INNOVATIVE DESIGN. **CLASSIC RESULTS.**

FINAL DRAINAGE REPORT
FOR
RETREAT AT TIMBERRIDGE
FILING NO. 1

Also see comment letter.

Prepared for:
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Engineering Review
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Job No. 1185.00

PCD Project No. SF-19-xx 009

FINAL DRAINAGE REPORT FOR
RETREAT AT TIMBERRIDGE FILING NO. 1

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: 6385 Corporate Dr., Suite 200

Colorado Springs, CO 80919

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.

________________________________ ____________________

Jennifer Irvine, P.E. Date
County Engineer, / ECM Administrator

Conditions:

CLASSIC CONSULTING ENGINEERS & SURVEYORS

FINAL DRAINAGE REPORT FOR
RETREAT AT TIMBERRIDGE FILING NO. 1

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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. 1 is 68.14-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 and east by future development phases within the TimberRidge property, to the south by Sterling Ranch property (zoned for future urban development) and to the west by 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. 1 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. and submitted along with the Preliminary Plan. (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 recently 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 has decided to continue to utilize the much larger FEMA recognized flows for all proposed channel improvements through this property. However, given the County's approval of the Sterling Ranch MDDP, and as such the acknowledgment of these reasonable lower flow quantities through this Reach, a deviation will be submitted for relief from the allowable clearance of the proposed major drainageway crossing as found in the DCM Vol. 1 6.4.2. The 2600 cfs FEMA recognized flows will be utilized in the structure calculations but relief from the 2 feet freeboard within the structure is being requested.

Not submitted yet?

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 = 4.2 cfs Q_5 = 28.5 cfs, Q_{100} = 219.2 cfs) This does not include the major off-site channel flows but reflects only the on-site and off-site flows that travel across the property and have a direct effect on the development. This total represents the allowed developed release off-site at this location. This total pre-development flow includes the flowing basins: EX-1, EX-4, EX-5, EX-6 and EX-7. Basins EX-1 (Q_2 = 0.5 cfs Q_5 = 3.9 cfs, Q_{100} = 30.0 cfs) and EX-6 (Q_2 = 0.7 cfs Q_5 = 5.8 cfs, Q_{100} = 44.8 cfs) consist of a good portion of the Filing 1 development and a significant future development area both on and off-site. These basins sheet flow in a southwesterly direction and eventually travel within various natural ravines created within the site. These ravines then route the predevelopment flows directly into Sand Creek in multiple locations. Upon development, over 90% of this historic tributary area will be routed directly into a proposed on-site facility and treated prior to entering Sand Creek. Basin EX-5 (Q_2 = 2.0 cfs Q_5 = 13.5 cfs, Q_{100} = 107.2 cfs) consists of the majority of the future TimberRidge development area along with an off-site future Sterling Ranch development area. This basin also sheet flows in a southerly direction within natural ravines that route the predevelopment flows directly into Sand Creek in multiple locations. Upon development, over 65% of this historic on-site tributary area will also be routed directly into a proposed on-site facility and treated prior to entering Sand Creek. Basin EX-7 (Q_2 = 1.0 cfs Q_5 = 5.2 cfs, Q_{100} = 32.1 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 and then within a natural ravine that routes the off-site flow directly into Sand Creek. This condition will remain with the development of Filing 1. Upon future TimberRidge development in this area, these off-site flows will be routed directly towards Sand Creek via an extension of the 48" storm within Arroya Lane.

EX DP-2 (Q_2 = 0.03 cfs Q_5 = 0.3 cfs, Q_{100} = 2.3 cfs) consists of a minimal portion of Filing 1 development area 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.

EX DP-3 (Q_2 = 0.4 cfs Q_5 = 3.4 cfs, Q_{100} = 26.8 cfs) consists of flows from on-site Basin EX-3 that travel off-site directly onto Sterling Ranch property prior to eventually entering the Sand Creek channel. Upon development, over nearly 100% of this historic tributary area will be routed directly into a proposed on-site facility and treated prior to entering Sand Creek.

EX DP-4 (Q_2 = 0.2 cfs Q_5 = 1.4 cfs, Q_{100} = 10.5 cfs) consists of on-site flows from Basin EX-4 that travel in a southeasterly direction directly towards Sand Creek. Upon development, nearly 60% of this historic tributary area will be routed directly into the proposed on-site facility and treated prior to entering Sand Creek.

and a 4-8' tall berm east of Vollmer Road?

PROPOSED DRAINAGE CONDITIONS

Proposed development within the Retreat at TimberRidge Filing No. 1 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, 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 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.

Include the area west of the berm. This flow should be conveyed east along Poco Road.

The following represent the basins west of Sand Creek:

Basin OS-1 (Q_2 = 2 cfs Q_5 = 2 cfs, Q_{100} = 5 cfs) represents off-site flows from the east half of Vollmer Road. These existing flows will continue to travel in a southerly direction within the current roadside ditch along the east side of Vollmer road to the intersection with Poco Road. At this location, **Design Point 3**, a proposed 18" RCP culvert will be installed to convey these flows under Poco Road. This facility will be designed and located to accommodate the future turn lane improvements at this intersection.

verify size based on inclusion of OS-5/A1.

Basin A (Q_2 = 2 cfs Q_5 = 5 cfs, Q_{100} = 26 cfs) represents the majority of the proposed 2.5 ac. rural lots adjacent to Vollmer Road. Developed flows from this basin will continue to sheet flow in a southeasterly direction towards the west side of Aspen Valley Road. These ditch flows travel to **Design Point 1** where proposed dual 24" RCP culverts will convey the flows under the road towards Pond 1. The sideroad ditch along the west side of Aspen Valley Road will be lined with a turf reinforcement matting (TRM) adjacent to Lot 1 and erosion control matting adjacent to Lots 2-7, in order to adequately convey the developed flows without exceeding the allowable velocity and shear stress limits. (See Appendix for ditch calculations)

ditch checks?

Basin B (Q_2 = 1 cfs Q_5 = 3 cfs, Q_{100} = 14 cfs) represents a portion of the proposed 2.5 ac. rural lots adjacent to Sand Creek. Developed flows from this basin will continue to sheet flow in a southeasterly direction towards Pond 1. The sideroad ditch along the north side of Poco Road east of Aspen Valley Road (within a 50' public drainage esmt.) will be lined with erosion control matting to adequately convey the developed flows directly into Pond 1 without exceeding the allowable velocity and shear stress limits. (See Appendix for ditch calculations)

Design Point 2 (Q_5 = 8 cfs, Q_{100} = 37 cfs) represents the total developed flows entering **Pond 1.** 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 UD Detention pond design sheets):

Detention Pond 1 (Full Spectrum EDB – see multiple storm release data below)

0.145 Ac.-ft. WQCV required

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

0.676 Ac.-ft. 100-yr. Storage

0.926 Ac.-ft. Total

Total In-flow:	**Q_2 = 2.4 cfs,**	**Q_5 = 3.7 cfs,**	**Q_{100} = 37.2 cfs**
Pond Design Release:	**Q_2 = 0.1 cfs,**	**Q_5 = 0.13 cfs,**	**Q_{100} = 15.3 cfs**
Pre-development Release:	**Q_2 = 0.2 cfs,**	**Q_5 = 0.39 cfs,**	**Q_{100} = 23.6 cfs**

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

Basin E (Q_2 = 0.4 cfs Q_5 = 1 cfs, Q_{100} = 6 cfs) represents a portion of the rural 2.5 ac. lots west of Sand Creek outside the proposed roadway improvements. Only lot 8 and possibly lot 9 is anticipated to have any building structure constructed within this basin. Per the ECM Section I.7.1.B, WQCV is not required for these lots given their size (2.5 Ac.). However, sediment control will be provided for this basin in the form of a permanent sediment basin at the northeast corner of lot 10 within a public drainage easement. (See Grading and Erosion Control Plan for design calculations and exact location) Basins OS-2 (Q_2 = 0.0 cfs Q_5 = 0.2 cfs, Q_{100} = 1.6 cfs) and F (Q_2 = 0.1 cfs Q_5 = 0.4 cfs, Q_{100} = 1.9 cfs) represent minor portions (both under 1.0 Ac.) of 2.5 Ac. lots that are not planned to have any building structure or roadway constructed within these basins. Thus, per ECM Section I.7.1.B, WQCV is not required and sediment control will be handled by silt fence and straw bale barriers as a part of the Grading and erosion Control Plan. Basin G (Q_2 = 0.2 cfs Q_5 = 0.8 cfs, Q_{100} = 6 cfs) represents a portion of Sand Creek that will be platted with this Filing. No residential development is proposed within this basin other than the gravel trail along the west side of the creek and the proposed channel improvements as recommended in the DBPS.

show on plans

Basins C (Q_2 = 3 cfs Q_5 = 5 cfs, Q_{100} = 14 cfs) and D (Q_2 = 2 cfs Q_5 = 3 cfs, Q_{100} = 5 cfs) represent flows from a portion of the 2.5 Ac. lots proposed adjacent to Vollmer Road and the development of Poco Road. Both of these basins develop flows that end up as curb and gutter flow in an easterly direction towards Design Points 4 and 7. **Design Point 4 (Q_5 = 3 cfs, Q_{100} = 5 cfs)** represents the developed flow from Basin D where 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 around the corner of the intersection of Poco Road and Antelope Ravine Dr.

How does this get to the inlet instead of flowing to the creek?

The following represent the basins east of Sand Creek:

Basin H (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 6 cfs) represents the rear yards of lots and the open space adjacent to Sand Creek within Tract E. These flows will sheet flow and be directed towards Design Point 7. **Design Point 7 (Q_5 = 6 cfs, Q_{100} = 19 cfs)** represents the developed flow from Basins C, H and a portion of the 100 yr. flow-by from Design Point 6, described later. At this location, 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 around the corner of the intersection of Poco Road and Antelope Ravine Dr.

Design Point 5 (Q_5 = 6 cfs, Q_{100} = 18 cfs) represents the developed flow from future Basin OS-4 and I. At this location, a proposed 15' Type R At-Grade Inlet will be installed to intercept 100% of the 5 yr. and 73% of the 100 yr. developed flows. The flow-by that will continue down the east side of the street equals Q_5 = 0 cfs, Q_{100} = 4.9 cfs. (See Appendix for calculations) This flow-by will combine with Basin L and continue to travel in a southerly direction towards Design Point 10.

Design Point 6 (Q_5 = 2 cfs, Q_{100} = 8 cfs) represents the developed flow from future Basin OS-3. At this location, a proposed 10' Type R At-Grade Inlet will be installed 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 equals Q_5 = 0 cfs, Q_{100} = 1.7 cfs. (See Appendix for calculations) This flow-by will combine with Basins C and H and continue to travel in a southerly direction towards Design Point 7.

Design Point 8 (Q_5 = 1 cfs, Q_{100} = 4 cfs) represents the developed flow from Basin K. 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 around the corner of the intersection of Bison Valley Trail and Rabbit Tail Place.

Design Point 9 (Q_5 = 5 cfs, Q_{100} = 15 cfs) represents the developed flow from Basins J and future OS-7. At this location, 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 over the highpoint at the intersection of Bison Valley Trail and Rabbit Tail Place.

Design Point 10 (Q_5 = 5 cfs, Q_{100} = 22 cfs) represents the developed flow from Basin L and the flow-by from Design Point 5. At this location, a proposed 15' Type R At-Grade Inlet will be installed to intercept 100% of the 5 yr. and 66% of the 100 yr. developed flows. The flow-by that will continue down the east side of the street equals Q_5 = 0 cfs, Q_{100} = 7.4 cfs. (See Appendix for calculations) This flow-by will combine with Basin P and continue to travel in a southerly direction towards Design Point 11.

How? It appears that it will continue south to the temp. sed. basin then DP 22.

Design Point 11 (Q_5 = 5 cfs, Q_{100} = 22 cfs) represents the developed flow from Basins N, O, P and a portion of the 100 yr. flow-by from Design Point 10. 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 ponding of 9" and then spill directly into Pond 2.

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The following represent future basins and Design Points anticipated to be constructed with the future filings that will all be tributary to Pond 2:

Future Design Point 12 (Q_5 = 9 cfs, Q_{100} = 33 cfs) represents the future developed flow from Basin OS-5. At this location, a future 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 westerly over the highpoint Elk Antler Lane.

Future Design Point 13 (Q_5 = 1 cfs, Q_{100} = 13 cfs) represents the future developed flow from Basin OS-6. Again, this basin is mainly comprised of tributary area off-site within the Sterling Ranch Master Plan. At this location, a future 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 westerly over the highpoint Elk Antler Lane. These basins are mainly comprised of tributary area off-site within the Sterling Ranch Master Plan. It is planned with this report that with the future development of this portion of Sterling Ranch developed flows equal to pre-development quantities are accounted for downstream in the 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. With the development of the proposed Filing No. 1 only, these pre-development flows will continue to enter the Timber Ridge property and be handled in multiple temporary sediment basins on-site. (See Interim Developed Drainage Map)

Future Design Point 14 (Q_5 = 1 cfs, Q_{100} = 3 cfs) represents the future developed flow from Basin OS-8. At this location, a future 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.

south then west to
Bison Valley...?

Future Design Point 15 (Q_5 = 3 cfs, Q_{100} = 12 cfs) represents the future developed flow from Basin OS-9. This basin is comprised of a good portion of tributary area off-site within the Sterling Ranch Master Plan. At this location, a future 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 westerly over the highpoint Elk Antler Lane. It is planned with this report that with the future development of this portion of Sterling Ranch developed flows equal to pre-development quantities are accounted for downstream in the 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. With the development of the proposed Filing No. 1 only, these pre-development flows will continue to enter the Timber Ridge property and be handled in multiple temporary sediment basins on-site. (See Interim Developed Drainage Map)

Future Design Point 16 (Q_5 = 1 cfs, Q_{100} = 3 cfs) represents the future developed flow from Basin OS-10. At this location, a future 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.

Future Design Point 17 (Q_5 = 7 cfs, Q_{100} = 22 cfs) represents the future developed flow from Basin OS-11. At this location, a future 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 westerly over the highpoint Elk Antler Lane.

southerly, Bison Valley into
Pond 2?

Future Design Point 18 (Q_5 = 6 cfs, Q_{100} = 30 cfs) represents flows from future development area both on and off-site. However, with the construction of the secondary gravel road connection up to Arroya Lane, the ultimate 30" RCP culvert is planned to be constructed with Filing No. 1 to collect these flows. In the interim it will act as just a culvert routing these pre-developed flows under the gravel road towards Sand Creek as currently taking place. Upon future development in this area, this 30" RCP storm system will be extended further downstream within the future roadway and ultimately into Pond 2.

Future Design Point 19 (Q_5 = 1 cfs, Q_{100} = 4 cfs) represents the future developed flow from Basin OS-13. At this location, a future 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.

show on plan

Future Design Point 20 (Q_5 = 6 cfs, Q_{100} = 21 cfs) represents the future developed flow from Basin OS-14. At this location, a future 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 westerly over the highpoint Elk Antler Lane. This basin is comprised of a portion of tributary area off-site within the Sterling Ranch Master Plan. It is planned with this report that with the future development of this portion of Sterling Ranch developed flows equal to pre-development quantities are accounted for downstream in the 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. With the development of the proposed Filing No. 1 only, these pre-development flows will continue to enter the Timber Ridge property and be handled in multiple temporary sediment basins on-site. (See Interim Developed Drainage Map)

mostly?

Future Design Point 21 (Q_5 = 6 cfs, Q_{100} = 40 cfs) represents the pre-development flows from Basin OS-15. This basin is entirely comprised of tributary area off-site within the Sterling Ranch Master Plan. With the development of the proposed Filing No. 1 only, these pre-development flows will continue to enter the existing stock pond located on-site. (See Interim Developed Drainage Map) This facility will act as a temporary sediment pond and a formal outlet pipe will be constructed. Also constructed with Filing No. 1 will be a permanent 24" RCP storm system routing the release from this existing stock pond directly towards Sand Creek, as currently taking place. Upon future TimberRidge development in this area, this storm system will be extended further east to the property line, the existing stock pond will be removed and another formal sediment pond will be constructed within the Sterling Ranch property. An appropriate drainage easement will be acquired for this construction. The Sterling Ranch development will be responsible for the required treatment and detention for future development in this basin, with formal outfall through the 24" RCP storm system.

Design Point 22 (Q_5 = 52 cfs, Q_{100} = 191 cfs) represents the total developed flows entering **Pond 2.** These flows include Basin Q (Q_2 = 0.5 cfs Q_5 = 1 cfs, Q_{100} = 6 cfs) which represents the developed flow within the actual detention basin. 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 UD Detention pond design sheets):

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

1.060 Ac.-ft. WQCV required

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

3.465 Ac.-ft. 100-yr. Storage

5.705 Ac.-ft. Total

Total In-flow:	**Q_2 = 24.7 cfs,**	**Q_5 = 35.9 cfs,**	**Q_{100} = 190.6 cfs**
Pond Design Release:	**Q_2 = 0.7 cfs,**	**Q_5 = 0.87 cfs,**	**Q_{100} = 111.5 cfs**
Pre-development Release:	**Q_2 = 1.1 cfs,**	**Q_5 = 1.91 cfs,**	**Q_{100} = 115.2 cfs**

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

This will need a deviation if not a standard WQCV facility. It may not be required depending on the amount of developed (urban and road) area not going through a BMP.

Basin M (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 6 cfs) represents the rear yards of lots and the open space adjacent to Sand Creek within Tract C. These flows will sheet flow in a southwesterly direction and be directed towards a permanent sediment basin. (See Grading and Erosion Control Plan) This facility will treat the developed stormwater within this basin prior to entering Sand Creek. It will be constructed within a public drainage easement with ownership and maintenance by the TrimberRidge Metro District. Access for maintenance will be from the north (Poco Road).

Basin R (Q_2 = 1 cfs Q_5 = 2 cfs, Q_{100} = 5 cfs) represents developed flows from the rear yards of lots 22-28 that are not reasonably feasible to be routed to a proposed treatment facility. However, as noted on the drainage map, all impervious roof area within this basin will require roof drains to be routed to the front of the lots ad directly into the public roadway. As such, these flows are then treated by Pond 2. Any remaining minor impervious area not able to be routed to the front of the lots must travel across a grass buffer (sodded rear yard) prior to exiting the lot.

deviation request is required

Basin S (Q_2 = 0.2 cfs Q_5 = 0.9 cfs, Q_{100} = 7 cfs) represents a portion of Sand Creek that will be platted with this Filing. No residential development is proposed within this basin other than the proposed channel improvements as recommended in the DBPS.

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 the multiple Full Spectrum Detention Basins and permanent 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 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 and/or drop 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 will vary depending upon the existing riparian vegetation/wetlands found within the bankfull channel and floodplain terrace areas. A separate HEC-RAS analysis for this portion of Reach SC-9 will be provided to determine exact locations of required structures and confirm the 100 Yr. floodplain boundaries. 404 permitting for these improvements and the likely impacts to jurisdictional waters will be prepared by CORE Consultants, Inc. for review/approval by US Fish and Wildlife. Upon completion, appropriate permit documentation will be provided to County Staff.

has been? This is required.

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 segment no. 171. The anticipated developed flows exiting this property are Q_{10} = 670 cfs and Q_{100} = 2260 cfs as depicted within segment no. 170. As discussed earlier, the FEMA FIS flows appear to be significantly higher than both those presented

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Provide deviation request.

in the DBPS and the Sterling Ranch MDDP. Based on the approved Sterling Ranch MDDP, the recently submitted box culvert design at Arroya Lane (TimberRidge Estates Development) and the anticipated future CLOMR/LOMR processing by Sterling Ranch, we have continued to utilize the significantly larger flows as determined by the FEMA FIS (2600 cfs) in the channel improvement designs but request relief from the allowable clearance of the proposed major drainageway crossing as found in the DCM Vol. 1 6.4.2. The 2600 cfs will be utilized in the structure calculations but relief from the 2 feet freeboard within the structure is being requested via formal deviation.

and pending approval of deviation request,

The proposed public roadway crossing of Sand Creek is planned for this site. (Extension of Poco Road) Upon development of Filing No. 1, the proposed crossing will consist of a triple cell 8'x12' CBC to facilitate the conveyance of the 100 yr. flow. This facility has an Hw/D = 1.15 utilizing the 2600 cfs FEMA flows and using the anticipated future flows of 1500 cfs as presented in the approved MDDP, it has an Hw/D = 0.74 and allows for the required 2' freeboard within the structure per DCM 6.4.2. The proposed channel improvements within this Filing consist of a single check structure located approximately 800 LF south of the Poco Road crossing. This check structure is designed to be sheet piling with a concrete cap per Urban Drainage Vol. 2 Figures 9-26 thru 9-28. This location is consistent with the DBPS and will be confirmed with the separate HEC-RAS analysis provided. This analysis will determine the exact location and quantity of check structures through this Reach along with any locations that will require selective rip-rap lining. The analysis will also better define any change in the current FEMA floodplain as determined by the LOMR 08-080541P.

See plan redlines regarding bank stabilization and check structures. Address all areas of concern.

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. The overall pre-development design model was

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calculated using PondPack V8i with time of concentrations estimated using NRCS Unit Hydrograph procedures described in the DCM based upon the hydrologic soil type and runoff ARC II curve numbers (CN) chart (Table 6-10) with a 24 hour NRCS Type II distribution. 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 streets (rear yards of lots adjacent to Sand Creek), sheet flows will travel across landscaped rear yards towards the Sand Creek channel within the open space corridor. This channel corridor will then be protected with various channel improvements as recommended in the Sand Creek DBPS 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 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.

update to G series, 2018

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 0535F and the previously mentioned LOMR 08-08-0541P both with effective date of July 23, 2009. (See Appendix).

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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. 1 has a total area of 68.14 acres with the following different land uses proposed:

6.95 Ac.	Sand Creek Drainage corridor (Tracts A & C)
3.73 Ac.	Detention Facilities & Park (Tracts B, D & E)
33.60 Ac.	2.5 Ac. lots (Rural Lots 1-11,& Tract F)
23.86 Ac.	1/3 Ac. lots (Urban Lots 12-70)
68.14	Total

The percent imperviousness for this subdivision is calculated as follows:

<u>Fees for Sand Creek Drainage Corridor</u>

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

6.95 Ac. x 2% = **0.14 Impervious Ac.**

<u>Fees for Detention Facilities & Park</u>

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

3.73 Ac. x 7% = **0.26 Impervious Ac.**

<u>Fees for 2.5 Ac. lots</u>

(Per El Paso County Percent Impervious Chart: 11**%** with 25% fee reduction for 2.5 ac. lots planned)

33.60 Ac. x 11% x 75% = **2.77 Impervious Ac.**

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Fees for 1/3 Ac. lots Please provide actual average lot size.

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

23.86 Ac. x 30% = **7.16 Impervious Ac.**

Total Impervious Acreage: **10.33 Imp. Ac.**

The following calculations are based on the 2019 Sand Creek drainage/bridge fees:

ESTIMATED FEE TOTALS:

11.25 (bridge fees are not reduced for large lots)

Bridge Fees

$ 5,559.00 x 10.33 Impervious Ac. = **$ 57,424.47**

Drainage Fees

$ 18,940.00 x 10.33 Impervious Ac. = **$ 195,650.20**

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:

Sand Creek Channel Improvements per DBPS $ 175,000 = $ 175,000.00

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

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SUMMARY

The proposed Retreat at TimberRidge Filing No. 1 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

maw/118500/FDR.doc

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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

APPENDIX

VICINITY MAP

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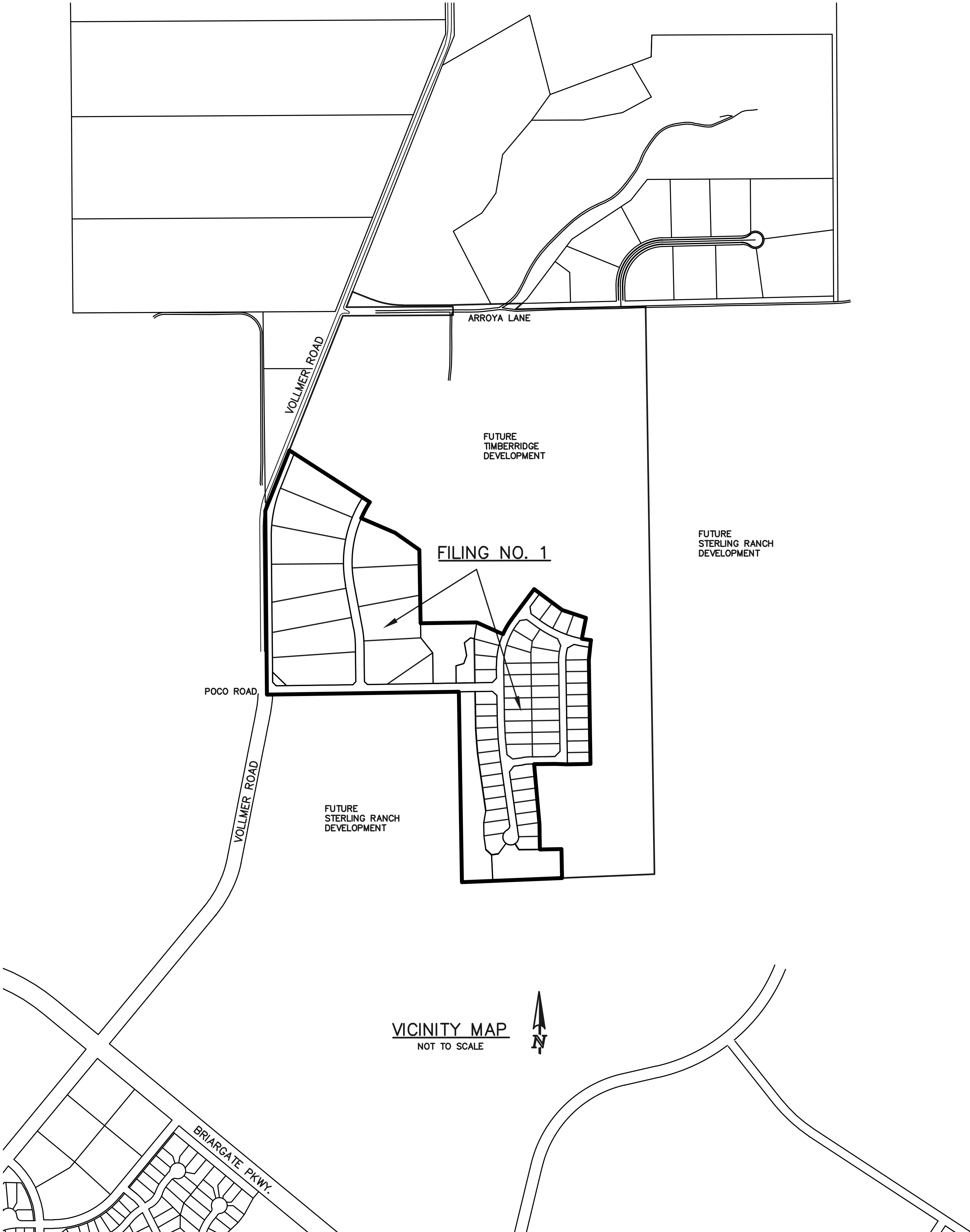
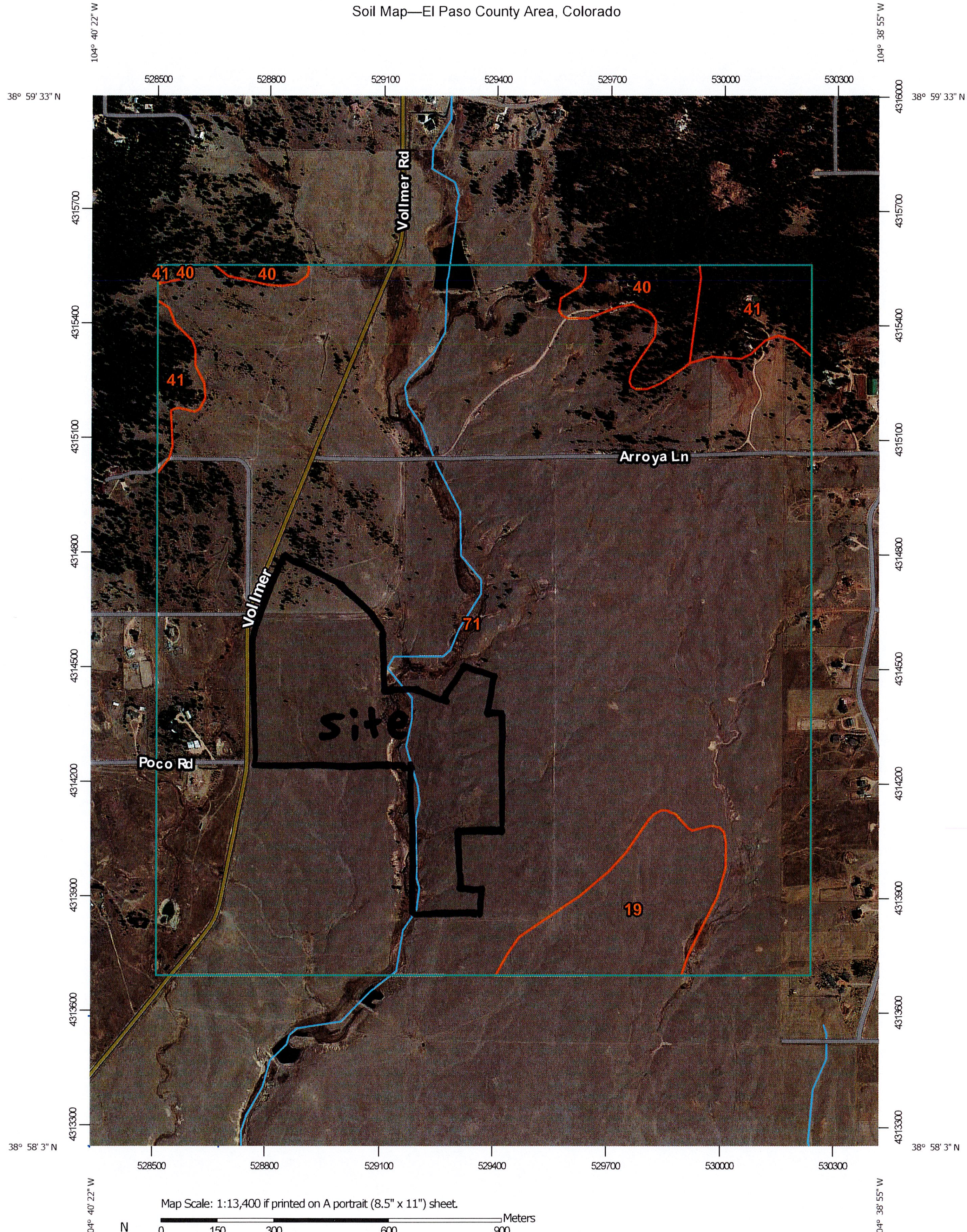


ARROYA LANE
VOLLMER ROAD
FUTURE
TIMBERRIDGE
DEVELOPMENT
FILING NO. 1
FUTURE
STERLING RANCH
DEVELOPMENT
POCO ROAD
VOLLMER ROAD
FUTURE
STERLING RANCH
DEVELOPMENT
VICINITY MAP
NOT TO SCALE
N
BRIARGATE PKWY.

SOILS MAP (S.C.S SURVEY)

Soil Map—El Paso County Area, Colorado



Map Scale: 1:13,400 if printed on A portrait (8.5" x 11") sheet.

N

0 150 300 600 900 Meters

0 500 1000 2000 3000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 14, Sep 23, 2016

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

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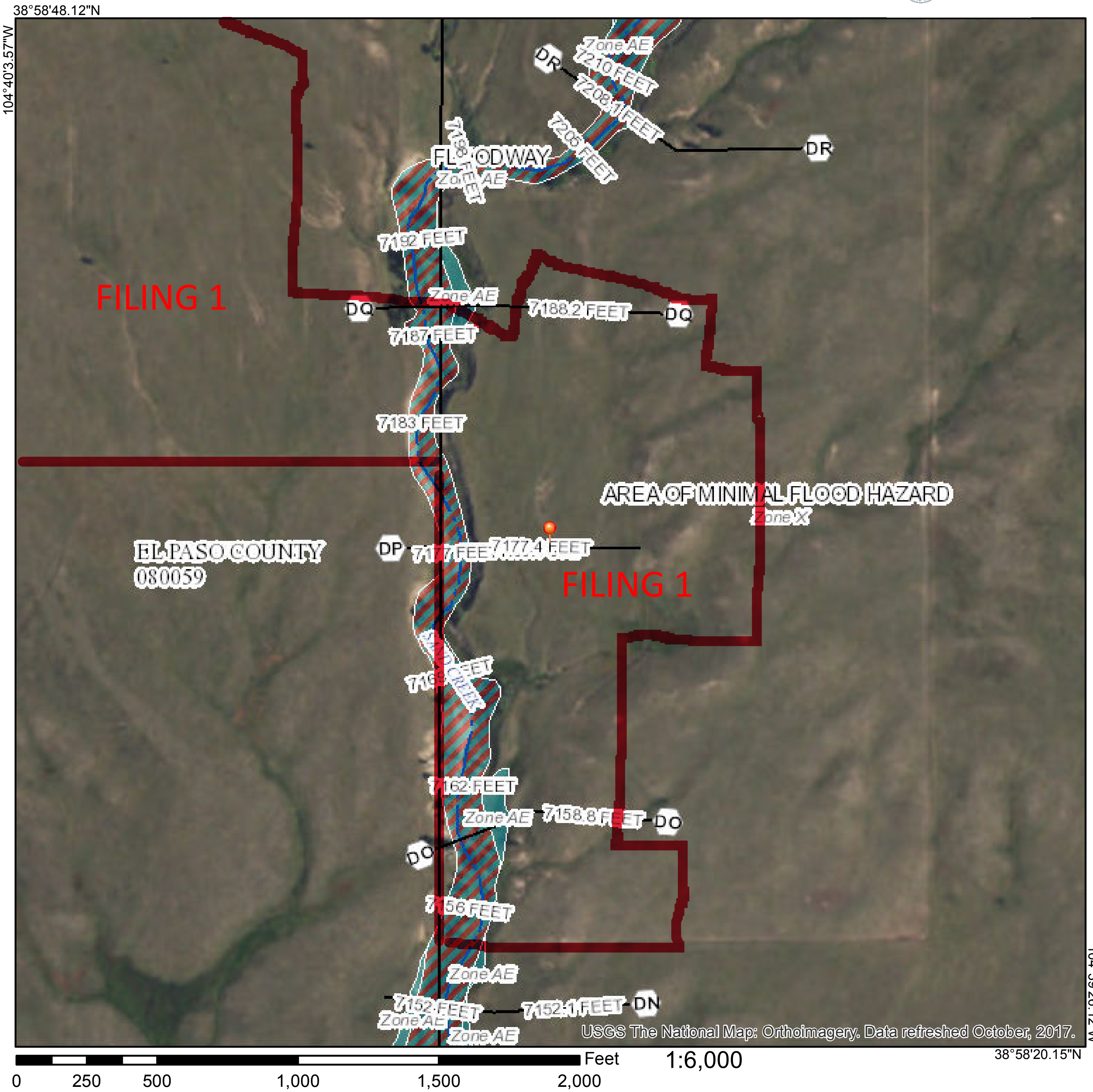
National Flood Hazard Layer FIRMette

FEMA



Legend

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

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

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

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

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

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

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

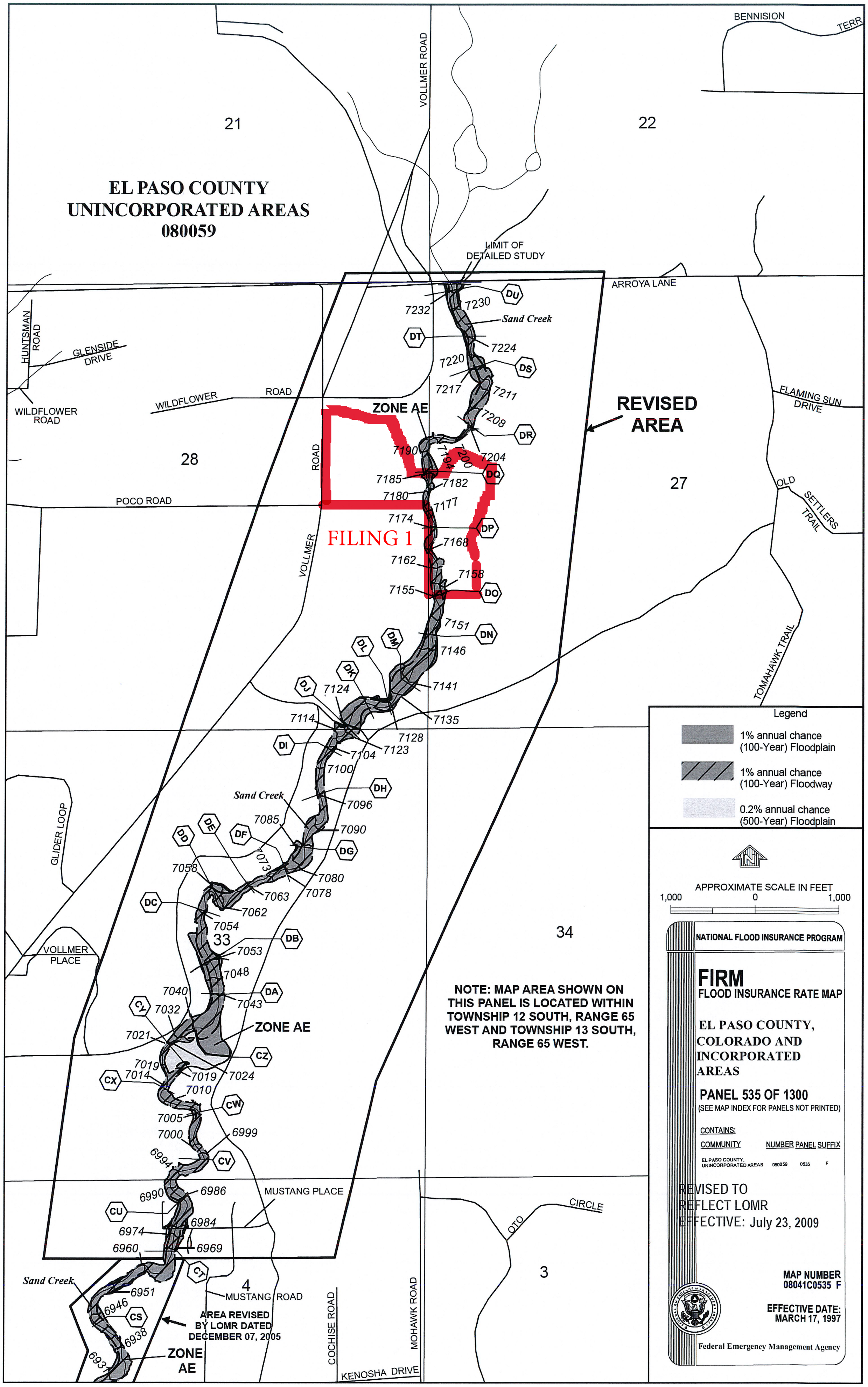
N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/3/2019 at 10:15:04 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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


EL PASO COUNTY
UNINCORPORATED AREAS
080059
21
22
28
27
33
34
3
4
BENNISION
TERR
VOLLMER ROAD
LIMIT OF DETAILED STUDY
ARROYA LANE
HUNTSMAN ROAD
GLENSIDE DRIVE
WILDFLOWER ROAD
POCO ROAD
VOLLMER ROAD
FLAMING SUN DRIVE
OLD SETTLERS TRAIL
TOMAHAWK TRAIL
GLIDER LOOP
VOLLMER PLACE
MUSTANG PLACE
MUSTANG ROAD
COCHISE ROAD
MOHAWK ROAD
KENOSHA DRIVE
OTO CIRCLE
Sand Creek
ZONE AE
REVISED AREA
FILING 1
AREA REVISED BY LOMR DATED DECEMBER 07, 2005
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
1,000 0 1,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 535 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
REVISED TO REFLECT LOMR EFFECTIVE: July 23, 2009
MAP NUMBER 08041C0535 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency

 | Issue Date: March 6, 2009 | Effective Date: July 23, 2009 | Case No.: 08-08-0541P | LOMR-APP

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas) COMMUNITY NO.: 080059	NO PROJECT	HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
IDENTIFIER	Sand Creek Letter of Map Revision, Mustang Place to Arroya Lane	APPROXIMATE LATITUDE & LONGITUDE: 38.971, -104.668 SOURCE: USGS QUADRANGLE DATUM: NAD 27	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 08041C0535 F DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILE(S): 204P(a), 204P(b), 204P(c) AND 204P(d) FLOODWAY DATA TABLE: 5

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Sand Creek - from approximately 360 feet downstream of Mustang Place to just downstream of Arroya Lane

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sand Creek	Zone A	Zone AE	YES	YES
	No BFEs*	BFEs	YES	NONE
	No Floodway	Floodway	YES	NONE

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom

David N. Bascom, Program Specialist
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom

David N. Bascom, Program Specialist
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom

David N. Bascom, Program Specialist
Engineering Management Branch
Mitigation Directorate

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD 29)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Sand Creek	Just upstream of Mustang Place	None	6,984	08041C0535 F
	Just downstream of Arroya Lane	None	7,238	08041C0535 F

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. A short notice also will be published in your local newspaper on or about the dates listed below. Please refer to FEMA's website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp for a more detailed description of proposed BFE changes, which will be posted within a week of the date of this letter.

