WATERVIEW EAST
PRELIMINARY DRAINAGE REPORT
EL PASO COUNTY, COLORADO

PROJECT NO. 181710214

Portions of the site drains offsite without going through a WQ facility.

Submit a deviation request regarding Appendix I Section I.7.1.B 1st bullet point which noted providing water quality for the entire development.

Include an exhibit identify the areas that does no go through a WQ facility. Example: Backyards of proposed basin 17 & 18. Note the area and percent total relative to the entire subdivision.

Prepared for:
CPR ENTITLEMENTS
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June 21, 2017

Add "PCD File No: SP-17-010"

CERTIFICATIONS

Design 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.

_____ Seal

Charlene. M. Durham, P.E. #36727

Owner/Developer's Statement:

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

Add a line below the signature line with the printed name

By (signature): _____ Date: _____

Title: _____

Address: 31 N. Tejon, Suite 500

Colorado Springs, CO 80903

El Paso County:

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

_____ _____

Jennifer Irvine, P.E., Date

County Engineer / ECM Administrator

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PURPOSE

The purpose of this Preliminary Drainage Report (PDR) is to identify and present on and offsite drainage patterns, locate and identify tributary and downstream drainage features and facilities that impact the proposed site. Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs Drainage Criteria Manual (DCM).

Waterview East is approximately 195.4 acres and is part of the overall Waterview development, which is 721.8 acres within El Paso County. This portion includes the area east of Powers Boulevard and south of Bradley Road. Of the 195.4 acres, 26.1 acres will be commercial/retail and 169.3 acres will be single family residential (713 lots). The site is bordered by Powers Boulevard to the west, Bradley Road to the north and undeveloped areas to the east and south.

Revise. The County the City/County DCM Revised Nov 1991. Only specific sections of the current City DCM have been implemented (see Resolution 15-042).

GENERAL LOCATION & DESCRIPTION

The Waterview East development site is located within 2 major drainage basins, Big Johnson Reservoir on the west and Jimmy Camp Creek on the east.

Big Johnson Reservior Drainage Planning Study had originally stated that developed flows would be released into the Big Johnson Reservoir and no detention would be required as long as water quality measures were taken within the basin. However, within recent years, this is no longer the case. Detention will be required within all basins.

There is currently no approved Drainage Basin Planning Study (DBPS) for Jimmy Camp. This report may be updated if/when a DBPS is approved.

Design, phasing, responsibility and maintenance of any proposed improvements will be discussed in the final drainage report. Fees will be assessed and paid according to the current rates at the time of platting for each filing.

Description of Property

The project site is 195.4 acres of vegetation, consisting of short grasses and weeds. The average slope of the site is between 3 and 8%, with a minimum slope of 1% along Powers Boulevard and a maximum of 19% through the central area and along the eastern boundary of the site.

The site is composed of several different soil types. From the NRCS report in Appendix A, the site falls into the following soil types:

8 - Blakeland loamy sand (1-9%) – Type A Soil
52 - Manzanst clay loam (3-8%) – Type C Soil
56 - Nelson Tassel fine sandy loam (3-19%) – Nelson Type B Soil, Tassel Type D Soil
86 - Stoneham sandy loam (3-8%) – Type B Soil
108 - Wiley silt loam (3-9%) – Type B Soil

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Climate

The climate of the site is typical of a sub-humid to semiarid climate with mild summers and winters. The average temperature is 31 degrees F in the winter and 68.4 degrees in the summer. Total annual precipitation is 15.21 inches.

Floodplain Statement

The Flood Insurance Rate Map (FIRM No. 08041C0768-F dated 3/17/99) indicates that there is no floodplain in the vicinity of the proposed site. See Figure 2: FIRM.

Utilities & Other Encumberances

The site is currently undeveloped and there are no known utilities on site.

Drainage Basins and Sub-Basins

Major Basin Description

Waterview East development lies within 2 major basins, Big Johnson and Jimmy Camp Creek Drainage Basins. This project is part of the overall Waterview Development and design complies with the Amendment to the Master Drainage and Development Plan (MDDP) dated July 21, 2014 by Springs Engineering.

The western third of the site drains to the Big Johnson Reservoir and will need to be detained prior to crossing under Powers Boulevard. The remainder of the site is within the Jimmy Camp Creek Basin and will also need to be detained prior to exiting the site. All developed runoff will meet El Paso County standards for water quality and discharge rates.

Sub-Basin Description

Historic Drainage Patterns

The historic drainage patterns of the site were analyzed in the Master Development Drainage Plan for Waterview by Merrick and Company. No new historic calculations were done.

Off-Site Drainage

There is one off-site basin within the Jimmy Camp Creek Basin. It is shown in the hydrology calculations for existing and proposed basins. Currently twin 42" cmp's carry the flow under Bradley Road on site.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

The City of Colorado Springs Drainage Criteria Manual (DCM), El Paso County Engineering Criteria Manual (ECM) and Urban Storm Drainage Criteria Manual (USDCM) by Urban Drainage & Flood Control District was used in preparation of this report. Additional preliminary and final drainage plans, master development drainage plans and drainage basin planning studies used in the preparation of the report are listed in the References Section.

Hydrologic Criteria

Rational Method

The rational method was used to determine onsite flows, as required by the current City of Colorado Springs Drainage Criteria Manual (DCM). Both the 5-year and 100-year storm events were considered in this analysis. Runoff coefficients appropriate to the existing and proposed land uses were selected for an SCS type "B" soil from Table 6-6 of the DCM. The time of concentration was calculated per DCM requirements. Rational Method results are shown in the Appendix B & C. USDCM spreadsheets were used to design the detention and water quality pond features.

Storm Sewer Design

Storm Sewer systems will be designed to the 100-year storm and checked with the 5-year storm. Inlets will be placed at sump areas and intersections where street flow is larger than street capacity. UDFCD Inlet spreadsheet will be used to determine the size of all at-grade and sump inlets. There will be two systems within the site, one which will release into the West Pond in the Big Johnson Basin and one releasing into the East Pond in the Jimmy Camp Basin. These facilities will be designed as part of the Final Drainage Report (FDR) for the site.

Detention Storage Criteria

This report addresses the preliminary design stage of the 2 detention/water quality features within the proposed development. Ponds and water quality was based on the UDFCD Volume 3 spreadsheet for an Extended Detention Basin.

Preliminary storage volumes and outflows have been calculated for both detention facilities. A copy of these designs have been included in the appendix, as detention was not considered in the original MDDP report for the Big Johnson/Cruz Gulch Basin. Final calculations will be completed at the time of final platting for these facilities.

Waivers

No variances are being requested for this development.

DRAINAGE BASINS

Offsite Basins

There is one off site basin (OS-1) which contributes flow to the Jimmy Camp Basin of the development via twin 42" cmp's under Bradley Boulevard (Design Point A). The contributing area of the basin is 12.66 acres, is currently undeveloped and generates 6.26 cfs and 33.54 cfs for the minor and major storm events.

Does this combine with JCD-2 at DP JCD-C or with JCD1 at DP JCD-B? Appendix B or C do not appear to account for the routing of OS-1.

Existing Drainage Basins

Big Johnson Basin

There are two basins which are in the Big Johnson Basin portion of the development. Both of these basins release under Powers Boulevard via existing culverts to the Big Johnson Reservoir to the west.

- Basin BJD-13 (46.18 acres) is the top two-thirds of the area along Powers Boulevard and accounts for the majority of Basin BJD-13 shown in the MDDP. Flow is directed to an existing low spot located at Powers Boulevard (Design Point BJD-M) where an existing 60 cmp will release the flow into the open space on the west side of Powers and into the Big Johnson Reservoir. Flows for this basin are 19.06 cfs for the 5-year storm and 102.07 cfs for the 100-year storm.

- Basin BJD-13A (10.72 acres) is the remaining portion of the development along the Powers corridor and accounts for the remainder of the MDDP Basin BJD-13. This flow will leave the site at the southwest corner (Design Point B) where it is directed along Powers Boulevard to an existing 48" cmp directly south of the site. The existing culvert will release into the open space on the west side of Powers and reach the Big Johnson Reservoir. This basin generates 4.70 cfs and 25.14 cfs for the 5 and 100-year storms.

Jimmy Camp Basin

There are 3 existing basins which are located within the Jimmy Camp basin for this proposed development. The offsite basin discussed previously, is also located within the Jimmy Camp Basin. The three on site basins are described below.

- Basin JCD-2 (9.25 acres) located at Bradley Road and the northeast corner of the site. Flows in this basin are carried within the roadside ditch and leave the site at Design Point JCD-C (Corresponds to the same design point in the MDDP). Flows for this basin are 4.96 cfs for the 5-year storm and 26.55 cfs for the 100-year storm.

- Basin JCD-1 (120.14 acres) covers the majority of the site in the Jimmy Camp basin between Bradley Road and the south boundary. Flow is conveyed through natural swales til it exits the site along the eastern boundary at Design Point JCD-B, which corresponds to the same MDDP design point. An existing stock pond is located just downstream of this design point. This basin generates 43.23 cfs and 231.52 cfs for the 5 and 100-year storms.

- Basin JCD-1A (20.80 acres) is located along the southern boundary of the site and exits to the south at Design Point C. Flows for this basin are 8.99 cfs for the 5-year storm and 48.16 cfs for the 100-year storm.

Proposed Drainage Analysis

The proposed development lies within two separate basins: Jimmy Camp Creek and the Big Johnson. The eastern two-thirds, which is located in the Jimmy Camp Creek Basin, will all head to the east towards the East Pond, where it will be intercepted prior to exiting the site. The western third of the site is all directed towards the West Pond, located along the Powers Boulevard, where flows will be detained prior to exiting the site and entering the open space/Big Johnson Reservoir on the east site of the roadway. Below is a summary of the Design Points within each of these two basins.

Big Johnson Basin

The area within the Big Johnson Basin is approximately 46.5 acres. This area will include a portion of the commercial area and future ROW Ramp area for Powers Boulevard, both located at the northwest area of the site. Flows will all be directed via curb and gutter to various inlets through the site, where all flows will release into the West Pond, which has been designed to release flows less than historic, as the Big Johnson Reservoir no longer is able to accept any additional flows. Below is a summary of the design points within the Big Johnson Basin.

- Design Point AAA (Q_5=3.0, Q_{100}=8.6) consists of flow from Basins 102 and 103. Flows are combined at the intersection of Road R and Road O and continue to the south as gutter flow in Road R to DP-AAA.

- Design Point BBB (Q_5=4.0, Q_{100}=11.1) consists of flow from Basin 104 and DP-AAA. Flows are combined at the intersection of Road R and Road O and continue to the south as gutter flow in Road R to DP-CCC.

- Design Point CCC (Q_5=9.2, Q_{100}=22.2) consists of flow from Basins 106 and DP-BBB. It is anticipated that an at-grade inlet will installed to intercept these flows in Road R. Any flowby will continue south in Road R to DP-III.

- Design Point DDD (Q_5=3.0, Q_{100}=8.0) consists of flow from Basins 113 and 114. Flows are combined at the intersection of Road S and Road V and continue to the south as gutter flow in Road S to DP-DDD.

- Design Point EEE (Q_5=4.4, Q_{100}=11.5) consists of flow from Basin 115 and DP-DDD. It is anticipated that an at-grade inlet will be installed to intercept these flows. Any flowby will continue to street flow to the south in Road S to DP-FFF.

- Design Point FFF (Q_5=2.6, Q_{100}=9.8) consists of flow from Basins 116and 117, along with any bypass flow from the inlet at DP-EEE. Flows are combined at the intersection of Road W and Road S and continue to the south as gutter flow in Road S to DP-GGG.

- Design Point GGG (Q_5=3.8, Q_{100}=13.2) consists of flow from Basin 118 and DP-FFF. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue south in Road S to DP-HHH.

- Design Point HHH (Q_5=2.4, Q_{100}=7.9) consists of flow from Basin 119 and bypass flow from DP-GGG. Flows will continue as gutter flow in Road R to DP-III.

Missing the narrative for basin 150, 200, and 202. Double check that all DP or sub-basin is included in the narrative.

- Design Point III (Q_5=6.8, Q_{100}=21.2) consists of flow from Basin 120, DP-HHH and bypass flow from the at-grade inlet at DP-CCC. Flows will continue south as gutter flow in Road R to DP-LLL.

- Design Point JJJ (Q_5=0.7, Q_{100}=2.1) consists of flow from Basin 105. Flows are combined at the intersection of Road R and Road T and continue to the south as gutter flow in Road R.

- Design Point KKK (Q_5=4.9, Q_{100}=9.9) consists of flow from Basins 107 and 108 and DP-JJJ. It is anticipated that an at-grade inlet will used to intercept these flows. Any flowby will continue to the west in Road M to DP-LLL.

- Design Point LLL (Q_5=2.7, Q_{100}=17.1) consists of flow from Basin 121 and bypass flows from DP-III and DP-KKK. An at-grade inlet will be utilized to intercept these flows. Bypass flows will continue as street flow to the west in Road M to the low point at DP-NNN.

- Design Point MMM (Q_5=1.1, Q_{100}=3.7) consists of flow from Basin 109. Flows are combined at the intersection of Road R and Road M and continues to the west as gutter flow in Road M to DP-OOO.

- Design Point NNN (Q_5=4.7, Q_{100}=12.8) consists of flow from Basins 122 and 125 along with bypass flow from DP-LLL. A sump inlet will be installed at this location in Road M to intercept the remaining street flow. This will connect with the storm system which releases into the West Pond along Powers Boulevard.

- Design Point OOO (Q_5=6.6, Q_{100}=15.2) consists of flow from Basins 123 and 124 along with street flow from DP-MMM. A sump inlet will be installed here to intercept the street flow on the west side of Road M. This will connect with the storm system which will release into the West Pond.

- Design Point PPP (Q_5=2.6, Q_{100}=8.6) consists of flow from Basin 130. This is a low point in Road L, where a sump inlet will be installed to intercept this flow. The inlet will connect to the main storm system and release into the West Pond.

- Design Point QQQ (Q_5=1.7, Q_{100}=6.0) consists of flow from Basin 131. This is a low point in Road L, where a sump inlet will be installed to intercept this flow. The inlet will connect to the main storm system and release into the West Pond.

- Design Point RRR (Q_5=3.1, Q_{100}=9.2) consists of flow from Basins 110, 111 and 126. Flows are combined at the intersection of Road L and Road O and continue to the south as gutter flow in Road L at DP-SSS.

- Design Point SSS (Q_5=4.7, Q_{100}=11.7) consists of flow from Basins 112 and 127 along with street flow from DP-RRR. It is anticipated that an ag-grade inlet will be installed to intercept the combined street flow. Flowby will continue south in Road L to DP-TTT.

- Design Point TTT (Q_5=5.9, Q_{100}=16.4) consists of flow from Basin 128 and bypass flow from DP-SSS This is a low point in Road L, where a sump inlet will be installed to intercept this flow. The inlet will connect to the main storm system and release into the West Pond.

- Design Point UUU (Q_5=5.7, Q_{100}=13.7) consists of flow from Basin 129 and flowby from the inlet at DP-100. This is a low point in Road L, where a sump inlet will be installed to intercept this flow. The inlet will connect to the main storm system and release into the West Pond.

- Design Point West Pond (Q_5=67.3, Q_{100}=123.6) consists of all of the flow from the Big Johnson portion of the site. This design point corresponds to Design Point BJD-M in the Waterview MDDP. Based on the detention pond spreadsheet, the release rate of the pond at this location is 1.9 cfs and 54.0 cfs for the 5 and 100-year events. The current pipes located under the roadway will be replaced with the new pipe/outlet for the pond.

Jimmy Camp Creek Basin

The area within the Jimmy Camp Creek Basin is approximately 147.0 acres. This area will include a portion of the commercial area along with residential. Flows will all be directed via curb and gutter to various inlets through the site, where all flows will release into the East Pond, which has been designed to release flows less than historic, into an existing drainageway east of the development. Below is a summary of the design points within the Jimmy Camp Creek Basin.

- Design Point A (Q_5=32.3, Q_{100}=56.3) consists of flow from Basin 3 along with bypass flow from the at-grade inlet in Basin 4. A sump inlet will be installed at this location in Road K to intercept the remaining street flow. This will connect with the storm system which releases into the East Pond.

- Design Point B (Q_5=3.6, Q_{100}=10.3) consists of flow from Basins 6 and 7. A sump inlet will be installed here to intercept the street flow on the east side of Road K. This will connect with the storm system which will release into the East Pond.

- Design Point C (Q_5=2.8, Q_{100}=8.0) consists of flow from Basins 9 and 10. Flows are combined at the intersection of Road U and Road P and continue to the south as gutter flow in Road P to DP-D.

- Design Point D (Q_5=3.6, Q_{100}=10.1) consists of flow from Basins 8 and 11 and street flow from DP-C. Flows are combined at the southwest intersection of Road U and Road P and continue to the south as gutter flow in Road P to DP-E.

- Design Point E (Q_5=7.3, Q_{100}=19.6) consists of flow from Basins 12 and 13 with street flow from DP-E. Flows are combined at the intersection of Road P and Road O and continue to the south as gutter flow in Road P to DP-F.

- Design Point F (Q_5=8.7, Q_{100}=23.3) consists of flow from Basin 14 and DP-E. Flows are combined at the intersection of Road P and Road O and continue to the south as gutter flow in Road P to DP-G.

- Design Point G (Q_5=12.2, Q_{100}=22.4) consists of flow from Basin 16. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue south in Road T to DP-H.

- Design Point H (Q_5=7.8, Q_{100}=18.3) consists of flow from Basin 15 and flow by from DP-G. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue south in Road M to DP-I.

- Design Point I (Q_5=5.2, Q_{100}=14.7) consists of flow from Basins 23 and 24 along with flow by from DP-H. Flows are combined at the intersection of Road Q and Road M and continue to the east as gutter flow in Road M to DP-J.

- Design Point J (Q_5=6.7, Q_{100}=17.1) consists of flow from Basin 28 and street flow from DP-I. Flows are combined at the intersection of Road Q and Road M and continue to the east as gutter flow in Road M to DP-K.

- Design Point K (Q_5=9.9, Q_{100}=22.3) consists of flow from Basins 29 and 30 with street flow from DP-J. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue east in Road M to DP-L.

- Design Point L (Q_5=4.1, Q_{100}=14.0) consists of flow from Basin 34 and by pass flow from DP-K. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue east in Road M to DP-M.

- Design Point M (Q_5=1.4, Q_{100}=8.4) consists of flow from Basins 35 and 36 along with by pass flow from DP-L. Flows are combined at the intersection of Road Z and Road M and continue to the east as gutter flow in Road M to DP-N.

- Design Point N (Q_5=3.8, Q_{100}=9.6) consists of flow from Basin 37 and DP-M. Flows are combined at the intersection of Road Z and Road M and continue to the east as gutter flow in Road M to DP-O.

- Design Point RR (Q_5=9.5, Q_{100}=25.5) consists of flow from Basins 32, 32 and 33 at the intersection of Road X with Road N. It is anticipated that an at-grade inlet will be needed to intercept these flows at the southwest corner of the intersection. Flowby will continue south in Road N to DP-O.

- Design Point O (Q_5=5.4, Q_{100}=17.0) consists of flow from Basins 38 and 39, along with street flow from DP-N and by pass flow DP-RR. It is anticipated that an at-grade inlet will be needed to intercept these flows at the northwest corner of Road N and Road M. Flowby will continue east in Road M to DP-SS.

- Design Point P (Q_5=10.8, Q_{100}=27.1) consists of flow from Basin 21and DP-F with by pass flow from a proposed at-grade inlet in Basin 22. It is anticipated that an at-grade inlet will be needed, at the southwest corner of Road Q and Road P to intercept these flows. Flowby will continue south in Road P to DP-Q.

- Design Point Q (Q_5=3.8, Q_{100}=17.3) consists of flow from Basin 27 and by pass flow from DP-P. It is anticipated that an at-grade inlet will be needed to intercept these flows at the southeast corner of the Road Q and Road P intersection. Flowby will continue south in Road P to DP-R.

- Design Point R (Q_5=0.7, Q_{100}=6.63) consists of flow from Basin 26 and flow by from the at-grade inlet at DP-Q. It is anticipated that an at-grade inlet will be needed at the southwest corner of Road N and Road P to intercept these flows. Flowby will continue south in Road P to DP-QQ.

- Design Point S (Q_5=14.6, Q_{100}=32.4) consists of flow from Basins 5, 52, 54 and 55 at the intersection of Road A and Road K. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue south in Road A to DP-T.

- Design Point Z (Q_5=9.7, Q_{100}=22.2) consists of flow from Basins 53, 64 and 65. Flows are combined at the intersection of Road E and Road D and continue to the south as gutter flow in Road E to DP-AA.

- Design Point AA (Q_5=12.6, Q_{100}=28.0) consists of flow from Basins 67 and 68 with street flow from DP-Z. It is anticipated that an at-grade inlet will be needed to intercept these flows at the southwest corner of the Road E and Road C intersection. Flowby will continue south in Road E to DP-LL.

- Design Point LL (Q_5=8.4, Q_{100}=25.5) consists of flow from Basin 77 and flow by from DP-AA. It is anticipated that an at-grade inlet, at the northeast corner of the Road E and Road H intersection, will be needed to intercept these flows. Flowby will continue south in Road E to DP-T.

- Design Point T (Q_5=3.7, Q_{100}=22.6) consists of flow from Basin 79, bypass flow from Basin 51, DP-S and DP-LL. A sump inlet will be installed at this location in Road A to intercept the remaining street flow. This will connect with the storm system which releases into the East Pond.

- Design Point U (Q_5=4.7, Q_{100}=11.5) consists of flow from Basins 19 and 43. Flows are combined at the intersection of Road A and Road O and continue to the south as gutter flow in Road A to DP-V.

- Design Point V (Q_5=5.2, Q_{100}=12.6) consists of flow from Basin 20 and DP-U. Flows are combined at the intersection of Road A and Road O and continue to the south as gutter flow in Road A to DP-W.

- Design Point W (Q_5=8.6, Q_{100}=19.2) consists of flow from Basin 44 and DP-V. It is anticipated that an at-grade inlet will be needed at the southwest corner of Road O and Road A to intercept these flows. Flowby will continue south in Road A to DP-X.

- Design Point X (Q_5=2.0, Q_{100}=9.6) consists of flow from Basin 50 and bypass flow from DP-W. A sump inlet will be installed at this location in Road A to intercept the remaining street flow. This will connect with the storm system which releases into the East Pond.

- Design Point Y (Q_5=5.0, Q_{100}=11.6) consists of flow from Basins 62 and 63. It is anticipated that an at-grade inlet will be needed to intercept these flows at the northeast corner of Road B and Road D. Flowby will continue east and then south in Road E to DP-MM.

- Design Point BB (Q_5=10.3, Q_{100}=24.8) consists of flow from Basin 56. A sump inlet will be installed at this location in Road H to intercept the street flow. This will connect with the storm system which releases into the East Pond.

- Design Point CC (Q_5=3.5, Q_{100}=9.2) consists of flow from Basins 68 and 69. Flows are combined at the northwest intersection of Road I and Road G and continue to the south as gutter flow in Road G to DP-DD.

- Design Point DD (Q_5=4.8, Q_{100}=12.4) consists of flow from Basin 70 and DP-CC. Flows are combined at the southwest intersection of Road I and Road G and continue to the south as gutter flow in Road G to DP-EE.

