8 cfs, Q_{100} = 23 cfs) represents flows from Basin S and the flow-by from Basin R mentioned above. At this location, a proposed 15' Type R Sump Inlet will be installed to completely intercept both the 5 yr. and 100 yr. developed flows. The emergency overflow will be 12" and then southerly over the highpoint.

of Bison Valley Trail? Why not into Pond 2 with a curb chase?

Design Point 14 (Q_5 = 1 cfs, Q_{100} = 3 cfs) represents flows from Basin T. At this location, a proposed 5' Type R Sump Inlet will be installed to completely intercept both the 5 yr. and 100 yr. developed flows. The emergency overflow will be 12" and then southerly over the highpoint.

Pipe Run 12 (Q_5 = 25 cfs, Q_{100} = 85 cfs) represents the total developed flows entering the existing Pond 2 at the NE corner via the existing 42" RCP storm stub provided with Filing No. 1 construction. These flows are compared to the anticipated flows at this location in the Filing No. 1 report of Q_5 = 19 cfs, Q_{100} = 74 cfs. The existing Pond 2 continues to adequately provide detention and stormwater quality per County criteria with these additional flows.

This is emergency flows only if clogged.
Majority of flows on east side of road.
36" wide chase only accepts 3.5 cfs.
It would end up getting overflown without
use and become more of a maint. issue.
Ultimately, downstream road will connect and
easily accept these emergency flows.

The following represents the existing Pond 2 with the minor adjusted developed flows:

(See revised MHFD-Detention Pond Design Sheets in Appendix)

Existing Detention Pond 2 (Full Spectrum EDB – see multiple storm release data below)

1.03 Ac.-ft. WQCV required

1.16 Ac.-ft. EURV required with 4:1 max. slopes

3.36 Ac.-ft. 100-yr. Storage

5.55 Ac.-ft. Total

Total In-flow:	**Q_2 = 24.5 cfs,**	**Q_5 = 43.1 cfs,**	**Q_{100} = 135.8 cfs**
Pond Design Release:	**Q_2 = 0.9 cfs,**	**Q_5 = 13.5 cfs,**	**Q_{100} = 96.2 cfs**
Pre-development Release:	**Q_2 = 9.1 cfs,**	**Q_5 = 25.4 cfs,**	**Q_{100} = 115.0 cfs**

(Existing ownership and maintenance by the Retreat at TimberRidge Metro District)

Basin U (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 5 cfs) represents a portion of the rear yards of proposed lots 61-67. These developed flows were accounted for in the previous report for Filing No. 1 and remain consistent with the anticipated flows at this location of (Q_5 = 2 cfs, Q_{100} = 5 cfs). Basin V (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 6 cfs) represents the rear yards of the proposed lots 44-53. These developed flows will sheet flow in a southeasterly direction off-site. Based on the large lot depths and as noted on the drainage map, these lots are required to have all impervious area constructed within Basin R with no impervious area allowed within Basin V. Basin OS-7 (Q_2 = 0.2 cfs Q_5 = 0.8 cfs, Q_{100} = 5 cfs) represents an off-site basin within the future Sterling Ranch development that will continue to sheet flow in its historic drainage pattern. The TimberRidge development will coordinate with the Sterling Ranch property owner for the acquisition of appropriate temporary grading and drainage easements along the eastern property line to facility this interim drainage condition. Basin W (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 5 cfs) represents the rear yards of the proposed lots 54-60. While this basin exceeds the allowable 1.0 ac. of untreated developed area, we are coordinating with the Sterling Ranch property owner for the

And a permanent drainage easement(s)

See Revised

See comment letter.

acquisition of appropriate temporary grading and drainage easements along the southern property line to facilitate a temporary sediment basin in this interim condition. Ultimately, this basin will be treated further downstream prior to entering Sand Creek.

DETENTION / STORMWATER QUALITY FACILITES

As required, storm water quality measures will be utilized in order to reduce the amount of sediment, debris and pollutants that are allowed to enter Sand Creek. These features include but are not limited to Full Spectrum Detention Basins and temporary sediment basins. Site Planning and design techniques for the large lot, rural areas should help limit impervious area, minimize directly impervious area, lengthen time of travel and increase infiltration in order to decrease the rate and volume of stormwater runoff. Urban areas that require detention will provide a Water Quality Capture Volume (WQCV) and Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume that will release the more frequent storms at a slower rate to help minimize the effects of development of the property. The proposed detention/SWQ facilities are to be private facilities with ownership and maintenance by the TimberRidge Metropolitan District. After completion of construction and upon the Board of County Commissioners acceptance, the Sand Creek channel will be owned and maintained by the El Paso County along with all drainage facilities within the public Right of Way.

SAND CREEK CHANNEL IMPROVEMENTS

As stated in the Sand Creek DBPS, this Reach SC-9 is recommended as a floodplain preservation design concept. Given the fact of the current requirements for detention/SWQ facilities planned for the property with designed release at or below pre-development flows, the existing Sand Creek drainageway is expected to remain stable. Existing FEMA FIS channel velocities as found in the LOMR 08-080541P seem to exceed recommended allowable velocities. Although, based on the findings from the CORE Consultants, Inc. Impact Identification Report, no significant erosion or channel degradation through this property currently exists at this time. Specifically located grade control structures (See Appendix) were specified in the DBPS through this reach in

order to slow the cannel velocity to the DBPS recommended 7 feet per second and to prevent localized and long-term stream degradation affecting channel linings and overbanks. The allowable velocity and shear stress will vary depending upon the existing riparian vegetation/wetlands found within the channel and overbank floodplain terrace areas. A HEC-RAS hydraulic analysis for this portion of Reach SC-9 has been provided in order to determine the necessary channel improvements for the proposed Filing No. 2 development and future Filings. A separate wetland impact report along with the Section 404 permitting, prepared by CORE Consultants, has been developed based on these proposed channel improvements and submitted directly to the U.S. Army Corps of Engineers with necessary consult with U.S. Fish and Wildlife for their review and approval. This report and documentation can be found in the Appendix for El Paso County staff review.

update for this filing

HEC-RAS MODELING

HEC-RAS ver. 5.0.6 was used to perform a one-dimensional, steady flow hydraulic model of a portion of Reach SC-9 from Arroya Lane to approximately 650 feet downstream of the TimberRidge south property line. HEC-RAS was used to define the stream centerline, overbanks, cross-sections and manning's n values. The stream centerline follows the channel thalweg to define the reach network. Cross-section topography data was obtained by using the generated surface from the 2-ft. flown contours utilized for all site design. This data was then exported from AutoCAD containing three-dimensional coordinates for the stream centerline, cross-sections, reach stations, overbank stations, reach lengths and imported into HEC-RAS. Two separate models defining the existing condition and proposed condition were prepared using the same centerline stationing. The proposed model included the introduction of the ineffective flow area for the culvert added for the Poco Road crossing. Different Manning's n values were applied across the various channel cross-sections to reflect the changes in vegetative cover within the channel and overbanks. The selected Manning's n values for the channel and overbanks were determined using Tables 10-1 and 10-2 from the DCM and Table 3 from the USGS Guide for

selecting Manning's Roughness Coefficients based on numerous site visits in an effort to photograph and document each cross-section. (See Appendix) The following table summarizes the selected Manning's n values:

Table 1 Manning's n Values

Feature	Manning's n Value
Main Channel	0.03 – 0.10
Overbank Floodplain Terraces	0.12 – 0.16

Steady flow data was entered starting at Arroya Lane, channel station 55+32.95, with a flow change location at station 15+07.91 representing the Sand Creek DBPS segment change from 171 to 170. Steady flow data corresponding to recurrence intervals of 10 Yr. and 100 Yr. for the FEMA, DBPS and Sterling Ranch MDDP conditions was entered. The models were run in subcritical mode to evaluate hydraulic conditions. Boundary conditions for the entire reach were based on normal depth calculations for the upstream and downstream channel slopes. The following table summarizes the flows used in the models:

Table 2 Model Flow Values

Flood Event / Location	Flow Value (cfs)
Arroya Lane (Sta: 55+32.95)	
FEMA 100 Yr.	2600
DBPS 100 Yr.	2170
DBPS 10 Yr.	630
Sterling MDDP 100 Yr.	1487
Sterling MDDP 10 Yr.	430
DBPS Segment 170 (Sta: 15+07.91)	

FEMA 100 Yr.	2600
DBPS 100 Yr.	2260
DBPS 10 Yr.	670
Sterling MDDP 100 Yr.	1520
Sterling MDDP 10 Yr.	450

Per the approved DBPS, the anticipated developed flows just upstream of this project are Q_{10} = 630 cfs and Q_{100} = 2170 cfs as depicted within DBPS segment no. 171. The anticipated developed flows exiting this property are Q_{10} = 670 cfs and Q_{100} = 2260 cfs as depicted within DBPS segment no. 170. As discussed earlier, the FEMA FIS flows appear to be significantly higher than both those presented in the DBPS and the Sterling Ranch MDDP. We understand that Sterling Ranch may be processing a CLOMR/LOMR in the near future, however, we have continued to utilize the significantly larger flows as determined by the FEMA FIS (2600 cfs) in the channel improvement designs. The proposed public roadway crossing of Sand Creek was constructed with Filing No. 1 and consisted of a two cell multi-plate steel single radius arch (24' x 10.33') with concrete headwalls to facilitate the conveyance of the 100 yr. flow.

Based on site visits during May and July of 2019, the entire Sand Creek drainage corridor through the Retreat at TimberRidge development was walked and photographed for documentation purposes and aide in the HEC-RAS modeling. (See Appendix) As discovered in the field and documented in the photos taken at each HES-RAS station, this reach of the Sand Creek channel appears very stable with no signs of erosion within the main channel or channel overbanks. This is mainly due to the significant vegetal cover throughout the reach. The classification of the vegetal cover seems to have a range from Retardance Class A-C as defined by HEC-15 chart (See Appendix) This type of vegetation retardance significantly increases the allowable shear stress within the channel while reducing the velocity. The following table defines the retardance level based on the vegetation class:

Table 3

Vegetal Retardance Curve Index by SCS Retardance Class

SCS Retardance Class	Retardance Curve Index
A	10.0
B	7.64
C	5.60
D	4.44
E	2.88

Based on this information, the maximum allowable sheer stress is found by the flowing equation:

$$\tau = 0.75 \text{Curve Index}$$

Thus, the range of shear stress for this reach of Sand Creek equals 4.2 – 7.5 (lb/ft^2).

Referencing the HES-RAS model calculations in the Appendix shows that only a few stations showed shear stress exceeding this limit. (Sta: 33+34.27, 20+83.66 and 18+79.67) All three of these stations were within the Filing 1 development area and with the proposed channel improvements and selective embankment lining, the shear stress at those locations will be reduced to the allowable range.

The proposed channel improvements within Filing No. 2 consist of two additional check structures located in the narrower portions of the creek. The DBPS only depicts one structure along this stretch of channel but the additional one is being planned to further limit degradation and help control the elevation of the channel invert. These check structures are designed to be sheet piling with a concrete cap per Urban Drainage Vol. 2 Figures 9-27 thru 9-28. The intent of these structures is to hold grade so if the stream wants to flatten its equilibrium slope, the incision is limited. Thus, the plan is for these structures to eventually become drop structures as dictated by future channel characteristics.

The DBPS also recommended to provide selective rip-rap channel stabilization located at culvert crossings, pipe outlets and outside bends of the channel. Based on the mean channel slope and maximum allowable velocity of 7.0 fps, Type L Rip-Rap stabilization will be provided at select locations within Filing No. 2. (See Appendix for tables describing slope, velocity, shear, Froude No., etc.) The existing channel slope throughout this reach ranges from 0.6% to 7.3%. These steeper slopes seem to represent numerous areas with isolated shallow pools within the main channel which help support the growth of the wetlands. These isolated areas will remain with only minimal disturbance taking place at the locations of the proposed improvements (i.e. check structures and culvert crossing). Per the HEC-RAS model, the proposed channel velocities range from 2.7 ft./sec. to 6.0 ft./sec. All stations are within the allowable velocity of 7.0 ft./sec.

The HEC-RAS model calculations shows no stations with Froude No. over 1.0 for this stretch of the creek within Filing No. 2. Thus, the Froude No. at all stations remains less than 1.0, with subcritical flow characteristics.

Describe channel and pond maintenance access.

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. Individual on-site developed basin design used for detention/SWQ basin sizing, inlet sizing and storm system routing was calculated using the Rational Method. Runoff Coefficients are based on the imperviousness of the particular land use and the hydrologic soil type in accordance with Table 6-6. The average rainfall intensity, by recurrence interval found in the Intensity-Duration-Frequency (IDF) curves in Figure 6-5. (See Appendix)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

This site adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Proposed rural lot impervious area (roof tops, patios, etc.) will sheet flow across lengthy landscape/natural areas within the large lots and proposed urban lot impervious areas (roof tops, patios, etc.) will sheet flow across landscaped yards and through open space areas to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets or detention facilities. This will minimize directly connected impervious areas within the project site.

2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through the front and rear yards, developed flows will travel via roadside ditches in the large lot, rural portions of the development, curb and gutter within the public streets in the urban portions of the development and eventually public storm systems. These collected flows are then routed directly to multiple extended detention basins (full-spectrum facilities). Where developed flows are not able to be routed to public street, sheet flows will travel across landscaped rear yards and then through undeveloped property prior to entering Sand Creek. The Sand Creek channel corridor will be protected with various channel improvements as recommended in the Sand Creek DBPS and proposed with this Filing in order to reduce velocities to erosive levels.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV and excess urban runoff volume (EURV) in the proposed Full-Spectrum permanent Extended Detention Basins designed per current El Paso County drainage criteria.

4. **Consider need for Industrial and Commercial BMPs**: No industrial or commercial uses are proposed within this development. However, a site-specific storm water quality and erosion control plan and narrative has been submitted along with the grading and erosion control plan. Details such as site-specific sediment and erosion control construction BMP's as well as temporary and permanent BMP's were detailed in this plan and narrative to protect receiving waters. Multiple temporary BMP's are proposed based on specific phasing of the overall development. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

FLOODPLAIN STATEMENT

Portions of this site are located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C 0535G with effective date of December 7, 2018 and the previously mentioned LOMR 08-08-0541P with an effective date of July 23, 2009. (See Appendix).

DRAINAGE AND BRIDGE FEES

This site lies entirely within the Sand Creek Drainage Basin boundaries.