LOCAL NEWSPAPER Name: *El Paso County News*
Dates: 03/18/09 03/25/09

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom

David N. Bascom, Program Specialist
Engineering Management Branch
Mitigation Directorate

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
Sand Creek (cont'd)								
CA	65,292	164	427	6.1	6,748.7	6,748.7	6,749.4	0.7
CB	66,092	41	223	11.7	6,761.2	6,761.2	6,762.2	1.0
CC	66,247	90	270	9.6	6,773.6	6,773.6	6,773.7	0.1
CD	67,647	50	218	11.9	6,782.6	6,782.6	6,783.3	0.7
CE	68,297	65	284	8.8	6,793.9	6,793.9	6,794.4	0.5
CF	69,147	50	213	11.7	6,804.5	6,804.5	6,804.5	0.0
CG	70,157	50	213	11.7	6,815.1	6,815.1	6,815.3	0.2
CH	70,577	205	347	7.2	6,823.9	6,823.9	6,824.5	0.6
CI	70,627	180	267	9.4	6,826.7	6,826.7	6,827.7	1.0
CJ	70,727	210	340	7.3	6,831.1	6,831.1	6,831.1	0.0
CK	70,807	195	334	7.5	6,832.5	6,832.5	6,832.5	0.0
CL	71,162	90	255	9.8	6,838.0	6,838.0	6,839.0	1.0
CM	71,977	226	503	5.2	6,847.4	6,847.4	6,848.3	0.9
CN	73,052	174	328	7.9	6,861.1	6,861.1	6,861.2	0.1
CO	73,644	237	364	7.1	6,870.2	6,870.2	6,870.2	0.0
CP	75,142	172	324	8.0	6,888.5	6,888.5	6,888.7	0.2
CQ	76,161	109	283	9.2	6,903.5	6,903.5	6,903.7	0.2
CR	77,846	100	272	9.6	6,926.1	6,926.1	6,926.7	0.6
CS	79,187	117	287	9.1	6,944.1	6,944.1	6,944.1	0.0
CT	80,808	142	310	8.4	6,969.2	6,969.2	6,969.2	0.0
CU	81,501	120	342	7.6	6,986.1	6,986.1	6,986.5	0.4
CV	82,281	124	295	8.8	6,997.4	6,997.4	6,997.4	0.0
CW	82,897	64	237	11.0	7,005.3	7,005.3	7,006.1	0.8
CX	83,517	90	266	9.8	7,013.9	7,013.9	7,013.9	0.0
CY	84,087	70	244	10.7	7,024.3	7,024.3	7,024.3	0.0
CZ	84,473	160	322	8.1	7,040.2	7,040.2	7,040.2	0.0

Revised Data From LOMR Dated Dec. 7, 2005

Revised Data

REVISED TO REFLECT LOMR EFFECTIVE: July 23, 2009

[1] Feet Above Confluence With Fountain Creek

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY
EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
Sand Creek (cont'd)								
DA	85,073	139	456	5.7	7,043.0	7,043.0	7,043.1	0.1
DB	85,483	170	328	7.9	7,053.4	7,053.4	7,053.5	0.1
DC	86,103	100	274	9.5	7,054.4	7,054.4	7,054.4	0.0
DD	86,673	197	434	6.0	7,061.7	7,061.7	7,062.0	0.3
DE	87,073	83	270	9.6	7,068.2	7,068.2	7,068.3	0.1
DF	87,573	98	325	8.0	7,077.7	7,077.7	7,077.9	0.2
DG	88,003	135	304	8.6	7,085.1	7,085.1	7,085.1	0.0
DH	88,738	89	263	9.9	7,096.9	7,096.9	7,096.9	0.0
DI	89,303	74	249	10.4	7,104.1	7,104.1	7,104.3	0.2
DJ	89,663	143	309	8.4	7,123.2	7,123.2	7,123.2	0.0
DK	90,058	140	426	6.1	7,125.1	7,125.1	7,125.2	0.1
DL	90,348	102	276	9.4	7,127.6	7,127.6	7,127.8	0.2
DM	90,698	300	398	6.5	7,141.0	7,141.0	7,141.0	0.0
DN	91,388	120	292	8.9	7,148.5	7,148.5	7,148.6	0.1
DO	91,868	105	313	8.3	7,155.2	7,155.2	7,155.9	0.7
DP	92,748	65	239	10.9	7,173.8	7,173.8	7,173.8	0.0
DQ	93,468	117	288	9.0	7,184.6	7,184.6	7,184.6	0.0
DR	94,448	81	260	10.0	7,204.5	7,204.5	7,204.6	0.1
DS	95,343	100	274	9.5	7,216.8	7,216.8	7,217.2	0.4
DT	95,723	77	252	10.3	7,224.2	7,224.2	7,224.3	0.1
DU	96,333	90	266	9.8	7,232.5	7,232.5	7,233.0	0.5

[1] Feet Above Confluence With Fountain Creek

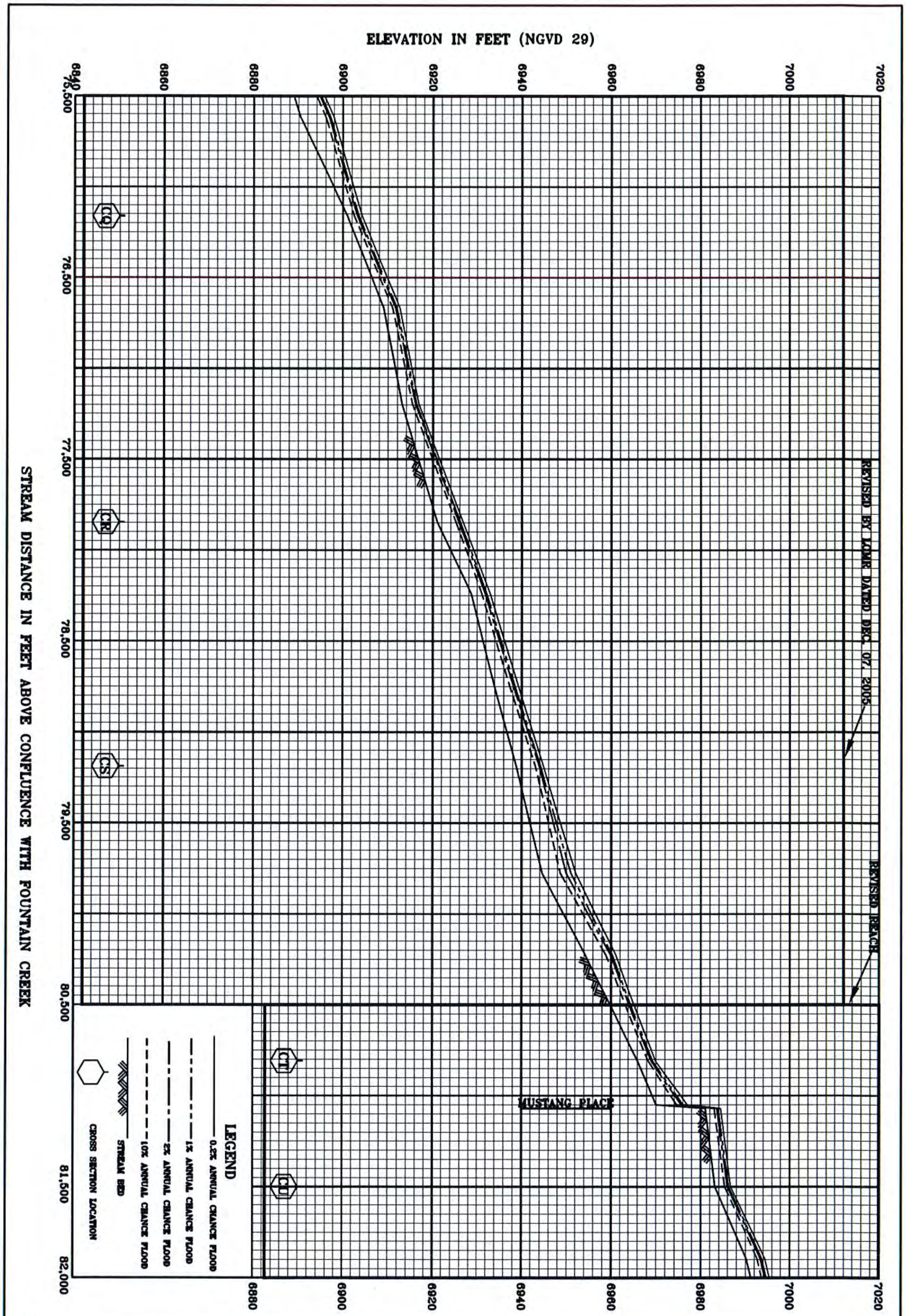
REVISED TO REFLECT LOMR
EFFECTIVE: July 23, 2009

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY
EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK



FEDERAL EMERGENCY MANAGEMENT AGENCY

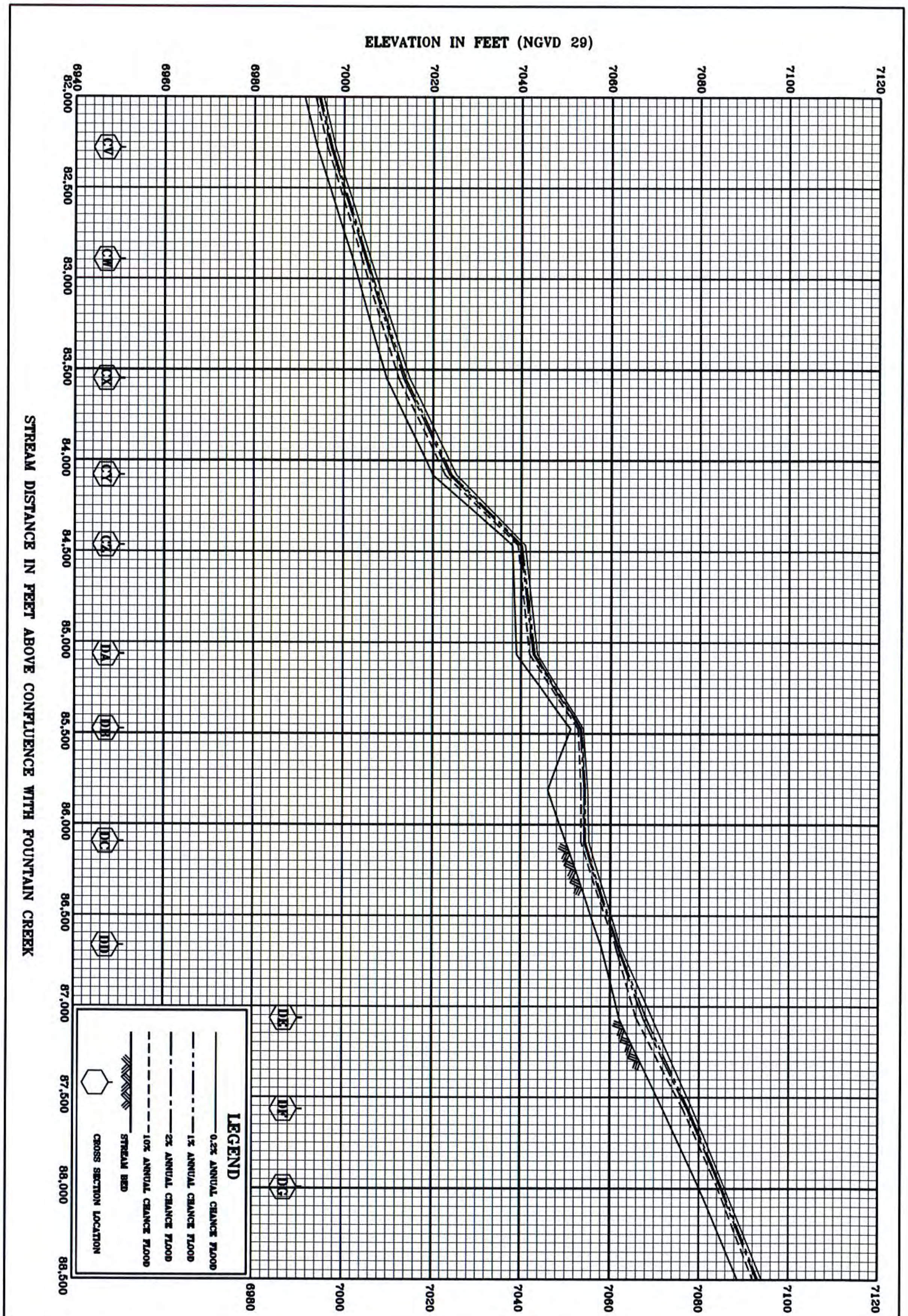
EL PASO COUNTY, CO
AND INCORPORATED AREAS

REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009

FLOOD PROFILES

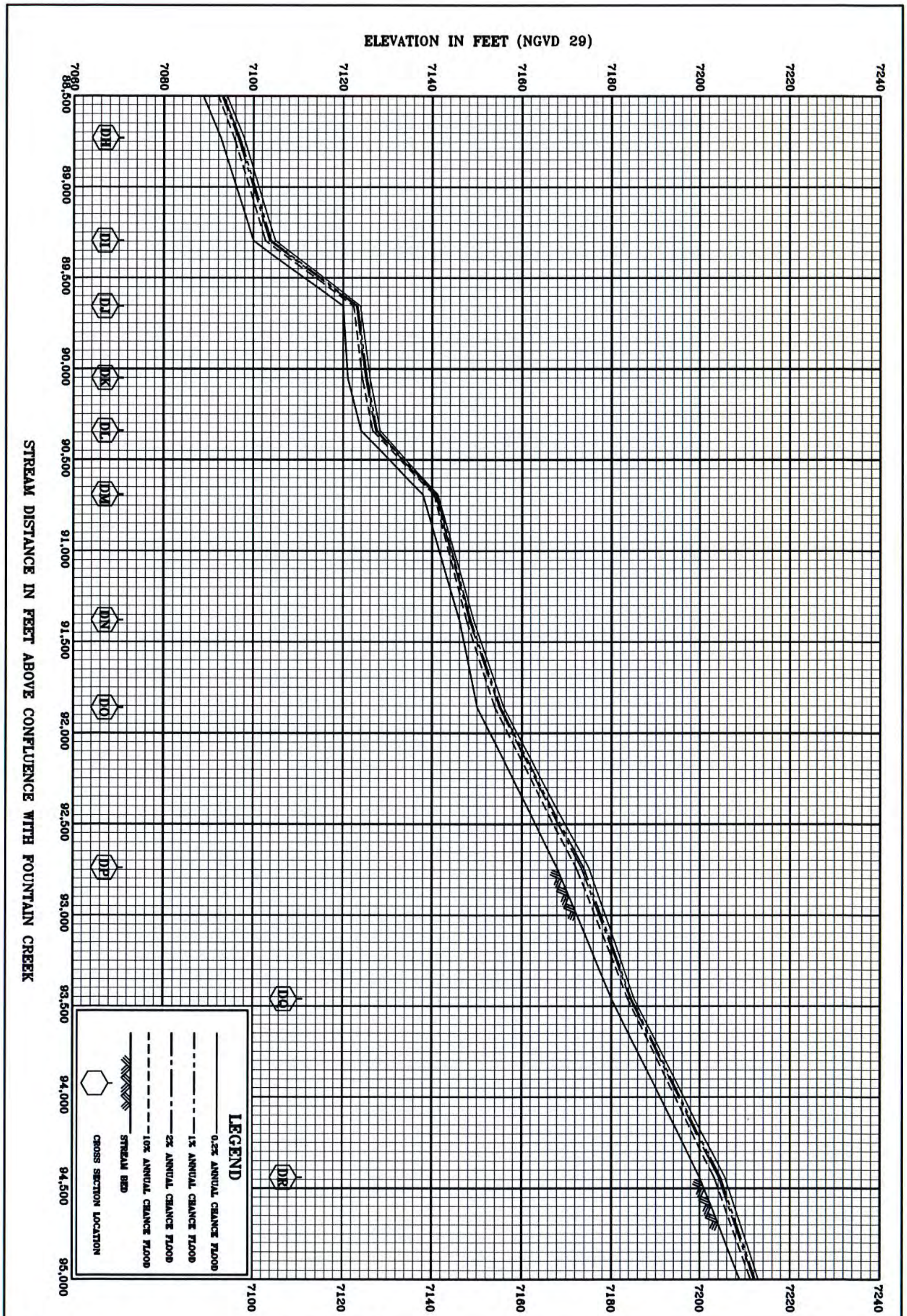
SAND CREEK

204P(a)



204P(b)

FEDERAL EMERGENCY MANAGEMENT AGENCY EL PASO COUNTY, CO AND INCORPORATED AREAS	FLOOD PROFILES REVISED TO REFLECT LOMR EFFECTIVE: July 23, 2009 SAND CREEK



FEDERAL EMERGENCY MANAGEMENT AGENCY

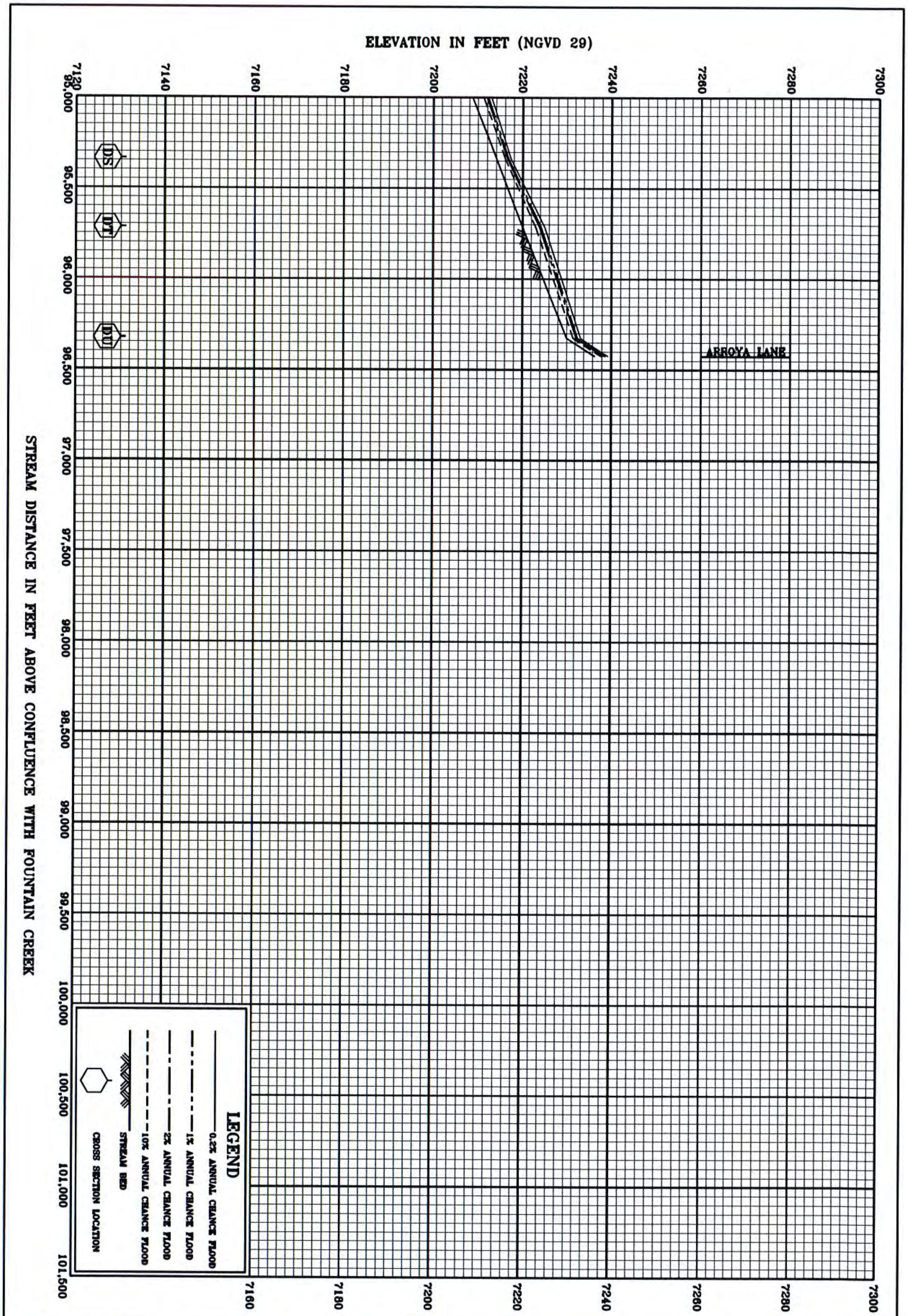
EL PASO COUNTY, CO
AND INCORPORATED AREAS

REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009

FLOOD PROFILES

SAND CREEK

204P(c)



204P(d)

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

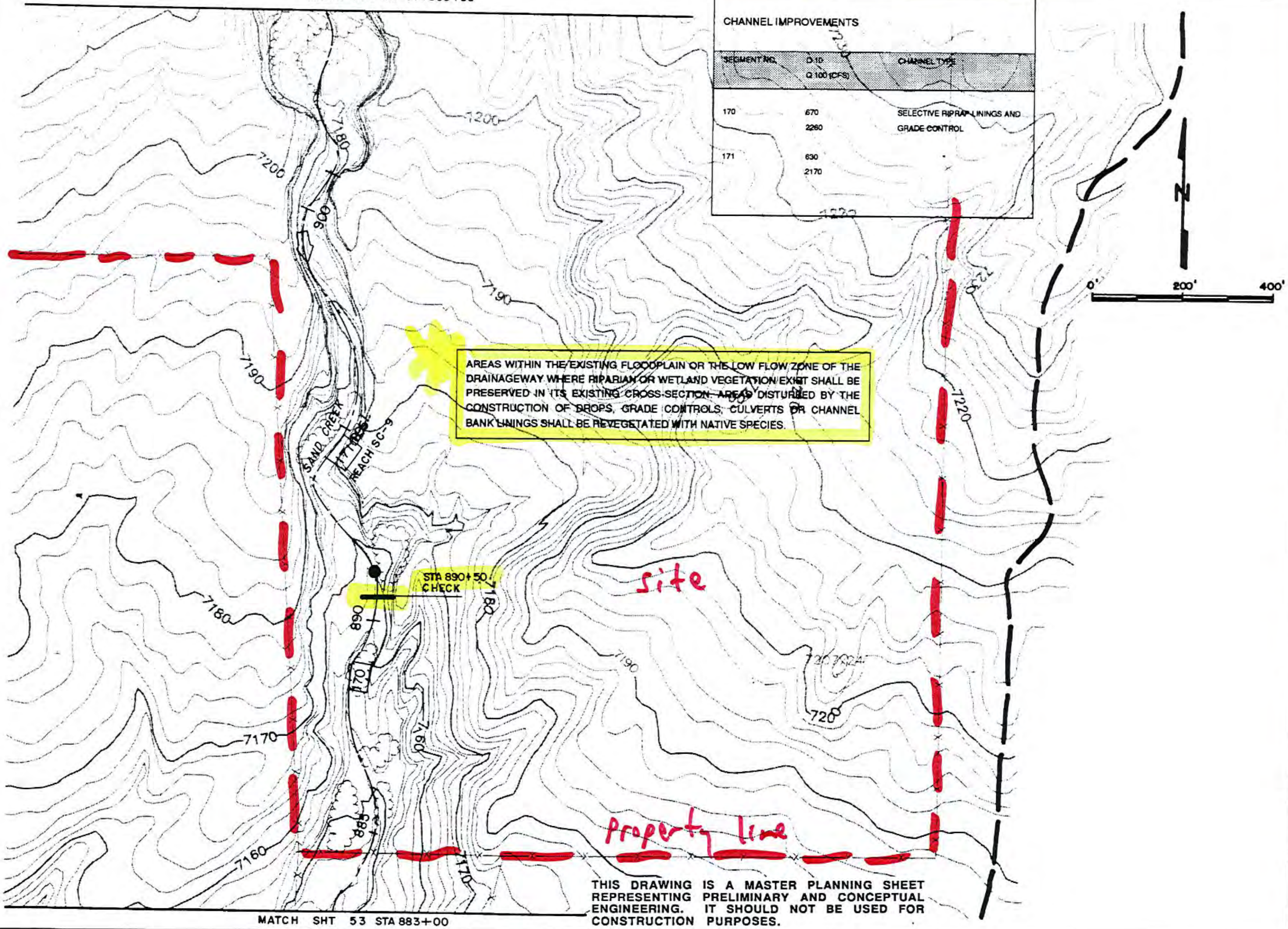
FLOOD PROFILES

REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009

SAND CREEK

RECOMMENDATIONS PER SAND CREEK DBPS

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS



CHANNEL IMPROVEMENTS

SEGMENT NO.	D 10 / Q 100 (CFS)	CHANNEL TYPE
170	670 / 2260	SELECTIVE RIPRAP LININGS AND GRADE CONTROL
171	630 / 2170	

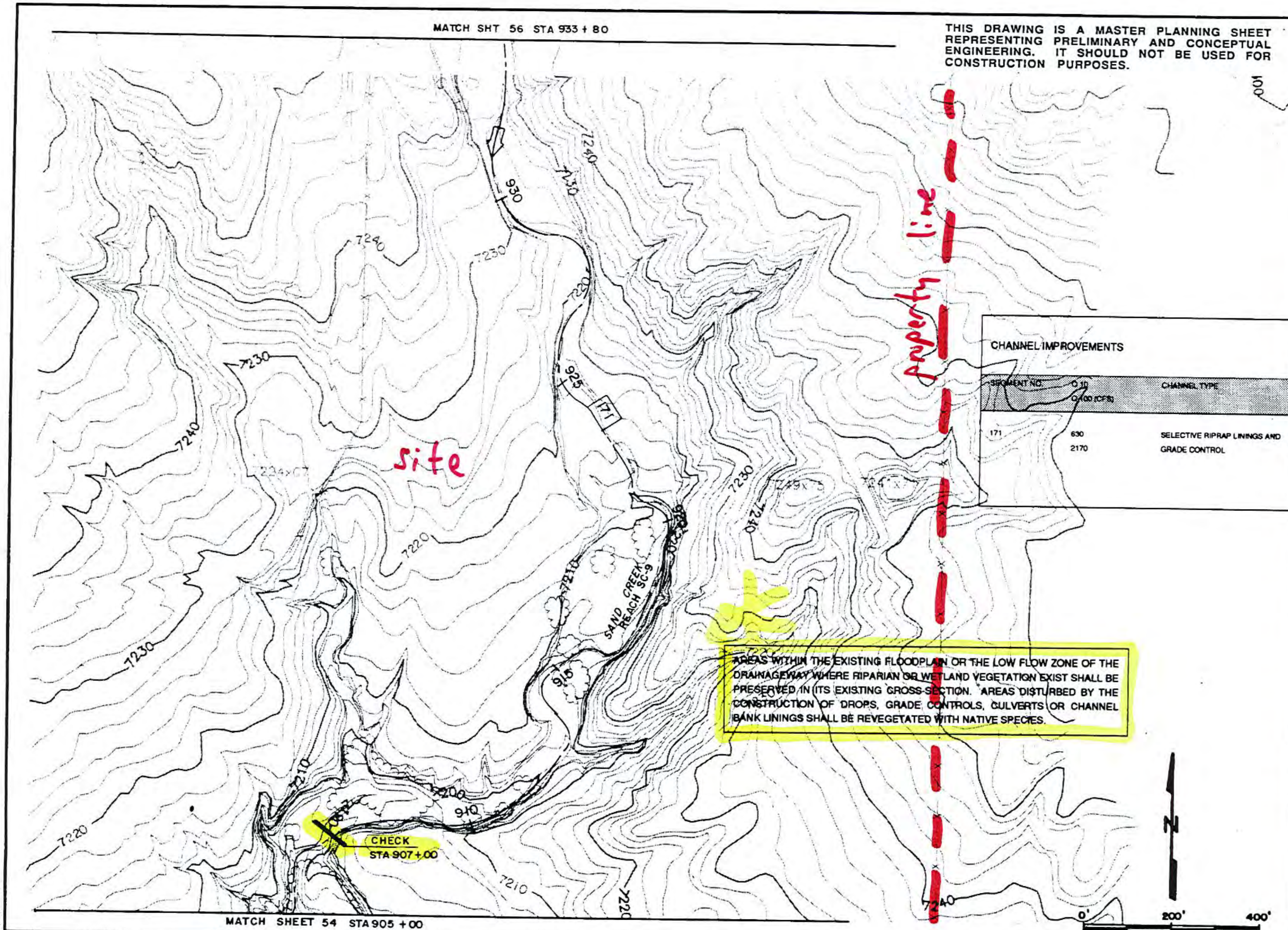
THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN PLANS

Project No. 90-04-09
Date: 9/92
Design: RNW
Drawn: EAK
Check: RNW
Revisions:



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

Project No.	90-04-09
Date:	9/92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	

55

VI. DEVELOPMENT OF ALTERNATIVES AND RECOMMENDED PLAN

The concepts which are available for handling stormwater runoff within the Sand Creek basin have been presented and discussed in detail in the Sand Creek Drainage Basin Planning Study Development of Alternatives Report and the draft East Fork Sand Creek Drainage Basin Planning Study. The process of combining the various channel treatment options, detention schemes and roadway crossing structures into a contiguous plan for all of the reaches is presented in this chapter of the report. As a result of the evaluation of the flood control, environmental, open space, operations and maintenance, and implementation concerns within the Sand Creek basin, the following concepts were identified as having sufficient feasibility to warrant further evaluation and review:

Channel Concepts:	Floodplain Preservation Channelization, 10- or 100-year Selective Improvements
Detention:	Regional detention systems

Channel Concepts: The channel concepts listed above have been evaluated with respect to the parameters listed in the previous chapter. A concept's feasibility depends upon its impact, positive or negative, upon the evaluation parameters. ***The floodplain preservation*** concept has been considered to be the same as the ***"do-nothing"*** alternative. The floodplain preservation concept would involve the regulation of the floodplain limits, generally as depicted on the effective City of Colorado Springs and El Paso County Flood Insurance Rate Maps. Regulation of the floodplain so that future encroachments are minimized and the floodproofing of structures which are currently within the 100-year floodplain would presumably be the methods used to address the flood hazard concerns along Sand Creek. In the upper reaches of Sand Creek, the ownership or easements associated with the 100-year floodplain (or greater limits to allow for an erosion buffer zone) would be a primary issue in regards to implementation of such a concept. Detention in the upper reaches of the basin Sand Creek basin and in the East Fork Sand Creek basin will maintain the 100-year floodplain at existing limits within the lower reaches of Sand Creek. The "do-nothing" concept is feasible wherever the existing drainageway improvements are of adequate capacity to convey flood flows. ***Channelization*** would involve the lining of the Creek into a more confined flow area, and could be done for either the ***100-year or 10-year*** flood discharges. Several typical channel concepts have been presented. The primary bank lining material would probably be riprap. Grade control and/or drop structures would be required in a channelization concept so that the flood velocities could be controlled to a level requiring medium to heavy riprap. Soil cement offers an alternative to riprap and concrete for the construction of drops or grade control structures. Revegetation would occur wherever the native vegetation was disturbed by the channel construction. Willows at the toe of the riprap banks would be a minimum replacement. ***Selective linings*** would involve the construction of grade controls, drop structures, bank linings, storm sewer outlet control structures selectively sited to resist stream erosion or to reduce potential flooding damages. Areas of future concern such as at the outside bends of the creek, or at the outlets of bridges or culverts which will cross the drainageway would be subject to selective improvements.

Detention Concepts: The two general detention concepts evaluated were onsite versus regional detention. During the evaluation process, it was determined that the onsite detention concept has a low feasibility relative to a regional concept. This is because, (1) onsite detention has a unpredictable impact upon lowering peak discharges from urbanized areas to historic conditions (reference, Urbonas and Glidden, "Effect of Detention on Flows in Major Drainageways" ASCE Water Forum '81, 1981), (2) an onsite concept has little impact upon maintaining or enhancing water quality, (3) the number of onsite detention basins, their locations and size cannot be accurately determined in the undeveloped portions of the basin at this time, and (4) onsite detention would present a substantial maintenance responsibility to the jurisdictions involved. For these reasons the onsite detention concept was eliminated and regional detention basin concepts were developed. In the analysis of the channel concepts, regional detention facilities were assumed to be in place.

Channel Alternatives

Presented on Table VI-1 is a matrix of channel alternatives which were evaluated. All reaches of Sand Creek and the East Fork of Sand Creek had at least three alternatives analyzed. Presented on Tables VI-2 through VI-6 are comparative evaluations of the floodplain preservation (do-nothing), channelization and selective lining concepts, for the mainstem Sand Creek basin, by reach. The purpose of the evaluation process was to identify the relative advantages and disadvantages of each concept within each reach.

100-year peak discharge to levels. This will allow for the channel improvements to be constructed within the existing right-of way.

Reaches SC-5 and SC-6: A selective channel improvement concept has been recommended for these reaches. Detention in Reach SC-8 of the basin will maintain flows to historic peak discharge levels, however the low flows will increase in frequency and volume. For this reason it has been recommended to provide riprap channel linings at selective locations to at least the 10-year water surface and install grade controls. This will prevent the long-term degradation of the invert. A residual 100-year floodplain will remain and will offer opportunities for habitat replacement and open space preservation. Land adjacent to the drainageway is currently undeveloped or unplatted at this time which makes the feasibility of implementing this concept greater in comparison to the urbanized reaches of the creek.

Reaches SC-7 and SC-8: A selective improvement concept involving the localized lining of channel banks and grade control construction has been recommended for these reaches. The feasibility of this concept stems from the fact that flows will be reduced because of detention. Numerous individual rural ownerships cross the drainageway, however no habitable structures lie within the 100-year floodplain. Because of this, the economic feasibility of channelization concepts is low. Non-structural measures can be used to limit encroachments into floodprone areas. Additionally, the City of Colorado Springs Comprehensive plan recommends that the floodplains be maintained as open space. Potential habitat disturbances can be avoided with a selective plan, or simply replaced as part of the particular construction activity which caused the disturbance.

Reach SC-9: A floodplain preservation concept has been recommended for this reach. Little increase in urbanization is anticipated in this reach, and for this reason the existing drainageway is expected to remain stable. Localized improvements may be necessary to limit erosion caused by flow concentrations at culverts or storm sewers. Private ownership of the drainageway is anticipated to continue which lower the feasibility of channel concepts which require permanent right-of-ways or easements for construction and maintenance.

Reaches WF-1 through WF-3: A 100-year channel concept has been recommended for these reaches primarily because of the potential for flooding damages. Several roadway crossings are in need of replacement because of the flood hazard the constrictions create. Some open space enhancement potential exists for this concept since these reaches have been degraded visually by debris accumulation, bank sloughing and sedimentation. Little opportunity exists for widening the drainageway because the

Development of the Recommended Plan

Presented on Table VI-7 is a matrix representing the recommended plan for each major drainageway reach. The selection of a recommended channel treatment scheme has been based upon the qualitative and quantitative information presented in the Sand Creek Drainage Basin Planning Study Development of Alternatives report and the draft East Fork Sand Creek Drainage Basin Planning Study. Contained within the Technical Addendum to the Sand Creek Drainage Basin Planning Study Development of Alternatives report, is the alternative hydrologic, hydraulic and conceptual cost data used in the evaluation and comparison of each of the alternatives within the mainstem Sand Creek basin.

Discussion of Recommended Plan

The recommendation of a particular channel treatment or detention scheme has been based upon the qualitative and quantitative data presented. For each reach the flood hazard, environmental, cost, operations and maintenance and open space aspects of the drainageway were weighed for each alternative concept.

Reach SC-1: For this reach a 10-year channel section was recommended for further evaluation. With the implementation of regional detention in the upper basin, the 100-year floodplain will generally be confined within the existing banks, excepting at roadway crossings lacking 100-year capacity. It is recommended that a 10-year low flow channel be constructed within the invert of the existing channel through the construction of benches and sand bars. As urbanization continues towards the full development scenario, the base flow and annual flows will increase in volume and frequency. For this reason, the low flow area must be stabilized to protect the existing channel banks from undermining and subsequent bank sloughing. The benched areas offer an opportunity for habitat replacement and enhancement. At some locations within this reach, a residual 100-year floodplain will remain which will have to be regulated. The residual 100-year floodplain offers some potential for open space preservation and enhancement. This is particularly true in the portion of the reach downstream of Hancock Expressway.

Reaches SC-2 through SC-4: A 100-year channel concept has been recommended primarily because of the potential for flooding damages which exists in these reaches. Habitat disturbed by the construction of channel linings and grade control structures could be replaced along the channel toes and on the overbanks. The replacement of the Waynoka Road crossing will reduce the potential for flood damages in areas adjacent to these roadways. The detention within the upper reaches will limit the

VII. PRELIMINARY DESIGN

The results of the preliminary design analysis are summarized in this section. The alternative improvements have been quantitatively and qualitatively evaluated, and presented to the City of Colorado Springs and other interested agencies and individuals. Field review of specific areas of concern have been conducted in order to refine the channel treatments suggested for use along Sand Creek, East Fork Sand Creek and their major tributaries. The preliminary plan for the recommended alternative is shown on the drawings contained at the rear of this report.

Criteria

The City of Colorado Springs, El Paso County Drainage Criteria Manual was used in the development of the typical sections and plans for the major drainageways within the Basin. The City/County manual was supplemented by various criteria manuals with more specific application. These were:

1. "Design Guidelines and Criteria for Channels and Hydraulic Structures on Sandy Soils," prepared by Simons, Li & Associates, Inc., 1981.

2. Urban Storm Drainage Criteria Manual, Volumes I, II, and III, prepared by the Urban Drainage and Flood Control District.

Various design plans for roadway and channel improvement projects, either proposed or already constructed were reviewed in order to prepare the preliminary design plans. Specifically, the project design plans for the Las Vegas Street and Galley Road bridge replacement projects were reviewed and the improvements incorporated in the preliminary design. The **proposed** Sand Creek Stabilization Project, AT&SF Railroad to Hancock Expressway and the **proposed** Sand Creek Stabilization Project at Fountain Boulevard design plans have been reviewed and incorporated into the preliminary design plan and profiles.

Hydrology

Presented on Table VII-1 is selected hydrologic data to be used for the sizing of major drainageway improvements within the Basin. **Peak flow rates for the 10- and 100-year frequency incorporating and the selected detention alternatives for the Sand Creek and East Fork Sand Creek Basin are summarized for key points along the major drainageways.** Contained within the The technical addenda of this report contains a complete listing of peak discharges for all the sub-basins, stream segments and design points shown on Exhibit 1.

The sizing the drainageway improvements for the tributaries will need to be verified during the final design and layout of the proposed drainageway facilities. Land development activities may alter the location of design points along the tributaries, and therefore slight alteration in a sub-basin's length, slope and area may occur. The methods outlined in the City/County Drainage Criteria Manual should be applied during final design analysis. The rational method should be used to check the peak flow rates for all tributary drainageways and storm sewers draining areas less than 100 acres in size.

Channels

The recommended channel sections for each reach of drainageway has been outlined in Section VI of this report. In general, the banks of Sand Creek channel, from the confluence with Fountain Creek to the proposed Sand Creek Detention Basin No. 2 are to be lined, or in some cases relined, with riprap to either a 10-year or 100-year flow depth, as shown on the preliminary design plans. Above the Sand Creek Detention Basin No. 2, selectively located riprap bank protection such as at outside bends, at bridge or culvert outlets, and at confluences with side tributaries have been recommended. In conjunction with the selective improvement measures, and the 10-year low flow concept, the 100-year floodplain should be preserved and regulated. Wherever existing bank linings were judged to be adequate, no improvements have been recommended at this time.

For the West Fork Sand Creek, 100-year riprap bank linings have been recommended in order to address the 100-year flooding hazard which exists at numerous locations along the West Fork. The final design improvements shown in the Palmer Park Bridge Replacement project drawings have been incorporated into the preliminary design plans. In the uppermost reaches of the West Fork, a short segment of rectangular concrete channel has been recommended because of right-of-way constraints.

For the Center Tributary of Sand Creek, 100-year riprap lined channels have been recommended from the confluence with East Fork to Platte Avenue. Above Platte Avenue, the existing concrete channels have adequate capacity except where the drainageway channel has yet to be improved. The final design plans for the US 24 Bypass Project, Phase II have been incorporated into the plans. As part of the bypass construction, it is proposed to line the Center Tributary using riprap. The location of the proposed roadway, new crossings, drops and channel as shown on the Phase II Bypass plans have been reflected on the preliminary design drawings.

For the East Fork Sand Creek drainageway, riprap lined channel banks have been recommended for the majority of the reaches. This is mainly because of the high level of development predicted for the basin in the area known as the Banning-Lewis Ranch development. Open space to accommodate the 100-year floodplains should be allowed for as the East Fork Sand Creek drainageways develop. This is consistent with the Banning-Lewis Ranch master development plan which was approved at the time of annexation of this property. Above Woodmen Road, selective channel lining improvements and grade control structures have been recommended.

For the most part the side tributaries have been recommended to be lined with riprap, however there are some locations in the upper basin which have been proposed to be grasslined. The location of the side drainageways should be considered approximate and may very likely be modified in the future because of land development.