- Design Point EE (Q_5=8.0, Q_{100}=20.0) consists of flow from Basins 71 and 84 with street flow from DP-DD. Flows are combined at the intersection of Road J and Road G and continue to the south as gutter flow in Road G to DP-FF.

- Design Point FF (Q_5=9.2, Q_{100}=22.8) consists of flow from Basin 72 and DP-EE. It is anticipated that an at-grade inlet, at the southwest corner of Road J and Road G will be needed to intercept these flows. Flowby will continue south in Road G to DP-GG.

- Design Point GG (Q_5=8.9, Q_{100}=28.0) consists of flow from Basins 73 and 85 with flowby from DP-FF. It is anticipated that an at-grade inlet, at the northwest corner of Road G and Road F will be needed to intercept these flows. Flowby will continue south in Road G to DP-HH.

- Design Point HH (Q_5=8.1, Q_{100}=30.5) consists of flow from Basins 58 and 59 with bypass flow from DP-GG. It is anticipated that an at-grade inlet, at the southwest corner of Road G and Road F will be needed to intercept these flows. Flowby will continue south in Road G to DP-II.

- Design Point KK (Q_5=8.0, Q_{100}=19.2) consists of flow from Basins 57 and 76. A sump inlet will be installed at this location in Road H to intercept the remaining street flow. This will connect with the storm system which releases into the East Pond.

- Design Point II (Q_5=1.0, Q_{100}=14.9) consists of flow from Basin 74 along with street flow from DP-KK and bypass flow from DP-HH. A sump inlet will be installed here, on the west side of Road G to intercept the street flow. This will connect with the storm system which will release into the East Pond.

- Design Point JJ (Q_5=7.1, Q_{100}=17.3) consists of flow from Basin 75. A sump inlet will be installed at this location in Road G to intercept the east side of the street flow. This will connect with the storm system which releases into the East Pond.

- Design Point MM (Q_5=12.1, Q_{100}=20.3) consists of flow from Basin 78 along with bypass flow from DP-Y. A sump inlet will be installed here to intercept the street flow on the northeast corner of Road A and Road E. This will connect with the storm system which will release into the East Pond.

- Design Point VV (Q_5=5.4, Q_{100}=13.5) consists of flow from Basins 18 and 25. Flows are combined at the intersection of Road P and Road N and continue to the south as gutter flow in Road P to DP-NN.

- Design Point NN (Q_5=6.3, Q_{100}=15.5) consists of flow from Basins 45 and 46 with street flow from DP-NN. It is anticipated that an at-grade inlet will be needed to intercept these flows at the northeast corner of the intersection. Flowby will continue south in Road P to DP-OO.

- Design Point OO (Q_5=3.3, Q_{100}=10.4) consists of flow from Basins 47 and 80 with flowby from DP-NN. It is anticipated that an at-grade inlet will be needed at the north corner of the intersection of Roads P and E, to intercept these flows. Flowby will continue south in Road P to DP-PP.

- Design Point PP (Q_5=3.0, Q_{100}=10.6) consists of flow from Basin 81 and bypass flow from DP-OO. It is anticipated that an at-grade inlet will be needed to intercept these flows. Flowby will continue south in Road P to DP-QQ.

- Design Point QQ (Q_5=4.3, Q_{100}=17.6) consists of flow from Basins 48 and 82 along with flowby from DP-R and DP-PP. A sump inlet will be installed here to intercept all the remaining street flow in Road P. This will connect with the storm system which will release into the north side of the East Pond.

- D flow from Basin 40 and flowby from DP-O. Fl and Road M and continue to the east as gutter flo

Based on the GEC, overland flow from the back of the lots drain offsite for basins 17 and 86. Identify what drains off-site and it's impacts to the adjacent property. Are there recommended mitigation needed?

- Design Point TT (Q_5=7.0, Q_{100}=18.3) consists of flow from Basin 17. It is anticipated that an at-grade inlet will be needed to intercept these flows at the southeast corner of the Road M and N intersection. Flowby will continue east in Road M to DP-UU.

- Design Point UU (Q_5=17.2, Q_{100}=31.7) consists of flow from Basins 42 and 86 along with street flow from DP-SS and bypass flow from DP-TT. A sump inlet will be installed here to intercept the remaining street flow in Road M. This will connect with the storm system which will release into the south side of the East Pond.

- Design Point East Pond (Q_5=96.6, Q_{100}=154.7) consists of all of the flow from the Jimmy Camp Creek portion of the site. This design point corresponds to Design Point JCD-B, which has 170 cfs and 335 cfs for the existing minor and major storms in the Waterview MDDP Amendment. Based on the detention pond spreadsheet, the release rate of the pond at this location is 27.3 cfs and 140.4 cfs for the 5 and 100-year events, which are well below the existing flows at this location. The pond will release into an existing drainageway prior to exiting the development site and continue along the same flow path as shown under existing conditions.

DRAINAGE FACILITY DESIGN

General Concept

Waterview East is located within the Big Johnson and Jimmy Camp Creek Drainage Basins. Approximately one-third of the site drains towards the west in the Big Johnson Basin and the remaining two-thirds drains towards the east in the Jimmy Camp Basin.

Storm Sewer System

All development is anticipated to be urban and will include storm sewer and street inlets. Storm sewers collect storm water runoff and convey the runoff to water quality/detention facilities prior to discharging to historic drainages.

As commercial and residential development continues in this area, there will be a need for storm system design. Final Plat submittals will include details concerning inlet location, storm sewer sizing and locations as part of the Final Drainage Report for each submittal.

Identify who owns/maintains the two EDBs.

On-Site Water Quality & Detention

There are two proposed water quality/detention ponds on site that will provide water quality and detention for proposed improvements. All flows will pass through the outlet structures of one of the two proposed ponds. The outlet structures of the ponds will be designed to detain onsite flows and release at 90% of predevelopment flows plus any contributing offsite flows. Pond sizing calculations are provided in Appendix D.

The WQCV is treated through two proposed extended detention basins, East Pond and West Pond. There are no proposed major drainageways for the site that would need to be stabilized. Some site specific so t fencing placed around dov entrances, covered st

Add a section listing the 4 step process (ECM Appendix I Section I.7.2) and summarize how each step was considered/incorporated for the development.

Add a section for other government agency requirements.
-Identify that a "Non-Jurisdictional Water Impoundment Structure" application to the Colorado State Engineer is required prior to construction. A copy of the application shall be provided to El Paso County Planning & Community Development Department.

Add a section regarding Drainage and Bridge Fees.
- State that both basins are part of the drainage basin fee program. The applicable fees will be presented with the final drainage report.

Add a section regarding Drainage Infrastructure Costs
- State that presentation of an accurate, complete, current estimate of cost of proposed facilities will be presented with the final drainage report.

SUMM

Developme /3 of the site is within the l. This crossing will have a ric rates, as the Big Johnso

The Jimmy cation will have a detention

REFER

1. "City of Colorado Springs Drainage Criteria Manual Volume 1" May 2014.

2. Master Development Drainage Plan for Waterview, May 2006. Prepared by Merrick & Co.

3. “Big Johnson Reservoir/Crews Gulch Drainage Basin Planning Study”, Kiowa Engineering Corporation, September 1991.

4. Soils Survey of El Paso County Area, Natural Resources Conservation Services of Colorado.

5. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

6. “City of Colorado Springs Drainage Criteria Manual, Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices (BMPs)” May 2014.

7. “Engineering Criteria Manual El Paso County” January 9, 2006, Revised July 29, 2015.

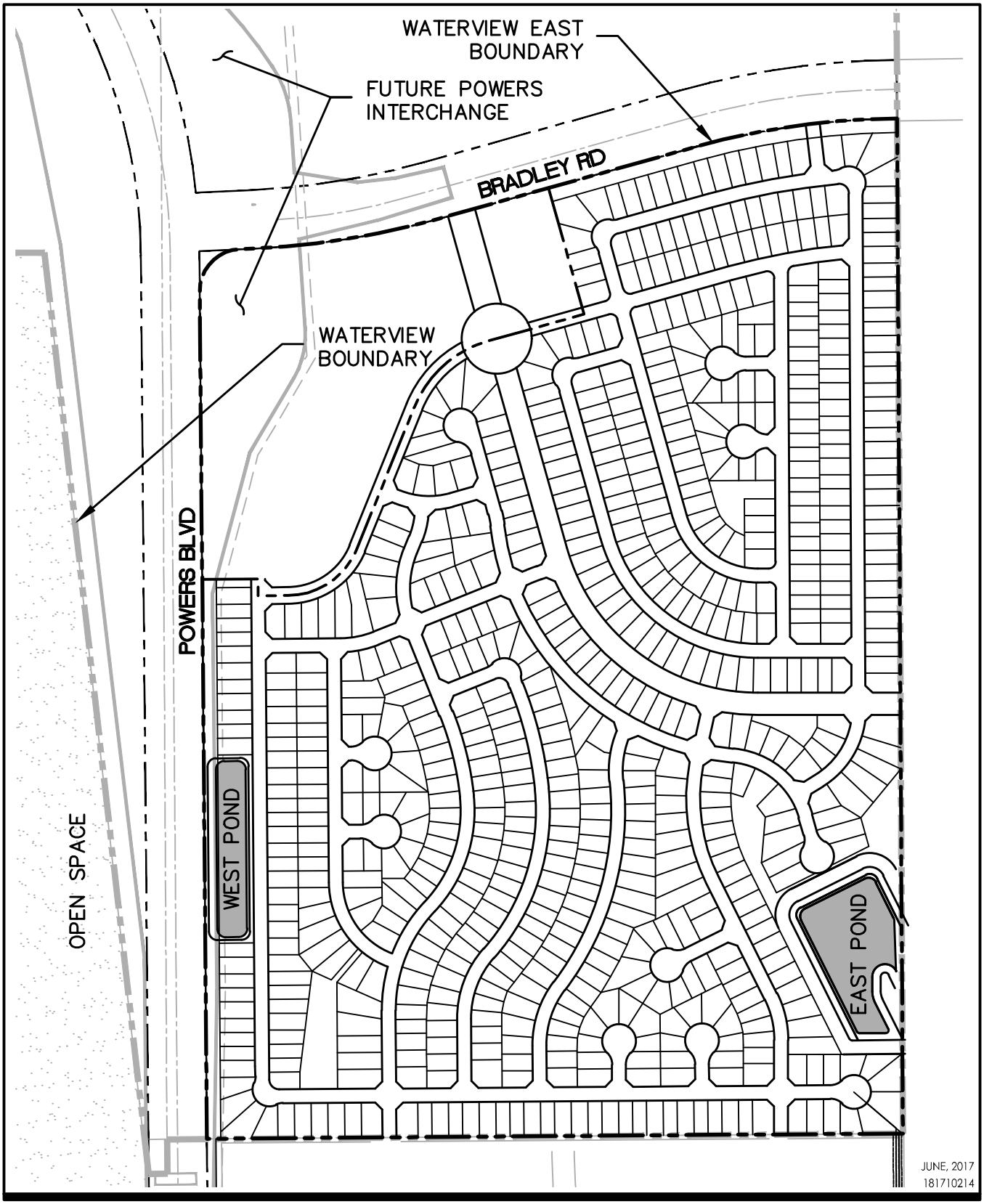
8. “Urban Storm Drainage Criteria Manual, Volume 1: Management, Hydrology & Hydraulics” Original September 1969, Updated January 2016.

9. “Urban Storm Drainage Criteria Manual, Volume 2: Structures, Storage & Recreation” Original September 1969, Updated January 2016.

10. “Urban Storm Drainage Criteria Manual, Volume 3: Stormwater Quality” Original September 1992, Updated November 2010.

11. “Amendment to Waterview Master Drainage Development Plan” July 21, 2014. Prepared by Springs Engineering.

Figure 1: Vicinity Map



V:\1817\ACTIVE\181710214\REPORTS\DRAINAGE\EXHIBITS\FIG01&02&03-VMAP&SOILS&FIRM.DWG
8/16/2017 3:37 PM

—N—

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Client/Project
CPR ENTITLEMENTS, LLC
WATERVIEW EAST

Figure No.
1.0

Title
VICINITY MAP

Figure 2: FIRM Map

NEW

CORPORATE LIMITS

EL PASO COUNTY
UNINCORPORATED AREAS
080059

CITY OF COLORADO SI
080060

8

9

16

17

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

ZONE X

ZONE A

38°45'00"
104°41'15"

JOINS PANEL 0956

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 768 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0768	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0768	F

MAP NUMBER
08041C0768 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

Figure 3: Existing Drainage Map

Move the existing and proposed drainage map at the end of the pdf file. The appendix identified this as back pocket.

JCD-C

JCD-2
5.0 | 26.6
9.25

JCD-B

C

JCD-1
43.2 | 231.5
120.14

EX. WATERVIEW EAST BOUNDARY

JCD-1A
9.0 | 48.2
20.80

BRADLEY RD

EX. TWIN 42" CMP'S

A

Fix so the red box outlining objects are not visible.

JIMMY CAMP BASIN

BIG JOHNSON BASIN

OS-1
6.3 | 33.5
12.66

BJD-13
19.1 | 102.1
46.18

JIMMY CAMP BASIN

BIG JOHNSON BASIN

BJD-13A
4.7 | 25.1
10.72

EX. 60" CMP

EX. 48" CMP

B

POWERS BLVD

BJD-M

Fix the north arrow orientation

1"=200'

200 0 200 400

N

Add a summary table for the DP/Basin Q5/Q100 flows

LEGEND

EXISTING 2' CONTOUR
EXISTING 10' CONTOUR

WATERVIEW BOUNDARY
MAJOR DRAINAGE BASIN BOUNDARY
DRAINAGE BASIN BOUNDARY

DESIGN POINT

N
LABEL
Q5 | Q100
AREA

BASIN LABEL

Computer File Information			
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Last Modification Date:	6-6-17	Initials:	BG
Full Path & Drawing File Name:	V:\1817\active\181710214\Reports\Drainage\Exhibits Ex BASIN Exhibits COS.dwg		
Acad Ver.	2014	Scale: see plan	Units: Feet

Index of Revisions

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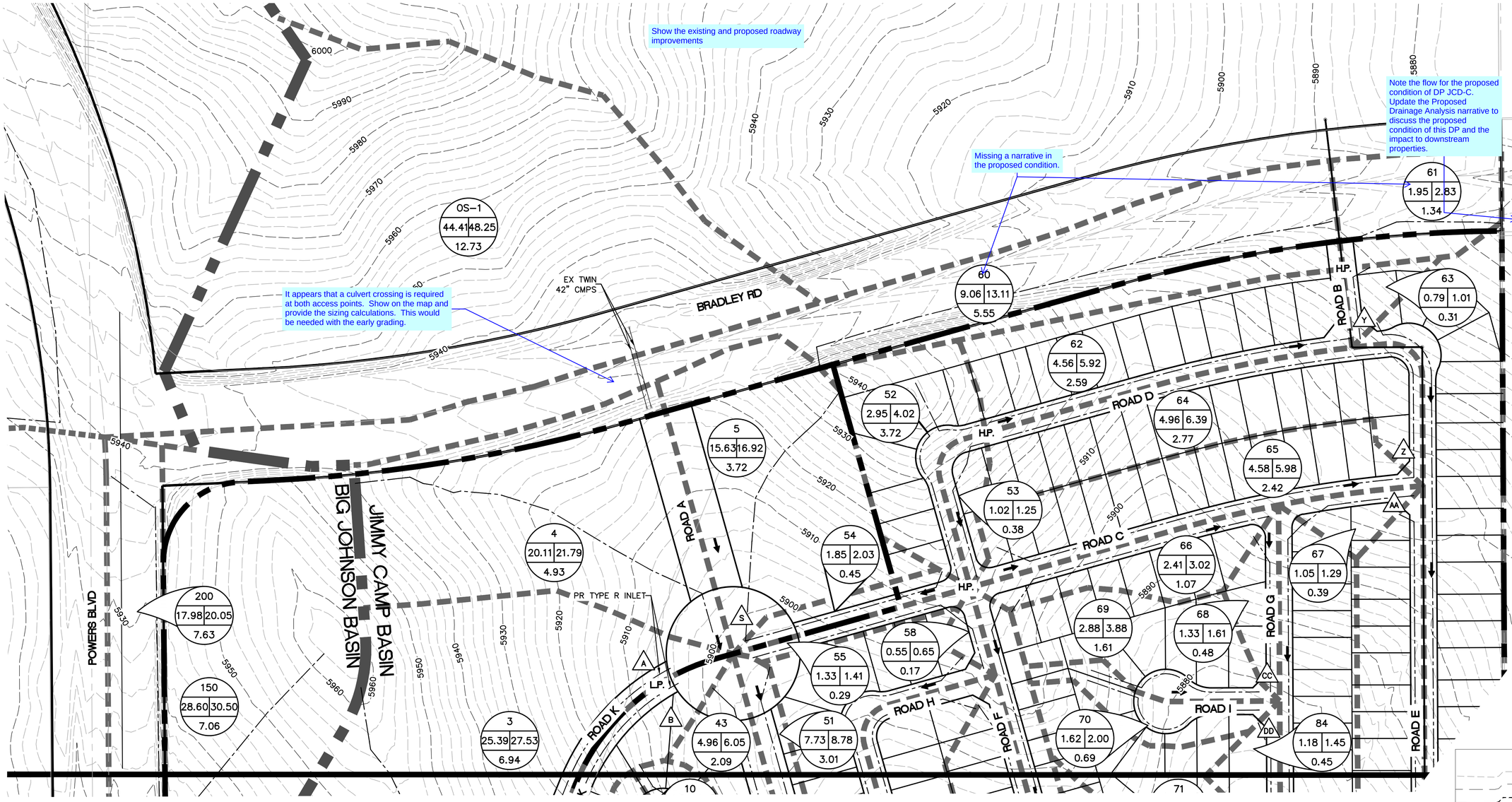
WATERVIEW EAST
EX. DRAINAGE PLAN

Designer:	BG	Structure Numbers	
Detailer:	PF		
Sheet Subset:			

Project No./Code
181710214

Sheet Number 1 of 1

Figure 4: Proposed Drainage Map



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B	3.6	10.3
C	2.8	8.0
D	3.6	10.1
E	7.3	19.6
F	8.7	23.3
G	12.2	22.4
H	7.8	18.3
I	5.2	14.7
J	6.7	17.1
K	9.9	22.3
L	4.1	14.0
M	1.4	8.4
N	3.8	9.6
O	5.4	17.0
P	10.8	27.1
Q	3.8	17.3
R	0.7	6.6
S	14.6	32.4
T	3.7	22.6
U	4.7	11.5
V	5.2	12.6
W	8.6	19.2
X	2.0	9.6
Y	5.0	11.6
Z	9.7	22.2
AA	12.5	28.0
BB	10.3	24.8
CC	3.5	9.2
DD	4.8	12.4
EE	8.0	20.0
FF	9.2	22.8
GG	8.9	27.9
HH	8.1	30.5
II	1.0	14.9
JJ	7.1	17.3
KK	8.0	19.2
LL	8.4	25.5
MM	12.1	20.3
NN	6.3	15.5
OO	3.3	10.4
PP	3.0	10.6
QQ	4.3	17.6
RR	9.5	25.5
SS	3.5	10.1
TT	7.0	18.3
UU	17.2	31.7
VV	5.4	13.5
AAA	3.0	8.6
BBB	4.0	11.1
CCC	9.2	22.3
DDD	3.0	8.0
EEE	4.4	11.5
FFF	2.6	9.8
GGG	3.8	13.2
HHH	2.4	7.9
III	6.8	21.2
JJJ	0.7	2.1
KKK	4.9	9.9
LLL	2.7	17.1
MMM	1.1	3.7
NNN	4.7	12.8
OOO	6.6	15.2
PPP	2.6	8.6
QQQ	1.7	6.0
RRR	3.1	9.2
SSS	4.7	11.7
TTT	5.9	16.4
UUU	5.7	13.7
EAST POND	29.5	56.9
WEST POND	27.2	56.8

LEGEND

- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- WATERVIEW BOUNDARY
- MAJOR DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN BOUNDARY
- PROPOSED 2' CONTOUR
- PROPOSED 10' CONTOUR
- DESIGN POINT
- BASIN LABEL (BASIN: Q5 | Q100 | AREA)

Computer File Information

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Last Modification Date: 12-16-16 Initials: BG

Full Path & Drawing File Name: V:\52876\active\187608731\Reports\Drainage\Exhibits\Pr Basin Exhibit

Acad Ver. 2014 Scale: see plan Units: Feet

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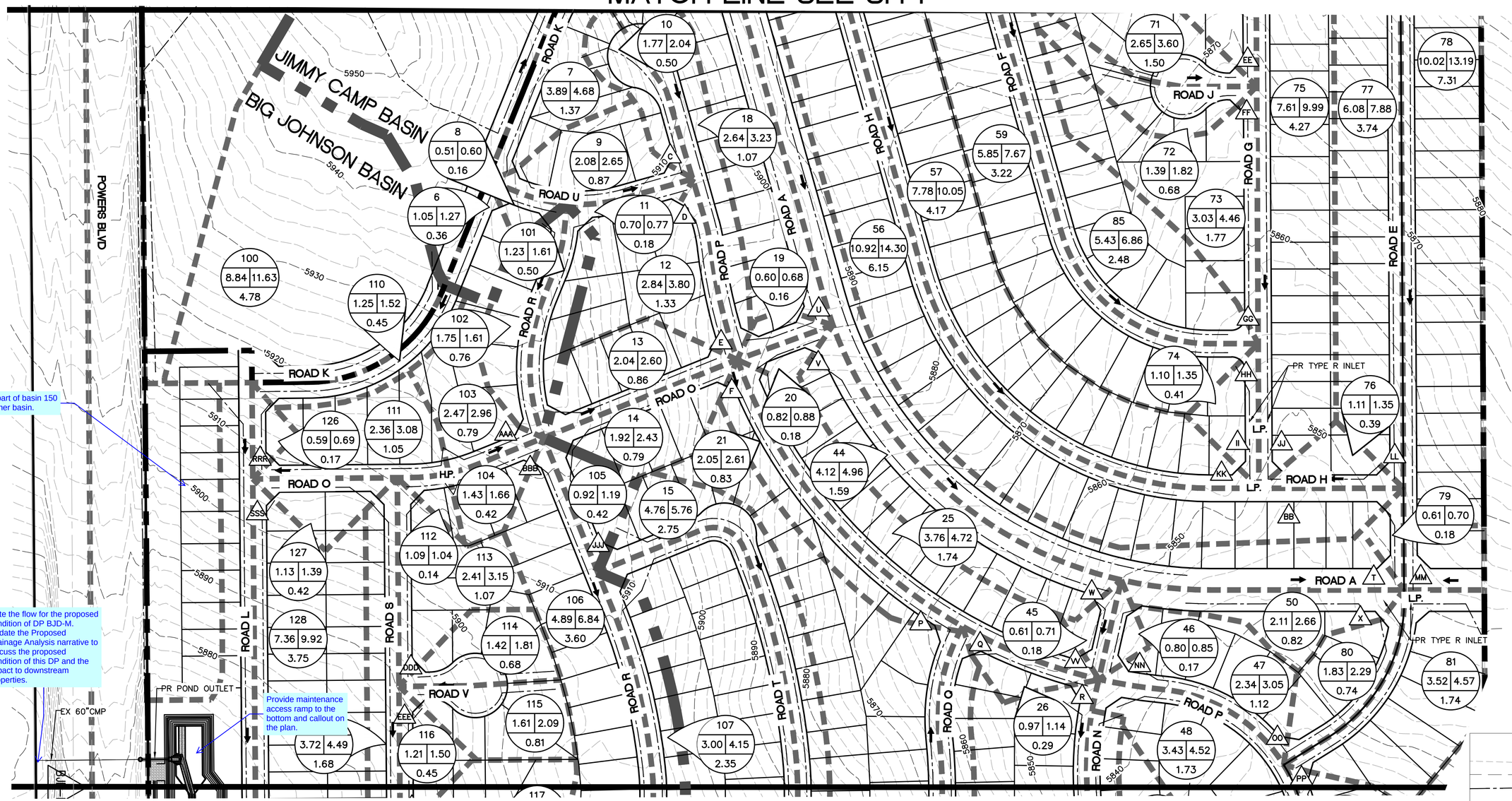
Sheet Number 1 of 3