The fees are calculated using the following impervious acreage method approved by El Paso County. The Retreat at TimberRidge Filing No. 2 has a total area of 75.83 acres with the following different land uses proposed:

8.09 Ac.	Sand Creek Drainage corridor (Tract C)
0.64 Ac.	Detention Facility (Tract B)
34.27 Ac.	2.5 Ac. lots (Rural Lots 1-12 incl. Tract A)
32.83 Ac.	1/3 Ac. lots (Urban Lots 13-90 with avg. size 15,575 SF)
75.83	Total

The percent imperviousness for this subdivision is calculated as follows:

Fees for Sand Creek Drainage Corridor

(Per El Paso County Percent Impervious Chart: **2%**)

8.09 Ac. x 2% = **0.16 Impervious Ac.**

Fees for Detention Facilities & Park

(Per El Paso County Percent Impervious Chart: **7%**)

0.64 Ac. x 7% = **0.04 Impervious Ac.**

Fees for 2.5 Ac. lots

(Per El Paso County Percent Impervious Chart: **11%** with

25% fee reduction for 2.5 ac. lots planned) – *Reduction for Drainage Fees only*

34.27 Ac. x 11% x 75% = **2.83 Impervious Ac.** (Drainage Fees)

34.27 Ac. x 11% = **3.77 Impervious Ac.** (Bridge Fees)

Fees for 1/3 Ac. lots (Avg. lot size of 15,575 SF)

(Per El Paso County Percent Impervious Chart: **30%**)

32.83 Ac. x 30% = **9.85 Impervious Ac.**

Total Impervious Acreage: **12.88 Imp. Ac.** (Drainage Fees)

Total Impervious Acreage: **13.82 Imp. Ac.** (Bridge Fees)

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The following calculations are based on the 2021 Sand Creek drainage/bridge fees:

ESTIMATED FEE TOTALS:

Bridge Fees

$ 8,339.00 x 13.82 Impervious Ac. = **$ 115,244.98**

Drainage Fees

$ 20,387.00 x 12.88 Impervious Ac. = **$ 262,584.56**

Per the ECM 3.10.5.a, this development requests a reduction of drainage fees based on the on-site regional channel improvements for this stretch of Sand Creek Reach SC-9 as shown in the DBPS. The following facilities within the Sand Creek Drainage Basin seem to meet the criteria for this reduction:

See comment letter

See Revised text

Sand Creek Channel Improvements per DBPS	=	$175,000

Proposed Sand Creek Channel Improvements:

Sheet Pile Check Structure w/ Conc. Cap	$45,000 EA x 2 =	$ 90,000
Selective Bank Stabilization (Buried Rip-Rap)	$100/LF x 535 LF =	$ 53,500
Selective Bank Stabilization (Grading & Reveg.)	=	$ 80,000
Total	=	**$223,500**

(Exact facility costs provided upon construction and acceptance by County. Any credits may be used for future Filings)

approved

Classic Consulting Engineers & Surveyors cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

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SUMMARY

The proposed Retreat at TimberRidge Filing No. 2 is within the Sand Creek Drainage Basin. Recommendations are made within this report concerning necessary improvements that will be required as a result of development of this property. The points of storm water release from the proposed site are required to be at or below the calculated historic flow quantities. The development of the proposed site does not significantly impact any downstream facility or property to an extent greater than that which currently exists in the 'historic' conditions. All drainage facilities within this report were sized according to the Drainage Criteria Manuals and the full-spectrum storm water quality requirements.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Marc A. Whorton, P.E.
Project Manager

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REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

2. "Urban Storm Drainage Criteria Manual Volume 1, 2 & 3" Urban Drainage and Flood Control District, dated January 2016.

3. "Final Drainage Report for Forest Gate Subdivision" Law & Mariotti Consultants, Inc. dated October 2004.

4. "Sand Creek Drainage Basin Planning Study," Kiowa Engineering Corporation, dated March 1996.

5. "Master Development Drainage Plan for The Retreat at TimberRidge", Classic Consulting, approved March 2018.

6. "Preliminary Drainage Report for The Retreat at TimberRidge Preliminary Plan – South of Arroya Lane", Classic Consulting, approved October 2018.

7. "2018 Sterling Ranch MDDP", M&S Civil Consultants, Inc., June 2018

8. "Final Drainage Report for Retreat at Sand Creek Filing No. 1", Classic Consulting, approved November, 2020.

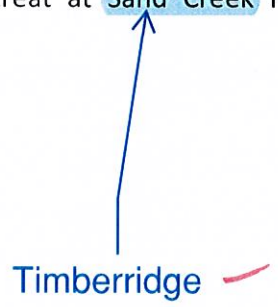

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TABLE VIII-2: SAND CREEK DRAINAGE BASIN PLANNING STUDY
DRAINAGEWAY CONVEYANCE COST ESTIMATE
WITH SELECTED DETENTION ALTERNATIVES

SEGMENT NUMBER	REACH NUMBER	SEGMENT LENGTH (FT)	IMPROVEMENT TYPE	IMP. LENGTH (FT)	UNIT COST ($/LF)	NUMBER OF GRADE CONTROLS	GRADE CONTROL LENGTH (FT)	TOTAL REIMBURSABL COSTS	TOTAL COST
148-2	"	2600	"	2150	127	5	620	$384,650	$384,650
151	SC-8	1700	10-YEAR RIPRAP	500	238	3	250	$164,000	$164,000
160	"	5100	SEL. LININGS (1 SIDE)	4400	127	6	720	$688,400	$688,400
			10-YR RIPRAP	600	238	0	0	$142,800	$142,800
163	"	6300	SEL. LININGS (1 SIDE)	2600	127	15	1200	$546,200	$546,200
			10-YR RIPRAP	350	238	0	0	$83,300	$83,300
187	"	1200	SEL. LININGS (1 SIDE)	0	0	2	160	$28,800	$28,800
170	SC-9	3200	"	0	0	4	320	$57,600	$57,600
171	"	5000	"	0	0	2	170	$30,600	$30,600
172	"	3650	"	0	0	2	150	$27,000	$27,000
TOTAL SAND CREEK DRAINAGEWAY								$15,560,220	$18,279,420

offsite

Claimed in Filing 1?

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TABLE VIII-3: SAND CREEK DRAINAGE BASIN PLANNING STUDY
TRIBUTARY DRAINAGEWAY CONVEYANCE COST ESTIMATE
SAND CREEK, CENTER TRIBUTARY AND WEST FORK SAND CREEK

SEGMENT NUMBER	REACH NUMBER	IMPROVEMENT TYPE	IMP. LENGTH (FT)	UNIT COST ($/LF)	NUMBER OF GRADE CONTROLS	LENGTH OF GRADE CONTROL (FT)	TOTAL REIMBURSABLE COSTS	TOTAL COST
147-2	"	"	1150	200	1	30	$235,400	$235,400
153-1	"	"	600	150	0	0	$90,000	$90,000
153-2	"	"	450	150	0	0	$67,500	$67,500
152-1	SC-7	100-YEAR GRASSLINED	1650	150	0	0	$247,500	$247,500
152-2	"	"	800	150	2	100	$138,000	$138,000
150-1	"	100-YEAR STORM SEWER 36" RCP	800	58	0	0	$46,400	$46,400
150-2	"	100-YEAR RIPRAP	2400	200	0	0	$480,000	$480,000
161-1	"	100-YEAR GRASSLINED	550	150	0	0	$82,500	$82,500
154	SC-8	"	2100	200	10	600	$528,000	$528,000
157	"	"	2400	200	13	520	$573,600	$573,600
155-1	"	100-YEAR GRASSLINED	550	175	4	140	$121,450	$121,450
159	"	100-YEAR RIPRAP	3450	200	14	840	$841,200	$841,200
164	"	"	1350	200	5	200	$306,000	$306,000
186	"	"	2250	200	5	200	$486,000	$486,000
169	"	"	650	175	1	40	$120,950	$120,950
173	SC-9	"	950	175	8	320	$223,850	$223,850
WEST FORK SAND CREEK								
154-1	WF-1	100-YEAR RIPRAP	1550	223	2	100	$0	$363,650
161	"	"	600	223	2	80	$0	$148,200
164-2	"	100-YEAR GRASSLINED	500	150	0	0	$0	$75,000
164-4	"	100-YEAR RIPRAP	2500	175	9	280	$0	$487,900
165-1	"	"	1350	175	0	0	$0	$236,250
TOTAL SAND CREEK TRIBUTARY DRAINAGEWAYS							$7,420,650	$12,543,750

offsite

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JOB NAME: *RETREAT AT TIMBERRIDGE FILING NO. 2*
JOB NUMBER: *1185.20*
DATE: *03/17/21*
CALCULATED BY: *MAW*

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS				LANDSCAPE/DEVELOPED AREAS				WEIGHTED			WEIGHTED CA			EFFECTIVE IMPERVIOUS (%)
		AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)	
EX-1	12.7	0.00	0.89	0.90	0.96	12.7	0.05	0.12	0.39	0.03	0.09	0.36	**0.38**	**1.14**	**4.57**	2.0%
EX-2	29.4	0.00	0.89	0.90	0.96	29.4	0.05	0.12	0.39	0.03	0.09	0.36	**0.88**	**2.65**	**10.58**	2.0%
EX-3	9.1	0.00	0.89	0.90	0.96	9.1	0.05	0.12	0.39	0.03	0.09	0.36	**0.27**	**0.82**	**3.28**	2.0%
EX-4	84.9	1.50	0.57	0.59	0.70	83.4	0.05	0.12	0.39	0.03	0.09	0.36	**2.55**	**7.64**	**30.56**	3.4%
EX-5	34.2	1.50	0.57	0.59	0.70	32.7	0.05	0.12	0.39	0.03	0.09	0.36	**1.03**	**3.08**	**12.31**	5.4%
EX-7	27.6	0.00	0.89	0.90	0.96	27.6	0.05	0.12	0.39	0.05	0.12	0.39	**1.38**	**3.31**	**10.76**	7.0%
OS-1	3.9	0.20	0.89	0.90	0.96	3.7	0.06	0.14	0.40	0.10	0.18	0.43	**0.40**	**0.70**	**1.67**	15.1%
OS-2	2.9	0.50	0.89	0.90	0.96	2.4	0.06	0.14	0.40	0.20	0.27	0.50	**0.59**	**0.79**	**1.44**	24.6%
OS-3	0.9	0.00	0.89	0.90	0.96	0.9	0.06	0.14	0.40	0.06	0.14	0.40	**0.05**	**0.13**	**0.36**	11.0%
OS-4	2.5	0.00	0.89	0.90	0.96	2.5	0.03	0.09	0.36	0.03	0.09	0.36	**0.08**	**0.23**	**0.90**	2.0%
OS-5	13.7	0.00	0.89	0.90	0.96	13.7	0.03	0.09	0.36	0.03	0.09	0.36	**0.41**	**1.23**	**4.93**	2.0%
OS-6	1.5	0.00	0.89	0.90	0.96	1.5	0.03	0.09	0.36	0.03	0.09	0.36	**0.05**	**0.14**	**0.54**	2.0%
OS-7	2.6	0.00	0.89	0.90	0.96	2.6	0.03	0.09	0.36	0.03	0.09	0.36	**0.08**	**0.23**	**0.94**	2.0%
OS-8	3.6	0.00	0.89	0.90	0.96	3.6	0.18	0.25	0.47	0.18	0.25	0.47	**0.65**	**0.90**	**1.69**	30.0%
OS-9	0.9	0.00	0.89	0.90	0.96	0.9	0.18	0.25	0.47	0.18	0.25	0.47	**0.16**	**0.23**	**0.42**	30.0%
A	9.5	0.50	0.89	0.90	0.96	9.00	0.06	0.14	0.40	0.10	0.18	0.43	**0.99**	**1.71**	**4.08**	15.2%
B	6.0	0.60	0.89	0.90	0.96	5.40	0.06	0.14	0.40	0.14	0.22	0.46	**0.86**	**1.30**	**2.74**	18.9%
C	3.3	0.50	0.89	0.90	0.96	2.80	0.06	0.14	0.40	0.19	0.26	0.48	**0.61**	**0.84**	**1.60**	23.0%
D	2.3	0.20	0.89	0.90	0.96	2.10	0.06	0.14	0.40	0.13	0.21	0.45	**0.30**	**0.47**	**1.03**	17.9%
E	8.5	0.50	0.89	0.90	0.96	8.00	0.06	0.14	0.40	0.11	0.18	0.43	**0.93**	**1.57**	**3.68**	15.6%
F	13.6	0.00	0.89	0.90	0.96	13.60	0.04	0.10	0.38	0.04	0.10	0.38	**0.54**	**1.36**	**5.17**	6.5%
G	1.4	0.60	0.89	0.90	0.96	0.80	0.06	0.14	0.40	0.42	0.47	0.64	**0.58**	**0.65**	**0.90**	55.7%
H1	0.5	0.15	0.89	0.90	0.96	0.37	0.15	0.22	0.46	0.36	0.42	0.60	**0.19**	**0.22**	**0.31**	47.3%
H2	0.5	0.15	0.89	0.90	0.96	0.32	0.15	0.22	0.46	0.39	0.44	0.62	**0.18**	**0.21**	**0.29**	49.1%
I	0.17	0.05	0.89	0.90	0.96	0.12	0.18	0.25	0.47	0.39	0.44	0.61	**0.07**	**0.08**	**0.10**	47.6%
J	5.90	0.70	0.89	0.90	0.96	5.20	0.18	0.25	0.47	0.26	0.33	0.53	**1.56**	**1.93**	**3.12**	37.1%
K	1.50	0.00	0.89	0.90	0.96	1.50	0.18	0.25	0.47	0.18	0.25	0.47	**0.27**	**0.38**	**0.71**	30.0%
L	0.53	0.00	0.89	0.90	0.96	0.53	0.18	0.25	0.47	0.18	0.25	0.47	**0.10**	**0.13**	**0.25**	30.0%
M	0.81	0.20	0.89	0.90	0.96	0.61	0.18	0.25	0.47	0.36	0.41	0.59	**0.29**	**0.33**	**0.48**	44.8%
N	0.63	0.15	0.89	0.90	0.96	0.48	0.18	0.25	0.47	0.35	0.40	0.59	**0.22**	**0.26**	**0.37**	44.3%
O	2.80	0.25	0.89	0.90	0.96	2.55	0.18	0.25	0.47	0.24	0.31	0.51	**0.68**	**0.86**	**1.44**	35.4%
P	1.00	0.25	0.89	0.90	0.96	0.75	0.18	0.25	0.47	0.36	0.41	0.59	**0.36**	**0.41**	**0.59**	45.0%
Q	1.90	0.00	0.89	0.90	0.96	1.90	0.06	0.14	0.40	0.06	0.14	0.40	**0.11**	**0.27**	**0.76**	30.0%
R	2.70	0.60	0.89	0.90	0.96	2.10	0.18	0.25	0.47	0.34	0.39	0.58	**0.91**	**1.07**	**1.56**	43.3%
S	6.60	0.90	0.89	0.90	0.96	5.70	0.18	0.25	0.47	0.28	0.34	0.54	**1.83**	**2.24**	**3.54**	38.2%
T	1.00	0.30	0.89	0.90	0.96	0.70	0.02	0.08	0.35	0.28	0.33	0.53	**0.28**	**0.33**	**0.53**	48.0%
U	1.50	0.00	0.89	0.90	0.96	1.50	0.18	0.25	0.47	0.18	0.25	0.47	**0.27**	**0.38**	**0.71**	30.0%
V	2.10	0.00	0.89	0.90	0.96	2.10	0.18	0.25	0.47	0.18	0.25	0.47	**0.38**	**0.53**	**0.99**	30.0%
W	1.40	0.15	0.89	0.90	0.96	1.25	0.18	0.25	0.47	0.26	0.32	0.52	**0.36**	**0.45**	**0.73**	36.4%

Not now. See revised

Should this be lower for basin V?