The primary criteria used when sizing the proposed channel sections has been velocity. For all riprap lined channels, the average design velocity should be no greater than 9 feet per second. This criteria allows for the use of Type H riprap within the main flow area of the drainageway. For the case of a 10-year channel with an overall floodplain section, limiting the main channel velocity to 9 feet per second will result in overbank velocities in the five feet per second range. At this level of overbank velocity, native vegetation will be able to withstand the erosive forces which might result in a 100-year flow event. Velocities approaching 10 feet per second could occur at constrictions such as at roadway crossings and at culvert outlets.

Drop Structures and Check Structures

Drop and check structures have been sited along Sand Creek in order to slow the channel velocity to the recommended 7 feet per second, and to prevent localized and long-term stream degradation from affecting channel linings and overbanks. In the reaches to be selectively lined, drops and check structures will protect the native vegetation from the detrimental effects of stream invert headcutting. Several types of structures could be considered for the Sand Creek Basin. For channel bottom widths in excess of fifty feet, soil cement or sheet piling drops/checks are feasible. For channels narrower than this, reinforced concrete structures are probably the best alternative. **A maximum drop height of three feet is recommended. The methodology recommended for use when designing vertical structures is contained with Volume II of the Urban Storm Drainage Criteria Manual.**

Detention

The recommended plan calls for the construction of six regional detention basins within the Sand Creek basin, and six regional basins within the East Fork Sand Creek basin. The purpose of the Sand Creek detention basins is to limit peak discharges at Powers Boulevard to existing development condition levels. The detention basins in the upper portions of the Sand Creek basin will keep the majority of the existing channel sections and bridges below Powers Boulevard with adequate flow capacity in the future development condition. The detention basins within the East Fork Sand Creek basin have been sized to maintain the flow outfalling from the Banning-Lewis Ranch property at existing levels. This in turn will help to reduce flow to the mainstem of Sand Creek. The detention basins have been designed to accommodate the 100-year future condition volume without overtopping the overflow spillway. Sand Creek Basin Nos. 2 and 6, and East Fork Sand Creek Basin Nos. 1, 2, and 3 will be classified as jurisdictional structures, and their design and operation would be subject to State Engineer's office criteria. Sand Creek basins number 1 and 3 should be designed so as to take advantage of the adjacent roadway embankments, and therefore classifying as incidental storage and not subject State Engineer's regulations.

At Stetson Hills Boulevard, the roadway embankment has created a 2 acre open water wetland which was identified during the environmental review of the basin. It is recommended that this wetland be preserved. Accordingly, an outlet control structure will have to be constructed to pass the 100-year discharge to the downstream channel without overtopping the roadway. No floodwater storage or routing has been accounted for in the hydrology modelling at this roadway for the selected detention plan.

For the East Fork Sand Creek detention basin numbers 2, and 3, the existing embankment and outlet structure act to maintain a permanent pool at this time. It is recommended that the design of these detention basins be directed at maintaining the permanent pool when the flood control storage is to be added. The existence of a permanent pool may enhance the water quality aspects of these basins, and offer the opportunity of open space development conducive with open water.

Water Quality

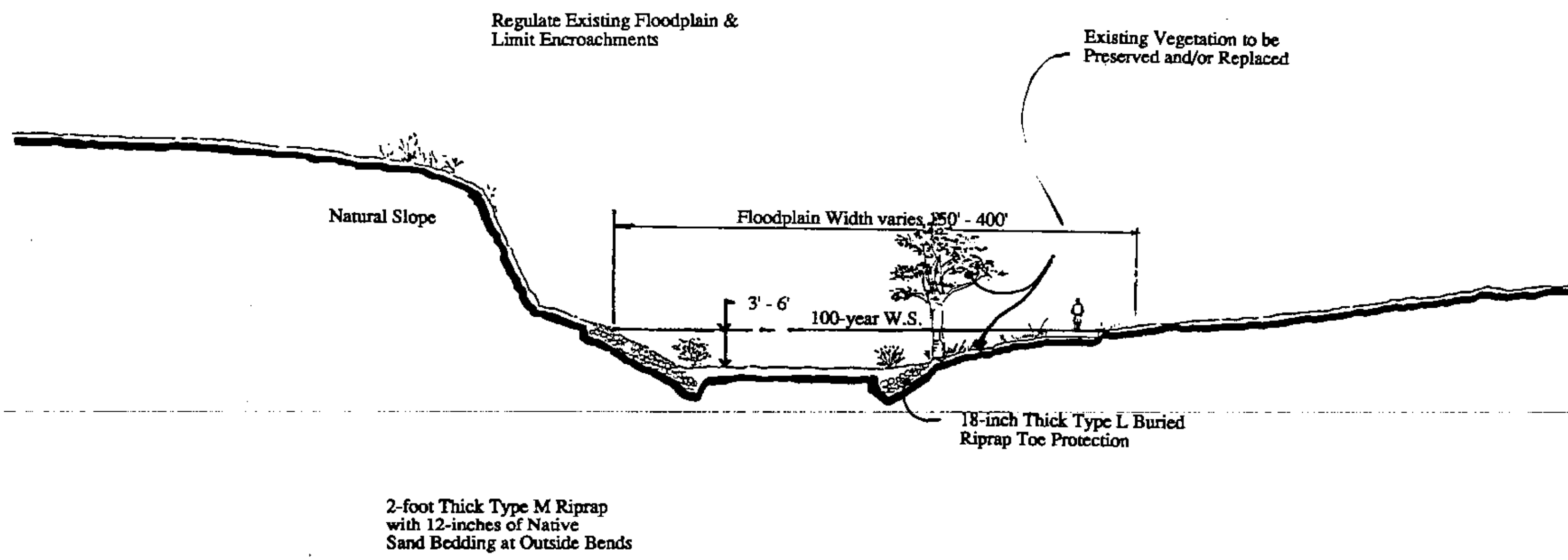
Improvement of urban stormwater quality has become and important issue in drainage basin planning. Many pollutants are naturally associated with sediments that enter sensitive receiving waters. The pollutants are naturally occurring compounds that are carried to the drainageways in storm runoff. Other pollutants are the result of urbanization such as lawn chemicals, oil and grease, pet feces, lawn clippings and other items. Many pollutants can be limited by programs such as erosion control at construction sites, educational programs to inform the public as to the proper use of lawn chemicals, oil recycling programs and street sweeping programs. Even with these programs in place, erosion along the drainageways can generate large quantities of sediment that can settle out along the downstream channel bottoms.

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

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



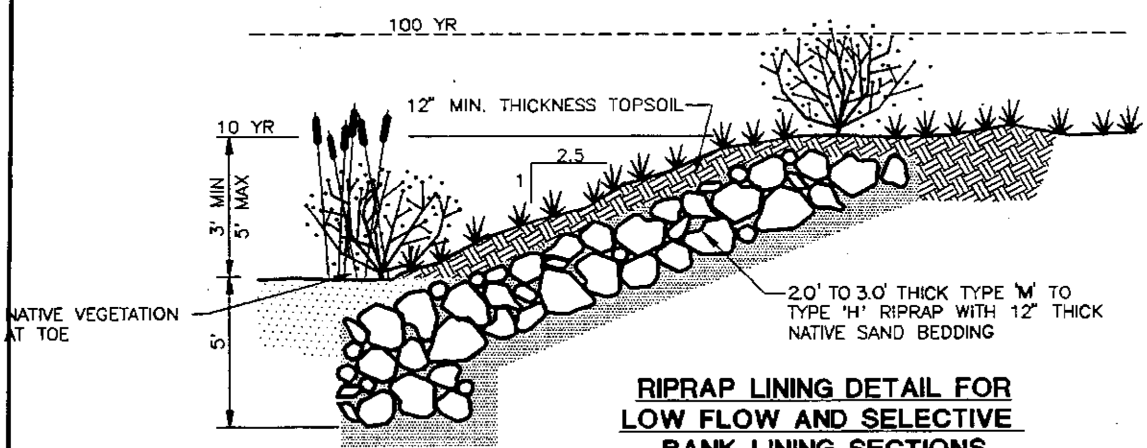
Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

Typical Channel Sections

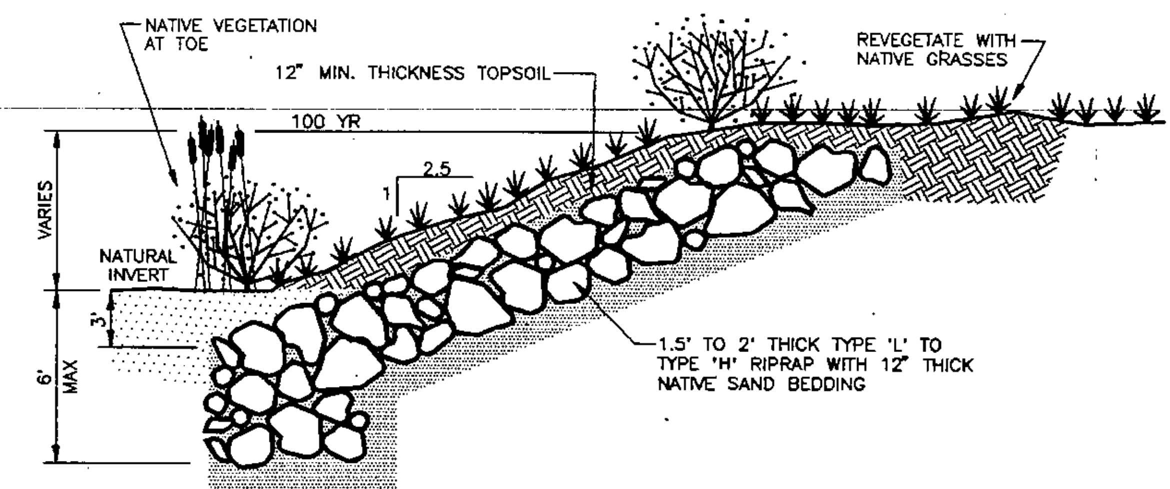
Project No.:
Date:
Design:
Drawn:
Check:
Revisions:

CS-3



RIPRAP LINING DETAIL FOR LOW FLOW AND SELECTIVE BANK LINING SECTIONS

NTS



RIPRAP LINING DETAIL FOR 100 YR CHANNEL SECTIONS

NTS

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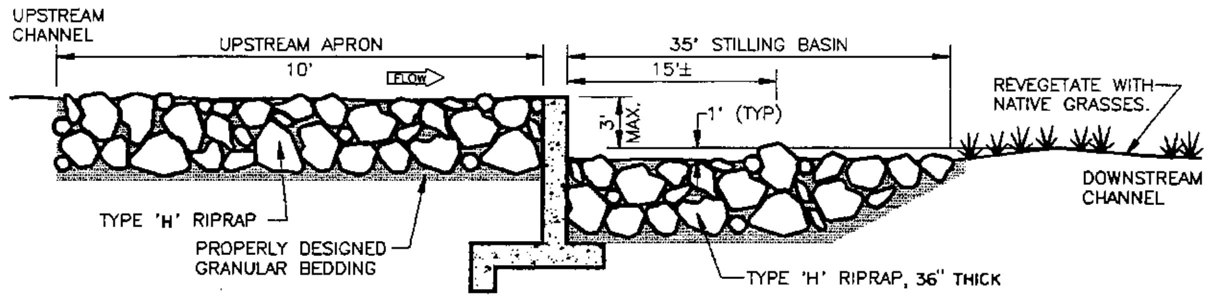
SAND CREEK DRAINAGE BASIN PLANNING STUDY

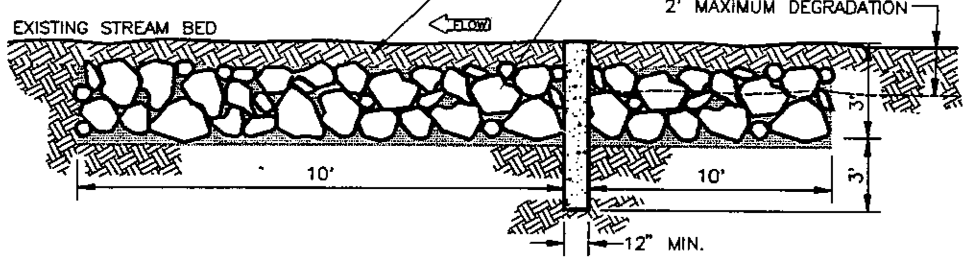
Project No.
Date:
Design:
Drawn:
Check.
Revisions:

CS-6



NOTE: DIMENSIONS OF APRON, STILLING BASIN, RIPRAP, AND CHECK STRUCTURE IS TO BE DETERMINED DURING FINAL DESIGN.

TYPICAL DROP STRUCTURE
GENERALIZED PROFILE
NTS



TYPICAL EROSION CONTROL
CHECK PROFILE
NTS

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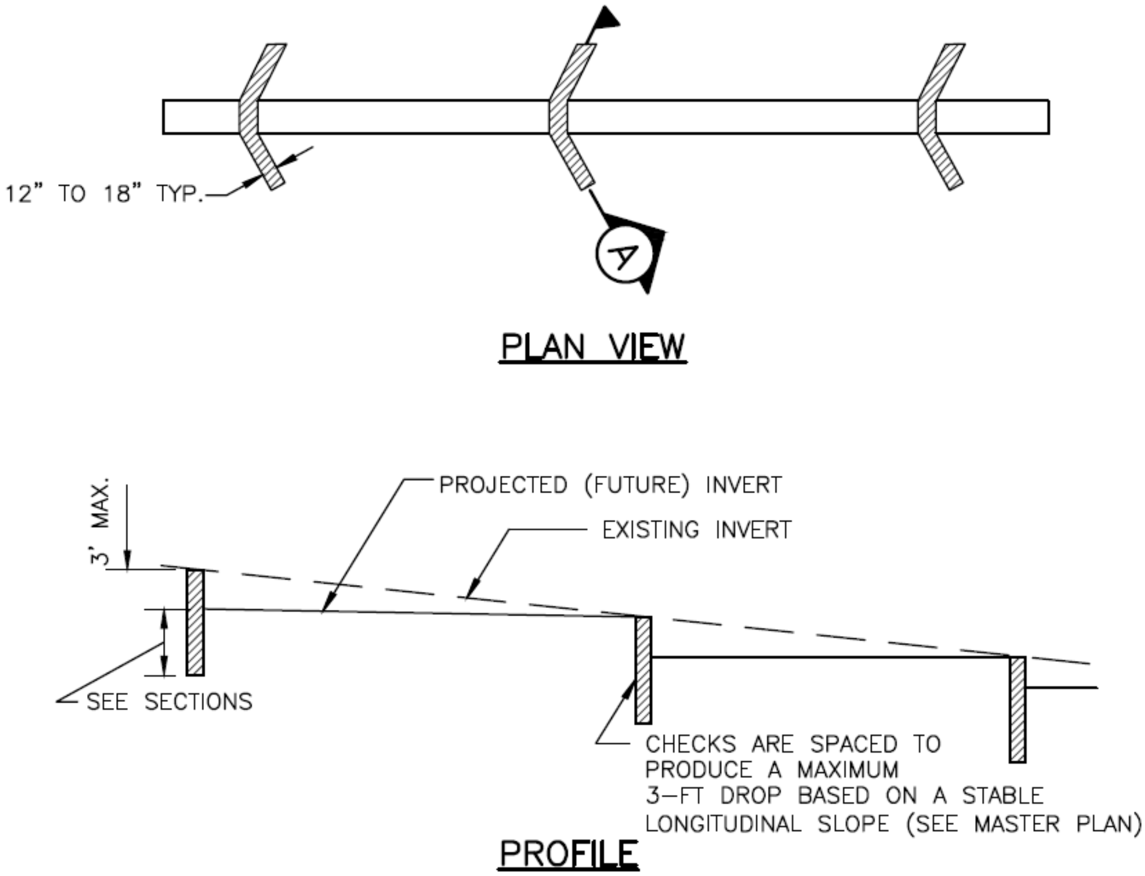
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

Project No:
Date:
Design:
Drawn:
Check:
Revisions:

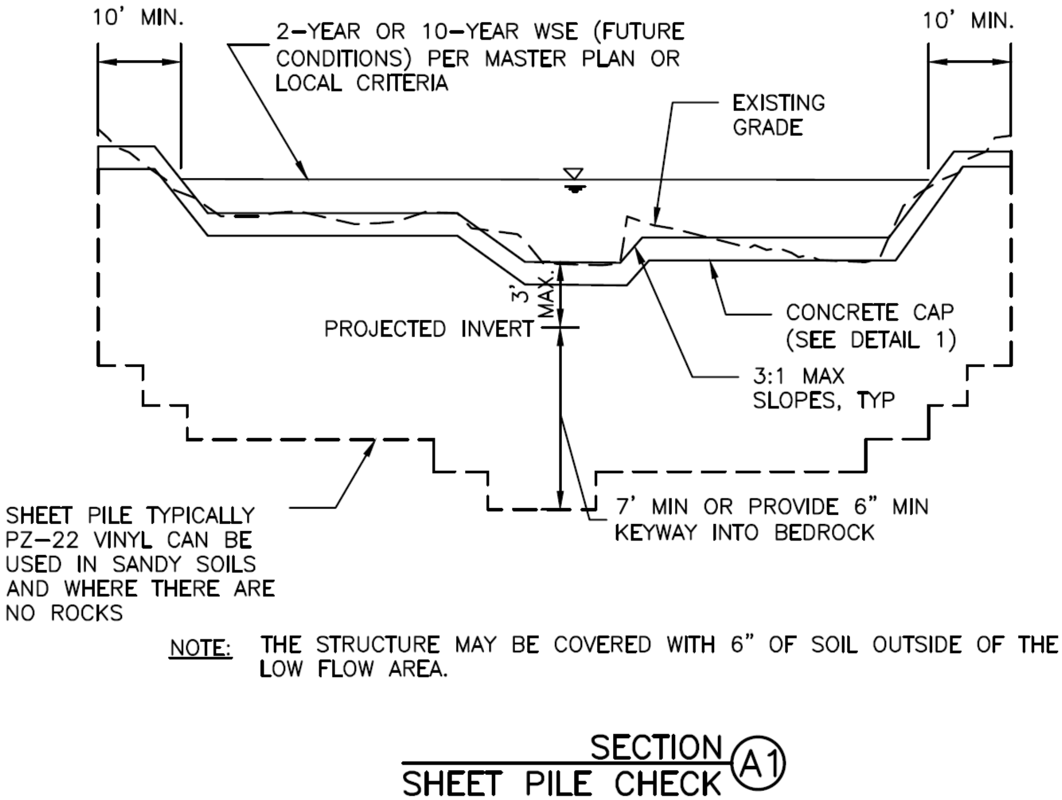
CS-7



NOTES:

1. SHEET PILE IS PREFERRED AND MUST BE USED WHERE SOIL CANNOT HOLD A VERTICAL WALL.

Figure 9-26. Check structure details (Part 1 of 3)



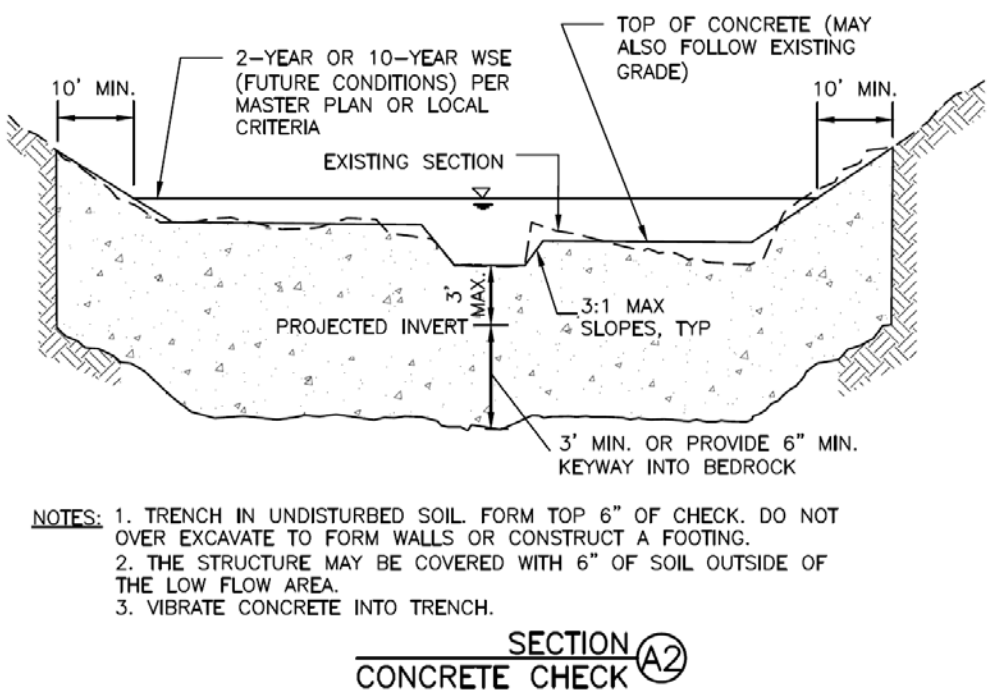


Figure 9-27. Check structure details (Part 2 of 3)

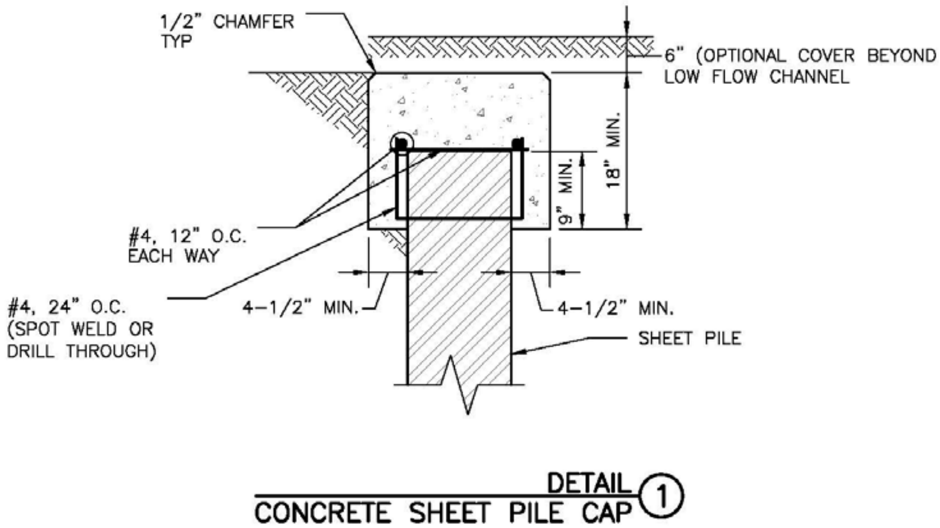


Figure 9-28. Check structure details (Part 3 of 3)

PRELIMINARY WETLANDS MAPPING

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Trails at Timber Ridge

Maximum Extent of Wetlands Map

El Paso County, Colorado

CORE CONSULTANTS
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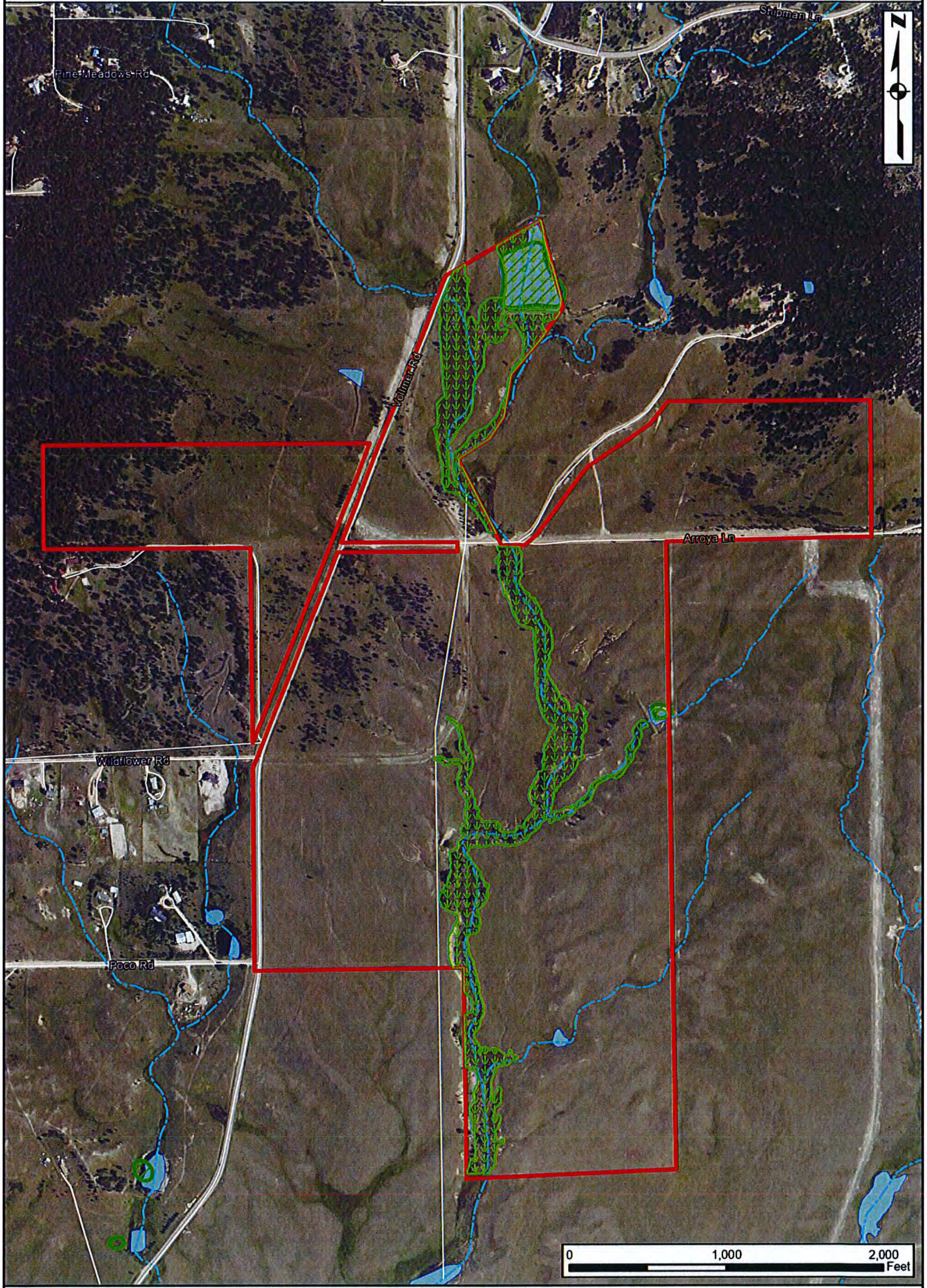
DEVELOPMENT CONSULTING
NATURAL RESOURCES CONSULTING
LAND SURVEYING
303.703.4444
1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120



Project Boundary
NHD Watercourse
NHD Waterbody
NWI Wetland
Preliminary Wetland

Date: 4/3/2017

CORE Project #: 16-059

HYDROLOGIC CALCULATIONS

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For Colorado Springs and much of the Fountain Creek watershed, the 1-hour depths are fairly uniform and are summarized in Table 6-2. Depending on the location of the project, rainfall depths may be calculated using the described method and the NOAA Atlas maps shown in Figures 6-6 through 6-17.

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where Z= 6,840 ft/100

These depths can be applied to the design storms or converted to intensities (inches/hour) for the Rational Method as described below. However, as the basin area increases, it is unlikely that the reported point rainfalls will occur uniformly over the entire basin. To account for this characteristic of rain storms an adjustment factor, the Depth Area Reduction Factor (DARF) is applied. This adjustment to rainfall depth and its effect on design storms is also described below. The UDFCD UD-Rain spreadsheet, available on UDFCD's website, also provides tools to calculate point rainfall depths and Intensity-Duration-Frequency curves[2] and should produce similar depth calculation results.

2.2 Design Storms

Design storms are used as input into rainfall/runoff models and provide a representation of the typical temporal distribution of rainfall events when the creation or routing of runoff hydrographs is required. It has long been observed that rainstorms in the Front Range of Colorado tend to occur as either short-duration, high-intensity, localized, convective thunderstorms (cloud bursts) or longer-duration, lower-intensity, broader, frontal (general) storms. The significance of these two types of events is primarily determined by the size of the drainage basin being studied. Thunderstorms can create high rates of runoff within a relatively small area, quickly, but their influence may not be significant very far downstream. Frontal storms may not create high rates of runoff within smaller drainage basins due to their lower intensity, but tend to produce larger flood flows that can be hazardous over a broader area and extend further downstream.

- **Thunderstorms**: Based on the extensive evaluation of rain storms completed in the Carlton study (Carlton 2011), it was determined that typical thunderstorms have a duration of about 2 hours. The study evaluated over 300,000 storm cells using gage-adjusted NEXRAD data, collected over a 14-year period (1994 to 2008). Storms lasting longer than 3 hours were rarely found. Therefore, the results of the Carlton study have been used to define the shorter duration design storms.

  To determine the temporal distribution of thunderstorms, 22 gage-adjusted NEXRAD storm cells were studied in detail. Through a process described in a technical memorandum prepared by the City of Colorado Springs (City of Colorado Springs 2012), the results of this analysis were interpreted and normalized to the 1-hour rainfall depth to create the distribution shown in Table 6-3 with a 5 minute time interval for drainage basins up to 1 square mile in size. This distribution represents the rainfall

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

3.2 Time of Concentration

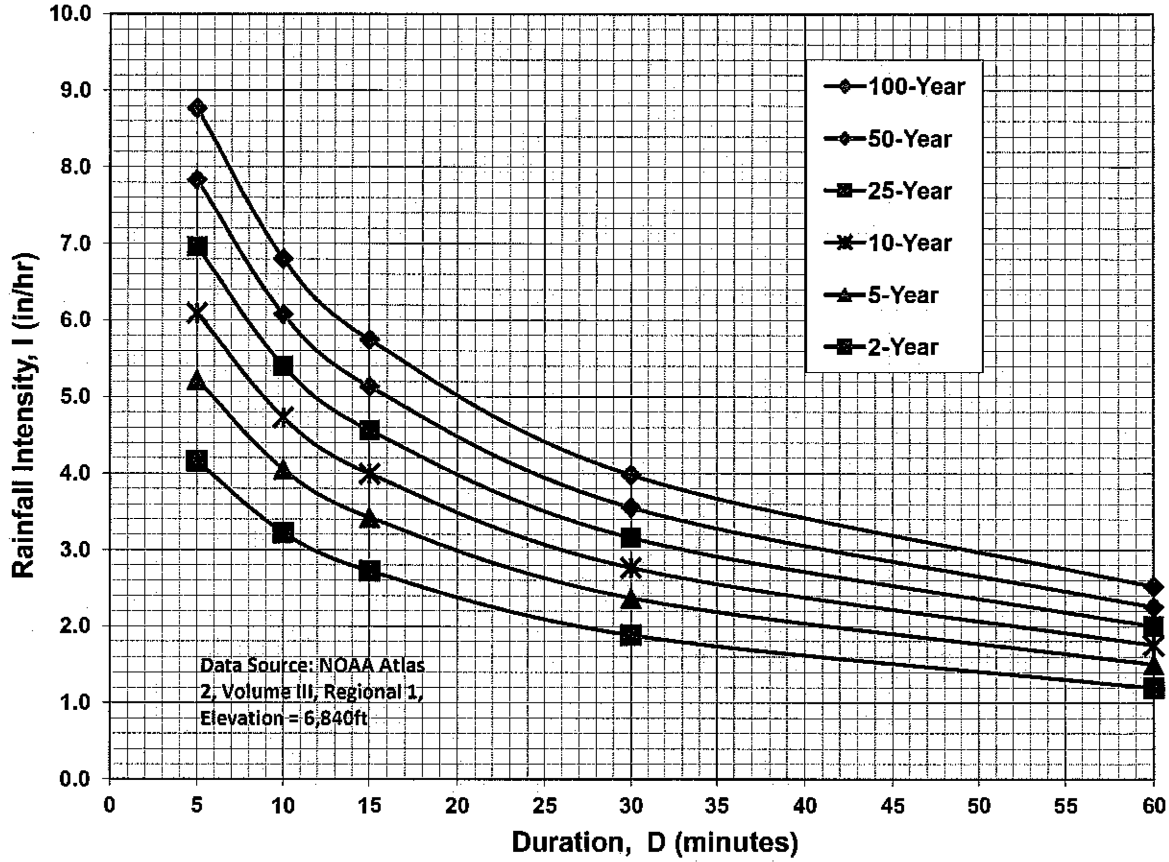
One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Table 6-10. NRCS Curve Numbers for Frontal Storms & Thunderstorms for Developed Conditions (ARCII)

Fully Developed Urban Areas (vegetation established)[1]	Treatment	Hydrologic Condition	% I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	-----	-----	---	68	79	86	89
Fair condition (grass cover 50% to 75%)	-----	-----	---	49	69	79	84
Good condition (grass cover > 75%)	-----	-----	---	39	61	74	80
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way	-----	-----	---	98	98	98	98
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	-----	-----	---	98	98	98	98
Paved; open ditches (including right-of-way)	-----	-----	---	83	89	92	93
Gravel (including right-of-way)	-----	-----	---	76	85	89	91
Dirt (including right-of-way)	-----	-----	---	72	82	87	89
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	-----	-----	---	63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	-----	-----	---	96	96	96	96
Urban districts:							
Commercial and business	-----	-----	85	89	92	94	95
Industrial	-----	-----	72	81	88	91	93
Residential districts by average lot size:							
1/8 acre or less (town houses)	-----	-----	65	77	85	90	92
1/4 acre	-----	-----	38	61	75	83	87
1/3 acre	-----	-----	30	57	72	81	86
1/2 acre	-----	-----	25	54	70	80	85
1 acre	-----	-----	20	51	68	79	84
2 acres	-----	-----	12	46	65	77	82
Developing Urban Areas[1]	**Treatment[2]**	**Hydrologic Condition[3]**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Newly graded areas (pervious areas only, no vegetation)	-----	-----	---	77	86	91	94
Cultivated Agricultural Lands[1]	**Treatment**	**Hydrologic Condition**	**% I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Fallow	Bare soil	-----	---	77	86	91	94
	Crop residue cover (CR)	Poor	---	76	85	90	93
		Good	---	74	83	88	90
Row crops	Straight row (SR)	Poor	---	72	81	88	91
		Good	---	67	78	85	89
	SR + CR	Poor	---	71	80	87	90
		Good	---	64	75	82	85
	Contoured (C)	Poor	---	70	79	84	88
		Good	---	65	75	82	86
	C + CR	Poor	---	69	78	83	87
		Good	---	64	74	81	85
	Contoured & terraced (C&T)	Poor	---	66	74	80	82
		Good	---	62	71	78	81
	C&T+ CR	Poor	---	65	73	79	81
		Good	---	61	70	77	80
Small grain	SR	Poor	---	65	76	84	88
		Good	---	63	75	83	87
	SR + CR	Poor	---	64	75	83	86
		Good	---	60	72	80	84
	C	Poor	---	63	74	82	85
		Good	---	61	73	81	84
	C + CR Poor	Poor	---	62	73	81	84
		Good	---	60	72	80	83
	C&T	Poor	---	61	72	79	82
		Good	---	59	70	78	81
	C&T+ CR	Poor	---	60	71	78	81
		Good	---	58	69	77	80

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

JOB NAME: *RETREAT AT TIMBERRIDGE FILING NO. 1*
JOB NUMBER: *1185.00*
DATE: *02/08/19*
CALCULATED BY: *MAW*

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

		IMPERVIOUS AREA / STREETS							LANDSCAPE/DEVELOPED AREAS							WEIGHTED			WEIGHTED CA		
BASIN	TOTAL AREA (AC)	AREA (AC)	C(2)	C(5)	C(10)	C(25)	C(50)	C(100)	AREA (AC)	C(2)	C(5)	C(10)	C(25)	C(50)	C(100)	C(2)	C(5)	C(100)	**CA(2)**	**CA(5)**	**CA(100)**
OS-1	1.20	0.75	0.89	0.90	0.92	0.94	0.95	0.96	0.45	0.02	0.08	0.15	0.25	0.30	0.35	0.56	0.59	0.73	**0.68**	**0.71**	**0.88**
OS-2	0.90	0.00	0.89	0.90	0.92	0.94	0.95	0.96	0.90	0.02	0.08	0.15	0.25	0.30	0.35	0.02	0.08	0.35	**0.02**	**0.07**	**0.32**
OS-3	2.50	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.50	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.45**	**0.63**	**1.18**
OS-4	3.10	0.00	0.89	0.90	0.92	0.94	0.95	0.96	3.10	0.15	0.22	0.30	0.37	0.41	0.46	0.15	0.22	0.46	**0.47**	**0.68**	**1.43**
OS-5	20.90	0.00	0.89	0.90	0.92	0.94	0.95	0.96	20.90	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**1.25**	**2.93**	**8.36**
OS-6	1.20	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.20	0.07	0.16	0.24	0.32	0.37	0.41	0.07	0.16	0.41	**0.08**	**0.19**	**0.49**
OS-7	2.10	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.10	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.38**	**0.53**	**0.99**
OS-8	1.00	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.00	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.18**	**0.25**	**0.47**
OS-9	5.30	0.00	0.89	0.90	0.92	0.94	0.95	0.96	5.30	0.07	0.16	0.24	0.32	0.37	0.41	0.07	0.16	0.41	**0.37**	**0.85**	**2.17**
OS-10	1.00	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.00	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.18**	**0.25**	**0.47**
OS-11	7.90	0.00	0.89	0.90	0.92	0.94	0.95	0.96	7.90	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**1.42**	**1.98**	**3.71**
OS-12	15.00	0.00	0.89	0.90	0.92	0.94	0.95	0.96	15.00	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**0.90**	**2.10**	**6.00**
OS-13	1.40	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.40	0.12	0.20	0.27	0.35	0.40	0.44	0.12	0.20	0.44	**0.17**	**0.28**	**0.62**
OS-14	9.10	0.00	0.89	0.90	0.92	0.94	0.95	0.96	9.10	0.12	0.20	0.27	0.35	0.40	0.44	0.12	0.20	0.44	**1.09**	**1.82**	**4.00**
OS-15	23.40	0.00	0.89	0.90	0.92	0.94	0.95	0.96	23.40	0.03	0.09	0.17	0.26	0.31	0.36	0.03	0.09	0.36	**0.70**	**2.11**	**8.42**
A	16.30	0.00	0.89	0.90	0.92	0.94	0.95	0.96	16.30	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**0.98**	**2.28**	**6.52**
B	7.70	0.00	0.89	0.90	0.92	0.94	0.95	0.96	7.70	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**0.46**	**1.08**	**3.08**
C	6.40	1.20	0.89	0.90	0.92	0.94	0.95	0.96	5.20	0.06	0.14	0.23	0.31	0.36	0.40	0.22	0.28	0.51	**1.38**	**1.81**	**3.23**
D	1.10	0.80	0.89	0.90	0.92	0.94	0.95	0.96	0.30	0.02	0.08	0.15	0.25	0.30	0.35	0.65	0.68	0.79	**0.72**	**0.74**	**0.87**
E	3.20	0.00	0.89	0.90	0.92	0.94	0.95	0.96	3.20	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**0.19**	**0.45**	**1.28**
F	0.90	0.00	0.89	0.90	0.92	0.94	0.95	0.96	0.90	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**0.05**	**0.13**	**0.36**
G	2.40	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.40	0.02	0.08	0.15	0.25	0.30	0.35	0.02	0.08	0.35	**0.05**	**0.19**	**0.84**
H	2.00	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.00	0.15	0.22	0.30	0.37	0.41	0.46	0.15	0.22	0.46	**0.30**	**0.44**	**0.92**
I	4.00	0.00	0.89	0.90	0.92	0.94	0.95	0.96	4.00	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.72**	**1.00**	**1.88**
J	3.60	0.00	0.89	0.90	0.92	0.94	0.95	0.96	3.60	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.65**	**0.90**	**1.69**
K	1.50	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.50	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.27**	**0.38**	**0.71**
L	7.30	0.00	0.89	0.90	0.92	0.94	0.95	0.96	7.30	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**1.31**	**1.83**	**3.43**
M	1.90	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.90	0.15	0.22	0.30	0.37	0.41	0.46	0.15	0.22	0.46	**0.29**	**0.42**	**0.87**
N	2.10	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.10	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.38**	**0.53**	**0.99**
O	2.10	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.10	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.38**	**0.53**	**0.99**
P	2.50	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.50	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.45**	**0.63**	**1.18**
Q	2.30	0.00	0.89	0.90	0.92	0.94	0.95	0.96	2.30	0.06	0.14	0.23	0.31	0.36	0.40	0.06	0.14	0.40	**0.14**	**0.32**	**0.92**
R	1.50	0.00	0.89	0.90	0.92	0.94	0.95	0.96	1.50	0.18	0.25	0.32	0.39	0.43	0.47	0.18	0.25	0.47	**0.27**	**0.38**	**0.71**
S	3.40	0.00	0.89	0.90	0.92	0.94	0.95	0.96	3.40	0.02	0.08	0.15	0.25	0.30	0.35	0.02	0.08	0.35	**0.07**	**0.27**	**1.19**

JOB NAME:	*RETREAT AT TIMBERRIDGE FILING NO. 1*
JOB NUMBER:	*1185.00*
DATE:	*02/08/19*
CALC'D BY:	*MAW*

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

*For buried riprap, select C_v value based on type of vegetative cover.