MATCH LINE SEE SH 1



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E	7.3	19.6
F	8.7	23.3
G	12.2	22.4
H	7.8	18.3
I	5.2	14.7
J	6.7	17.1
K	9.9	22.3
L	4.1	14.0
M	1.4	8.4
N	3.8	9.6
O	5.4	17.0
P	10.8	27.1
Q	3.8	17.3
R	0.7	6.6
S	14.6	32.4
T	3.7	22.6
U	4.7	11.5
V	5.2	12.6
W	8.6	19.2
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Y	5.0	11.6
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AA	12.5	28.0
BB	10.3	24.8
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DD	4.8	12.4
EE	8.0	20.0
FF	9.2	22.8
GG	8.9	27.9
HH	8.1	30.5
II	1.0	14.9
JJ	7.1	17.3
KK	8.0	19.2
LL	8.4	25.5
MM	12.1	20.3
NN	6.3	15.5
OO	3.3	10.4
PP	3.0	10.6
QQ	4.3	17.6
RR	9.5	25.5
SS	3.5	10.1
TT	7.0	18.3
UU	17.2	31.7
VV	5.4	13.5
AAA	3.0	8.6
BBB	4.0	11.1
CCC	9.2	22.3
DDD	3.0	8.0
EEE	4.4	11.5
FFF	2.6	9.8
GGG	3.8	13.2
HHH	2.4	7.9
III	6.8	21.2
JJJ	0.7	2.1
KKK	4.9	9.9
LLL	2.7	17.1
MMM	1.1	3.7
NNN	4.7	12.8
OOO	6.6	15.2
PPP	2.6	8.6
QQQ	1.7	6.0
RRR	3.1	9.2
SSS	4.7	11.7
TTT	5.9	16.4
UUU	5.7	13.7
EAST POND	29.5	56.9
WEST POND	27.2	56.8

LEGEND

- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- WATERVIEW BOUNDARY
- MAJOR DRAINAGE BASIN BOUND
- DRAINAGE BASIN BOUNDARY
- PROPOSED 2' CONTOUR
- PROPOSED 10' CONTOUR
- DESIGN POINT
- BASIN LABEL (N / BASIN / Q5 Q100 / AREA)

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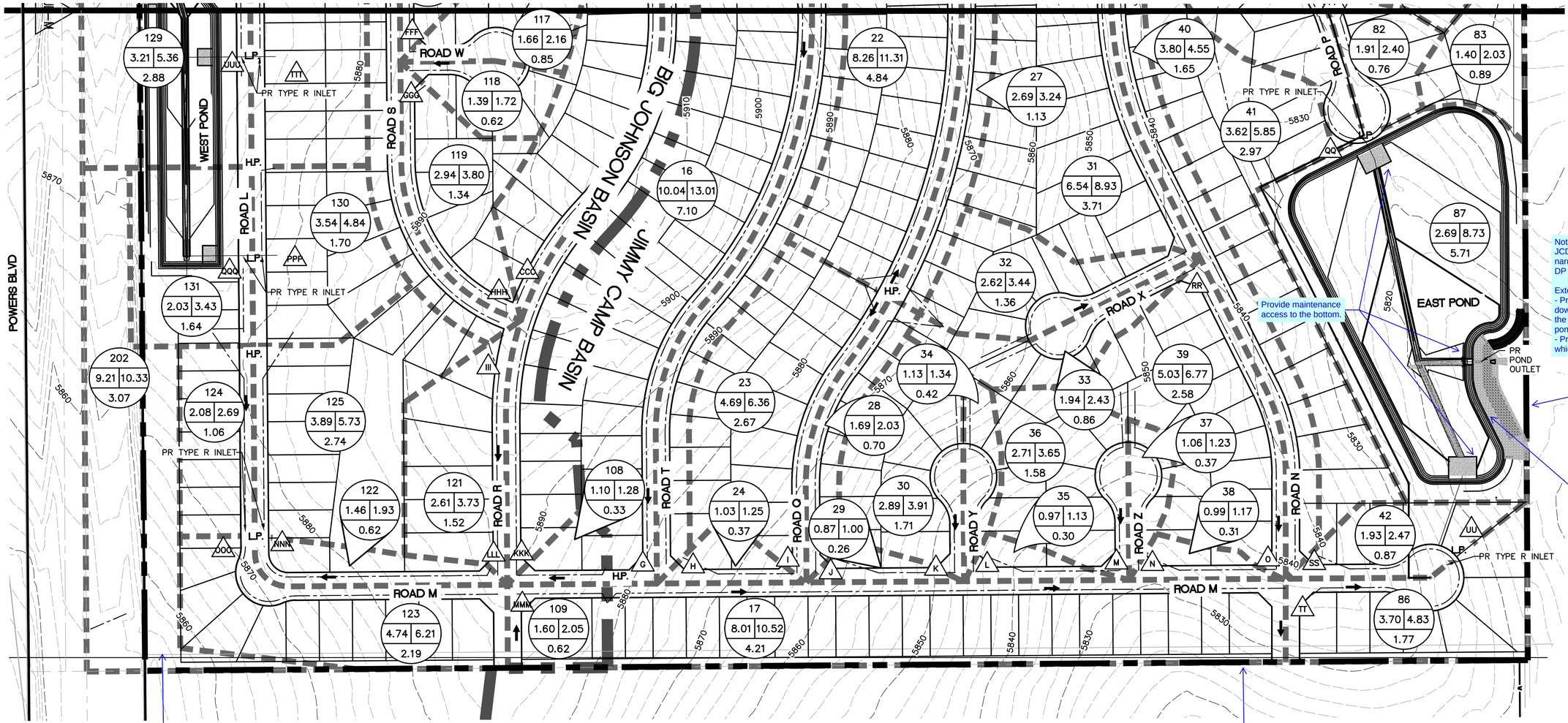
MATCH LINE SEE SH 3



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I	5.2	14.7
J	6.7	17.1
K	9.9	22.3
L	4.1	14.0
M	1.4	8.4
N	3.8	9.6
O	5.4	17.0
P	10.8	27.1
Q	3.8	17.3
R	0.7	6.6
S	14.6	32.4
T	3.7	22.6
U	4.7	11.5
V	5.2	12.6
W	8.6	19.2
X	2.0	9.6
KK	8.0	19.2
LL	8.4	25.5
MM	12.1	20.3
NN	6.3	15.5
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PP	3.0	10.6
QQ	4.3	17.6
RR	9.5	25.5
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FFF	2.6	9.8
GGG	3.8	13.2
HHH	2.4	7.9
III	6.8	21.2
JJJ	0.7	2.1
KKK	4.9	9.9
LLL	2.7	17.1
MMM	1.1	3.7
NNN	4.7	12.8
OOO	6.6	15.2
PPP	2.6	8.6
QQQ	1.7	6.0
RRR	3.1	9.2
SSS	4.7	11.7
TTT	5.9	16.4
UUU	5.7	13.7
EAST POND	29.5	56.9
WEST POND	27.2	56.8

Note the flow for the proposed condition of DP JCD-B. Update the Proposed Drainage Analysis narrative to discuss the proposed condition of this DP and the impact to downstream properties.

Extend the analysis further downstream.
- Provide analysis of the existing drainage way downstream for erosion stability with respect to the concentrated flow released by the proposed pond.
- Provide an embankment breach analysis. which includes a dam break inundation map.

Note the flow for the proposed condition of DP B. Update the Proposed Drainage Analysis narrative to discuss the proposed condition of this DP and the impact to downstream properties.

Add a pond summary table.

Note the flow for the proposed condition of DP C. Update the Proposed Drainage Analysis narrative to discuss the proposed condition of this DP and the impact to downstream properties.

1"=100

100 0 100 200

N

LEGEND

- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- WATERVIEW BOUNDARY
- MAJOR DRAINAGE BASIN BOUND
- DRAINAGE BASIN BOUNDARY
- PROPOSED 2' CONTOUR
- PROPOSED 10' CONTOUR
- DESIGN POINT
- BASIN LABEL

N
BASIN
Q5 Q100
AREA

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Sheet Number 3 of 3

Appendix A: NRCS Soil Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado

June 21, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:6,740 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
8	Blakeland loamy sand, 1 to 9 percent slopes	17.1	8.3%
31	Fort Collins loam, 3 to 8 percent slopes	0.0	0.0%
52	Manzanst clay loam, 0 to 3 percent slopes	21.0	10.2%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	137.8	67.0%
86	Stoneham sandy loam, 3 to 8 percent slopes	5.7	2.8%
108	Wiley silt loam, 3 to 9 percent slopes	24.3	11.8%
Totals for Area of Interest		**205.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Blakeland

Setting

Landform: Flats, hills
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

31—Fort Collins loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3684
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 48 to 52 degrees F
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Fort Collins

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 9 inches: loam
Bt - 9 to 16 inches: clay loam
Bk - 16 to 21 inches: clay loam
Ck - 21 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R067BY002CO)
Other vegetative classification: LOAMY PLAINS (069AY006CO)
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

52—Manzanst clay loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2w4nr
Elevation: 4,060 to 6,660 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Manzanst and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanst

Setting
Landform: Terraces, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Clayey alluvium derived from shale

Typical profile
A - 0 to 3 inches: clay loam
Bt - 3 to 12 inches: clay
Btk - 12 to 37 inches: clay
Bk1 - 37 to 52 inches: clay
Bk2 - 52 to 79 inches: clay

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 3 percent
Salinity, maximum in profile: Slightly saline (4.0 to 7.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: Saline Overflow (R067BY037CO)
Hydric soil rating: No

Minor Components

Ritoazul

Percent of map unit: 7 percent
Landform: Drainageways, interfluves
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Plains (R067BY042CO)
Hydric soil rating: No

Arvada

Percent of map unit: 6 percent
Landform: Drainageways, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Salt Flat (R067XY033CO)
Hydric soil rating: No

Wiley

Percent of map unit: 2 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Plains (R067BY002CO)
Hydric soil rating: No

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet

Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 45 percent
Tassel and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Shaly Plains (R067BY045CO)
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shaly Plains (R067BY045CO)
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

86—Stoneham sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b2
Elevation: 5,100 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Stoneham and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stoneham

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

A - 0 to 4 inches: sandy loam
Bt - 4 to 8 inches: sandy clay loam
Btk - 8 to 11 inches: sandy clay loam
Ck - 11 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: SANDY PLAINS (069AY026CO)
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

108—Wiley silt loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 367b
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Wiley

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty eolian deposits

Typical profile

A - 0 to 4 inches: silt loam
Bt - 4 to 16 inches: silt loam
Bk - 16 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R067BY002CO)
Other vegetative classification: LOAMY PLAINS (069AY006CO)
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

Appendix B: Existing Hydrology Calculations

Standard Form SF-1 . Time of Concentration

Project: Waterview East
Section: Existing Conditions

Created by: CMD Date: 1/13/2017
Checked by: CKC Date:

Urban TOC_{min} = 5 min
Rural TOC_{min} = 10 min

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)
									Type of Land Surface					TOTAL					
Basin ID	Description	C_5	Area (ac)	Length, L (ft)	Slope, s (ft/ft)	t_i (min) (1)	Length (ft)	S_w (ft/ft)	Code	Description	Convey Coef (C_v) (2)	Velocity (V) (ft/s) (3)	t_t Travel Time (min) (4)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min) (5)	$Tc_{max} > t_c$	
OS-1	Offsite Basin North of Bradley Rd	0.16	12.66	300	0.1	13.75	685	0.0642	4	Nearly bare ground	10.00	2.53	4.51	18.26	NO	985.00	15.47	Check	18.3
BJD-13	Part of Basin BJD-13 in MDDP	0.16	46.18	300	0.076667	15.01	1400	0.0486	4	Nearly bare ground	10.00	2.20	10.59	25.60	NO	1700.00	19.44	Check	25.6
BJD-13A	Part of Basin BJD-13 in MDDP	0.16	10.72	300	0.036667	19.15	555	0.0577	4	Nearly bare ground	10.00	2.40	3.85	23.00	NO	855.00	14.75	Check	23.0
JCD-2	Basin JCD-2 in MDDP	0.16	9.25	215	0.16744	9.82	965	0.0352	5	Grassed waterway	15.00	2.82	5.71	15.53	NO	1180.00	16.56	Check	15.5
JCD-1	Part of Basin JCD-1 in MDDP	0.16	120.14	300	0.113333	13.19	3090	0.0320	5	Grassed waterway	15.00	2.68	19.18	32.37	NO	3390.00	28.83	Check	32.4
JCD-1A	Part of Basin JCD-1 in MDDP	0.16	20.80	300	0.086667	14.41	960	0.0625	3	Short pasture and lawns	7.00	1.75	9.14	23.56	NO	1260.00	17.00	Check	23.6

Notes:
All Equations are from UDFCD Drainage Criteria Manual/Runoff
(1) $t_i = (0.395*(1.1-C_5)*(L^{0.5}))/(S^{0.33})$, from UDFCD Equation RO-3
(2) Cv from UDFCD Table RO-2
(3) Velocity from $V = C_v*S_w^{0.5}$, from UDFCD Equation RO-4
(4) $t_t = L/60V$
(5) t_i max = 10+L/180, from UDFCD Eqn RO-5

UDFCD Table RO-2	Land Surface Coefficients	
Code	Description	Cv
1	Heavy meadow	2.5
2	Tillage/field	5
3	Short pasture and lawns	7
4	Nearly bare ground	10
5	Grassed waterway	15
6	Paved areas and shallow paved swales	20
*7	Riprap (not buried)	7.0

* determined for the project based on UDFCD equations (Equation RO-4)

Standard Form SF-2 . Storm Drainage System Design (Rational Method Procedure)

Project: Waterview East
Section: Existing Conditions

Created by: CMD Date: 1/13/2017
Checked by: CKC Date:

Design Storm: 5-yr P = 1.50 in

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Offsite Basin North of Bradley Rd	A	OS-1	12.66	0.16	18.26	2.02	3.09	6.26													
Part of Basin BJD-13 in MDDP	BJD-M	BJD-13	46.18	0.16	25.60	7.39	2.58	19.06													
Part of Basin BJD-13 in MDDP	B	BJD-13A	10.72	0.16	23.00	1.71	2.74	4.70													
Basin JCD-2 in MDDP	JCD-C	JCD-2	9.25	0.16	15.53	1.48	3.35	4.96													
Part of Basin JCD-1 in MDDP	JCD-B	JCD-1	120.14	0.16	32.37	19.22	2.25	43.23													
Part of Basin JCD-1 in MDDP	C	JCD-1A	20.80	0.16	23.56	3.33	2.70	8.99													

Standard Form SF-2 . Storm Drainage System Design (Rational Method Procedure)

Project: Waterview East
Section: Existing Conditions

Created by: CMD Date: 1/13/2017
Checked by: CKC Date:

Design Storm: 100-yr P = 2.52 in

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		BASIN ID	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Offsite Basin North of Bradley Rd	1	OS-1	12.66	0.51	18.26	6.45	5.20	33.54													
Part of Basin BJD-13 in MDDP	1	BJD-13	46.18	0.51	25.60	23.55	4.33	102.07													
Part of Basin BJD-13 in MDDP	2	BJD-13A	10.72	0.51	23.00	5.47	4.60	25.14													
Basin JCD-2 in MDDP	3	JCD-2	9.25	0.51	15.53	4.72	5.63	26.55													
Part of Basin JCD-1 in MDDP	4	JCD-1	120.14	0.51	32.37	61.27	3.78	231.52													
Part of Basin JCD-1 in MDDP	5	JCD-1A	20.80	0.51	23.56	10.61	4.54	48.16													

All Equations follow UDFCD Rational Method

(1) Basin Description linked to C-Value Sheet
(2) Basin Design Point
(3) Enter the Basin Name from C-Value Sheet
(4) Basin Area linked to C-Value Sheet
(5) Composite C linked to C-Value Sheet
(6) Time of Concentration linked to SF-1 Sheet
(7) =Column 4 x Column 5
(8) =28.5*P/(10+Column 6)^0.786
(9) =Column 7 x Column 8
(10) =Column 6 + Column 21
(11) Add the C.A. Values Column 7 to get the cummulative C.A. Values
(12) =28.5*P/(10+Column 10)^0.786
(13) Sum of Qs
(14) Additional Street Longitudinal Slope
(15) Additional Street Overland Flow
(16) Additional Pipe Design Flow
(17) Additional Pipe Slope
(18) Additional Pipe Size
(19) Additional Flow Length
(20) Street or Pipe Velocity
(21) =Column 15 OR Column 16 OR Column 20 / 60

Update the DP labels to correspond with the map.

Appendix C: Proposed Hydrology Calculations

Runoff Coefficients (C-Values)

Project: Waterview East
Section: Proposed Conditions

Created by: CMD Date: 1/23/2017
Checked by: CKC Date:

Sub-Basin Data			Composite C		Parks			Commercial			Streets (Paved)			Residential (1/6 Ac or less)		
Basin ID	Description	Total Area (ac)	C_5	C_{100}	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)
OS-1	Offsite - Fut Commercial	12.73	0.81	0.88	0.12	0.39	0.00	0.81	0.88	12.73	0.90	0.96	0.00	0.38	0.55	0.00
JIMMY CAMP CREEK BASIN																
3	Fut Commercial	6.94	0.82	0.89	0.12	0.39	0.00	0.81	0.88	6.32	0.90	0.96	0.62	0.38	0.55	0.00
4	Fut Commercial	4.93	0.82	0.89	0.12	0.39	0.00	0.81	0.88	4.28	0.90	0.96	0.65	0.38	0.55	0.00
5	Fut Commercial	3.72	0.83	0.89	0.12	0.39	0.00	0.81	0.88	3.06	0.90	0.96	0.66	0.38	0.55	0.00
6	Residential & Road "K"	0.36	0.57	0.69	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.14	0.38	0.55	0.21
7	Residential & Road "K"	1.37	0.60	0.73	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.58	0.38	0.55	0.79
8	Residential & Road "U"	0.16	0.65	0.76	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.08	0.38	0.55	0.07
9	Residential & Road "U"	0.87	0.51	0.65	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	0.65
10	Residential & Road "P"	0.50	0.70	0.81	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.30	0.38	0.55	0.20
11	Residential & Road "U"	0.18	0.77	0.86	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.14	0.38	0.55	0.04
12	Residential & Road "P"	1.33	0.46	0.61	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.19	0.38	0.55	1.14
13	Residential & Road "O"	0.86	0.51	0.65	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	0.64
14	Residential & Road "O"	0.79	0.52	0.66	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	0.57
15	Residential & Road "T"	2.75	0.60	0.72	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	1.13	0.38	0.55	1.62
16	Residential & Road "T"	7.10	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	1.55	0.38	0.55	5.55
17	Residential & Road "M"	4.21	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.78	0.38	0.55	3.43
18	Residential & Road "P"	1.07	0.57	0.70	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.39	0.38	0.55	0.68
19	Residential & Road "O"	0.16	0.72	0.82	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.11	0.38	0.55	0.06
20	Residential & Road "O"	0.18	0.90	0.96	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.00
21	Residential & Road "P"	0.83	0.54	0.69	0.12	0.39	0.24	0.81	0.88	0.00	0.90	0.96	0.38	0.38	0.55	0.21
22	Residential & Road "Q"	4.84	0.43	0.59	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.48	0.38	0.55	4.36
23	Residential & Road "Q"	2.67	0.44	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.32	0.38	0.55	2.35
24	Residential & Road "M"	0.37	0.59	0.71	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.23
25	Residential & Road "P"	1.74	0.54	0.67	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.53	0.38	0.55	1.21
26	Residential & Road "P"	0.29	0.65	0.76	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.14
27	Residential & Road "Q"	1.13	0.60	0.73	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.48	0.38	0.55	0.65
28	Residential & Road "Q"	0.70	0.61	0.73	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.31	0.38	0.55	0.39
29	Residential & Road "M"	0.26	0.69	0.79	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.16	0.38	0.55	0.11
30	Residential & Road "Y"	1.71	0.44	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.21	0.38	0.55	1.50

Sub-Basin Data			Composite C		Parks			Commercial			Streets (Paved)			Residential (1/6 Ac or less)		
Basin ID	Description	Total Area (ac)	C_5	C_{100}	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)
31	Residential & Road "N"	3.71	0.43	0.59	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.39	0.38	0.55	3.32
32	Residential & Road "X"	1.36	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.25	0.38	0.55	1.10
33	Residential & Road "X"	0.86	0.54	0.68	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.26	0.38	0.55	0.60
34	Residential & Road "Y"	0.42	0.63	0.75	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.20	0.38	0.55	0.22
35	Residential & Road "M"	0.30	0.67	0.77	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.16	0.38	0.55	0.13
36	Residential & Road "Z"	1.58	0.45	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.21	0.38	0.55	1.37
37	Residential & Road "Z"	0.37	0.67	0.78	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.20	0.38	0.55	0.16
38	Residential & Road "M"	0.31	0.64	0.75	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.16	0.38	0.55	0.16
39	Residential & Road "N"	2.58	0.45	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.34	0.38	0.55	2.24
40	Residential & Road "N"	1.65	0.61	0.73	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.74	0.38	0.55	0.92
41	Park	2.97	0.32	0.51	0.12	0.39	0.74	0.81	0.88	0.00	0.90	0.96	0.00	0.38	0.55	2.24
42	Residential & Road "M"	0.87	0.51	0.65	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	0.65
43	Residential & Road "A"	2.09	0.58	0.71	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.81	0.38	0.55	1.29
44	Residential & Road "A"	1.59	0.60	0.73	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.69	0.38	0.55	0.91
45	Residential & Road "N"	0.18	0.67	0.78	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.10	0.38	0.55	0.08
46	Residential & Road "N"	0.17	0.91	0.97	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.17	0.38	0.55	0.00
47	Residential & Road "P"	1.12	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.23	0.38	0.55	0.90
48	Residential & Road "P"	1.73	0.48	0.64	0.12	0.39	0.20	0.81	0.88	0.00	0.90	0.96	0.45	0.38	0.55	1.08
50	Residential & Road "A" & Park	0.82	0.57	0.72	0.12	0.39	0.34	0.81	0.88	0.00	0.90	0.96	0.47	0.38	0.55	0.01
51	Residential & Road "A"	3.01	0.72	0.82	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	1.97	0.38	0.55	1.04
52	Residential & Road "D"	1.72	0.44	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.19	0.38	0.55	1.52
53	Residential & Road "D"	0.38	0.57	0.70	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.14	0.38	0.55	0.24
54	Residential & Road "C"	0.45	0.81	0.89	0.12	0.39	0.00	0.81	0.88	0.11	0.90	0.96	0.28	0.38	0.55	0.05
55	Residential & Road "C"	0.29	0.90	0.96	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.29	0.38	0.55	0.00
56	Residential & Road "H"	6.15	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	1.19	0.38	0.55	4.96
57	Residential & Road "H"	4.17	0.50	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.94	0.38	0.55	3.23
58	Residential & Road "F"	0.17	0.66	0.77	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.09	0.38	0.55	0.08
59	Residential & Road "F"	3.22	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.62	0.38	0.55	2.60
60	Bradley Road & Road "B"	5.55	0.38	0.55	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.00	0.38	0.55	5.55
61	Bradley Road & Road "B"	1.34	0.38	0.55	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.00	0.38	0.55	1.34
62	Residential & Road "D" & Road "B"	2.59	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.55	0.38	0.55	2.05
63	Residential & Road "B"	0.31	0.52	0.66	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.08	0.38	0.55	0.23
64	Residential & Road "D" & Road "E"	2.77	0.50	0.65	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.65	0.38	0.55	2.12