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Removed pond 4 Revised

Designer:	Marc A. Whorton, P.E.
Company:	Classic Consulting
Date:	April 1, 2021
Project:	Retreat at TimberRidge Filing No. 2
Location:	Pond 3 ← Is this duplicate?

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 13.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.130

C) Contributing Watershed Area — Area = 64.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$) — V_{DESIGN} = ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.434 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 0 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 100 %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— $EURV_{DESIGN}$ = 0.801 ac-ft

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$ = ac-ft

2. Basin Shape: Length to Width Ratio

(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.013 ac-ft

B) Actual Forebay Volume — V_F = 0.013 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 71.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.42 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 6.4 in

See comment letter regarding location of Pond 3.
Pond 3 details will be reviewed following resolution of the pond location.

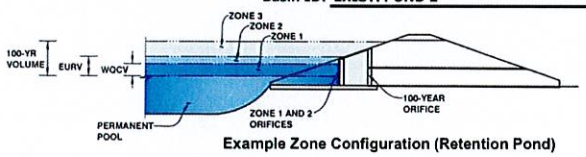
Revised location

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: RETREAT AT TIMBERRIDGE FILING NO. 2

Basin ID: EXIST. POND 2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.80	1.033	Orifice Plate
Zone 2 (EURV)	5.36	1.163	Orifice Plate
Zone 3 (100-year)	8.80	3.357	Weir&Pipe (Restrict)
Total (all zones)		5.553	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft²
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

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

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	5.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.40	2.80	4.20				
Orifice Area (sq. inches)	3.00	4.00	4.00	4.00				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.50	N/A	feet
Overflow Weir Front Edge Length =	8.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	2.57	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	24.74	N/A	ft²
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	12.37	N/A	ft²
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	9.62	N/A	ft²
Outlet Pipe Diameter =	42.00	N/A	inches	Outlet Orifice Centroid =	1.75	N/A	feet
Restrictor Plate Height Above Pipe Invert =	42.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.77	feet
Spillway Crest Length =	65.00	feet	Stage at Top of Freeboard =	10.77	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	1.21	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.94	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).*

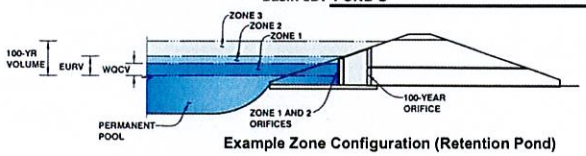
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.85
CUHP Runoff Volume (acre-ft) =	1.033	2.196	2.378	4.231	5.985	8.800	10.837	13.643	25.127
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.378	4.231	5.985	8.800	10.837	13.643	25.127
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	9.1	25.4	39.2	71.6	90.0	115.0	215.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.25	0.39	0.71	0.89	1.14	2.13
Peak Inflow Q (cfs) =	N/A	N/A	24.5	43.1	57.8	90.5	110.1	135.8	242.6
Peak Outflow Q (cfs) =	0.5	0.9	0.9	13.5	28.3	55.8	72.1	96.2	218.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.8	0.8	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.5	1.1	2.2	2.9	3.8	5.0
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) =	43	59	62	59	56	52	49	46	35
Time to Drain 99% of Inflow Volume (hours) =	**46**	65	68	69	67	64	62	59	53
Maximum Ponding Depth (ft) =	3.80	5.36	5.37	6.27	6.70	7.29	7.68	8.30	9.61
Area at Maximum Ponding Depth (acres) =	0.65	0.83	0.83	0.91	0.95	0.99	1.02	1.07	1.18
Maximum Volume Stored (acre-ft) =	1.035	2.203	2.203	2.988	3.388	3.969	4.351	4.998	6.468

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: RETREAT AT TIMBERRIDGE FILING NO. 2

Basin ID: POND 3



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.31	0.444	Orifice Plate
Zone 2 (EURV)	4.36	0.354	Orifice Plate
Zone 3 (100-year)	7.92	1.881	Weir&Pipe (Restrict)
Total (all zones)		2.680	

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

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

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

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.292E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	18.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.86	sq. inches (diameter = 1-1/2 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 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	3.00					
Orifice Area (sq. inches)	1.86	1.86	1.86					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.50	N/A	feet
Overflow Weir Front Edge Length =	8.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.04	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	24.74	N/A	ft^2
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	12.37	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.25	N/A	feet
Restrictor Plate Height Above Pipe Invert =	30.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	6.75	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.72	feet
Spillway Crest Length =	35.00	feet	Stage at Top of Freeboard =	8.47	feet
Spillway End Slopes =	10.00	H:V	Basin Area at Top of Freeboard =	0.74	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.07	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	3.85
CUHP Runoff Volume (acre-ft) =	0.444	0.799	1.015	2.087	3.141	4.964	6.227	8.024	15.211
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.015	2.087	3.141	4.964	6.227	8.024	15.211
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	6.0	16.9	25.8	46.6	58.4	74.9	139.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.40	0.73	0.91	1.17	2.18
Peak Inflow Q (cfs) =	N/A	N/A	11.3	22.7	31.8	52.4	64.6	80.8	147.1
Peak Outflow Q (cfs) =	0.2	0.3	1.1	11.1	20.6	41.6	54.1	66.8	143.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.8	0.9	0.9	0.9	1.0
Structure Controlling Flow =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.03	0.4	0.8	1.7	2.2	2.7	2.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	52	57	52	49	43	40	36	23
Time to Drain 99% of Inflow Volume (hours) =	40	55	61	59	58	54	53	50	44
Maximum Ponding Depth (ft) =	3.31	4.36	4.64	5.20	5.51	6.02	6.27	6.73	7.46
Area at Maximum Ponding Depth (acres) =	0.30	0.38	0.41	0.45	0.47	0.51	0.53	0.57	0.65
Maximum Volume Stored (acre-ft) =	0.445	0.802	0.912	1.152	1.295	1.542	1.678	1.927	2.378

A larger outlet area is recommended for safety. see revised

CLASSIC CONSULTING

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Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

RETREAT AT TIMBERRIDGE FILING NO. 1
CONSTRUCTION PLANS
HEC-RAS ANALYSIS
CHANNEL STATIONING EXHIBIT

DESIGNED BY	MAW	SCALE		DATE	7/22/19
DRAWN BY	MAW	(H) 1"= 100'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	1185.00

HEC-RAS Plan: EX Channel River: EX Channel Reach: Sand Creek CL

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	Max Chl Dpth	Hydr Radius	E.G. Elev	E.G. Slope	Vel Total	Shear Total	Flow Area	Top Width	Froude # XS
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(lb/sq ft)	(sq ft)	(ft)	
Sand Creek CL	5532.95	FEMA 100 Yr.	2600	7231.08	7235.52	7234.05	4.68	3.62	7236.03	0.022518	4.63	5.09	561.42	154.26	0.53
Sand Creek CL	5532.95	DBPS 100 Yr.	2170	7231.08	7235.07	7233.74	4.23	3.30	7235.53	0.022947	4.40	4.73	493.69	148.91	0.53
Sand Creek CL	5532.95	DBPS 10 Yr.	630	7231.08	7233.06	7232.34	2.22	1.74	7233.25	0.023166	2.89	2.51	217.95	125.24	0.47
Sand Creek CL	5532.95	Sterling MDDP 10	1487	7231.08	7234.29	7233.20	3.45	2.72	7234.65	0.023415	3.91	3.98	380.63	139.25	0.51
Sand Creek CL	5532.95	Sterling MDDP 10	430	7231.08	7232.68	7232.07	1.84	1.41	7232.83	0.022799	2.51	2.01	171.34	121.05	0.46
Sand Creek CL	5182.08	FEMA 100 Yr.	2600	7225.89	7231.60		5.71	4.25	7232.06	0.018385	4.83	4.88	538.23	124.78	0.46
Sand Creek CL	5182.08	DBPS 100 Yr.	2170	7225.89	7231.01		5.12	3.90	7231.43	0.019231	4.65	4.68	466.74	118.05	0.46
Sand Creek CL	5182.08	DBPS 10 Yr.	630	7225.89	7228.24		2.35	2.06	7228.46	0.026081	3.45	3.36	182.78	87.91	0.46
Sand Creek CL	5182.08	Sterling MDDP 10	1487	7225.89	7229.95		4.06	3.25	7230.29	0.021236	4.28	4.30	347.54	105.91	0.46
Sand Creek CL	5182.08	Sterling MDDP 10	430	7225.89	7227.75		1.86	1.66	7227.92	0.027783	3.07	2.88	140.24	84.02	0.45
Sand Creek CL	4903.69	FEMA 100 Yr.	2600	7221.98	7229.08		7.11	5.44	7229.23	0.006455	3.11	2.19	834.70	150.79	0.24
Sand Creek CL	4903.69	DBPS 100 Yr.	2170	7221.98	7228.48		6.51	5.02	7228.62	0.006274	2.91	1.96	746.03	146.41	0.23
Sand Creek CL	4903.69	DBPS 10 Yr.	630	7221.98	7225.44		3.47	2.71	7225.49	0.005936	1.88	1.00	335.16	122.57	0.20
Sand Creek CL	4903.69	Sterling MDDP 10	1487	7221.98	7227.37		5.40	4.20	7227.47	0.006024	2.53	1.58	587.29	138.03	0.22
Sand Creek CL	4903.69	Sterling MDDP 10	430	7221.98	7224.80		2.83	2.20	7224.84	0.006110	1.66	0.84	258.95	116.82	0.20
Sand Creek CL	4712.26	FEMA 100 Yr.	2600	7218.00	7224.69	7222.56	6.72	3.42	7225.02	0.022929	4.37	4.90	595.24	173.14	0.44
Sand Creek CL	4712.26	DBPS 100 Yr.	2170	7218.00	7224.22	7222.15	6.25	3.28	7224.53	0.022188	4.18	4.55	518.63	157.21	0.43
Sand Creek CL	4712.26	DBPS 10 Yr.	630	7218.00	7221.76	7220.18	3.79	2.30	7221.91	0.017028	2.93	2.44	214.93	92.93	0.36
Sand Creek CL	4712.26	Sterling MDDP 10	1487	7218.00	7223.37	7221.47	5.40	2.97	7223.62	0.020309	3.76	3.77	395.96	132.51	0.40
Sand Creek CL	4712.26	Sterling MDDP 10	430	7218.00	7221.22	7219.78	3.25	2.01	7221.33	0.015413	2.57	1.94	167.53	82.63	0.34
Sand Creek CL	4444.93	FEMA 100 Yr.	2600	7213.88	7217.40		3.56	2.63	7217.79	0.040891	4.87	6.70	534.32	202.97	0.54
Sand Creek CL	4444.93	DBPS 100 Yr.	2170	7213.88	7217.11		3.27	2.39	7217.45	0.040693	4.56	6.08	475.64	198.27	0.53
Sand Creek CL	4444.93	DBPS 10 Yr.	630	7213.88	7215.68		1.84	1.27	7215.82	0.041199	3.01	3.27	209.50	164.71	0.48
Sand Creek CL	4444.93	Sterling MDDP 10	1487	7213.88	7216.56		2.72	1.95	7216.83	0.041676	4.02	5.07	369.61	189.52	0.52
Sand Creek CL	4444.93	Sterling MDDP 10	430	7213.88	7215.35		1.50	1.05	7215.47	0.043935	2.73	2.88	157.50	149.90	0.48
Sand Creek CL	4231.86	FEMA 100 Yr.	2600	7206.00	7213.03		7.03	4.68	7213.17	0.006020	2.76	1.76	943.27	200.14	0.24
Sand Creek CL	4231.86	DBPS 100 Yr.	2170	7206.00	7212.39		6.39	4.11	7212.52	0.006641	2.66	1.70	815.20	196.97	0.25
Sand Creek CL	4231.86	DBPS 10 Yr.	630	7206.00	7209.91		3.91	1.87	7209.98	0.008532	1.84	1.00	342.68	182.71	0.29
Sand Creek CL	4231.86	Sterling MDDP 10	1487	7206.00	7211.38		5.38	3.22	7211.49	0.007400	2.40	1.49	619.75	191.59	0.26
Sand Creek CL	4231.86	Sterling MDDP 10	430	7206.00	7209.47		3.47	1.52	7209.54	0.008470	1.63	0.81	264.54	173.30	0.29
Sand Creek CL	3915.99	FEMA 100 Yr.	2600	7203.98	7210.60		6.63	5.34	7210.78	0.007035	3.26	2.35	798.22	146.52	0.26
Sand Creek CL	3915.99	DBPS 100 Yr.	2170	7203.98	7209.86		5.89	5.10	7210.03	0.006918	3.12	2.20	695.96	133.69	0.25
Sand Creek CL	3915.99	DBPS 10 Yr.	630	7203.98	7206.76		2.79	2.41	7206.84	0.008573	2.12	1.29	297.77	122.23	0.25
Sand Creek CL	3915.99	Sterling MDDP 10	1487	7203.98	7208.63		4.66	4.05	7208.76	0.007497	2.79	1.90	533.48	129.49	0.25
Sand Creek CL	3915.99	Sterling MDDP 10	430	7203.98	7206.17		2.20	1.88	7206.23	0.009588	1.90	1.12	226.66	119.89	0.25
Sand Creek CL	3708.56	FEMA 100 Yr.	2600	7200.10	7207.58		7.58	4.46	7208.29	0.025118	5.87	6.99	442.80	97.22	0.56
Sand Creek CL	3708.56	DBPS 100 Yr.	2170	7200.10	7206.95		6.95	4.30	7207.59	0.024758	5.65	6.64	384.15	87.35	0.54
Sand Creek CL	3708.56	DBPS 10 Yr.	630	7200.10	7203.92		3.91	2.65	7204.18	0.022000	3.75	3.63	168.13	62.56	0.45
Sand Creek CL	3708.56	Sterling MDDP 10	1487	7200.10	7205.77		5.77	4.03	7206.26	0.023468	5.11	5.91	291.24	70.38	0.49
Sand Creek CL	3708.56	Sterling MDDP 10	430	7200.10	7203.44		3.44	2.30	7203.63	0.018000	3.09	2.58	139.24	59.81	0.40
Sand Creek CL	3540.59	FEMA 100 Yr.	2600	7193.71	7201.17		7.54	5.28	7201.56	0.016232	4.87	5.35	534.27	98.51	0.38
Sand Creek CL	3540.59	DBPS 100 Yr.	2170	7193.71	7200.52		6.89	4.82	7200.87	0.016396	4.61	4.93	470.91	95.30	0.37
Sand Creek CL	3540.59	DBPS 10 Yr.	630	7193.71	7197.39		3.76	2.52	7197.56	0.017944	3.18	2.82	198.37	77.51	0.36

See revised

This is next to Lot 13 - if the channel is anticipated to drop 5' in this location additional protection is needed.