$$t_c = \frac{L}{180} + 10$$

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$

$$V = C_v S_w^{0.5}$$

Tc=L/V

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	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(10) (in/hr)	I(25) (in/hr)	I(50) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	0.68	0.71	0.76	0.82	0.85	0.88	0.08	10	0.2	4.6	1700	3.5%	1.9	15.1	19.8	2.48	3.11	3.62	4.14	4.66	5.21	2	2	5
OS-2	0.02	0.07	0.14	0.23	0.27	0.32	0.08	300	10.5	21.1					21.1	2.41	3.01	3.51	4.01	4.51	5.05	0.0	0.2	1.6
OS-3	0.45	0.63	0.80	0.98	1.08	1.18	0.25	55	1.1	9.1	600	3.0%	3.5	2.9	11.9	3.08	3.86	4.51	5.15	5.80	6.49	1	2	8
OS-4	0.47	0.68	0.93	1.15	1.27	1.43	0.22	200	6	15.6	400	3.0%	3.5	1.9	17.6	2.62	3.28	3.83	4.38	4.93	5.51	1	2	8
OS-5	1.25	2.93	4.81	6.48	7.52	8.36	0.14	200	8	15.5	750	2.0%	2.8	4.4	19.9	2.47	3.09	3.61	4.13	4.64	5.19	3	9	43
OS-6	0.08	0.19	0.29	0.38	0.44	0.49	0.16	55	1.1	10.0	500	3.0%	3.5	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	0.3	1	3
OS-7	0.38	0.53	0.67	0.82	0.90	0.99	0.25	100	10	7.2					7.2	3.69	4.63	5.40	6.17	6.94	7.77	1	2	8
OS-8	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	400	3.0%	3.5	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.70	1	1	3
OS-9	0.37	0.85	1.27	1.70	1.96	2.17	0.16	200	10	14.1	400	3.0%	3.5	1.9	16.0	2.73	3.42	3.99	4.56	5.13	5.74	1	3	12
OS-10	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	450	3.8%	3.9	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.69	1	1	3
OS-11	1.42	1.98	2.53	3.08	3.40	3.71	0.25	200	10	12.8	450	3.8%	3.9	1.9	14.7	2.84	3.55	4.14	4.74	5.33	5.96	4	7	22
OS-12	0.90	2.10	3.45	4.65	5.40	6.00	0.14	300	13	18.5	600	2.0%	2.8	3.5	22.0	2.35	2.94	3.43	3.93	4.42	4.94	2	6	30
OS-13	0.17	0.28	0.38	0.49	0.56	0.62	0.20	55	1.1	9.6	450	2.0%	2.8	2.7	12.2	3.05	3.83	4.46	5.10	5.74	6.42	0.5	1	4
OS-14	1.09	1.82	2.46	3.19	3.64	4.00	0.20	300	12	17.8	350	2.0%	2.8	2.1	19.9	2.48	3.10	3.62	4.13	4.65	5.20	3	6	21
OS-15	0.70	2.11	3.98	6.08	7.25	8.42	0.09	300	16	18.2	1300	3.5%	3.7	5.8	24.0	2.25	2.82	3.29	3.76	4.23	4.73	2	6	40
A	0.98	2.28	3.75	5.05	5.87	6.52	0.14	300	10.5	19.9	1280	3.2%	1.8	11.9	31.8	1.92	2.39	2.79	3.19	3.59	4.02	2	5	26
B	0.46	1.08	1.77	2.39	2.77	3.08	0.14	300	10.5	19.9	400	2.0%	1.4	4.7	24.6	2.23	2.78	3.24	3.71	4.17	4.67	1	3	14
C	1.38	1.81	2.30	2.74	3.01	3.23	0.14	300	10.5	19.9	1100	1.5%	2.4	7.5	27.3	2.10	2.62	3.06	3.49	3.93	4.40	3	5	14

JOB NAME:	***RETREAT AT TIMBERRIDGE FILING NO. 1***
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Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

*For buried riprap, select C_v value based on type of vegetative cover.

$$t_c = \frac{L}{180} + 10$$

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$

$$V = C_v S_w^{0.5}$$

Tc=L/V

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

	WEIGHTED						OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY						TOTAL FLOWS		
BASIN	CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	CA(100)	C(5)	Length	Height	Tc	Length	Slope	Velocity	Tc	TOTAL	I(2)	I(5)	I(10)	I(25)	I(50)	I(100)	Q(2)	Q(5)	Q(100)
								(ft)	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(in/hr)*	*(in/hr)*	*(in/hr)*	*(in/hr)*	*(cfs)*	*(cfs)*	*(cfs)*
D	0.72	0.74	0.78	0.83	0.85	0.87	0.08	15	0.3	5.7	1400	1.5%	2.4	9.5	15.2	2.80	3.50	4.08	4.67	5.25	5.88	2	**3**	**5**
E	0.19	0.45	0.74	0.99	1.15	1.28	0.14	300	10.5	19.9	300	2.0%	1.4	3.5	23.4	2.28	2.85	3.33	3.81	4.28	4.79	0.4	**1**	**6**
F	0.05	0.13	0.21	0.28	0.32	0.36	0.14	300	10.5	19.9					19.9	2.48	3.10	3.62	4.13	4.65	5.20	0.1	**0.4**	**1.9**
G	0.05	0.19	0.36	0.60	0.72	0.84	0.08	70	14	5.7	400	2.0%	1.4	4.7	10.4	3.24	4.06	4.74	5.42	6.10	6.82	0.2	**0.8**	**6**
H	0.30	0.44	0.60	0.74	0.82	0.92	0.22	100	4	10.1	300	3.0%	3.5	1.4	11.5	3.13	3.92	4.57	5.23	5.88	6.58	1	**2**	**6**
I	0.72	1.00	1.28	1.56	1.72	1.88	0.25	120	3	12.4	550	3.5%	3.7	2.4	14.9	2.82	3.53	4.12	4.71	5.30	5.93	2	**4**	**11**
J	0.65	0.90	1.15	1.40	1.55	1.69	0.25	120	3	12.4	600	2.0%	2.8	3.5	16.0	2.74	3.43	4.00	4.57	5.14	5.75	2	**3**	**10**
K	0.27	0.38	0.48	0.59	0.65	0.71	0.25	55	1.1	9.1	600	2.0%	2.8	3.5	12.6	3.02	3.78	4.41	5.05	5.68	6.35	0.8	**1**	**4**
L	1.31	1.83	2.34	2.85	3.14	3.43	0.25	150	4.5	13.1	850	2.5%	3.2	4.5	17.6	2.62	3.28	3.83	4.38	4.93	5.51	3	**6**	**19**
M	0.29	0.42	0.57	0.70	0.78	0.87	0.22	100	4	10.1	350	2.5%	3.2	1.8	11.9	3.09	3.87	4.51	5.16	5.80	6.49	1	**2**	**6**
N	0.38	0.53	0.67	0.82	0.90	0.99	0.25	55	1.1	9.1	1050	2.0%	2.8	6.2	15.2	2.79	3.50	4.08	4.66	5.25	5.87	1	**2**	**6**
O	0.38	0.53	0.67	0.82	0.90	0.99	0.25	80	5	7.5					7.5	3.64	4.56	5.32	6.08	6.84	7.66	1	**2**	**8**
P	0.45	0.63	0.80	0.98	1.08	1.18	0.25	120	3	12.4	450	1.5%	2.4	3.1	15.5	2.77	3.47	4.05	4.63	5.21	5.83	1	**2**	**7**
Q	0.14	0.32	0.53	0.71	0.83	0.92	0.14	90	22	5.7	300	1.5%	1.2	4.1	9.8	3.32	4.16	4.85	5.54	6.24	6.98	0.5	**1**	**6**
R	0.27	0.38	0.48	0.59	0.65	0.71	0.25	90	6	7.8					7.8	3.59	4.50	5.26	6.01	6.76	7.56	1	**2**	**5**
S	0.07	0.27	0.51	0.85	1.02	1.19	0.08	140	14	10.2	750	1.5%	2.4	5.1	15.3	2.79	3.49	4.07	4.66	5.24	5.86	0.2	**0.9**	**7**

JOB NAME: *RETREAT AT TIMBERRIDGE FILING NO. 1*
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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	A (16.3 Ac.)	2.28	6.52	31.8	2.39	4.02	5	26	DUAL 24" RCP CULVERTS
2	**TOTAL INFLOW INTO POND 1 A and B (24.0 Ac.)**	**3.36**	**9.60**	**33.8**	**2.30**	**3.86**	**8**	**37**	**POND 1**
3	OS-1 (1.2 Ac.)	0.71	0.88	19.8	3.11	5.21	2	5	24" RCP CULVERT
4	D (1.1 Ac.)	0.74	0.87	15.2	3.50	5.88	3	5	5' TYPE R SUMP INLET
5	OS-4 (3.1 Ac.), I (3.8 Ac.)	1.68	3.31	17.7	3.28	5.50	6	18	15' TYPE R AT-GRADE INLET
6	OS-3 (2.5 Ac.)	0.63	1.18	11.9	3.86	6.49	2	8	10' TYPE R AT-GRADE INLET
7	Basin C, Basin H and 50% of 100 yr Flowby from DP-6 (10.9 Ac)	2.25	4.28	27.3	2.62	4.40	6	19	10' TYPE R SUMP INLET
8	K (1.5 Ac.)	0.38	0.71	12.6	3.78	6.35	1	4	5' TYPE R SUMP INLET
9	J and OS-7 (5.7 Ac.)	1.43	2.68	16.0	3.43	5.75	5	15	10' TYPE R SUMP INLET
10	Flowby from DP-5 and Basin L (7.3 Ac)	1.83	4.32	21.2	3.00	5.04	5	22	15' TYPE R AT-GRADE INLET
11	Basins N, O, P and 50% 100 Yr Flowby from DP 6 and portion of 100 Yr Flowby from DP 10 (13.6 Ac)	1.68	4.74	24.2	2.80	4.70	5	22	15' TYPE R SUMP INLET
12	OS-5 (20.9Ac.)	2.93	6.27	19.9	3.09	5.19	9	33	15' TYPE R SUMP INLET
13	OS-6 (1.2Ac.)	0.19	2.06	12.4	3.80	6.39	1	13	10' TYPE R SUMP INLET

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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
14	OS-8 (1.0Ac.)	0.25	0.47	11.0	3.99	6.70	1	3	5' TYPE R SUMP INLET
15	OS-9 (5.3 Ac.)	0.85	2.17	16.0	3.42	5.74	3	12	10' TYPE R SUMP INLET
16	OS-10 (1.0 Ac.)	0.25	0.47	11.0	3.99	6.69	1	3	5' TYPE R SUMP INLET
17	OS-11 (7.9 Ac.)	1.98	3.71	14.7	3.55	5.96	7	22	10' TYPE R SUMP INLET
18	OS-12 (15.0 Ac.)	2.10	6.00	22.0	2.94	4.94	6	30	30" RCP CULVERT
19	OS-13 (1.4 Ac.)	0.28	0.62	12.2	3.83	6.42	1	4	5' TYPE R SUMP INLET
20	OS-14 (9.1 Ac.)	1.82	4.00	19.9	3.10	5.20	6	21	5' TYPE R SUMP INLET
21	**TOTAL INFLOW INTO EXIST. STOCK POND (23.4 Ac.)**	**2.11**	**8.42**	**24.0**	**2.82**	**4.73**	**6**	**40**	**EXIST. STOCK POND W ITH OUTLET**
22	**TOTAL INFLOW INTO POND 2 (104.8 Ac.)**	**21.56**	**46.69**	**31.0**	**2.43**	**4.08**	**52**	**191**	**POND 2**

JOB NAME: *RETREAT AT TIMBERRIDGE FILING NO. 1*
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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Pipe Size*
1	DP-18	2.10	6.00	23.2	2.86	4.81	6	29	30" RCP
2	DP-19	0.28	0.62	12.2	3.83	6.42	1	4	18" RCP
3	DP-20	1.82	4.00	19.9	3.10	5.20	6	21	24" RCP
4	PR-1, PR-2, PR-3	4.20	10.62	23.9	2.82	4.73	12	50	36" RCP
5	Captured from DP-5	1.68	2.41	17.7	3.28	5.50	6	13	24" RCP
6	Captured from DP-6	0.63	0.93	11.9	3.86	6.49	2	6	18" RCP
7	PR-4, PR-5, PR-6	6.51	13.96	24.4	2.79	4.68	18	65	36" RCP
8	DP-4	0.74	0.87	15.2	3.50	5.88	3	5	18" RCP
9	DP-7	2.25	4.28	27.3	2.62	4.40	6	19	24" RCP
10	PR-8, PR-9	2.99	5.15	27.5	2.61	4.38	8	23	30" RCP
11	PR-7, PR-10	9.50	19.11	28.0	2.58	4.33	25	83	42" RCP
12	Captured from DP-10	1.83	2.85	21.2	3.00	5.04	5	14	24" RCP
13	PR-11, PR-12	11.32	21.96	28.1	2.58	4.33	29	95	42" RCP
14	DP-8	0.38	0.71	12.6	3.78	6.35	1	4	18" RCP
15	DP-9	1.43	2.68	16.0	3.43	5.75	5	15	24" RCP

JOB NAME: ***RETREAT AT TIMBERRIDGE FILING NO. 1***
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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Pipe Size*
16	PR-14, PR-15	1.80	3.38	16.4	3.39	5.69	6	19	24" RCP
17	PR-13, PR-16	13.12	25.35	28.6	2.55	4.28	33	109	48" RCP
18	DP-11	1.68	4.74	24.2	2.80	4.70	5	22	30" RCP
19	**PR-17, PR-18 W'LY FOREBAY OUTFALL**	**14.80**	**30.09**	**28.8**	**2.54**	**4.26**	**38**	**128**	**48" RCP**
20	DP-12	2.93	6.27	19.9	3.09	5.19	9	33	30" RCP
21	DP-13	0.19	2.06	12.4	3.80	6.39	1	13	24" RCP
22	PR-20, PR-21	3.12	8.33	20.7	3.04	5.10	9	42	30" RCP
23	DP-14	0.25	0.47	11.0	3.99	6.70	1	3	18" RCP
24	DP-15	0.85	2.17	16.0	3.42	5.74	3	12	24" RCP
25	PR-22, PR-23, PR-24	4.22	10.97	22.0	2.94	4.94	12	54	36" RCP
26	DP-16	0.25	0.47	11.0	3.99	6.69	1	3	18" RCP
27	DP-17	1.98	3.71	14.7	3.55	5.96	7	22	30" RCP
28	PR-26, PR-27	2.23	4.18	14.9	3.53	5.93	8	25	30" RCP
29	**PR-25, PR-28 E'LY FOREBAY OUTFALL**	**6.44**	**15.16**	**22.3**	**2.92**	**4.91**	**19**	**74**	**42" RCP**

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, CO 80903

Project: Timber Ridge Fil. 1
Date: 3/5/19
Contact:
Phone:
By: MAW

NOTES
- ❑ Telephone Record
- ❑ Note to the File
- ❑ Job Information
- ❑ Meeting Minutes
- ❑ ______

Effective Imperviousness

Pond 1

Basin A 16.3 Ac. @ 11% Imp.
Basin B 7.7 Ac. @ 11% Imp.

Total trib. acreage = 24.0 Ac. @ 11% Imp.

Pond 2

Basin C 6.4 Ac. @ 1.1 Ac. 90%
= 27% Imp. 0.9 Ac. 30%
4.4 Ac. 11%

Basin D 1.1 Ac. @ 90% Imp.
Basin H 2.0 Ac. @ 25% Imp.
Basin I 4.0 Ac. @ 30% Imp.
Basin J 3.6 Ac. @ 30% Imp.
Basin K 1.5 Ac. @ 30% Imp.
Basin L 7.3 Ac. @ 30% Imp.
Basin N 2.1 Ac. @ 30% Imp.
Basin O 1.5 Ac. @ 30% Imp.
Basin P 2.7 Ac. @ 30% Imp.
Basin Q 2.2 Ac. @ 10% Imp.

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Colorado Springs, CO 80903

Project:
Date:
Contact:
Phone:
By:

NOTES
- ❑ Telephone Record
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- ❑ Job Information
- ❑ Meeting Minutes
- ❑

Effective Imperviousness (cont.)

Pond 2

OS-3 3.2 Ac. @ 30% Imp.
OS-4 8.2 Ac. @ 25% Imp.

OS-5 21.9 Ac. @ 5.7 Ac. 30%
= 10% Imp. 15.2 Ac. 2%

OS-6 1.2 Ac. @ 0.6 Ac. 30%
= 16% Imp. 0.6 Ac. 2%

OS-7 2.1 Ac. @ 30% Imp.
OS-8 1.0 Ac. @ 30% Imp.
OS-9 5.3 Ac. @ 2.8 Ac. 30%
2.5 Ac. 2%
= 17% Imp.
OS-10 1.0 Ac. @ 30%
OS-11 7.9 Ac. @ 30%
OS-12 15.0 Ac. @ 10%
OS-13 0.8 Ac. @ 20%
OS-14 3.8 Ac. @ 20%

Total trib. acreage = 104.8 Ac.

Eff. Imp. = 21.4%

Ph: 719.785.0790 Fax: 719.785.0799
www.classicconsulting.net

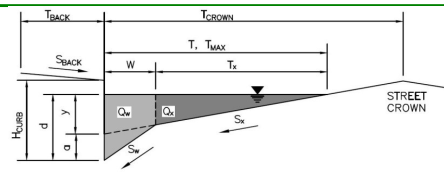
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-4



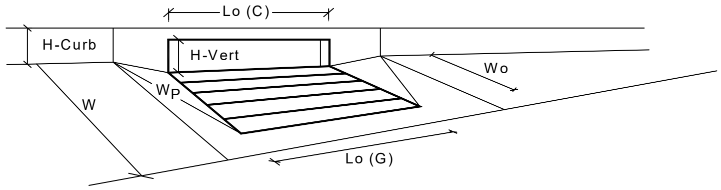
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

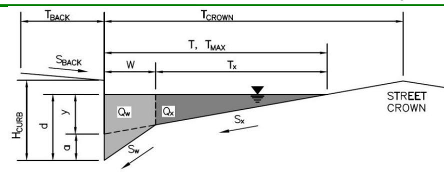
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.4**	**12.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.0	5.0	cfs

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-5



Gutter Geometry (Enter data in the blue cells)

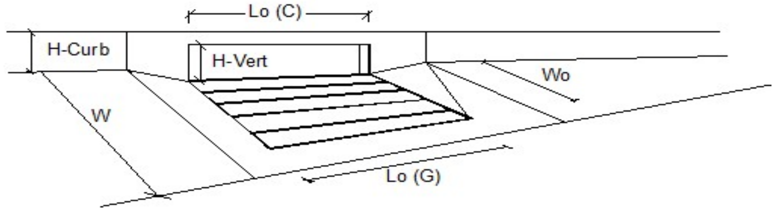
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.017		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**14.2**	**14.2**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.0**	**13.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**4.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**73**	**%**

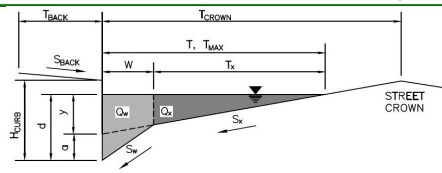
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-6



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.017	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

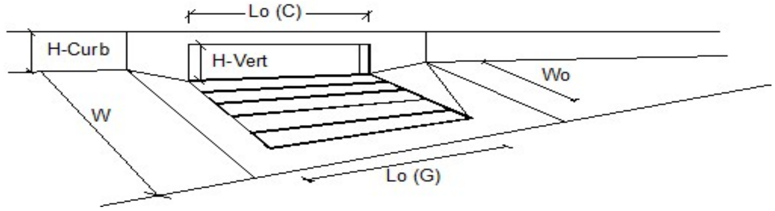
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**14.2**	**14.2**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.0**	**6.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**79**	**%**

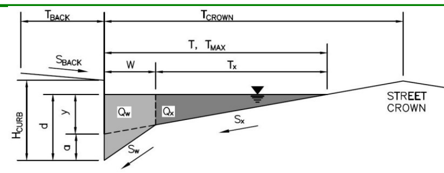
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-7



Gutter Geometry (Enter data in the blue cells)

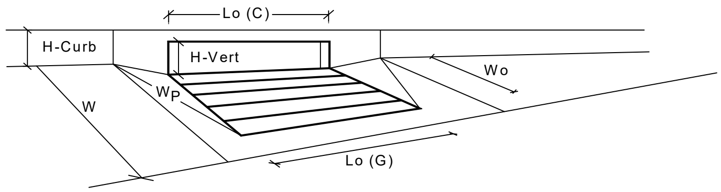
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.3**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.0	19.0	cfs

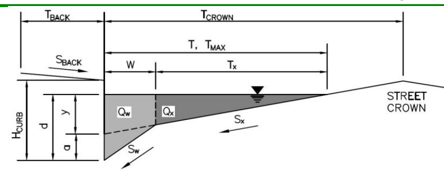
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-8



Gutter Geometry (Enter data in the blue cells)

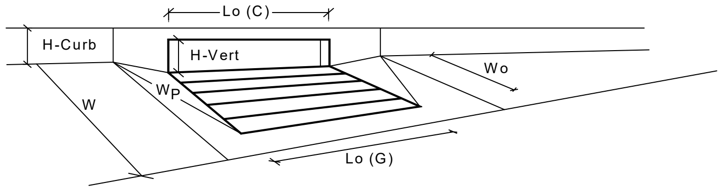
Description	Symbol	Value	Units
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.4**	**12.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.0	4.0	cfs

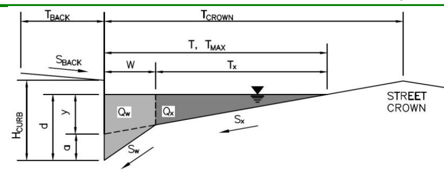
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-9



Gutter Geometry (Enter data in the blue cells)

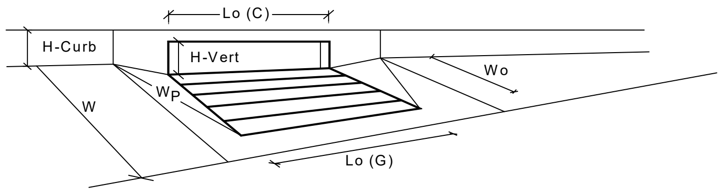
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.3**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.0	15.0	cfs

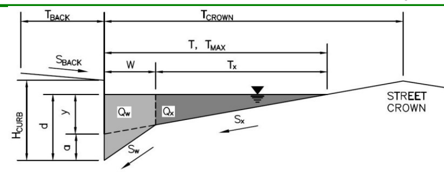
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-10



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

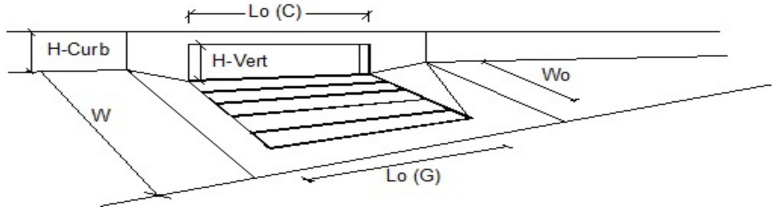
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**13.3**	**13.3**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**5.0**	**14.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**7.4**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**66**	**%**

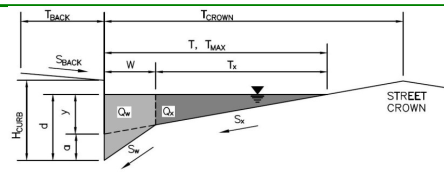
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-11



Gutter Geometry (Enter data in the blue cells)

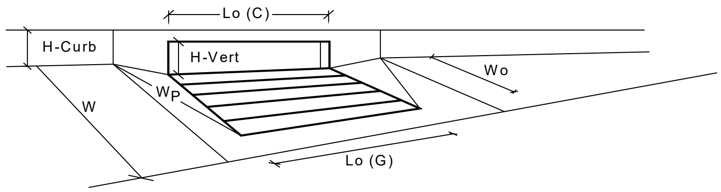
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	9.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.58	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.85	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.93	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**9.7**	**26.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.0	22.0	cfs

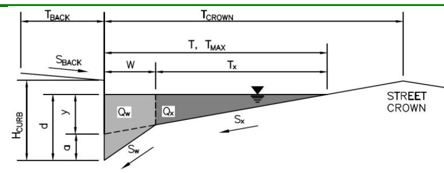
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-12



Gutter Geometry (Enter data in the blue cells)

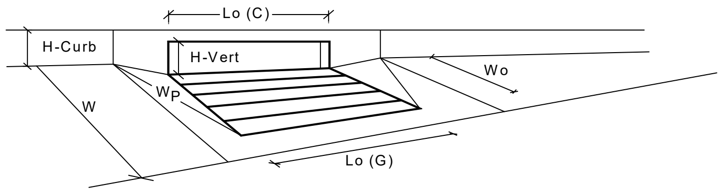
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**9.7**	**39.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	9.0	33.0	cfs

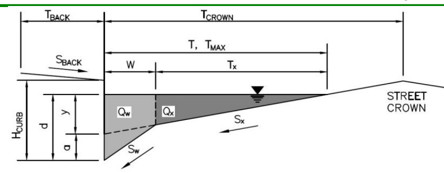
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-13

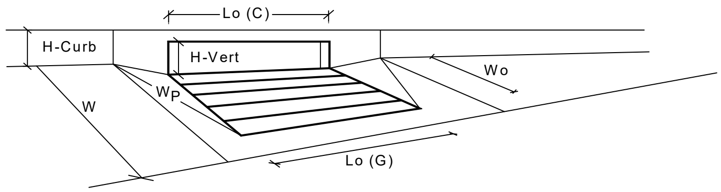


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



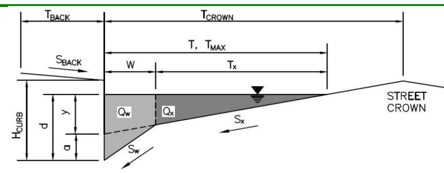
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**8.3**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	1.0	13.0	cfs

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-14



Gutter Geometry (Enter data in the blue cells)

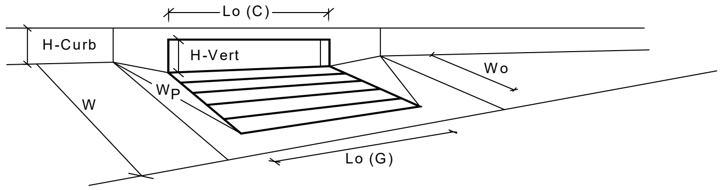
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**5.4**	**12.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	1.0	3.0	cfs

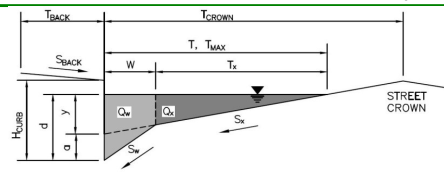
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-15



Gutter Geometry (Enter data in the blue cells)

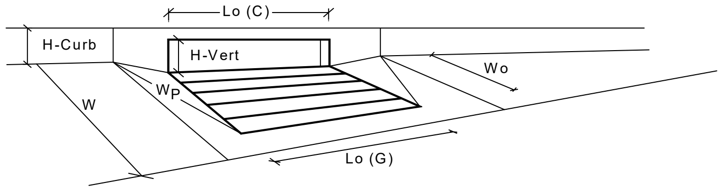
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**8.3**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	3.0	12.0	cfs

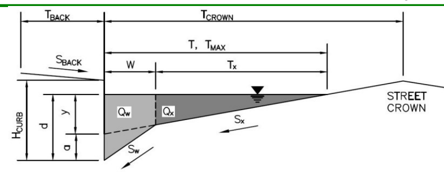
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-16



Gutter Geometry (Enter data in the blue cells)

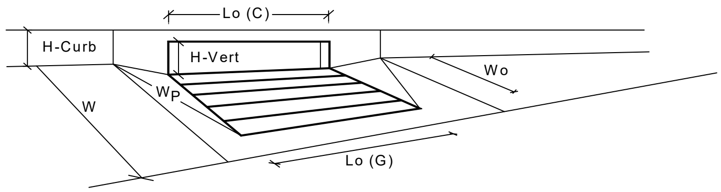
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**5.4**	**12.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	1.0	3.0	cfs

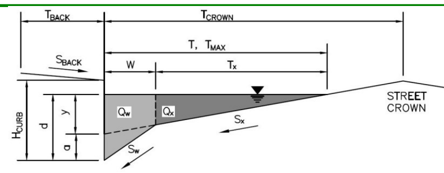
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-17



Gutter Geometry (Enter data in the blue cells)

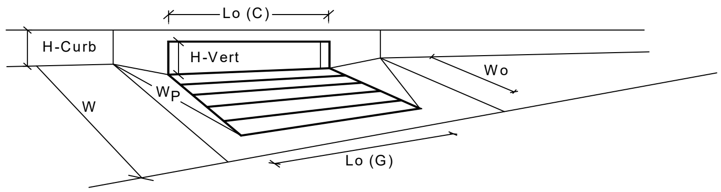
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.3**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.0	22.0	cfs

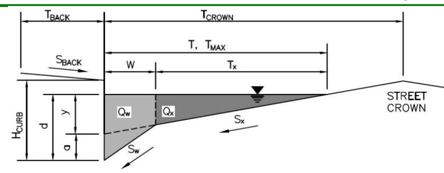
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-19



Gutter Geometry (Enter data in the blue cells)

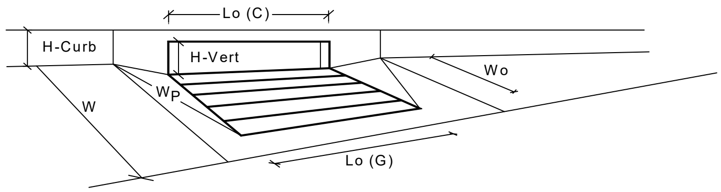
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**5.4**	**12.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	1.0	4.0	cfs

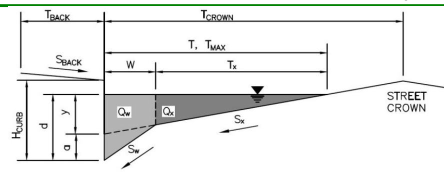
Version 4.05 Released March 2017

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

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

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Inlet ID: DP-20



Gutter Geometry (Enter data in the blue cells)

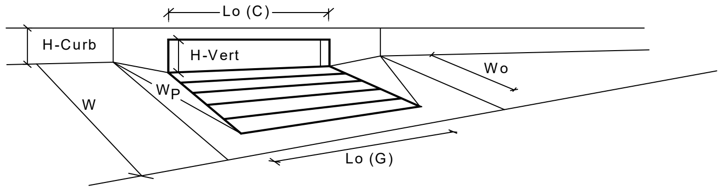
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.3**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.0	21.0	cfs

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 18 2019

DUAL 24 IN RCP CULVERTS AT DP-1

Invert Elev Dn (ft)	=	7196.35
Pipe Length (ft)	=	65.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7197.00
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	2
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

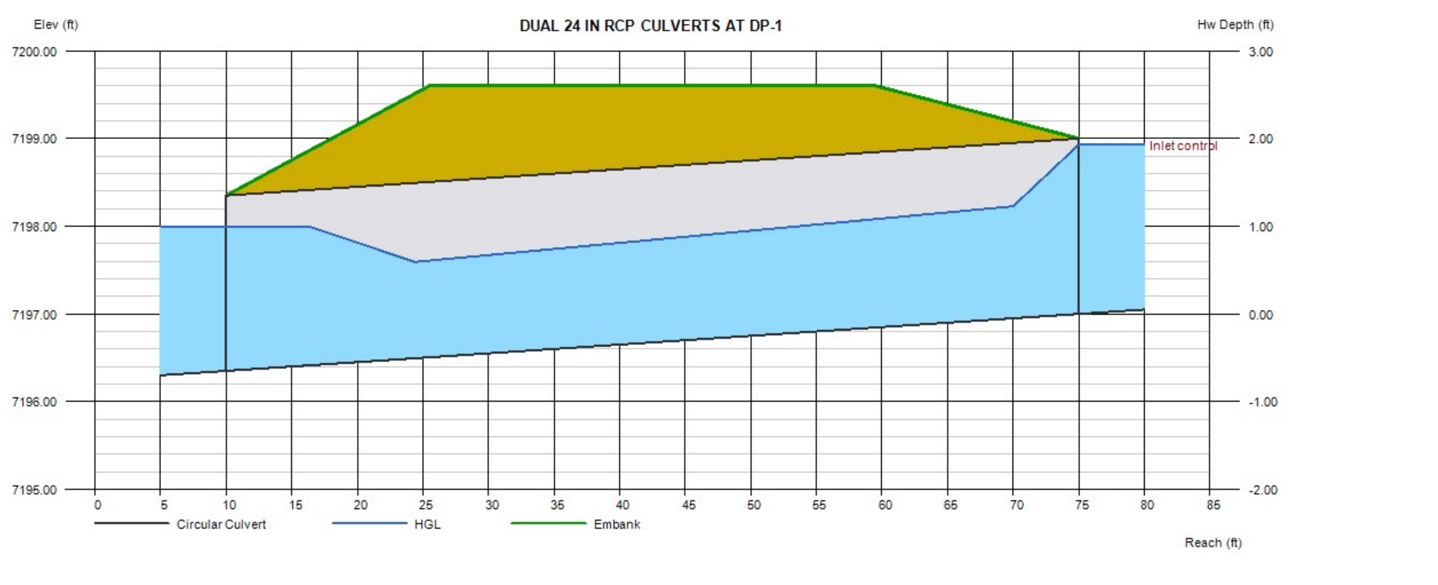
Top Elevation (ft)	=	7199.60
Top Width (ft)	=	34.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	26.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	26.00
Qpipe (cfs)	=	26.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.69
Veloc Up (ft/s)	=	6.03
HGL Dn (ft)	=	7198.00
HGL Up (ft)	=	7198.30
Hw Elev (ft)	=	7198.93
Hw/D (ft)	=	0.96
Flow Regime	=	Inlet Control



Culvert Report

18 IN RCP CULVERT AT DP-3

Invert Elev Dn (ft)	=	7208.50
Pipe Length (ft)	=	75.00
Slope (%)	=	2.00
Invert Elev Up (ft)	=	7210.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

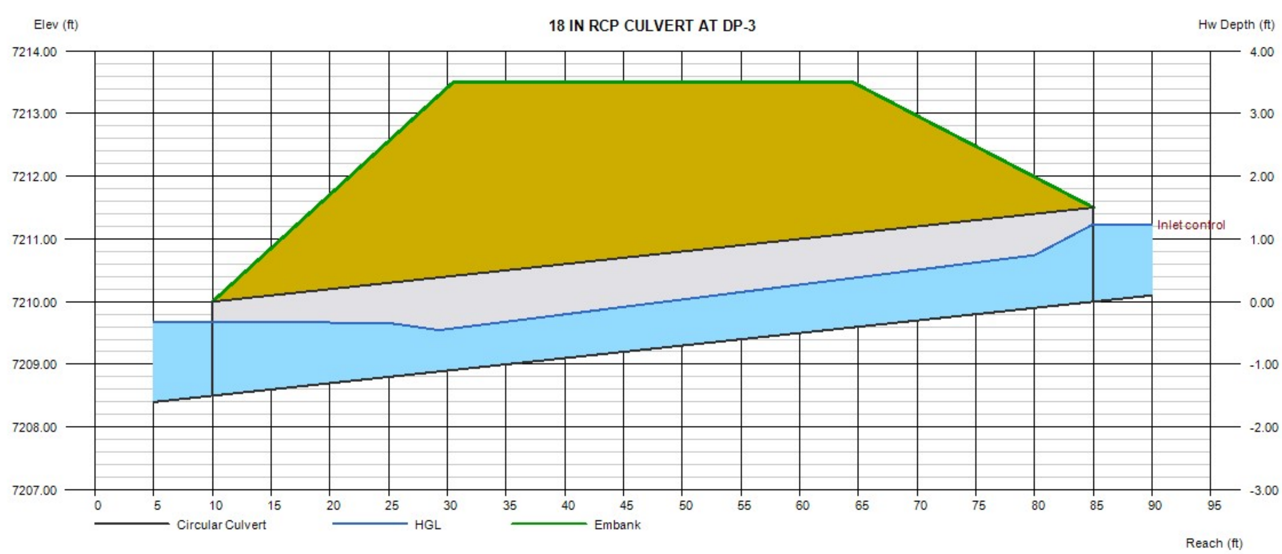
Top Elevation (ft)	=	7213.50
Top Width (ft)	=	34.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.00
Qpipe (cfs)	=	5.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.35
Veloc Up (ft/s)	=	4.77
HGL Dn (ft)	=	7209.68
HGL Up (ft)	=	7210.86
Hw Elev (ft)	=	7211.24
Hw/D (ft)	=	0.82
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 18 2019

30 IN. RCP CULVERT AT DP-18

Invert Elev Dn (ft)	=	7242.65
Pipe Length (ft)	=	35.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7243.00
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

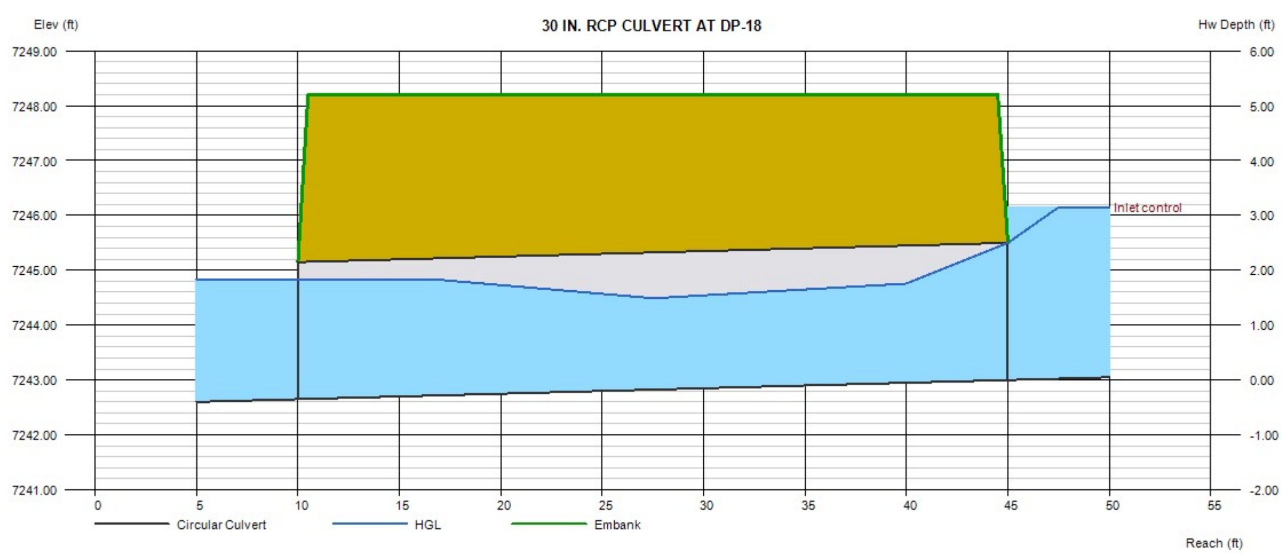
Top Elevation (ft)	=	7248.20
Top Width (ft)	=	34.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	30.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

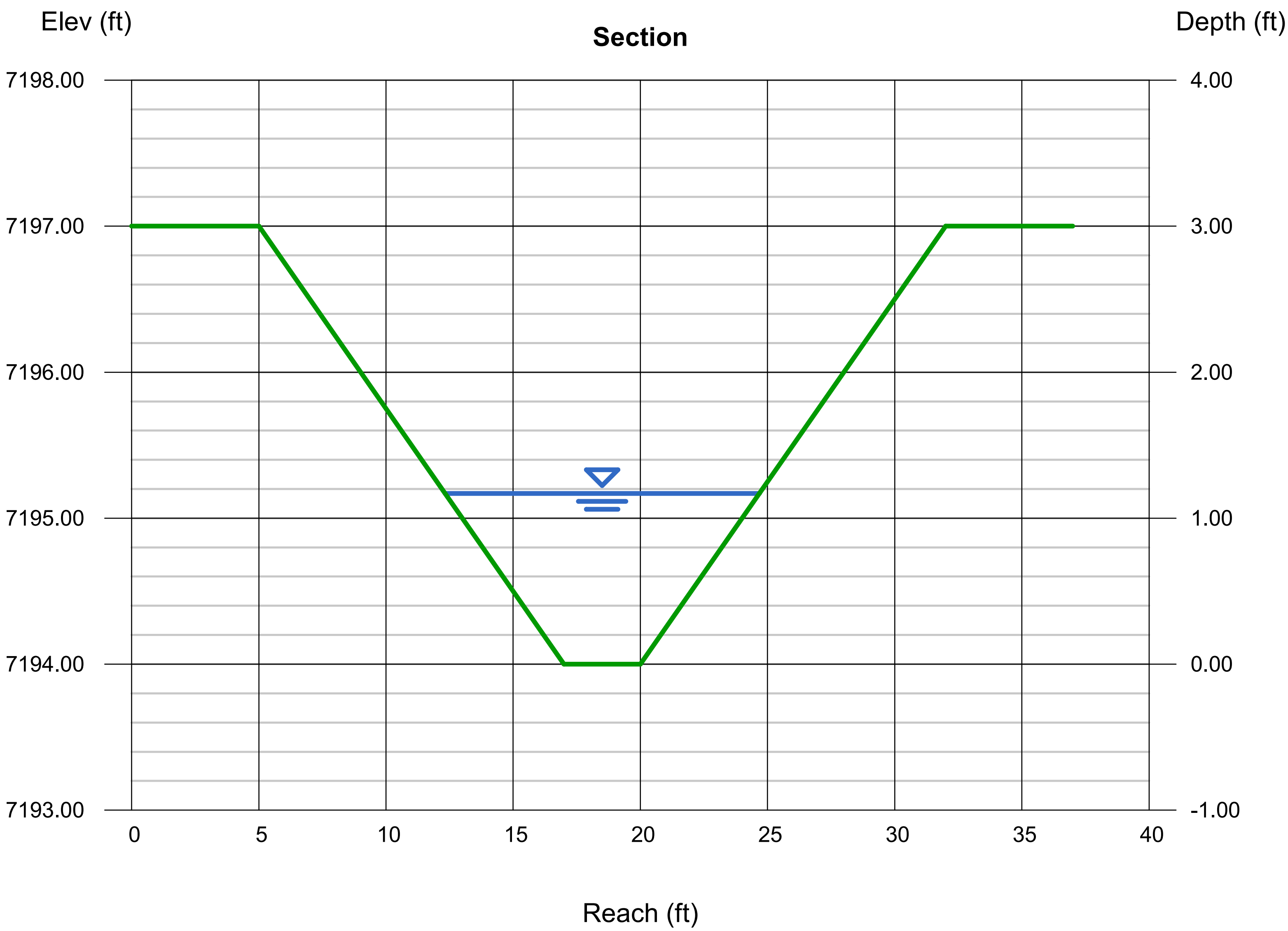
Qtotal (cfs)	=	30.00
Qpipe (cfs)	=	30.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.60
Veloc Up (ft/s)	=	7.64
HGL Dn (ft)	=	7244.83
HGL Up (ft)	=	7244.87
Hw Elev (ft)	=	7246.15
Hw/D (ft)	=	1.26
Flow Regime	=	Inlet Control