Sub-Basin Data			Composite C		Parks			Commercial			Streets (Paved)			Residential (1/6 Ac or less)		
Basin ID	Description	Total Area (ac)	C_5	C_{100}	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)
65	Residential & Road "C"	2.42	0.49	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.49	0.38	0.55	1.93
66	Residential & Road "C"	1.07	0.54	0.68	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.33	0.38	0.55	0.74
67	Residential & Road "C"	0.39	0.58	0.71	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.24
68	Residential & Road "G"	0.48	0.59	0.72	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.20	0.38	0.55	0.28
69	Residential & Road "I"	1.61	0.45	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.20	0.38	0.55	1.41
70	Residential & Road "I"	0.69	0.56	0.69	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.23	0.38	0.55	0.46
71	Residential & Road "J"	1.50	0.44	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.17	0.38	0.55	1.33
72	Residential & Road "J"	0.68	0.49	0.64	0.12	0.39	0.07	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.43
73	Residential & Road "G" & Park	1.77	0.38	0.57	0.12	0.39	0.50	0.81	0.88	0.00	0.90	0.96	0.27	0.38	0.55	1.00
74	Residential & Road "G"	0.41	0.56	0.70	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.27
75	Residential & Road "G"	4.27	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.79	0.38	0.55	3.48
76	Residential & Road "H"	0.39	0.58	0.71	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.24
77	Residential & Road "E"	3.74	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.81	0.38	0.55	2.92
78	Residential & Road "E"	7.31	0.47	0.62	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	1.33	0.38	0.55	5.98
79	Residential & Road "E"	0.18	0.67	0.78	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.10	0.38	0.55	0.08
80	Residential & Road "E"	0.74	0.54	0.68	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.23	0.38	0.55	0.51
81	Residential & Road "E"	1.74	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.37	0.38	0.55	1.37
82	Residential & Road "P"	0.76	0.53	0.67	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	0.53
83	Residential & Park	0.89	0.38	0.55	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.00	0.38	0.55	0.89
84	Residential & Road "G"	0.45	0.56	0.69	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.30
85	Residential & Road "F"	2.48	0.53	0.67	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.70	0.38	0.55	1.78
86	Residential & Road "M"	1.77	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.36	0.38	0.55	1.42
87	Pond	5.71	0.12	0.39	0.12	0.39	5.71	0.81	0.88	0.00	0.90	0.96	0.00	0.38	0.55	0.00
BIG JOHNSON BASIN																
100	Fut Commercial & Road "K"	4.78	0.47	0.62	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.87	0.38	0.55	3.91
101	Residential & Road "R"	0.50	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.10	0.38	0.55	0.40
102	Residential & Road "R"	0.76	0.51	0.65	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.58
103	Residential & Road "O"	0.79	0.61	0.73	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.35	0.38	0.55	0.44
104	Residential & Road "O"	0.42	0.68	0.79	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.24	0.38	0.55	0.18
105	Residential & Road "R"	0.42	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.09	0.38	0.55	0.33
106	Residential & Road "R"	3.60	0.41	0.57	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	3.38
107	Residential & Road "R"	2.35	0.42	0.58	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	2.17

Sub-Basin Data			Composite C		Parks			Commercial			Streets (Paved)			Residential (1/6 Ac or less)		
Basin ID	Description	Total Area (ac)	C_5	C_{100}	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)
108	Residential & Road "M"	0.33	0.66	0.77	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.15
109	Residential & Road "M & Road "R"	0.62	0.51	0.65	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.47
110	Residential & Road "K"	0.45	0.59	0.72	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.27
111	Residential & Road "O"	1.05	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.21	0.38	0.55	0.84
112	Residential & Road "O"	0.14	1.51	1.44	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.31	0.38	0.55	-0.17
113	Residential & Road "S"	1.07	0.49	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.22	0.38	0.55	0.86
114	Residential & Road "V"	0.68	0.52	0.66	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.50
115	Residential & Road "V"	0.81	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.63
116	Residential & Road "S"	0.45	0.56	0.69	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.30
117	Residential & Road "W"	0.85	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.18	0.38	0.55	0.67
118	Residential & Road "W"	0.62	0.55	0.69	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.21	0.38	0.55	0.41
119	Residential & Road "S"	1.34	0.50	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.31	0.38	0.55	1.04
120	Residential & Road "S"	1.68	0.60	0.72	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.71	0.38	0.55	0.97
121	Residential & Road "R"	1.52	0.41	0.58	0.12	0.39	0.36	0.81	0.88	0.00	0.90	0.96	0.27	0.38	0.55	0.90
122	Residential & Road "M" & Park	0.62	0.51	0.67	0.12	0.39	0.23	0.81	0.88	0.00	0.90	0.96	0.27	0.38	0.55	0.12
123	Residential & Road "M"	2.19	0.48	0.63	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.42	0.38	0.55	1.77
124	Residential & Road "L"	1.06	0.49	0.64	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.23	0.38	0.55	0.82
125	Residential & Road "L" & Park	2.74	0.38	0.56	0.12	0.39	0.48	0.81	0.88	0.00	0.90	0.96	0.23	0.38	0.55	2.03
126	Residential & Road "L"	0.17	0.66	0.77	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.10	0.38	0.55	0.08
127	Residential & Road "O"	0.42	0.56	0.69	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.15	0.38	0.55	0.27
128	Residential & Road "L"	3.75	0.45	0.60	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.49	0.38	0.55	3.27
129	Residential & Road "L" & Pond	2.88	0.32	0.53	0.12	0.39	1.88	0.81	0.88	0.00	0.90	0.96	0.60	0.38	0.55	0.41
130	Residential & Road "L"	1.70	0.43	0.59	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	0.17	0.38	0.55	1.53
131	Residential & Road "L" & Pond	1.64	0.30	0.51	0.12	0.39	0.82	0.81	0.88	0.00	0.90	0.96	0.17	0.38	0.55	0.64
150	ROW Fut Powers Ramp	7.06	0.90	0.96	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	7.06	0.38	0.55	0.00
200	Powers ROW	7.63	0.77	0.86	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	5.68	0.38	0.55	1.95
202	Powers ROW	3.07	0.75	0.84	0.12	0.39	0.00	0.81	0.88	0.00	0.90	0.96	2.19	0.38	0.55	0.88

Notes:

1. Runoff Coefficients (C-Values) determined by City of Colorado Springs Drainage Criteria Manual Vol. 1 Table 6-6

Standard Form SF-1 . Time of Concentration

Project: Waterview East
Section: Proposed Conditions

Created by: CMD
Checked by: CKC

Date: 1/23/2017
Date:

Urban TOC $_{min}$ = 5 min
Rural TOC $_{min}$ = 10 min

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)
									Type of Land Surface					TOTAL					
Basin ID	Description	C_5	Area (ac)	Length, L (ft)	Slope, s (%)	t_i (min) (1)	Length (ft)	S_w (%)	Code	Description	Convey Coef (C_v) (2)	Velocity (V) (ft/s) (3)	t_t Travel Time (min) (4)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min) (5)	$Tc_{max} > t_c$	
OS-1	Offsite - Fut Commercial	0.81	12.73	100	1.0%	5.24	885	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	3.30	8.53	YES	985.00	15.47	Check	8.5
JIMMY CAMP CREEK BASIN																			
3	Fut Commercial	0.82	6.94	100	4.5%	3.10	955	3.0%	6	Paved areas and shallow paved swales	20.00	3.46	4.59	7.69	YES	1055.00	15.86	Check	7.7
4	Fut Commercial	0.82	4.93	100	7.0%	2.64	670	3.9%	6	Paved areas and shallow paved swales	20.00	3.95	2.83	5.47	YES	770.00	14.28	Check	5.5
5	Fut Commercial	0.83	3.72	100	10.0%	2.32	425	6.4%	6	Paved areas and shallow paved swales	20.00	5.06	1.40	3.72	YES	525.00	12.92	Check	5.0
6	Residential & Road "K"	0.57	0.36	13	2.0%	2.76	125	4.9%	6	Paved areas and shallow paved swales	20.00	4.43	0.47	3.23	YES	138.00	10.77	Check	5.0
7	Residential & Road "K"	0.60	1.37	30	2.0%	3.91	540	3.0%	6	Paved areas and shallow paved swales	20.00	3.46	2.60	6.51	YES	570.00	13.17	Check	6.5
8	Residential & Road "U"	0.65	0.16	10	2.0%	2.04	105	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	0.62	2.66	YES	115.00	10.64	Check	5.0
9	Residential & Road "U"	0.51	0.87	45	2.0%	5.68	290	5.4%	6	Paved areas and shallow paved swales	20.00	4.65	1.04	6.72	YES	335.00	11.86	Check	6.7
10	Residential & Road "P"	0.70	0.50	55	2.0%	4.22	28	3.2%	6	Paved areas and shallow paved swales	20.00	3.58	0.13	4.35	YES	83.00	10.46	Check	5.0
11	Residential & Road "U"	0.77	0.18	60	2.0%	3.66	140	5.4%	6	Paved areas and shallow paved swales	20.00	4.65	0.50	4.16	YES	200.00	11.11	Check	5.0
12	Residential & Road "P"	0.46	1.33	40	2.0%	5.83	255	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	0.87	6.70	YES	295.00	11.64	Check	6.7
13	Residential & Road "O"	0.51	0.86	50	2.0%	5.98	270	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	0.92	6.90	YES	320.00	11.78	Check	6.9
14	Residential & Road "O"	0.52	0.79	50	2.0%	5.86	270	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	0.92	6.78	YES	320.00	11.78	Check	6.8
15	Residential & Road "T"	0.60	2.75	65	2.0%	5.84	1760	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	14.67	20.51	YES	1825.00	20.14	Check	20.5
16	Residential & Road "T"	0.49	7.10	65	2.0%	7.02	1695	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	14.13	21.15	YES	1760.00	19.78	Check	21.1
17	Residential & Road "M"	0.48	4.21	50	2.0%	6.33	1210	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	4.12	10.44	YES	1260.00	17.00	Check	10.4
18	Residential & Road "P"	0.57	1.07	50	2.0%	5.37	665	3.2%	6	Paved areas and shallow paved swales	20.00	3.58	3.10	8.47	YES	715.00	13.97	Check	8.5
19	Residential & Road "O"	0.72	0.16	50	2.0%	3.87	85	8.5%	6	Paved areas and shallow paved swales	20.00	5.83	0.24	4.11	YES	135.00	10.75	Check	5.0
20	Residential & Road "O"	0.90	0.18	50	2.0%	2.03	85	8.5%	6	Paved areas and shallow paved swales	20.00	5.83	0.24	2.27	YES	135.00	10.75	Check	5.0
21	Residential & Road "P"	0.54	0.83	40	2.0%	5.08	595	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	2.22	7.30	YES	635.00	13.53	Check	7.3
22	Residential & Road "Q"	0.43	4.84	55	2.0%	7.12	795	3.5%	6	Paved areas and shallow paved swales	20.00	3.74	3.54	10.66	YES	850.00	14.72	Check	10.7
23	Residential & Road "Q"	0.44	2.67	50	2.0%	6.69	515	1.3%	6	Paved areas and shallow paved swales	20.00	2.24	3.84	10.52	YES	565.00	13.14	Check	10.5

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)
										Type of Land Surface				TOTAL					
Basin ID	Description	C_5	Area (ac)	Length, L (ft)	Slope, s (%)	t_i (min) (1)	Length (ft)	S_w (%)	Code	Description	Convey Coef (C_v) (2)	Velocity (V) (ft/s) (3)	t_t Travel Time (min) (4)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min) (5)	$Tc_{max} > t_c$	
24	Residential & Road "M"	0.59	0.37	70	2.0%	6.18	140	5.8%	6	Paved areas and shallow paved swales	20.00	4.82	0.48	6.67	YES	210.00	11.17	Check	6.7
25	Residential & Road "P"	0.54	1.74	80	2.0%	7.23	785	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	2.93	10.15	YES	865.00	14.81	Check	10.2
26	Residential & Road "P"	0.65	0.29	45	2.0%	4.36	180	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	0.67	5.03	YES	225.00	11.25	Check	5.0
27	Residential & Road "Q"	0.60	1.13	100	2.0%	7.14	800	3.5%	6	Paved areas and shallow paved swales	20.00	3.74	3.56	10.71	YES	900.00	15.00	Check	10.7
28	Residential & Road "Q"	0.61	0.70	100	2.0%	7.03	490	1.3%	6	Paved areas and shallow paved swales	20.00	2.24	3.65	10.68	YES	590.00	13.28	Check	10.7
29	Residential & Road "M"	0.69	0.26	90	2.0%	5.59	140	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	0.48	6.07	YES	230.00	11.28	Check	6.1
30	Residential & Road "Y"	0.44	1.71	100	2.0%	9.46	250	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	2.08	11.55	YES	350.00	11.94	Check	11.5
31	Residential & Road "N"	0.43	3.71	45	2.0%	6.42	600	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	3.54	9.95	YES	645.00	13.58	Check	10.0
32	Residential & Road "X"	0.48	1.36	100	2.0%	8.94	345	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	1.17	10.11	YES	445.00	12.47	Check	10.1
33	Residential & Road "X"	0.54	0.86	100	2.0%	8.06	345	6.0%	6	Paved areas and shallow paved swales	20.00	4.90	1.17	9.24	YES	445.00	12.47	Check	9.2
34	Residential & Road "Y"	0.63	0.42	100	2.0%	6.77	250	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	2.08	8.85	YES	350.00	11.94	Check	8.9
35	Residential & Road "M"	0.67	0.30	70	2.0%	5.22	170	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	0.63	5.86	YES	240.00	11.33	Check	5.9
36	Residential & Road "Z"	0.45	1.58	100	2.0%	9.37	250	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	2.08	11.45	YES	350.00	11.94	Check	11.5
37	Residential & Road "Z"	0.67	0.37	100	2.0%	6.22	250	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	2.08	8.30	YES	350.00	11.94	Check	8.3
38	Residential & Road "M"	0.64	0.31	55	2.0%	4.94	170	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	0.63	5.57	YES	225.00	11.25	Check	5.6
39	Residential & Road "N"	0.45	2.58	30	2.0%	5.12	530	1.9%	6	Paved areas and shallow paved swales	20.00	2.72	3.25	8.37	YES	560.00	13.11	Check	8.4
40	Residential & Road "N"	0.61	1.65	45	2.0%	4.71	1190	1.9%	6	Paved areas and shallow paved swales	20.00	2.72	7.29	12.00	YES	1235.00	16.86	Check	12.0
41	Park	0.32	2.97	25	1.0%	7.08	400	5.0%	3	Short pasture and lawns	7.00	1.57	4.26	11.34	YES	425.00	12.36	Check	11.3
42	Residential & Road "M"	0.51	0.87	75	2.0%	7.34	200	2.7%	6	Paved areas and shallow paved swales	20.00	3.26	1.02	8.36	YES	275.00	11.53	Check	8.4
43	Residential & Road "A"	0.58	2.09	55	2.0%	5.53	730	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	4.30	9.84	YES	785.00	14.36	Check	9.8
44	Residential & Road "A"	0.60	1.59	70	2.0%	5.96	650	4.0%	6	Paved areas and shallow paved swales	20.00	4.00	2.71	8.67	YES	720.00	14.00	Check	8.7
45	Residential & Road "N"	0.67	0.18	20	2.0%	2.77	110	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	0.65	3.41	YES	130.00	10.72	Check	5.0
46	Residential & Road "N"	0.91	0.17	20	2.0%	1.23	110	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	0.65	1.88	YES	130.00	10.72	Check	5.0
47	Residential & Road "P"	0.48	1.12	65	2.0%	7.13	285	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	1.50	8.63	YES	350.00	11.94	Check	8.6
48	Residential & Road "P"	0.48	1.73	55	2.0%	6.57	605	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	3.19	9.75	YES	660.00	13.67	Check	9.8
50	Residential & Road "A" & Park	0.57	0.82	40	2.0%	4.83	325	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	2.71	7.54	YES	365.00	12.03	Check	7.5
51	Residential & Road "A"	0.72	3.01	65	2.0%	4.40	1560	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	9.19	13.59	YES	1625.00	19.03	Check	13.6
52	Residential & Road "D"	0.44	1.72	100	2.0%	9.50	290	3.0%	6	Paved areas and shallow paved swales	20.00	3.46	1.40	10.89	YES	390.00	12.17	Check	10.9

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)
									Type of Land Surface					TOTAL					
Basin ID	Description	C_5	Area (ac)	Length, L (ft)	Slope, s (%)	t_i (min) (1)	Length (ft)	S_w (%)	Code	Description	Convey Coef (C_v) (2)	Velocity (V) (ft/s) (3)	t_t Travel Time (min) (4)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min) (5)	$Tc_{max} > t_c$	
53	Residential & Road "D"	0.57	0.38	55	2.0%	5.63	170	3.0%	6	Paved areas and shallow paved swales	20.00	3.46	0.82	6.44	YES	225.00	11.25	Check	6.4
54	Residential & Road "C"	0.81	0.45	30	2.0%	2.25	370	1.7%	6	Paved areas and shallow paved swales	20.00	2.61	2.36	4.61	YES	400.00	12.22	Check	5.0
55	Residential & Road "C"	0.90	0.29	30	2.0%	1.55	365	1.7%	6	Paved areas and shallow paved swales	20.00	2.61	2.33	3.89	YES	395.00	12.19	Check	5.0
56	Residential & Road "H"	0.48	6.15	60	2.0%	6.89	1510	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	5.63	12.52	YES	1570.00	18.72	Check	12.5
57	Residential & Road "H"	0.50	4.17	65	2.0%	6.98	1375	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	5.12	12.11	YES	1440.00	18.00	Check	12.1
58	Residential & Road "F"	0.66	0.17	40	2.0%	4.02	75	3.0%	6	Paved areas and shallow paved swales	20.00	3.46	0.36	4.39	YES	115.00	10.64	Check	5.0
59	Residential & Road "F"	0.48	3.22	90	2.0%	8.44	925	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	3.45	11.89	YES	1015.00	15.64	Check	11.9
60	Bradley Road & Road "B"	0.38	5.55	40	50.0%	2.26	990	3.0%	5	Grassed waterway	15.00	2.60	6.35	8.61	YES	1030.00	15.72	Check	8.6
61	Bradley Road & Road "B"	0.38	1.34	100	2.0%	10.34	195	3.5%	5	Grassed waterway	15.00	2.81	1.16	11.50	YES	295.00	11.64	Check	11.5
62	Residential & Road "D" & Road "B"	0.49	2.59	100	2.0%	8.76	790	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	4.66	13.42	YES	890.00	14.94	Check	13.4
63	Residential & Road "B"	0.52	0.31	35	2.0%	4.92	115	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	0.96	5.88	YES	150.00	10.83	Check	5.9
64	Residential & Road "D" & Road "E"	0.50	2.77	30	2.0%	4.71	1060	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	8.83	13.54	YES	1090.00	16.06	Check	13.5
65	Residential & Road "C"	0.49	2.42	65	2.0%	7.12	735	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	3.87	10.99	YES	800.00	14.44	Check	11.0
66	Residential & Road "C"	0.54	1.07	75	2.0%	6.96	455	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	2.40	9.36	YES	530.00	12.94	Check	9.4
67	Residential & Road "C"	0.58	0.39	60	2.0%	5.80	160	3.8%	6	Paved areas and shallow paved swales	20.00	3.87	0.69	6.49	YES	220.00	11.22	Check	6.5
68	Residential & Road "G"	0.59	0.48	55	2.0%	5.39	240	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	1.26	6.66	YES	295.00	11.64	Check	6.7
69	Residential & Road "I"	0.45	1.61	100	2.0%	9.40	240	4.5%	6	Paved areas and shallow paved swales	20.00	4.24	0.94	10.34	YES	340.00	11.89	Check	10.3
70	Residential & Road "I"	0.56	0.69	100	2.0%	7.83	275	4.5%	6	Paved areas and shallow paved swales	20.00	4.24	1.08	8.91	YES	375.00	12.08	Check	8.9
71	Residential & Road "J"	0.44	1.50	100	2.0%	9.51	170	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	0.63	10.14	YES	270.00	11.50	Check	10.1
72	Residential & Road "J"	0.49	0.68	100	2.0%	8.72	190	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	0.71	9.43	YES	290.00	11.61	Check	9.4
73	Residential & Road "G" & Park	0.38	1.77	30	2.0%	5.63	405	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	2.13	7.76	YES	435.00	12.42	Check	7.8
74	Residential & Road "G"	0.56	0.41	55	2.0%	5.71	165	2.9%	6	Paved areas and shallow paved swales	20.00	3.41	0.81	6.52	YES	220.00	11.22	Check	6.5
75	Residential & Road "G"	0.48	4.27	35	2.0%	5.30	1315	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	6.93	12.23	YES	1350.00	17.50	Check	12.2
76	Residential & Road "H"	0.58	0.39	40	2.0%	4.74	180	3.0%	6	Paved areas and shallow paved swales	20.00	3.46	0.87	5.60	YES	220.00	11.22	Check	5.6
77	Residential & Road "E"	0.49	3.74	30	2.0%	4.77	1350	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	11.25	16.02	YES	1380.00	17.67	Check	16.0
78	Residential & Road "E"	0.47	7.31	25	2.0%	4.49	1960	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	16.33	20.82	YES	1985.00	21.03	Check	20.8
79	Residential & Road "E"	0.67	0.18	35	2.0%	3.64	100	4.0%	6	Paved areas and shallow paved swales	20.00	4.00	0.42	4.05	YES	135.00	10.75	Check	5.0
80	Residential & Road "E"	0.54	0.74	60	2.0%	6.22	275	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	1.02	7.24	YES	335.00	11.86	Check	7.2