HEC-RAS Plan: EX Channel River: EX Channel Reach: Sand Creek CL (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	Max Chl Dpth	Hydr Radius	E.G. Elev	E.G. Slope	Vel Total	Shear Total	Flow Area	Top Width	Froude # XS
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(lb/sq ft)	(sq ft)	(ft)	
Sand Creek CL	3540.59	Sterling MDDP 10	1487	7193.71	7199.33		5.70	3.95	7199.61	0.016974	4.12	4.19	360.69	89.33	0.37
Sand Creek CL	3540.59	Sterling MDDP 10	430	7193.71	7196.61		2.98	1.92	7196.77	0.023749	3.08	2.85	139.68	71.70	0.41
Sand Creek CL	3334.27	FEMA 100 Yr.	2600	7188.62	7193.49		5.51	2.86	7194.42	0.073099	7.17	13.07	362.87	124.31	0.80
Sand Creek CL	3334.27	DBPS 100 Yr.	2170	7188.62	7193.30	7192.93	5.32	2.69	7194.05	0.062288	6.40	10.47	338.85	123.57	0.74
Sand Creek CL	3334.27	DBPS 10 Yr.	630	7188.62	7191.99	7190.34	4.01	1.52	7192.26	0.028882	3.48	2.73	180.90	117.69	0.59
Sand Creek CL	3334.27	Sterling MDDP 10	1487	7188.62	7192.91	7191.64	4.93	2.34	7193.41	0.045393	5.11	6.64	291.05	122.07	0.65
Sand Creek CL	3334.27	Sterling MDDP 10	430	7188.62	7191.30		3.32	2.48	7191.48	0.021255	3.35	3.29	128.21	50.30	0.37
Sand Creek CL	3179.66	FEMA 100 Yr.	2600	7183.98	7189.19		5.39	4.12	7189.37	0.006748	2.74	1.73	948.90	229.38	0.30
Sand Creek CL	3179.66	DBPS 100 Yr.	2170	7183.98	7188.60		4.80	3.57	7188.78	0.007669	2.67	1.71	813.47	226.82	0.32
Sand Creek CL	3179.66	DBPS 10 Yr.	630	7183.98	7186.09		2.29	1.62	7186.22	0.014340	2.17	1.45	290.92	179.91	0.40
Sand Creek CL	3179.66	Sterling MDDP 10	1487	7183.98	7187.59		3.79	2.71	7187.76	0.009833	2.53	1.66	588.17	216.49	0.35
Sand Creek CL	3179.66	Sterling MDDP 10	430	7183.98	7185.63		1.83	1.30	7185.75	0.016735	2.03	1.36	211.87	163.01	0.42
Sand Creek CL	2960.1	FEMA 100 Yr.	2600	7177.99	7186.35	7184.86	8.36	5.44	7187.34	0.012352	4.82	4.20	539.23	95.90	0.59
Sand Creek CL	2960.1	DBPS 100 Yr.	2170	7177.99	7185.67	7184.40	7.68	4.93	7186.58	0.012498	4.57	3.85	474.47	93.36	0.60
Sand Creek CL	2960.1	DBPS 10 Yr.	630	7177.99	7182.47	7182.17	4.48	2.36	7183.11	0.013648	3.23	2.01	195.10	81.29	0.73
Sand Creek CL	2960.1	Sterling MDDP 10	1487	7177.99	7184.43	7183.56	6.44	3.98	7185.23	0.012904	4.11	3.21	362.09	88.65	0.63
Sand Creek CL	2960.1	Sterling MDDP 10	430	7177.99	7181.87	7181.32	3.88	1.91	7182.44	0.013267	2.92	1.58	147.46	76.10	0.77
Sand Creek CL	2652.02	FEMA 100 Yr.	2600	7176.16	7183.16	7182.30	7.09	5.22	7184.74	0.023111	6.45	7.53	403.16	74.63	0.77
Sand Creek CL	2652.02	DBPS 100 Yr.	2170	7176.16	7182.47	7181.65	6.40	4.70	7183.93	0.024025	6.16	7.06	352.38	72.79	0.78
Sand Creek CL	2652.02	DBPS 10 Yr.	630	7176.16	7179.24	7178.95	3.17	2.37	7180.06	0.030771	4.53	4.56	139.00	57.91	0.82
Sand Creek CL	2652.02	Sterling MDDP 10	1487	7176.16	7181.25	7180.65	5.18	3.82	7182.47	0.025760	5.59	6.14	265.78	68.09	0.79
Sand Creek CL	2652.02	Sterling MDDP 10	430	7176.16	7178.61	7178.43	2.54	1.89	7179.31	0.034408	4.16	4.05	103.47	54.37	0.86
Sand Creek CL	2416.82	FEMA 100 Yr.	2600	7171.94	7180.36	7178.02	8.55	6.07	7181.30	0.011436	4.97	4.33	523.13	83.01	0.54
Sand Creek CL	2416.82	DBPS 100 Yr.	2170	7171.94	7179.62	7177.44	7.81	5.57	7180.45	0.011348	4.69	3.95	462.48	80.17	0.54
Sand Creek CL	2416.82	DBPS 10 Yr.	630	7171.94	7176.05		4.24	3.04	7176.43	0.010721	3.12	2.03	201.81	65.32	0.50
Sand Creek CL	2416.82	Sterling MDDP 10	1487	7171.94	7178.26	7176.44	6.45	4.63	7178.92	0.011294	4.17	3.26	356.97	74.99	0.53
Sand Creek CL	2416.82	Sterling MDDP 10	430	7171.94	7175.35		3.54	2.52	7175.65	0.010263	2.73	1.61	157.59	61.66	0.48
Sand Creek CL	2083.66	FEMA 100 Yr.	2600	7169.76	7176.69	7175.91	6.94	5.14	7178.44	0.025935	6.78	8.33	383.61	71.31	0.81
Sand Creek CL	2083.66	DBPS 100 Yr.	2170	7169.76	7176.07	7175.37	6.32	4.71	7177.63	0.025755	6.38	7.57	340.07	69.34	0.80
Sand Creek CL	2083.66	DBPS 10 Yr.	630	7169.76	7173.24	7172.78	3.49	2.55	7173.91	0.022028	4.02	3.51	156.72	60.20	0.72
Sand Creek CL	2083.66	Sterling MDDP 10	1487	7169.76	7175.04	7174.37	5.29	3.95	7176.21	0.023864	5.50	5.89	270.45	66.10	0.76
Sand Creek CL	2083.66	Sterling MDDP 10	430	7169.76	7172.64	7172.30	2.89	2.06	7173.19	0.022350	3.55	2.87	121.00	57.95	0.73
Sand Creek CL	1879.67	FEMA 100 Yr.	2600	7165.97	7171.58		5.62	4.11	7172.20	0.031597	5.84	8.10	445.17	106.68	0.54
Sand Creek CL	1879.67	DBPS 100 Yr.	2170	7165.97	7171.26		5.30	3.86	7171.76	0.027995	5.28	6.74	411.26	105.05	0.51
Sand Creek CL	1879.67	DBPS 10 Yr.	630	7165.97	7169.15	7168.17	3.19	2.16	7169.34	0.020911	3.13	2.82	201.37	92.62	0.42
Sand Creek CL	1879.67	Sterling MDDP 10	1487	7165.97	7170.46		4.50	3.22	7170.84	0.025939	4.52	5.22	329.27	100.99	0.48
Sand Creek CL	1879.67	Sterling MDDP 10	430	7165.97	7168.72	7167.81	2.76	1.82	7168.86	0.018628	2.65	2.11	162.36	88.70	0.39
Sand Creek CL	1507.91	FEMA 100 Yr.	2600	7159.88	7164.63		4.81	3.17	7164.87	0.017371	3.66	3.44	710.48	222.91	0.39
Sand Creek CL	1507.91	DBPS 100 Yr.	2260	7159.88	7164.25		4.43	2.85	7164.49	0.019124	3.60	3.41	627.63	218.99	0.41
Sand Creek CL	1507.91	DBPS 10 Yr.	670	7159.88	7162.05		2.23	1.66	7162.19	0.024465	2.81	2.54	238.69	143.21	0.41
Sand Creek CL	1507.91	Sterling MDDP 10	1520	7159.88	7163.40		3.58	2.46	7163.60	0.020266	3.34	3.11	455.39	184.75	0.40
Sand Creek CL	1507.91	Sterling MDDP 10	450	7159.88	7161.47		1.65	1.40	7161.59	0.028902	2.69	2.52	167.28	119.36	0.42

HEC-RAS Plan: EX Channel River: EX Channel Reach: Sand Creek CL (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	Max Chl Dpth	Hydr Radius	E.G. Elev	E.G. Slope	Vel Total	Shear Total	Flow Area	Top Width	Froude # XS
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(lb/sq ft)	(sq ft)	(ft)	
Sand Creek CL	1145.05	FEMA 100 Yr.	2600	7153.95	7160.23	7159.42	6.28	3.31	7161.04	0.018058	4.12	3.73	631.41	188.80	0.70
Sand Creek CL	1145.05	DBPS 100 Yr.	2260	7153.95	7159.81	7159.14	5.86	3.24	7160.55	0.017537	4.07	3.55	555.35	169.18	0.67
Sand Creek CL	1145.05	DBPS 10 Yr.	670	7153.95	7157.71	7157.18	3.76	1.90	7158.17	0.014815	2.77	1.76	242.20	126.57	0.69
Sand Creek CL	1145.05	Sterling MDDP 10	1520	7153.95	7158.97	7158.47	5.02	2.72	7159.61	0.017078	3.61	2.90	420.68	153.10	0.68
Sand Creek CL	1145.05	Sterling MDDP 10	450	7153.95	7157.21		3.26	1.66	7157.58	0.013177	2.46	1.37	183.29	109.31	0.66
Sand Creek CL	902.8	FEMA 100 Yr.	2600	7149.98	7156.19	7154.92	6.23	3.64	7156.73	0.014044	3.77	3.19	690.52	188.81	0.55
Sand Creek CL	902.8	DBPS 100 Yr.	2260	7149.98	7155.77	7154.68	5.81	3.47	7156.29	0.014165	3.67	3.07	615.10	176.13	0.54
Sand Creek CL	902.8	DBPS 10 Yr.	670	7149.98	7153.41	7153.18	3.45	1.74	7153.84	0.017688	2.74	1.93	244.11	139.26	0.70
Sand Creek CL	902.8	Sterling MDDP 10	1520	7149.98	7154.82	7154.13	4.86	2.83	7155.28	0.015038	3.34	2.66	454.67	159.84	0.57
Sand Creek CL	902.8	Sterling MDDP 10	450	7149.98	7152.93	7151.96	2.97	1.36	7153.36	0.019136	2.51	1.62	179.05	131.17	0.79
Sand Creek CL	520.2	FEMA 100 Yr.	2600	7147.90	7153.90		6.02	4.22	7154.32	0.011080	3.69	2.92	703.76	165.62	0.44
Sand Creek CL	520.2	DBPS 100 Yr.	2260	7147.90	7153.53		5.65	4.03	7153.90	0.010740	3.51	2.70	643.44	158.55	0.43
Sand Creek CL	520.2	DBPS 10 Yr.	670	7147.90	7151.16		3.28	2.22	7151.34	0.009545	2.25	1.32	298.12	134.11	0.40
Sand Creek CL	520.2	Sterling MDDP 10	1520	7147.90	7152.61		4.73	3.37	7152.89	0.010122	3.03	2.13	502.03	148.42	0.41
Sand Creek CL	520.2	Sterling MDDP 10	450	7147.90	7150.66		2.77	1.79	7150.80	0.009331	1.94	1.04	231.62	129.32	0.40
Sand Creek CL	250.3	FEMA 100 Yr.	2600	7145.93	7150.36	7148.66	4.44	3.22	7150.70	0.015312	3.54	3.07	735.42	228.27	0.46
Sand Creek CL	250.3	DBPS 100 Yr.	2260	7145.93	7150.07	7148.42	4.16	3.03	7150.38	0.014997	3.36	2.84	671.63	221.45	0.45
Sand Creek CL	250.3	DBPS 10 Yr.	670	7145.93	7148.11		2.20	1.84	7148.24	0.013148	2.26	1.51	296.30	160.55	0.38
Sand Creek CL	250.3	Sterling MDDP 10	1520	7145.93	7149.32	7147.88	3.40	2.59	7149.55	0.014349	2.96	2.32	512.69	197.96	0.43
Sand Creek CL	250.3	Sterling MDDP 10	450	7145.93	7147.68		1.76	1.52	7147.77	0.012772	1.96	1.21	229.25	150.37	0.36
Sand Creek CL	53.78	FEMA 100 Yr.	2600	7139.97	7144.87	7143.86	4.90	2.76	7145.22	0.016021	3.29	2.76	789.78	286.02	0.50
Sand Creek CL	53.78	DBPS 100 Yr.	2260	7139.97	7144.62	7143.69	4.65	2.57	7144.95	0.016006	3.15	2.56	718.39	279.57	0.51
Sand Creek CL	53.78	DBPS 10 Yr.	670	7139.97	7142.93	7142.58	2.96	1.45	7143.15	0.016007	2.19	1.45	305.31	210.61	0.56
Sand Creek CL	53.78	Sterling MDDP 10	1520	7139.97	7143.95	7143.24	3.98	2.16	7144.24	0.016020	2.81	2.16	541.68	250.80	0.51
Sand Creek CL	53.78	Sterling MDDP 10	450	7139.97	7142.56	7141.97	2.59	1.18	7142.77	0.016010	1.95	1.18	230.97	196.16	0.60

Please highlight the cross-sections within and adjacent to this plat.

2 Lic Revised

HEC-RAS Plan: SC PR River: Sand Creek Impro Reach: CL-PR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	Max Chl Dpth	Hydr Radius	E.G. Elev	E.G. Slope	Vel Total	Shear Total	Flow Area	Top Width	Froude # XS
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(lb/sq ft)	(sq ft)	(ft)	
CL-PR	5532.95	FEMA 100 Yr.	2600	7230.84	7235.52	7234.26	4.68	3.61	7236.12	0.022532	4.65	5.08	559.31	154.07	0.57
CL-PR	5532.95	DBPS 100 Yr.	2170	7230.84	7235.07	7233.95	4.23	3.29	7235.61	0.022905	4.41	4.71	491.77	148.65	0.57
CL-PR	5532.95	DBPS 10 Yr.	630	7230.84	7233.06	7232.50	2.22	1.73	7233.31	0.023035	2.91	2.48	216.54	125.20	0.54
CL-PR	5532.95	Sterling MDDP 10	1487	7230.84	7234.29	7233.38	3.45	2.71	7234.72	0.023299	3.92	3.95	379.06	139.17	0.56
CL-PR	5532.95	Sterling MDDP 10	430	7230.84	7232.68	7232.24	1.84	1.40	7232.87	0.022857	2.53	2.00	169.66	120.97	0.53
CL-PR	5182.08	FEMA 100 Yr.	2600	7225.96	7231.65		5.70	4.27	7232.07	0.018615	4.79	4.96	542.74	125.32	0.44
CL-PR	5182.08	DBPS 100 Yr.	2170	7225.96	7231.06		5.11	3.92	7231.45	0.019462	4.61	4.76	470.87	118.58	0.44
CL-PR	5182.08	DBPS 10 Yr.	630	7225.96	7228.29		2.34	2.08	7228.49	0.026314	3.41	3.41	185.01	88.36	0.44
CL-PR	5182.08	Sterling MDDP 10	1487	7225.96	7229.99		4.04	3.26	7230.32	0.021471	4.24	4.37	351.05	106.45	0.44
CL-PR	5182.08	Sterling MDDP 10	430	7225.96	7227.79		1.84	1.68	7227.95	0.027798	3.02	2.92	142.22	84.05	0.43
CL-PR	4903.69	FEMA 100 Yr.	2600	7222.00	7229.08		7.08	5.44	7229.24	0.006504	3.12	2.21	834.06	150.85	0.24
CL-PR	4903.69	DBPS 100 Yr.	2170	7222.00	7228.49		6.48	5.01	7228.62	0.006323	2.91	1.98	745.50	146.47	0.23
CL-PR	4903.69	DBPS 10 Yr.	630	7222.00	7225.44		3.44	2.71	7225.50	0.005992	1.88	1.01	334.88	122.66	0.20
CL-PR	4903.69	Sterling MDDP 10	1487	7222.00	7227.37		5.37	4.19	7227.47	0.006083	2.53	1.59	586.67	138.19	0.22
CL-PR	4903.69	Sterling MDDP 10	430	7222.00	7224.81		2.81	2.20	7224.85	0.006187	1.66	0.85	258.54	116.93	0.20
CL-PR	4712.26	FEMA 100 Yr.	2600	7217.98	7224.67	7222.49	6.69	3.43	7225.00	0.022684	4.36	4.86	596.20	172.82	0.44
CL-PR	4712.26	DBPS 100 Yr.	2170	7217.98	7224.21	7222.08	6.23	3.29	7224.51	0.022022	4.17	4.52	520.04	157.47	0.43
CL-PR	4712.26	DBPS 10 Yr.	630	7217.98	7221.75	7220.15	3.76	2.32	7221.89	0.016998	2.91	2.46	216.66	92.87	0.35
CL-PR	4712.26	Sterling MDDP 10	1487	7217.98	7223.35	7221.41	5.37	2.98	7223.60	0.020224	3.75	3.77	396.37	132.21	0.40
CL-PR	4712.26	Sterling MDDP 10	430	7217.98	7221.22	7219.76	3.24	2.03	7221.33	0.015199	2.52	1.93	170.41	83.30	0.33
CL-PR	4444.93	FEMA 100 Yr.	2600	7213.93	7217.38		3.45	2.59	7217.78	0.041470	4.92	6.71	528.48	203.56	0.56
CL-PR	4444.93	DBPS 100 Yr.	2170	7213.93	7217.10		3.17	2.37	7217.45	0.040993	4.61	6.07	470.76	198.02	0.54
CL-PR	4444.93	DBPS 10 Yr.	630	7213.93	7215.68		1.75	1.26	7215.83	0.040995	3.03	3.23	207.63	164.62	0.49
CL-PR	4444.93	Sterling MDDP 10	1487	7213.93	7216.56		2.63	1.93	7216.83	0.041638	4.06	5.02	366.53	189.42	0.53
CL-PR	4444.93	Sterling MDDP 10	430	7213.93	7215.34		1.41	1.04	7215.47	0.044949	2.78	2.90	154.49	149.20	0.50
CL-PR	4231.86	FEMA 100 Yr.	2600	7206.00	7213.05		7.05	4.68	7213.18	0.005951	2.75	1.74	944.92	200.18	0.24
CL-PR	4231.86	DBPS 100 Yr.	2170	7206.00	7212.39		6.39	4.11	7212.52	0.006602	2.66	1.69	815.09	196.97	0.25
CL-PR	4231.86	DBPS 10 Yr.	630	7206.00	7209.91		3.91	1.87	7209.99	0.008531	1.84	0.99	341.65	182.71	0.29
CL-PR	4231.86	Sterling MDDP 10	1487	7206.00	7211.38		5.38	3.21	7211.49	0.007400	2.40	1.48	618.74	191.90	0.26
CL-PR	4231.86	Sterling MDDP 10	430	7206.00	7209.48		3.48	1.52	7209.55	0.008382	1.63	0.80	264.61	173.44	0.30
CL-PR	3915.99	FEMA 100 Yr.	2600	7203.99	7210.67		6.67	5.37	7210.84	0.006819	3.22	2.28	807.78	147.59	0.25
CL-PR	3915.99	DBPS 100 Yr.	2170	7203.99	7209.92		5.93	5.14	7210.08	0.006714	3.09	2.16	702.67	133.86	0.25
CL-PR	3915.99	DBPS 10 Yr.	630	7203.99	7206.76		2.77	2.41	7206.84	0.008606	2.12	1.29	297.60	122.40	0.25
CL-PR	3915.99	Sterling MDDP 10	1487	7203.99	7208.64		4.65	4.07	7208.77	0.007426	2.78	1.88	535.10	129.53	0.25
CL-PR	3915.99	Sterling MDDP 10	430	7203.99	7206.17		2.17	1.87	7206.23	0.009769	1.91	1.14	225.47	119.97	0.26
CL-PR	3708.56	FEMA 100 Yr.	2600	7200.00	7207.61		7.61	4.48	7208.47	0.022675	5.84	6.34	445.42	97.38	0.61
CL-PR	3708.56	DBPS 100 Yr.	2170	7200.00	7207.00		7.00	4.31	7207.76	0.022077	5.59	5.94	388.08	88.02	0.59
CL-PR	3708.56	DBPS 10 Yr.	630	7200.00	7203.76		3.76	2.53	7204.15	0.022567	3.98	3.57	158.43	61.66	0.55
CL-PR	3708.56	Sterling MDDP 10	1487	7200.00	7205.80		5.80	4.06	7206.39	0.020504	5.07	5.19	293.58	70.55	0.53
CL-PR	3708.56	Sterling MDDP 10	430	7200.00	7203.33		3.33	2.21	7203.60	0.017709	3.25	2.44	132.37	59.09	0.49
CL-PR	3540.56	FEMA 100 Yr.	2600	7193.66	7200.57		6.91	4.85	7201.18	0.020761	5.47	6.29	474.94	95.52	0.49
CL-PR	3540.56	DBPS 100 Yr.	2170	7193.66	7199.95		6.29	4.40	7200.51	0.021210	5.21	5.83	416.82	92.51	0.50
CL-PR	3540.56	DBPS 10 Yr.	630	7193.66	7197.31		3.65	2.46	7197.55	0.017340	3.28	2.66	191.88	76.96	0.43
CL-PR	3540.56	Sterling MDDP 10	1487	7193.66	7198.86		5.20	3.61	7199.31	0.021767	4.66	4.91	319.14	86.58	0.50

See Revised

How did the channel drop 5 feet? If this model is "future, post-erosion, it needs to be labeled as such. Do the check structures allow for 5' of erosion?