Channel Report

Grass Swale into Pond 1

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 3.00	Depth (ft)	= 1.17
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 37.00
Total Depth (ft)	= 3.00	Area (sqft)	= 8.99
Invert Elev (ft)	= 7194.00	Velocity (ft/s)	= 4.12
Slope (%)	= 1.50	Wetted Perim (ft)	= 12.65
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.09
		Top Width (ft)	= 12.36
Calculations		EGL (ft)	= 1.43
Compute by:	Known Q		
Known Q (cfs)	= 37.00		



ROADSIDE DITCH CALCUALTIONS

Aspen Valley Road - West side of roadway (Sta. 1+50 to Sta. 3+50)

	Erosion Control Blanket (ECB)	**Turf Reinforcement Mat (TRM)**	**Revegetation - Grass lined**
	(North American Green - SC150)	**(North American Green - P300)**	**(Native Seed Mix)**
Given:	**(Temporary - 24 months)**	**(Permanent)**	
Design Flow (cfs)	26.0	26.0	5.0
Permissible Shear (lbs/ft.^{2})	2.0	8.0	0.1
Permissible Velocity (ft./sec.)	8.0	16.0	3.0
Safety Factor	1	1	1
Ditch Slope (Max.)	3.8%	3.8%	2.0%
Ditch Section (24 in. depth)	V-Ditch	V-Ditch	V-Ditch
Flow Area (ft.^{2})	2.89	4.84	1.96
Wetted Perimeter (ft.)	7.02	9.09	5.78
Hydraulic Radius	0.41	0.53	0.34
Mannings n	0.035	0.030	0.030
Depth of Flow (max.)	0.9	1.1	0.7
Calculations:			
Shear Stress (lbs/ft.^{2})	2.0	2.6	0.9
Velocity (ft./sec.)	9.0	5.4	2.6
Allowed Flow (cfs)	13.3	30.8	6.7

ROADSIDE DITCH CALCUALTIONS

Aspen Valley Road - West side of roadway (Sta. 3+50 to Sta. 9+00)

		Erosion Control Blanket (ECB)		**Turf Reinforcement Mat (TRM)**		**Revegetation - Grass lined**
		(North American Green - SC150)		**(North American Green - P300)**		**(Native Seed Mix)**
	Given:	**(Temporary - 24 months)**		**(Permanent)**		
	Design Flow (cfs)	13.0		3.0		3.0
	Permissible Shear (lbs/ft.^{2})	2.0		8.0		0.1
	Permissible Velocity (ft./sec.)	8.0		16.0		3.0
	Safety Factor	1		1		1
	Ditch Slope (Max.)	3.8%		5.5%		5.5%
	Ditch Section (24 in. depth)	V-Ditch		V-Ditch		V-Ditch
	Flow Area (ft.^{2})	2.96		9.00		1.00
	Wetted Perimeter (ft.)	7.10		12.39		4.13
	Hydraulic Radius	0.42		0.73		0.24
	Mannings n	0.035		0.030		0.030
	Depth of Flow (max.)	0.9		1.5		0.5
	Calculations:					
	Shear Stress (lbs/ft.^{2})	2.0		5.1		1.7
	Velocity (ft./sec.)	4.4		0.3		3.0
	Allowed Flow (cfs)	13.7		84.7		4.5

ROADSIDE DITCH CALCUALTIONS

Aspen Valley Road - West side of roadway (Sta. 9+00 to Sta. 14+39)

	Erosion Control Blanket (ECB)	**Turf Reinforcement Mat (TRM)**	**Revegetation - Grass lined**
	(North American Green - SC150)	**(North American Green - P300)**	**(Native Seed Mix)**
Given:	**(Temporary - 24 months)**	**(Permanent)**	
Design Flow (cfs)	9.0	3.0	3.0
Permissible Shear (lbs/ft.^{2})	2.0	8.0	0.1
Permissible Velocity (ft./sec.)	8.0	16.0	3.0
Safety Factor	1	1	1
Ditch Slope (Max.)	2.5%	5.5%	5.5%
Ditch Section (24 in. depth)	V-Ditch	V-Ditch	V-Ditch
Flow Area (ft.^{2})	2.56	9.00	1.00
Wetted Perimeter (ft.)	6.61	12.39	4.13
Hydraulic Radius	0.39	0.73	0.24
Mannings n	0.035	0.030	0.030
Depth of Flow (max.)	0.8	1.5	0.5
Calculations:			
Shear Stress (lbs/ft.^{2})	1.2	5.1	1.7
Velocity (ft./sec.)	3.5	0.3	3.0
Allowed Flow (cfs)	9.2	84.7	4.5

ROADSIDE DITCH CALCUALTIONS

Poco Road - Channel into pond north of roadway (Sta. 8+00 to Sta. 10+00)

	Erosion Control Blanket (ECB) (North American Green - SC150) (Temporary - 24 months)	Turf Reinforcement Mat (TRM) (North American Green - P300) (Permanent)	Revegetation - Grass lined (Native Seed Mix)
Given:			
Design Flow (cfs)	37.0	2.0	2.0
Permissible Shear (lbs/ft.^{2})	2.0	8.0	0.1
Permissible Velocity (ft./sec.)	8.0	16.0	3.0
Safety Factor	1	1	1
Ditch Slope (Max.)	1.5%	1.5%	1.5%
Ditch Section (36 in. depth)	Trapezoidal-Ditch (3' wide)	V-Ditch	V-Ditch
Flow Area (ft.^{2})	8.99	1.00	1.00
Wetted Perimeter (ft.)	12.67	4.13	4.13
Hydraulic Radius	0.71	0.24	0.24
Mannings n	0.035	0.030	0.030
Depth of Flow (max.)	1.2	0.5	0.5
Calculations:			
Shear Stress (lbs/ft.^{2})	1.1	0.5	0.5
Velocity (ft./sec.)	4.1	2.0	2.0
Allowed Flow (cfs)	37.3	2.4	2.4

If temporary ECB is proposed provide calculation showing long-term native vegetation stability.

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 7168.91

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
MH 1 SWR 1 - 1	142.67	14.83	32.32	9.31	21.46	14.96	2.22	Pressurized	74.00	28.00	
MH 2 SWR 2 - 1	352.36	36.62	32.32	9.31	13.06	28.99	5.76	Supercritical Jump	74.00	2.87	
MH 6 SWR 6 - 1	115.84	16.39	28.64	8.96	17.28	16.10	2.68	Supercritical	54.00	0.00	
MH 3 SWR 3 - 1	41.13	8.38	20.44	7.02	16.89	8.78	1.45	Pressurized	25.00	41.77	
MH 5 SWR 5 - 1	50.37	10.26	19.14	6.66	13.87	9.91	1.85	Supercritical Jump	22.00	4.65	
MH 4 SWR 4 - 1	22.34	12.64	7.90	4.02	4.45	8.81	3.03	Pressurized	3.00	6.86	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

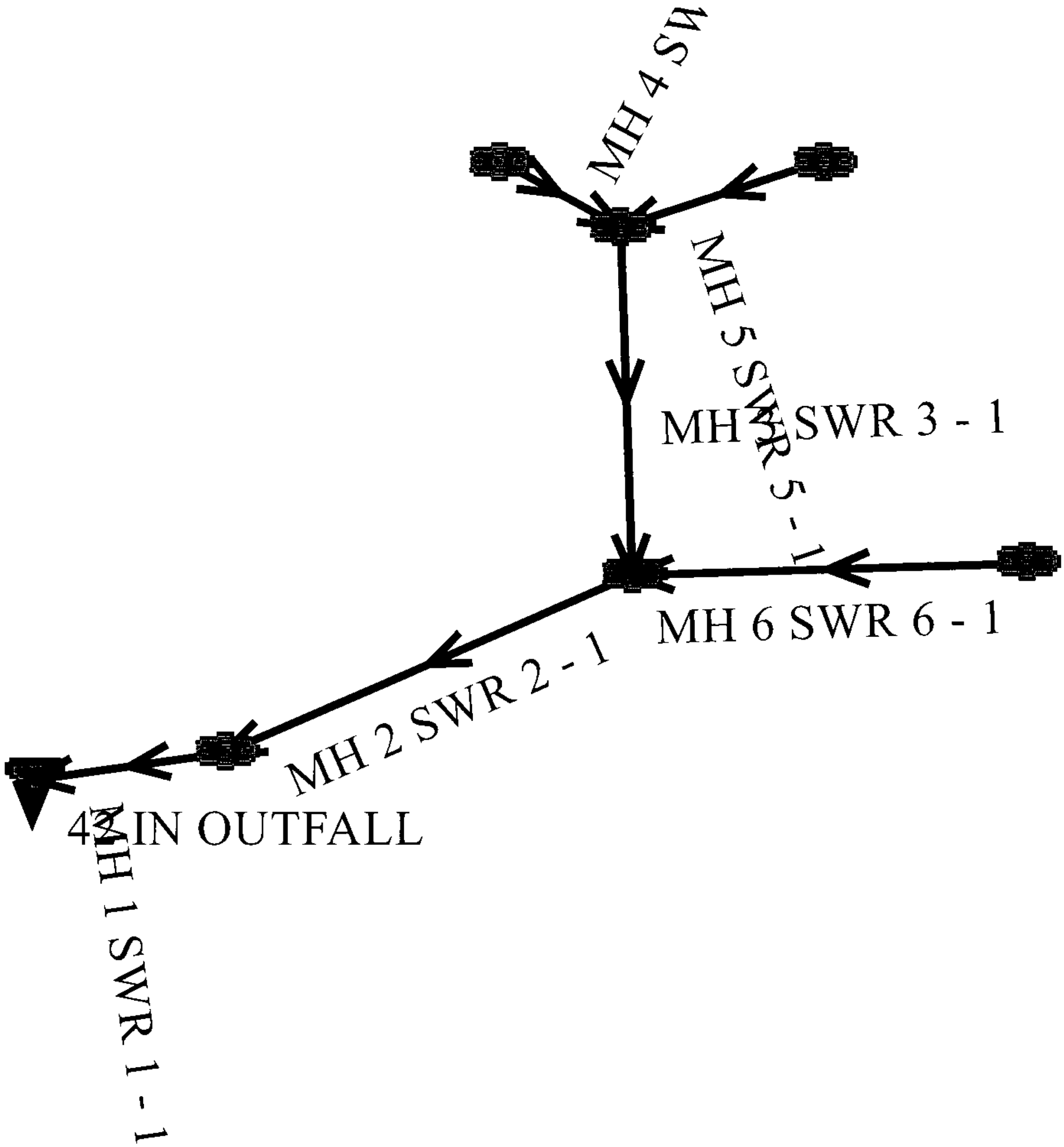
deviation?

Grade Line Summary:

Tailwater Elevation (ft): 7168.91

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
MH 1 SWR 1 - 1	7164.75	7165.31	0.00	0.00	7168.91	7169.06	7169.83	0.15	7169.98
MH 2 SWR 2 - 1	7165.30	7178.00	0.07	0.00	7169.13	7180.69	7170.05	11.99	7182.04
MH 6 SWR 6 - 1	7178.50	7179.40	0.07	0.01	7180.78	7183.06	7183.97	0.00	7183.97
MH 3 SWR 3 - 1	7179.00	7179.42	0.33	0.00	7181.97	7182.13	7182.37	0.15	7182.53
MH 5 SWR 5 - 1	7179.92	7180.31	0.26	0.00	7182.48	7182.48	7182.79	0.06	7182.84
MH 4 SWR 4 - 1	7180.42	7180.73	0.03	0.00	7182.51	7182.52	7182.56	0.01	7182.56

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


MH 4 SW
MH 5 SWR 5 - 1
MH SWR 3 - 1
MH 6 SWR 6 - 1
MH 2 SWR 2 - 1
4 IN OUTFALL
MH 1 SWR 1 - 1

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 7168.91

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
MH 1 SWR 1 - 1	203.69	16.21	40.67	11.27	27.59	17.12	2.20	Pressurized	128.00	51.14	
MH 2 SWR 2 - 1	176.40	14.04	37.88	10.25	27.30	14.77	1.91	Supercritical Jump	109.00	74.57	
MH 3 SWR 3 - 1	100.88	10.49	36.11	10.80	32.41	11.92	1.28	Supercritical	95.00	0.00	
MH 14 SWR 14 - 1	44.22	14.07	16.17	6.22	9.28	12.49	2.90	Supercritical	14.00	0.00	
MH 4 SWR 4 - 1	123.55	12.84	34.09	9.92	25.20	13.77	1.83	Supercritical	83.00	0.00	
MH 12 SWR 12 - 1	41.13	8.38	19.58	6.78	16.04	8.61	1.47	Supercritical Jump	23.00	69.95	
MH 15 SWR 15 - 1	22.68	7.22	18.82	7.19	16.81	8.09	1.26	Supercritical	19.00	0.00	
MH 13 SWR 13 - 1	11.54	6.53	13.15	5.78	11.03	7.05	1.41	Supercritical	8.00	0.00	
MH 5 SWR 5 - 1	109.89	15.55	31.02	10.03	19.92	16.20	2.46	Supercritical	65.00	0.00	
MH 17 SWR 17 - 1	22.68	7.22	15.56	6.03	13.02	7.47	1.41	Supercritical	13.00	0.00	
MH 6 SWR 6 - 1	89.73	12.69	27.61	8.59	19.21	13.04	2.03	Supercritical	50.00	0.00	
MH 16 SWR 16 - 1	24.92	14.10	11.35	5.11	6.01	11.60	3.38	Supercritical	6.00	0.00	
MH 8 SWR 8 - 1	46.49	14.80	18.82	7.19	10.69	14.05	3.00	Supercritical Jump	19.00	42.39	
MH 9 SWR 9 - 1	22.68	7.22	18.82	7.19	16.81	8.09	1.26	Supercritical Jump	19.00	17.60	
MH 11 SWR 11 - 1	22.68	7.22	16.75	6.41	14.25	7.72	1.37	Supercritical	15.00	0.00	
MH 10 SWR 10 - 1	24.92	14.10	9.18	4.41	4.88	10.34	3.38	Supercritical	4.00	0.00	
MH 7 SWR 7 - 1	82.26	16.76	19.14	6.66	10.60	14.19	3.11	Supercritical	22.00	0.00	

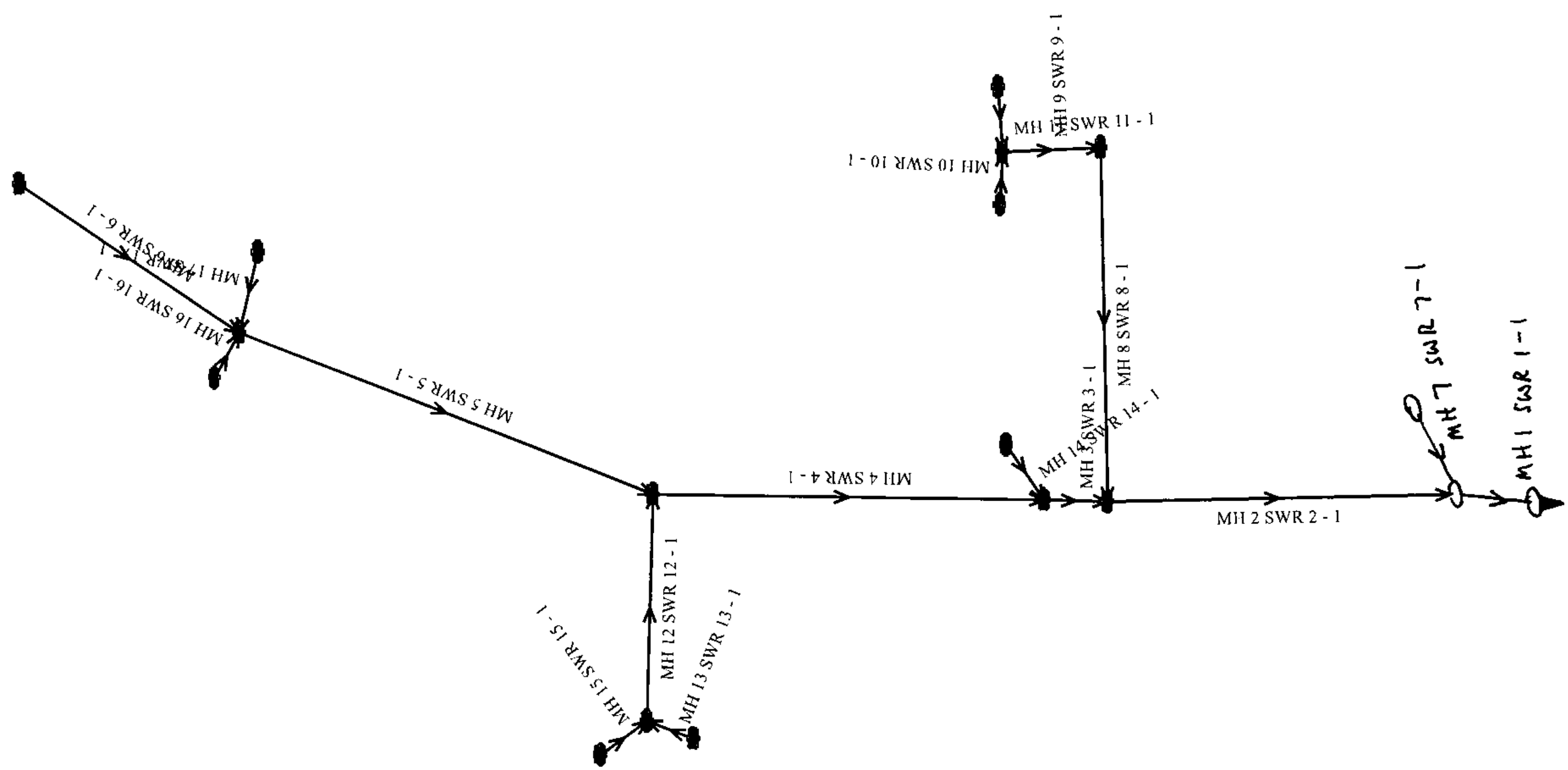
- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Grade Line Summary:

Tailwater Elevation (ft): 7168.91

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
MH 1 SWR 1 - 1	7162.50	7163.52	0.00	0.00	7168.91	7169.31	7170.52	0.40	7170.92
MH 2 SWR 2 - 1	7165.57	7173.78	0.06	0.44	7170.26	7176.94	7171.43	7.14	7178.57
MH 3 SWR 3 - 1	7174.27	7174.73	0.08	0.00	7177.01	7177.74	7179.18	0.37	7179.55
MH 14 SWR 14 - 1	7176.73	7177.83	0.12	0.00	7177.86	7179.55	7179.92	0.00	7179.92
MH 4 SWR 4 - 1	7175.23	7182.57	0.06	0.36	7178.15	7185.41	7180.27	6.67	7186.94
MH 12 SWR 12 - 1	7184.07	7185.41	0.45	0.00	7187.05	7187.05	7187.39	0.37	7187.76
MH 15 SWR 15 - 1	7185.91	7186.14	0.22	0.00	7187.31	7187.71	7188.33	0.19	7188.51
MH 13 SWR 13 - 1	7186.41	7186.60	0.34	0.00	7187.39	7187.70	7188.10	0.11	7188.22
MH 5 SWR 5 - 1	7186.15	7199.87	0.07	0.00	7187.81	7202.46	7191.89	12.13	7204.02
MH 17 SWR 17 - 1	7202.13	7202.38	0.35	0.00	7203.26	7203.68	7204.04	0.20	7204.24
MH 6 SWR 6 - 1	7200.37	7204.60	0.04	0.54	7203.03	7206.90	7204.61	3.44	7208.05
MH 16 SWR 16 - 1	7202.38	7202.67	0.24	0.00	7202.88	7204.79	7204.97	0.00	7204.97
MH 8 SWR 8 - 1	7175.27	7192.15	0.75	0.00	7178.75	7193.72	7179.32	15.20	7194.52
MH 9 SWR 9 - 1	7192.65	7193.85	0.75	0.00	7194.70	7195.42	7195.27	0.95	7196.22
MH 11 SWR 11 - 1	7194.35	7194.60	0.47	0.00	7196.33	7196.33	7196.69	0.06	7196.75
MH 10 SWR 10 - 1	7194.85	7195.14	0.11	0.00	7195.52	7196.84	7196.92	0.00	7196.92
MH 7 SWR 7 - 1	7167.14	7167.47	0.20	0.00	7169.51	7170.84	7171.15	0.00	7171.15

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


MH 1 SWR 1-1
MH 7 SWR 7-1
MH 2 SWR 2 - 1
MH 8 SWR 8 - 1
MH 9 SWR 9 - 1
MH 10 SWR 10 - 1
MH 3 SWR 3 - 1
MH 14 SWR 14 - 1
MH 4 SWR 4 - 1
MH 12 SWR 12 - 1
MH 13 SWR 13 - 1
MH 15 SWR 15 - 1
MH 5 SWR 5 - 1
MH 16 SWR 16 - 1
MH 6 SWR 6 - 1

Description

A sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. Sediment basins are designed to capture site runoff and slowly release it to allow time for settling of sediment prior to discharge. Sediment basins are often constructed in locations that will later be modified to serve as post-construction stormwater basins.

Photograph SB-1. Sediment basin at the toe of a slope. Photo courtesy of WWE.

Appropriate Uses

Most large construction sites (typically greater than 2 acres) will require one or more sediment basins for effective management of construction site runoff. On linear construction projects, sediment basins may be impractical; instead, sediment traps or other combinations of BMPs may be more appropriate.

Sediment basins should not be used as stand-alone sediment controls. Erosion and other sediment controls should also be implemented upstream.

When feasible, the sediment basin should be installed in the same location where a permanent post-construction detention pond will be located.

Design and Installation

The design procedure for a sediment basin includes these steps:

- **Basin Storage Volume**: Provide a storage volume of at least 3,600 cubic feet per acre of drainage area. To the extent practical, undisturbed and/or off-site areas should be diverted around sediment basins to prevent "clean" runoff from mixing with runoff from disturbed areas. For undisturbed areas (both on-site and off-site) that cannot be diverted around the sediment basin, provide a minimum of 500 ft^3/acre of storage for undeveloped (but stable) off-site areas in addition to the 3,600 ft^3/acre for disturbed areas. For stable, developed areas that cannot be diverted around the sediment basin, storage volume requirements are summarized in Table SB-1.

- **Basin Geometry:** Design basin with a minimum length-to-width ratio of 2:1 (L:W). If this cannot be achieved because of site space constraints, baffling may be required to extend the effective distance between the inflow point(s) and the outlet to minimize short-circuiting.

- **Dam Embankment**: It is recommended that embankment slopes be 4:1 (H:V) or flatter and no steeper than 3:1 (H:V) in any location.

Sediment Basins	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

- **Inflow Structure**: For concentrated flow entering the basin, provide energy dissipation at the point of inflow.

Table SB-1. Additional Volume Requirements for Undisturbed and Developed Tributary Areas Draining through Sediment Basins

Imperviousness (%)	Additional Storage Volume (ft^3) Per Acre of Tributary Area
Undeveloped	500
10	800
20	1230
30	1600
40	2030
50	2470
60	2980
70	3560
80	4360
90	5300
100	6460

- **Outlet Works**: The outlet pipe shall extend through the embankment at a minimum slope of 0.5 percent. Outlet works can be designed using one of the following approaches:
  - **Riser Pipe (Simplified Detail):** Detail SB-1 provides a simplified design for basins treating no more than 15 acres.
  - **Orifice Plate or Riser Pipe**: Follow the design criteria for Full Spectrum Detention outlets in the EDB Fact Sheet provided in Chapter 4 of this manual for sizing of outlet perforations with an emptying time of approximately 72 hours. In lieu of the trash rack, pack uniformly sized 1½ - to 2-inch gravel in front of the plate or surrounding the riser pipe. This gravel will need to be cleaned out frequently during the construction period as sediment accumulates within it. The gravel pack will need to be removed and disposed of following construction to reclaim the basin for use as a permanent detention facility. If the basin will be used as a permanent extended detention basin for the site, a trash rack will need to be installed once contributing drainage areas have been stabilized and the gravel pack and accumulated sediment have been removed.
  - **Floating Skimmer**: If a floating skimmer is used, install it using manufacturer's recommendations. Illustration SB-1 provides an illustration of a Faircloth Skimmer Floating Outlet™, one of the more commonly used floating skimmer outlets. A skimmer should be designed to release the design volume in no less than 48 hours. The use of a floating skimmer outlet can increase the sediment capture efficiency of a basin significantly. A floating outlet continually decants cleanest water off the surface of the pond and releases cleaner water than would discharge from a perforated riser pipe or plate.

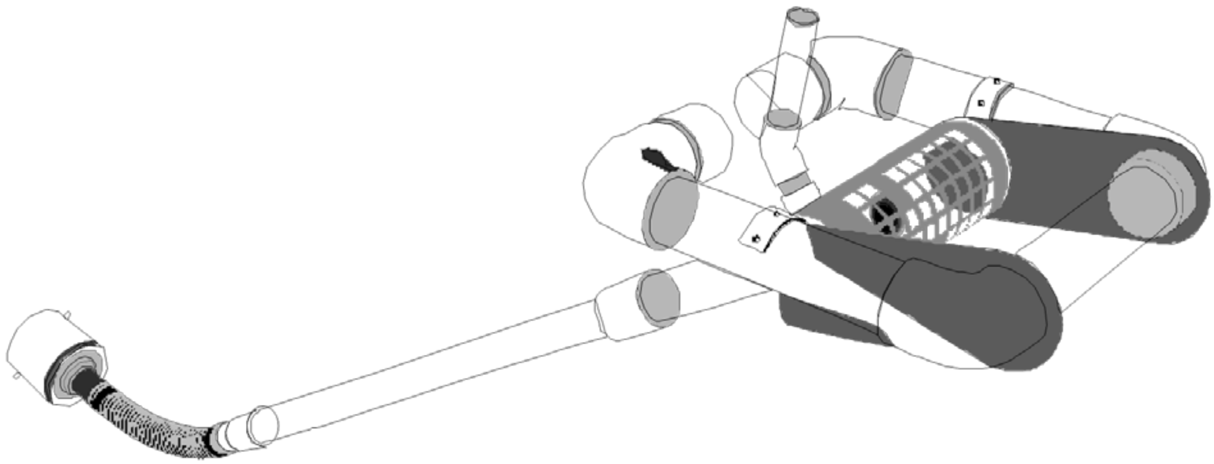


Illustration SB-1. Outlet structure for a temporary sediment basin - Faircloth Skimmer Floating Outlet. Illustration courtesy of J. W. Faircloth & Sons, Inc., FairclothSkimmer.com.

- **Outlet Protection and Spillway:** Consider all flow paths for runoff leaving the basin, including protection at the typical point of discharge as well as overtopping.
  - **Outlet Protection:** Outlet protection should be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway into which discharge occurs. This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.
  - **Emergency Spillway:** Provide a stabilized emergency overflow spillway for rainstorms that exceed the capacity of the sediment basin volume and its outlet. Protect basin embankments from erosion and overtopping. If the sediment basin will be converted to a permanent detention basin, design and construct the emergency spillway(s) as required for the permanent facility. If the sediment basin will not become a permanent detention basin, it may be possible to substitute a heavy polyvinyl membrane or properly bedded rock cover to line the spillway and downstream embankment, depending on the height, slope, and width of the embankments.

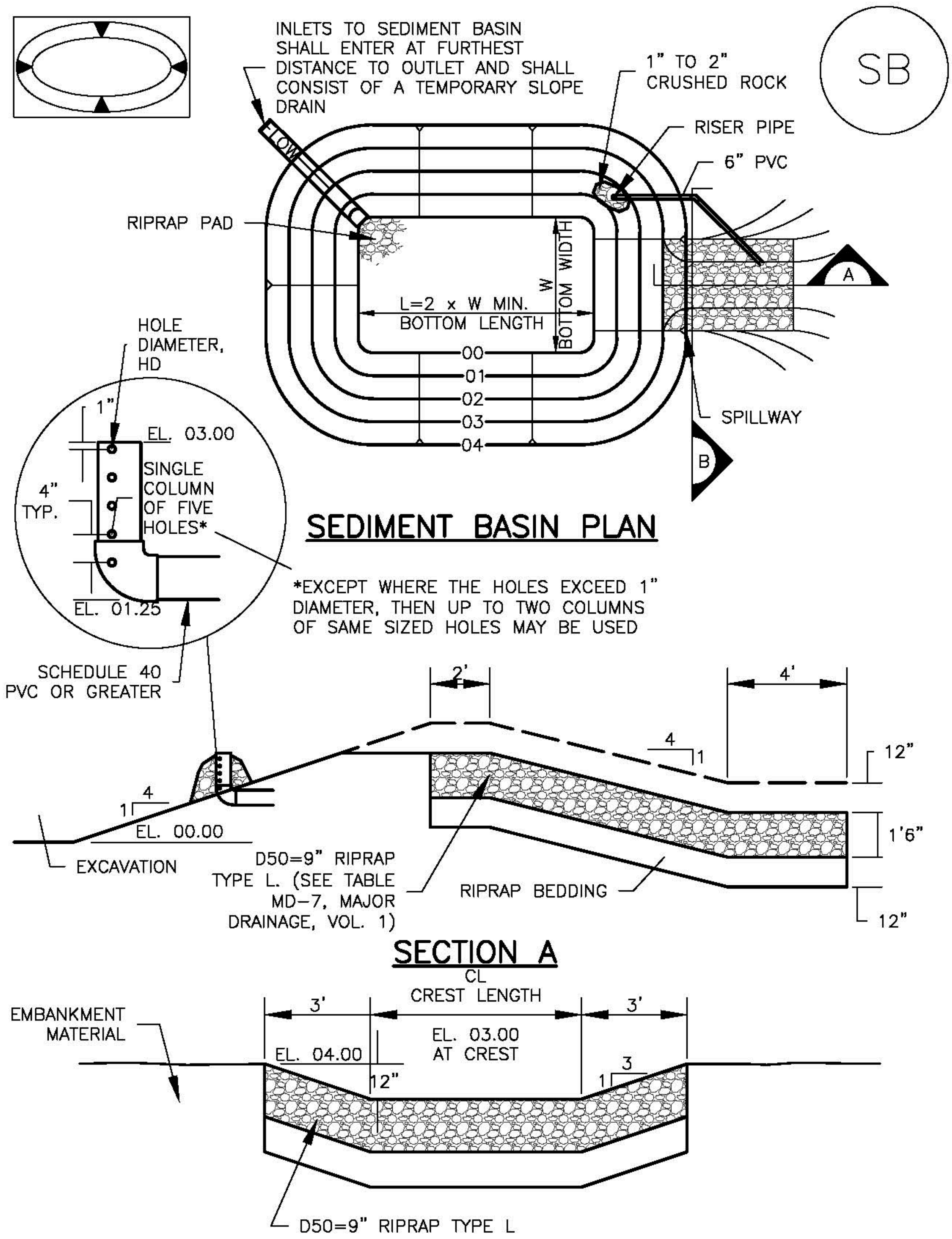
Maintenance and Removal

Maintenance activities include the following:

- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- Do not remove a sediment basin until the upstream area has been stabilized with vegetation.

Final disposition of the sediment basin depends on whether the basin will be converted to a permanent post-construction stormwater basin or whether the basin area will be returned to grade. For basins being converted to permanent detention basins, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. If the sediment basin is not to be used as a permanent detention facility, fill the excavated area with soil and stabilize with vegetation.

Include in I&M Plan



INLETS TO SEDIMENT BASIN SHALL ENTER AT FURTHEST DISTANCE TO OUTLET AND SHALL CONSIST OF A TEMPORARY SLOPE DRAIN
1" TO 2" CRUSHED ROCK
SB
RISER PIPE
6" PVC
FLOW
RIPRAP PAD
W BOTTOM WIDTH
L=2 x W MIN. BOTTOM LENGTH
A
00
01
02
03
04
SPILLWAY
B
HOLE DIAMETER, HD
1"
EL. 03.00
SINGLE COLUMN OF FIVE HOLES*
4" TYP.
EL. 01.25
SEDIMENT BASIN PLAN
*EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED
SCHEDULE 40 PVC OR GREATER
2'
4'
4
1
12"
1'6"
12"
EL. 00.00
EXCAVATION
D50=9" RIPRAP TYPE L. (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1)
RIPRAP BEDDING
SECTION A
CL
CREST LENGTH
EMBANKMENT MATERIAL
3'
3'
EL. 04.00
EL. 03.00 AT CREST
12"
3
1
D50=9" RIPRAP TYPE L

TABLE SB-1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 1/2	2	9/32
2	21	3	13/16
3	28	5	1/2
4	33 1/2	6	9/16
5	38 1/2	8	21/32
6	43	9	21/32
7	47 1/4	11	25/32
8	51	12	27/32
9	55	13	7/8
10	58 1/4	15	15/16
11	61	16	31/32
12	64	18	1
13	67 1/2	19	1 1/16
14	70 1/2	21	1 1/8
15	73 1/4	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION OF SEDIMENT BASIN.
   - TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   - FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   - FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND-DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).

5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.

6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Marc A. Whorton, P.E.**
Company:	**Classic Consulting**
Date:	**March 22, 2019**
Project:	**Retreat at TimberRidge Filing No. 1**
Location:	**Pond 1**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 11.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.110
C) Contributing Watershed Area	Area = 24.000 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 ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= 0.142 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 ii) Percentage of Watershed consisting of Type B Soils iii) Percentage of Watershed consisting of Type C/D Soils	 HSG_A = 0 % HSG_B = 100 % $HSG_{C/D}$ = 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 0.251 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
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:	Rip-Rap and Concrete Forebay into Concrete trickle channel
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV)	V_{FMIN} = 0.003 ac-ft
B) Actual Forebay Volume	V_F = 0.003 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 8.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 37.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.74 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 = 6.5 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Marc A. Whorton, P.E.**
Company:	**Classic Consulting**
Date:	**March 22, 2019**
Project:	**Retreat at TimberRidge Filing No. 1**
Location:	**Pond 1**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 45 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.75 inches
E) Total Outlet Area	A_{ot} = 3.48 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 22.5 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 125 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*S.S. Well Screen with 60% Open Area*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 208 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 2.5 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 58 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: March 22, 2019
Project: Retreat at TimberRidge Filing No. 1
Location: Pond 1

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	Buried Rip-Rap
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 10.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	Maintenace provided via access road

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**MARC A. WHORTON, P.E.**
Company:	**CLASSICCONSULTING**
Date:	**March 26, 2019**
Project:	**RETREAT AT TIMBERRIDGE FILING NO. 1**
Location:	**POND 2 (EAST FOREBAY)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 16.5 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.165
C) Contributing Watershed Area	Area = 37.300 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 ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= 0.305 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 ii) Percentage of Watershed consisting of Type B Soils iii) Percentage of Watershed consisting of Type C/D Soils	 HSG_A = 0 % HSG_B = 100 % $HSG_{C/D}$ = 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 0.604 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
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} = 0.009 ac-ft
B) Actual Forebay Volume	V_F = 0.009 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} = 74.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.48 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 = 6.5 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**MARC A. WHORTON, P.E.**
Company:	**CLASSICCONSULTING**
Date:	**March 26, 2019**
Project:	**RETREAT AT TIMBERRIDGE FILING NO. 1**
Location:	**POND 2 (EAST FOREBAY)**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 200 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 2.25 inches
E) Total Outlet Area	A_{ot} = 13.43 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 40 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 100.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 418 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 588 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 5 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 88 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**MARC A. WHORTON, P.E.**
Company:	**CLASSICCONSULTING**
Date:	**March 26, 2019**
Project:	**RETREAT AT TIMBERRIDGE FILING NO. 1**
Location:	**POND 2 (WEST FOREBAY)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 25.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.250
C) Contributing Watershed Area	Area = 65.300 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 ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= 0.717 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 ii) Percentage of Watershed consisting of Type B Soils iii) Percentage of Watershed consisting of Type C/D Soils	 HSG_A = 0 % HSG_B = 100 % $HSG_{C/D}$ = 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 1.656 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
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} = 0.022 ac-ft
B) Actual Forebay Volume	V_F = 0.022 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} = 128.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 2.56 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 = 8.6 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**MARC A. WHORTON, P.E.**
Company:	**CLASSICCONSULTING**
Date:	**March 26, 2019**
Project:	**RETREAT AT TIMBERRIDGE FILING NO. 1**
Location:	**POND 2 (WEST FOREBAY)**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 200 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 2.25 inches
E) Total Outlet Area	A_{ot} = 13.43 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 94 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 100.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 418 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 588 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 5 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 88 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	MARC A. WHORTON, P.E.
Company:	CLASSICCONSULTING
Date:	March 28, 2019
Project:	RETREAT AT TIMBERRIDGE FILING NO. 1
Location:	POND 2

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 21.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.214
C) Contributing Watershed Area	Area = 104.800 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 ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= 1.035 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: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 2.247 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
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} = 0.031 ac-ft
B) Actual Forebay Volume	V_F = ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = cfs
E) Forebay Discharge Design	Choose One ○ Berm With Pipe ○ Wall with Rect. Notch ○ Wall with V-Notch Weir
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: MARC A. WHORTON, P.E.
Company: CLASSICCONSULTING
Date: March 28, 2019
Project: RETREAT AT TIMBERRIDGE FILING NO. 1
Location: POND 2

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 270 sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.95 inches
E) Total Outlet Area	A_{ot} = 15.00 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 135 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 135.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 480 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 676 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 5.5 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 94 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**MARC A. WHORTON, P.E.**
Company:	**CLASSICCONSULTING**
Date:	**March 28, 2019**
Project:	**RETREAT AT TIMBERRIDGE FILING NO. 1**
Location:	**POND 2**

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	100 yr. flows contained within pond and released through outlet box. However, emergency overflow designed to handle 100 yr. flows with rip-rap protection
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	Access ramp provided for maintenance

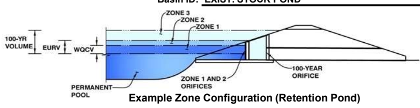
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: EXIST. STOCK POND