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)							TOTAL	Tc CHECK (Urbanized basins)				FINAL Tc (min)
									Type of Land Surface										
Basin ID	Description	C_5	Area (ac)	Length, L (ft)	Slope, s (%)	t_i (min) (1)	Length (ft)	S_w (%)	Code	Description	Convey Coef (C_v) (2)	Velocity (V) (ft/s) (3)	t_t Travel Time (min) (4)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min) (5)	$Tc_{max} > t_c$	
81	Residential & Road "E"	0.49	1.74	80	2.0%	7.83	500	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	1.86	9.69	YES	580.00	13.22	Check	9.7
82	Residential & Road "P"	0.53	0.76	40	2.0%	5.15	245	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	1.29	6.44	YES	285.00	11.58	Check	6.4
83	Residential & Park	0.38	0.89	45	2.0%	6.94	225	5.0%	3	Short pasture and lawns	7.00	1.57	2.40	9.33	YES	270.00	11.50	Check	9.3
84	Residential & Road "G"	0.56	0.45	60	2.0%	6.04	165	5.0%	6	Paved areas and shallow paved swales	20.00	4.47	0.61	6.65	YES	225.00	11.25	Check	6.7
85	Residential & Road "F"	0.53	2.48	45	2.0%	5.52	1090	5.4%	6	Paved areas and shallow paved swales	20.00	4.65	3.91	9.43	YES	1135.00	16.31	Check	9.4
86	Residential & Road "M"	0.48	1.77	60	2.0%	6.85	325	2.7%	6	Paved areas and shallow paved swales	20.00	3.29	1.65	8.50	YES	385.00	12.14	Check	8.5
87	Pond	0.12	5.71	60	2.0%	10.90			6	Paved areas and shallow paved swales	20.00	0.00	0.00	10.90	YES	60.00	10.33	Check	10.9
BIG JOHNSON BASIN																			
100	Fut Commercial & Road "K"	0.47	4.78	100	2.0%	8.98	400	2.5%	6	Paved areas and shallow paved swales	20.00	3.16	2.11	11.09	YES	500.00	12.78	Check	11.1
101	Residential & Road "R"	0.48	0.50	20	2.0%	3.96	38	1.6%	6	Paved areas and shallow paved swales	20.00	2.53	0.25	4.21	YES	58.00	10.32	Check	5.0
102	Residential & Road "R"	0.51	0.76	30	2.0%	4.68	385	1.6%	6	Paved areas and shallow paved swales	20.00	2.53	2.54	7.22	YES	415.00	12.31	Check	7.2
103	Residential & Road "O"	0.61	0.79	35	2.0%	4.15	90	4.0%	6	Paved areas and shallow paved swales	20.00	4.00	0.38	4.53	YES	125.00	10.69	Check	5.0
104	Residential & Road "O"	0.68	0.42	35	2.0%	3.59	90	4.0%	6	Paved areas and shallow paved swales	20.00	4.00	0.38	3.96	YES	125.00	10.69	Check	5.0
105	Residential & Road "R"	0.49	0.42	55	2.0%	6.50	160	1.5%	6	Paved areas and shallow paved swales	20.00	2.45	1.09	7.59	YES	215.00	11.19	Check	7.6
106	Residential & Road "R"	0.41	3.60	35	2.0%	5.85	1210	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	10.08	15.94	YES	1245.00	16.92	Check	15.9
107	Residential & Road "R"	0.42	2.35	50	2.0%	6.91	1430	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	11.92	18.83	YES	1480.00	18.22	Check	18.8
108	Residential & Road "M"	0.66	0.33	15	2.0%	2.43	155	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	1.29	3.72	YES	170.00	10.94	Check	5.0
109	Residential & Road "M & Road "R"	0.51	0.62	20	2.0%	3.80	155	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	1.29	5.09	YES	175.00	10.97	Check	5.1
110	Residential & Road "K"	0.59	0.45	30	2.0%	4.01	490	2.4%	6	Paved areas and shallow paved swales	20.00	3.10	2.64	6.64	YES	520.00	12.89	Check	6.6
111	Residential & Road "O"	0.48	1.05	30	2.0%	4.86	370	2.6%	6	Paved areas and shallow paved swales	20.00	3.22	1.91	6.77	YES	400.00	12.22	Check	6.8
112	Residential & Road "O"	1.51	0.14	25	2.0%	-2.95	140	4.0%	6	Paved areas and shallow paved swales	20.00	4.00	0.58	-2.37	YES	165.00	10.92	Check	5.0
113	Residential & Road "S"	0.49	1.07	35	2.0%	5.23	300	2.3%	6	Paved areas and shallow paved swales	20.00	3.03	1.65	6.87	YES	335.00	11.86	Check	6.9
114	Residential & Road "V"	0.52	0.68	100	2.0%	8.38	180	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	1.50	9.88	YES	280.00	11.56	Check	9.9
115	Residential & Road "V"	0.49	0.81	100	2.0%	8.71	185	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	1.54	10.26	YES	285.00	11.58	Check	10.3
116	Residential & Road "S"	0.56	0.45	40	2.0%	4.93	190	2.3%	6	Paved areas and shallow paved swales	20.00	3.03	1.04	5.97	YES	230.00	11.28	Check	6.0
117	Residential & Road "W"	0.49	0.85	100	2.0%	8.73	220	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	1.83	10.57	YES	320.00	11.78	Check	10.6
118	Residential & Road "W"	0.55	0.62	100	2.0%	7.84	260	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	2.17	10.01	YES	360.00	12.00	Check	10.0

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)
									Type of Land Surface					TOTAL					
Basin ID	Description	C_5	Area (ac)	Length, L (ft)	Slope, s (%)	t_i (min) (1)	Length (ft)	S_w (%)	Code	Description	Convey Coef (C_v) (2)	Velocity (V) (ft/s) (3)	t_t Travel Time (min) (4)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min) (5)	$Tc_{max} > t_c$	
119	Residential & Road "S"	0.50	1.34	35	2.0%	5.10	445	1.5%	6	Paved areas and shallow paved swales	20.00	2.45	3.03	8.13	YES	480.00	12.67	Check	8.1
120	Residential & Road "S"	0.60	1.68	45	2.0%	4.82	1135	1.5%	6	Paved areas and shallow paved swales	20.00	2.45	7.72	12.55	YES	1180.00	16.56	Check	12.5
121	Residential & Road "R"	0.41	1.52	60	2.0%	7.69	360	4.0%	6	Paved areas and shallow paved swales	20.00	4.00	1.50	9.19	YES	420.00	12.33	Check	9.2
122	Residential & Road "M" & Park	0.51	0.62	15	2.0%	3.30	405	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	3.38	6.68	YES	420.00	12.33	Check	6.7
123	Residential & Road "M"	0.48	2.19	15	2.0%	3.45	490	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	4.08	7.53	YES	505.00	12.81	Check	7.5
124	Residential & Road "L"	0.49	1.06	100	2.0%	8.70	325	2.2%	6	Paved areas and shallow paved swales	20.00	2.97	1.83	10.52	YES	425.00	12.36	Check	10.5
125	Residential & Road "L" & Park	0.38	2.74	100	2.0%	10.37	300	2.2%	6	Paved areas and shallow paved swales	20.00	2.97	1.69	12.06	YES	400.00	12.22	Check	12.1
126	Residential & Road "L"	0.66	0.17	25	2.0%	3.13	100	5.4%	6	Paved areas and shallow paved swales	20.00	4.65	0.36	3.49	YES	125.00	10.69	Check	5.0
127	Residential & Road "O"	0.56	0.42	50	2.0%	5.45	145	2.6%	6	Paved areas and shallow paved swales	20.00	3.22	0.75	6.20	YES	195.00	11.08	Check	6.2
128	Residential & Road "L"	0.45	3.75	40	2.0%	5.93	620	5.4%	6	Paved areas and shallow paved swales	20.00	4.65	2.22	8.15	YES	660.00	13.67	Check	8.1
129	Residential & Road "L" & Pond	0.32	2.88	100	2.0%	11.23	795	5.4%	6	Paved areas and shallow paved swales	20.00	4.65	2.85	14.08	YES	895.00	14.97	Check	14.1
130	Residential & Road "L"	0.43	1.70	25	2.0%	4.80	160	1.0%	6	Paved areas and shallow paved swales	20.00	2.00	1.33	6.13	YES	185.00	11.03	Check	6.1
131	Residential & Road "L" & Pond	0.30	1.64	55	2.0%	8.48	135	0.8%	6	Paved areas and shallow paved swales	20.00	1.73	1.30	9.78	YES	190.00	11.06	Check	9.8
150	ROW Fut Powers Ramp	0.90	7.06	100	5.8%	2.02	935	2.0%	6	Paved areas and shallow paved swales	20.00	2.83	5.51	7.53	YES	1035.00	15.75	Check	7.5
200	Powers ROW	0.77	7.63	100	2.0%	4.78	1790	2.1%	5	Grassed waterway	15.00	2.17	13.72	18.51	YES	1890.00	20.50	Check	18.5
202	Powers ROW	0.75	3.07	70	2.0%	4.19	790	2.0%	5	Grassed waterway	15.00	2.12	6.21	10.40	YES	860.00	14.78	Check	10.4

Notes:

All Equations are from UDFCD Drainage Criteria Manual/Runoff

(1) $t_i = (0.395*(1.1-C_5)*(L^0.5))/(S^0.33)$, from UDFCD Equation RO-3

(2) Cv from UDFCD Table RO-2

(3) Velocity from $V = C_v*S_w^0.5$, from UDFCD Equation RO-4

(4) $t_t = L/60V$

(5) t_i max = 10+L/180, from UDFCD Eqn RO-5

UDFCD Table RO-2	Land Surface Coefficients	
Code	Description	Cv
1	Heavy meadow	2.5
2	Tillage/field	5
3	Short pasture and lawns	7
4	Nearly bare ground	10
5	Grassed waterway	15
6	Paved areas and shallow paved swales	20
*7	Riprap (not buried)	7.0

* determined for the project based on UDFCD equations (Equation RO-4)

Standard Form SF-2 . Storm Drainage System Design (Rational Method Procedure)

Project: Waterview East
Section: Proposed Conditions

Created by: CMD Date: 1/23/2017
Checked by: CKC Date:

Design Storm: 5-yr P = 1.50 in

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Offsite - Fut Commercial		OS-1	12.73	0.81	8.53	10.31	4.31	44.41													
JIMMY CAMP CREEK BASIN																					
Fut Commercial		3	6.94	0.82	7.69	5.68	4.47	25.39													
Fut Commercial		4	4.93	0.82	5.47	4.05	4.97	20.11													
Fut Commercial		5	3.72	0.83	5.00	3.07	5.09	15.63													
Residential & Road "K"		6	0.36	0.57	5.00	0.21	5.09	1.05													
Residential & Road "K"		7	1.37	0.60	6.51	0.82	4.72	3.89													
Residential & Road "U"		8	0.16	0.65	5.00	0.10	5.09	0.51	6.72	0.55	4.67	2.55									
Residential & Road "U"		9	0.87	0.51	6.72	0.44	4.67	2.08													
Residential & Road "P"		10	0.50	0.70	5.00	0.35	5.09	1.77													
Residential & Road "U"		11	0.18	0.77	5.00	0.14	5.09	0.70													
Residential & Road "P"		12	1.33	0.46	6.70	0.61	4.68	2.84													
Residential & Road "O"		13	0.86	0.51	6.90	0.44	4.63	2.04													
Residential & Road "O"		14	0.79	0.52	6.78	0.41	4.66	1.92	21.15	3.92	2.86	37.14									
Residential & Road "T"		15	2.75	0.60	20.51	1.63	2.91	4.76				28.76									
Residential & Road "T"		16	7.10	0.49	21.15	3.50	2.86	10.04													
Residential & Road "M"		17	4.21	0.48	10.44	2.01	3.99	8.01													
Residential & Road "P"		18	1.07	0.57	8.47	0.61	4.32	2.64													
Residential & Road "O"		19	0.16	0.72	5.00	0.12	5.09	0.60													
Residential & Road "O"		20	0.18	0.90	5.00	0.16	5.09	0.82													
Residential & Road "P"		21	0.83	0.54	7.30	0.45	4.55	2.05													
Residential & Road "Q"		22	4.84	0.43	10.66	2.09	3.96	8.26													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "Q"		23	2.67	0.44	10.52	1.18	3.98	4.69													
Residential & Road "M"		24	0.37	0.59	6.67	0.22	4.68	1.03													
Residential & Road "P"		25	1.74	0.54	10.15	0.93	4.03	3.76													
Residential & Road "P"		26	0.29	0.65	5.03	0.19	5.08	0.97	10.71	0.87	3.95	3.44									
Residential & Road "Q"		27	1.13	0.60	10.71	0.68	3.95	2.69													
Residential & Road "Q"		28	0.70	0.61	10.68	0.43	3.95	1.69													
Residential & Road "M"		29	0.26	0.69	6.07	0.18	4.82	0.87													
Residential & Road "Y"		30	1.71	0.44	11.55	0.75	3.83	2.89													
Residential & Road "N"		31	3.71	0.43	9.95	1.61	4.07	6.54													
Residential & Road "X"		32	1.36	0.48	10.11	0.65	4.04	2.62													
Residential & Road "X"		33	0.86	0.54	9.24	0.46	4.18	1.94													
Residential & Road "Y"		34	0.42	0.63	8.85	0.27	4.25	1.13													
Residential & Road "M"		35	0.30	0.67	5.86	0.20	4.87	0.97													
Residential & Road "Z"		36	1.58	0.45	11.45	0.71	3.84	2.71													
Residential & Road "Z"		37	0.37	0.67	8.30	0.24	4.35	1.06													
Residential & Road "M"		38	0.31	0.64	5.57	0.20	4.94	0.99													
Residential & Road "N"		39	2.58	0.45	8.37	1.16	4.34	5.03													
Residential & Road "N"		40	1.65	0.61	12.00	1.01	3.77	3.80													
Park		41	2.97	0.32	11.34	0.94	3.86	3.62													
Residential & Road "M"		42	0.87	0.51	8.36	0.44	4.34	1.93													
Residential & Road "A"		43	2.09	0.58	9.84	1.21	4.08	4.96													
Residential & Road "A"		44	1.59	0.60	8.67	0.96	4.28	4.12													
Residential & Road "N"		45	0.18	0.67	5.00	0.12	5.09	0.61													
Residential & Road "N"		46	0.17	0.91	5.00	0.16	5.09	0.80													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "P"		47	1.12	0.48	8.63	0.55	4.29	2.34													
Residential & Road "P"		48	1.73	0.48	9.75	0.84	4.10	3.43													
Residential & Road "A" & Park		50	0.82	0.57	7.54	0.47	4.50	2.11													
Residential & Road "A"		51	3.01	0.72	13.59	2.17	3.56	7.73													
Residential & Road "D"		52	1.72	0.44	10.89	0.75	3.92	2.95													
Residential & Road "D"		53	0.38	0.57	6.44	0.21	4.73	1.02													
Residential & Road "C"		54	0.45	0.81	5.00	0.36	5.09	1.85													
Residential & Road "C"		55	0.29	0.90	5.00	0.26	5.09	1.33													
Residential & Road "H"		56	6.15	0.48	12.52	2.95	3.70	10.92													
Residential & Road "H"		57	4.17	0.50	12.11	2.07	3.75	7.78													
Residential & Road "F"		58	0.17	0.66	5.00	0.11	5.09	0.55													
Residential & Road "F"		59	3.22	0.48	11.89	1.55	3.78	5.85													
Bradley Road & Road "B"		60	5.55	0.38	8.61	2.11	4.29	9.06													
Bradley Road & Road "B"		61	1.34	0.38	11.50	0.51	3.83	1.95													
Residential & Road "D" & Road "B"		62	2.59	0.49	13.42	1.27	3.59	4.56													
Residential & Road "B"		63	0.31	0.52	5.88	0.16	4.86	0.79													
Residential & Road "D" & Road "E"		64	2.77	0.50	13.54	1.39	3.57	4.96													
Residential & Road "C"		65	2.42	0.49	10.99	1.17	3.91	4.58													
Residential & Road "C"		66	1.07	0.54	9.36	0.58	4.16	2.41													
Residential & Road "C"		67	0.39	0.58	6.49	0.22	4.72	1.05													
Residential & Road "G"		68	0.48	0.59	6.66	0.28	4.69	1.33													
Residential & Road "I"		69	1.61	0.45	10.34	0.72	4.00	2.88													
Residential & Road "I"		70	0.69	0.56	8.91	0.38	4.24	1.62													
Residential & Road "J"		71	1.50	0.44	10.14	0.66	4.04	2.65													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "J"		72	0.68	0.49	9.43	0.34	4.15	1.39													
Residential & Road "G" & Park		73	1.77	0.38	7.76	0.68	4.45	3.03													
Residential & Road "G"		74	0.41	0.56	6.52	0.23	4.72	1.10													
Residential & Road "G"		75	4.27	0.48	12.23	2.04	3.73	7.61													
Residential & Road "H"		76	0.39	0.58	5.60	0.22	4.93	1.11													
Residential & Road "E"		77	3.74	0.49	16.02	1.84	3.30	6.08													
Residential & Road "E"		78	7.31	0.47	20.82	3.47	2.89	10.02													
Residential & Road "E"		79	0.18	0.67	5.00	0.12	5.09	0.61													
Residential & Road "E"		80	0.74	0.54	7.24	0.40	4.56	1.83													
Residential & Road "E"		81	1.74	0.49	9.69	0.86	4.11	3.52													
Residential & Road "P"		82	0.76	0.53	6.44	0.40	4.73	1.91													
Residential & Park		83	0.89	0.38	9.33	0.34	4.17	1.40													
Residential & Road "G"		84	0.45	0.56	6.65	0.25	4.69	1.18													
Residential & Road "F"		85	2.48	0.53	9.43	1.31	4.15	5.43													
Residential & Road "M"		86	1.77	0.48	8.50	0.86	4.31	3.70													
Pond		87	5.71	0.12	10.90	0.69	3.92	2.69													
BIG JOHNSON BASIN																					
Fut Commercial & Road "K"		100	4.78	0.47	11.09	2.27	3.89	8.84													
Residential & Road "R"		101	0.50	0.48	5.00	0.24	5.09	1.23													
Residential & Road "R"		102	0.76	0.51	7.22	0.38	4.57	1.75													
Residential & Road "O"		103	0.79	0.61	5.00	0.49	5.09	2.47													
Residential & Road "O"		104	0.42	0.68	5.00	0.28	5.09	1.43													
Residential & Road "R"		105	0.42	0.49	7.59	0.20	4.49	0.92													
Residential & Road "R"		106	3.60	0.41	15.94	1.48	3.31	4.89													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "R"		107	2.35	0.42	18.83	0.98	3.04	3.00													
Residential & Road "M"		108	0.33	0.66	5.00	0.22	5.09	1.10													
Residential & Road "M & Road "R"		109	0.62	0.51	5.09	0.32	5.06	1.60													
Residential & Road "K"		110	0.45	0.59	6.64	0.27	4.69	1.25													
Residential & Road "O"		111	1.05	0.48	6.77	0.51	4.66	2.36													
Residential & Road "O"		112	0.14	1.51	5.00	0.21	5.09	1.09													
Residential & Road "S"		113	1.07	0.49	6.87	0.52	4.64	2.41													
Residential & Road "V"		114	0.68	0.52	9.88	0.35	4.08	1.42													
Residential & Road "V"		115	0.81	0.49	10.26	0.40	4.02	1.61													
Residential & Road "S"		116	0.45	0.56	5.97	0.25	4.84	1.21													
Residential & Road "W"		117	0.85	0.49	10.57	0.42	3.97	1.66													
Residential & Road "W"		118	0.62	0.55	10.01	0.34	4.06	1.39													
Residential & Road "S"		119	1.34	0.50	8.13	0.67	4.38	2.94													
Residential & Road "S"		120	1.68	0.60	12.55	1.01	3.69	3.72													
Residential & Road "R"		121	1.52	0.41	9.19	0.62	4.19	2.61													
Residential & Road "M" & Park		122	0.62	0.51	6.68	0.31	4.68	1.46													
Residential & Road "M"		123	2.19	0.48	7.53	1.05	4.50	4.74													
Residential & Road "L"		124	1.06	0.49	10.52	0.52	3.98	2.08													
Residential & Road "L" & Park		125	2.74	0.38	12.06	1.03	3.76	3.89													
Residential & Road "L"		126	0.17	0.66	5.00	0.12	5.09	0.59													
Residential & Road "O"		127	0.42	0.56	6.20	0.24	4.79	1.13													
Residential & Road "L"		128	3.75	0.45	8.15	1.68	4.38	7.36													
Residential & Road "L" & Pond		129	2.88	0.32	14.08	0.92	3.51	3.21													
Residential & Road "L"		130	1.70	0.43	6.13	0.74	4.81	3.54													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "L" & Pond		131	1.64	0.30	9.78	0.50	4.09	2.03													
ROW Fut Powers Ramp		150	7.06	0.90	7.53	6.35	4.50	28.60													
Powers ROW		200	7.63	0.77	18.51	5.85	3.07	17.98													
Powers ROW		202	3.07	0.75	10.40	2.30	4.00	9.21													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		Design Storm:					100-yr		P =	2.52	in										
Offsite - Fut Commercial		OS-1	12.73	0.88	8.53	11.20	4.31	48.25													
JIMMY CAMP CREEK BASIN																					
Fut Commercial		3	6.94	0.89	7.69	6.16	4.47	27.53													
Fut Commercial		4	4.93	0.89	5.47	4.39	4.97	21.79													
Fut Commercial		5	3.72	0.89	5.00	3.33	5.09	16.92													
Residential & Road "K"		6	0.36	0.69	5.00	0.25	5.09	1.27													
Residential & Road "K"		7	1.37	0.73	6.51	0.99	4.72	4.68													
Residential & Road "U"		8	0.16	0.76	5.00	0.12	5.09	0.60	6.72	0.69	4.67	3.21									
Residential & Road "U"		9	0.87	0.65	6.72	0.57	4.67	2.65													
Residential & Road "P"		10	0.50	0.81	5.00	0.40	5.09	2.04													
Residential & Road "U"		11	0.18	0.86	5.00	0.15	5.09	0.77													
Residential & Road "P"		12	1.33	0.61	6.70	0.81	4.68	3.80													
Residential & Road "O"		13	0.86	0.65	6.90	0.56	4.63	2.60													
Residential & Road "O"		14	0.79	0.66	6.78	0.52	4.66	2.43	21.15	5.06	2.86	40.94									
Residential & Road "T"		15	2.75	0.72	20.51	1.98	2.91	5.76				29.76									
Residential & Road "T"		16	7.10	0.64	21.15	4.54	2.86	13.01													
Residential & Road "M"		17	4.21	0.63	10.44	2.64	3.99	10.52													
Residential & Road "P"		18	1.07	0.70	8.47	0.75	4.32	3.23													
Residential & Road "O"		19	0.16	0.82	5.00	0.13	5.09	0.68													
Residential & Road "O"		20	0.18	0.96	5.00	0.17	5.09	0.88													
Residential & Road "P"		21	0.83	0.69	7.30	0.57	4.55	2.61													
Residential & Road "Q"		22	4.84	0.59	10.66	2.86	3.96	11.31													
Residential & Road "Q"		23	2.67	0.60	10.52	1.60	3.98	6.36													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "M"		24	0.37	0.71	6.67	0.27	4.68	1.25													
Residential & Road "P"		25	1.74	0.67	10.15	1.17	4.03	4.72													
Residential & Road "P"		26	0.29	0.76	5.03	0.22	5.08	1.14	10.71	1.04	3.95	4.12									
Residential & Road "Q"		27	1.13	0.73	10.71	0.82	3.95	3.24													
Residential & Road "Q"		28	0.70	0.73	10.68	0.51	3.95	2.03													
Residential & Road "M"		29	0.26	0.79	6.07	0.21	4.82	1.00													
Residential & Road "Y"		30	1.71	0.60	11.55	1.02	3.83	3.91													
Residential & Road "N"		31	3.71	0.59	9.95	2.20	4.07	8.93													
Residential & Road "X"		32	1.36	0.63	10.11	0.85	4.04	3.44													
Residential & Road "X"		33	0.86	0.68	9.24	0.58	4.18	2.43													
Residential & Road "Y"		34	0.42	0.75	8.85	0.31	4.25	1.34													
Residential & Road "M"		35	0.30	0.77	5.86	0.23	4.87	1.13													
Residential & Road "Z"		36	1.58	0.60	11.45	0.95	3.84	3.65													
Residential & Road "Z"		37	0.37	0.78	8.30	0.28	4.35	1.23													
Residential & Road "M"		38	0.31	0.75	5.57	0.24	4.94	1.17													
Residential & Road "N"		39	2.58	0.60	8.37	1.56	4.34	6.77													
Residential & Road "N"		40	1.65	0.73	12.00	1.21	3.77	4.55													
Park		41	2.97	0.51	11.34	1.52	3.86	5.85													
Residential & Road "M"		42	0.87	0.65	8.36	0.57	4.34	2.47													
Residential & Road "A"		43	2.09	0.71	9.84	1.48	4.08	6.05													
Residential & Road "A"		44	1.59	0.73	8.67	1.16	4.28	4.96													
Residential & Road "N"		45	0.18	0.78	5.00	0.14	5.09	0.71													
Residential & Road "N"		46	0.17	0.97	5.00	0.17	5.09	0.85													
Residential & Road "P"		47	1.12	0.63	8.63	0.71	4.29	3.05													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "P"			48	1.73	0.64	9.75	1.10	4.10	4.52													
Residential & Road "A" & Park			50	0.82	0.72	7.54	0.59	4.50	2.66													
Residential & Road "A"			51	3.01	0.82	13.59	2.46	3.56	8.78													
Residential & Road "D"			52	1.72	0.60	10.89	1.02	3.92	4.01													
Residential & Road "D"			53	0.38	0.70	6.44	0.26	4.73	1.25													
Residential & Road "C"			54	0.45	0.89	5.00	0.40	5.09	2.03													
Residential & Road "C"			55	0.29	0.96	5.00	0.28	5.09	1.41													
Residential & Road "H"			56	6.15	0.63	12.52	3.87	3.70	14.30													
Residential & Road "H"			57	4.17	0.64	12.11	2.68	3.75	10.05													
Residential & Road "F"			58	0.17	0.77	5.00	0.13	5.09	0.65													
Residential & Road "F"			59	3.22	0.63	11.89	2.03	3.78	7.67													
Bradley Road & Road "B"			60	5.55	0.55	8.61	3.05	4.29	13.11													
Bradley Road & Road "B"			61	1.34	0.55	11.50	0.74	3.83	2.83													
Residential & Road "D" & Road "B"			62	2.59	0.64	13.42	1.65	3.59	5.92													
Residential & Road "B"			63	0.31	0.66	5.88	0.21	4.86	1.01													
Residential & Road "D" & Road "E"			64	2.77	0.65	13.54	1.79	3.57	6.39													
Residential & Road "C"			65	2.42	0.63	10.99	1.53	3.91	5.98													
Residential & Road "C"			66	1.07	0.68	9.36	0.72	4.16	3.02													
Residential & Road "C"			67	0.39	0.71	6.49	0.27	4.72	1.29													
Residential & Road "G"			68	0.48	0.72	6.66	0.34	4.69	1.61													
Residential & Road "I"			69	1.61	0.60	10.34	0.97	4.00	3.88													
Residential & Road "I"			70	0.69	0.69	8.91	0.47	4.24	2.00													
Residential & Road "J"			71	1.50	0.60	10.14	0.89	4.04	3.60													
Residential & Road "J"			72	0.68	0.64	9.43	0.44	4.15	1.82													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "G" & Park		73	1.77	0.57	7.76	1.00	4.45	4.46													
Residential & Road "G"		74	0.41	0.70	6.52	0.29	4.72	1.35													
Residential & Road "G"		75	4.27	0.63	12.23	2.68	3.73	9.99													
Residential & Road "H"		76	0.39	0.71	5.60	0.27	4.93	1.35													
Residential & Road "E"		77	3.74	0.64	16.02	2.39	3.30	7.88													
Residential & Road "E"		78	7.31	0.62	20.82	4.57	2.89	13.19													
Residential & Road "E"		79	0.18	0.78	5.00	0.14	5.09	0.70													
Residential & Road "E"		80	0.74	0.68	7.24	0.50	4.56	2.29													
Residential & Road "E"		81	1.74	0.64	9.69	1.11	4.11	4.57													
Residential & Road "P"		82	0.76	0.67	6.44	0.51	4.73	2.40													
Residential & Park		83	0.89	0.55	9.33	0.49	4.17	2.03													
Residential & Road "G"		84	0.45	0.69	6.65	0.31	4.69	1.45													
Residential & Road "F"		85	2.48	0.67	9.43	1.65	4.15	6.86													
Residential & Road "M"		86	1.77	0.63	8.50	1.12	4.31	4.83													
Pond		87	5.71	0.39	10.90	2.23	3.92	8.73													
BIG JOHNSON BASIN																					
Fut Commercial & Road "K"		100	4.78	0.62	11.09	2.99	3.89	11.63													
Residential & Road "R"		101	0.50	0.63	5.00	0.32	5.09	1.61													
Residential & Road "R"		102	0.76	0.65	7.22	0.49	4.57	2.25													
Residential & Road "O"		103	0.79	0.73	5.00	0.58	5.09	2.96													
Residential & Road "O"		104	0.42	0.79	5.00	0.33	5.09	1.66													
Residential & Road "R"		105	0.42	0.64	7.59	0.27	4.49	1.19													
Residential & Road "R"		106	3.60	0.57	15.94	2.07	3.31	6.84													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "R"		107	2.35	0.58	18.83	1.36	3.04	4.15													
Residential & Road "M"		108	0.33	0.77	5.00	0.25	5.09	1.28													
Residential & Road "M & Road "R"		109	0.62	0.65	5.09	0.41	5.06	2.05													
Residential & Road "K"		110	0.45	0.72	6.64	0.32	4.69	1.52													
Residential & Road "O"		111	1.05	0.63	6.77	0.66	4.66	3.08													
Residential & Road "O"		112	0.14	1.44	5.00	0.20	5.09	1.04													
Residential & Road "S"		113	1.07	0.63	6.87	0.68	4.64	3.15													
Residential & Road "V"		114	0.68	0.66	9.88	0.44	4.08	1.81													
Residential & Road "V"		115	0.81	0.64	10.26	0.52	4.02	2.09													
Residential & Road "S"		116	0.45	0.69	5.97	0.31	4.84	1.50													
Residential & Road "W"		117	0.85	0.64	10.57	0.54	3.97	2.16													
Residential & Road "W"		118	0.62	0.69	10.01	0.42	4.06	1.72													
Residential & Road "S"		119	1.34	0.64	8.13	0.87	4.38	3.80													
Residential & Road "S"		120	1.68	0.72	12.55	1.21	3.69	4.49													
Residential & Road "R"		121	1.52	0.58	9.19	0.89	4.19	3.73													
Residential & Road "M" & Park		122	0.62	0.67	6.68	0.41	4.68	1.93													
Residential & Road "M"		123	2.19	0.63	7.53	1.38	4.50	6.21													
Residential & Road "L"		124	1.06	0.64	10.52	0.68	3.98	2.69													
Residential & Road "L" & Park		125	2.74	0.56	12.06	1.52	3.76	5.73													
Residential & Road "L"		126	0.17	0.77	5.00	0.14	5.09	0.69													
Residential & Road "O"		127	0.42	0.69	6.20	0.29	4.79	1.39													
Residential & Road "L"		128	3.75	0.60	8.15	2.27	4.38	9.92													
Residential & Road "L" & Pond		129	2.88	0.53	14.08	1.53	3.51	5.36													
Residential & Road "L"		130	1.70	0.59	6.13	1.01	4.81	4.84													