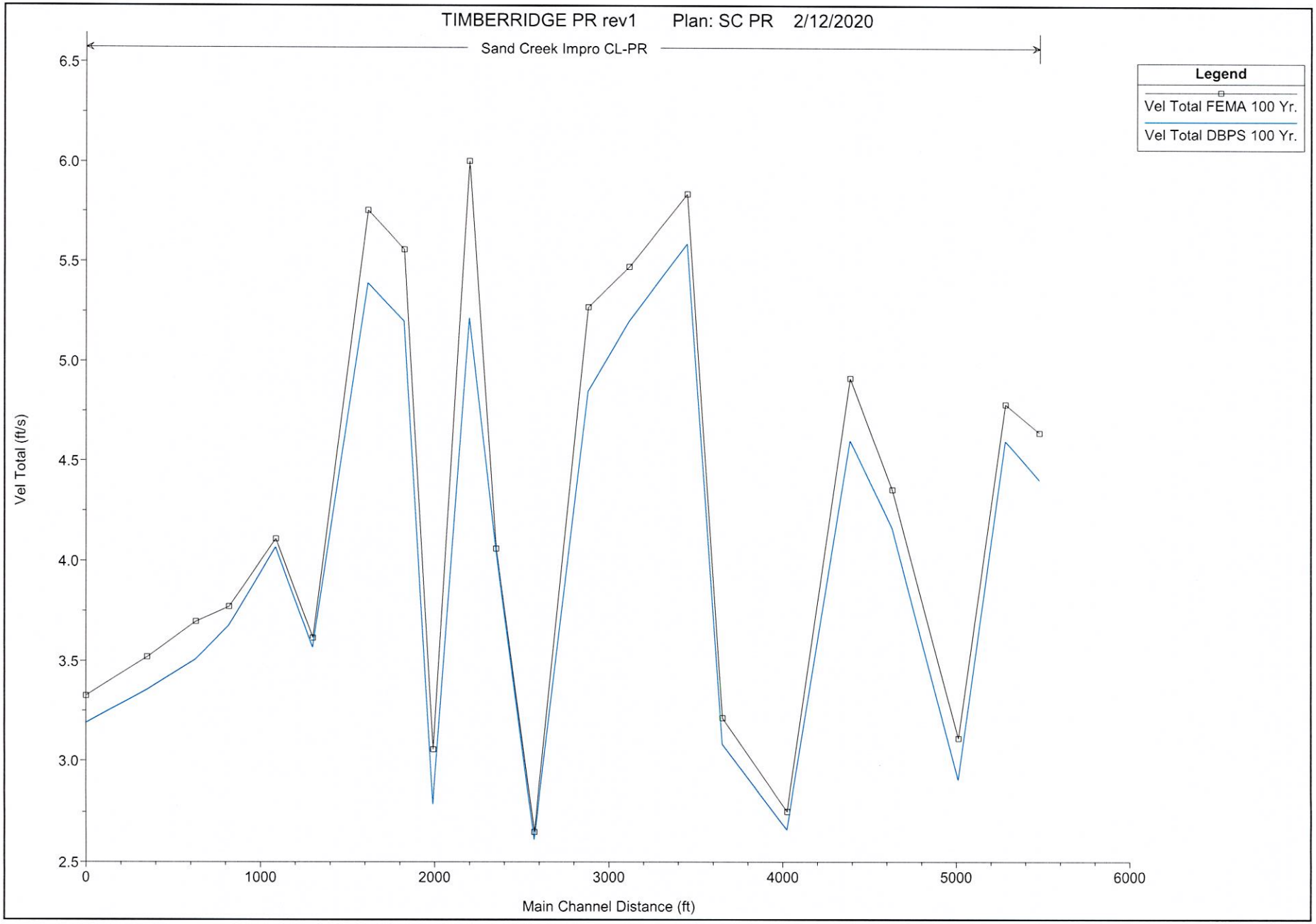
HEC-RAS Plan: SC PR River: Sand Creek Impro Reach: CL-PR (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	Max Chl Dpth	Hydr Radius	E.G. Elev	E.G. Slope	Vel Total	Shear Total	Flow Area	Top Width	Froude # XS
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(lb/sq ft)	(sq ft)	(ft)	
CL-PR	3540.56	Sterling MDDP 10	430	7193.66	7196.50		2.84	1.84	7196.75	0.024145	3.26	2.77	131.95	70.93	0.51
CL-PR	3443.11	FEMA 100 Yr.	2600	7187.94	7194.51	7194.51	6.56	3.73	7196.07	0.021671	5.27	5.04	492.98	129.56	0.91
CL-PR	3443.11	DBPS 100 Yr.	2170	7187.94	7194.15	7194.15	6.21	3.42	7195.54	0.020111	4.85	4.30	447.03	127.88	0.89
CL-PR	3443.11	DBPS 10 Yr.	630	7187.94	7191.36	7190.82	3.42	2.37	7192.50	0.025903	4.74	3.84	132.80	54.41	0.96
CL-PR	3443.11	Sterling MDDP 10	1487	7187.94	7193.45	7193.45	5.51	2.83	7194.60	0.017805	4.14	3.14	359.38	124.76	0.89
CL-PR	3443.11	Sterling MDDP 10	430	7187.94	7190.91	7190.56	2.97	2.24	7191.62	0.019329	3.94	2.70	109.12	47.34	0.79
CL-PR	3334.25	FEMA 100 Yr.	2600	7183.81	7189.32		5.52	4.23	7189.51	0.005907	2.65	1.56	981.23	230.65	0.30
CL-PR	3334.25	DBPS 100 Yr.	2170	7183.81	7188.66		4.86	3.64	7188.85	0.006937	2.61	1.58	830.90	227.52	0.32
CL-PR	3334.25	DBPS 10 Yr.	630	7183.81	7186.03		2.23	1.57	7186.19	0.015218	2.24	1.50	280.91	178.27	0.45
CL-PR	3334.25	Sterling MDDP 10	1487	7183.81	7187.56		3.76	2.68	7187.75	0.009702	2.55	1.62	582.77	217.08	0.38
CL-PR	3334.25	Sterling MDDP 10	430	7183.81	7185.57	7185.03	1.77	1.27	7185.72	0.017980	2.12	1.42	202.82	159.92	0.48
CL-PR	3179.68	FEMA 100 Yr.	2600	7178.00	7186.71	7185.49	8.71	5.63	7187.94	0.007518	4.06	2.64	639.85	110.97	0.65
CL-PR	3179.68	DBPS 100 Yr.	2170	7178.00	7185.75	7184.94	7.75	4.91	7187.04	0.008743	4.05	2.68	535.16	106.58	0.72
CL-PR	3179.68	DBPS 10 Yr.	630	7178.00	7182.53	7182.53	4.53	2.33	7183.49	0.009626	2.92	1.40	215.73	91.59	0.91
CL-PR	3179.68	Sterling MDDP 10	1487	7178.00	7184.63	7184.05	6.63	4.06	7185.70	0.008282	3.55	2.10	418.93	101.39	0.72
CL-PR	3179.68	Sterling MDDP 10	430	7178.00	7181.91	7181.80	3.91	1.84	7182.82	0.009671	2.68	1.11	160.58	86.43	0.99
CL-PR	2960.1	FEMA 100 Yr.	2600	7177.88	7183.81	7183.81	5.93	4.52	7186.24	0.015014	6.00	4.24	433.01	89.70	1.00
CL-PR	2960.1	DBPS 100 Yr.	2170	7177.88	7183.62	7183.62	5.74	4.49	7185.43	0.011742	5.22	3.29	415.72	86.85	0.87
CL-PR	2960.1	DBPS 10 Yr.	630	7177.88	7180.25	7180.25	2.37	2.07	7181.27	0.020692	4.06	2.68	155.15	73.90	0.99
CL-PR	2960.1	Sterling MDDP 10	1487	7177.88	7181.69	7181.69	3.81	3.37	7183.66	0.021780	5.67	4.58	262.04	74.31	1.06
CL-PR	2960.1	Sterling MDDP 10	430	7177.88	7179.69	7179.69	1.81	1.59	7180.56	0.024632	3.75	2.45	114.63	71.48	1.04
CL-PR	2652.02		Culvert												
CL-PR	2416.82	FEMA 100 Yr.	2600	7168.00	7178.03		10.03	7.75	7178.46	0.001610	3.06	0.78	850.03	104.94	0.32
CL-PR	2416.82	DBPS 100 Yr.	2170	7168.00	7177.34		9.34	7.31	7177.69	0.001441	2.79	0.66	778.14	102.14	0.30
CL-PR	2416.82	DBPS 10 Yr.	630	7168.00	7173.86		5.86	4.92	7173.94	0.000608	1.41	0.19	447.31	88.13	0.18
CL-PR	2416.82	Sterling MDDP 10	1487	7168.00	7176.06		8.06	6.46	7176.28	0.001131	2.29	0.46	650.59	96.97	0.26
CL-PR	2416.82	Sterling MDDP 10	430	7168.00	7173.14		5.14	4.39	7173.19	0.000445	1.12	0.12	384.42	85.21	0.15
CL-PR	2083.66	FEMA 100 Yr.	2600	7169.86	7176.67	7175.20	6.81	5.12	7177.75	0.018458	5.56	5.90	467.69	89.07	0.64
CL-PR	2083.66	DBPS 100 Yr.	2170	7169.86	7176.09	7174.72	6.23	4.72	7177.04	0.017970	5.20	5.29	417.06	86.40	0.63
CL-PR	2083.66	DBPS 10 Yr.	630	7169.86	7173.17	7172.49	3.31	2.49	7173.62	0.017534	3.42	2.72	183.97	73.27	0.59
CL-PR	2083.66	Sterling MDDP 10	1487	7169.86	7175.02	7173.85	5.16	3.93	7175.75	0.017320	4.55	4.25	327.03	81.60	0.60
CL-PR	2083.66	Sterling MDDP 10	430	7169.86	7172.54	7172.09	2.68	1.96	7172.93	0.019196	3.10	2.35	138.88	70.36	0.62
CL-PR	1879.67	FEMA 100 Yr.	2600	7165.99	7171.19	7171.19	5.21	3.81	7172.98	0.028576	5.75	6.80	451.84	117.40	0.96
CL-PR	1879.67	DBPS 100 Yr.	2170	7165.99	7170.77	7170.77	4.79	3.48	7172.37	0.028116	5.39	6.11	402.44	114.64	0.96
CL-PR	1879.67	DBPS 10 Yr.	630	7165.99	7168.82	7168.76	2.84	1.90	7169.55	0.021750	3.29	2.58	191.77	100.63	0.88
CL-PR	1879.67	Sterling MDDP 10	1487	7165.99	7170.01	7170.01	4.03	2.87	7171.29	0.026838	4.68	4.82	317.64	109.73	0.94
CL-PR	1879.67	Sterling MDDP 10	430	7165.99	7168.47	7168.38	2.49	1.60	7169.02	0.018443	2.74	1.84	156.86	97.71	0.83
CL-PR	1507.91	FEMA 100 Yr.	2600	7159.96	7164.39	7162.99	4.45	3.06	7164.73	0.016308	3.62	3.12	718.84	233.19	0.47
CL-PR	1507.91	DBPS 100 Yr.	2260	7159.96	7164.01	7162.75	4.07	2.77	7164.36	0.017902	3.57	3.09	633.11	227.58	0.50
CL-PR	1507.91	DBPS 10 Yr.	670	7159.96	7161.95	7161.23	2.01	1.78	7162.17	0.024174	2.99	2.68	224.05	125.58	0.50
CL-PR	1507.91	Sterling MDDP 10	1520	7159.96	7163.22	7162.20	3.28	2.22	7163.52	0.019435	3.30	2.69	460.79	206.84	0.51
CL-PR	1507.91	Sterling MDDP 10	450	7159.96	7161.46	7160.95	1.52	1.36	7161.65	0.029371	2.75	2.49	163.35	120.10	0.52

HEC-RAS Plan: SC PR River: Sand Creek Impro Reach: CL-PR (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	Max Chl Dpth	Hydr Radius	E.G. Elev	E.G. Slope	Vel Total	Shear Total	Flow Area	Top Width	Froude # XS
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(lb/sq ft)	(sq ft)	(ft)	
CL-PR	1145.05	FEMA 100 Yr.	2600	7153.97	7160.24	7159.42	6.27	3.31	7161.05	0.017947	4.11	3.71	632.55	188.76	0.69
CL-PR	1145.05	DBPS 100 Yr.	2260	7153.97	7159.81	7159.12	5.84	3.25	7160.55	0.017500	4.07	3.55	555.47	169.09	0.67
CL-PR	1145.05	DBPS 10 Yr.	670	7153.97	7157.71	7157.23	3.74	1.89	7158.17	0.014848	2.76	1.75	242.44	127.39	0.69
CL-PR	1145.05	Sterling MDDP 10	1520	7153.97	7158.97	7158.47	5.00	2.72	7159.61	0.017020	3.61	2.89	420.96	153.05	0.68
CL-PR	1145.05	Sterling MDDP 10	450	7153.97	7157.22		3.25	1.64	7157.59	0.013306	2.45	1.36	183.48	111.09	0.67
CL-PR	902.8	FEMA 100 Yr.	2600	7149.99	7156.18	7154.92	6.20	3.63	7156.73	0.014153	3.77	3.20	689.09	188.94	0.55
CL-PR	902.8	DBPS 100 Yr.	2260	7149.99	7155.77	7154.69	5.79	3.47	7156.29	0.014206	3.68	3.08	614.39	175.99	0.54
CL-PR	902.8	DBPS 10 Yr.	670	7149.99	7153.42	7153.18	3.44	1.75	7153.84	0.017659	2.74	1.93	244.17	139.03	0.69
CL-PR	902.8	Sterling MDDP 10	1520	7149.99	7154.82	7154.13	4.84	2.83	7155.28	0.015070	3.35	2.66	454.21	159.68	0.57
CL-PR	902.8	Sterling MDDP 10	450	7149.99	7152.94	7152.85	2.96	1.36	7153.37	0.019105	2.51	1.62	179.34	131.19	0.79
CL-PR	520.2	FEMA 100 Yr.	2600	7147.98	7153.90		5.92	4.25	7154.31	0.011062	3.70	2.94	703.30	164.34	0.44
CL-PR	520.2	DBPS 100 Yr.	2260	7147.98	7153.53		5.55	4.04	7153.90	0.010733	3.51	2.71	643.97	158.44	0.42
CL-PR	520.2	DBPS 10 Yr.	670	7147.98	7151.16		3.18	2.22	7151.33	0.009612	2.25	1.33	297.97	134.05	0.39
CL-PR	520.2	Sterling MDDP 10	1520	7147.98	7152.61		4.63	3.37	7152.89	0.010142	3.03	2.13	502.24	148.41	0.41
CL-PR	520.2	Sterling MDDP 10	450	7147.98	7150.66		2.68	1.79	7150.80	0.009375	1.94	1.05	231.82	129.26	0.39
CL-PR	250.3	FEMA 100 Yr.	2600	7145.95	7150.37	7148.65	4.45	3.22	7150.71	0.015150	3.52	3.05	738.50	228.86	0.46
CL-PR	250.3	DBPS 100 Yr.	2260	7145.95	7150.08	7148.41	4.16	3.03	7150.39	0.014919	3.36	2.82	673.05	221.77	0.45
CL-PR	250.3	DBPS 10 Yr.	670	7145.95	7148.12		2.20	1.85	7148.24	0.012952	2.25	1.50	297.75	160.58	0.37
CL-PR	250.3	Sterling MDDP 10	1520	7145.95	7149.33	7147.88	3.41	2.59	7149.56	0.014206	2.95	2.30	514.46	198.14	0.42
CL-PR	250.3	Sterling MDDP 10	450	7145.95	7147.68		1.76	1.53	7147.78	0.012593	1.95	1.20	230.66	150.96	0.35
CL-PR	53.78	FEMA 100 Yr.	2600	7139.68	7144.84	7143.96	5.16	2.74	7145.25	0.016008	3.33	2.74	781.65	284.79	0.55
CL-PR	53.78	DBPS 100 Yr.	2260	7139.68	7144.58	7143.81	4.90	2.56	7144.97	0.016007	3.19	2.56	708.62	276.00	0.55
CL-PR	53.78	DBPS 10 Yr.	670	7139.68	7142.89	7142.65	3.21	1.43	7143.19	0.016011	2.24	1.42	298.70	209.26	0.64
CL-PR	53.78	Sterling MDDP 10	1520	7139.68	7143.92	7143.35	4.24	2.14	7144.27	0.016001	2.85	2.14	534.10	249.07	0.57
CL-PR	53.78	Sterling MDDP 10	450	7139.68	7142.52	7142.40	2.84	1.15	7142.81	0.016008	2.01	1.15	224.09	193.76	0.70

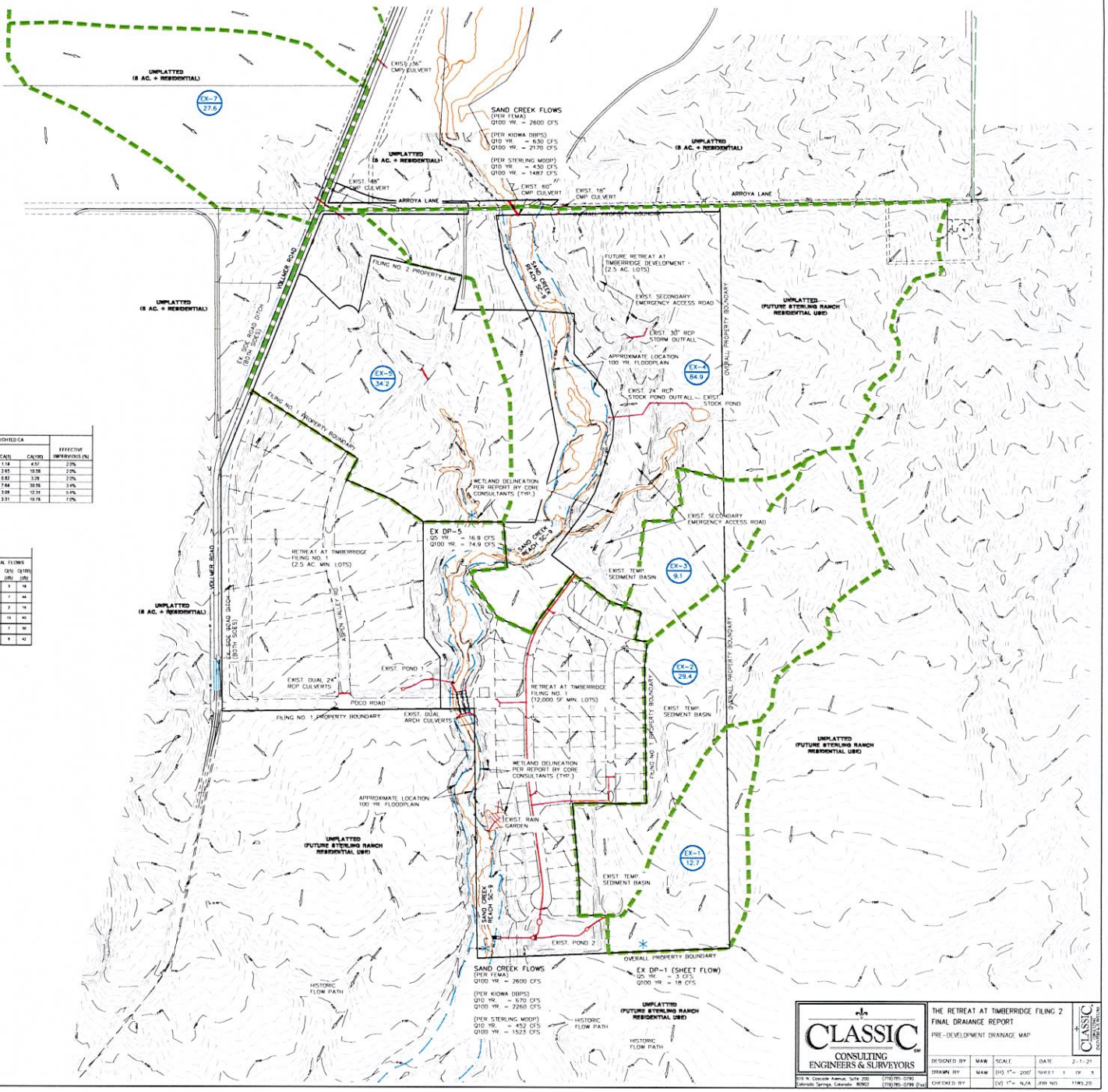
Please highlight the cross-sections within and adjacent to this plat.