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	25.10	acres		
Watershed Length =	1,700	ft		
Watershed Slope =	0.035	ft/ft		
Watershed Imperviousness =	2.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.032	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.041	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.024	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.043	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.291	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.268	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.868	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.652	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.85 in.) =	5.095	acre-feet	3.85	inches
Approximate 2-yr Detention Volume =	0.022	acre-feet		
Approximate 5-yr Detention Volume =	0.040	acre-feet		
Approximate 10-yr Detention Volume =	0.231	acre-feet		
Approximate 25-yr Detention Volume =	0.357	acre-feet		
Approximate 50-yr Detention Volume =	0.342	acre-feet		
Approximate 100-yr Detention Volume =	0.469	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.032	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.010	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.428	acre-feet
Total Detention Basin Volume =	0.469	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = 2 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	4,007	0.092		
7244	--	2.00	--	--	--	7,668	0.176	11,598	0.266
7246	--	4.00	--	--	--	13,084	0.300	32,427	0.744
7248	--	6.00	--	--	--	22,537	0.517	68,048	1.562
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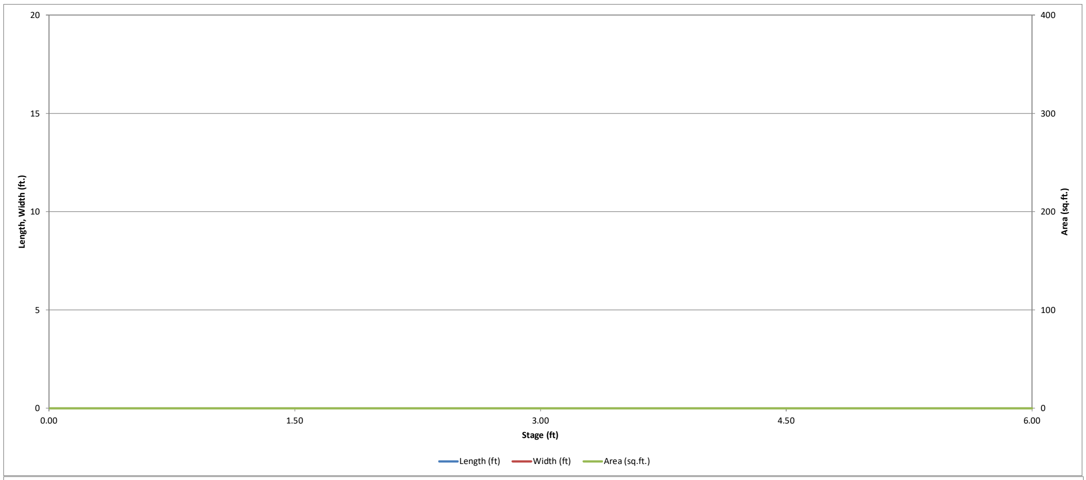
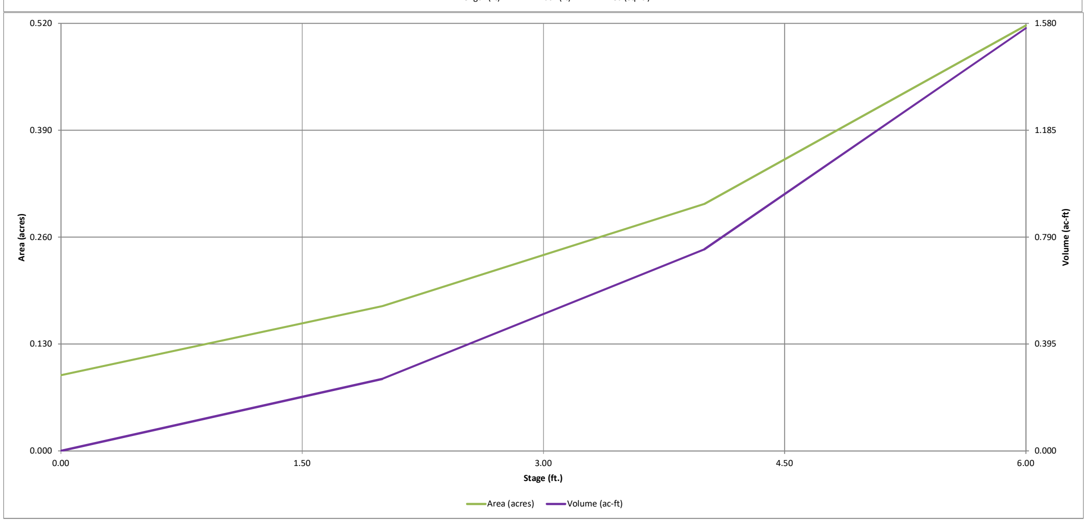
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



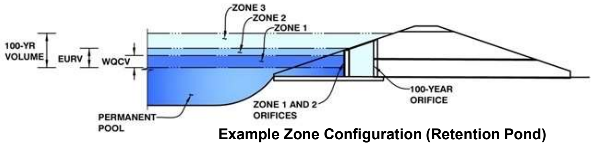


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: EXIST. STOCK POND



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.33	0.032	Orifice Plate
Zone 2 (EURV)	0.42	0.010	Orifice Plate
Zone 3 (100-year)	2.98	0.428	Weir&Pipe (Restrict)
		0.469	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	3.60	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.30	0.60	0.90	1.20			
Orifice Area (sq. inches)	0.78	0.91	0.91	0.91	0.91			

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	1.77	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	1.77	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.50	N/A	feet
Over Flow Weir Slope Length =	1.77	N/A	feet
Grate Open Area / 100-yr Orifice Area =	1.33	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	2.35	N/A	ft^2
Overflow Grate Open Area w/ Debris =	1.17	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	20.00	feet
Spillway End Slopes =	2.00	H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

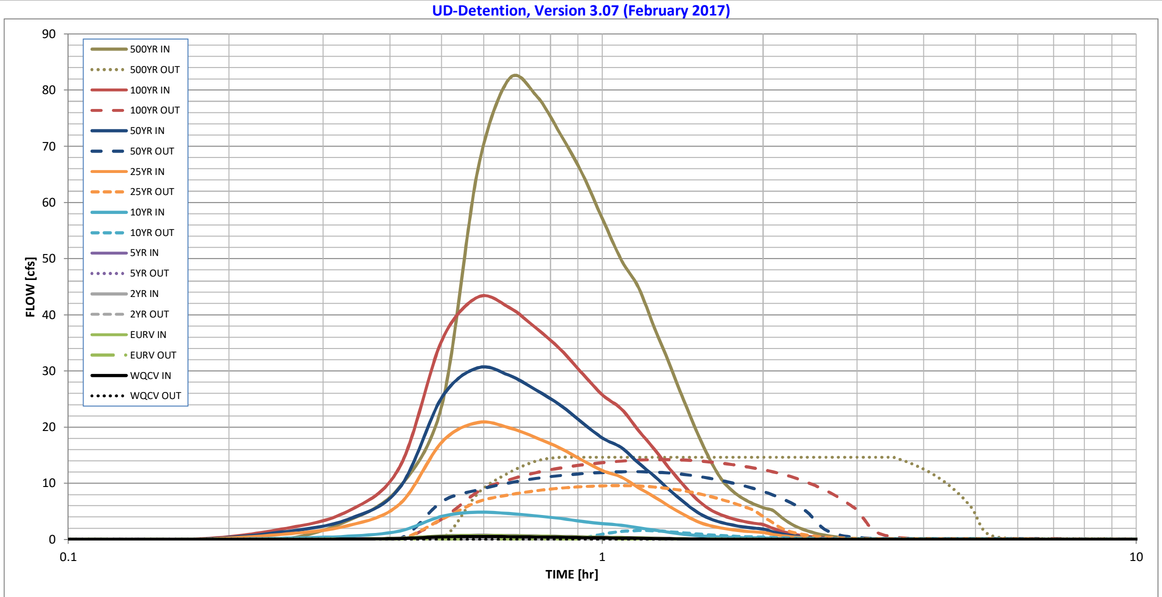
Spillway Design Flow Depth=	0.77	feet
Stage at Top of Freeboard =	6.77	feet
Basin Area at Top of Freeboard =	0.52	acres

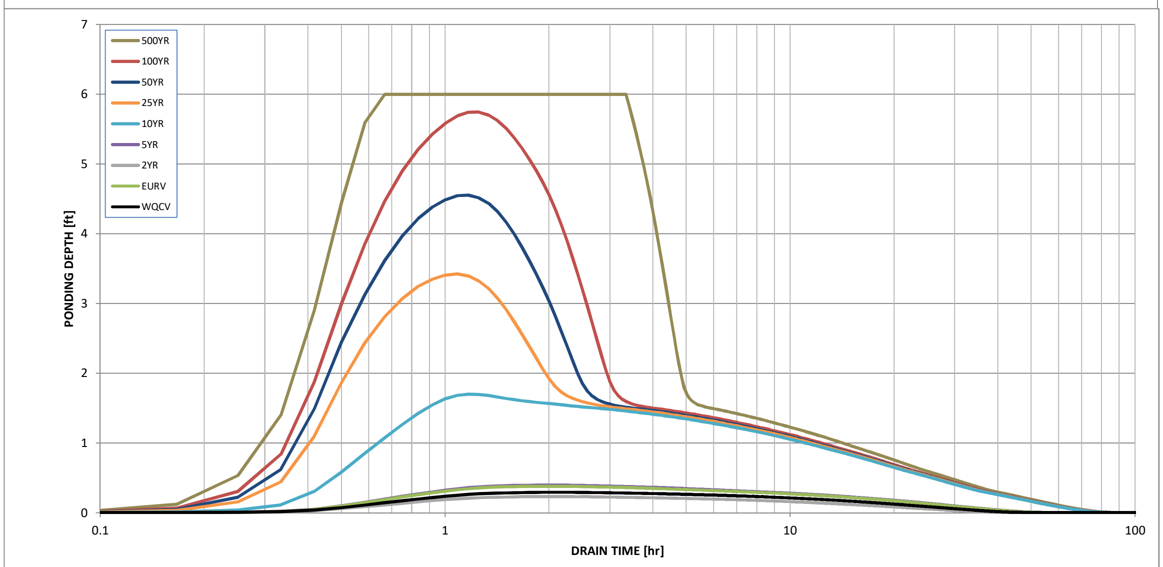
Routed Hydrograph Results

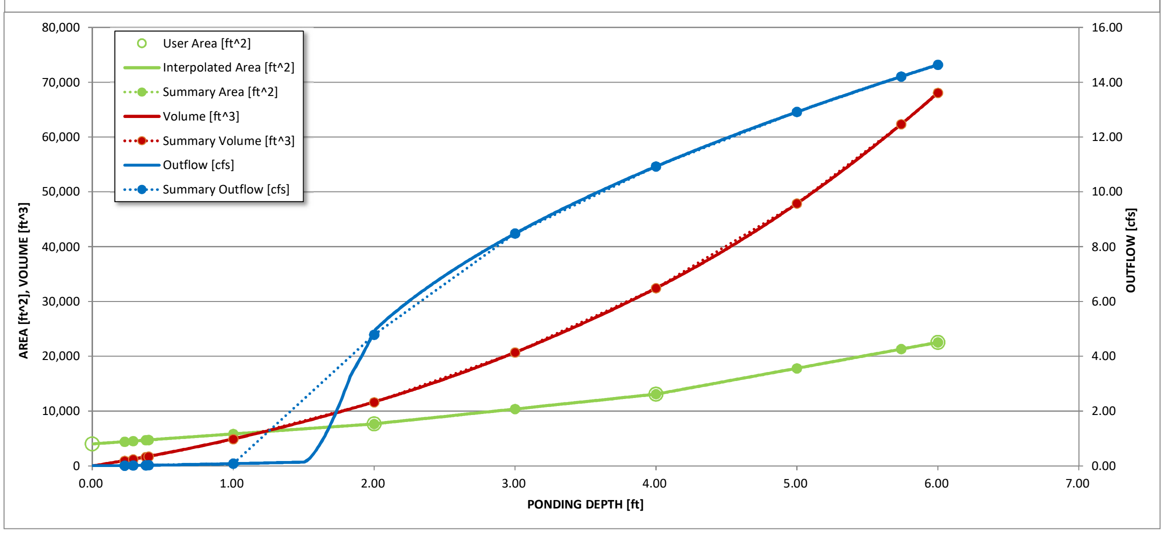
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.85
Calculated Runoff Volume (acre-ft) =	0.032	0.041	0.024	0.043	0.291	1.268	1.868	2.652	5.095
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.031	0.041	0.024	0.043	0.290	1.266	1.867	2.649	5.087
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.20	0.66	0.91	1.23	2.23
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	0.519	5.0	16.6	22.9	30.9	56.0
Peak Inflow Q (cfs) =	0.5	0.7	0.4	0.7	4.9	20.8	30.6	43.1	81.9
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.026	1.6	9.6	12.1	14.2	14.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.0	0.3	0.6	0.5	0.5	0.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.6	4.0	5.0	5.9	6.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	42	46	37	47	59	32	25	19	9
Time to Drain 99% of Inflow Volume (hours) =	**47**	51	42	52	70	54	47	40	29
Maximum Ponding Depth (ft) =	0.29	0.38	0.23	0.40	1.70	3.42	4.55	5.74	6.00
Area at Maximum Ponding Depth (acres) =	0.10	0.11	0.10	0.11	0.16	0.26	0.36	0.49	0.52
Maximum Volume Stored (acre-ft) =	0.028	0.037	0.022	0.039	0.215	0.581	0.926	1.431	1.562

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.01 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph Constant	0:10:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:02	0.02	0.03	0.02	0.03	0.22	0.91	1.32	1.84	3.33
0.997	0:20:02	0.07	0.09	0.05	0.09	0.59	2.46	3.59	5.04	9.35
	0:25:03	0.17	0.22	0.13	0.23	1.50	6.32	9.22	12.94	24.01
	0:30:04	0.46	0.61	0.37	0.64	4.14	17.37	25.32	35.52	65.79
	0:35:04	0.53	0.71	0.42	0.74	4.86	20.82	30.55	43.14	81.91
	0:40:05	0.50	0.67	0.40	0.70	4.63	19.91	29.25	41.36	79.08
	0:45:05	0.45	0.61	0.36	0.63	4.21	18.12	26.62	37.64	72.14
	0:50:06	0.40	0.53	0.31	0.56	3.74	16.24	23.90	33.84	65.01
	0:55:07	0.34	0.45	0.26	0.47	3.22	14.08	20.76	29.49	56.95
	1:00:07	0.29	0.39	0.23	0.41	2.81	12.24	18.03	25.68	49.76
	1:05:08	0.27	0.36	0.21	0.37	2.54	11.10	16.36	23.25	44.85
	1:10:08	0.21	0.28	0.17	0.30	2.08	9.22	13.63	19.42	37.68
	1:15:09	0.17	0.23	0.13	0.24	1.69	7.57	11.24	16.04	31.26
	1:20:10	0.12	0.16	0.09	0.17	1.28	5.90	8.80	12.63	24.84
	1:25:10	0.09	0.12	0.07	0.12	0.94	4.45	6.70	9.68	19.24
	1:30:11	0.06	0.09	0.05	0.09	0.69	3.24	4.92	7.17	14.43
	1:35:11	0.05	0.07	0.04	0.07	0.54	2.48	3.74	5.41	10.78
	1:40:12	0.04	0.06	0.03	0.06	0.44	2.03	3.04	4.38	8.64
	1:45:13	0.04	0.05	0.03	0.05	0.38	1.72	2.57	3.70	7.27
	1:50:13	0.03	0.04	0.03	0.05	0.33	1.51	2.25	3.22	6.31
	1:55:14	0.03	0.04	0.02	0.04	0.30	1.35	2.02	2.89	5.64
	2:00:14	0.03	0.04	0.02	0.04	0.28	1.24	1.85	2.65	5.16
	2:05:15	0.02	0.03	0.02	0.03	0.20	0.91	1.37	1.96	3.87
	2:10:16	0.01	0.02	0.01	0.02	0.15	0.67	1.00	1.42	2.80
	2:15:16	0.01	0.01	0.01	0.02	0.11	0.49	0.73	1.05	2.07
	2:20:17	0.01	0.01	0.01	0.01	0.08	0.36	0.54	0.78	1.54
	2:25:17	0.01	0.01	0.00	0.01	0.06	0.26	0.39	0.57	1.13
	2:30:18	0.00	0.00	0.00	0.01	0.04	0.19	0.28	0.41	0.81
	2:35:19	0.00	0.00	0.00	0.00	0.03	0.13	0.20	0.29	0.59
	2:40:19	0.00	0.00	0.00	0.00	0.02	0.09	0.14	0.20	0.41
	2:45:20	0.00	0.00	0.00	0.00	0.01	0.06	0.09	0.13	0.27
	2:50:20	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.07	0.16
	2:55:21	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.07
	3:00:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
	3:05:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
2 Yr.	0.23	4,410	0.101	926	0.021	0.01
WQCV	0.29	4,520	0.104	1,194	0.027	0.01
EURV	0.38	4,684	0.108	1,608	0.037	0.02
5 Yr.	0.40	4,721	0.108	1,702	0.039	0.03
	1.00	5,819	0.134	4,864	0.112	0.08
	2.00	7,650	0.176	11,598	0.266	4.79
	3.00	10,376	0.238	20,697	0.475	8.48
	4.00	13,084	0.300	32,427	0.744	10.92
	5.00	17,810	0.409	47,874	1.099	12.91
100 Yr.	5.74	21,308	0.489	62,348	1.431	14.21
	6.00	22,537	0.517	68,048	1.562	14.64

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

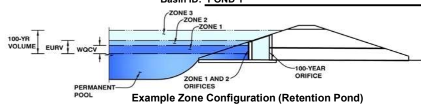
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	24.00	acres		
Watershed Length =	2,000	ft		
Watershed Slope =	0.020	ft/ft		
Watershed Imperviousness =	11.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.145	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.250	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.174	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.268	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.584	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.485	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.049	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.786	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.85 in.) =	5.171	acre-feet	3.85	inches
Approximate 2-yr Detention Volume =	0.161	acre-feet		
Approximate 5-yr Detention Volume =	0.251	acre-feet		
Approximate 10-yr Detention Volume =	0.500	acre-feet		
Approximate 25-yr Detention Volume =	0.687	acre-feet		
Approximate 50-yr Detention Volume =	0.721	acre-feet		
Approximate 100-yr Detention Volume =	0.926	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.145	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.105	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.676	acre-feet
Total Detention Basin Volume =	0.926	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	2.00	--	--	--	6,905	0.159	6,886	0.158
	--	4.00	--	--	--	12,575	0.289	26,435	0.607
	--	6.00	--	--	--	18,016	0.414	57,026	1.309
	--	8.00	--	--	--	26,430	0.607	101,472	2.329
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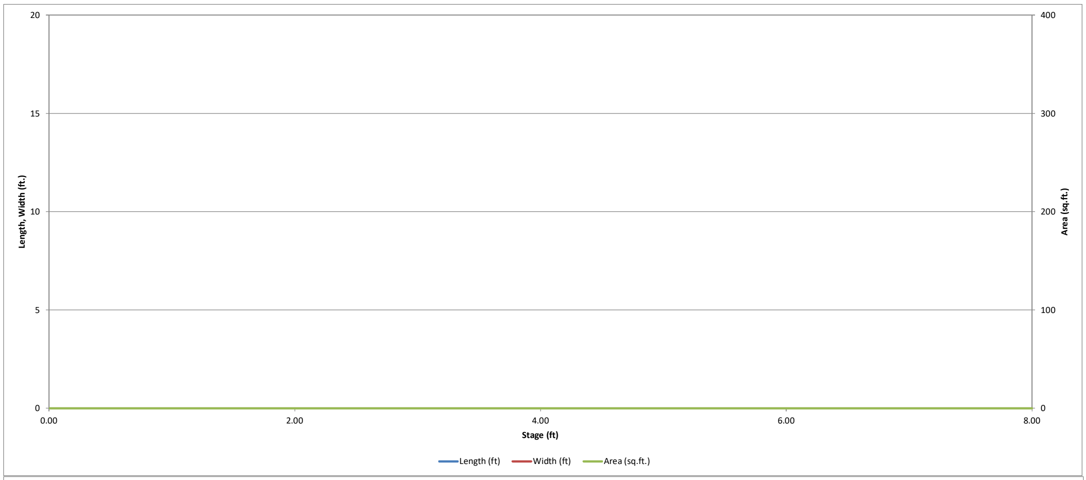
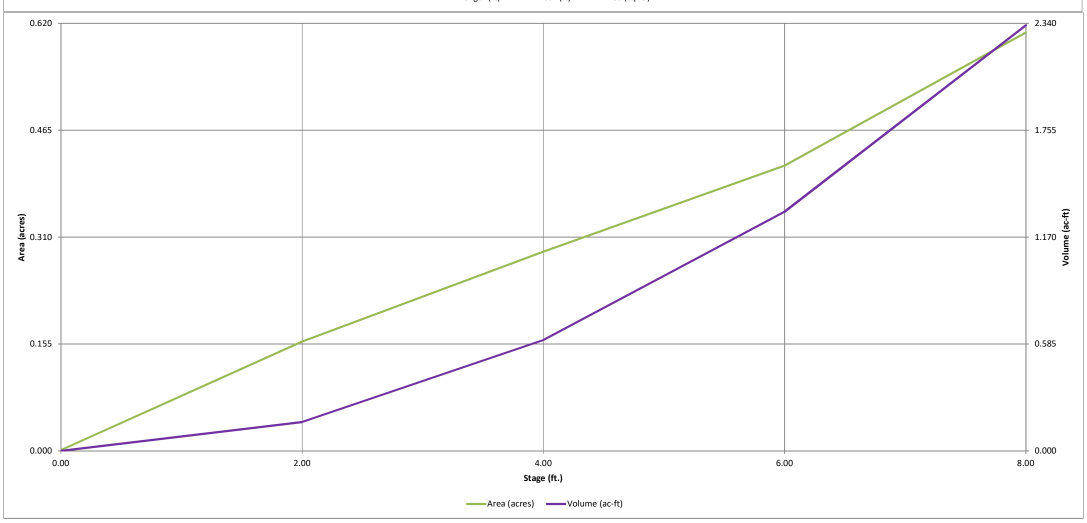
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



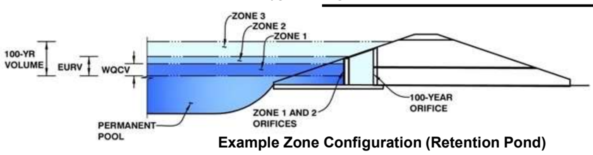


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.91	0.145	Orifice Plate
Zone 2 (EURV)	2.52	0.105	Orifice Plate
Zone 3 (100-year)	5.00	0.676	Weir&Pipe (Restrict)
		0.926	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	6.00	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00	1.50	2.00			
Orifice Area (sq. inches)	0.44	0.76	0.76	0.76	0.76			

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.50	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	10.93	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	12.37	N/A	ft^2
Overflow Grate Open Area w/ Debris =	6.18	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	11.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.13	N/A	ft^2
Outlet Orifice Centroid =	0.52	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.79	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

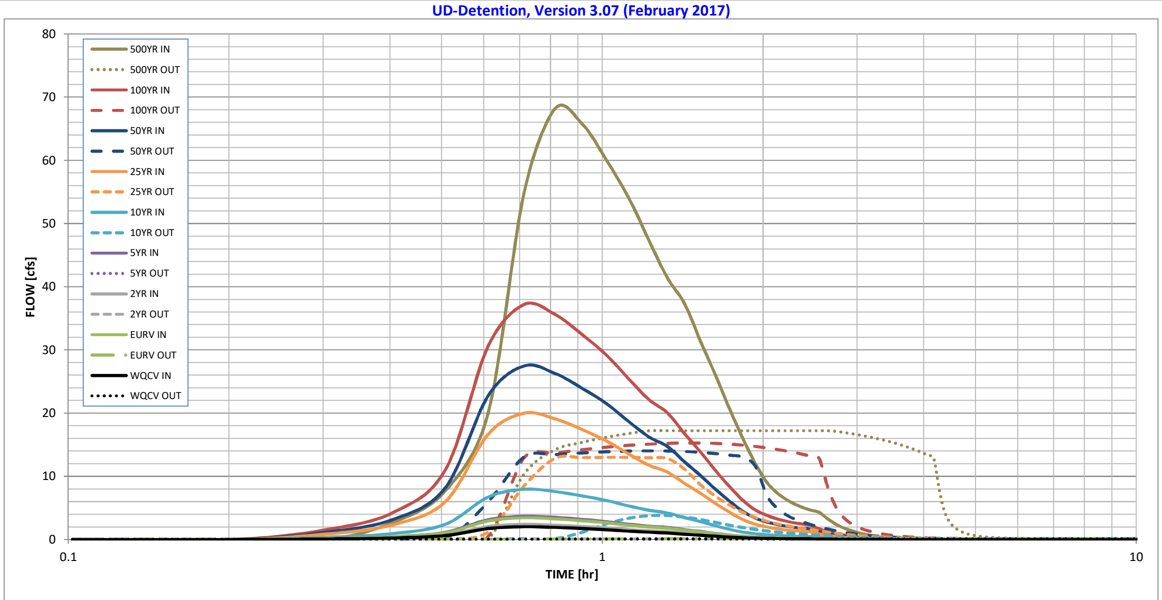
Spillway Design Flow Depth=	0.53	feet
Stage at Top of Freeboard =	7.53	feet
Basin Area at Top of Freeboard =	0.56	acres

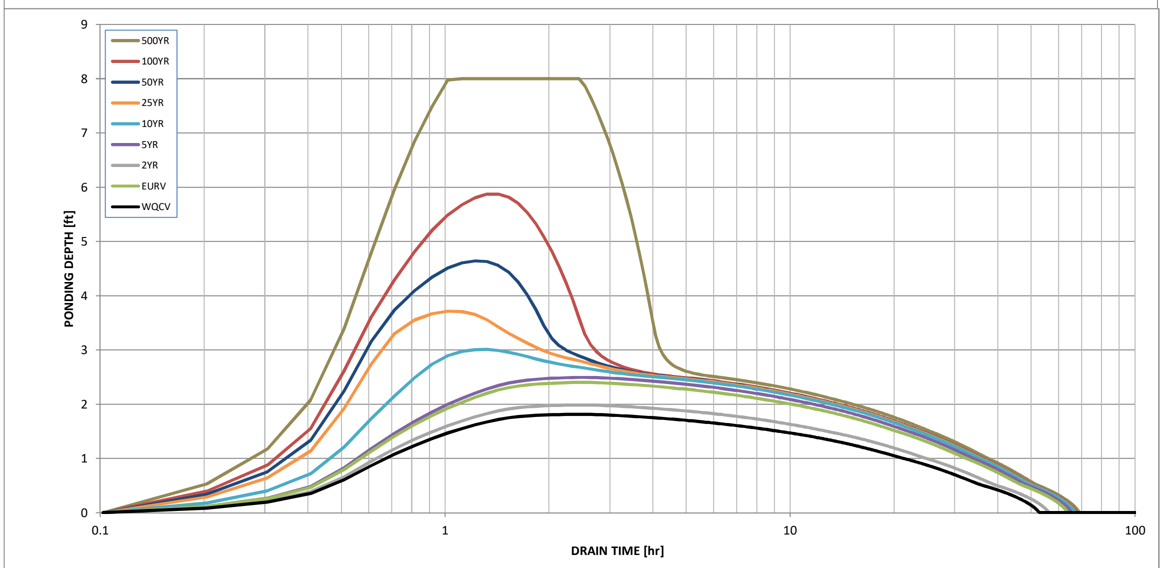
Routed Hydrograph Results

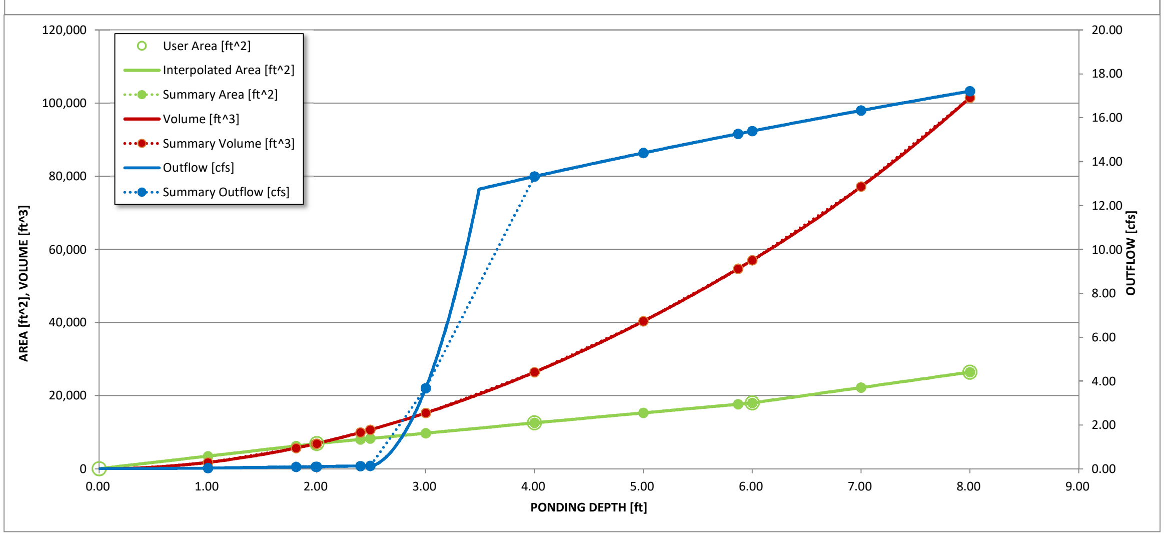
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.85
Calculated Runoff Volume (acre-ft) =	0.145	0.250	0.174	0.268	0.584	1.485	2.049	2.786	5.171
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.145	0.249	0.173	0.268	0.584	1.484	2.049	2.785	5.161
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.15	0.52	0.72	0.98	1.79
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	0.387	3.6	12.5	17.4	23.6	42.9
Peak Inflow Q (cfs) =	2.0	3.4	2.4	3.7	7.9	20.0	27.5	37.2	68.1
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.133	3.8	13.0	14.0	15.3	17.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	1.0	1.0	0.8	0.6	0.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.3	1.0	1.1	1.2	1.4
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) =	44	51	46	52	46	35	30	26	16
Time to Drain 99% of Inflow Volume (hours) =	**49**	58	52	59	56	48	45	41	34
Maximum Ponding Depth (ft) =	1.81	2.40	1.99	2.49	3.01	3.72	4.64	5.87	8.00
Area at Maximum Ponding Depth (acres) =	0.14	0.18	0.16	0.19	0.22	0.27	0.33	0.41	0.61
Maximum Volume Stored (acre-ft) =	0.131	0.228	0.157	0.245	0.351	0.526	0.804	1.256	2.329

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	
6.11 min	
Hydrograph Constant	0.818

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:06:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:12:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:18:20	0.09	0.16	0.11	0.17	0.35	0.87	1.18	1.58	2.77
0:24:26	0.24	0.41	0.29	0.44	0.95	2.36	3.22	4.34	7.77
0:30:33	0.63	1.06	0.74	1.14	2.44	6.05	8.28	11.14	19.95
0:36:40	1.73	2.92	2.05	3.13	6.70	16.62	22.72	30.57	54.67
0:42:46	2.01	3.43	2.39	3.68	7.95	19.97	27.46	37.17	68.12
0:48:53	1.91	3.26	2.27	3.50	7.58	19.11	26.29	35.64	65.78
0:54:59	1.74	2.97	2.06	3.18	6.90	17.39	23.93	32.44	60.02
1:01:06	1.54	2.64	1.83	2.83	6.16	15.60	21.49	29.17	54.09
1:07:13	1.31	2.26	1.57	2.43	5.32	13.53	18.69	25.44	47.39
1:13:19	1.15	1.98	1.37	2.12	4.63	11.76	16.24	22.15	41.41
1:19:26	1.04	1.79	1.24	1.92	4.20	10.67	14.72	20.05	37.32
1:25:32	0.84	1.46	1.01	1.57	3.46	8.87	12.28	16.75	31.36
1:31:39	0.68	1.18	0.81	1.27	2.82	7.30	10.13	13.84	26.01
1:37:46	0.51	0.90	0.61	0.96	2.17	5.70	7.94	10.91	20.68
1:43:52	0.37	0.66	0.44	0.71	1.61	4.31	6.06	8.37	16.02
1:49:59	0.27	0.48	0.33	0.52	1.17	3.15	4.46	6.20	12.01
1:56:05	0.21	0.38	0.26	0.40	0.91	2.41	3.38	4.68	8.98
2:02:12	0.18	0.31	0.21	0.33	0.75	1.97	2.75	3.79	7.19
2:08:19	0.15	0.26	0.18	0.28	0.63	1.66	2.32	3.19	6.05
2:14:25	0.13	0.23	0.16	0.25	0.56	1.45	2.03	2.78	5.26
2:20:32	0.12	0.21	0.14	0.23	0.50	1.31	1.82	2.49	4.70
2:26:38	0.11	0.20	0.13	0.21	0.46	1.20	1.67	2.29	4.30
2:32:45	0.08	0.14	0.10	0.15	0.34	0.88	1.23	1.69	3.22
2:38:52	0.06	0.10	0.07	0.11	0.25	0.65	0.90	1.23	2.33
2:44:58	0.04	0.08	0.05	0.08	0.18	0.47	0.66	0.91	1.72
2:51:05	0.03	0.06	0.04	0.06	0.13	0.35	0.49	0.67	1.28
2:57:11	0.02	0.04	0.03	0.04	0.10	0.25	0.36	0.49	0.94
3:03:18	0.02	0.03	0.02	0.03	0.07	0.18	0.25	0.35	0.68
3:09:25	0.01	0.02	0.01	0.02	0.05	0.13	0.18	0.25	0.49
3:15:31	0.01	0.01	0.01	0.01	0.03	0.09	0.13	0.18	0.34
3:21:38	0.00	0.01	0.00	0.01	0.02	0.05	0.08	0.11	0.22
3:27:44	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.06	0.13
3:33:51	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.06
3:39:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
3:46:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:52:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:58:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:04:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:16:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:22:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:28:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:34:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:41:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:47:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:53:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:59:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:11:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:17:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:23:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:29:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:36:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:42:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:48:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:54:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:06:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:12:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:18:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:24:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:31:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:37:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:43:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:49:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:55:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:01:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:07:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:13:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:19:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	1.00	3,443	0.079	1,729	0.040	0.03
WQCV	1.81	6,220	0.143	5,642	0.130	0.09
2 Yr.	1.99	6,836	0.157	6,818	0.157	0.09
	2.00	6,871	0.158	6,886	0.158	0.09
EURV	2.40	8,039	0.185	9,944	0.228	0.13
5 Yr.	2.49	8,294	0.190	10,679	0.245	0.13
	3.00	9,740	0.224	15,277	0.351	3.68
	4.00	12,575	0.289	26,435	0.607	13.32
	5.00	15,295	0.351	40,370	0.927	14.39
100 Yr.	5.87	17,662	0.405	54,707	1.256	15.26
	6.00	18,016	0.414	57,026	1.309	15.39
	7.00	22,223	0.510	77,145	1.771	16.33
	8.00	26,430	0.607	101,472	2.329	17.21

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

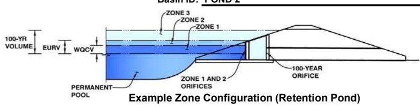
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	104.80	acres		
Watershed Length =	4,000	ft		
Watershed Slope =	0.032	ft/ft		
Watershed Imperviousness =	21.40%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	1.060	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	2.240	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	1.661	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.430	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.096	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.856	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	10.271	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	13.428	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.85 in.) =	24.089	acre-feet	3.85	inches
Approximate 2-yr Detention Volume =	1.547	acre-feet		
Approximate 5-yr Detention Volume =	2.278	acre-feet		
Approximate 10-yr Detention Volume =	3.613	acre-feet		
Approximate 25-yr Detention Volume =	4.421	acre-feet		
Approximate 50-yr Detention Volume =	4.669	acre-feet		
Approximate 100-yr Detention Volume =	5.705	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.060	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.180	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.465	acre-feet
Total Detention Basin Volume =	5.705	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 2 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	277	0.006		
7162	--	2.00	--	--	--	10,268	0.236	10,442	0.240
7164	--	4.00	--	--	--	30,108	0.691	50,921	1.169
7166	--	6.00	--	--	--	38,919	0.893	119,948	2.754
7168	--	8.00	--	--	--	45,498	1.044	204,365	4.692
7170	--	10.00	--	--	--	52,628	1.208	302,491	6.944
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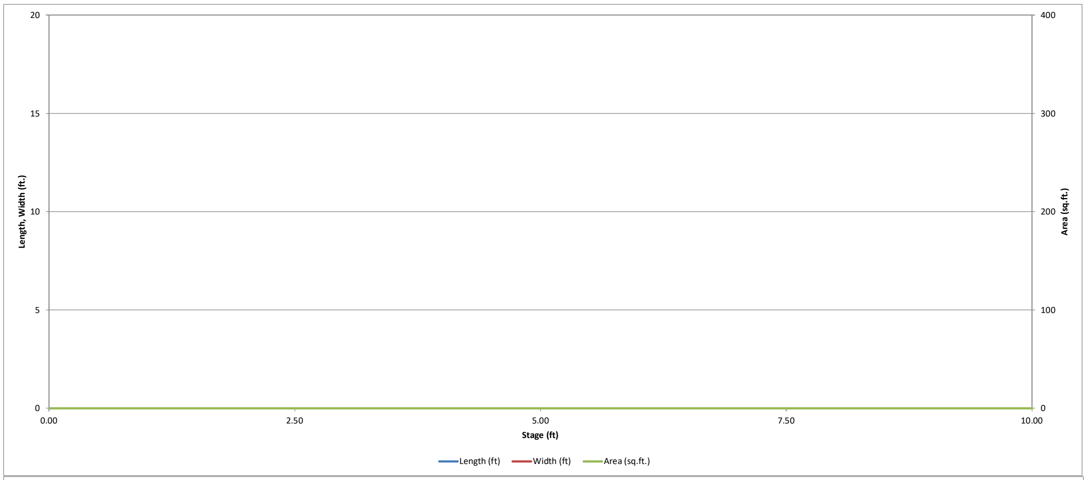
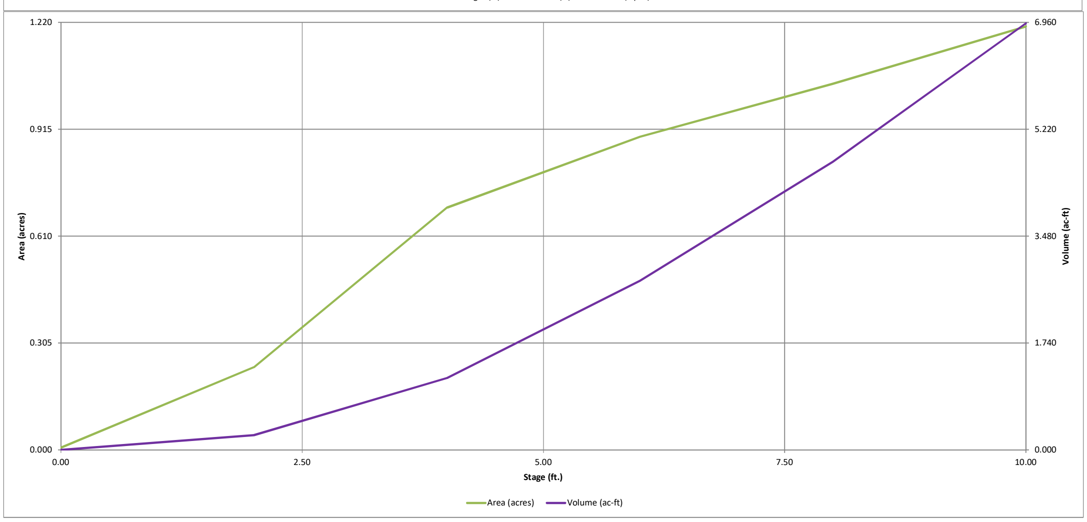
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



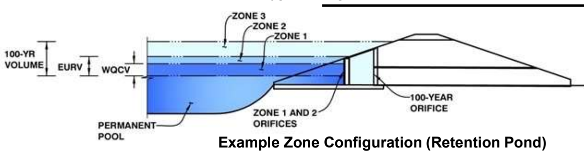


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: RETREAT AT TIMBERRIDGE FILING NO. 1

Basin ID: POND 2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.84	1.060	Orifice Plate
Zone 2 (EURV)	5.41	1.180	Orifice Plate
Zone 3 (100-year)	8.94	3.465	Weir&Pipe (Restrict)
		5.705	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	16.50	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.40	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	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.50	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.57	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	24.74	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.37	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	42.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	9.62	N/A	ft^2
Outlet Orifice Centroid =	1.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	65.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	9.96	feet
Basin Area at Top of Freeboard =	1.20	acres