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (A) (AC)	RUNOFF COEFF (C)	t_c (MIN)	C.A. (AC)	I (IN / HR)	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (INCHES)	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Residential & Road "L" & Pond		131	1.64	0.51	9.78	0.84	4.09	3.43													
ROW Fut Powers Ramp		150	7.06	0.96	7.53	6.78	4.50	30.50													
Powers ROW		200	7.63	0.86	18.51	6.53	3.07	20.05													
Powers ROW		202	3.07	0.84	10.40	2.58	4.00	10.33													

All Equations follow UDFCD Rational Method

(1) Basin Description linked to C-Value Sheet
(2) Basin Design Point
(3) Enter the Basin Name from C-Value Sheet
(4) Basin Area linked to C-Value Sheet
(5) Composite C linked to C-Value Sheet
(6) Time of Concentration linked to SF-1 Sheet
(7) =Column 4 x Column 5
(8) =28.5*P/(10+Column 6)^0.786
(9) =Column 7 x Column 8
(10) =Column 6 + Column 21
(11) Add the C.A. Values Column 7 to get the cummulative C.A. Values
(12) =28.5*P/(10+Column 10)^0.786
(13) Sum of Qs
(14) Additional Street Longitudinal Slope
(15) Additional Street Overland Flow
(16) Additional Pipe Design Flow
(17) Additional Pipe Slope
(18) Additional Pipe Size
(19) Additional Flow Length
(20) Street or Pipe Velocity
(21) =Column 15 OR Column 16 OR Column 20 / 60

WATERVIEW EAST
SURFACE ROUTING - NO INLETS

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
Jimmy Camp Creek Basin								
A	3	5.68	6.16	7.7	4.5	7.8	43.7	82.7
	4	4.05	4.39	TRAVEL TIME				
		9.73	10.55	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
						3.5	0.0	7.7
B	6	0.21	0.25	6.5	3.5	8.3	3.6	10.3
	7	0.82	0.99	TRAVEL TIME				
		1.03	1.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
					270	4.4	1.0	7.5
C	9	0.44	0.57	6.7	3.5	8.2	2.8	8.0
	10	0.35	0.40	TRAVEL TIME				
		0.79	0.97	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.6	0.2	6.9
D	8	0.10	0.12	6.9	3.5	8.2	3.6	10.1
	11	0.14	0.15					
	DP C	0.79	0.97	TRAVEL TIME				
		1.03	1.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	300	2.8	1.8	8.7
E	12	0.61	0.81	8.7	3.5	7.5	7.3	19.6
	13	0.44	0.56					
	DP D	1.03	1.24	TRAVEL TIME				
		2.08	2.61	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	4.9	0.1	8.8
F	14	0.41	0.52	8.8	3.5	7.4	8.7	23.3
	DP E	2.08	2.61	TRAVEL TIME				
		2.49	3.14	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	590	4.9	2.0	10.8
G	16	3.50	4.54	21.1	3.5	4.9	12.2	22.4
				TRAVEL TIME				
		3.50	4.54	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	21.5
H	15	1.63	1.98	20.5	3.5	5.0	17.9	32.7
	DP G	3.50	4.54	TRAVEL TIME				
		5.14	6.52	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.0	1.5	22.0
I	23	1.18	1.60	22.0	3.5	4.8	22.8	40.6
	24	0.22	0.27					
	DP H	5.14	6.52	TRAVEL TIME				
		6.54	8.39	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.2	0.3	22.3

WATERVIEW EAST
SURFACE ROUTING - INLET DESIGN

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
Jimmy Camp Creek Basin								
A	3	5.68	6.16	7.7	4.5	7.8	32.3	56.3
	4 (Bypass from Inlet)	1.51	1.02	TRAVEL TIME				
		7.20	7.18	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
						3.5	0.0	7.7
B	6	0.21	0.25	6.5	3.5	8.3	3.6	10.3
	7	0.82	0.99	TRAVEL TIME				
		1.03	1.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
					270	4.4	1.0	7.5
C	9	0.44	0.57	6.7	3.5	8.2	2.8	8.0
	10	0.35	0.40	TRAVEL TIME				
		0.79	0.97	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.6	0.2	6.9
D	8	0.10	0.12	6.9	3.5	8.2	3.6	10.1
	11	0.14	0.15					
	DP C	0.79	0.97	TRAVEL TIME				
		1.03	1.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	300	2.8	1.8	8.7
E	12	0.61	0.81	8.7	3.5	7.5	7.3	19.6
	13	0.44	0.56					
	DP D	1.03	1.24	TRAVEL TIME				
		2.08	2.61	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	4.9	0.1	8.8
F	14	0.41	0.52	8.8	3.5	7.4	8.7	23.3
	DP E	2.08	2.61	TRAVEL TIME				
		2.49	3.14	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	590	4.9	2.0	10.8
G	16	3.50	4.54	21.1	3.5	4.9	12.2	22.4
				TRAVEL TIME				
		3.50	4.54	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	21.5
H	15	1.63	1.98	20.5	3.5	5.0	7.8	18.3
	DP G (Bypass)	0.60	1.67	TRAVEL TIME				
		2.24	3.65	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.0	1.5	22.0
I	23	1.18	1.60	22.0	3.5	4.8	5.2	14.7
	24	0.22	0.27					
	DP H (Bypass)	0.09	1.18	TRAVEL TIME				
		1.48	3.04	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.2	0.3	22.3

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
J	28	0.43	0.51	22.3	3.5	4.8	6.7	17.1
	DP I	1.48	3.04	TRAVEL TIME				
		1.91	3.56	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.2	1.3	23.6
K	29	0.18	0.21	23.6	3.5	4.7	9.9	22.3
	30	0.75	1.02					
	DP I	1.91	3.56	TRAVEL TIME				
		2.85	4.79	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	23.9
L	34	0.27	0.31	23.9	3.5	4.6	4.1	14.0
	DP K (Bypass)	0.92	2.71	TRAVEL TIME				
		1.18	3.02	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.0	1.5	25.4
M	35	0.20	0.23	25.4	3.5	4.5	1.4	8.4
	36	0.20	0.95					
	DP L (Bypass)	0.00	0.69	TRAVEL TIME				
		0.40	1.88	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	25.7
N	37	0.71	0.28	25.7	3.5	4.4	3.8	9.6
	DP M	0.40	1.88	TRAVEL TIME				
		1.10	2.16	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.0	1.5	27.2
RR	31	1.61	2.20	10.1	3.5	7.0	9.5	25.5
	32	0.65	0.85					
	33	0.46	0.58	TRAVEL TIME				
		2.72	3.63	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	580	2.8	3.5	13.6
O	38	0.24	0.24	27.2	3.5	4.3	5.4	17.0
	39	0.20	1.56					
	DP N	1.10	2.16	TRAVEL TIME				
	DP-RR (Bypass)	0.26	2.47					
		1.55	3.96	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.7	0.2	27.4
P	21	0.45	0.57	10.8	3.5	6.8	10.8	27.1
	22 (Bypass)	0.14	0.25					
	DP F	2.49	3.14	TRAVEL TIME				
		3.08	3.96	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.7	0.2	11.0
Q	27	0.68	0.82	11.0	3.5	6.8	3.8	17.3
	DP P (Bypass)	0.40	1.72	TRAVEL TIME				
		1.08	2.54	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	3.7	0.8	11.8
R	26	0.19	0.22	11.8	3.5	6.6	0.7	6.6
	DP Q (Bypass)	0.00	0.77	TRAVEL TIME				
		0.19	1.00	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	4.5	0.6	12.5

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
S	5	3.07	3.33	10.9	3.5	6.8	14.6	32.4
	52	0.75	1.02					
	54	0.36	0.40	TRAVEL TIME				
	55	0.26	0.28					
		4.19	4.75	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	1590	2.6	10.2	21.1
Z	53	0.21	0.26	13.5	3.5	6.2	9.7	22.2
	64	1.39	1.79					
	65	1.17	1.53	TRAVEL TIME				
		2.78	3.58	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	13.9
AA	66	0.58	0.72	13.9	3.5	6.1	12.5	28.0
	67	0.22	0.27					
	DP Z	2.78	3.58	TRAVEL TIME				
		3.58	4.58	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	14.1
LL	77	1.84	2.39	16.0	3.5	5.7	8.4	25.5
	DP AA (Bypass)	0.57	2.09	TRAVEL TIME				
		2.42	4.48	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	100	2.0	0.8	16.9
T	51 (Bypass)	0.06	0.10	21.1	3.5	4.9	3.7	22.6
	79	0.12	0.14					
	DP S (Bypass)	0.89	3.07					
	DP LL (Bypass)	0.00	1.25	TRAVEL TIME				
		1.06	4.57	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.8	0.0	21.1
U	19	0.12	0.13	9.8	3.5	7.1	4.7	11.5
	43	1.21	1.48	TRAVEL TIME				
		1.33	1.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.8	0.2	10.1
V	20	0.16	0.17	10.1	3.5	7.1	5.2	12.6
	DP U	1.33	1.62	TRAVEL TIME				
		1.49	1.79	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	700	5.8	2.0	12.1
W	44	0.96	1.16	12.1	3.5	6.5	8.6	19.2
	DP V	1.49	1.79	TRAVEL TIME				
		2.46	2.94	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	250	4.0	1.0	13.1
X	50	0.47	0.59	13.1	3.5	6.3	2.0	9.6
	DP W (Bypass)	0.11	0.94	TRAVEL TIME				
		0.58	1.53	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	13.1
Y	62	1.27	1.65	13.4	3.5	6.2	5.0	11.6
	63	0.16	0.21	TRAVEL TIME				
		1.43	1.86	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	2000	2.0	16.7	30.1

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
BB	56	2.95	3.87	12.5	3.5	6.4	10.3	24.8
				TRAVEL TIME				
		2.95	3.87	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		4.5	0.0	12.5
CC	68	0.28	0.34	10.3	3.5	7.0	3.5	9.2
	69	0.72	0.97	TRAVEL TIME				
		1.00	1.31	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	10.5
DD	70	0.38	0.47	10.5	3.5	6.9	4.8	12.4
	DP CC	1.00	1.31	TRAVEL TIME				
		1.38	1.79	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.2	0.8	11.3
EE	71	0.66	0.89	11.3	3.5	6.7	8.0	20.0
	84	0.25	0.31					
	DP DD	1.38	1.79	TRAVEL TIME				
		2.29	2.99	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	4.5	0.1	11.5
FF	72	0.34	0.44	11.5	3.5	6.7	9.2	22.8
	DP EE	2.29	2.99	TRAVEL TIME				
		2.63	3.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.5	0.7	12.2
GG	73	0.68	1.00	12.2	3.5	6.5	8.9	27.9
	85	1.31	1.65					
	DP FF (Bypass)	0.57	1.65	TRAVEL TIME				
		2.56	4.31	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	12.4
HH	58	0.11	0.13	12.4	3.5	6.4	8.1	30.5
	59	1.55	2.03					
	DP GG (Bypass)	0.66	2.58	TRAVEL TIME				
		2.32	4.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	150	3.5	0.7	13.2
KK	57	2.07	2.68	12.1	3.5	6.5	8.0	19.2
	76	0.22	0.27	TRAVEL TIME				
		2.30	2.95	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	100	3.5	0.5	12.6
II	74	0.23	0.29	13.2	3.5	6.3	1.0	14.9
	DP HH (Bypass)	0.06	2.09					
	DP KK	0.00	0.00	TRAVEL TIME				
		0.29	2.38	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	150	3.4	0.7	13.9
JJ	75	2.04	2.68	12.2	3.5	6.5	7.1	17.3
				TRAVEL TIME				
		2.04	2.68	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		3.2	0.0	12.2

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
MM	78	3.47	4.57	30.1	3.5	4.0	12.1	20.3
	DP Y (Bypass)	0.00	0.45	TRAVEL TIME				
		3.47	5.01	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	2.0	1.7	31.7
VV	18	0.61	0.75	10.2	3.5	7.0	5.4	13.5
	25	0.93	1.17	TRAVEL TIME				
		1.54	1.92	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.6	0.2	10.3
NN	45	0.12	0.14	10.3	3.5	7.0	6.3	15.5
	46	0.16	0.17					
	DP VV	1.54	1.92	TRAVEL TIME				
		1.82	2.22	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	335	2.8	2.0	12.3
OO	47	0.55	0.71	12.3	3.5	6.5	3.3	10.4
	80	0.40	0.50					
	DP NN (Bypass)	0.00	0.40	TRAVEL TIME				
		0.95	1.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	12.5
PP	81	0.86	1.11	12.5	3.5	6.4	3.0	10.6
	DP OO (Bypass)	0.00	0.55	TRAVEL TIME				
		0.86	1.66	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.5	0.7	13.3
QQ	48	0.84	1.10	12.5	3.5	6.4	4.3	17.6
	82	0.40	0.51					
	DP R (Bypass)	0.00	0.56					
	DP PP (Bypass)	0.00	0.58	TRAVEL TIME				
		1.24	2.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		3.2	0.0	12.5
SS	40	1.01	1.21	27.4	3.5	4.3	3.5	10.1
	DP O (Bypass)	0.00	1.15	TRAVEL TIME				
		1.01	2.36	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	2.7	1.2	28.7
TT	17	2.01	2.64	10.4	3.5	6.9	7.0	18.3
				TRAVEL TIME				
		2.01	2.64	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.9	0.7	11.1
UU	42	0.44	0.57	28.7	3.5	4.2	17.2	31.7
	86	1.48	2.07					
	DP SS	1.01	2.36					
	DP TT (Bypass)	2.01	2.64	TRAVEL TIME				
		4.94	7.63	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.3	0.2	28.9

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
EAST POND	41	0.94	1.52	28.9	3.5	4.1	29.5	56.9
	83	0.34	0.49					
	87	0.98	1.36					
	DP QQ	1.24	2.74					
	DP UU	4.94	7.63	TRAVEL TIME				
		8.44	13.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		1.6	0.0	28.9
Big Johnson Basin								
AAA	102	0.38	0.49	7.2	3.5	8.0	3.0	8.6
	103	0.49	0.58	TRAVEL TIME				
		0.87	1.08	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.5	0.3	7.5
BBB	104	0.28	0.33	7.5	3.5	7.9	4.0	11.1
	DP AAA	0.87	1.08	TRAVEL TIME				
		1.15	1.40	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	1200	4.0	5.0	12.5
CCC	106	1.48	2.07	12.5	3.5	6.4	9.2	22.3
	DP BBB	1.15	1.40	TRAVEL TIME				
		2.63	3.47	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	12.8
DDD	113	0.52	0.68	9.9	3.5	7.1	3.0	8.0
	114	0.35	0.44	TRAVEL TIME				
		0.87	1.12	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	10.2
EEE	115	0.40	0.52	10.3	3.5	7.0	4.4	11.5
	DP DDD	0.87	1.12	TRAVEL TIME				
		1.27	1.64	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	250	2.0	2.1	12.3
FFF	116	0.25	0.31	12.3	3.5	6.5	2.6	9.8
	117	0.42	0.54					
	DP EEE (Bypass)	0.09	0.67	TRAVEL TIME				
		0.76	1.52	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	12.7
GGG	118	0.34	0.54	12.7	3.5	6.4	3.8	13.2
	DP FFF	0.76	1.52	TRAVEL TIME				
		1.10	2.06	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	400	2.0	3.3	16.0
HHH	119	0.67	0.42	16.0	3.5	5.7	2.4	7.9
	DP GGG (Bypass)	0.03	0.96	TRAVEL TIME				
		0.70	1.39	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.5	0.3	16.3