TIMBERRIDGE PR rev1 Plan: SC PR 2/12/2020
Sand Creek Impro CL-PR
Legend
Vel Total FEMA 100 Yr.
Vel Total DBPS 100 Yr.
Vel Total (ft/s)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)

DRAINAGE MAPS

Move drainage plans to end of report pdf

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS



FINAL DRAINAGE REPORT – BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS AREA (AC)	C(2)	C(5)	C(100)	LANDSCAPE/DEVELOPED AREAS AREA (AC)	C(2)	C(5)	C(100)	WEIGHTED C(2)	WEIGHTED C(5)	WEIGHTED C(100)	WEIGHTED CA CA(2)	CA(5)	CA(100)	EFFECTIVE IMPERVIOUS (%)
EX-1	12.7	0.00	0.89	0.90	0.96	12.7	0.05	0.12	0.39	0.03	0.09	0.36	0.38	1.14	4.57	2.0%
EX-2	29.4	0.00	0.89	0.90	0.96	29.4	0.05	0.12	0.39	0.03	0.09	0.36	0.88	2.65	10.58	2.0%
EX-3	9.1	0.00	0.89	0.90	0.96	9.1	0.05	0.12	0.39	0.03	0.09	0.36	0.27	0.82	3.28	2.0%
EX-4	84.9	1.50	0.57	0.59	0.70	83.4	0.05	0.12	0.39	0.03	0.09	0.36	2.55	7.64	30.55	3.4%
EX-5	34.2	1.50	0.57	0.59	0.70	32.7	0.05	0.12	0.39	0.03	0.09	0.36	1.03	3.08	12.31	5.4%
EX-7	27.6	0.00	0.89	0.90	0.96	27.6	0.05	0.12	0.39	0.05	0.12	0.39	1.38	3.31	10.78	7.0%

FINAL DRAINAGE REPORT – BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
EX-1	0.38	1.14	4.57	0.12	300	15	20.6	1000	3.0%	1.4	11.8	32.4	1.90	2.97	7.97	1	3	14
EX-2	0.88	2.65	10.58	0.12	300	15	20.6	800	2.0%	1.4	9.4	30.0	1.99	3.08	8.28	2	7	44
EX-3	0.27	0.82	3.28	0.12	300	9	21.3	200	2.0%	1.4	2.4	23.7	2.27	3.54	9.75	1	2	19
EX-4	2.55	7.64	30.55	0.12	300	12	19.4	2500	2.0%	1.4	29.5	48.9	1.41	1.75	2.83	4	13	85
EX-5	1.03	3.08	12.31	0.12	300	12	19.4	1200	3.0%	1.7	11.5	30.9	1.95	2.43	4.98	2	7	61
EX-7	1.38	3.31	10.78	0.12	300	12	19.4	1900	3.0%	1.7	14.4	33.8	1.84	2.30	3.86	3	8	42

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
DESIGN POINT	
BASIN IDENTIFIER / AREA IN ACRES	EX-5 / 34.2
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	
WETLAND DELINEATION	

200 100 0 200 400

SCALE: 1" = 200'

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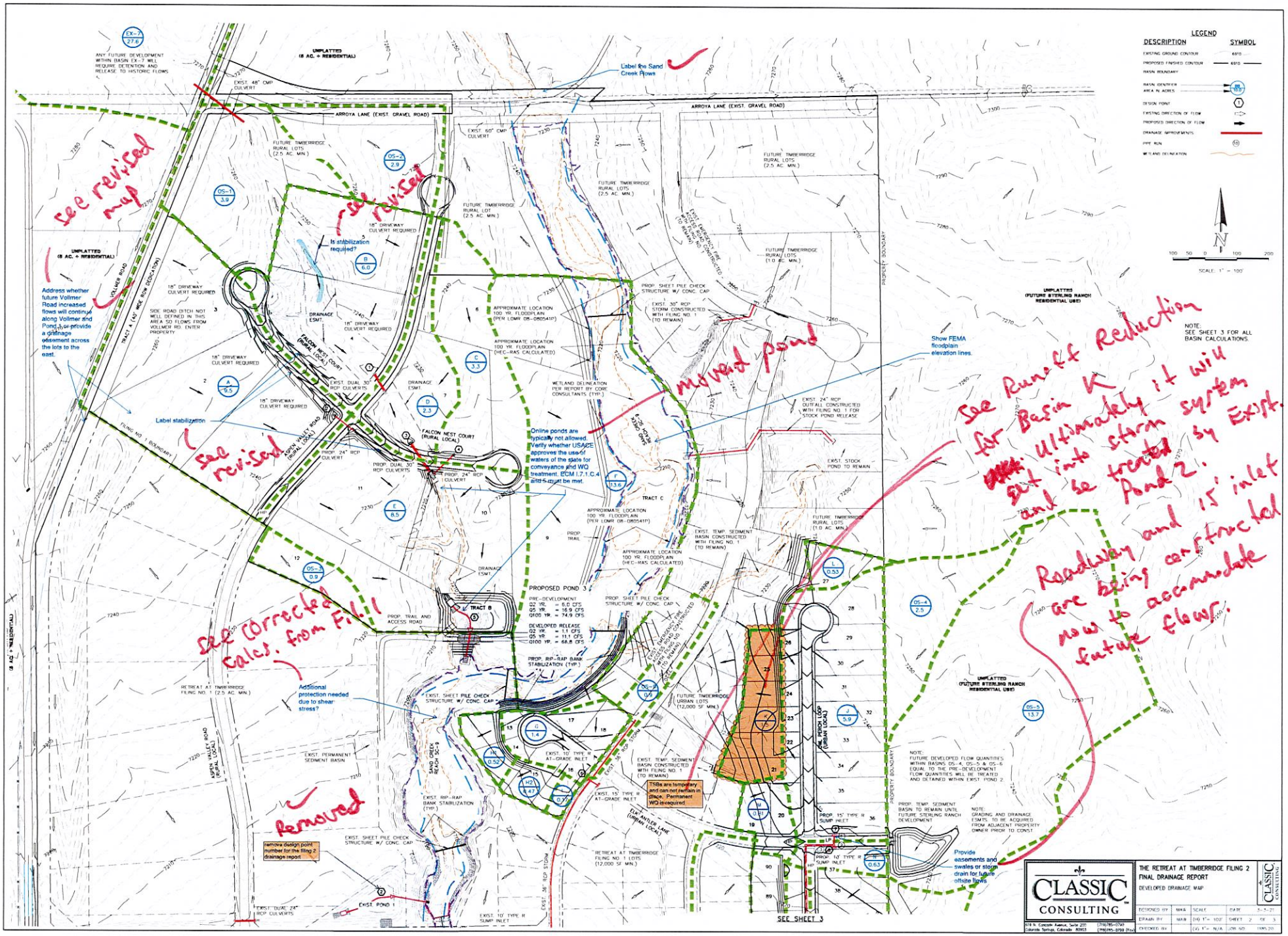
THE RETREAT AT TIMBERRIDGE FILING 2
FINAL DRAIANCE REPORT
PRE-DEVELOPMENT DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	2-1-21
DRAWN BY	MAW	(H) 1"= 200'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	1190.20


LEGEND
DESCRIPTION
SYMBOL
EXISTING GROUND CONTOUR
PROPOSED FINISHED CONTOUR
BASIN BOUNDARY
BASIN IDENTIFIER
AREA IN ACRES
DESIGN POINT
EXISTING DIRECTION OF FLOW
PROPOSED DIRECTION OF FLOW
DRAINAGE IMPROVEMENTS
PIPE RUN
WETLAND DELINEATION
SCALE: 1" = 100'
NOTE: SEE SHEET 3 FOR ALL BASIN CALCULATIONS.
ARROYA LANE (EXIST. GRAVEL ROAD)
UNPLATTED (8 AC. ± RESIDENTIAL)
VOLLMER ROAD
ASPEN VALLEY ROAD (RURAL LOCAL)
FALCON NEST COURT (RURAL LOCAL)
FUTURE TIMBERRIDGE RURAL LOTS (2.5 AC. MIN.)
FUTURE TIMBERRIDGE RURAL LOTS (1.0 AC. MIN.)
FUTURE TIMBERRIDGE URBAN LOTS (12,000 SF MIN.)
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
RETREAT AT TIMBERRIDGE FILING NO. 1 (2.5 AC. MIN.)
RETREAT AT TIMBERRIDGE FILING NO. 1 LOTS (12,000 SF MIN.)
PROPERTY BOUNDARY
TRACT A 140' WIDE ROW DEDICATION
TRACT B
TRACT C
FILING NO. 1 BOUNDARY
PROPOSED POND 3
PRE-DEVELOPMENT Q2 YR. = 6.0 CFS Q5 YR. = 16.9 CFS Q100 YR. = 74.9 CFS
DEVELOPED RELEASE Q2 YR. = 1.1 CFS Q5 YR. = 11.1 CFS Q100 YR. = 68.8 CFS
EXIST. POND 1
EXIST. POND 2
EXIST. STOCK POND TO REMAIN
EXIST. TEMP. SEDIMENT BASIN CONSTRUCTED WITH FILING NO. 1 (TO REMAIN)
PROP. TEMP. SEDIMENT BASIN TO REMAIN UNTIL FUTURE STERLING RANCH DEVELOPMENT
EXIST. PERMANENT SEDIMENT BASIN
SAND CREEK REACH SC-9
EXIST. 60" CMP CULVERT
EXIST. 48" CMP CULVERT
EXIST. 30" RCP STORM CONSTRUCTED WITH FILING NO. 1 (TO REMAIN)
EXIST. 24" RCP OUTFALL CONSTRUCTED WITH FILING NO. 1 FOR STOCK POND RELEASE
EXIST. 36" RCP STORM
EXIST. 10' TYPE R AT-GRADE INLET
EXIST. 15' TYPE R AT-GRADE INLET
PROP. 10' TYPE R SUMP INLET
PROP. 15' TYPE R SUMP INLET
PROP. SHEET PILE CHECK STRUCTURE W/ CONC. CAP
PROP. RIP-RAP BANK STABILIZATION (TYP.)
EXIST. RIP-RAP BANK STABILIZATION (TYP.)
PROP. TRAIL AND ACCESS ROAD
PROP. TRAIL
DRAINAGE ESMT.
APPROXIMATE LOCATION 100 YR. FLOODPLAIN (PER LOMR 08-08054IP)
APPROXIMATE LOCATION 100 YR. FLOODPLAIN (HEC-RAS CALCULATED)
WETLAND DELINEATION PER REPORT BY CORE CONSULTANTS (TYP.)
NOTE: FUTURE DEVELOPED FLOW QUANTITIES WITHIN BASINS OS-4, OS-5 & OS-6 EQUAL TO THE PRE-DEVELOPMENT FLOW QUANTITIES WILL BE TREATED AND DETAINED WITHIN EXIST. POND 2
NOTE: GRADING AND DRAINAGE ESMTS. TO BE ACQUIRED FROM ADJACENT PROPERTY OWNER PRIOR TO CONST.
SEE SHEET 3
Label the Sand Creek Flows
Is stabilization required?
Address whether future Vollmer Road increased flows will continue along Vollmer and Pond 1, or provide a drainage easement across the lots to the east.
Label stabilization
Online ponds are typically not allowed. Verify whether USACE approves the use of waters of the state for conveyance and WQ treatment. ECM I.7.1.C.4 and 5 must be met.
Show FEMA floodplain elevation lines.
Additional protection needed due to shear stress?
TSBs are temporary and can not remain in place. Permanent WQ is required.
Provide easements and swales or storm drain for future offsite flows
remove design point number for the filing 2 drainage report
see revised m-4
see revised
removed
moved pond
See Runoff Reduction for Basin K. Ultimately it will get into storm system and be treated by Exist. Pond 2.
See Corrected calcs. from Fill
Roadway and 15' inlet are being constructed now to accommodate future flows.
CLASSIC CONSULTING
THE RETREAT AT TIMBERRIDGE FILING 2
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
DESIGNED BY MAS
DRAWN BY MAS
CHECKED BY
SCALE (H) 1"= 100' (V) 1"= N/A
DATE 5-5-21
SHEET 2 OF 3
JOB NO. 1995.20

FINAL DRAINAGE REPORT – PIPE ROUTING SUMMARY

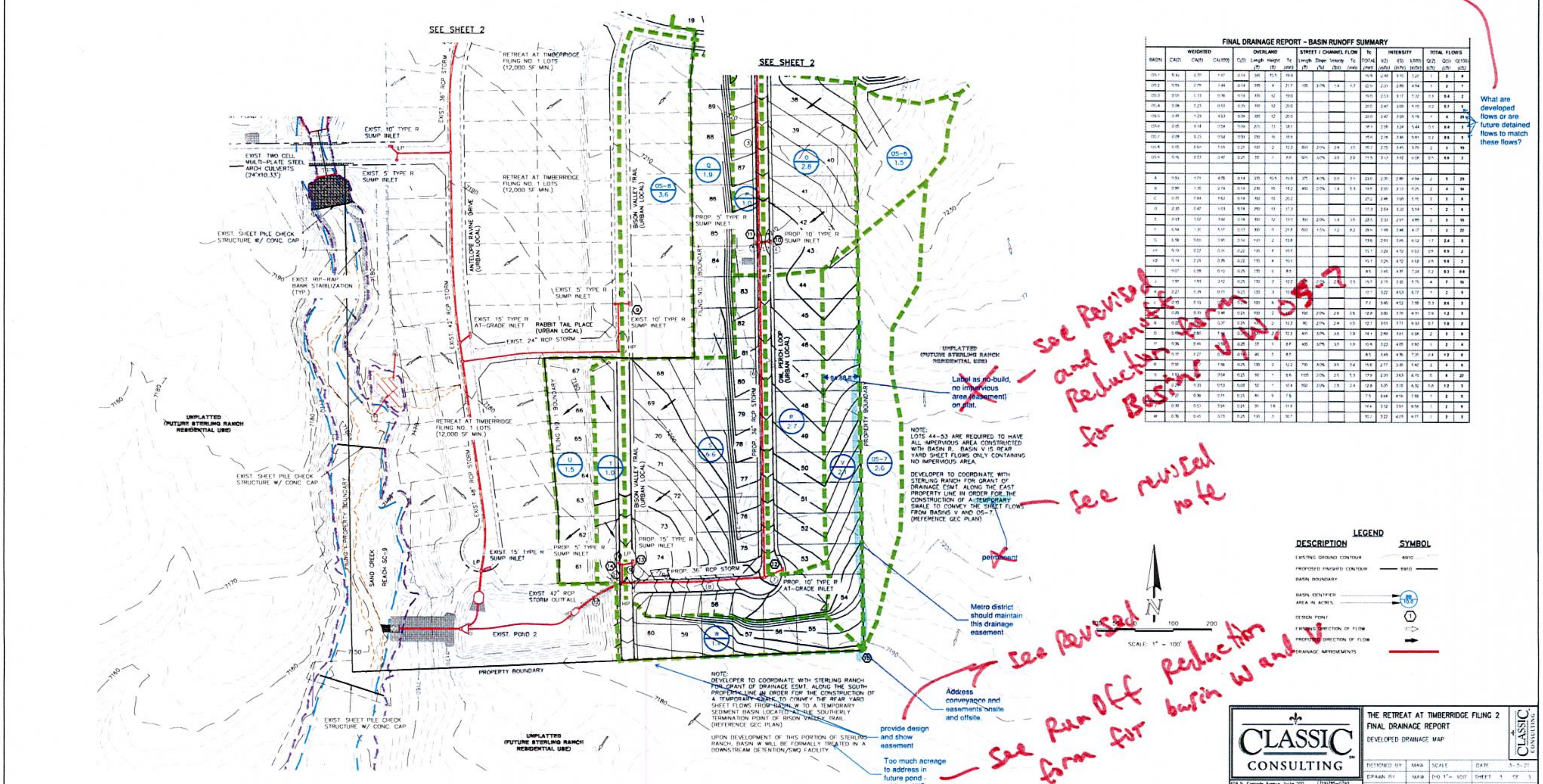
Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP-7	3.02	7.47	20.2	3.08	5.18	9	39	30" RCP
2	DP-8	0.62	1.85	20.2	3.08	5.18	2	10	24" RCP
3	PR-1, PR-2	3.64	9.32	20.8	3.03	5.09	11	47	30" RCP
4	DP-10	1.00	1.98	10.6	4.05	6.80	4	13	24" RCP
5	DP-11	0.41	0.59	13.8	3.66	6.12	2	4	18" RCP
6	PR-3, PR-4, PR-5	6.05	11.89	21.8	2.95	4.97	16	59	36" RCP
7	DP-12 Pickup	1.05	1.17	15.5	3.48	5.82	4	7	24" RCP
8	PR-6, PR-7	6.11	13.06	22.2	2.91	4.92	18	64	36" RCP
9	DP-13	2.25	3.93	18.1	3.42	5.74	8	23	30" RCP
10	DP-14	0.33	0.53	16.3	3.47	5.77	1	3	18" RCP
11	PR-9, PR-10	2.57	4.47	16.3	3.40	5.71	9	25	30" RCP
12	**PR-8, PR-11**	**8.68**	**17.53**	**22.7**	**2.90**	**4.87**	**25**	**85**	**42" RCP**

FINAL DRAINAGE REPORT – SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Inlet Size
1	EX-7, OS-1, OS-2, B (49.4 AC.)	6.09	16.61	49.4	2.04	3.41	12	57	DUAL 30" RCP CULVERTS
2	Basin A (9.5 AC.)	1.71	4.08	23.0	2.89	4.86	5	20	24" RCP CULVERT
3	DP-1, Basin D (42.7 ac.)	6.57	17.64	49.9	2.02	3.38	13	60	DUAL 30" RCP CULVERTS
4	Basin C (3.3 AC.)	0.84	1.60	20.2	3.08	5.18	3	8	24" RCP CULVERT
5	**POND 1 TOTAL INFLOW (64.0 AC.)**	**10.89**	**27.00**	**46.4**	**1.83**	**3.07**	**20**	**83**	**POND 1**
6	Basin G, Basin OS-9 (2.3 ac.)	0.89	1.32	13.8	3.65	6.12	3	8	Exist. 10' TYPE R AT GRADE
7	Basin OS-4, 3 and 70% of Basin OS-5 (18.0 ac.)	3.07	7.47	20.2	3.08	5.18	9	39	15' TYPE R SUMP INLET
8	Basin H and 30% of Basin OS-5 (4.7 ac.)	0.62	1.85	20.2	3.08	5.18	2	10	10' TYPE R SUMP INLET
9	Basin OS-8, Q (5.5 ac.)	1.17	2.45	15.7	3.45	5.79	4	14	Exist. 10' TYPE R SUMP INLET
10	Basin OS-6, O (4.3 ac.)	1.00	1.98	18.1	3.24	5.44	3	11	10' TYPE R SUMP INLET
11	Basin P (1.0 ac.)	0.41	0.59	10.5	4.05	6.80	2	4	5' TYPE R SUMP INLET
12	Basin R (2.7 ac.)	1.07	1.58	15.6	3.46	5.82	4	9	10' TYPE R AT GRADE INLET
13	Basin S and Flow-by from Basin R (9.2 ac.)	2.28	3.93	18.1	3.42	5.74	8	23	15' TYPE R SUMP INLET
14	Basin T (1.6 ac.)	0.33	0.53	12.8	3.77	6.32	1	3	5' TYPE R SUMP INLET
15	Basin V and OS-7 (4.7 ac.)	0.76	1.92	15.6	3.46	5.81	3	11	REAR YARD SWALE

FINAL DRAINAGE REPORT – BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	0.42	0.77	1.47	0.14	300	15.5	19.9					19.9	2.46	3.10	5.20	1	2	8
OS-2	0.59	2.79	1.48	0.14	300	8	21.7	100	3.0%	1.4	1.2	22.9	2.31	2.89	4.94	1	2	7
OS-3	0.05	0.13	0.36	0.14	300	12	19.0					19.0	2.53	3.17	5.32	0.1	0.4	2
OS-4	0.08	0.23	0.50	0.09	300	12	20.0					20.0	2.47	3.09	5.19	0.2	0.7	3
OS-5	0.48	1.29	4.53	0.09	300	12	20.0					20.0	2.47	3.09	5.19	1	4	23
OS-6	0.05	0.14	0.54	0.09	273	11	18.1					18.1	2.59	3.24	5.44	0.1	0.4	3
OS-7	0.08	0.23	0.54	0.09	250	16	15.6					15.6	2.76	3.46	5.81	0.2	0.8	3
OS-8	0.65	0.91	1.65	0.25	100	2	12.2	800	2.0%	2.8	3.5	15.7	2.75	3.45	5.79	2	3	10
OS-9	0.16	0.23	0.47	0.25	50	1	8.6	600	3.0%	3.8	2.9	11.5	3.13	3.92	6.58	0.5	0.9	3
A	0.93	1.71	4.08	0.14	300	15.5	19.9	375	4.0%	2.0	3.1	23.0	2.30	2.88	4.84	2	5	20
B	0.98	1.30	2.74	0.14	200	15	14.2	400	2.0%	1.4	5.3	19.5	2.50	3.13	5.25	2	4	14
C	0.35	0.84	1.60	0.14	300	10	20.2					20.2	2.46	3.08	5.15	2	3	8
D	0.30	0.47	1.53	0.14	250	10	17.3					17.3	2.64	3.30	5.54	1	2	6
E	0.63	1.07	3.96	0.14	300	12	19.1	350	2.0%	1.4	3.5	22.6	2.32	2.91	4.89	2	3	15
F	0.54	1.30	5.17	0.17	300	5	21.8	400	1.5%	1.2	8.2	29.9	1.98	2.48	4.17	1	3	22
G	0.58	0.60	0.95	0.14	100	2	13.8					13.8	2.91	3.65	6.12	1.7	2.4	5
H1	0.19	0.27	0.31	0.22	100	4	10.1					10.1	3.29	4.12	6.92	0.6	0.9	2
H2	0.19	0.29	0.39	0.22	100	4	10.1					10.1	3.29	4.12	6.92	0.6	0.9	2
I	0.07	0.08	0.12	0.25	100	6	8.5					8.5	3.49	4.37	7.34	0.2	0.3	0.4
J	1.56	1.91	3.12	0.25	100	2	12.2	[illegible]	2.0%	2.8	3.5	15.7	2.75	3.45	5.79	4	7	18
K	0.27	0.39	0.71	0.25	100	3	[illegible]					10.7	3.27	4.53	6.77	1	2	5
L	0.10	0.13	[illegible]	[illegible]	100	6	[illegible]					7.7	3.60	4.52	7.59	0.3	0.5	2
M	0.29	0.37	0.48	0.25	100	2	[illegible]	150	2.0%	2.8	0.8	12.8	3.00	3.76	6.31	0.9	1.2	3
N	0.22	[illegible]	0.37	0.25	[illegible]	2	12.2	90	2.0%	2.8	0.5	12.7	3.01	3.77	6.33	0.7	1.0	2
O	[illegible]	0.80	1.44	0.25	[illegible]	2	12.2	400	3.0%	3.8	1.9	14.1	2.88	3.61	6.06	2	3	9
P	0.36	0.41	[illegible]	0.25	50	1	8.6	400	3.0%	3.5	1.9	10.6	3.23	4.05	6.80	1	2	4
Q	0.17	0.27	[illegible]	[illegible]	45	5	8.5					8.5	3.49	4.38	7.35	0.4	1.2	6
R	0.91	[illegible]	1.58	0.25	100	2	12.2	700	3.0%	3.5	3.4	15.6	2.77	3.48	5.82	3	4	9
S	1.53	[illegible]	3.54	0.25	50	1	8.6	1100	2.0%	2.5	5.3	13.9	2.89	3.63	6.10	5	8	21
T	0.27	0.33	0.53	0.08	50	1	10.8	550	2.0%	2.5	2.4	12.8	3.00	3.76	6.32	0.8	1.2	3
U	0.27	0.39	0.71	0.25	90	5	7.5					7.5	3.64	4.56	7.66	1	2	5
V	0.38	0.51	3.04	0.25	35	1.6	11.8					11.6	3.12	3.91	6.58	1	2	8
W	0.38	0.45	3.73	0.25	100	3	10.7					10.7	3.22	4.05	6.77	1	2	3



SEE SHEET 2
RETREAT AT TIMBERRIDGE FILING NO. 1 LOTS (12,000 SF MIN.)
ANTELOPE RAVINE DRIVE (URBAN LOCAL)
BISON VALLEY TRAIL (URBAN LOCAL)
OWL PERCH LOOP (URBAN LOCAL)
RABBIT TAIL PLACE (URBAN LOCAL)
EXIST. TWO CELL MULTI-PLATE STEEL ARCH CULVERTS (24'X10.33')
EXIST. SHEET PILE CHECK STRUCTURE W/ CONC. CAP
EXIST. RIP-RAP BANK STABILIZATION (TYP.)
SAND CREEK REACH SC-9
EXIST. POND 2
EXIST. 42" RCP STORM OUTFALL
PROP. 36" RCP STORM
PROPERTY BOUNDARY
FILING NO. 1 BOUNDARY
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
NOTE: LOTS 44-53 ARE REQUIRED TO HAVE ALL IMPERVIOUS AREA CONSTRUCTED WITH BASIN R. BASIN V IS REAR YARD SHEET FLOWS ONLY CONTAINING NO IMPERVIOUS AREA.
DEVELOPER TO COORDINATE WITH STERLING RANCH FOR GRANT OF DRAINAGE ESMT. ALONG THE EAST PROPERTY LINE IN ORDER FOR THE CONSTRUCTION OF A TEMPORARY SWALE TO CONVEY THE SHEET FLOWS FROM BASINS V AND OS-7. (REFERENCE GEC PLAN)
NOTE: DEVELOPER TO COORDINATE WITH STERLING RANCH FOR GRANT OF DRAINAGE ESMT. ALONG THE SOUTH PROPERTY LINE IN ORDER FOR THE CONSTRUCTION OF A TEMPORARY SWALE TO CONVEY THE REAR YARD SHEET FLOWS FROM BASIN W TO A TEMPORARY SEDIMENT BASIN LOCATED AT THE SOUTHERLY TERMINATION POINT OF BISON VALLEY TRAIL. (REFERENCE GEC PLAN)
UPON DEVELOPMENT OF THIS PORTION OF STERLING RANCH, BASIN W WILL BE FORMALLY TREATED IN A DOWNSTREAM DETENTION/SWQ FACILITY.
LEGEND
DESCRIPTION
SYMBOL
EXISTING GROUND CONTOUR
PROPOSED FINISHED CONTOUR
BASIN BOUNDARY
BASIN IDENTIFIER
AREA IN ACRES
DESIGN POINT
EXISTING DIRECTION OF FLOW
PROPOSED DIRECTION OF FLOW
DRAINAGE IMPROVEMENTS
SCALE: 1" = 100'
What are developed flows or are future detained flows to match these flows?
Label as no-build, no impervious area (easement) on plat.
permanent
Metro district should maintain this drainage easement
Address conveyance and easements onsite and offsite.
provide design and show easement
Too much acreage to address in future pond - address WQ
Future flows to match there. Added more text in report
See revised and Runoff Reduction form for Basins V, W, OS-7
See revised note
See revised
See Run Off Reduction form for basin W and

THE RETREAT AT TIMBERRIDGE FILING 2
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

CLASSIC CONSULTING
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DESIGNED BY	MAR	SCALE		DATE	3-5-21
DRAWN BY	MAR	(H) 1"= 100'		SHEET	1 OF 3
CHECKED BY		(V) 1"= N/A		JOB NO.	1185.20

SECTION 404 PERMTTING

WETLAND IMPACT MAP

(CORE CONSULTANTS REPORT)

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

Update for Filing 2

COMPENSATORY MITIGATION PLAN

The Retreat at Timber Ridge Residential Development – Filing No. 1 El Paso County, CO

PREPARED FOR:

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PREPARED BY:

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Contact: Dan Maynard
CORE Project Number: 19-XXX

July 2019