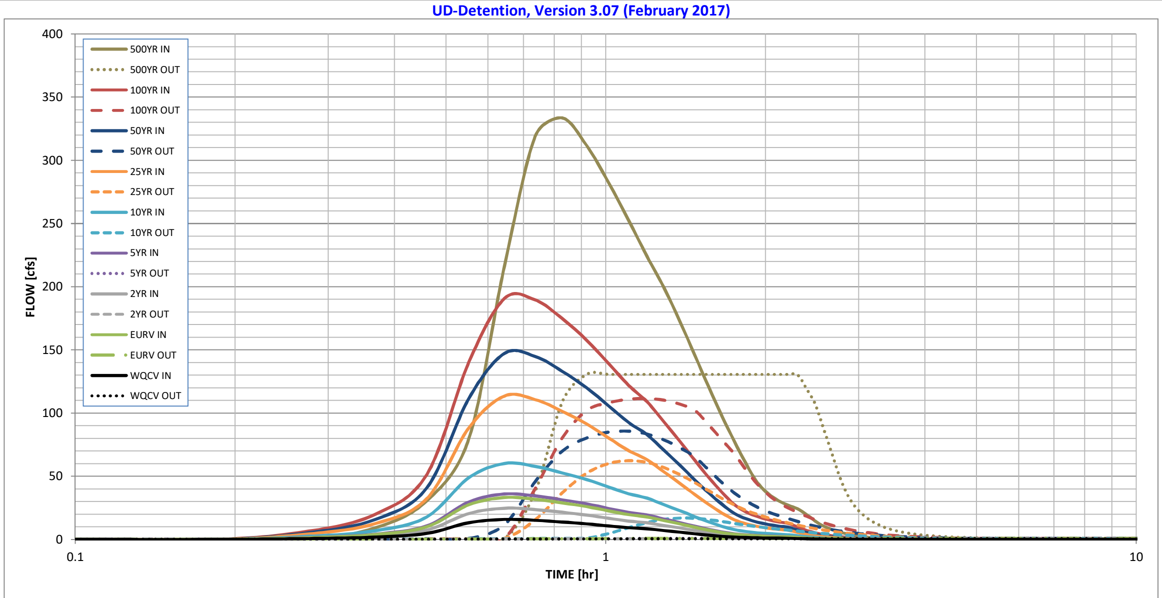
Routed Hydrograph Results

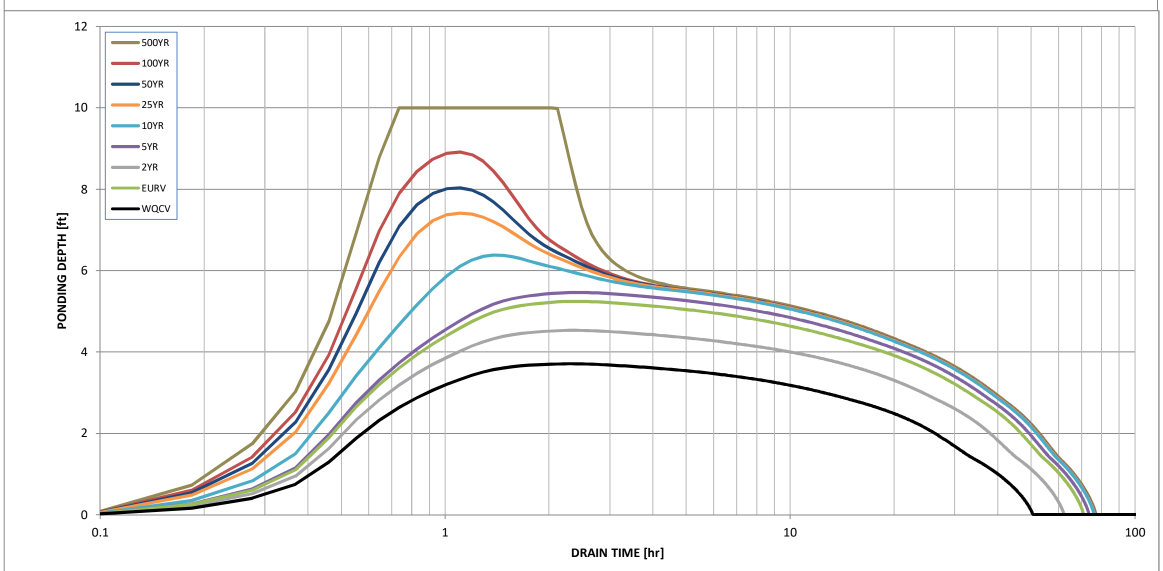
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.85
Calculated Runoff Volume (acre-ft) =	1.060	2.240	1.661	2.430	4.096	7.856	10.271	13.428	24.089
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.058	2.239	1.659	2.428	4.094	7.847	10.264	13.420	24.076
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.17	0.59	0.81	1.10	2.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.1	1.911	18.1	61.5	85.2	115.2	209.2
Peak Inflow Q (cfs) =	15.8	33.2	24.7	35.9	60.1	113.4	147.2	190.6	333.5
Peak Outflow Q (cfs) =	0.5	0.8	0.7	0.873	16.9	62.3	85.6	111.5	130.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.9	1.0	1.0	1.0	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.6	2.5	3.4	4.5	5.2
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) =	44	60	54	62	59	53	49	45	35
Time to Drain 99% of Inflow Volume (hours) =	48	66	58	68	69	64	62	59	53
Maximum Ponding Depth (ft) =	3.71	5.24	4.53	5.46	6.38	7.41	8.03	8.91	10.00
Area at Maximum Ponding Depth (acres) =	0.62	0.82	0.74	0.84	0.92	1.00	1.05	1.12	1.21
Maximum Volume Stored (acre-ft) =	0.972	2.104	1.550	2.286	3.099	4.088	4.723	5.676	6.944

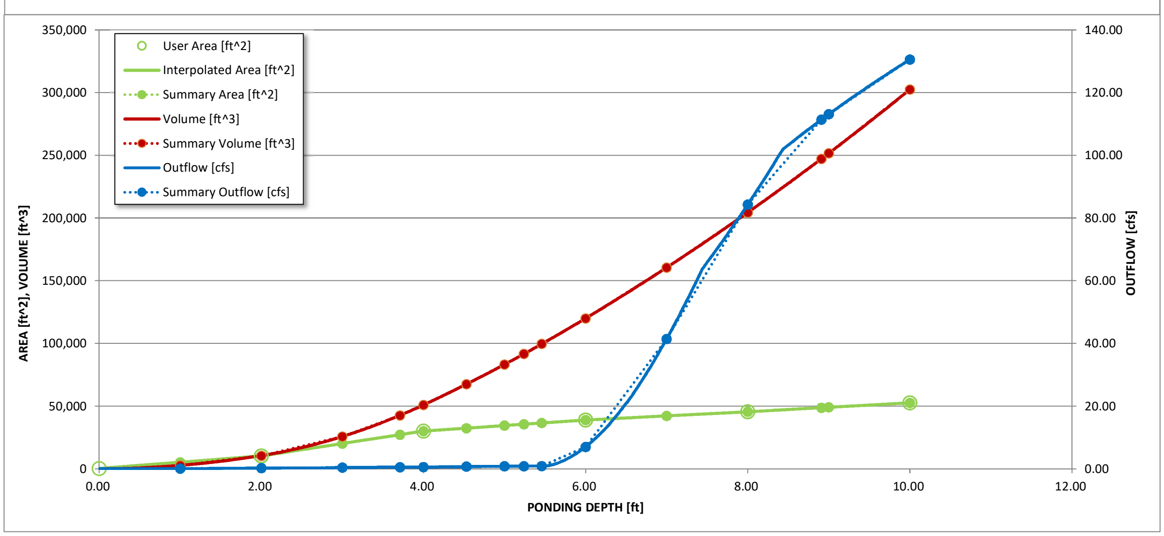
Address the safety issue.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	Hydrograph Constant
5.52 min	0.905

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:11:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:16:34	0.69	1.42	1.07	1.53	2.50	4.35	5.38	6.57	9.26
0:22:05	1.88	3.89	2.91	4.21	6.94	12.56	15.90	19.99	30.59
0:27:36	4.82	9.98	7.47	10.80	17.81	32.26	40.84	51.40	79.60
0:33:07	13.24	27.40	20.50	29.64	48.83	88.26	111.60	140.22	216.02
0:38:38	15.83	33.18	24.68	35.93	60.11	113.42	147.17	190.60	318.77
0:44:10	15.13	31.78	23.62	34.44	57.82	110.65	144.81	189.51	333.55
0:49:41	13.77	28.93	21.50	31.34	52.66	101.34	133.04	174.71	311.82
0:55:12	12.33	25.99	19.29	28.17	47.43	91.41	120.07	157.76	282.47
1:00:43	10.68	22.62	16.75	24.53	41.49	80.34	105.75	139.25	252.72
1:06:14	9.29	19.67	14.55	21.35	36.22	70.31	92.62	122.02	224.07
1:11:46	8.42	17.82	13.20	19.33	32.70	63.14	82.96	108.98	199.14
1:17:17	6.98	14.87	10.99	16.14	27.40	53.37	70.45	93.01	172.33
1:22:48	5.73	12.27	9.05	13.33	22.70	44.36	58.62	77.48	145.79
1:28:19	4.45	9.64	7.07	10.48	17.99	35.50	47.11	62.54	120.66
1:33:50	3.34	7.36	5.37	8.02	13.89	27.65	36.80	48.99	97.51
1:39:22	2.42	5.43	3.93	5.92	10.37	20.87	27.89	37.29	77.48
1:44:53	1.86	4.11	3.00	4.48	7.78	15.49	20.60	27.55	59.66
1:50:24	1.53	3.34	2.44	3.63	6.26	12.33	16.33	21.70	44.88
1:55:55	1.29	2.82	2.07	3.07	5.27	10.34	13.67	18.12	36.23
2:01:26	1.13	2.46	1.81	2.68	4.58	8.96	11.82	15.63	30.74
2:06:58	1.02	2.21	1.62	2.40	4.10	7.99	10.53	13.89	26.94
2:12:29	0.94	2.02	1.49	2.20	3.75	7.30	9.60	12.65	24.22
2:18:00	0.69	1.50	1.10	1.63	2.80	5.55	7.39	9.86	19.60
2:23:31	0.51	1.09	0.80	1.18	2.03	4.00	5.32	7.10	14.38
2:29:02	0.37	0.80	0.59	0.87	1.50	2.97	3.95	5.27	10.46
2:34:34	0.27	0.59	0.44	0.65	1.11	2.21	2.93	3.91	7.83
2:40:05	0.20	0.43	0.32	0.47	0.82	1.63	2.17	2.90	5.86
2:45:36	0.14	0.31	0.22	0.34	0.59	1.18	1.57	2.10	4.36
2:51:07	0.10	0.22	0.16	0.24	0.42	0.85	1.14	1.52	3.20
2:56:38	0.07	0.15	0.11	0.17	0.30	0.60	0.81	1.09	2.38
3:02:10	0.04	0.10	0.07	0.11	0.19	0.40	0.54	0.73	1.70
3:07:41	0.02	0.05	0.04	0.06	0.11	0.23	0.32	0.44	1.14
3:13:12	0.01	0.02	0.01	0.02	0.05	0.11	0.16	0.22	0.68
3:18:43	0.00	0.00	0.00	0.01	0.01	0.04	0.05	0.08	0.35
3:24:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
3:29:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:46:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:51:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:57:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:02:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:08:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:13:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:19:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:24:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:36:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:41:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:47:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:52:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:58:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:03:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:09:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:14:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:31:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:36:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:42:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:47:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:53:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:04:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:09:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:15:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:20:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:26:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:31:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:37:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	1.00	5,223	0.120	2,722	0.062	0.10
	2.00	10,218	0.235	10,442	0.240	0.24
	3.00	20,188	0.463	25,773	0.592	0.40
WQCV	3.71	27,231	0.625	42,607	0.978	0.52
	4.00	30,108	0.691	50,921	1.169	0.56
2 Yr.	4.53	32,443	0.745	67,497	1.550	0.70
	5.00	34,513	0.792	83,232	1.911	0.80
EURV	5.24	35,571	0.817	91,642	2.104	0.84
5 Yr.	5.46	36,540	0.839	99,574	2.286	0.87
	6.00	38,919	0.893	119,948	2.754	6.98
	7.00	42,208	0.969	160,512	3.685	41.43
	8.00	45,498	1.044	204,365	4.692	84.29
100 Yr.	8.91	48,742	1.119	247,244	5.676	111.39
	9.00	49,063	1.126	251,645	5.777	113.09
	10.00	52,628	1.208	302,491	6.944	130.55

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

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

Pre-Dev 100 Year Routing

Project Summary	
Title	Retreat atTimberRidge Filing No. 1 Final Drainage Report
Engineer	MAW
Company	CCES
Date	3/15/2019

Notes	Pre-Dev 2 year SCS Model

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Pre-Dev 100 Year Routing

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
EX-1	Pre-Development 2 YEAR	2	0.249	12.600	0.54
EX-2	Pre-Development 2 YEAR	2	0.013	12.300	0.03
EX-3	Pre-Development 2 YEAR	2	0.198	12.450	0.44
EX-4	Pre-Development 2 YEAR	2	0.074	12.400	0.17
EX-4	Pre-Development 2 YEAR	2	0.074	12.400	0.17
EX-5	Pre-Development 2 YEAR	2	0.945	12.750	2.04
EX-6	Pre-Development 2 YEAR	2	0.322	12.400	0.72
EX-7	Pre-Development 2 YEAR	2	0.287	12.300	0.97

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
EX DP-1	Pre-Development 2 YEAR	2	1.876	12.500	4.21
EX DP-2	Pre-Development 2 YEAR	2	0.013	12.300	0.03
EX DP-3	Pre-Development 2 YEAR	2	0.198	12.450	0.44
EX DP-4	Pre-Development 2 YEAR	2	0.074	12.400	0.17

Pre-Dev 100 Year Routing

Subsection: Time-Depth Curve — Return Event: 2 years
Label: Colo Springs 2015 — Storm Event: TYPE II 24 HOUR

Time-Depth Curve: TYPE II 24 HOUR	
Label	TYPE II 24 HOUR
Start Time	0.000 hours
Increment	0.250 hours
End Time	24.000 hours
Return Event	2 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.250 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
1.250	0.0	0.0	0.0	0.0	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.750	0.1	0.1	0.1	0.1	0.1
5.000	0.1	0.1	0.2	0.2	0.2
6.250	0.2	0.2	0.2	0.2	0.2
7.500	0.2	0.2	0.3	0.3	0.3
8.750	0.3	0.3	0.3	0.3	0.4
10.000	0.4	0.4	0.4	0.5	0.5
11.250	0.5	0.6	0.8	1.4	1.5
12.500	1.5	1.6	1.6	1.7	1.7
13.750	1.7	1.7	1.8	1.8	1.8
15.000	1.8	1.8	1.8	1.9	1.9
16.250	1.9	1.9	1.9	1.9	1.9
17.500	1.9	1.9	1.9	1.9	2.0
18.750	2.0	2.0	2.0	2.0	2.0
20.000	2.0	2.0	2.0	2.0	2.0
21.250	2.0	2.0	2.0	2.1	2.1
22.500	2.1	2.1	2.1	2.1	2.1
23.750	2.1	2.1	(N/A)	(N/A)	(N/A)

Pre-Dev 100 Year Routing

Subsection: Addition Summary | Return Event: 2 years
Label: EX DP-1 | Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-1
<Catchment to Outflow Node>	EX-5
<Catchment to Outflow Node>	EX-6
<Catchment to Outflow Node>	EX-7
<Catchment to Outflow Node>	EX-4

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-1	0.249	12.600	0.54
Flow (From)	EX-5	0.945	12.750	2.04
Flow (From)	EX-6	0.322	12.400	0.72
Flow (From)	EX-7	0.287	12.300	0.97
Flow (From)	EX-4	0.074	12.400	0.17
Flow (In)	EX DP-1	1.876	12.500	4.21

Pre-Dev 100 Year Routing

Subsection: Addition Summary
Label: EX DP-2

Return Event: 2 years
Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-2'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-2

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-2	0.013	12.300	0.03
Flow (In)	EX DP-2	0.013	12.300	0.03

Pre-Dev 100 Year Routing

Subsection: Addition Summary | Return Event: 2 years
Label: EX DP-3 | Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-3'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-3

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-3	0.198	12.450	0.44
Flow (In)	EX DP-3	0.198	12.450	0.44

Pre-Dev 100 Year Routing

Subsection: Addition Summary
Return Event: 2 years
Label: EX DP-4
Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-4'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-4

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-4	0.074	12.400	0.17
Flow (In)	EX DP-4	0.074	12.400	0.17

Pre-Dev 100 Year Routing

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Pre-Dev 100 Year Routing

Project Summary	
Title	Retreat atTimberRidge Filing No. 1 Final Drainage Report
Engineer	MAW
Company	CCES
Date	3/15/2019

Notes	Pre-Dev 5 year SCS Model

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Pre-Dev 100 Year Routing

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
EX-1	Pre-Development 5 YEAR	5	0.691	12.250	3.85
EX-2	Pre-Development 5 YEAR	5	0.036	12.100	0.31
EX-3	Pre-Development 5 YEAR	5	0.549	12.200	3.44
EX-4	Pre-Development 5 YEAR	5	0.205	12.150	1.38
EX-4	Pre-Development 5 YEAR	5	0.205	12.150	1.38
EX-5	Pre-Development 5 YEAR	5	2.624	12.300	13.49
EX-6	Pre-Development 5 YEAR	5	0.893	12.150	5.79
EX-7	Pre-Development 5 YEAR	5	0.717	12.200	5.15

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
EX DP-1	Pre-Development 5 YEAR	5	5.131	12.200	28.49
EX DP-2	Pre-Development 5 YEAR	5	0.036	12.100	0.31
EX DP-3	Pre-Development 5 YEAR	5	0.549	12.200	3.44
EX DP-4	Pre-Development 5 YEAR	5	0.205	12.150	1.38

Pre-Dev 100 Year Routing

Subsection: Time-Depth Curve | Return Event: 5 years
Label: Colo Springs 2015 | Storm Event: TYPE II 24 HOUR

Time-Depth Curve: TYPE II 24 HOUR	
Label	TYPE II 24 HOUR
Start Time	0.000 hours
Increment	0.250 hours
End Time	24.000 hours
Return Event	5 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.250 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
1.250	0.0	0.0	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.750	0.1	0.1	0.1	0.2	0.2
5.000	0.2	0.2	0.2	0.2	0.2
6.250	0.2	0.2	0.3	0.3	0.3
7.500	0.3	0.3	0.3	0.3	0.4
8.750	0.4	0.4	0.4	0.4	0.5
10.000	0.5	0.5	0.5	0.6	0.6
11.250	0.7	0.8	1.0	1.8	1.9
12.500	2.0	2.0	2.1	2.1	2.2
13.750	2.2	2.2	2.3	2.3	2.3
15.000	2.3	2.3	2.3	2.4	2.4
16.250	2.4	2.4	2.4	2.4	2.5
17.500	2.5	2.5	2.5	2.5	2.5
18.750	2.5	2.5	2.5	2.6	2.6
20.000	2.6	2.6	2.6	2.6	2.6
21.250	2.6	2.6	2.6	2.6	2.6
22.500	2.7	2.7	2.7	2.7	2.7
23.750	2.7	2.7	(N/A)	(N/A)	(N/A)

Pre-Dev 100 Year Routing

Subsection: Addition Summary — Return Event: 5 years

Label: EX DP-1 — Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-1
<Catchment to Outflow Node>	EX-5
<Catchment to Outflow Node>	EX-6
<Catchment to Outflow Node>	EX-7
<Catchment to Outflow Node>	EX-4

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-1	0.691	12.250	3.85
Flow (From)	EX-5	2.624	12.300	13.49
Flow (From)	EX-6	0.893	12.150	5.79
Flow (From)	EX-7	0.717	12.200	5.15
Flow (From)	EX-4	0.205	12.150	1.38
Flow (In)	EX DP-1	5.131	12.200	28.49

Pre-Dev 100 Year Routing

Subsection: Addition Summary — Return Event: 5 years

Label: EX DP-2 — Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-2'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-2

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-2	0.036	12.100	0.31
Flow (In)	EX DP-2	0.036	12.100	0.31

Pre-Dev 100 Year Routing

Subsection: Addition Summary | Return Event: 5 years
Label: EX DP-3 | Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-3'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-3

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-3	0.549	12.200	3.44
Flow (In)	EX DP-3	0.549	12.200	3.44

Pre-Dev 100 Year Routing

Subsection: Addition Summary — Return Event: 5 years
Label: EX DP-4 — Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-4'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-4

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-4	0.205	12.150	1.38
Flow (In)	EX DP-4	0.205	12.150	1.38

Pre-Dev 100 Year Routing

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Pre-Dev 100 Year Routing

Project Summary	
Title	Retreat atTimberRidge Filing No. 1 Final Drainage Report
Engineer	MAW
Company	CCES
Date	3/15/2019

Notes	Pre-Dev 100 year SCS Model

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Pre-Dev 100 Year Routing

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
EX-1	Pre-Development 100 YEAR	100	3.044	12.150	29.97
EX-2	Pre-Development 100 YEAR	100	0.160	12.050	2.25
EX-3	Pre-Development 100 YEAR	100	2.420	12.150	26.76
EX-4	Pre-Development 100 YEAR	100	0.904	12.100	10.53
EX-4	Pre-Development 100 YEAR	100	0.904	12.100	10.53
EX-5	Pre-Development 100 YEAR	100	11.571	12.200	107.20
EX-6	Pre-Development 100 YEAR	100	3.932	12.100	44.84
EX-7	Pre-Development 100 YEAR	100	2.887	12.150	32.06

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
EX DP-1	Pre-Development 100 YEAR	100	22.338	12.150	219.24
EX DP-2	Pre-Development 100 YEAR	100	0.160	12.050	2.25
EX DP-3	Pre-Development 100 YEAR	100	2.420	12.150	26.76
EX DP-4	Pre-Development 100 YEAR	100	0.904	12.100	10.53

Pre-Dev 100 Year Routing

Subsection: Time-Depth Curve | Return Event: 100 years
Label: Colo Springs 2015 | Storm Event: TYPE II 24 HOUR

Time-Depth Curve: TYPE II 24 HOUR	
Label	TYPE II 24 HOUR
Start Time	0.000 hours
Increment	0.250 hours
End Time	24.000 hours
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.250 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.1
1.250	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.2	0.2	0.2
3.750	0.2	0.2	0.2	0.3	0.3
5.000	0.3	0.3	0.3	0.3	0.4
6.250	0.4	0.4	0.4	0.5	0.5
7.500	0.5	0.5	0.6	0.6	0.6
8.750	0.6	0.7	0.7	0.7	0.8
10.000	0.8	0.9	0.9	1.0	1.1
11.250	1.2	1.3	1.8	3.0	3.3
12.500	3.4	3.5	3.6	3.6	3.7
13.750	3.7	3.8	3.8	3.9	3.9
15.000	3.9	4.0	4.0	4.0	4.1
16.250	4.1	4.1	4.1	4.2	4.2
17.500	4.2	4.2	4.2	4.3	4.3
18.750	4.3	4.3	4.3	4.4	4.4
20.000	4.4	4.4	4.4	4.4	4.4
21.250	4.5	4.5	4.5	4.5	4.5
22.500	4.5	4.5	4.5	4.6	4.6
23.750	4.6	4.6	(N/A)	(N/A)	(N/A)

Pre-Dev 100 Year Routing

Subsection: Addition Summary | Return Event: 100 years
Label: EX DP-1 | Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-1
<Catchment to Outflow Node>	EX-5
<Catchment to Outflow Node>	EX-6
<Catchment to Outflow Node>	EX-7
<Catchment to Outflow Node>	EX-4

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-1	3.044	12.150	29.97
Flow (From)	EX-5	11.571	12.200	107.20
Flow (From)	EX-6	3.932	12.100	44.84
Flow (From)	EX-7	2.887	12.150	32.06
Flow (From)	EX-4	0.904	12.100	10.53
Flow (In)	EX DP-1	22.338	12.150	219.24

Pre-Dev 100 Year Routing

Subsection: Addition Summary — Return Event: 100 years
Label: EX DP-2 — Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-2'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-2

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	EX-2	0.160	12.050	2.25
Flow (In)	EX DP-2	0.160	12.050	2.25

Pre-Dev 100 Year Routing

Subsection: Addition Summary
Label: EX DP-3

Return Event: 100 years
Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-3'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-3

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-3	2.420	12.150	26.76
Flow (In)	EX DP-3	2.420	12.150	26.76

Pre-Dev 100 Year Routing

Subsection: Addition Summary — Return Event: 100 years
Label: EX DP-4 — Storm Event: TYPE II 24 HOUR

Summary for Hydrograph Addition at 'EX DP-4'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EX-4

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	EX-4	0.904	12.100	10.53
Flow (In)	EX DP-4	0.904	12.100	10.53

Pre-Dev 100 Year Routing

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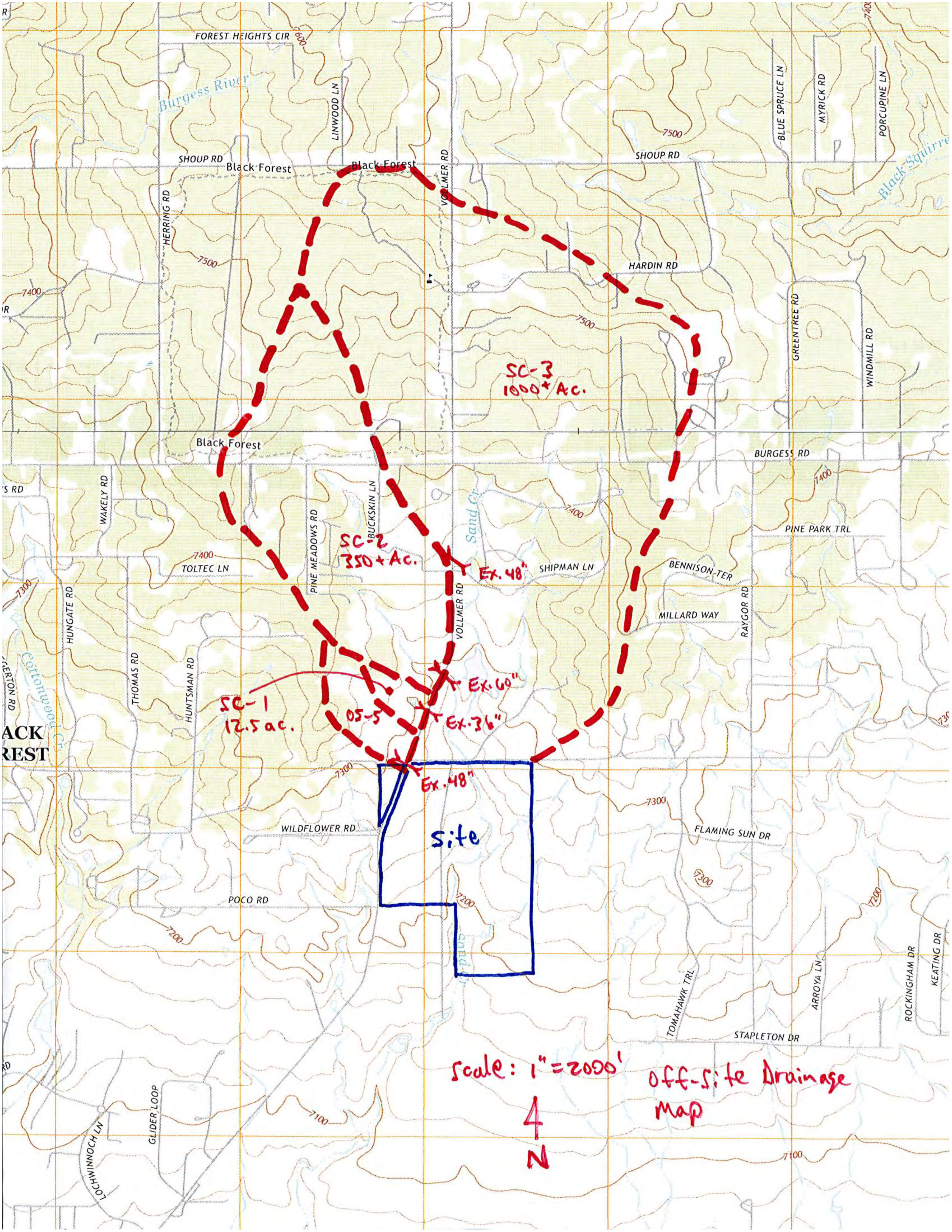
DRAINAGE MAPS

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS


FOREST HEIGHTS CIR
Burgess River
LINWOOD LN
SHOUP RD
Black Forest
VOLLMER RD
BLUE SPRUCE LN
MYRICK RD
PORCUPINE LN
HERRING RD
HARDIN RD
GREENTREE RD
WINDMILL RD
SC-3
1000± Ac.
BURGESS RD
WAKELY RD
BUCKSKIN LN
PINE MEADOWS RD
Sand Cr.
PINE PARK TRL
SC-2
350± Ac.
Ex. 48"
TOLTEC LN
SHIPMAN LN
BENNISON TER
HUNGATE RD
MILLARD WAY
RAYGOR RD
Cottonwood Cr.
THOMAS RD
HUNTSMAN RD
Ex. 60"
SC-1
12.5 ac.
OS-5
Ex. 36"
BLACK FOREST
Ex. 48"
WILDFLOWER RD
Site
FLAMING SUN DR
POCO RD
TOMAHAWK TRL
ARROYA LN
ROCKINGHAM DR
KEATING DR
STAPLETON DR
Scale: 1" = 2000'
Off-Site Drainage Map
N
GLIDER LOOP
LOCHWINNOCH LN

CN VALUES - EXISTING CONDITIONS

BASIN (label)	BASIN AREA (Ac)	SOIL TYPE B CN	SOIL TYPE B AREA (Ac.)	WEIGHTED CN
EX-1	32.4	61	32.4	61
EX-2	1.7	61	1.7	61
EX-3	25.7	61	25.7	61
EX-4	9.6	61	9.6	61
EX-5	123.3	61	123.3	61
EX-6	41.8	61	41.8	61
EX-7	27.6	63	27.6	63

TIME OF CONCENTRATION - EXISTING CONDITIONS

BASIN	Cn	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)	Tc LAG (min)	Tc LAG (hr)
EX-1	61.0	0.08	300	10	21.4	1500	1.8%	1.3	19.2	40.7	24.4	0.41
EX-2	61.0	0.08	300	10	21.4					21.4	12.9	0.21
EX-3	61.0	0.08	300	12	20.2	1500	4.0%	1.8	13.9	34.1	20.4	0.34
EX-4	61.0	0.08	300	10	21.4	1000	4.0%	1.8	9.3	30.7	18.4	0.31
EX-5	61.0	0.08	300	8	23.1	1800	2.0%	1.3	23.1	46.2	27.7	0.46
EX-6	61.0	0.08	300	10	21.4	800	3.0%	1.3	10.3	31.7	19.0	0.32
EX-7	63.0	0.08	300	10	21.4	1200	3.0%	1.4	14.3	35.7	21.4	0.36

BASIN SUMMARY - EXISTING CONDITIONS

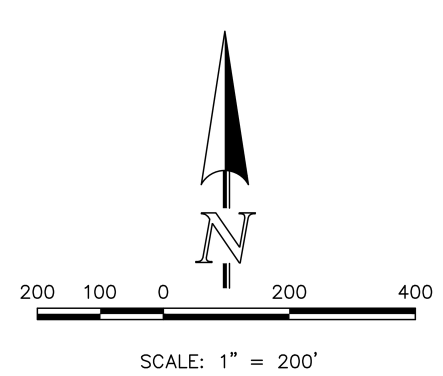
BASIN (label)	TOTAL BASIN AREA (acres)	WEIGHTED CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
EX-1	32.4	61	0.41	0.5	3.9	30.0
EX-2	1.7	61	0.21	0.03	0.3	2.3
EX-3	25.7	61	0.34	0.4	3.4	26.8
EX-4	9.6	61	0.31	0.2	1.4	10.5
EX-5	123.3	61	0.46	2.0	13.5	107.2
EX-6	41.8	61	0.32	0.7	5.8	44.8
EX-7	27.6	63	0.36	1.0	5.2	32.1

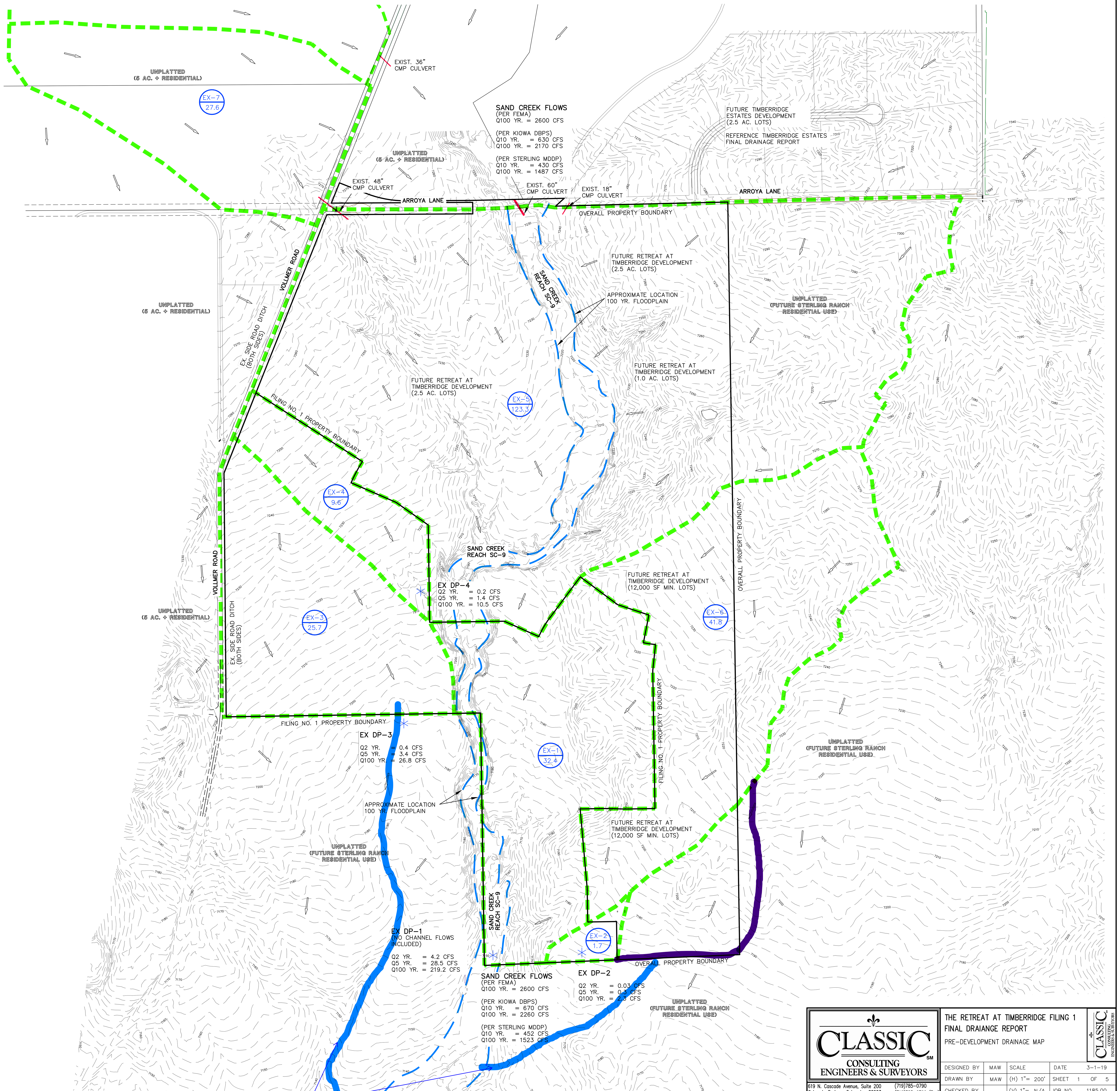
DESIGN POINTS SURFACE ROUTING SUMMARY - EXISTING CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
EX DP-1	BASINS EX-1, EX-4, EX-5, EX-6, EX-7 (234.7 AC.)	4.2	28.5	219.2
EX DP-2	BASIN EX-2 (1.7 AC.)	0.03	0.3	2.3
EX DP-3	BASIN EX-3 (25.7 AC.)	0.4	3.4	26.8
EX-DP-4	BASIN EX-4 (9.6 AC.)	0.2	1.4	10.5

LEGEND

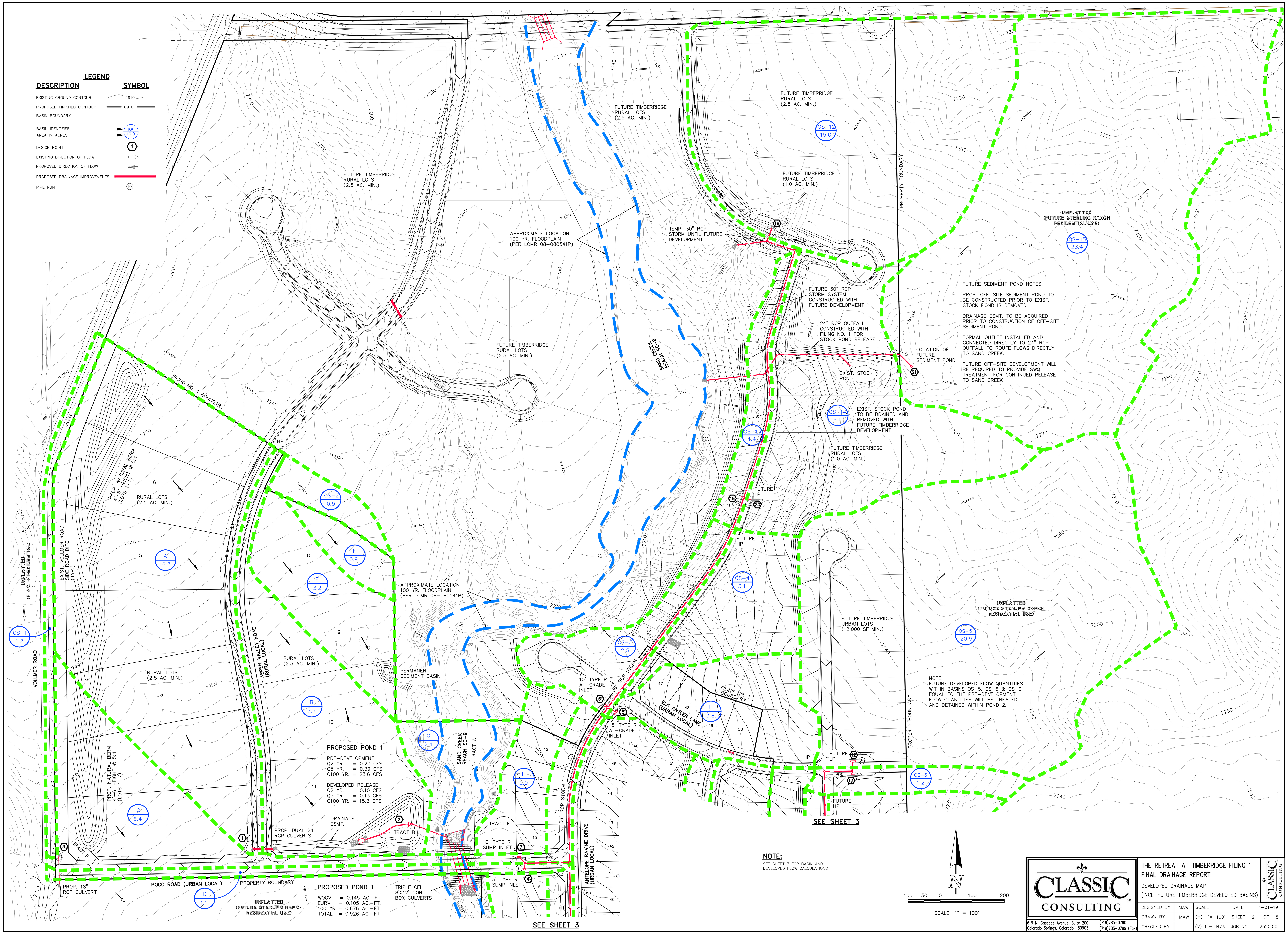
DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
DESIGN POINT	
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	





Show and label historic flow paths.

CLASSIC CONSULTING ENGINEERS & SURVEYORS	THE RETREAT AT TIMBERRIDGE FILING 1 FINAL DRAIANGE REPORT PRE-DEVELOPMENT DRAINAGE MAP			
619 N. Cascade Avenue, Suite 200 Colorado Springs, Colorado 80903 (719)785-0790 (719)785-0799 (Fax)	DESIGNED BY	MAW	SCALE	DATE 3-1-19
	DRAWN BY	MAW	(H) 1"= 200'	SHEET 1 OF 5
	CHECKED BY		(V) 1"= N/A	JOB NO. 1185.00



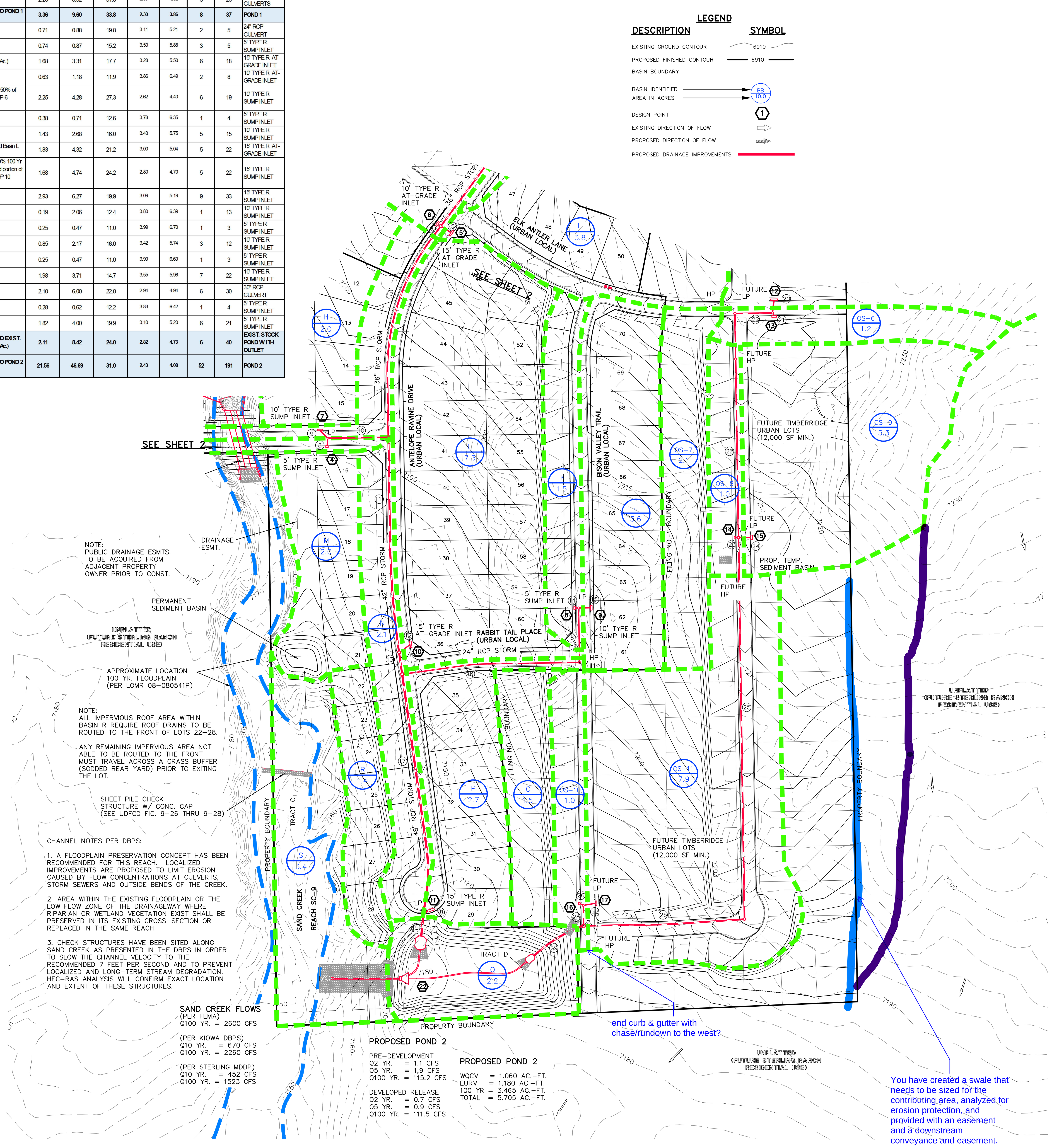
LEGEND
DESCRIPTION
SYMBOL
EXISTING GROUND CONTOUR
PROPOSED FINISHED CONTOUR
BASIN BOUNDARY
BASIN IDENTIFIER
AREA IN ACRES
DESIGN POINT
EXISTING DIRECTION OF FLOW
PROPOSED DIRECTION OF FLOW
PROPOSED DRAINAGE IMPROVEMENTS
PIPE RUN
FUTURE TIMBERRIDGE RURAL LOTS (2.5 AC. MIN.)
FUTURE TIMBERRIDGE RURAL LOTS (1.0 AC. MIN.)
APPROXIMATE LOCATION 100 YR. FLOODPLAIN (PER LOMR 08-080541P)
TEMP. 30" RCP STORM UNTIL FUTURE DEVELOPMENT
FUTURE 30" RCP STORM SYSTEM CONSTRUCTED WITH FUTURE DEVELOPMENT
24" RCP OUTFALL CONSTRUCTED WITH FILING NO. 1 FOR STOCK POND RELEASE
LOCATION OF FUTURE SEDIMENT POND
EXIST. STOCK POND
EXIST. STOCK POND TO BE DRAINED AND REMOVED WITH FUTURE TIMBERRIDGE DEVELOPMENT
FUTURE SEDIMENT POND NOTES:
PROP. OFF-SITE SEDIMENT POND TO BE CONSTRUCTED PRIOR TO EXIST. STOCK POND IS REMOVED
DRAINAGE ESMT. TO BE ACQUIRED PRIOR TO CONSTRUCTION OF OFF-SITE SEDIMENT POND.
FORMAL OUTLET INSTALLED AND CONNECTED DIRECTLY TO 24" RCP OUTFALL TO ROUTE FLOWS DIRECTLY TO SAND CREEK.
FUTURE OFF-SITE DEVELOPMENT WILL BE REQUIRED TO PROVIDE SWQ TREATMENT FOR CONTINUED RELEASE TO SAND CREEK
UNPLATTED (FUTURE STERLING RANCH RESIDENTIAL USE)
UNPLATTED (5 AC. + RESIDENTIAL)
PROPERTY BOUNDARY
FILING NO. 1 BOUNDARY
SAND CREEK REACH SC-9
FUTURE TIMBERRIDGE URBAN LOTS (12,000 SF MIN.)
NOTE:
FUTURE DEVELOPED FLOW QUANTITIES WITHIN BASINS OS-5, OS-6 & OS-9 EQUAL TO THE PRE-DEVELOPMENT FLOW QUANTITIES WILL BE TREATED AND DETAINED WITHIN POND 2.
RURAL LOTS (2.5 AC. MIN.)
PROP. NATURAL BERM 4'-6' HEIGHT @ 5:1 (LOTS 1-7)
EXIST. VOLLMER ROAD SIDE ROAD DITCH (TYP.)
VOLLMER ROAD
ASPEN VALLEY ROAD (RURAL LOCAL)
PERMANENT SEDIMENT BASIN
PROPOSED POND 1
PRE-DEVELOPMENT
Q2 YR. = 0.20 CFS
Q5 YR. = 0.39 CFS
Q100 YR. = 23.6 CFS
DEVELOPED RELEASE
Q2 YR. = 0.10 CFS
Q5 YR. = 0.13 CFS
Q100 YR. = 15.3 CFS
DRAINAGE ESMT.
PROP. DUAL 24" RCP CULVERTS
PROP. 18" RCP CULVERT
POCO ROAD (URBAN LOCAL)
PROPOSED POND 1
WQCV = 0.145 AC.-FT.
EURV = 0.105 AC.-FT.
100 YR = 0.676 AC.-FT.
TOTAL = 0.926 AC.-FT.
TRIPLE CELL 8'X12' CONC. BOX CULVERTS
10' TYPE R AT-GRADE INLET
15' TYPE R AT-GRADE INLET
10' TYPE R SUMP INLET
5' TYPE R SUMP INLET
36" RCP STORM
ELK ANTLER LANE (URBAN LOCAL)
ANTELOPE RAVINE DRIVE (URBAN LOCAL)
FUTURE LP
FUTURE HP
SEE SHEET 3
NOTE:
SEE SHEET 3 FOR BASIN AND DEVELOPED FLOW CALCULATIONS
SCALE: 1" = 100'
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200 Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)
THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(INCL. FUTURE TIMBERRIDGE DEVELOPED BASINS)
DESIGNED BY MAW
DRAWN BY MAW
CHECKED BY
SCALE (H) 1"= 100' (V) 1"= N/A
DATE 1-31-19
SHEET 2 OF 5
JOB NO. 2520.00

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	A (16.3 Ac.)	2.28	6.52	31.8	2.39	4.02	5	26	DUAL 24" RCP CULVERTS
2	**TOTAL INFLOW INTO POND 1 A and B (24.0 Ac.)**	**3.36**	**9.60**	**33.8**	2.30	3.86	**8**	**37**	**POND 1**
3	OS-1 (1.2 Ac.)	0.71	0.88	19.8	3.11	5.21	2	5	24" RCP CULVERT
4	D (1.1 Ac.)	0.74	0.87	15.2	3.50	5.88	3	5	5' TYPE R SUMP INLET
5	OS-4 (3.1 Ac.), I (3.8 Ac.)	1.68	3.31	17.7	3.28	5.50	6	18	15' TYPE R AT-GRADE INLET
6	OS-3 (2.5 Ac.)	0.63	1.18	11.9	3.86	6.49	2	8	10' TYPE R AT-GRADE INLET
7	Basin C, Basin H and 50% of 100 yr Flowby from DP-6 (10.9 Ac)	2.25	4.28	27.3	2.62	4.40	6	19	10' TYPE R SUMP INLET
8	K (1.5 Ac.)	0.38	0.71	12.6	3.78	6.35	1	4	5' TYPE R SUMP INLET
9	J and OS-7 (5.7 Ac.)	1.43	2.68	16.0	3.43	5.75	5	15	10' TYPE R SUMP INLET
10	Flowby from DP-5 and Basin L (7.3 Ac)	1.83	4.32	21.2	3.00	5.04	5	22	15' TYPE R AT-GRADE INLET
11	Basins N, O, P and 50% 100 Yr Flowby from DP 6 and portion of 100 Yr Flowby from DP 10 (13.6 Ac)	1.68	4.74	24.2	2.80	4.70	5	22	15' TYPE R SUMP INLET
12	OS-5 (20.9Ac.)	2.93	6.27	19.9	3.09	5.19	9	33	15' TYPE R SUMP INLET
13	OS-6 (1.2Ac.)	0.19	2.06	12.4	3.80	6.39	1	13	10' TYPE R SUMP INLET
14	OS-8 (1.0Ac.)	0.25	0.47	11.0	3.99	6.70	1	3	5' TYPE R SUMP INLET
15	OS-9 (5.3 Ac.)	0.85	2.17	16.0	3.42	5.74	3	12	10' TYPE R SUMP INLET
16	OS-10 (1.0 Ac.)	0.25	0.47	11.0	3.99	6.69	1	3	5' TYPE R SUMP INLET
17	OS-11 (7.9 Ac.)	1.98	3.71	14.7	3.55	5.96	7	22	10' TYPE R SUMP INLET
18	OS-12 (15.0 Ac.)	2.10	6.00	22.0	2.94	4.94	6	30	30" RCP CULVERT
19	OS-13 (1.4 Ac.)	0.28	0.62	12.2	3.83	6.42	1	4	5' TYPE R SUMP INLET
20	OS-14 (9.1 Ac.)	1.82	4.00	19.9	3.10	5.20	6	21	5' TYPE R SUMP INLET
21	**TOTAL INFLOW INTO EXIST. STOCK POND (23.4 Ac.)**	**2.11**	**8.42**	**24.0**	2.82	4.73	**6**	**40**	**EXIST. STOCK POND WITH OUTLET**
22	**TOTAL INFLOW INTO POND 2 (104.8 Ac.)**	**21.56**	**46.69**	**31.0**	2.43	4.08	**52**	**191**	**POND 2**

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	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(10) (in/hr)	I(25) (in/hr)	I(50) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	0.68	0.71	0.76	0.82	0.85	0.88	0.08	10	0.2	4.6	1700	3.5%	1.9	15.1	19.8	2.48	3.11	3.62	4.14	4.66	5.21	2	2	5
OS-2	0.02	0.07	0.14	0.23	0.27	0.32	0.08	300	10.5	21.1					21.1	2.41	3.01	3.51	4.01	4.51	5.05	0.0	0.2	1.6
OS-3	0.45	0.63	0.80	0.98	1.08	1.18	0.25	55	1.1	9.1	600	3.0%	3.5	2.9	11.9	3.08	3.86	4.51	5.15	5.80	6.49	1	2	8
OS-4	0.47	0.68	0.93	1.15	1.27	1.43	0.22	200	6	15.6	400	3.0%	3.5	1.9	17.6	2.62	3.28	3.83	4.38	4.93	5.51	1	2	8
OS-5	1.25	2.93	4.81	6.48	7.52	8.36	0.14	200	8	15.5	750	2.0%	2.8	4.4	19.9	2.47	3.09	3.61	4.13	4.64	5.19	3	9	43
OS-6	0.08	0.19	0.29	0.38	0.44	0.49	0.16	55	1.1	10.0	500	3.0%	3.5	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	0.3	1	3
OS-7	0.38	0.53	0.67	0.82	0.90	0.99	0.25	100	10	7.2					7.2	3.69	4.63	5.40	6.17	6.94	7.77	1	2	8
OS-8	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	400	3.0%	3.5	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.70	1	1	3
OS-9	0.37	0.85	1.27	1.70	1.96	2.17	0.16	200	10	14.1	400	3.0%	3.5	1.9	16.0	2.73	3.42	3.99	4.56	5.13	5.74	1	3	12
OS-10	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	450	3.8%	3.9	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.69	1	1	3
OS-11	1.42	1.98	2.53	3.08	3.40	3.71	0.25	200	10	12.8	450	3.8%	3.9	1.9	14.7	2.84	3.55	4.14	4.74	5.33	5.96	4	7	22
OS-12	0.90	2.10	3.45	4.65	5.40	6.00	0.14	300	13	18.5	600	2.0%	2.8	3.5	22.0	2.35	2.94	3.43	3.93	4.42	4.94	2	6	30
OS-13	0.17	0.28	0.38	0.49	0.56	0.62	0.20	55	1.1	9.6	450	2.0%	2.8	2.7	12.2	3.05	3.83	4.46	5.10	5.74	6.42	0.5	1	4
OS-14	1.09	1.82	2.46	3.19	3.64	4.00	0.20	300	12	17.8	350	2.0%	2.8	2.1	19.9	2.48	3.10	3.62	4.13	4.65	5.20	3	6	21
OS-15	0.70	2.11	3.98	6.08	7.25	8.42	0.09	300	16	18.2	1300	3.5%	3.7	5.8	24.0	2.25	2.82	3.29	3.76	4.23	4.73	2	6	40
A	0.98	2.28	3.75	5.05	5.87	6.52	0.14	300	10.5	19.9	1280	3.2%	1.8	11.9	31.8	1.92	2.39	2.79	3.19	3.59	4.02	2	5	26
B	0.46	1.08	1.77	2.39	2.77	3.08	0.14	300	10.5	19.9	400	2.0%	1.4	4.7	24.6	2.23	2.78	3.24	3.71	4.17	4.67	1	3	14
C	1.38	1.81	2.30	2.74	3.01	3.23	0.14	300	10.5	19.9	1100	1.5%	2.4	7.5	27.3	2.10	2.62	3.06	3.49	3.93	4.40	3	5	14
D	0.72	0.74	0.78	0.83	0.85	0.87	0.08	15	0.3	5.7	1400	1.5%	2.4	9.5	15.2	2.80	3.50	4.08	4.67	5.25	5.88	2	3	5
E	0.19	0.45	0.74	0.99	1.15	1.28	0.14	300	10.5	19.9	300	2.0%	1.4	3.5	23.4	2.28	2.85	3.33	3.81	4.28	4.79	0.4	1	6
F	0.05	0.13	0.21	0.28	0.32	0.36	0.14	300	10.5	19.9					19.9	2.48	3.10	3.62	4.13	4.65	5.20	0.1	0.4	1.9
G	0.05	0.19	0.36	0.60	0.72	0.84	0.08	70	14	5.7	400	2.0%	1.4	4.7	10.4	3.24	4.06	4.74	5.42	6.10	6.82	0.2	0.8	6
H	0.30	0.44	0.60	0.74	0.82	0.92	0.22	100	4	10.1	300	3.0%	3.5	1.4	11.5	3.13	3.92	4.57	5.23	5.88	6.58	1	2	6
I	0.72	1.00	1.28	1.56	1.72	1.88	0.25	120	3	12.4	550	3.5%	3.7	2.4	14.9	2.82	3.53	4.12	4.71	5.30	5.93	2	4	11
J	0.65	0.90	1.15	1.40	1.55	1.69	0.25	120	3	12.4	600	2.0%	2.8	3.5	16.0	2.74	3.43	4.00	4.57	5.14	5.75	2	3	10
K	0.27	0.38	0.48	0.59	0.65	0.71	0.25	55	1.1	9.1	600	2.0%	2.8	3.5	12.6	3.02	3.78	4.41	5.05	5.68	6.35	0.8	1	4
L	1.31	1.83	2.34	2.85	3.14	3.43	0.25	150	4.5	13.1	850	2.5%	3.2	4.5	17.6	2.62	3.28	3.83	4.38	4.93	5.51	3	6	19
M	0.29	0.42	0.57	0.70	0.78	0.87	0.22	100	4	10.1	350	2.5%	3.2	1.8	11.9	3.09	3.87	4.51	5.16	5.80	6.49	1	2	6
N	0.38	0.53	0.67	0.82	0.90	0.99	0.25	55	1.1	9.1	1050	2.0%	2.8	6.2	15.2	2.79	3.50	4.08	4.66	5.25	5.87	1	2	6
O	0.38	0.53	0.67	0.82	0.90	0.99	0.25	80	5	7.5					7.5	3.64	4.56	5.32	6.08	6.84	7.66	1	2	8
P	0.45	0.63	0.80	0.98	1.08	1.18	0.25	120	3	12.4	450	1.5%	2.4	3.1	15.5	2.77	3.47	4.05	4.63	5.21	5.83	1	2	7
Q	0.14	0.32	0.53	0.71	0.83	0.92	0.14	90	22	5.7	300	1.5%	1.2	4.1	9.8	3.32	4.16	4.85	5.54	6.24	6.98	0.5	1	6
R	0.27	0.38	0.48	0.59	0.65	0.71	0.25	90	6	7.8					7.8	3.59	4.50	5.26	6.01	6.76	7.56	1	2	5
S	0.07	0.27	0.51	0.85	1.02	1.19	0.08	140	14	10.2	750	1.5%	2.4	5.1	15.3	2.79	3.49	4.07	4.66	5.24	5.86	0.2	0.9	7



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-18	2.10	6.00	23.2	2.86	4.81	6	29	30" RCP
2	DP-19	0.28	0.62	12.2	3.83	6.42	1	4	18" RCP
3	DP-20	1.82	4.00	19.9	3.10	5.20	6	21	24" RCP
4	PR-1, PR-2, PR-3	4.20	10.62	23.9	2.82	4.73	12	50	36" RCP
5	Captured from DP-5	1.68	2.41	17.7	3.28	5.50	6	13	24" RCP
6	Captured from DP-6	0.63	0.93	11.9	3.86	6.49	2	6	18" RCP
7	PR-4, PR-5, PR-6	6.51	13.96	24.4	2.79	4.68	18	65	36" RCP
8	DP-4	0.74	0.87	15.2	3.50	5.88	3	5	18" RCP
9	DP-7	2.25	4.28	27.3	2.62	4.40	6	19	24" RCP
10	PR-8, PR-9	2.99	5.15	27.5	2.61	4.38	8	23	30" RCP
11	PR-7, PR-10	9.50	19.11	28.0	2.58	4.33	25	83	42" RCP
12	Captured from DP-10	1.83	2.85	21.2	3.00	5.04	5	14	24" RCP
13	PR-11, PR-12	11.32	21.96	28.1	2.58	4.33	29	95	42" RCP
14	DP-8	0.38	0.71	12.6	3.78	6.35	1	4	18" RCP
15	DP-9	1.43	2.68	16.0	3.43	5.75	5	15	24" RCP
16	PR-14, PR-15	1.80	3.38	16.4	3.39	5.69	6	19	24" RCP
17	PR-13, PR-16	13.12	25.35	28.6	2.55	4.28	33	109	48" RCP
18	DP-11	1.68	4.74	24.2	2.80	4.70	5	22	30" RCP
19	**PR-17, PR-18 W'LY FOREBAY OUTFALL**	**14.80**	**30.09**	**28.8**	2.54	4.26	**38**	**128**	**48" RCP**
20	DP-12	2.93	6.27	19.9	3.09	5.19	9	33	30" RCP
21	DP-13	0.19	2.06	12.4	3.80	6.39	1	13	24" RCP
22	PR-20, PR-21	3.12	8.33	20.7	3.04	5.10	9	42	30" RCP
23	DP-14	0.25	0.47	11.0	3.99	6.70	1	3	18" RCP
24	DP-15	0.85	2.17	16.0	3.42	5.74	3	12	24" RCP
25	PR-22, PR-23, PR-24	4.22	10.97	22.0	2.94	4.94	12	54	36" RCP
26	DP-16	0.25	0.47	11.0	3.99	6.69	1	3	18" RCP
27	DP-17	1.98	3.71	14.7	3.55	5.96	7	22	30" RCP
28	PR-26, PR-27	2.23	4.18	14.9	3.53	5.93	8	25	30" RCP
29	**PR-25, PR-28 E'LY FOREBAY OUTFALL**	**6.44**	**15.16**	**22.3**	2.92	4.91	**19**	**74**	**42" RCP**

100 50 0 100 200

SCALE: 1" = 100'

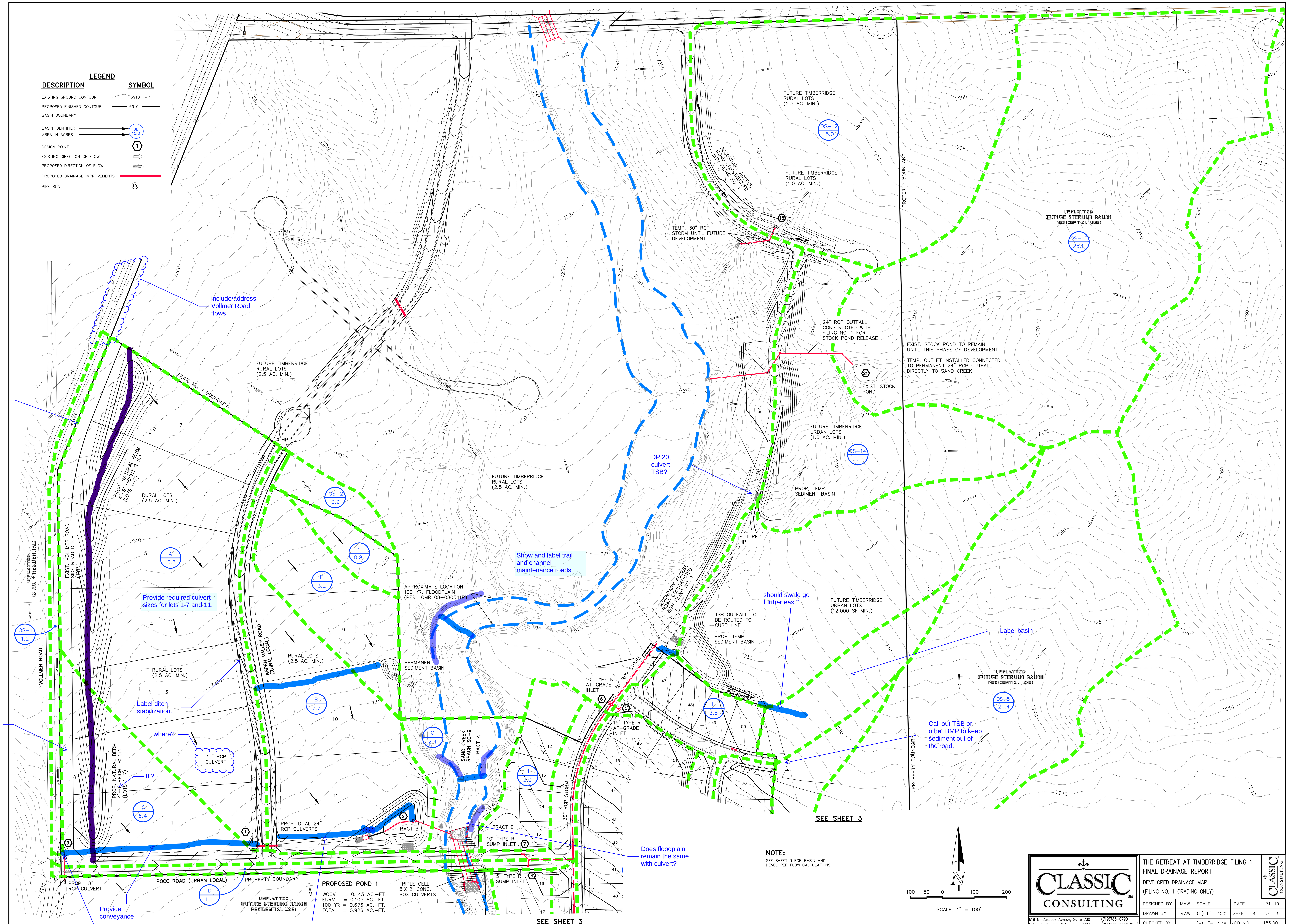
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785–0790
(719)785–0799 (Fax)

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(INCL. FUTURE DEVELOPED TIMBERRIDGE BASINS)

DESIGNED BY	MAW	SCALE	DATE 1–31–19
DRAWN BY	MAW	(H) 1"= 100'	SHEET 3 OF 5
CHECKED BY		(V) 1"= N/A	JOB NO. 2520.00

Does Vollmer Road flow enter property?

Dimension ROW/dedication



Vollmer Road ditch flows should go east.

Show maintenance access roads

CLASSIC CONSULTING

619 N. Cascade Avenue, Suite 200 Colorado Springs, Colorado 80903 (719)785-0790 (719)785-0799 (Fax)

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(FILING NO. 1 GRADING ONLY)

DESIGNED BY	MAW	SCALE	DATE 1-31-19
DRAWN BY	MAW	(H) 1"= 100'	SHEET 4 OF 5
CHECKED BY		(V) 1"= N/A	JOB NO. 1185.00

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

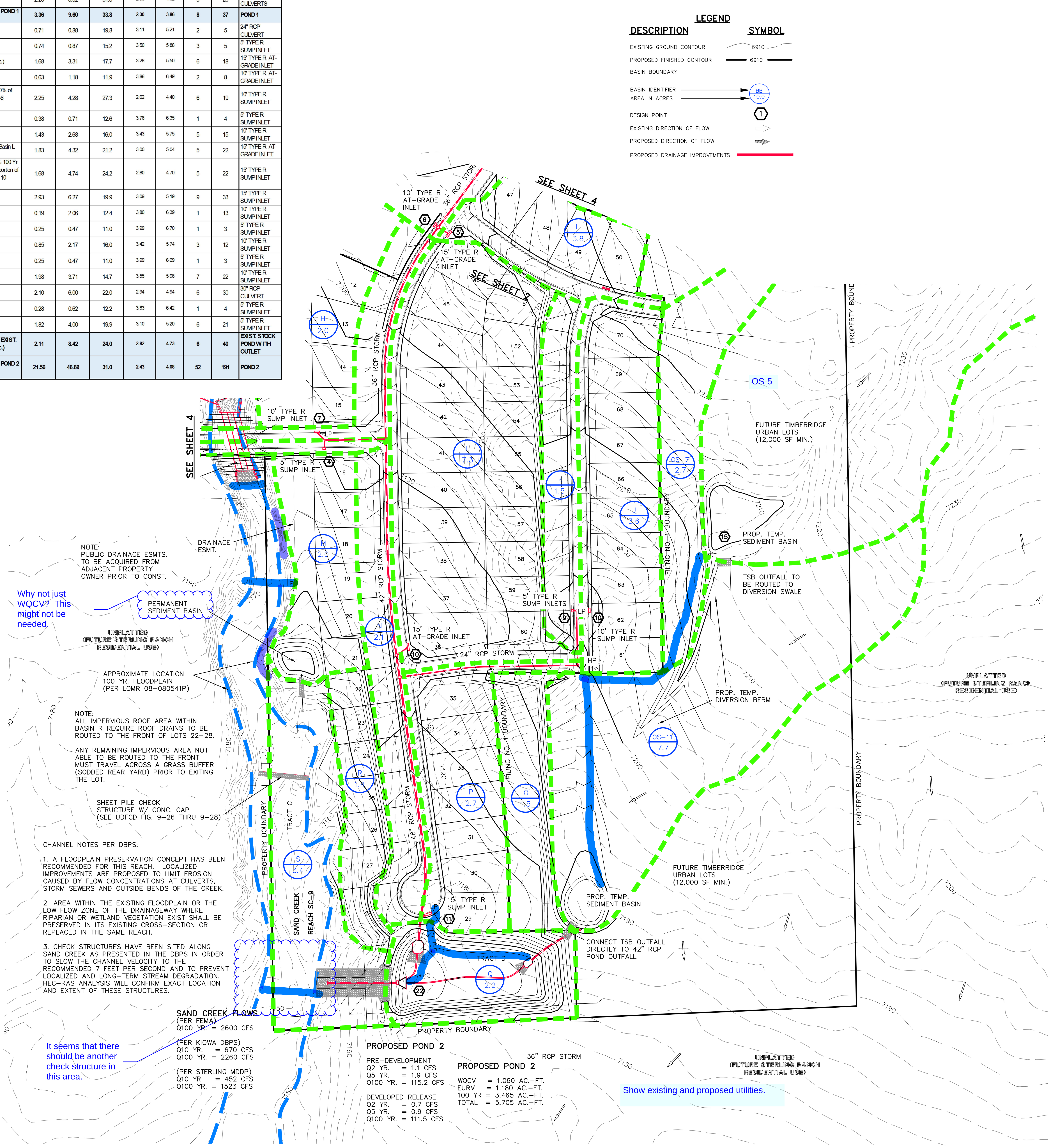
Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Inlet Size
1	A (16.3 Ac.)	2.28	6.52	31.8	2.39	4.02	5	26	DUAL 24" RCP CULVERTS
2	**TOTAL INFLOW INTO POND 1 A and B (24.0 Ac.)**	**3.36**	**9.60**	**33.8**	2.30	3.86	**8**	**37**	**POND 1**
3	OS-1 (1.2 Ac.)	0.71	0.88	19.8	3.11	5.21	2	5	24" RCP CULVERT
4	D (1.1 Ac.)	0.74	0.87	15.2	3.50	5.88	3	5	5' TYPE R SUMP INLET
5	OS-4 (3.1 Ac.), I (3.8 Ac.)	1.68	3.31	17.7	3.28	5.50	6	18	15' TYPE R AT-GRADE INLET
6	OS-3 (2.5 Ac.)	0.63	1.18	11.9	3.86	6.49	2	8	10' TYPE R AT-GRADE INLET
7	Basin C, Basin H and 50% of 100 yr Flowby from DP-6 (10.9 Ac)	2.25	4.28	27.3	2.62	4.40	6	19	10' TYPE R SUMP INLET
8	K (1.5 Ac.)	0.38	0.71	12.6	3.78	6.35	1	4	5' TYPE R SUMP INLET
9	J and OS-7 (5.7 Ac.)	1.43	2.68	16.0	3.43	5.75	5	15	10' TYPE R SUMP INLET
10	Flowby from DP-5 and Basin L (7.3 Ac)	1.83	4.32	21.2	3.00	5.04	5	22	15' TYPE R AT-GRADE INLET
11	Basins N, O, P and 50% 100 Yr Flowby from DP 6 and portion of 100 Yr Flowby from DP 10 (13.6 Ac)	1.68	4.74	24.2	2.80	4.70	5	22	15' TYPE R SUMP INLET
12	OS-5 (20.9Ac.)	2.93	6.27	19.9	3.09	5.19	9	33	15' TYPE R SUMP INLET
13	OS-6 (1.2Ac.)	0.19	2.06	12.4	3.80	6.39	1	13	10' TYPE R SUMP INLET
14	OS-8 (1.0Ac.)	0.25	0.47	11.0	3.99	6.70	1	3	5' TYPE R SUMP INLET
15	OS-9 (5.3 Ac.)	0.85	2.17	16.0	3.42	5.74	3	12	10' TYPE R SUMP INLET
16	OS-10 (1.0 Ac.)	0.25	0.47	11.0	3.99	6.69	1	3	5' TYPE R SUMP INLET
17	OS-11 (7.9 Ac.)	1.98	3.71	14.7	3.55	5.96	7	22	10' TYPE R SUMP INLET
18	OS-12 (15.0 Ac.)	2.10	6.00	22.0	2.94	4.94	6	30	30" RCP CULVERT
19	OS-13 (1.4 Ac.)	0.28	0.62	12.2	3.83	6.42	1	4	5' TYPE R SUMP INLET
20	OS-14 (9.1 Ac.)	1.82	4.00	19.9	3.10	5.20	6	21	5' TYPE R SUMP INLET
21	**TOTAL INFLOW INTO EXIST. STOCK POND (23.4 Ac.)**	**2.11**	**8.42**	**24.0**	2.82	4.73	**6**	**40**	**EXIST. STOCK POND WITH OUTLET**
22	**TOTAL INFLOW INTO POND 2 (104.8 Ac.)**	**21.56**	**46.69**	**31.0**	2.43	4.08	**52**	**191**	**POND 2**

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	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(10) (in/hr)	I(25) (in/hr)	I(50) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	0.68	0.71	0.76	0.82	0.85	0.88	0.08	10	0.2	4.6	1700	3.5%	1.9	15.1	19.8	2.48	3.11	3.62	4.14	4.66	5.21	2	2	5
OS-2	0.02	0.07	0.14	0.23	0.27	0.32	0.08	300	10.5	21.1					21.1	2.41	3.01	3.51	4.01	4.51	5.05	0.0	0.2	1.6
OS-3	0.45	0.63	0.80	0.98	1.08	1.18	0.25	55	1.1	9.1	600	3.0%	3.5	2.9	11.9	3.08	3.86	4.51	5.15	5.80	6.49	1	2	8
OS-4	0.47	0.68	0.93	1.15	1.27	1.43	0.22	200	6	15.6	400	3.0%	3.5	1.9	17.6	2.62	3.28	3.83	4.38	4.93	5.51	1	2	8
OS-5	1.25	2.93	4.81	6.48	7.52	8.36	0.14	200	8	15.5	750	2.0%	2.8	4.4	19.9	2.47	3.09	3.61	4.13	4.64	5.19	3	9	43
OS-6	0.08	0.19	0.29	0.38	0.44	0.49	0.16	55	1.1	10.0	500	3.0%	3.5	2.4	12.4	3.04	3.80	4.44	5.07	5.71	6.39	0.3	1	3
OS-7	0.38	0.53	0.67	0.82	0.90	0.99	0.25	100	10	7.2					7.2	3.69	4.63	5.40	6.17	6.94	7.77	1	2	8
OS-8	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	400	3.0%	3.5	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.70	1	1	3
OS-9	0.37	0.85	1.27	1.70	1.96	2.17	0.16	200	10	14.1	400	3.0%	3.5	1.9	16.0	2.73	3.42	3.99	4.56	5.13	5.74	1	3	12
OS-10	0.18	0.25	0.32	0.39	0.43	0.47	0.25	55	1.1	9.1	450	3.8%	3.9	1.9	11.0	3.18	3.99	4.65	5.32	5.98	6.69	1	1	3
OS-11	1.42	1.98	2.53	3.08	3.40	3.71	0.25	200	10	12.8	450	3.8%	3.9	1.9	14.7	2.84	3.55	4.14	4.74	5.33	5.96	4	7	22
OS-12	0.90	2.10	3.45	4.65	5.40	6.00	0.14	300	13	18.5	600	2.0%	2.8	3.5	22.0	2.35	2.94	3.43	3.93	4.42	4.94	2	6	30
OS-13	0.17	0.28	0.38	0.49	0.56	0.62	0.20	55	1.1	9.6	450	2.0%	2.8	2.7	12.2	3.05	3.83	4.46	5.10	5.74	6.42	0.5	1	4
OS-14	1.09	1.82	2.46	3.19	3.64	4.00	0.20	300	12	17.8	350	2.0%	2.8	2.1	19.9	2.48	3.10	3.62	4.13	4.65	5.20	3	6	21
OS-15	0.70	2.11	3.98	6.08	7.25	8.42	0.09	300	16	18.2	1300	3.5%	3.7	5.8	24.0	2.25	2.82	3.29	3.76	4.23	4.73	2	6	40
A	0.98	2.28	3.75	5.05	5.87	6.52	0.14	300	10.5	19.9	1280	3.2%	1.8	11.9	31.8	1.92	2.39	2.79	3.19	3.59	4.02	2	5	26
B	0.46	1.08	1.77	2.39	2.77	3.08	0.14	300	10.5	19.9	400	2.0%	1.4	4.7	24.6	2.23	2.78	3.24	3.71	4.17	4.67	1	3	14
C	1.38	1.81	2.30	2.74	3.01	3.23	0.14	300	10.5	19.9	1100	1.5%	2.4	7.5	27.3	2.10	2.62	3.06	3.49	3.93	4.40	3	5	14
D	0.72	0.74	0.78	0.83	0.85	0.87	0.08	15	0.3	5.7	1400	1.5%	2.4	9.5	15.2	2.80	3.50	4.08	4.67	5.25	5.88	2	3	5
E	0.19	0.45	0.74	0.99	1.15	1.28	0.14	300	10.5	19.9	300	2.0%	1.4	3.5	23.4	2.28	2.85	3.33	3.81	4.28	4.79	0.4	1	6
F	0.05	0.13	0.21	0.28	0.32	0.36	0.14	300	10.5	19.9					19.9	2.48	3.10	3.62	4.13	4.65	5.20	0.1	0.4	1.9
G	0.05	0.19	0.36	0.60	0.72	0.84	0.08	70	14	5.7	400	2.0%	1.4	4.7	10.4	3.24	4.06	4.74	5.42	6.10	6.82	0.2	0.8	6
H	0.30	0.44	0.60	0.74	0.82	0.92	0.22	100	4	10.1	300	3.0%	3.5	1.4	11.5	3.13	3.92	4.57	5.23	5.88	6.58	1	2	6
I	0.72	1.00	1.28	1.56	1.72	1.88	0.25	120	3	12.4	550	3.5%	3.7	2.4	14.9	2.82	3.53	4.12	4.71	5.30	5.93	2	4	11
J	0.65	0.90	1.15	1.40	1.55	1.69	0.25	120	3	12.4	600	2.0%	2.8	3.5	16.0	2.74	3.43	4.00	4.57	5.14	5.75	2	3	10
K	0.27	0.38	0.48	0.59	0.65	0.71	0.25	55	1.1	9.1	600	2.0%	2.8	3.5	12.6	3.02	3.78	4.41	5.05	5.68	6.35	0.8	1	4
L	1.31	1.83	2.34	2.85	3.14	3.43	0.25	150	4.5	13.1	850	2.5%	3.2	4.5	17.6	2.62	3.28	3.83	4.38	4.93	5.51	3	6	19
M	0.29	0.42	0.57	0.70	0.78	0.87	0.22	100	4	10.1	350	2.5%	3.2	1.8	11.9	3.09	3.87	4.51	5.16	5.80	6.49	1	2	6
N	0.38	0.53	0.67	0.82	0.90	0.99	0.25	55	1.1	9.1	1050	2.0%	2.8	6.2	15.2	2.79	3.50	4.08	4.66	5.25	5.87	1	2	6
O	0.38	0.53	0.67	0.82	0.90	0.99	0.25	80	5	7.5					7.5	3.64	4.56	5.32	6.08	6.84	7.66	1	2	8
P	0.45	0.63	0.80	0.98	1.08	1.18	0.25	120	3	12.4	450	1.5%	2.4	3.1	15.5	2.77	3.47	4.05	4.63	5.21	5.83	1	2	7
Q	0.14	0.32	0.53	0.71	0.83	0.92	0.14	90	22	5.7	300	1.5%	1.2	4.1	9.8	3.32	4.16	4.85	5.54	6.24	6.98	0.5	1	6
R	0.27	0.38	0.48	0.59	0.65	0.71	0.25	90	6	7.8					7.8	3.59	4.50	5.26	6.01	6.76	7.56	1	2	5
S	0.07	0.27	0.51	0.85	1.02	1.19	0.08	140	14	10.2	750	1.5%	2.4	5.1	15.3	2.79	3.49	4.07	4.66	5.24	5.86	0.2	0.9	7

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-18	2.10	6.00	23.2	2.86	4.81	6	29	30" RCP
2	DP-19	0.28	0.62	12.2	3.83	6.42	1	4	18" RCP
3	DP-20	1.82	4.00	19.9	3.10	5.20	6	21	24" RCP
4	PR-1, PR-2, PR-3	4.20	10.62	23.9	2.82	4.73	12	50	36" RCP
5	Captured from DP-5	1.68	2.41	17.7	3.28	5.50	6	13	24" RCP
6	Captured from DP-6	0.63	0.93	11.9	3.86	6.49	2	6	18" RCP
7	PR-4, PR-5, PR-6	6.51	13.96	24.4	2.79	4.68	18	65	36" RCP
8	DP-4	0.74	0.87	15.2	3.50	5.88	3	5	18" RCP
9	DP-7	2.25	4.28	27.3	2.62	4.40	6	19	24" RCP
10	PR-8, PR-9	2.99	5.15	27.5	2.61	4.38	8	23	30" RCP
11	PR-7, PR-10	9.50	19.11	28.0	2.58	4.33	25	83	42" RCP
12	Captured from DP-10	1.83	2.85	21.2	3.00	5.04	5	14	24" RCP
13	PR-11, PR-12	11.32	21.96	28.1	2.58	4.33	29	95	42" RCP
14	DP-8	0.38	0.71	12.6	3.78	6.35	1	4	18" RCP
15	DP-9	1.43	2.68	16.0	3.43	5.75	5	15	24" RCP
16	PR-14, PR-15	1.80	3.38	16.4	3.39	5.69	6	19	24" RCP
17	PR-13, PR-16	13.12	25.35	28.6	2.55	4.28	33	109	48" RCP
18	DP-11	1.68	4.74	24.2	2.80	4.70	5	22	30" RCP
19	**PR-17, PR-18 W'LY FOREBAY OUTFALL**	**14.80**	**30.09**	**28.8**	2.54	4.26	**38**	**128**	**48" RCP**
20	DP-12	2.93	6.27	19.9	3.09	5.19	9	33	30" RCP
21	DP-13	0.19	2.06	12.4	3.80	6.39	1	13	24" RCP
22	PR-20, PR-21	3.12	8.33	20.7	3.04	5.10	9	42	30" RCP
23	DP-14	0.25	0.47	11.0	3.99	6.70	1	3	18" RCP
24	DP-15	0.85	2.17	16.0	3.42	5.74	3	12	24" RCP
25	PR-22, PR-23, PR-24	4.22	10.97	22.0	2.94	4.94	12	54	36" RCP
26	DP-16	0.25	0.47	11.0	3.99	6.69	1	3	18" RCP
27	DP-17	1.98	3.71	14.7	3.55	5.96	7	22	30" RCP
28	PR-26, PR-27	2.23	4.18	14.9	3.53	5.93	8	25	30" RCP
29	**PR-25, PR-28 E'LY FOREBAY OUTFALL**	**6.44**	**15.16**	**22.3**	2.92	4.91	**19**	**74**	**42" RCP**



SCALE: 1" = 100'

THE RETREAT AT TIMBERRIDGE FILING 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP
(FILING NO. 1 GRADING ONLY)

CLASSIC CONSULTING

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(719)785-0799 (Fax)

DESIGNED BY	MAW	SCALE	DATE 1-31-19
DRAWN BY	MAW	(H) 1"= 100'	SHEET 5 OF 5
CHECKED BY		(V) 1"= N/A	JOB NO. 1185.00