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
III	120	1.01	0.87	16.3	3.5	5.7	6.8	21.2
	DP CCC (Bypass)	0.23	1.48					
	DP HHH	0.70	1.39	TRAVEL TIME				
		1.94	3.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	400	2.5	2.7	18.9
JJJ	105	0.20	0.27	7.6	3.5	7.9	0.7	2.1
				TRAVEL TIME				
		0.20	0.27	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.5	0.3	7.9
KKK	107	0.98	1.36	18.8	3.5	5.3	4.9	9.9
	108	0.22	0.25					
	DP JJJ	0.20	0.27	TRAVEL TIME				
		1.40	1.88	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	19.2
LLL	121	0.62	1.21	19.2	3.5	5.2	2.7	17.1
	DP III (Bypass)	0.03	1.46					
	DP KKK (Bypass)	0.11	0.61	TRAVEL TIME				
		0.77	3.29	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	425	4.0	1.8	20.9
MMM	109	0.32	0.41	5.1	3.5	9.0	1.1	3.7
				TRAVEL TIME				
		0.32	0.41	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	450	2.0	3.8	8.8
NNN	122	0.31	0.89	20.9	3.5	5.0	4.7	12.8
	125	1.03	0.68					
	DP LLL (Bypass)	0.00	1.01	TRAVEL TIME				
		1.35	2.57	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	20.9
OOO	123	1.05	0.41	10.5	3.5	6.9	6.6	15.2
	124	0.52	1.38					
	DP MMM	0.32	0.41	TRAVEL TIME				
		1.89	2.20	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	10.5
PPP	130	0.74	1.01	6.1	3.5	8.5	2.6	8.6
				TRAVEL TIME				
		0.74	1.01	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	6.1
QQQ	131	0.50	0.84	9.8	3.5	7.1	1.7	6.0
				TRAVEL TIME				
		0.50	0.84	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		1.7	0.0	9.8
RRR	110	0.27	0.32	6.8	3.5	8.2	3.1	9.2
	111	0.51	0.66					
	126	0.12	0.14	TRAVEL TIME				
		0.89	1.12	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	500	3.1	2.7	9.5

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
SSS	112	0.21	0.20	9.5	3.5	7.2	4.7	11.7
	127	0.24	0.29					
	DP RRR	0.89	1.12	TRAVEL TIME				
		1.34	1.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	600	3.2	3.1	12.6
TTT	128	1.68	2.27	12.6	3.5	6.4	5.9	16.4
	DP SSS (Bypass)	0.00	0.30	TRAVEL TIME				
		1.68	2.56	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		4.7	0.0	12.6
UUU	100 (Bypass)	0.72	0.72	14.1	3.5	6.1	5.7	13.7
	129	0.92	1.53	TRAVEL TIME				
		1.63	2.25	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		3.2	0.0	14.1
WEST	DP NNN	1.35	2.57	20.9	3.5	5.0	27.2	56.8
POND	DP OOO	1.89	2.20					
	DP PPP	0.74	1.01					
	DP QQQ	0.50	0.84					
	DP TTT	1.68	2.56					
	DP UUU	1.63	2.25	TRAVEL TIME				
		7.79	11.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	600	1.7	5.9	26.8

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
J	28	0.43	0.51	22.3	3.5	4.8	24.3	42.7
	DP I	6.54	8.39	TRAVEL TIME				
		6.97	8.90	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.2	1.3	23.6
K	29	0.18	0.21	23.6	3.5	4.7	27.6	47.1
	30	0.75	1.02					
	DP I	6.97	8.90	TRAVEL TIME				
		7.90	10.13	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	23.9
L	34	0.27	0.31	23.9	3.5	4.6	28.5	48.2
	DP K	7.90	10.13	TRAVEL TIME				
		8.17	10.44	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.0	1.5	25.4
M	35	0.20	0.23	25.4	3.5	4.5	29.9	51.9
	36	0.20	0.95					
	DP L	8.17	10.44	TRAVEL TIME				
		8.56	11.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	25.7
N	37	0.71	0.28	25.7	3.5	4.4	32.4	52.8
	DP M	8.56	11.62	TRAVEL TIME				
		9.27	11.91	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	2.0	1.5	27.2
RR	31	1.61	2.20	10.1	3.5	7.0	9.5	25.5
	32	0.65	0.85					
	33	0.46	0.58	TRAVEL TIME				
		2.72	3.63	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	580	2.8	3.5	13.6
O	38	0.24	0.24	27.2	3.5	4.3	33.9	58.8
	39	0.20	1.56					
	DP N	9.27	11.91	TRAVEL TIME				
	DP-RR	2.72	3.63					
		9.71	13.70	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.7	0.2	27.4
P	21	0.45	0.57	10.8	3.5	6.8	17.6	44.9
	22	2.09	2.86					
	DP F	2.49	3.14	TRAVEL TIME				
		5.03	6.57	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.7	0.2	11.0
Q	27	0.68	0.82	11.0	3.5	6.8	19.9	50.2
	DP P	5.03	6.57	TRAVEL TIME				
		5.71	7.39	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	3.7	0.8	11.8
R	26	0.19	0.22	11.8	3.5	6.6	20.6	50.1
	DP Q	5.71	7.39	TRAVEL TIME				
		5.90	7.61	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	175	4.5	0.6	12.5

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
S	5	3.07	3.33	10.9	3.5	6.8	14.6	32.4
	52	0.75	1.02					
	54	0.36	0.40	TRAVEL TIME				
	55	0.26	0.28					
		4.19	4.75	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	1590	2.6	10.2	21.1
Z	53	0.21	0.26	13.5	3.5	6.2	9.7	22.2
	64	1.39	1.79					
	65	1.17	1.53	TRAVEL TIME				
		2.78	3.58	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	13.9
AA	66	0.58	0.72	13.9	3.5	6.1	12.5	28.0
	67	0.22	0.27					
	DP Z	2.78	3.58	TRAVEL TIME				
		3.58	4.58	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	14.1
LL	77	1.84	2.39	16.0	3.5	5.7	18.9	39.8
	DP AA	3.58	4.58	TRAVEL TIME				
		5.42	6.97	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	100	2.0	0.8	16.9
T	51	2.17	2.46	21.1	3.5	4.9	41.5	70.8
	79	0.12	0.14					
	DP S	4.19	4.75					
	DP LL	5.42	6.97	TRAVEL TIME				
		11.90	14.32	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.8	0.0	21.1
U	19	0.12	0.13	9.8	3.5	7.1	4.7	11.5
	43	1.21	1.48	TRAVEL TIME				
		1.33	1.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.8	0.2	10.1
V	20	0.16	0.17	10.1	3.5	7.1	5.2	12.6
	DP U	1.33	1.62	TRAVEL TIME				
		1.49	1.79	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	700	5.8	2.0	12.1
W	44	0.96	1.16	12.1	3.5	6.5	8.6	19.2
	DP V	1.49	1.79	TRAVEL TIME				
		2.46	2.94	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	250	4.0	1.0	13.1
X	50	0.47	0.59	13.1	3.5	6.3	10.2	22.2
	DP W	2.46	2.94	TRAVEL TIME				
		2.92	3.54	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	250	2.0	2.1	15.2
Y	62	1.27	1.65	13.4	3.5	6.2	5.0	11.6
	63	0.16	0.21	TRAVEL TIME				
		1.43	1.86	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	2000	2.0	16.7	30.1

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
BB	56	2.95	3.87	12.5	3.5	6.4	10.3	24.8
				TRAVEL TIME				
		2.95	3.87	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		4.5	0.0	12.5
CC	68	0.28	0.34	10.3	3.5	7.0	3.5	9.2
	69	0.72	0.97	TRAVEL TIME				
		1.00	1.31	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	10.5
DD	70	0.38	0.47	10.5	3.5	6.9	4.8	12.4
	DP CC	1.00	1.31	TRAVEL TIME				
		1.38	1.79	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.2	0.8	11.3
EE	71	0.66	0.89	11.3	3.5	6.7	8.0	20.0
	84	0.25	0.31					
	DP DD	1.38	1.79	TRAVEL TIME				
		2.29	2.99	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	4.5	0.1	11.5
FF	72	0.34	0.44	11.5	3.5	6.7	9.2	22.8
	DP EE	2.29	2.99	TRAVEL TIME				
		2.63	3.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.5	0.7	12.2
GG	73	0.68	1.00	12.2	3.5	6.5	16.1	39.4
	85	1.31	1.65					
	DP FF	2.63	3.43	TRAVEL TIME				
		4.61	6.08	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	12.4
HH	58	0.11	0.13	12.4	3.5	6.4	21.9	53.0
	59	1.55	2.03					
	DP GG	4.61	6.08	TRAVEL TIME				
		6.27	8.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	150	3.5	0.7	13.2
KK	57	2.07	2.68	12.1	3.5	6.5	8.0	19.2
	76	0.22	0.27	TRAVEL TIME				
		2.30	2.95	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	100	3.5	0.5	12.6
II	74	0.23	0.29	13.2	3.5	6.3	30.7	72.0
	DP HH	6.27	8.24					
	DP KK	2.30	2.95	TRAVEL TIME				
		8.80	11.48	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	150	3.4	0.7	13.9
JJ	75	2.04	2.68	12.2	3.5	6.5	7.1	17.3
				TRAVEL TIME				
		2.04	2.68	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		3.2	0.0	12.2

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
MM	78	3.47	4.57	30.1	3.5	4.0	17.1	26.0
	DP Y	1.43	1.86	TRAVEL TIME				
		4.91	6.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	2.0	1.7	31.7
VV	18	0.61	0.75	10.2	3.5	7.0	5.4	13.5
	25	0.93	1.17	TRAVEL TIME				
		1.54	1.92	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.6	0.2	10.3
NN	45	0.12	0.14	10.3	3.5	7.0	6.3	15.5
	46	0.16	0.17					
	DP VV	1.54	1.92	TRAVEL TIME				
		1.82	2.22	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	335	2.8	2.0	12.3
OO	47	0.55	0.71	12.3	3.5	6.5	9.7	22.2
	80	0.40	0.50					
	DP NN	1.82	2.22	TRAVEL TIME				
		2.77	3.44	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.2	0.2	12.5
PP	81	0.86	1.11	12.5	3.5	6.4	12.6	29.2
	DP OO	2.77	3.44	TRAVEL TIME				
		3.62	4.55	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.5	0.7	13.3
QQ	48	0.84	1.10	12.5	3.5	6.4	37.6	88.6
	82	0.40	0.51					
	DP R	5.90	7.61					
	DP PP	3.62	4.55	TRAVEL TIME				
		10.76	13.77	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		3.2	0.0	12.5
SS	40	1.01	1.21	27.4	3.5	4.3	37.4	63.7
	DP O	9.71	13.70	TRAVEL TIME				
		10.72	14.91	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	2.7	1.2	28.7
TT	17	2.01	2.64	10.4	3.5	6.9	7.0	18.3
				TRAVEL TIME				
		2.01	2.64	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	200	4.9	0.7	11.1
UU	42	0.44	0.57	28.7	3.5	4.2	51.1	84.0
	86	1.48	2.07					
	DP SS	10.72	14.91					
	DP TT	2.01	2.64	TRAVEL TIME				
		14.65	20.19	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	3.3	0.2	28.9

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
EAST POND	41	0.94	1.52	28.9	3.5	4.1	96.6	154.7
	83	0.34	0.49					
	87	0.98	1.36					
	DP QQ	10.76	13.77					
	DP UU	14.65	20.19	TRAVEL TIME				
		27.68	37.33	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		1.6	0.0	28.9
Big Johnson Basin								
AAA	102	0.38	0.49	7.2	3.5	8.0	3.0	8.6
	103	0.49	0.58	TRAVEL TIME				
		0.87	1.08	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.5	0.3	7.5
BBB	104	0.28	0.33	7.5	3.5	7.9	4.0	11.1
	DP AAA	0.87	1.08	TRAVEL TIME				
		1.15	1.40	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	1200	4.0	5.0	12.5
CCC	106	1.48	2.07	12.5	3.5	6.4	9.2	22.3
	DP BBB	1.15	1.40	TRAVEL TIME				
		2.63	3.47	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	12.8
DDD	113	0.52	0.68	9.9	3.5	7.1	3.0	8.0
	114	0.35	0.44	TRAVEL TIME				
		0.87	1.12	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	10.2
EEE	115	0.40	0.52	10.3	3.5	7.0	4.4	11.5
	DP DDD	0.87	1.12	TRAVEL TIME				
		1.27	1.64	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	250	2.0	2.1	12.3
FFF	116	0.25	0.31	12.3	3.5	6.5	6.8	16.1
	117	0.42	0.54					
	DP EEE	1.27	1.64	TRAVEL TIME				
		1.94	2.50	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	12.7
GGG	118	0.34	0.54	12.7	3.5	6.4	8.0	19.4
	DP FFF	1.94	2.50	TRAVEL TIME				
		2.28	3.04	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	400	2.0	3.3	16.0
HHH	119	0.67	0.42	16.0	3.5	5.7	10.3	19.8
	DP GGG	2.28	3.04	TRAVEL TIME				
		2.95	3.46	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.5	0.3	16.3

DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
III	120	1.01	0.87	16.3	3.5	5.7	23.0	44.1
	DP CCC	2.63	3.47					
	DP HHH	2.95	3.46	TRAVEL TIME				
		6.59	7.80	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	400	2.5	2.7	18.9
JJJ	105	0.20	0.27	7.6	3.5	7.9	0.7	2.1
				TRAVEL TIME				
		0.20	0.27	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.5	0.3	7.9
KKK	107	0.98	1.36	18.8	3.5	5.3	4.9	9.9
	108	0.22	0.25					
	DP JJJ	0.20	0.27	TRAVEL TIME				
		1.40	1.88	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	40	2.0	0.3	19.2
LLL	121	0.62	1.21	19.2	3.5	5.2	30.1	56.7
	DP III	6.59	7.80					
	DP KKK	1.40	1.88	TRAVEL TIME				
		8.62	10.89	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	425	4.0	1.8	20.9
MMM	109	0.32	0.41	5.1	3.5	9.0	1.1	3.7
				TRAVEL TIME				
		0.32	0.41	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	450	2.0	3.8	8.8
NNN	122	0.31	0.89	20.9	3.5	5.0	34.8	61.9
	125	1.03	0.68					
	DP LLL	8.62	10.89	TRAVEL TIME				
		9.96	12.46	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	20.9
OOO	123	1.05	0.41	10.5	3.5	6.9	6.6	15.2
	124	0.52	1.38					
	DP MMM	0.32	0.41	TRAVEL TIME				
		1.89	2.20	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	10.5
PPP	130	0.74	1.01	6.1	3.5	8.5	2.6	8.6
				TRAVEL TIME				
		0.74	1.01	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		2.0	0.0	6.1
QQQ	131	0.50	0.84	9.8	3.5	7.1	1.7	6.0
				TRAVEL TIME				
		0.50	0.84	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		1.7	0.0	9.8
RRR	110	0.27	0.32	6.8	3.5	8.2	3.1	9.2
	111	0.51	0.66					
	126	0.12	0.14	TRAVEL TIME				
		0.89	1.12	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	500	3.1	2.7	9.5

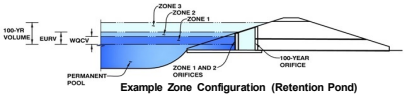
DESIGN POINT	CONTRIBUTING BASINS	CA (equivalent)		Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
SSS	112	0.21	0.20	9.5	3.5	7.2	4.7	11.7
	127	0.24	0.29					
	DP RRR	0.89	1.12	TRAVEL TIME				
		1.34	1.62	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	600	3.2	3.1	12.6
TTT	128	1.68	2.27	12.6	3.5	6.4	10.5	24.8
	DP SSS	1.34	1.62	TRAVEL TIME				
		3.02	3.88	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		4.7	0.0	12.6
UUU	100	2.27	2.99	14.1	3.5	6.1	11.1	27.4
	129	0.92	1.53	TRAVEL TIME				
		3.19	4.51	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street		3.2	0.0	14.1
WEST	DP NNN	9.96	12.46	20.9	3.5	5.0	67.3	123.6
POND	DP OOO	1.89	2.20					
	DP PPP	0.74	1.01					
	DP QQQ	0.50	0.84					
	DP TTT	3.02	3.88					
	DP UUU	3.19	4.51	TRAVEL TIME				
		19.29	24.89	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)
				Street	600	1.7	5.9	26.8

Appendix D: Detention Pond & Water Quality Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Waterview - East

Basin ID: Jimmy Camp Creek Basin (East Pond)



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	150.26	acres
Watershed Length =	3,925	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	69.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	86.0%	percent
Percentage Hydrologic Soil Groups C/D =	14.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	UDFCD Default	
Water Quality Capture Volume (WQCV) =	3.388	acre-feet
Excess Urban Runoff Volume (EURV) =	11.190	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	9.760	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	13.621	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	16.818	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	20.812	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	24.351	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	28.356	acre-feet
500-yr Runoff Volume (P1 = 3.29 in.) =	38.588	acre-feet
Approximate 2-yr Detention Volume =	9.261	acre-feet
Approximate 5-yr Detention Volume =	12.680	acre-feet
Approximate 10-yr Detention Volume =	13.858	acre-feet
Approximate 25-yr Detention Volume =	14.372	acre-feet
Approximate 50-yr Detention Volume =	15.542	acre-feet
Approximate 100-yr Detention Volume =	17.877	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	3.388	acre-feet
Zone 2 Volume (5-year - Zone 1) =	9.292	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.197	acre-feet
Total Detention Basin Volume =	17.877	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

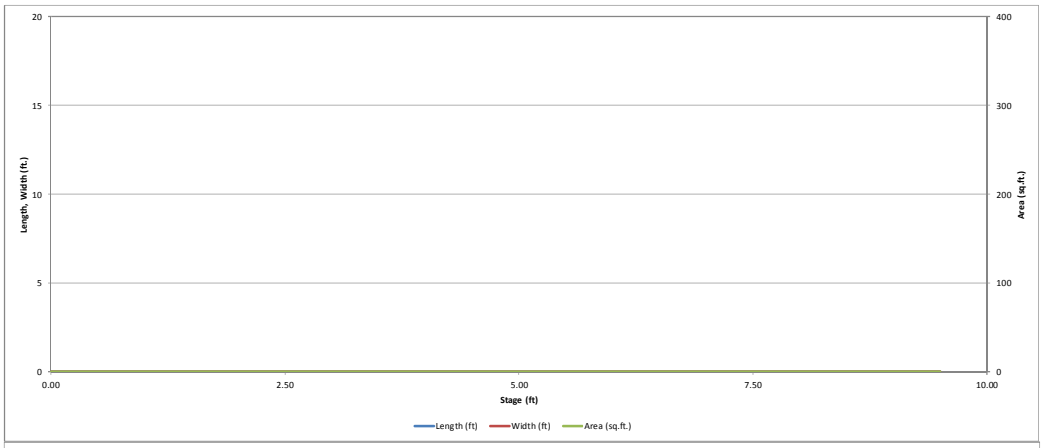
Depth Increment = 0.5 ft

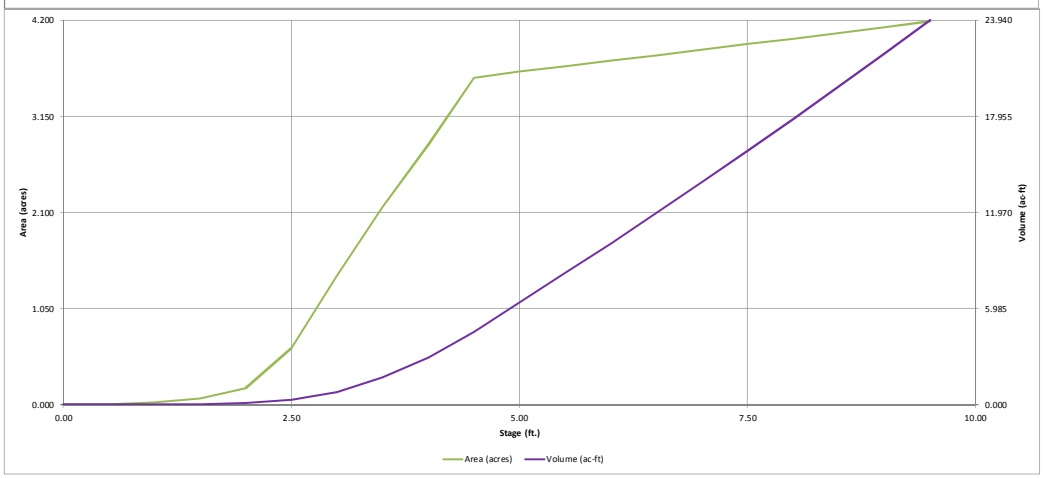
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	0	0.000		
	--	0.50	--	--	--	231	0.005	55	0.001
	--	1.00	--	--	--	1,155	0.027	393	0.009
	--	1.50	--	--	--	2,872	0.066	1,382	0.032
	--	2.00	--	--	--	7,819	0.179	4,006	0.092
	--	2.50	--	--	--	26,809	0.615	12,740	0.292
	--	3.00	--	--	--	61,209	1.405	34,745	0.798
	--	3.50	--	--	--	93,985	2.158	73,543	1.688
	--	4.00	--	--	--	123,742	2.841	127,975	2.938
	--	4.50	--	--	--	155,548	3.571	197,798	4.541
	--	5.00	--	--	--	158,442	3.637	276,295	6.343
	--	5.50	--	--	--	160,795	3.691	356,104	8.175
	--	6.00	--	--	--	163,633	3.757	437,211	10.037
	--	6.50	--	--	--	166,098	3.813	519,644	11.929
	--	7.00	--	--	--	168,872	3.877	603,386	13.852
	--	7.50	--	--	--	171,457	3.936	688,469	15.805
	--	8.00	--	--	--	174,158	3.998	774,873	17.789
	--	8.50	--	--	--	176,874	4.060	862,631	19.803
	--	9.00	--	--	--	179,603	4.123	951,750	21.849
	--	9.50	--	--	--	182,346	4.186	1,042,237	23.926

Revise Zone 2 to EURV - Zone 1

Use the latest version.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

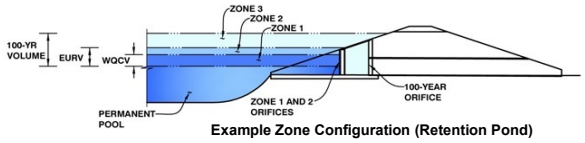




Detention Basin Outlet Structure Design

Project: Waterview East

Basin ID: Jimmy Camp Creek Basin (East Pond)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.16	3.388	Orifice Plate
Zone 2 (5-year)	6.70	9.292	Rectangular Orifice
Zone 3 (100-year)	8.03	5.197	Weir&Pipe (Restrict)
		17.877	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 =	3.80	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	12.00	inches
Orifice Plate: Orifice Area per Row =	6.27	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.354E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00	3.00				
Orifice Area (sq. inches)	6.27	6.27	6.27	6.27				

	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)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	4.00	4.75	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.00	6.70	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	3.00	3.00	inches
Vertical Orifice Width =	15.00	15.00	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.31	0.31	ft^2
Vertical Orifice Centroid =	0.13	0.13	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	10.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.10	N/A	feet
Over Flow Weir Slope Length =	10.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.28	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	70.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	35.00	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=	8.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	215.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	0.00	feet

1 ft.

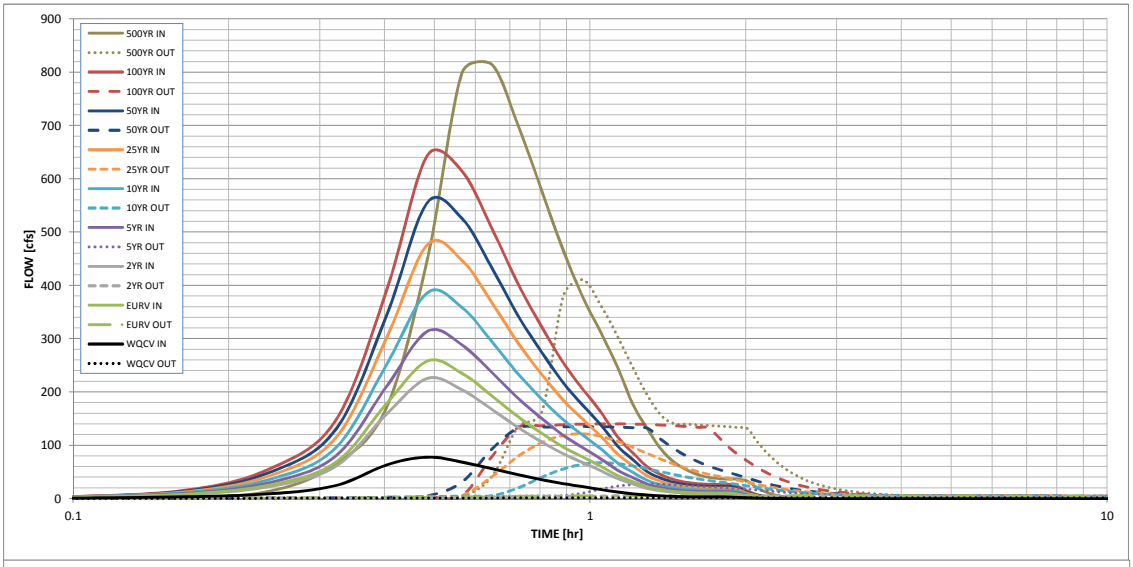
Calculated Parameters for Spillway

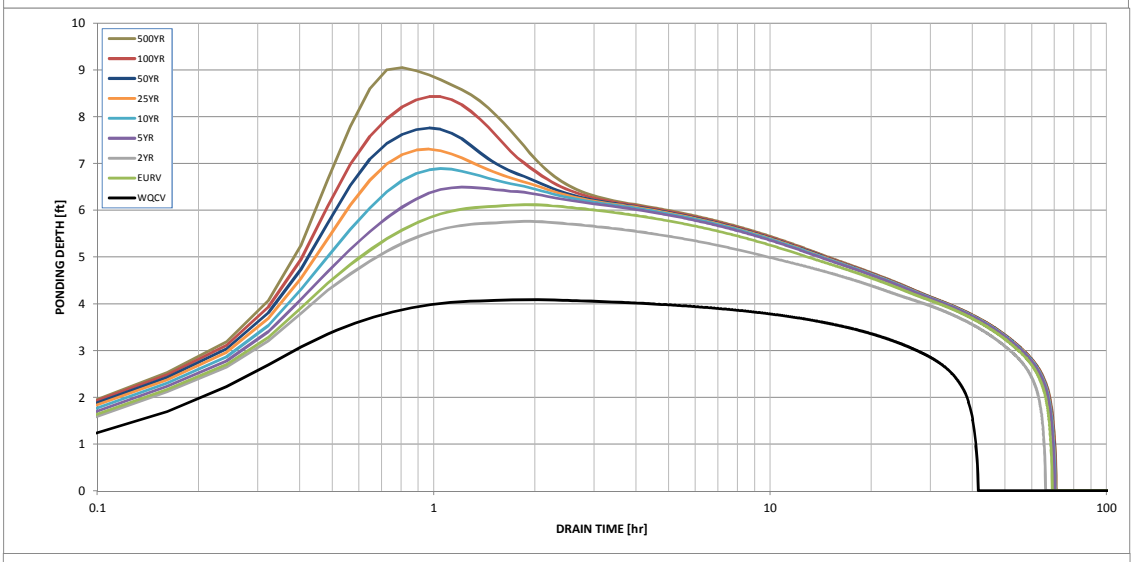
Spillway Design Flow Depth=	0.98	feet
Stage at Top of Freeboard =	9.48	feet
Basin Area at Top of Freeboard =	4.18	acres

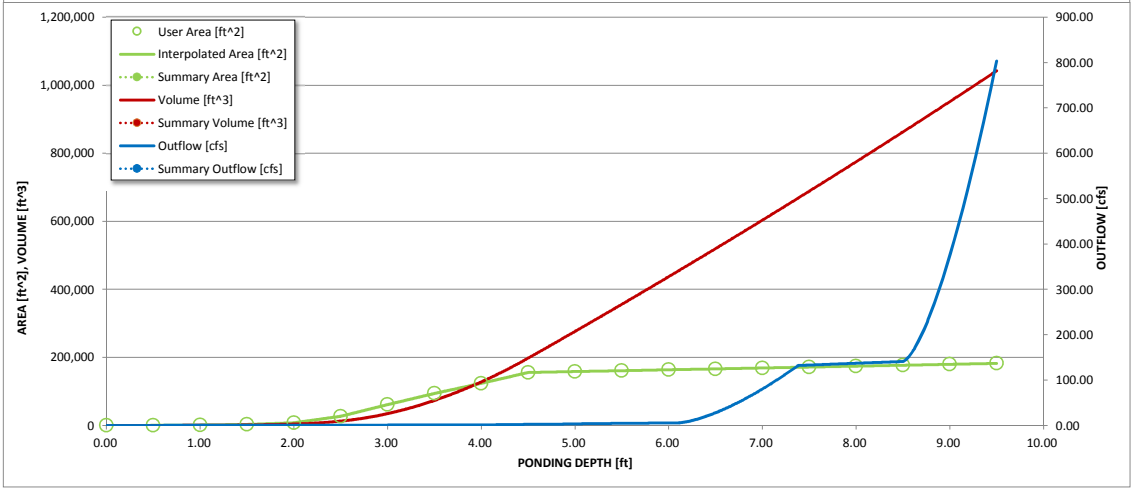
Routed Hydrograph Results

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	3.29
Calculated Runoff Volume (acre-ft) =	3.388	11.190	9.760	13.621	16.818	20.812	24.351	28.356	38.588
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	3.389	11.186	9.762	13.626	16.816	20.815	24.357	28.363	38.605
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.23	0.44	0.96	1.23	1.56	2.20
Predevelopment Peak Q (cfs) =	0.0	0.0	2.1	34.4	65.7	143.6	185.0	234.3	330.0
Peak Inflow Q (cfs) =	78.0	258.1	225.4	313.9	386.3	476.4	555.5	643.9	814.7
Peak Outflow Q (cfs) =	1.4	5.8	5.1	27.3	67.3	121.6	135.2	140.4	410.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.0	0.8	0.7	0.6	1.2
Structure Controlling Flow =	Vertical Orifice 1	Overflow Grate 1	Vertical Orifice 2	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	0.3	0.9	1.6	1.8	1.9	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	62	59	62	60	59	57	56	52
Time to Drain 99% of Inflow Volume (hours) =	**40**	66	63	66	66	65	65	64	63
Maximum Ponding Depth (ft) =	4.09	6.12	5.76	6.49	6.89	7.31	7.76	8.43	9.05
Area at Maximum Ponding Depth (acres) =	2.96	3.77	3.73	3.81	3.86	3.91	3.97	4.05	4.13
Maximum Volume Stored (acre-ft) =	3.170	10.489	9.139	11.891	13.426	15.020	16.833	19.519	22.055

Detention Basin Outlet Structure Design







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

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]
4.84 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:50	0.11	0.25	0.23	0.29	0.33	0.37	0.41	0.45	0.45
Hydrograph	0:09:41	3.35	7.98	7.28	9.11	10.45	11.98	13.22	14.52	14.70
Constant	0:14:31	9.15	26.13	23.25	30.94	37.01	44.35	50.64	57.51	65.27
1.034	0:19:22	24.74	68.61	61.22	80.90	96.37	115.03	131.01	148.47	170.12
	0:24:12	63.03	177.59	158.16	209.95	250.82	300.26	342.68	389.12	448.36
	0:29:02	77.99	258.10	225.44	313.85	386.28	476.39	555.55	643.89	798.28
	0:33:53	68.56	235.16	204.17	288.55	358.74	447.25	525.97	614.89	814.69
	0:38:43	55.99	192.80	167.36	236.70	294.56	367.72	432.99	507.26	699.24
	0:43:34	44.72	153.23	133.14	187.88	233.48	291.09	342.43	401.59	576.80
	0:48:24	35.42	122.17	106.07	149.96	186.58	232.90	274.22	321.59	465.29
	0:53:14	27.98	96.57	83.83	118.57	147.59	184.34	217.17	254.69	377.73
	0:58:05	22.60	77.90	67.63	95.62	118.99	148.58	175.00	205.17	311.88
	1:02:55	16.90	60.46	52.29	74.62	93.35	117.11	138.36	162.63	246.90
	1:07:46	12.45	43.48	37.66	53.54	66.85	83.76	98.91	116.26	176.51
	1:12:36	8.88	31.75	27.46	39.19	49.04	61.57	72.79	85.68	130.65
	1:17:26	6.30	22.09	19.14	27.21	33.98	42.59	50.30	59.21	92.59
	1:22:17	4.87	16.93	14.68	20.81	25.93	32.42	38.23	44.86	68.66
	1:27:07	3.94	13.54	11.76	16.61	20.66	25.79	30.36	35.59	54.53
	1:31:58	3.44	11.68	10.16	14.30	17.75	22.10	25.98	30.38	45.26
	1:36:48	3.28	10.92	9.52	13.33	16.48	20.44	23.96	27.94	39.87
	1:41:38	3.19	10.60	9.24	12.92	15.97	19.79	23.17	27.01	37.54
	1:46:29	3.19	10.54	9.20	12.85	15.85	19.62	22.96	26.74	36.60
	1:51:19	3.19	10.54	9.20	12.85	15.85	19.62	22.96	26.74	36.39
	1:56:10	2.28	8.41	7.25	10.42	13.09	16.47	19.50	22.96	32.63
	2:01:00	1.33	4.86	4.19	6.04	7.62	9.64	11.47	13.59	21.12
	2:05:50	0.77	2.83	2.44	3.52	4.43	5.60	6.65	7.89	13.03
	2:10:41	0.41	1.53	1.32	1.90	2.39	3.03	3.60	4.28	7.79
	2:15:31	0.21	0.81	0.69	1.02	1.29	1.65	1.98	2.36	4.43
	2:20:22	0.07	0.32	0.27	0.41	0.53	0.69	0.84	1.01	2.39
	2:25:12	0.00	0.05	0.04	0.07	0.10	0.14	0.18	0.23	0.97
	2:30:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
	2:34:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:39:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:44:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:49:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:54:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:59:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:03:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:08:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:13:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:18:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:23:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:28:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:42:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:47:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:52:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:57:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:02:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:06:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:11:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:16:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:21:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:26:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:31:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:43	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
	4:50:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:09:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:14:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:19:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:24:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:29:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:33:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:38:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:43:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:48:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

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]

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).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**Charlene Durham**
Company:	**Stantec**
Date:	**June 30, 2017**
Project:	**Waterview East**
Location:	**Jimmy Camp Basin - East Pond**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 69.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.690

C) Contributing Watershed Area — Area = 150.260 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = ____ 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} = 3.388 ac-ft

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

$V_{DESIGN\ OTHER}$ = ____ 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) Predominant Watershed NRCS Soil Group

Choose One
- ○ A
- ◉ B
- ○ C / D

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 = 11.407 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 = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

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

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Charlene Durham
Company: Stantec
Date: June 30, 2017
Project: Waterview East
Location: Jimmy Camp Basin - East Pond

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.102 ac-ft
B) Actual Forebay Volume	V_F = ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 643.90 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 12.88 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 = 28.9 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 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 = 10 sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 3.14 inches
E) Total Outlet Area	A_{ot} = 25.08 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Charlene Durham
Company: Stantec
Date: June 30, 2017
Project: Waterview East
Location: Jimmy Camp Basin - East Pond

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} = 442.8 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 5.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 717 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.)	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
Other (Y/N): N	
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} = 1010 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 6.13 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 101.56 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Charlene Durham
Company: Stantec
Date: June 30, 2017
Project: Waterview East
Location: Jimmy Camp Basin - East Pond

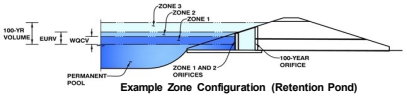
10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	
11. Vegetation	Choose One ○ Irrigated ○ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Waterview - East

Basin ID: Big Johnson Basin (West Pond)



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	49.46	acres
Watershed Length =	1,670	ft
Watershed Slope =	0.039	ft/ft
Watershed Imperviousness =	67.00%	percent
Percentage Hydrologic Soil Group A =	28.5%	percent
Percentage Hydrologic Soil Group B =	71.5%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	UDFCD Default	
Water Quality Capture Volume (WQCV) =	1.080	acre-feet
Excess Urban Runoff Volume (EURV) =	3.775	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.001	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	4.142	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	5.138	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	6.461	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	7.579	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	8.848	acre-feet
500-yr Runoff Volume (P1 = 3.29 in.) =	12.121	acre-feet
Approximate 2-yr Detention Volume =	2.854	acre-feet
Approximate 5-yr Detention Volume =	3.910	acre-feet
Approximate 10-yr Detention Volume =	4.431	acre-feet
Approximate 25-yr Detention Volume =	4.697	acre-feet
Approximate 50-yr Detention Volume =	5.072	acre-feet
Approximate 100-yr Detention Volume =	5.834	acre-feet

Optional User Override 1-hr Precipitation	
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

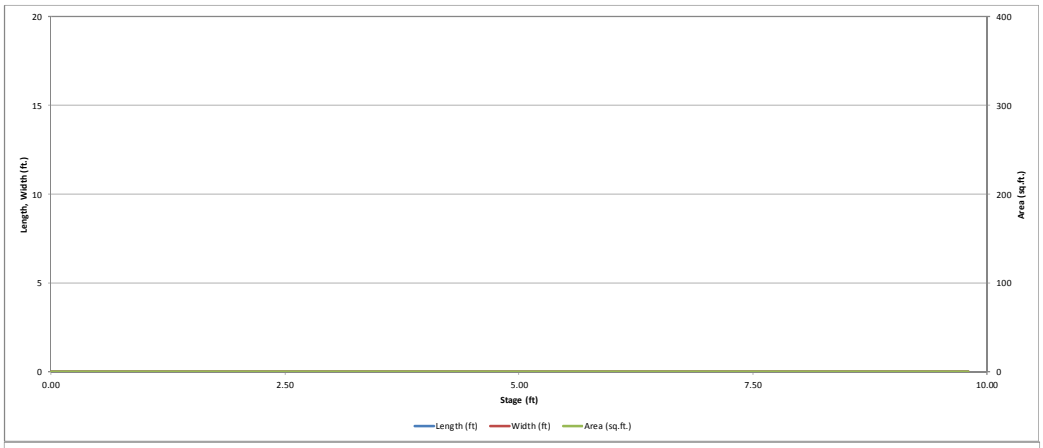
Zone 1 Volume (WQCV) =	1.080	acre-feet
Zone 2 Volume (5-year - Zone 1) =	2.830	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.924	acre-feet
Total Detention Basin Volume =	5.834	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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

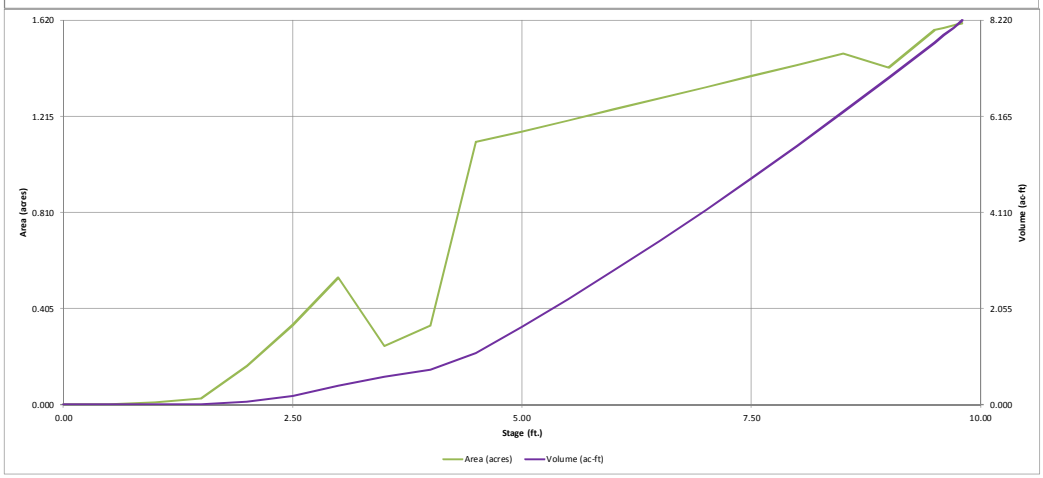
Revise Zone 2 to EURV - Zone 1

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	0	0.000		
	--	0.50	--	--	--	84	0.002	20	0.000
	--	1.00	--	--	--	448	0.010	149	0.003
	--	1.50	--	--	--	1,102	0.025	530	0.012
	--	2.00	--	--	--	7,143	0.164	2,532	0.058
	--	2.50	--	--	--	14,671	0.337	8,056	0.185
	--	3.00	--	--	--	23,274	0.534	17,542	0.403
	--	3.50	--	--	--	10,717	0.246	26,040	0.598
	--	4.00	--	--	--	14,453	0.332	32,333	0.742
	--	4.50	--	--	--	48,176	1.106	47,990	1.102
	--	5.00	--	--	--	50,148	1.151	72,571	1.666
	--	5.50	--	--	--	52,138	1.197	98,142	2.253
	--	6.00	--	--	--	54,146	1.243	124,713	2.863
	--	6.50	--	--	--	56,173	1.290	152,293	3.496
	--	7.00	--	--	--	58,217	1.336	180,890	4.153
	--	7.50	--	--	--	60,285	1.384	210,516	4.833
	--	8.00	--	--	--	62,359	1.432	241,177	5.537
	--	8.50	--	--	--	64,457	1.480	272,881	6.264
	--	9.00	--	--	--	61,843	1.420	304,456	6.989
	--	9.50	--	--	--	68,707	1.577	337,093	7.739
	--	9.60	--	--	--	69,136	1.587	343,985	7.897
	--	9.70	--	--	--	69,566	1.597	350,921	8.056
	--	9.80	--	--	--	69,996	1.607	357,899	8.216
	--		--	--	--				
	--		--	--	--				

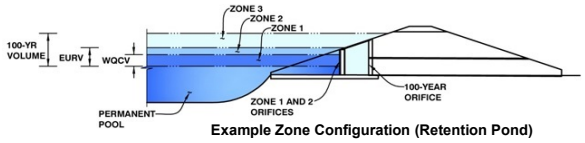
DETENTION BASIN STAGE-STORAGE TABLE BUILDER





Detention Basin Outlet Structure Design

Project: Waterview - East
Basin ID: Big Johnson Basin (West Pond)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.49	1.080	Orifice Plate
Zone 2 (5-year)	6.82	2.830	Rectangular Orifice
Zone 3 (100-year)	8.21	1.924	Weir&Pipe (Restrict)
		5.834	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.882E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.49	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.90	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.71	sq. inches (diameter = 1-13/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	2.99					
Orifice Area (sq. inches)	2.71	2.71	2.71					

	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)

	Zone 2 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	4.00	4.50	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.08	0.08	ft^2
Depth at top of Zone using Vertical Orifice =	7.11	7.50	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	0.08	feet
Vertical Orifice Height =	2.00	2.00	inches				
Vertical Orifice Width =	6.00	6.00	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.85	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.85	N/A	feet
Overflow Weir Front Edge Length =	6.00	N/A	feet	Over Flow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	7.13	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	25.20	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	12.60	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.53	N/A	ft^2
Outlet Pipe Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	0.86	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.74	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	10.89	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.61	acres
Freeboard above Max Water Surface =	0.35	feet			

1 ft

Calculated Parameters for Spillway

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	3.29
Calculated Runoff Volume (acre-ft) =	1.080	3.775	3.001	4.142	5.138	6.461	7.579	8.848	12.121
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.080	3.773	3.000	4.140	5.130	6.450	7.566	8.838	12.111
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.33	0.80	1.08	1.42	2.10
Predevelopment Peak Q (cfs) =	0.0	0.0	0.5	8.4	16.4	39.4	53.6	70.4	103.8
Peak Inflow Q (cfs) =	29.8	104.4	82.8	114.6	142.3	179.0	210.0	245.2	335.4
Peak Outflow Q (cfs) =	0.7	1.8	1.6	1.9	14.0	37.4	52.6	54.0	112.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.9	0.9	1.0	0.8	1.1
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 2	Vertical Orifice 2	Vertical Orifice 2	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.5	1.4	2.0	2.1	2.1
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) =	39	58	54	60	59	57	56	54	50
Time to Drain 99% of Inflow Volume (hours) =	**40**	63	58	65	65	65	64	63	62
Maximum Ponding Depth (ft) =	4.41	6.56	5.97	6.84	7.23	7.62	7.92	8.45	9.49
Area at Maximum Ponding Depth (acres) =	0.97	1.30	1.24	1.32	1.36	1.40	1.42	1.47	1.57
Maximum Volume Stored (acre-ft) =	1.008	3.574	2.826	3.927	4.449	5.000	5.422	6.176	7.707

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**Charlene Durham**
Company:	**Stantec**
Date:	**June 30, 2017**
Project:	**Waterview East**
Location:	**Big Johnson Basin - West Pond**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 67.0 %
B) Tributary Area's Imperviousness Ratio (i = I_a / 100)	i = 0.670
C) Contributing Watershed Area	Area = 49.460 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ 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}= 1.080 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))	$V_{DESIGN\ OTHER}$= ____ 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) Predominant Watershed NRCS Soil Group	Choose One: ○ A ◉ B ○ C / D
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 = 3.637 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 = 7.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 3.00 ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	

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5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.032 ac-ft
B) Actual Forebay Volume	V_F = ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 245.20 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 4.90 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 = 20.1 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 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 = 10 sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.81 inches
E) Total Outlet Area	A_{ot} = 8.13 square inches

Design Procedure Form: Extended Detention Basin (EDB)

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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} = 141.2 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 5.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 263 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.)	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
Other (Y/N): N	
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} = 371 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 6.62 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 107.44 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches

Design Procedure Form: Extended Detention Basin (EDB)

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10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	
11. Vegetation	Choose One ○ Irrigated ○ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes: