Final Drainage Report
The Glen at Widefield Filing No. 11
El Paso County, Colorado

Prepared for:
Widefield Investment Group
3 Widefield Boulevard
Colorado Springs, Colorado 80911

Prepared by:

Kiowa
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Kiowa Project No. 19016

April 30, 2021

PCD Project No. SF-204

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STATEMENTS AND APPROVALS

ENGINEER'S STATEMENT:

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

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

____ ______________________

Andrew W. McCord (PE #25057) Date

For and on Behalf of Kiowa Engineering Corporation

DEVELOPER'S STATEMENT:

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

By: ____ ______________________

Date

Print Name: J. Ryan Watson, Glen Development Company

Address: 3 Widefield Boulevard
Colorado Springs, Colorado 80911

EL PASO COUNTY:

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

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Jennifer Irvine, P.E. Date

El Paso County Engineer/ECM Administrator

I. GENERAL LOCATION AND DESCRIPTION

The Glen at Widefield Filing No. 11 (Filing 11) subdivision will be developed as a single-family residential subdivision located in the Widefield area of El Paso County. The subject property is located to the west of Marksheffel Road and north of Mesa Ridge Parkway. The site is located in the southwest portion of Section 22, Township 15 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. The site is bounded on east by Marksheffel Road, the south and west by the Glen at Widefield Filing No. 8-10, to the northwest by the Glen at Widefield Future Filing No. 12 (preliminarily platted), and the north by undeveloped raw land, currently unplatted. The property covers approximately 45.0 acres and is currently overlot-graded under early grading permit to approximate finished grade conditions. The property has previously been rough graded as a part of the Glen at Widefield East. Extended Detention Basin 'D' is partially constructed in the southern portion of the site. The detention basin was originally graded under early permit as a sedimentation basin. As a part of Filing No. 10, the basin is planned to be fitted with a 3-stage outlet structure, emergency spillway and access road for maintenance. With Filing No. 11, The Basin is to receive final grading, slope contouring, and perimeter maintenance roads, along with a low-flow trickle channel. Some outlet plate modification is expected within the outlet structure to accommodate final calculated values for the tributary and undetained areas impacted by development. A vicinity map of the site is shown on Figure 1 included in the Appendix.

The existing vegetative cover within the development is in poor to fair condition with minimal grasses throughout the site. The existing ground slopes within the property range from 0.2 to 25 percent. Soils within the subject site are classified to be within Hydrologic Soils Group C as shown in the *El Paso County Soils Survey*. For the purposes of computing the existing and proposed hydrology for the site, Hydrologic Soil Group C was used with weighted coefficients.

Existing utilities within or adjacent to the site include a pair of thirty-inch (30") Colorado Interstate Gas (CIG) mains that run along portions of the westerly property boundary (See Maps in Appendix D).

Poa Annua Street will be extended west into the site from Marksheffel Road and will be improved further with this development with sidewalks and pedestrian ramps.

Existing Roadside Ditch along Marksheffel was designed and built by others under a project called *Marksheffel Road Improvements Project South – Link Road to US 24 (Link Road Project)*. The Link Road Project proposed the existing trapezoidal channel lying along each side of the roadway at the time of this reporting and which is sized to convey the 100-year flow for The Project. A new box culvert crossing is planned at Poa Annua Street to convey the flows in the west side ditch.

Appendix A provides excerpts from the Link Road Project's approved drainage report, and highlights relevant structures, and reflects forward their declared flow volumes and design values.

II. MAJOR DRAINAGE BASINS AND SUBBASINS

The site lies within the West Fork Jimmy Camp Creek drainage basin. The majority of the overall site presently drains towards the south and southeast by a combination of overlot sheet flow along with curb, gutter, pipe and open channel conveyances to a minor drainage that combines with the West Fork of Jimmy Camp Creek just downstream of Mesa Ridge Parkway (Sub-basins EX-1 through EX-4 - See Drainage Map Sheet 1 of 3). The north portion of the site drains east and south within proposed roadway corridors to proposed Extended Detention Basin 'D'. The south portion of the site is conveyed north to proposed Extended Detention Basin 'D'. The tributary basins to Basin 'D' are prefaced with the letter 'D' and are numbered sequentially D1 to D24.

The remaining portions of the site consist of rear lot margins which cannot be captured due to topography. These marginal areas are expected to consist of lawn and rear slope areas which will substantially match Historic Conditions. These marginal areas will achieve 60% Water Quality Treatment through best practices of bioinfiltration (Permanent BMP - IRF). The existing drainage patterns for the site are shown on Drainage Plan Sheet 1 provided in a map pocket at the end of this report, and developed flows are compared on Sheets 2 & 3 to reflect pre- and post-development impacts.

The drainage reports that were reviewed in the process of preparing this drainage report are included in the References section. The Glen at Widefield East area was studied as a part of the *Master Development Drainage Plan (MDDP) for the Glen at Widefield* and the *West Fork Jimmy Camp Creek Drainage Basin Planning Study (DBPS).* A detention basin shown on the west side of the creek (DP 3101) was designed and constructed as part of the Filing No. 6 improvements. Two additional regional detention basins were identified for the site in the *MDDP*: one to serve the westerly side of the site with flows released west to the West Fork Jimmy Camp Creek (DP 3091), and the other to serve the easterly side of the site with flows released east across Marksheffel Road to a channel along the north side of Peaceful Valley Road and ultimately to the Jimmy Camp Creek main branch (DP 4021). The detention basin shown in the *MDDP* and *DBPS* at DP 3091 was designed and constructed as part of the Glen at Widefield Filing No. 7 improvements as Basin C. However, due to the proposed grading and drainage patterns north of Filing No. 7, two additional detention basins to serve the westerly side of the site were planned and constructed: one for Filing No. 8 (Basin B) and one for Filing No. 9 (Basin A), which is located just north of the Filing No. 8 area. The detention basin shown in the *MDDP* and *DBPS* at DP 4021 (Basin D) is designed herein and will be constructed to serve Filing 10, Filing 11, and Future Filing 12 within the Glen at Widefield master planned area.

The subject property limits are shown on Flood Insurance Rate Maps (FIRMs) 08041C0956G and 08041C0957G (both with effective dates of December 7, 2018) that are included in the Appendix. The FIRMs also show that the property to be developed with buildable lots is located outside of the FEMA regulated floodplain in an unshaded Zone X area, which is described as "Area of Minimal Flood Hazard."

III. DRAINAGE DESIGN CRITERIA

Hydrologic and hydraulic calculations for the site were performed using the methods outlined in the *El Paso County Drainage Criteria Manual*. Topography for the site was compiled using a two-foot contour interval and is presented on the Historic Conditions map. The hydrologic calculations were made for the historic and proposed site conditions. The Drainage Plan presents the drainage patterns for the site, including the 'D'-series sub-basins. The peak flow rates for the sub-basins were estimated using the Rational Method. The 5-year (Minor storm) and 100-year (Major storm) recurrence intervals were determined. The one-hour rainfall depth was determined from Table 6-2 of the *Drainage Criteria Manual*. These depths are shown in the runoff calculations spreadsheet. The peak flow data generated using the rational method was used to verify street capacities and to size inlets and storm sewers within the subdivision. The drainage basin area, time of concentration, and rainfall intensity were determined for each of the sub-basins within the property. The onsite soils were assumed to be mostly Hydrologic Soil Group C, based on the *Soil Survey* and the result of earth-moving operations. For existing conditions, runoff coefficients were determined using a land use of pasture/meadow. The land use for the proposed development will be residential with a density of approximately 4 lots per acre.

The onsite hydraulic structures were sized using the methods outlined in the *El Paso County Drainage Criteria Manual*. The hydraulic capacities of the streets and curb inlets were determined using the UD-Inlet spreadsheet developed by the Urban Drainage and Flood Control District (UDFCD), considering the County criteria for the Minor (5-year) and Major (100-year) storms. Ramp curbs will be used throughout the development, except for curb returns, where a 6-inch vertical curb will be used. Hydraulic calculations are provided in Appendix C for the proposed streets, pipe outlet erosion protection and open channel capacities.

The on-site detention basin is planned to be an Extended Detention Basin that uses Full Spectrum Detention. The UD-Detention spreadsheets created by UDFCD were used to size and design the detention basin with water quality enhancement, per the County's recommendation.

The supporting calculations associated with hydraulic functioning for this development's storm system are included in Appendix C of this report. Appendix C includes UD_Sewer and EPA-SWMM report summaries. The system was analyzed in EPA-SWMM in order to capture surface flows and pipe flows simultaneously. The Major Event results in some inlet flooding at the intersection of Pennycress Drive and Golden Buffs Drive. The Depth Of Node Flooding is calculated to be 0.427' above the lowest inlets at Peak Flow (T_{PK}) which occurs at about 55 minutes. This demonstrates that the overall capture is theoretically 100% as Depth Of Flow does not exceed the depth of the surrounding roadway corridor. The Node Flooding Value is the critical value for determination of function in this case, and is highlighted in Appendix C for clarity.

IV. DRAINAGE FACILITY DESIGN

The drainage of the site will be accomplished through a combination of sheet flow, gutter flow and pipe conveyance systems which will outlet directly to the planned extended detention basin (Basin 'D'). Two inflow points are identified with this development, and each will terminate within a pre-sedimentation forebay (Inflows 'H' & 'J') (See Map Exhibit Sheet 2).

The proposed drainage patterns for the site are shown on the Final Drainage Plan for the developed condition (Sheets 2 and 3) provided in the map pocket at the end of this report. The hydrologic and hydraulic calculations are provided in the Appendix. Refer to the Drainage Design Criteria section for additional information on the hydrologic and hydraulic calculations.

Evaluations related to sizing of onsite drainage improvements was carried out in accordance with the *County Storm Drainage Criteria Manual*. The capacities of the proposed onsite facilities were calculated in accordance with the *Criteria Manual* and current UDFCD supporting software.

Offsite runoff (from Sub-basin OS-2) is directed east to the existing roadside ditch along Marksheffel Road and conveyed within open channel sections and culvert sections (by others). These flows accumulate and increase as the channel travels south along the east margin of the site. Ultimately these flows will combine with flows discharged at Basin 'D'. Areas at the extreme north and east margins of the site ('E' Series) will sheet flow onto and across grassed hillsides, which are designed to provide Water Quality Treatment via Infiltration, and so that downstream elements are not adversely impacted.

The detention basin will include two pre-sedimentation forebays along with trickle channel to a planned three-stage outlet structure which was planned for construction as part of Filing 10, but will be revised with this report due to updated County criteria, related to MS4 impacts at Filing 11.

Under Fully Developed Conditions, Basin D will incorporate some pond shaping for additional storage, a perimeter maintenance trail, inflow sedimentation forebays, and a concrete trickle channel. The detention basin will be a private facility and will be maintained by The District.

The following is a description of the on-site storm sewer system:

The system will begin with sheet flow at the lot areas. Some sheet flow will reach the EDB in historic pattern across unplatted and undeveloped land. However, most of the flows will begin as sheet flow on the lot areas and will be directed via overlot grades to existing and proposed street corridors. Inlets and pipes planned with this filing will convey the Minor event (5-year) and most of the Major event (100-year) directly to the planned detention basin.

Two principal storm trunklines are planned, at Pennycress Drive and at Golden Buffs Drive that will convey captured flow to 100-year capacity curb inlets in a sump condition at DP 79, DP 81, DP 89 and DP 93a, and 93b, and ultimately convey those flows directly to existing Detention Basin 'D' (DP 94 is the Outlet Structure). Runoff from Sub-basins D19.1, D20, D-21, D-22 and D-23 will be captured in new curb and gutter of Pennycress Drive and conveyed to Detention Basin 'D' from the south. The flows from the south rely on surface conveyance, and inflow to Basin 'D' at a low point along Pennycress Drive identified as 'Inflow J'. An inlet pair at this location (Inlets J-1 & J-2) capture both Minor storm event (5yr) and Major storm event (100yr) flows.

The fully completed extended detention basin will occupy the location of partially constructed extended detention basin D planned with Filing No. 10, and currently in review with the County at the time of this report. The basin is proposed to fully accommodate water quality separation and the emergency conveyance of flow associated with Filing 10, Filing 11, and Future Filing No. 12.

The storm sewer system will provide storage and intercept most of the flows with some 100-year flows exceeding and by-passing inlets in the Major event. The Minor event is fully intercepted by the inlet and pipe systems.

WATER QUALITY METHODOLOGY (4-STEP PROCESS):

STEP 1: RUNOFF REDUCTION PRACTICES

New construction will utilize existing and proposed grassed areas as buffers, allowing sediment to drop out of the storm runoff and helping to reduce runoff. The existing grassed swales along the east
side of the site shall remain undisturbed. Sub-basins E-1 through a portion of E-4 are vegetated hillsides which provide some runoff reduction benefit, along with some biofiltering. Runoff Reduction calculations and *IRF Reduction Exhibit* are provided in Appendix C for the zone encompassing Sub-basins E-1 thru E-4 (Zones 1 thru 4). IRF Reduction Analysis for this zone resulted in a treatment value of at least 60% of the expected overall WQCV.

STEP 2: IMPLEMENT BMP'S THAT SLOWLY RELEASE THE WATER QUALITY CAPTURE VOLUME

Treatment and slow release of 40 hours of the water quality capture volume (WQCV) will be accomplished by the implementation of the proposed private extended detention basin.

STEP 3: STABILIZE DRAINAGEWAYS

There are no major drainageways affected by the development. No improvements to any downstream drainageways are required or anticipated, at this time. The project discharges into an existing EDB via new pipe systems.

STEP 4: IMPLEMENT SITE SPECIFIC & SOURCE CONTROL BMP'S

There are no potential sources of contaminants that could be introduced to The County MS4 that will not be controlled by temporary construction BMPs. Maintenance and sweeping of parking areas is recommended to limit sediment transport to new inlets, pipes and detention areas. Construction BMPs in the form of vehicle tracking control, concrete washout area, inlet protection, rock socks, and silt fences will be utilized during construction activities to protect receiving waters.

The Following is a description of the on-site drainage sub-basins:

Basin D

Sub-basins D-1 thru D-24 are not all located within Filing No. 11 but are all tributary to Detention Basin 'D'. Basins D1-D24 comprise approximately 60 acres. Some edge areas are released undetained and these are accounted for in the B-Series and E-Series of sub-basins discussed later in this report. The E-Series 'edge area' basins are substantially unchanged from their historic condition and flowrate.

The Sub-basins herein are generally organized and map-labeled in the order they sit from highest in elevation to lowest.

Detained flows released from Detention Basin 'D' will be conveyed to the existing roadside ditch along Marksheffel Road. Design Point D10-1 released flows are discharges from the outlet structure of the Extended Detention Basin within a reinforced trapezoidal channel. Under developed conditions the channel will discharge 59.6 cfs during the Major Event. Downstream Culverts have been analyzed for expected flow volume and channel capacity. Flow declarations are provided on the Developed Map Exhibit along both sides of Marksheffel Rd. Capacity appears to be adequate.

Sub-basins D-1 thru D-19 have similar characteristics with a mix of street, and residential lot area. Refer to Map Sheet 3 of 3 (D-2). The Following is a description of these sub-basins:

Sub-basin D-1 is approximately 2.53 acres in area and is located north and west of the subject property (Future Filing 12). Runoff from this basin will sheet flow south and concentrate in rough-cut street sections. This basin combines with Sub-basin D-2.

Sub-basin D-2 is approximately 1.46 acres in area and is located west of the subject property (Future Filing 12) with the exception of its extreme southeast corner which is on-site. Runoff from this basin will sheet flow south and concentrate in rough-cut street sections until reaching a 12 ft curb inlet at DP69 (Inlet E-2).

Sub-basin D-3 is approximately 1.62 acres in area and is located north and west of the subject property (Future Filing 12). Runoff from this basin will sheet flow south and concentrate in rough-cut street sections. This basin combines with Sub-basin D-4.

Sub-basin D-4 is approximately 2.07 acres in area and is located north and west of the subject property (Future Filing 12) with the exception of its extreme eastern corner which is on-site. Runoff from this basin will sheet flow south and concentrate in rough-cut street sections. It will also combine with concentrated runoff from upstream Sub-basin D-3 until reaching a 12 ft curb inlet at DP71 (Inlet E-1).

Sub-basin D-5 is approximately 2.41 acres in area and is located west of the subject property (Future Filing 12) with the exception of its extreme eastern corner which is on-site. Runoff from this basin will sheet flow north and concentrate in the south half of a rough-cut street section until reaching an interim storm inlet at DP72 (Inlet A-4). A-4 is actually a future storm manhole which is planned to be left as an area inlet until the time of future development (Filing No. 12).

Sub-basin D-6 is approximately 0.41 acres in area and is located in the north and west portion of the subject property. Runoff from this basin will sheet flow south and concentrate in Pennycress Drive and be conveyed by curb and gutter to the south (DP73) where it will continue across a crosspan at the intersection of Lance Leaf Drive and combine with additional surface flows from Sub-basin D-7.

Sub-basin D-7 is approximately 3.12 acres in area and is located along the westerly margin of the subject property. Some of the northwesterly margins of this sub-basin lie within Future Filing No.

12. Runoff from this basin will sheet flow south and east and concentrate in Pennycress Drive and be conveyed by curb and gutter to the south to on-grade inlet E-6 (DP75). In the Major storm event, 2.0 cfs of bypass flow will continue across a crosspan at the intersection of Marsh Elder Drive and combine with additional surface flows from Sub-basin D-8.

Sub-basin D-8 is approximately 1.76 acres in area and is located along the westerly margin of the subject property. Some of the northwesterly margins of this sub-basin lie within Future Filing No. 12. Runoff from this basin will sheet flow south and east and concentrate within The Marsh Elder Place cul-de-sac and within Pennycress Drive and be further conveyed by curb and gutter to the south within the Pennycress roadway corridor at DP76. In the Minor event, 2.2 cfs of bypass flow will continue south as gutter flow. In the Major storm event, 9.7 cfs of bypass flow will continue south as gutter flow (at DP 78) and combine with additional surface flows from Sub-basin D-10.

Sub-basin D-9 is approximately 2.11 acres in area and is located west of the subject property. Runoff from this basin will sheet flow southeast and concentrate in a temporary diversion ditch which terminates at Structure F-2 – an interim inlet consisting of the base portion of Manhole F-2. At such time as Filing No 12 is constructed, the temporary inlet will be converted to an enclosed manhole with cone section, and it will be fitted with an upstream RCP pipe for future flows concentrating in The Basin at DP77. For the purpose of hydraulic analysis, Developed Flows from Basin D-9 have been used in calculation and sizing of the storm system.

Sub-basin D-10 is approximately 2.99 acres in area and is located along the westerly margin of the subject property. Runoff from this basin will sheet flow south and east and concentrate within Pennycress Drive and be further conveyed by curb and gutter to the south within the Pennycress roadway corridor to a 20-foot curb inlet (Inlet H-2) at DP79. In the Minor event, 2.2 cfs of bypassed flow from upstream sub-basins D7 & D-8 will combine with flows from this sub-basin and continue south as gutter flow. In the Major storm event, 9.7 cfs of bypassed flow is received and will continue south as gutter flow to DP 79. Inlet H-2 lies in a sump condition along with a series of other inlets at this intersection which are all hydrostatically interconnected in the Major Event. These inlets collectively intercept one hundred percent (100%) of the Major Event. Hydraulic Analysis (HGL/EGL) using EPA SWMM was performed to validate the storm system's performance at this final junction in the Major Event. The SWMM Model results are included in Appendix C.

Sub-basin D-11 is approximately 3.96 acres in area and is located in the central area of the subject property. Runoff from this basin will sheet flow south and west and concentrate in Pennycress Drive and be conveyed by curb and gutter to the south (DP80) where it will continue across a crosspan at a knuckle cul-de-sac (See Sub-basin D-12).

Sub-basin D-12 is approximately 1.39 in area and is located in the central area of the subject property. Runoff from this basin will sheet flow south and west and concentrate in Pennycress Drive and be combined with gutter flow from Sub-basin D-11. 4.50 cfs in the Minor event, and 13.0 cfs in the Major event will combine with sub-basin flows and be conveyed by curb and gutter to the south to Inlet G-4 (DP81). Inlet G-4 lies in a sump condition along with a series of other inlets at this intersection which are all hydraulically connected. These inlets collectively intercept one hundred percent (100%) of the Major storm event.

Sub-basin D-13 is approximately 2.07 acres in area and is located in the central area of the subject property. Runoff from this basin will sheet flow south and east and concentrate in Golden Buffs Drive and be conveyed by curb and gutter to the south to on-grade curb inlet D-4 at DP82.

Sub-basin D-14 is approximately 3.30 acres in area and is located in the central area of the subject property. Runoff from this basin will sheet flow south and east and concentrate in Golden Buffs Drive and be conveyed by curb and gutter to the south to on-grade curb inlet G-3 at DP83. Some bypass flows (2.3 cfs) from Sub-basin D-13 will combine within the street's gutter section in the Major storm event.

Sub-basin D-15 is approximately 2.80 acres in area and is located north and west of the subject property (Future Filing 12). Runoff from this basin will sheet flow south and east and concentrate in rough-cut street sections at DP84. This basin combines with Sub-basin D-16 via future crosspan.

Sub-basin D-16 is approximately 2.14 acres in area and is located north and west of the subject property (Future Filing 12) excepting a very small portion of its easternmost edge. Runoff from this basin will sheet flow south and concentrate in rough-cut street sections. This basin combines with upstream Sub-basin D-15 at the point of a planned future crosspan. Combined flows continue east in the north half of the rough-cut street section (Future Golden Buffs Drive) to the subject property and the beginning of improved street Golden Buffs Drive. Combined flows continue east about another 80 feet to Inlet B-1 (DP84.1). Some bypass flow will continue east (5.2 cfs) to Sub-basin D-16.1 in the Major storm event.

Sub-basin D-16.1 is approximately 1.69 acres in area and is located in the north margins of the subject property. Runoff from this basin will sheet flow southwest and concentrate within Golden Buffs Drive. Flows from this basin combine with concentrated gutter flow from upstream Sub-basin D-16 at the point of a planned crosspan (DP84.1). Combined flows continue east in the north half of Golden Buffs Drive to Mouse Ear Place cul-de-sac (DP85) and the location of Inlet C-1. Some bypass flow will continue southeast (2.2 cfs) to Sub-basin D-17 in the Major storm event.

Sub-basin D-17 is approximately 2.29 acres in area and is located in the northeast area of the subject property. Runoff from this basin will sheet flow west and concentrate in Golden Buffs Drive, and within cul-de-sac gutter sections at Mouse Ear Place, and Kitten Tail Court. These flows combine at Inlet D-1 (DP86). Some bypass flow will continue south (1.7 cfs) to Sub-basin D-18 in the Major storm event.

Sub-basin D-18 is approximately 1.98 acres in area and is located in the east area of the subject property. Runoff from this basin will sheet flow west and concentrate in Golden Buffs Drive, and within cul-de-sac gutter sections at Horse Mint Trail. These flows combine at the east half of Golden Buffs Drive within the gutter section and ahead of an unnamed knuckle cul-de-sac (DP87). Some bypass flow will continue south to Sub-basin D-19; 2.3 cfs in the Minor storm event, and 8.2 cfs in the Major event.

Sub-basin D-19 is approximately 2.02 acres in area and is located in the southeast area of the subject property. Runoff from this basin will sheet flow west and concentrate in Golden Buffs Drive, and within an unnamed knuckle cul-de-sac. Concentrated gutter flows will combine with upstream bypassed flows from Sub-basin D-18. These combined flows will continue south (1.7 cfs) to Inlet G2 (DP88). Bypassing flows from Inlet G-2 are expected to overtop to Inlet G-1 in the Minor storm event and overtop to inlet G-1 and H-1 and J-2 in the Major storm event.

Sub-basin D-19.1 is approximately 0.15 acres in area and is located in the southeasterly corner of the subject property. Runoff from this basin will sheet flow west and concentrate in Pennycress Drive. These flows combine at Inlet G-1 (DP89). Some bypass flows will contribute to this inlet in both the Minor storm (0.1 cfs) and the Major storm event (5.7 cfs).

Sub-basins D20-24 have varying surface characteristics, and these are reflected in the weighted coefficients assigned to each basin through Rational methodology. These basins comprise the tributary areas inflowing to Basin 'D' from the south. Refer to Map Sheet 2 of 3 (D-1). The Following is a description of the southerly sub-basins:

Sub-basin D-20 is approximately 0.90 acres in area and is located south of the subject property. It is comprised of Pennycress Drive and some captured landscape areas. Runoff from this basin will sheet flow west and concentrate in Pennycress Drive at Inlet J-1 (DP92a). These flows combine at Inlet J-2 with flows from Sub-basin D-23 and inflow directly to Detention basin 'D'. There are no bypass flows.

Sub-basin D-21 is approximately 4.02 acres in area and is located south of the subject property within Filing No. 10. Sub-basin D-21 has similar surface characteristics to Sub-basins D-1 thru D-19. Runoff from this basin will sheet flow south and east and concentrate first within Peaceful Valley Road, and Buffalo Bur Trail, and then within Pennycress Drive existing street sections (DP90). These flows currently combine with flows from Sub-basin D-22 and are conveyed to the intersection of Pennycress Drive and Peaceful Valley Road. A crosspan conveys the flows to a point where the existing street terminates. From the street's terminus, a temporary outfall ditch, planned for construction with Filing No. 10 conveys these flows directly to Basin 'D'. Under proposed conditions, the temporary outfall ditch is eliminated in favor of extending Pennycress Drive north.

Sub-basin D-22 is approximately 1.15 acres in area and is located south of the subject property within Filing No. 10. It is comprised of existing sections of Peaceful Valley Road and some captured overlot areas. Runoff from this basin will sheet flow southwest and concentrate in Peaceful Valley Road (DP91). These flows combine with flows from Sub-basin D-21 and inflow directly to Detention Basin 'D'. There are no inlets. All flows from this sub-basin contribute to the north side gutter section of Pennycress Drive and are no longer ditch flow, but rather gutter flow within Sub-basin D-23.

Sub-basin D-23 is approximately 0.52 acres in area and is located south of the subject property. It is comprised of Pennycress Drive and some captured landscape areas. Runoff from this basin will sheet flow east and concentrate in Pennycress Drive at Inlet J-2 (DP92b). These flows combine at Inlet J-1 with flows from Sub-basin D-23 and inflow directly to Detention basin 'D'. There are no bypass flows.

Sub-basin D-24 is approximately 9.79 acres in area and is located along the west side of the subject property. This sub-basin encompasses all of the planned detention basin area, as well as off-site flows received from the west which traverse the Colorado Interstate Gas Pipeline Easement (C.I.G. Easement). These flows will remain unchanged from historic condition excepting roadway improvements. Flows from this sub-basin accumulate within rear lot areas north and west of the detention basin and are conveyed along shallow slopes with minimal velocity. There are no bypass flows, or inlets.

Basin E

The ‘E’ Series Basins are located along the easterly edge of the site between the property and Marksheffel Road. Sub-basins E-1 through E-5 drain offsite to the existing roadside ditch along Marksheffel Road.

A description of each of the ‘E’ Series Sub-basins follows:

Sub-basin E-1 contains 5.27 acres and is located within Filing No 11. This basin abuts existing Marksheffel Road and is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. A narrow strip along the north margin discharges nuisance flows to an east-west drainage that ends at Marksheffel Rd. For purposes of water quality treatment, that portion of these sub-basins discharging from within the Filing No 11 Boundary was analyzed using the IRF Runoff Reduction Method. An Exhibit and MHFD Calculation Sheet (*UD-BMP_v3.07.xls*) are provided in Appendix C. Developed Runoff from this basin will sheet flow southeast to the existing roadside ditch along Marksheffel Road (DP 95) as it does currently. A new box culvert crossing at Poa Annua will be installed with this project to receive and discharge ditch flows. The Poa Annua Culvert will consist of a two-foot high by three-feet wide double box culvert with wingwalls at each end, and aprons with cutoff walls. The culvert will pass flows from the Minor Event, and overtop some flow in the Major Event. Full Capacity (Q_{pipe}) is calculated to be 93.58 cfs (See Appendix C), with an additional 6.42 cfs overtopping ($Q_{overtop}$)in the Major Event

Sub-basin E-2 contains 0.50 acres and is located within Filing No 11 along the north side of planned Poa Annua Street. This basin also partially abuts existing Marksheffel Road and is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. For purposes of water quality treatment, that portion of these sub-basins discharging from within the Filing No 11 Boundary was analyzed using the IRF Runoff Reduction Method. An Exhibit and MHFD Calculation Sheet (*UD-BMP_v3.07.xls*) are provided in Appendix C. Developed Runoff from this basin will sheet flow southeast to the existing roadside ditch along Marksheffel Road (DP 96) as it does currently.

Sub-basin E-3 contains 1.67 acres and is located within Filing No 11 along the south side of planned Poa Annua Street. This basin also abuts existing Marksheffel Road and is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. For purposes of water quality treatment, that portion of these sub-basins discharging from within the Filing No 11 Boundary was analyzed using the IRF Runoff Reduction Method. An Exhibit and MHFD Calculation Sheet (*UD-BMP_v3.07.xls*) are provided in Appendix C. Developed Runoff from this basin will sheet flow southeast to the existing roadside ditch along Marksheffel Road (DP 97) as it does currently.

Sub-basin E-4 contains 1.17 acres and is located within Filing No 11 and lies between planned Pennycress Drive and existing Marksheffel Rd. It is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. For purposes of water quality treatment, that portion of these sub-basins discharging from within the Filing No 11 Boundary was analyzed using the IRF Runoff Reduction Method. An Exhibit and MHFD Calculation Sheet (*UD-BMP_v3.07.xls*) are provided in Appendix C. Developed Runoff from this basin will sheet flow southeast to the existing roadside ditch along Marksheffel Road (DP 98) as it does currently. Sub-basin E-4 terminates at an existing six-foot wide by two-foot-high concrete box culvert with two barrels (6’x2’ Double CBC) at Design Point 10-2. Just upstream a small eighteen-inch culvert crosses Marksheffel Road and connects the east and west borrow ditches hydraulically (Ref: HDR Report, Structure ‘CV152’). This culvert appears to function as a transfer pipe to allow for redundant outflow.

WATER QUALITY

Storm water quality measures are required by the County in Volume 2 of the County's *Drainage Criteria Manual*. The water quality measures to be instituted for the development will include:

1. Water quality enhancement of the detention basin. Existing Sedimentation Basin 'D' was operating as a temporary sedimentation basin prior to construction of the Extended Detention Basin (planned for construction with Filing No 10). Final improvements at this basin will impact water quality through the addition of pre-sedimentation forebays, trickle channel, and perimeter surface treatments.
2. Water Quality Treatment via IRF Methodology at the north and east margin of the site.
3. The outlet structure will include a water quality orifice plate modification to match design.

A. COST OF PROPOSED DRAINAGE FACILITIES

Table 2 presents a cost estimate for the construction of drainage improvements (Public) for The Glen at Widefield Filing No. 11 development.

B. DRAINAGE AND BRIDGE FEES

The site lies within the West Fork Jimmy Camp Creek Drainage Basin. The current drainage basin fee associated with the West Fork Jimmy Camp Creek Drainage Basin is $13,066 per impervious acre. The current bridge fee associated with the West Fork Jimmy Camp Creek Drainage Basin is $3,866 per impervious acre. The Glen at Widefield Filing No. 11 subdivision encompasses 45.00 acres. Table 1 details the fees due as part of this development.

V. CONCLUSIONS

The Glen at Widefield Filing No. 11 will be a single-lot family residential subdivision covering approximately 45.00 acres (with 62.07 Acres Tributary to EDB). Onsite drainage will include the use of surface conveyance elements such as gutter, crosspan, and inlets to route the runoff from the site to Detention Basin 'D'.

Basin D serves Filing 10 along with northern tributary area Filing 11 and Future Filing 12 (See Maps). Detained runoff from the site will be conveyed to the West Fork Jimmy Camp Creek. With detention serving the site and existing downstream conveyance elements in place, the development of the Glen at Widefield Filing No. 11 property will not adversely impact or deteriorate improvements or natural drainageways downstream of the property.

VI. REFERENCES

1) Preliminary Drainage Report, The Glen at Widefield East, prepared by Kiowa Engineering Corporation, dated December 16, 2015.

2) Final Drainage Report, The Glen at Widefield Filing No. 7, prepared by Kiowa Engineering Corporation, dated January 11, 2016.

3) Amended Master Development Drainage Plan, The Glen at Widefield, prepared by Kiowa Engineering Corporation, dated June 21, 2007.

4) Final Drainage Report, The Glen at Widefield Filing No. 6, prepared by Kiowa Engineering Corporation, dated December 6, 2007.

5) Preliminary and Final Drainage Report, Mesa Ridge Parkway Final Design, prepared by Kiowa Engineering Corporation, dated November 29, 2010.

6) Mesa Ridge Parkway Roadway Design, Autumn Glen Avenue to Marksheffel Road and Widening from Powers Boulevard to Autumn Glen Avenue, prepared by Kiowa Engineering Corporation, dated December 8, 2010.

7) Master Development Drainage Plan for the Glen at Widefield, prepared by Kiowa Engineering Corporation, dated December 10, 1999.

8) West Fork Jimmy Camp Creek Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, dated October 17, 2003.

9) City of Colorado Springs and El Paso County Flood Insurance Study, prepared by the Federal Emergency Management Agency, dated March 1997.

10) El Paso County Drainage Criteria Manual (Volumes 1 and 2) and Engineering Criteria Manual, current editions.

11) Soil Survey of El Paso County Area, Colorado, prepared by United States Department of Agriculture Soil Conservation Service, dated June 1981.

12) Final Drainage Report Marksheffel Road South - Link Road to US-24, El Paso County, CO, HDR Engineering, August 2015.

13) Final Drainage Report The Glen Filing No 10 Kiowa Engineering, September 2019 (Pending Review)

APPENDIX TABLE OF CONTENTS

APPENDIX

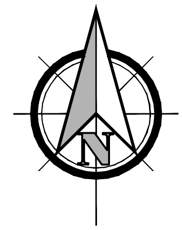
Figure 1: Vicinity Map

Figure 2: Soils Map

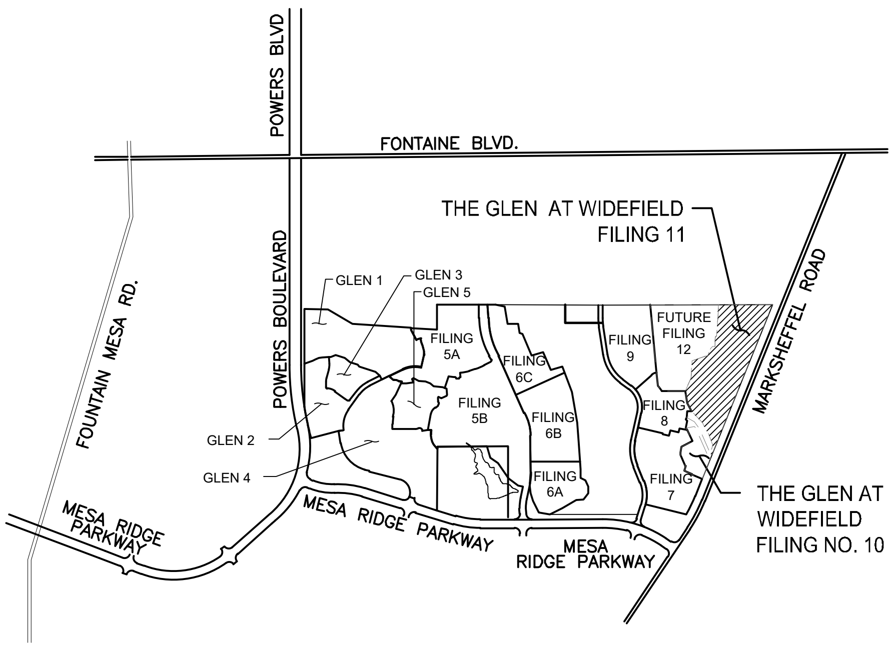
FEMA Flood Insurance Rate Map (Panels 956 and 957)

Table 1: Impervious Area and Drainage Basin & Bridge Fee Calc

Table 2: Opinion of Cost – Drainage Facilities



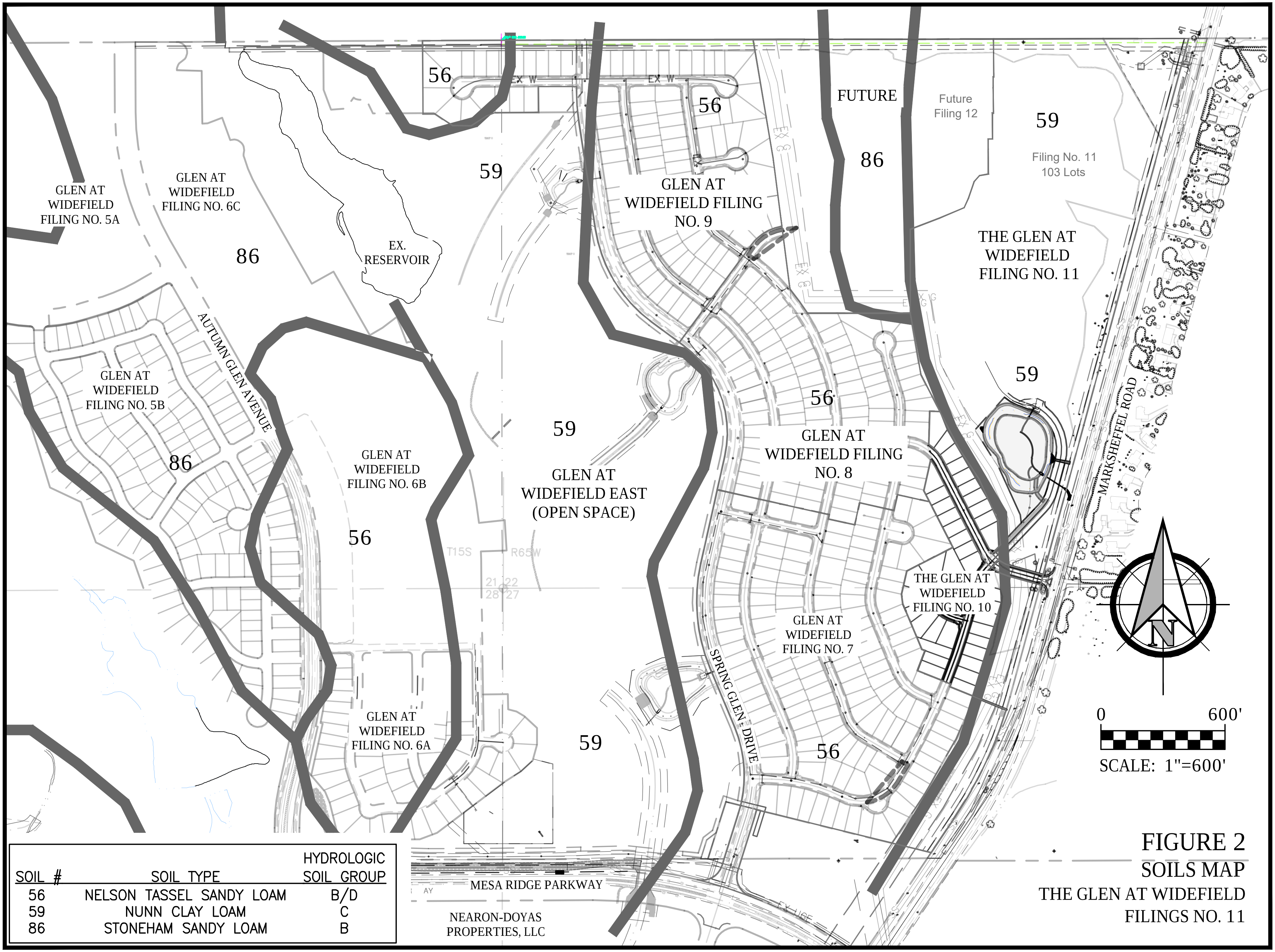
SCALE: NTS



VICINITY MAP
SCALE: N.T.S.

19016 Filing 11 - Historic Conditions.dwg/Jan 04, 2021

FIGURE 1
VICINITY MAP
THE GLEN AT WIDEFIELD FILING NO. 11



SOIL #	SOIL TYPE	HYDROLOGIC SOIL GROUP
56	NELSON TASSEL SANDY LOAM	B/D
59	NUNN CLAY LOAM	C
86	STONEHAM SANDY LOAM	B

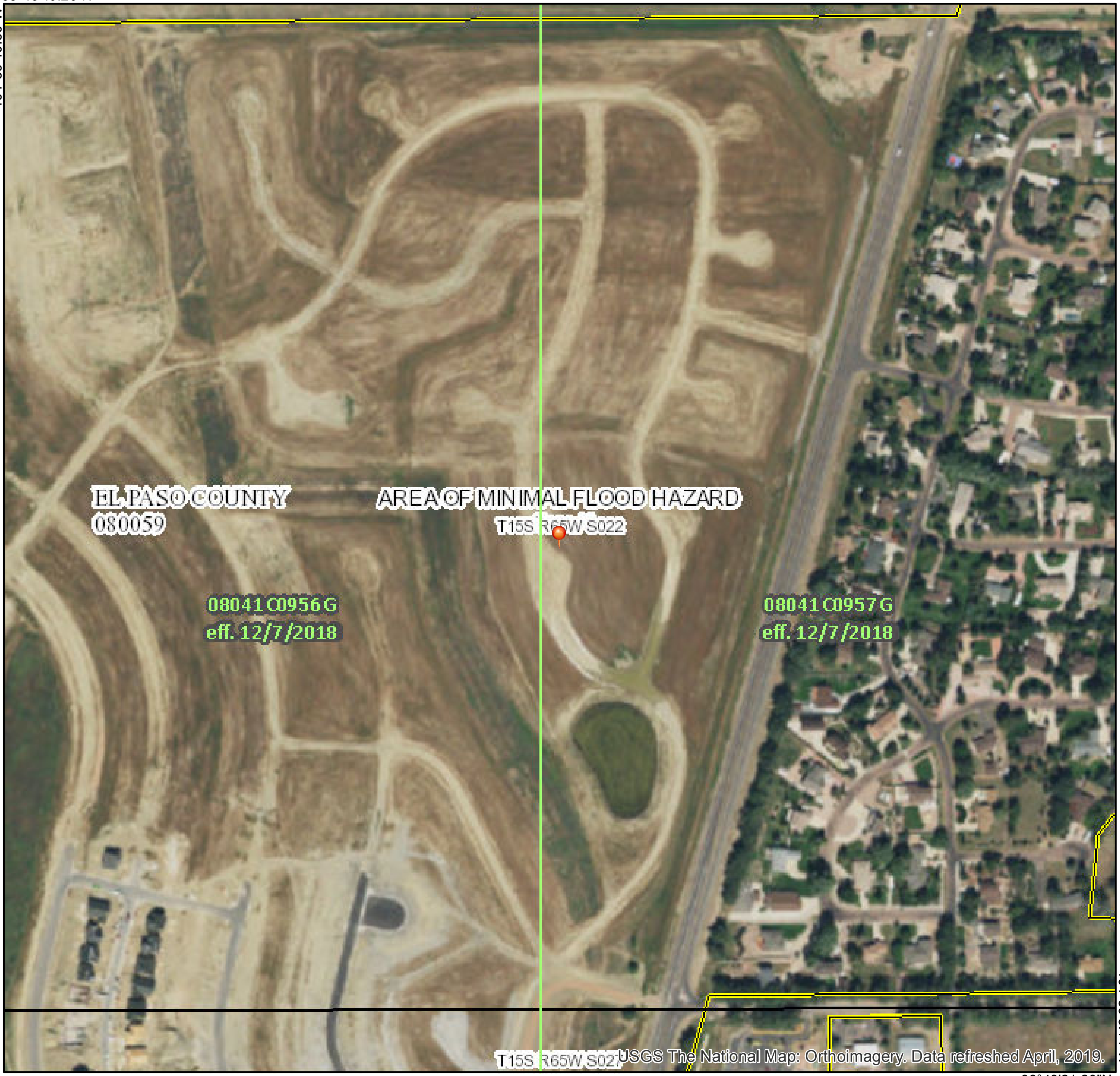
FIGURE 2
SOILS MAP
THE GLEN AT WIDEFIELD
FILINGS NO. 11

National Flood Hazard Layer FIRMette

FEMA

38°43'49.26"N

104°39'40.60"W



104°39'3.14"W

38°43'21.20"N

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

1:6,000

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/26/2019 at 12:16:52 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Table 1: Impervious Area and Drainage Basin & Bridge Fee Calculation

Total Lots =	103 lots
Total Development Area =	44.996 ac
Total Undeveloped Acres =	11.800 ac
Total Developed Area =	**33.2 ac**
Building/Patio/Drive Per Lot =	2,500 sf
Total Building/Patio/Drive Area =	5.911 ac
Total Street/Sidewalk Area =	6.700 ac
Total Impervious Area =	12.611 ac
% Impervious Area =	**37.99 %**

West Fork Jimmy Camp Creek Drainage Basin

Drainage Basin Fee and Bridge Fee Calculations			
Drainage Basin Fee =	$13,066 / ac	**Drainage Basin Fee =**	**$ 164,780.38**
Bridge Fee =	$3,866 / ac	**Bridge Fee =**	**$ 48,755.62**

Less Previous Drainage Fee Credit (Carry Over from Glen at Widefield Filing No. 7)	**$0.00**	$ 0.00
Drainage Basin Fee Reimbursement	**$0.00**	
Total Drainage Basin Fee Credit Available	**$0.00**	

	Drainage Basin	**Bridge**
Total Fees Due for the Glen at Widefield Filing No. 11	**$164,780.38**	**$ 48,755.62**

Table 2: Opinion of Cost - Public Drainage Facilities

Item	Quantity	Unit	Unit Cost	**Item Total**
18" RCP Class III	553	LF	$ 72.00	$ 39,823.20
21" RCP Class III	471	LF	$ 84.00	$ 39,547.20
24" RCP Class III	727	LF	$ 96.00	$ 69,744.00
27" RCP Class III	327	LF	$ 102.00	$ 33,333.60
30" RCP Class III	352	LF	$ 102.00	$ 35,924.40
33" RCP Class III	989	LF	$ 116.00	$ 114,700.80
36" RCP Class III	510	LF	$ 128.00	$ 65,241.60
36" RCP Class IV	432	LF	$ 142.00	$ 61,329.80
48" Equiv HERCP	102	LF	$ 140.00	$ 14,232.40
2'x3' Concrete Box Culvert	180	LF	$ 160.00	$ 28,800.00
Curb Inlet 12' (D-10-R)	10	EA	$ 7,500.00	$ 75,000.00
Curb Inlet 16' (D-10-R)	2	EA	$ 8,000.00	$ 16,000.00
Curb Inlet 16' (D-10-R) Modified Width	1	EA	$ 10,000.00	$ 10,000.00
Storm Manhole 4ft Diameter	10	EA	$ 4,575.00	$ 45,750.00
Storm Manhole 5ft Diameter	12	EA	$ 4,925.00	$ 59,100.00
Storm Manhole 6ft Dia (No Cone)	2	EA	$ 5,425.00	$ 10,850.00
End Treatment - Wingwall	2	EA	$ 1,200.00	$ 2,400.00
Geotextile (Erosion Control)	2,416	SY	$ 6.00	$ 14,496.00
Rip Rap, d50 Size from 6" to 24"	18	CY	$ 95.00	$ 1,710.00
Drainage Channel Construction, Size (18 x 2)	265	LF	$ 28.00	$ 7,420.00
Channel Lining, Rip Rap	8	CY	$ 112.00	$ 896.00
Channel Lining, Grass	3	AC	$ 1,287.00	$ 3,861.00
Detention Outlet Structure	0	EA	$ 12,000.00	$ 0.00
Detention Emergency Spillway	0	EA	$ 18,300.00	$ 0.00
Presedimentation Forebay	2	EA	$ 7,000.00	$ 14,000.00
Gravel Maintenance Access Trail	352	SY	$ 20.00	$ 7,044.00
Type II Bedding	112	CY	$ 35.00	$ 3,920.00
Detention Basin Seeding and Mulch	3	AC	$ 520.00	$ 1,528.80

Estimated Storm Drainage Facilities Cost: **$ 776,652.80**

Table 2: Opinion of Cost - Public Drainage Facilities

Item	Quantity	Unit	Unit Cost	**Item Total**
18" RCP Class III	1,015	LF	$ 72.00	$ 73,044.00
21" RCP Class III	596	LF	$ 84.00	$ 50,038.80
24" RCP Class III	411	LF	$ 96.00	$ 39,472.32
27" Equiv HERCP Class III (19x30)	112	LF	$ 102.00	$ 11,424.00
30" RCP Class III	505	LF	$ 102.00	$ 51,510.00
33" RCP Class III	1,289	LF	$ 116.00	$ 149,524.00
36" RCP Class III	78	LF	$ 128.00	$ 9,984.00
36" RCP Class IV	250	LF	$ 142.00	$ 35,500.00
48" Equiv HERCP	102	LF	$ 140.00	$ 14,232.40
2'x3' Concrete Box Culvert	180	LF	$ 160.00	$ 28,800.00
Curb Inlet 10' (Type R)	9	EA	$ 7,500.00	$ 67,500.00
Curb Inlet 15' (Type R)	2	EA	$ 8,000.00	$ 16,000.00
Curb Inlet 15' (Type R) Modified Width	2	EA	$ 10,000.00	$ 20,000.00
Curb Inlet 20' (Type R) Modified Width	2	EA	$ 12,000.00	$ 24,000.00
Storm Manhole 4ft Diameter	9	EA	$ 4,575.00	$ 41,175.00
Storm Manhole 5ft Diameter	13	EA	$ 4,925.00	$ 64,025.00
Storm Manhole 5ft Dia (No Cone)	3	EA	$ 6,500.00	$ 19,500.00
Storm Manhole 6ft Dia (No Cone)	2	EA	$ 8,500.00	$ 17,000.00
End Treatment - Wingwall, Apron, Cutoff	2	EA	$ 2,400.00	$ 4,800.00
Geotextile (Erosion Control)	2,416	SY	$ 6.00	$ 14,496.00
Rip Rap, d50 Size from 6" to 24"	18	CY	$ 95.00	$ 1,710.00
Drainage Channel Construction, Size (18 x 2)	265	LF	$ 28.00	$ 7,420.00
Channel Lining, Rip Rap	8	CY	$ 112.00	$ 896.00
Channel Lining, Grass	3	AC	$ 1,287.00	$ 3,861.00
Detention Outlet Structure (Plate Only)	1	EA	$ 525.00	$ 525.00
Detention Emergency Spillway (Partial)	0	EA	$ 800.00	$ 0.00
Presedimentation Forebay	2	EA	$ 6,850.00	$ 13,700.00
Gravel Maintenance Access Trail	352	SY	$ 20.00	$ 7,044.00
Type II Bedding	112	CY	$ 35.00	$ 3,920.00
Detention Basin Seeding and Mulch	3	AC	$ 520.00	$ 1,528.80

Estimated Storm Drainage Facilities Cost: **$ 792,630.32**

APPENDIX A

Hydrologic Calculations

Existing Condition – Runoff Co-eff, Time of Concentration and Runoff Calcs
Excerpts from Markscheffel Road Improvements Project South - Link Road to US-24
Developed Condition – Runoff Co-eff, Time of Concentration and Runoff Calcs

KIOWA ENGINEERING CORPORATION

JOB 14044 - GLEN AT WIDEFIELD EAST
SHEET NO. 1 OF 2
CALCULATED BY CJC DATE 4/24/15
CHECKED BY ________ DATE ________
SCALE ________

RUNOFF COEFF. CALC'S. — EXISTING CONDITION

USE UNDEVELOPED - "PASTURE/MEADOW" LAND USE :

B SOILS - $C_5 = 0.08$ $C_{100} = 0.35$
B/D SOILS - $C_5 = 0.15$ $C_{100} = 0.50$ (ASSUME C/D SOILS)
C SOILS - $C_5 = 0.15$ $C_{100} = 0.50$

BASIN EX-1 : TYPE C AND B/D SOILS
AREA = 48.60 AC (AREAS FROM CAD, TYP.)
$C_5 = 0.15$
$C_{100} = 0.50$

BASIN EX-2 : TYPE C AND B/D SOILS
AREA = 33.12 AC
$C_5 = 0.15$
$C_{100} = 0.50$

BASIN EX-3 : TYPE C AND B/D SOILS
AREA = 61.01 AC
$C_5 = 0.15$
$C_{100} = 0.50$

BASIN EX-4 : TYPE C AND B/D SOILS
AREA = 10.51 AC
$C_5 = 0.15$
$C_{100} = 0.50$

BASIN EX-5 : TYPE B SOIL - 12.2 AC ±
TYPE C SOIL - 39.3 AC ±
TYPE B/D SOIL - 23.2 AC ±
} FROM SOILS MAP
AREA = 74.74 AC

$$C_{5,WTD} = \frac{0.08(12.2) + 0.15(39.3 + 23.2)}{74.74} = 0.14$$

$$C_{100,WTD} = \frac{0.35(12.2) + 0.50(39.3 + 23.2)}{74.74} = 0.48$$

BASIN EX-6 = TYPE C AND B/D SOILS

AREA = 8.83 AC

$C_5 = 0.15$

$C_{100} = 0.50$

TIME OF CONCENTRATION CALC'S. – EXISTING CONDITION

BASIN OS-1 : FROM MDDP, HEC-1 MODEL INPUT : BASIN 3060

BASIN AREA (BA) = 0.119 SQ.mi. × 640 = 76.2 AC

SCS CURVE NO. (LS) = 79

SCS LAG TIME (UD) = 0.257 HRS. = $0.6\ t_c$

$t_c = 1.6\ (0.257)(60\ \text{min/hr}) = 24.7\ \text{min.}$

BASIN OS-2 = BA = 0.19 sq.mi. × 640 = 121.6 AC (BASIN 4010)

LS = 86

UD = 0.497 HRS.

$t_c = 1.6\ (0.497)(60) = 47.7\ \text{min.}$

The Glen at Widefield

Existing Condition

Runoff Coefficient and Percent Impervious Calculation

Basin / DP	Basin or DP Area (DP contributing basins)		Soil Type	PV % Imperv	Area 1 Land Use: Land Use Area	Area 1 Land Use: % Area	Area 1 Land Use: Comp Land Use % Imp	HI % Imperv	Area 2 Land Use: Land Use Area	Area 2 Land Use: % Area	Area 2 Land Use: Comp Land Use % Imp	US1 % Imperv	Area 3 Land Use: Land Use Area	Area 3 Land Use: % Area	Area 3 Land Use: Comp Land Use % Imp	US2 % Imperv	Area 4 Land Use: Land Use Area	Area 4 Land Use: % Area	Area 4 Land Use: Comp Land Use % Imp	RO % Imperv	Area 5 Land Use: Land Use Area	Area 5 Land Use: % Area	Area 5 Land Use: Comp Land Use % Imp	Basin % Imperv	Basin Runoff C_5	Basin Runoff C_{100}
EX-1	2,117,068 sf	48.60ac	C	100%		0%	0%	0%	48.60ac	100%	0%	85%		0%	0%	78%		0%	0%	90%		0%	0%	**0.0%**	**0.15**	**0.50**
EX-2	1,442,826 sf	33.12ac	C	100%		0%	0%	0%	33.12ac	100%	0%	85%		0%	0%	78%		0%	0%	90%		0%	0%	**0.0%**	**0.15**	**0.50**
EX-3	2,657,513 sf	61.01ac	C	100%		0%	0%	0%	61.01ac	100%	0%	85%		0%	0%	78%		0%	0%	90%		0%	0%	**0.0%**	**0.15**	**0.50**
EX-4	457,877 sf	10.51ac	C	100%		0%	0%	0%	10.51ac	100%	0%	85%		0%	0%	78%		0%	0%	90%		0%	0%	**0.0%**	**0.15**	**0.50**
EX-5	3,255,509 sf	74.74ac	C	100%		0%	0%	0%	74.74ac	100%	0%	85%		0%	0%	78%		0%	0%	90%		0%	0%	**0.0%**	**0.14**	**0.48**
EX-6	384,815 sf	8.83ac	C	100%		0%	0%	0%	8.83ac	100%	0%	85%		0%	0%	78%		0%	0%	90%		0%	0%	**0.0%**	**0.15**	**0.50**

Basin Runoff Coefficient is based on UDFCD % Imperviousness Calculation

Runoff Coefficients and Percents Impervious

Hydrologic Soil Type:	**C**		**Runoff Coef Calc Method**					%Imp
Land Use	Abb	%	C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}
Commercial Area	CO	95%	0.80	0.82	0.84	0.87	0.89	0.89
Drives and Walks	DR	90%	0.73	0.75	0.77	0.80	0.83	0.83
Streets - Gravel (Packed)	GR	40%	0.28	0.35	0.42	0.50	0.55	0.58
Undevelop-Pasture/Meadow	HI	0%	0.04	0.15	0.25	0.37	0.44	0.50
Lawns	LA	0%	0.04	0.15	0.25	0.37	0.44	0.50
Off-site flow-Undeveloped	OF	45%	0.31	0.37	0.44	0.51	0.56	0.59
Park	PA	7%	0.09	0.19	0.29	0.40	0.47	0.52
Playground	PL	13%	0.13	0.23	0.32	0.42	0.49	0.54
Streets - Paved	PV	100%	0.89	0.90	0.92	0.94	0.96	0.96
Roofs	RO	90%	0.73	0.75	0.77	0.80	0.83	0.83
User Input 1	US1	85%	0.66	0.68	0.71	0.75	0.78	0.79
User Input 2	US2	78%	0.57	0.60	0.64	0.68	0.72	0.73

Weighted
%Imp
A
B
C
D

Equations (% Impervious Calculation):

$C_A = K_A + (1.31\ i^3 - 1.44\ i^2 + 1.135\ i - 0.12)$ [Eqn RO-6]

$C_{CD} = K_{CD} + (0.858\ i^3 - 0.786\ i^2 + 0.774\ i + 0.04)$ [Eqn RO-7]

$C_B = (C_A + C_{CD}) / 2$

I = % imperviousness/100 as a decimal (See Table RO-3)

C_A = Runoff coefficient for NRCS Type A Soils

C_B = Runoff coefficient for NRCS Type B Soils

C_{CD} = Runoff coefficient for NRCS Type C and D Soils

Correction Factors - Table RO-4

K_A = For Type A Soils

K_A (2-yr)= 0

K_A (5-yr)= -0.08i + 0.09

K_A (10-yr)= -0.14i + 0.17

K_A (25-yr)= -0.19i + 0.24

K_A (50-yr)= -0.22i + 0.28

K_A (100-yr)= -0.25i + 0.32

K_{CD}=For Type C & D Soils

K_{CD} (2-yr)= 0

K_{CD} (5-yr)= -0.10i + 0.11

K_{CD} (10-yr)= -0.18i + 0.21

K_{CD} (25-yr)= -0.28i + 0.33

K_{CD} (50-yr)= -0.33i + 0.40

K_{CD} (100-yr)= -0.39i + 0.46

The Glen at Widefield
Existing Condition
Time of Concentration Calculation

Sub-Basin Data				Time of Concentration Estimate											Final t_c	Notes
Basin / Design Point	Contributing Basins	Area	C_5	Initial/Overland Time (t_i)			Travel Time (t_t)						Comp.			
				Length	Slope	t_i	Length	Slope	Land Type	Cv	Velocity	t_t	t_c			
EX-1		48.60ac	0.15	300lf	5.3%	17.3 min.	2200lf	1.9%	GW	15	2.1 ft/sec	17.7 min.	35.0 min.	**35.0 min.**	
EX-2		33.12ac	0.15	300lf	4.8%	17.9 min.	1370lf	3.2%	GW	15	2.7 ft/sec	8.5 min.	26.4 min.	**26.4 min.**	
EX-3		61.01ac	0.15			0.0 min.	2500lf	0.9%	GW	15	1.4 ft/sec	29.3 min.	29.3 min.	**29.3 min.**	
EX-4		10.51ac	0.15	300lf	4.0%	19.0 min.	900lf	4.9%	GW	15	3.3 ft/sec	4.5 min.	23.5 min.	**23.5 min.**	
EX-5		74.74ac	0.14	300lf	5.7%	17.0 min.	3250lf	1.0%	GW	15	1.5 ft/sec	36.1 min.	53.2 min.	**53.2 min.**	
EX-6		8.83ac	0.15	150lf	0.5%	26.8 min.	630lf	5.5%	GW	15	3.5 ft/sec	3.0 min.	29.8 min.	**29.8 min.**	
DP 1	OS-1	76.20ac	--	--	--	--	--	--		--	--	--	24.7 min.	**24.7 min.**	DP 3060 from MDDP
DP 2	OS-1, EX-1	124.80ac	0.15			0.0 min.	1000lf	1.0%	GW	15	1.5 ft/sec	11.1 min.	11.1 min.	**35.8 min.**	DP 1 routed to DP 2
DP 3	EX-2	33.12ac	0.15	300lf	4.8%	17.9 min.	1370lf	3.2%	GW	15	2.7 ft/sec	8.5 min.	26.4 min.	**26.4 min.**	
DP 4	OS-1, EX-1, EX-2	157.92ac	0.15			0.0 min.	300lf	0.5%	GW	15	1.1 ft/sec	4.7 min.	5.0 min.	**40.8 min.**	DP 2 and DP 3 routed to DP 4
DP 5	OS-1, EX-1, EX-2, EX-3	218.93ac	0.15			0.0 min.	800lf	1.3%	GW	15	1.7 ft/sec	7.8 min.	7.8 min.	**48.6 min.**	DP 4 routed to DP 5
DP 6	EX-4	10.51ac	0.15	300lf	4.0%	19.0 min.	900lf	4.9%	GW	15	3.3 ft/sec	4.5 min.	23.5 min.	**23.5 min.**	
DP 7	OS-1, EX-1, EX-2, EX-3, EX-4	229.44ac	0.15			0.0 min.	200lf	0.3%	GW	15	0.8 ft/sec	4.1 min.	5.0 min.	**53.6 min.**	DP 5 and DP 6 routed to DP 7
DP 8	OS-2	121.60ac	--	--	--	--	--	--		--	--	--	47.7 min.	**47.7 min.**	DP 4011 from MDDP
DP 9	OS-2, EX-5	196.34ac	0.15			0.0 min.	1550lf	0.6%	GW	15	1.1 ft/sec	23.2 min.	23.2 min.	**70.9 min.**	DP 8 routed to DP 9
DP 10	EX-6	8.83ac	0.15	150lf	0.5%	26.8 min.	630lf	5.5%	GW	15	3.5 ft/sec	3.0 min.	29.8 min.	**29.8 min.**	

Equations:

t_i (Overland) = $0.395(1.1-C_5)L^{0.5}S^{-0.333}$
C_5 = Runoff coefficient for 5-year
L = Length of overland flow (ft)
S = Slope of flow path (ft/ft)
tc Check = (L/180)+10 (Developed Cond. Only)
L = Overall Length

Velocity (Travel Time) = $CvS^{0.5}$
Cv = Conveyance Coef (see Table)
S = Watercourse slope (ft/ft)

Land Surface Type	Land Type
Grassed Waterway	GW
Heavy Meadow	HM
Nearly Bare Ground	NBG
Paved Area	PV
Riprap (Not Buried)	RR
Short Pasture/Lawns	SP
Tillage/Fields	TF

The Glen at Widefield
Existing Condition
Runoff Calculation

Basin / Design Point	Contributing Basins	Drainage Area	C_5	C_{100}	Time of Concentration	Rainfall Intensity i_5	i_{100}	Runoff Q_5	Q_{100}	Basin / DP	Notes
EX-1		48.60 ac	0.15	0.50	35.0 min.	2.2 in/hr	3.8 in/hr	**16.4 cfs**	**91.7 cfs**	EX-1	
EX-2		33.12 ac	0.15	0.50	26.4 min.	2.7 in/hr	4.5 in/hr	**13.3 cfs**	**74.3 cfs**	EX-2	
EX-3		61.01 ac	0.15	0.50	29.3 min.	2.5 in/hr	4.2 in/hr	**23.0 cfs**	**128.9 cfs**	EX-3	
EX-4		10.51 ac	0.15	0.50	23.5 min.	2.8 in/hr	4.8 in/hr	**4.5 cfs**	**25.1 cfs**	EX-4	
EX-5		74.74 ac	0.14	0.48	53.2 min.	1.6 in/hr	2.7 in/hr	**17.0 cfs**	**97.7 cfs**	EX-5	
EX-6		8.83 ac	0.15	0.50	29.8 min.	2.5 in/hr	4.2 in/hr	**3.3 cfs**	**18.5 cfs**	EX-6	
DP 1	OS-1	76.20 ac	--	--	24.7 min.	2.8 in/hr	4.7 in/hr	**48 cfs**	**163 cfs**	DP 1	DP 3060 from MDDP
DP 2	OS-1, EX-1	124.80 ac	0.15	0.50	35.8 min.	2.2 in/hr	3.7 in/hr	**41 cfs**	**232 cfs**	DP 2	
DP 3	EX-2	33.12 ac	0.15	0.50	26.4 min.	2.7 in/hr	4.5 in/hr	**13 cfs**	**74 cfs**	DP 3	
DP 4	OS-1, EX-1, EX-2	157.92 ac	0.15	0.50	40.8 min.	2.0 in/hr	3.4 in/hr	**48 cfs**	**268 cfs**	DP 4	
DP 5	OS-1, EX-1, EX-2, EX-3	218.93 ac	0.15	0.50	48.6 min.	1.8 in/hr	2.9 in/hr	**58 cfs**	**323 cfs**	DP 5	
DP 6	EX-4	10.51 ac	0.15	0.50	23.5 min.	2.8 in/hr	4.8 in/hr	**4 cfs**	**25 cfs**	DP 6	
DP 7	OS-1, EX-1, EX-2, EX-3, EX-4	229.44 ac	0.15	0.50	53.6 min.	1.6 in/hr	2.7 in/hr	**55 cfs**	**310 cfs**	DP 7	
DP 8	OS-2	121.60 ac	--	--	47.7 min.	1.8 in/hr	3.0 in/hr	**38 cfs**	**153 cfs**	DP 8	DP 4011 from MDDP
DP 9	OS-2, EX-5	196.34 ac	0.15	0.50	70.9 min.	1.2 in/hr	2.0 in/hr	**35 cfs**	**196 cfs**	DP 9	
DP 10	EX-6	8.83 ac	0.15	0.50	29.8 min.	2.5 in/hr	4.2 in/hr	**3 cfs**	**18 cfs**	DP 10	

Equations (taken from Fig 6-5, City of Colorado Springs DCM):

i_2=-1.19 ln(T_c) + 6.035
i_5=-1.50 ln(T_c) + 7.583
i_{10}=-1.75 ln(T_c) + 8.847
i_{25}=-2.00 ln(T_c) + 10.111
i_{50}=-2.25 ln(T_c) + 11.375
i_{100}=-2.52 ln(T_c) + 12.735

Q = CiA
Q = Peak Runoff Rate (cubic feet/second)
C = Runoff coef representing a ration of peak runoff rate to ave rainfall intensity for a duration equal to the runoff time of concentration.
i = average rainfall intensity in inches per hour
A = Drainage area in acres

P1	Inches
WQCV	0.60 in
2 yr	1.19 in
5 yr	1.50 in
10 yr	1.75 in
25 yr	2.00 in
50 yr	2.25 in
100 yr	2.52 in

KIOWA ENGINEERING CORPORATION

JOB 14044 - GLEN AT WIDEFIELD EAST
SHEET NO. 1 OF 2
CALCULATED BY CJC DATE 5/19/15
CHECKED BY DATE
SCALE

RUNOFF COEFFICIENT CALC'S. - DEVELOPED CONDITION (RESIDENTIAL AREAS)

A-BASINS:
A = 10.17 AC., 33 LOTS → 3.24 LOTS/AC.
A = 7.98 AC., 30 LOTS → 3.76 LOTS/AC.
→ 3.5 LOTS/AC.

BY INTERPOLATING FROM TABLE 6-6, I = 35%

⇒ $C_5 = 0.33$, $C_{100} = 0.57$ → SOIL GROUP C

B-BASINS:
A = 20.05 AC., 81 LOTS → 4.04 LOTS/AC.
A = 6.86 AC., 30 LOTS → 4.37 LOTS/AC.
→ 4.2 LOTS/AC.

FROM TABLE 6-6, I = 41%

⇒ $C_5 = 0.35$, $C_{100} = 0.58$ → SOIL GROUP C

C-BASINS:
A = 46.12 AC., 200 LOTS → 4.34 LOTS/AC.
A = 35.29 AC., 148 LOTS → 4.19 LOTS/AC.
→ 4.3 LOTS/AC.

FROM TABLE 6-6, I = 42%

⇒ $C_5 = 0.31$, $C_{100} = 0.50$ → SOIL GROUP B

RUNOFF COEFFICIENT CALC'S. - DEVELOPED CONDITION (CONT'D.):

(RESIDENTIAL AREAS)

D - BASINS:

A = 38.97 AC., 147 LOTS > 3.77 LOTS/AC.

A = 3.52 AC., 13 LOTS > 3.69 LOTS/AC.

> 3.7 LOTS/AC.

FROM TABLE 6-6, I = 37%

$\Rightarrow C_5 = 0.34$, $C_{100} = 0.58$ > SOIL GROUP C

E - BASINS:

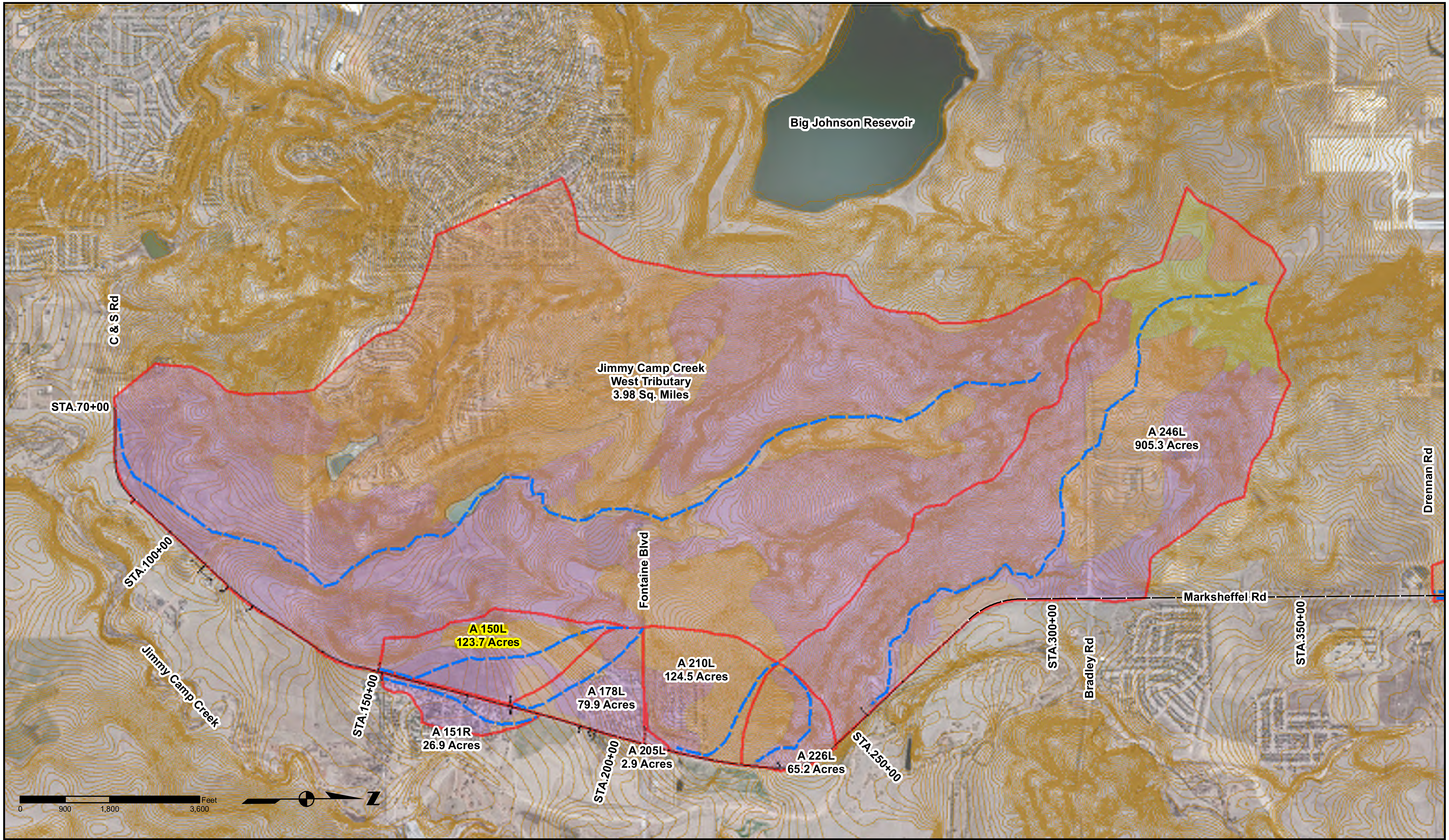
A = 2.81 AC., 7 LOTS > 2.49 LOTS/AC.

A = 1.6 AC., 4 LOTS > 2.5 LOTS/AC.

> 2.5 LOTS/AC.

FROM TABLE 6-6, I = 28%

$\Rightarrow C_5 = 0.30$, $C_{100} = 0.56$ > SOIL GROUP C



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Horiz. Scale:		Vert. Scale:	None
Unit Information		Unit Leader Initials	

HDR Engineering, Inc.

PARSONS BRINCKERHOFF

EL PASO COUNTY COLORADO

PPRTA

As Constructed	
No Revisions:	
Revised:	
Void:	

MARKSHEFFEL ROAD DRAINAGE BASIN

Designer:	E. Staten	Structure Numbers	
Detailer:	M.Johnson		
Sheet Subset:	BASIN	Subset Sheets:	1 of 3

Project No./Code

Sheet Number 1

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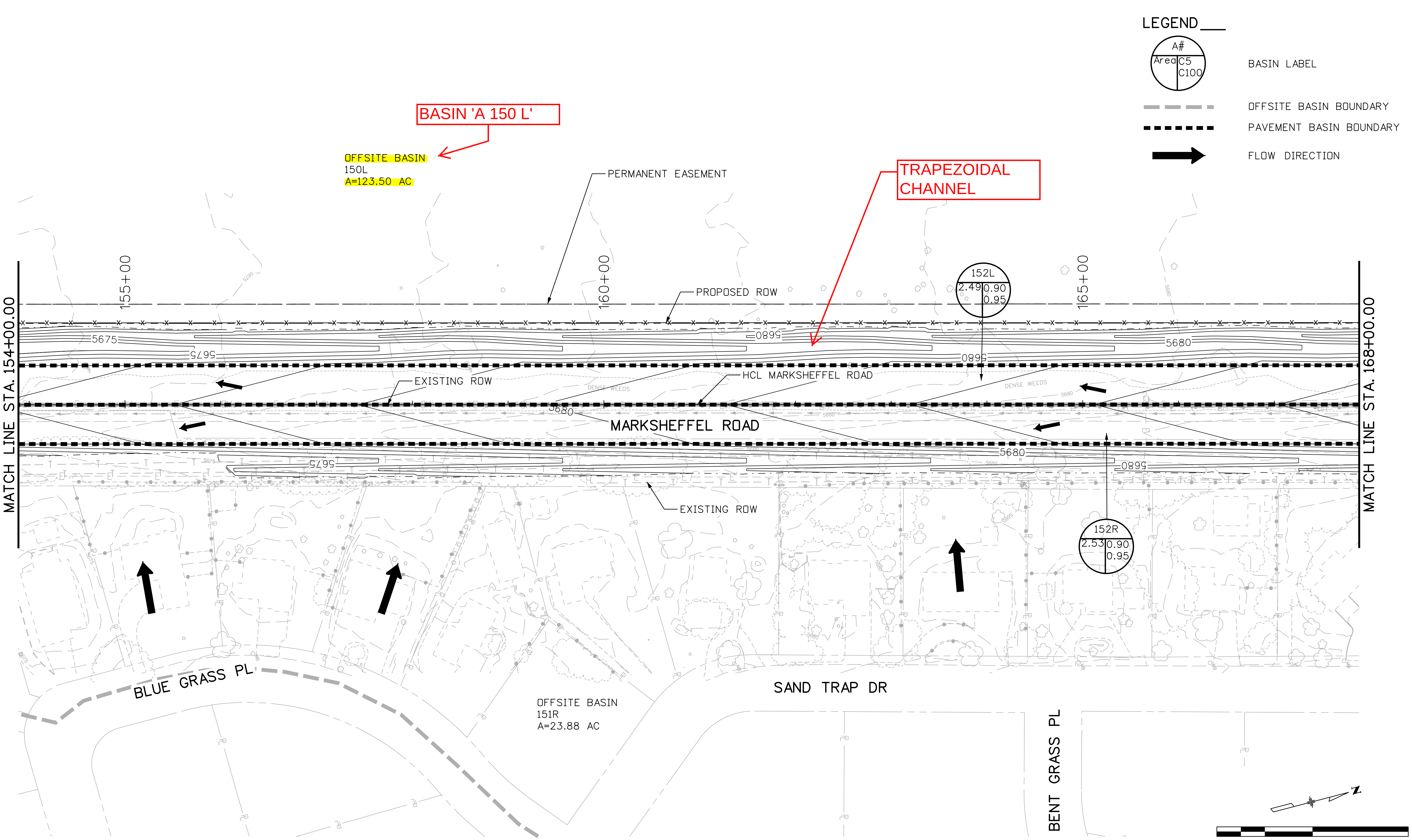

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Horiz. Scale: 1:100 Vert. Scale: As Noted
Unit Information Unit Leader Initials
HDR PARSONS BRINCKERHOFF

Sheet Revisions		
Date:	Comments	Init.

EL PASO COUNTY COLORADO
PPRTA

As Constructed
No Revisions:
Revised:
Void:

MARKSHEFFEL ROAD
DRAINAGE BASINS PLAN
154+00.00 TO 168+00.00

Designer:	E. STATEN	Structure Numbers	
Detailer:	D. MADDOCK		
Sheet Subset:	BASINS	Subset Sheets: 7 of 36	

Project No./Code
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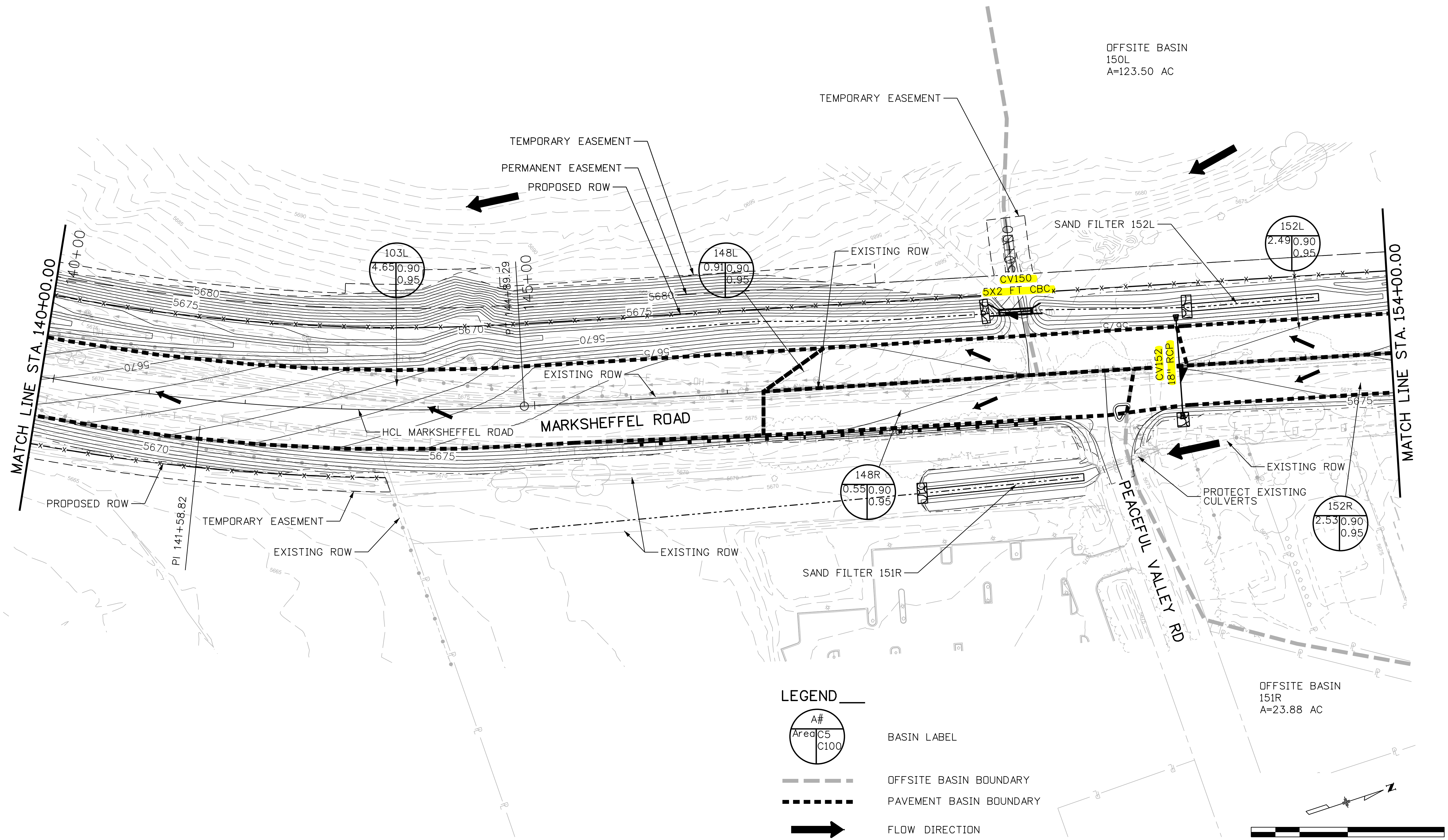

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Unit Information	Unit Leader Initials

HDR PARSONS BRINCKERHOFF

Sheet Revisions

Date:	Comments	Init.

EL PASO COUNTY COLORADO

PPRTA

As Constructed

No Revisions:

Revised:

Void:

MARKSHEFFEL ROAD DRAINAGE BASINS PLAN 140+00.00 TO 154+00.00

Designer:	E. STATEN	Structure Numbers
Detailer:	D. MADDOCK	
Sheet Subset:	BASINS	Subset Sheets: 6 of 36

Project No./Code

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Culvert Calculator Report
CV150

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	5,676.34 ft	Headwater Depth/Height	2.36
Computed Headwater Elevation	5,676.32 ft	Discharge	118.82 cfs
Inlet Control HW Elev.	5,676.32 ft	Tailwater Elevation	5,671.50 ft
Outlet Control HW Elev.	5,675.71 ft	Control Type	Inlet Control

Grades			
Upstream Invert	5,671.60 ft	Downstream Invert	5,671.50 ft
Length	35.00 ft	Constructed Slope	0.002857 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	2.00 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	2.00 ft
Velocity Downstream	9.90 ft/s	Critical Slope	0.011013 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	6.00 ft
Section Size	6 x 2 ft	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	5,675.71 ft	Upstream Velocity Head	1.52 ft
Ke	0.20	Entrance Loss	0.30 ft

Inlet Control Properties			
Inlet Control HW Elev.	5,676.32 ft	Flow Control	Submerged
Inlet Type	90° headwall w 45° bevels	Area Full	12.0 ft²
K	0.49500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	2
C	0.03140	Equation Form	2
Y	0.82000		

Culvert Calculator Report
CV152

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	5,675.19 ft	Headwater Depth/Height	1.27
Computed Headwater Elevation	5,673.97 ft	Discharge	8.68 cfs
Inlet Control HW Elev.	5,673.89 ft	Tailwater Elevation	5,671.52 ft
Outlet Control HW Elev.	5,673.97 ft	Control Type	Outlet Control

Grades

Upstream Invert	5,672.06 ft	Downstream Invert	5,671.52 ft
Length	108.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile

Profile	M2	Depth, Downstream	1.14 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.14 ft
Velocity Downstream	6.02 ft/s	Critical Slope	0.007955 ft/ft

Section

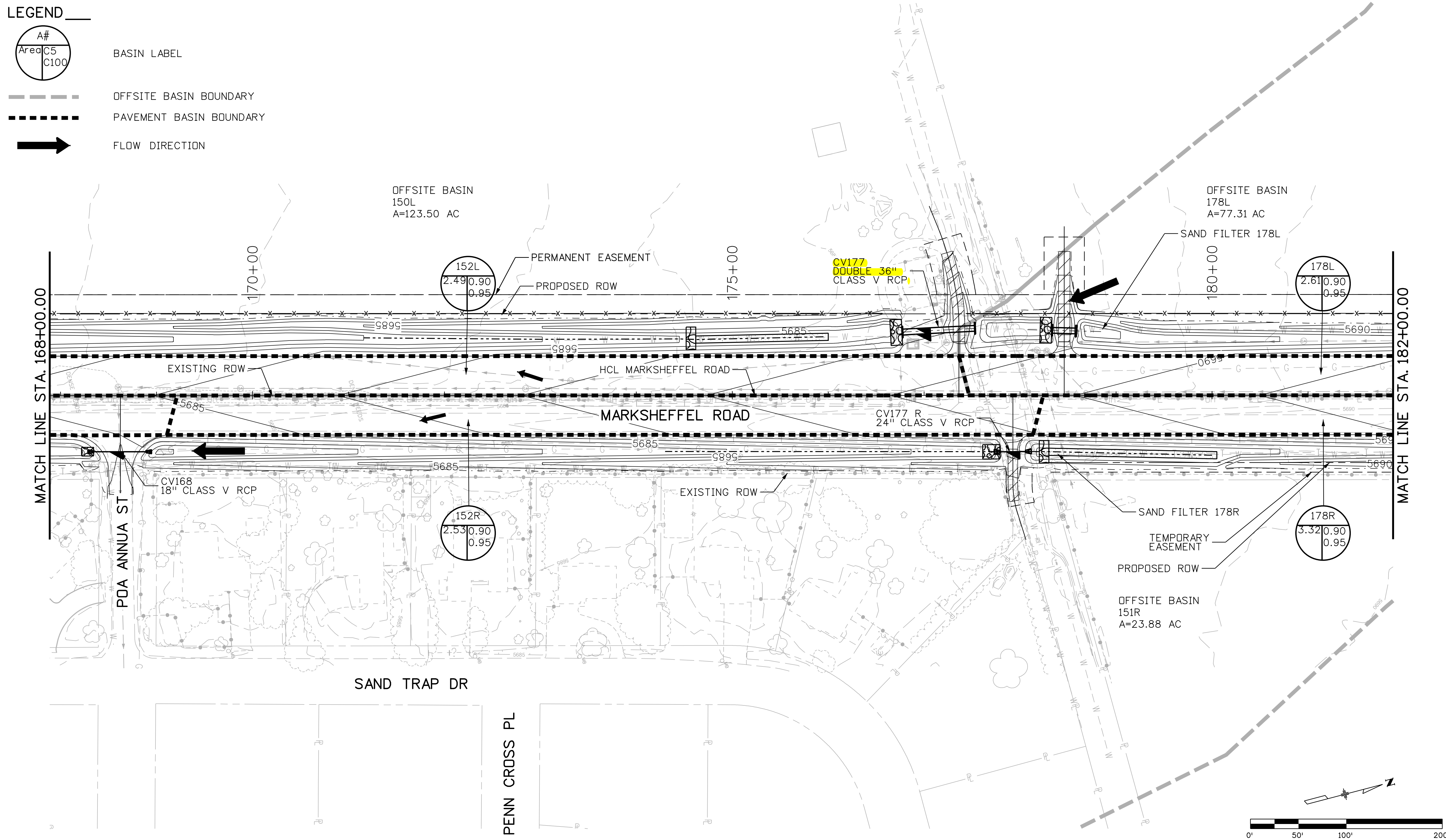
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	5,673.97 ft	Upstream Velocity Head	0.38 ft
Ke	0.20	Entrance Loss	0.08 ft

Inlet Control Properties

Inlet Control HW Elev.	5,673.89 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° bevels	Area Full	1.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		



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Unit Information	Unit Leader Initials	
HDR	PARSONS BRINCKERHOFF	

Sheet Revisions

Date:	Comments	Init.

EL PASO COUNTY COLORADO

PPRTA

As Constructed
No Revisions:
Revised:
Void:

MARKSHEFFEL ROAD
DRAINAGE BASINS PLAN
168+00.00 TO 182+00.00

Designer:	E. STATEN	Structure Numbers	
Detailer:	D. MADDOCK		
Sheet Subset:	BASINS	Subset Sheets: 8 of 36	

Project No./Code
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8

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Culvert Calculator Report
CV177

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	5,688.70 ft	Headwater Depth/Height	1.13
Computed Headwater Elevation	5,688.17 ft	Discharge	87.06 cfs
Inlet Control HW Elev.	5,688.06 ft	Tailwater Elevation	5,684.52 ft
Outlet Control HW Elev.	5,688.17 ft	Control Type	Outlet Control

Grades			
Upstream Invert	5,684.78 ft	Downstream Invert	5,684.52 ft
Length	77.00 ft	Constructed Slope	0.003377 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	2.15 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.15 ft
Velocity Downstream	8.03 ft/s	Critical Slope	0.005723 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	5,688.17 ft	Upstream Velocity Head	0.74 ft
Ke	0.20	Entrance Loss	0.15 ft

Inlet Control Properties			
Inlet Control HW Elev.	5,688.06 ft	Flow Control	Transition
Inlet Type	Beveled ring, 33.7° bevels	Area Full	14.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

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

Corridor / Design Package: Marksheffel
System Name: South Approach Pipes

Computed: MAJ Date: 6/28/2014
Checked: EVS Date: 6/30/2014

5-YR PIPE CALCULATIONS

Design Storm: 5-yr

	LOCATION	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
ZONE 3																						
1	Onsite flow from 233+00 to 246+00		CV233	2.37	0.90	9.85	2.13	2.79	5.95													
2	Onsite flow from 207+60 to 212+00		P205	0.44	0.90	6.41	0.40	3.36	1.33													
3	Onsite flow from 205+00 to 212+00		CV205	0.84	0.90	8.74	0.76	2.98	2.25													
4	Onsite flow from 195+00 to 205+00		CV195	1.68	0.90	13.63	1.51	2.31	3.49													
5	Onsite flow from 194+00 to 205+00		CV194	1.79	0.90	14.90	1.61	2.22	3.58													
6	Onsite flow from 192+00 to 205+00		CV192	1.99	0.90	16.82	1.79	2.08	3.73													
7	Onsite & Offsite flow from 177+00 to 205+00		CV177R	5.51	0.64	35.11	3.54	1.48	5.23													
8	Onsite flow from 168+00 to 179+00		CV168	0.95	0.90	16.85	0.86	2.08	1.78													
9	Onsite flow from 152+00 to 177+00		CV152	2.49	0.90	41.33	2.24	1.36	3.05													
ZONE 4																						
10	Onsite flow from 112+00 to 114+00		CV112	0.12	0.93	5.00	0.11	3.55	0.38													
11	Onsite flow from 109+00 to 114+00		CV109	0.27	0.90	6.61	0.24	3.36	0.82													
12	Onsite flow from 106+00 to 114+00		CV106	0.40	0.90	8.54	0.36	2.98	1.07													
13	Onsite flow from 99+00 to 103+00		CV99	0.20	0.90	5.00	0.18	3.55	0.62													

100-YR PIPE CALCULATIONS

Design Storm: 100-yr

	LOCATION	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
ZONE 3																						
1	Onsite flow from 233+00 to 246+00		CV233	2.37	0.95	9.85	2.25	7.49	16.87													
2	Onsite flow from 207+60 to 212+00		P205	0.44	0.95	6.41	0.42	9.02	3.77													
3	Onsite flow from 205+00 to 212+00		CV205	0.84	0.95	8.74	0.80	8.00	6.38													
4	Onsite flow from 195+00 to 205+00		CV195	1.68	0.95	13.63	1.59	6.19	9.87													
5	Onsite flow from 194+00 to 205+00		CV194	1.79	0.95	14.90	1.70	5.93	10.08													See TR-55 Peak Flow
6	Onsite flow from 192+00 to 205+00		CV192	1.99	0.95	16.82	1.89	5.57	10.53													
7	Onsite & Offsite flow from 177+00 to 205+00		CV177R	5.51	0.71	35.11	3.92	3.96	15.53													
8	Onsite flow from 168+00 to 179+00		CV168	0.95	0.95	16.85	0.90	5.57	5.03													
9	Onsite flow from 152+00 to 177+00		CV152	2.49	0.95	41.33	2.37	3.67	8.68													
ZONE 4																						
10	Onsite flow from 112+00 to 114+00		CV112	0.12	0.98	5.00	0.11	9.53	1.07													See TR-55 Peak Flow
11	Onsite flow from 109+00 to 114+00		CV109	0.27	0.95	6.61	0.26	9.02	2.31													
12	Onsite flow from 106+00 to 114+00		CV106	0.40	0.95	8.54	0.38	8.00	3.04													
13	Onsite flow from 99+00 to 103+00		CV99	0.20	0.95	5.00	0.19	9.53	1.77													

(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 C-Value 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 Basin Areas (7) to get the combined basin AC
(12) =28.5*P/(10+Column 10)^0.786
(13) Sum of Qs
(14) Additonal Street Overland Flow
(15) Additonal Street Overland Flow
(16) Design Pipe Flow
(17) Pipe Slope
(18) Pipe Size
(19) Additional Flow Length
(20) Velocity
(21) =Column 19 / Column 20 / 60

Standard Form SF-1 . Time of Concentration

Corridor / Design Package: Marksheffel
System Name: South

Computed: MAJ Date: 6/28/2014
Checked: EVS Date: 6/30/2014

SUB-BASIN DATA				INITIAL/OVERLAND FLOW (t_i)			TRAVEL TIME (t_t)							Total
									Type of Land Surface					
Basin ID	Description	C_5	Area (ac)	Length (ft)	Slope (ft/ft)	t_i (min)	Length (ft)	S_w (ft/ft)	Code	Description	Convey Coef (C_v)	Velocity (ft/s)	Travel Time (min)	$t_c = t_i + t_t$ (min)
ZONE 3														
A 256L	Sta 256+30 to 264+29	0.90	0.77	57	0.05263	1.63	190	0.0090	5	Grassed waterway	15.00	1.42	2.23	5.00
A 256R	Sta 256+30 to 264+30	0.90	0.77	63	0.06349	1.61	190	0.0090	5	Grassed waterway	15.00	1.42	2.23	5.00
A 247L	Sta. 246+00 to 256+30	0.90	0.96	56	0.07143	1.46	1020	0.0199	5	Grassed waterway	15.00	2.11	8.04	9.50
A 246R	Sta. 246+00 to 256+30	0.90	1.01	56	0.07143	1.46	1020	0.0199	5	Grassed waterway	15.00	2.11	8.04	9.50
A 246L	Sta 246+00 to No Work Zone	0.25	905.26	300	0.01667	23.23	9985	0.00951	3	Short pasture and lawns	7.00	0.68	243.73	266.96
A 229R	Sta. 229+00 to 232+00	0.90	0.31	56	0.05357	1.61	300	0.00953	5	Grassed waterway	15.00	1.46	3.41	5.02
A 226L	Sta. 226+00 to 246+00	0.28	65.23	300	0.03667	17.31	2440	0.02254	3	Short pasture and lawns	7.00	1.05	38.69	56.00
A 212L	Sta. 212+00 to 229+00	0.90	1.55	61	0.06557	1.57	1640	0.0083	5	Grassed waterway	15.00	1.37	20.00	21.57
A 212R	Sta. 212+00 to 229+00	0.90	1.55	57	0.07018	1.48	1640	0.0083	5	Grassed waterway	15.00	1.37	20.00	21.49
A 210L	Sta. 210+60 to 226+00	0.31	124.50	300	0.02667	18.43	2868	0.0258	5	Grassed waterway	15.00	2.41	19.84	38.27
A 210L_S1	Sta. 212+00 to 229+00	0.31	56.88	300	0.02667	18.51	2868	0.0258	5	Grassed waterway	15.00	2.41	19.84	38.34
A 208R	Sta. 207+60 to 212+00	0.90	0.44	57	0.07018	1.48	453	0.01044	5	Grassed waterway	15.00	1.53	4.93	6.41
A 206L	Sta. 205+00 to 212+00	0.90	0.74	61	0.06557	1.57	660	0.01045	5	Grassed waterway	15.00	1.53	7.17	8.74
A 205L	Sta 205+00 to 210+60	0.25	2.87	100	0.01	15.90	550	0.00364	5	Grassed waterway	15.00	0.90	10.13	26.03
A 178L	Sta. 179+00 to 205+00	0.34	79.92	300	0.01667	20.79	2880	0.01181	3	Short pasture and lawns	7.00	0.76	63.11	83.90
A 178R	Sta. 178+00 to 207+00	0.90	3.32	54	0.07407	1.42	2865	0.00999	5	Grassed waterway	15.00	1.50	31.86	33.27
A 152L	Sta. 152+00 to 178+00	0.90	2.49	53	0.0566	1.54	2600	0.00527	5	Grassed waterway	15.00	1.09	39.80	41.33
A 152R	Sta. 152+00 to 178+00	0.90	2.53	54	0.05556	1.56	2610	0.00523	5	Grassed waterway	15.00	1.09	40.09	41.65
A 151R	Sta. 152+00 to 170+50	0.42	39.34	300	0.01	22.03	2978	0.00168	5	Grassed waterway	15.00	0.61	80.75	102.78
A 150L	Sta. 150+00 to 179+00	0.25	123.68	300	0.02	21.88	4718	0.00763	3	Short pasture and lawns	7.00	0.61	128.60	150.48
A 148L	Sta. 148+00 to 152+00	0.90	0.41	54	0.05556	1.56	400	0.00183	5	Grassed waterway	15.00	0.64	10.40	11.96
A 148R	Sta. 147+80 to 152+00	0.90	0.55	55	0.07273	1.44	470	0.00145	5	Grassed waterway	15.00	0.57	13.73	15.17
ZONE 4														
A 125R	Sta. 124+50 to 137+50	0.90	1.08	44	0.09091	1.20	1285	0.00987	5	Grassed waterway	15.00	1.49	14.37	15.57
A 103L	Sta. 103+00 to148+00	0.90	4.65	100	0.06	2.07	4386	0.00876	5	Grassed waterway	15.00	1.40	52.06	54.13
A 103R	Sta. 100+00 to 114+00	0.90	0.57	37	0.08108	1.14	1090	0.00758	5	Grassed waterway	15.00	1.31	13.91	15.05
A 92L	Sta. 92+00 to 103+00	0.90	0.53	36	0.11111	1.01	1143	0.00725	5	Grassed waterway	15.00	1.28	14.91	15.93
A 92R	Sta. 92+00 to 103+00	0.90	0.58	36	0.11111	1.01	1150	0.0071	5	Grassed waterway	15.00	1.26	15.16	16.17
A 70L	Sta. 70+38 to 92+00	0.90	1.72	55	0.07273	1.44	2087	0.00631	5	Grassed waterway	15.00	1.19	29.19	30.63
A 70R	Sta. 70+38 to 78+00	0.90	0.27	33	0.12121	0.94	717	0.00904	5	Grassed waterway	15.00	1.43	8.38	9.32

Notes:

t_i= (1.87*(1.1-C_5)*(L^0.5))/(S^0.33), from COS DCM page 5-11

Velocity from V = C_v*S_w^0.5, from UDFCD Eqn RO-4, C_v from Table R0-2 (See Sheet Design Info)

t_t=L/60V

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

Corridor / Design Package: Marksheffel
System Name: South

Computed: MAJ Date: 6/28/2014
Checked: EVS Date: 6/30/2014

Design Storm: 5-yr

	LOCATION	DESIGN POINT	DIRECT RUNOFF: AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	TOTAL RUNOFF: t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	STREET: SLOPE (%)	STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	TRAVEL TIME: LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
ZONE 3																						
1	Sta 256+30 to 264+29		A 256L	0.77	0.90	5.00	0.69	3.55	2.46													
2	Sta 256+30 to 264+30		A 256R	0.77	0.90	5.00	0.69	3.55	2.46													
3	Sta. 246+00 to 256+30		A 247L	0.96	0.90	9.50	0.86	2.79	2.41													
4	Sta. 246+00 to 256+30		A 246R	1.01	0.90	9.50	0.91	2.79	2.54													
5	Sta 246+00 to No Work Zone		A 246L	905.26	0.25	266.96	227.44	0.45	101.89													
6	Sta. 229+00 to 232+00		A 229R	0.31	0.90	5.02	0.28	3.55	0.99													
7	Sta. 226+00 to 246+00		A 226L	65.23	0.28	56.00	18.23	1.08	19.69													
8	Sta. 212+00 to 229+00		A 212L	1.55	0.90	21.57	1.40	1.90	2.65													
9	Sta. 212+00 to 229+00		A 212R	1.55	0.90	21.49	1.40	1.90	2.65													
10	Sta. 210+60 to 226+00		A 210L	124.50	0.31	38.27	39.03	1.42	55.43													
	Sta. 212+00 to 229+00		A 210L_S1	56.88	0.31	38.34	17.65	1.42	25.06													
11	Sta. 207+60 to 212+00		A 208R	0.44	0.90	6.41	0.40	3.36	1.33													
12	Sta. 205+00 to 212+00		A 206L	0.74	0.90	8.74	0.67	2.98	1.99													
13	Sta 205+00 to 210+60		A 205L	2.87	0.25	26.03	0.72	1.72	1.23													
14	Sta. 179+00 to 205+00		A 178L	79.92	0.34	83.90	27.19	0.86	23.38													
15	Sta. 178+00 to 207+00		A 178R	3.32	0.90	33.27	2.99	1.51	4.51													
16	Sta. 152+00 to 178+00		A 152L	2.49	0.90	41.33	2.24	1.36	3.05													
17	Sta. 152+00 to 178+00		A 152R	2.53	0.90	41.65	2.28	1.36	3.10													
18	Sta. 152+00 to 170+50		A 151R	39.34	0.42	102.78	16.52	0.74	12.22													
19	Sta. 150+00 to 179+00		A 150L	123.68	0.25	150.48	31.04	0.53	16.45													
20	Sta. 148+00 to 152+00		A 148L	0.41	0.90	11.96	0.37	2.50	0.92													
21	Sta. 147+80 to 152+00		A 148R	0.55	0.90	15.17	0.50	2.12	1.05													
ZONE 4																						
22	Sta. 124+50 to 137+50		A 125R	1.08	0.90	15.57	0.97	2.12	2.06													
23	Sta. 103+00 to148+00		A 103L	4.65	0.90	54.13	4.19	1.12	4.69													
24	Sta. 100+00 to 114+00		A 103R	0.57	0.90	15.05	0.51	2.12	1.09													
25	Sta. 92+00 to 103+00		A 92L	0.53	0.90	15.93	0.48	2.12	1.01													
26	Sta. 92+00 to 103+00		A 92R	0.58	0.90	16.17	0.52	2.08	1.09													
27	Sta. 70+38 to 92+00		A 70L	1.72	0.90	30.63	1.55	1.57	2.43													
28	Sta. 70+38 to 78+00		A 70R	0.27	0.90	9.32	0.24	2.79	0.68													

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

Corridor / Design Package: Marksheffel
System Name: South

Computed: MAJ Date: 6/28/2014
Checked: EVS Date: 6/30/2014

Design Storm: 100-yr

	LOCATION	DESIGN POINT	AREA DESIGN	AREA (AC)	RUNOFF COEFF	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	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	REMARKS
			DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
ZONE 3																						
1	Sta 256+30 to 264+29		A 256L	0.77	0.95	5.00	0.73	9.53	6.97													
2	Sta 256+30 to 264+30		A 256R	0.77	0.95	5.00	0.73	9.53	6.97													
3	Sta. 246+00 to 256+30		A 247L	0.96	0.95	9.50	0.91	7.49	6.83													
4	Sta. 246+00 to 256+30		A 246R	1.01	0.95	9.50	0.96	7.49	7.19													
5	Sta 246+00 to No Work Zone		A 246L	905.26	0.35	266.96	317.88	1.25	397.35													
6	Sta. 229+00 to 232+00		A 229R	0.31	0.95	5.02	0.29	9.53	2.81													
7	Sta. 226+00 to 246+00		A 226L	65.23	0.38	56.00	24.61	2.95	72.59													
8	Sta. 212+00 to 229+00		A 212L	1.55	0.95	21.57	1.47	5.08	7.48													
9	Sta. 212+00 to 229+00		A 212R	1.55	0.95	21.49	1.47	5.08	7.48													
10	Sta. 210+60 to 226+00		A 210L	124.50	0.43	38.27	53.71	3.82	205.15													
	Sta. 212+00 to 229+00		A 210L_S1	56.88	0.42	38.34	24.11	3.82	92.09													
11	Sta. 207+60 to 212+00		A 208R	0.44	0.95	6.41	0.42	9.02	3.77													
12	Sta. 205+00 to 212+00		A 206L	0.74	0.95	8.74	0.70	8.00	5.63													
13	Sta 205+00 to 210+60		A 205L	2.87	0.35	26.03	1.00	4.59	4.61													
14	Sta. 179+00 to 205+00		A 178L	79.92	0.46	83.90	36.89	2.36	87.06													
										83.90	36.89	2.36	87.06						2753	4.14	11.08	
15	Sta. 178+00 to 207+00		A 178R	3.32	0.95	33.27	3.15	4.06	12.81													
16	Sta. 152+00 to 178+00		A 152L	2.49	0.95	41.33	2.37	3.67	8.68													
17	Sta. 152+00 to 178+00		A 152R	2.53	0.95	41.65	2.40	3.67	8.82													
18	Sta. 152+00 to 170+50		A 151R	39.34	0.56	102.78	21.87	2.03	44.39													
19	Sta. 150+00 to 179+00		A 150L	123.68	0.35	150.48	43.39	1.48	64.22													
		1	150L,178L							150.48	80.28	1.48	118.82									CV150
20	Sta. 148+00 to 152+00		A 148L	0.41	0.95	11.96	0.39	6.72	2.62													
21	Sta. 147+80 to 152+00		A 148R	0.55	0.95	15.17	0.52	5.67	2.96													
ZONE 4																						
22	Sta. 124+50 to 137+50		A 125R	1.08	0.95	15.57	1.03	5.67	5.82													
23	Sta. 103+00 to148+00		A 103L	4.65	0.95	54.13	4.42	3.05	13.47													
24	Sta. 100+00 to 114+00		A 103R	0.57	0.95	15.05	0.54	5.67	3.07													
25	Sta. 92+00 to 103+00		A 92L	0.53	0.95	15.93	0.50	5.67	2.85													
26	Sta. 92+00 to 103+00		A 92R	0.58	0.95	16.17	0.55	5.57	3.07													
27	Sta. 70+38 to 92+00		A 70L	1.72	0.95	30.63	1.63	4.20	6.86													
28	Sta. 70+38 to 78+00		A 70R	0.27	0.95	9.32	0.26	7.49	1.92													

(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 C-Value 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 Basin Areas (7) to get the combined basin AC
(12) =28.5*P/(10+Column 10)^0.786
(13) Sum of Qs
(14) Additonal Street Overland Flow
(15) Additonal Street Overland Flow
(16) Design Pipe Flow
(17) Pipe Slope
(18) Pipe Size
(19) Additional Flow Length
(20) Velocity
(21) =Column 19 / Column 20 / 60

The Glen at Widefield

Developed Condition

Runoff Coeficient and Percent Impervious Calculation

Basin	DP	Basin or DP Area (DP contributing basins)		Soil Type	PV: % Imperv	Area 1 Land Use: Land Use Area	% Area	Comp Land Use % Imp	LA: % Imperv	Area 2 Land Use: Land Use Area	% Area	Comp Land Use % Imp	RS1: % Imperv	Area 3 Land Use: Land Use Area	% Area	Comp Land Use % Imp	RS2: % Imperv	Area 4 Land Use: Land Use Area	% Area	Comp Land Use % Imp	Basin % Imperv	Basin Runoff C_5	Basin Runoff C_{100}
E-1	DP 95	229,727 sf	5.27ac	C	100%		0%	0%	0%	5.27ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-2	DP 96	21,807 sf	0.50ac	B	100%	0.19ac	37%	37%	0%	0.09ac	19%	0%	40%		0%	0%	28%		0%	0%	**37.4%**	**0.28**	**0.49**
E-3	DP 97	69,766 sf	1.60ac	B	100%	0.19ac	12%	12%	0%	1.41ac	88%	0%	40%		0%	0%	28%		0%	0%	**11.7%**	**0.15**	**0.41**
E-4	DP 98	50,997 sf	1.17ac	C	100%	0.22ac	19%	19%	0%	0.95ac	81%	0%	40%		0%	0%	28%		0%	0%	**18.7%**	**0.25**	**0.55**
E-5	DP 99	57,314 sf	1.32ac	C	100%	0.10ac	8%	8%	0%	1.08ac	82%	0%	40%		0%	0%	28%	0.14ac	11%	3%	**10.6%**	**0.21**	**0.53**
E-6	DP 100	187,508 sf	4.30ac	C	100%		0%	0%	0%	4.30ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-7	DP 101	192,653 sf	4.42ac	C	100%	0.42ac	9%	9%	0%	3.81ac	86%	0%	40%		0%	0%	28%	0.19ac	4%	1%	**10.7%**	**0.21**	**0.53**
E-8		382,642 sf	8.78ac	C	100%		0%	0%	0%	7.97ac	91%	0%	40%		0%	0%	28%	0.81ac	9%	3%	**2.6%**	**0.17**	**0.51**
E-9	DP 103	157,940 sf	3.63ac	C	100%		0%	0%	0%	3.63ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-10	DP 104	643,830 sf	14.78ac	C	100%		0%	0%	0%	14.78ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-11	DP 105	742,594 sf	17.05ac	C	100%		0%	0%	0%	17.05ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-12	DP 106	151,866 sf	3.49ac	C	100%		0%	0%	0%	3.49ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-13	DP 107	145,662 sf	3.34ac	C	100%		0%	0%	0%	3.34ac	100%	0%	40%		0%	0%	28%		0%	0%	**0.0%**	**0.15**	**0.50**
E-14	DP 108	15,862 sf	0.36ac	B	100%	0.33ac	91%	91%	0%	0.03ac	9%	0%	40%		0%	0%	28%		0%	0%	**90.6%**	**0.74**	**0.82**
	DP 102	OS-1, E-8	#REF!																				

Basin Runoff Coefficient is based on UDFCD % Imperviousness Calculation

Runoff Coefficients and Percents Impervious

Hydrologic Soil Type:	**B**	**Runoff Coef Calc Method**						**%Imp**
Land Use	Abb	%	C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}
Commercial Area	CO	95%	0.79	0.81	0.83	0.85	0.87	0.88
Drives and Walks	DR	90%	0.71	0.73	0.75	0.78	0.80	0.81
Streets - Gravel (Packed)	GR	40%	0.23	0.30	0.36	0.42	0.46	0.50
Historic Flow Analysis	HI	2%	0.03	0.08	0.17	0.26	0.31	0.36
Lawns	LA	0%	0.02	0.08	0.15	0.25	0.30	0.35
Off-site flow-Undeveloped	OF	45%	0.26	0.32	0.38	0.44	0.48	0.51
Park	PA	7%	0.05	0.12	0.20	0.29	0.34	0.39
Playground	PL	13%	0.07	0.16	0.24	0.32	0.37	0.42
Streets - Paved	PV	100%	0.89	0.90	0.92	0.94	0.95	0.96
Roofs	RO	90%	0.71	0.73	0.75	0.78	0.80	0.81
Residential: 1/4 Acre	RS1	40%	0.23	0.30	0.36	0.42	0.46	0.50
Residential: 2.5 Lots/Acre	RS2	28%	0.16	0.24	0.31	0.38	0.43	0.46

Equations (% Impervious Calculation):

$C_A = K_A + (1.31\,i^3 - 1.44\,i^2 + 1.135\,i - 0.12)$ [Eqn RO-6]

$C_{CD} = K_{CD} + (0.858\,i^3 - 0.786\,i^2 + 0.774\,i + 0.04)$ [Eqn RO-7]

$C_B = (C_A + C_{CD}) / 2$

I = % imperviousness/100 as a decimal (See Table RO-3)

C_A = Runoff coefficient for NRCS Type A Soils

C_B = Runoff coefficient for NRCS Type B Soils

C_{CD} = Runoff coefficient for NRCS Type C and D Soils

Correction Factors - Table RO-4

K_A = For Type A Soils

- K_A (2-yr)= 0
- K_A (5-yr)= -0.08i + 0.09
- K_A (10-yr)= -0.14i + 0.17
- K_A (25-yr)= -0.19i + 0.24
- K_A (50-yr)= -0.22i + 0.28
- K_A (100-yr)= -0.25i + 0.32

K_{CD}=For Type C & D Soils

- K_{CD} (2-yr)= 0
- K_{CD} (5-yr)= -0.10i + 0.11
- K_{CD} (10-yr)= -0.18i + 0.21
- K_{CD} (25-yr)= -0.28i + 0.33
- K_{CD} (50-yr)= -0.33i + 0.40
- K_{CD} (100-yr)= -0.39i + 0.46

The Glen at Widefield
Developed Condition
Runoff Coeficient and Percent Impervious Calculation

Filings 10-12 Ultimate Condition					PV	Area 1 Land Use			LA	Area 2 Land Use			RS2	Area 3 Land Use			RS1	Area 4 Land Use				Basin Runoff Coeficient	
Basin	DP	Basin or DP Area (DP contributing basins)		Soil Type	% Imperv	Land Use Area	% Area	Comp Land Use % Imp	% Imperv	Land Use Area	% Area	Comp Land Use % Imp	% Imperv	Land Use Area	% Area	Comp Land Use % Imp	% Imperv	Land Use Area	% Area	Comp Land Use % Imp	**Basin % Imperv**	C_5	C_{100}
D-1	DP 68	61,148 sf	1.40ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.40ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-2		63,184 sf	1.45ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.45ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-3	DP 70	73,555 sf	1.69ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.69ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-4		90,208 sf	2.07ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.07ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-5	DP 72	68,122 sf	1.56ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.56ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-6	DP 73	18,040 sf	0.41ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	0.41ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-7		130,015 sf	2.98ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.98ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-8		70,452 sf	1.62ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.62ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-9	DP 77	91,788 sf	2.11ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.11ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-10		130,320 sf	2.99ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.99ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-11	DP 80	172,355 sf	3.96ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	3.96ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-12		60,400 sf	1.39ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.39ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-13		89,754 sf	2.06ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.06ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-14		143,954 sf	3.30ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	3.30ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-15	DP 84	122,155 sf	2.80ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.80ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-16		98,963 sf	2.27ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.27ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-16.1		90,495 sf	2.08ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.08ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-17		150,208 sf	3.45ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	3.45ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-18		92,997 sf	2.13ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.13ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-19		129,215 sf	2.97ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.97ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-19.1	DP89	7,235 sf	0.17ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	0.17ac	100%	37%	**37.0%**	**0.34**	**0.58**
D-20a	DP 92a	35,151 sf	0.81ac	C	100%	0.34ac	42%	42%	0%	0.37ac	46%	0%	46%		0%	0%	37%	0.10ac	12%	4%	**46.6%**	**0.38**	**0.60**
D-20b	DP 92b	20,481 sf	0.47ac	C	100%	0.40ac	85%	85%	0%	0.07ac	15%	0%	46%		0%	0%	37%		0%	0%	**85.1%**	**0.68**	**0.79**
D-20c	DP 92d	15,896 sf	0.36ac	C	100%	0.17ac	47%	47%	0%	0.19ac	52%	0%	46%		0%	0%	37%		0%	0%	**46.6%**	**0.38**	**0.60**
D-21	DP 91	175,102 sf	4.02ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	4.02ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-22	DP 90	50,194 sf	1.15ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	1.15ac	100%	37%	**37.0%**	**0.28**	**0.49**
D-23	DP92e	12,393 sf	0.28ac	C	100%	0.24ac	84%	84%	0%	0.04ac	16%	0%	46%		0%	0%	37%		0%	0%	**84.4%**	**0.67**	**0.78**
D-24		443,273 sf	10.18ac	C	100%		0%	0%	0%	8.18ac	80%	0%	46%		0%	0%	37%	2.00ac	20%	7%	**7.3%**	**0.20**	**0.52**
Combined Design Point Summary																							
	DP 69	D1, D2	2.85ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.85ac	100%	37%	**37.0%**	**0.28**	**0.49**
	DP 71	D3, D4	3.76ac	B	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	3.76ac	100%	37%	**37.0%**	**0.28**	**0.49**
	DP 74	D3, D4, D6	4.17ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	4.17ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 75	D1-D4, D6, D7	10.01ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	10.01ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 76	D1-D4, D6-D8	11.63ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	11.63ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 78	D1-D4, D6-D9	13.74ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	13.74ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 79	D1-D4, D6-D10	16.73ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	16.73ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 81	D11, D12	5.34ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	5.34ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 82	D5, D13	3.62ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	3.62ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 83	D5, D13, D14	6.93ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	6.93ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 85	D15,D16, D16.1	7.15ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	7.15ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 86	D15 - D17	10.60ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	10.60ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 87	D15 - D18	12.74ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	12.74ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 88	D15 - D19	15.70ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	15.70ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 92a	D20a	0.81ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	2.94ac	364%	135%	**134.7%**	**1.73**	**1.69**
	DP 92b	D21,D22,D23	5.46ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	5.46ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 93a	D1 -D19.1	44.87ac	C	100%		0%	0%	0%		0%	0%	46%		0%	0%	37%	44.87ac	100%	37%	**37.0%**	**0.34**	**0.58**
	DP 93b	D20b,D20c,D23	1.12ac	C	100%	0.56ac	50%	50%	0%	0.56ac	50%	0%	46%		0%	0%	37%		0%	0%	**50.0%**	**0.40**	**0.60**
D1-24	**DP 94**	**ULTIMATE**	**62.15ac**	C	100%	1.15ac	2%	2%	0%	8.85ac	14%	0%	37%		0%	0%	37%	52.14ac	84%	31%	**32.9%**	**0.32**	**0.57**

Basin Runoff Coefficient is based on UDFCD % Imperviousness Calculation								
Runoff Coefficients and Percents Impervious								
Hydrologic Soil Type:	C	**Runoff Coef Calc Method**						%Imp
Land Use	Abb	%	C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}
Commercial Area	CO	95%	0.80	0.82	0.84	0.87	0.89	0.89
Drives and Walks	DR	90%	0.73	0.75	0.77	0.80	0.83	0.83
Streets - Gravel (Packed)	GR	40%	0.28	0.35	0.42	0.50	0.55	0.58
Historic Flow Analysis	HI	2%	0.06	0.16	0.26	0.38	0.45	0.51
Lawns	LA	0%	0.04	0.15	0.25	0.37	0.44	0.50
Off-site flow-Undeveloped	OF	45%	0.31	0.37	0.44	0.51	0.56	0.59
Park	PA	7%	0.09	0.19	0.29	0.40	0.47	0.52
Playground	PL	13%	0.13	0.23	0.32	0.42	0.49	0.54
Streets - Paved	PV	100%	0.89	0.90	0.92	0.94	0.96	0.96
Roofs	RO	90%	0.73	0.75	0.77	0.80	0.83	0.83
Residential: 3.7 Lots/Acre	RS1	37%	0.26	0.34	0.41	0.49	0.54	0.58
Residential: 1/5 Acre	RS2	46%	0.31	0.38	0.44	0.51	0.56	0.59

Weighted
%Imp
A
B
C
D

Equations (% Impervious Calculation):

$C_A = K_A+(1.31\ i^3 - 1.44\ i^2 + 1.135\ i - 0.12)$ [Eqn RO-6]

$C_{CD} = K_{CD}+(0.858\ i^3 - 0.786\ i^2 + 0.774\ i + 0.04)$ [Eqn RO-7]

$C_B = (C_A + C_{CD}) / 2$

I = % imperviousness/100 as a decimal (See Table RO-3)

C_A = Runoff coefficient for NRCS Type A Soils

C_B = Runoff coefficient for NRCS Type B Soils

C_{CD} = Runoff coefficient for NRCS Type C and D Soils

Correction Factors - Table RO-4

K_A = For Type A Soils

K_A (2-yr)= 0

K_A (5-yr)= -0.08i + 0.09

K_A (10-yr)= -0.14i + 0.17

K_A (25-yr)= -0.19i + 0.24

K_A (50-yr)= -0.22i + 0.28

K_A (100-yr)= -0.25i + 0.32

K_{CD}=For Type C & D Soils

K_{CD} (2-yr)= 0

K_{CD} (5-yr)= -0.10i + 0.11

K_{CD} (10-yr)= -0.18i + 0.21

K_{CD} (25-yr)= -0.28i + 0.33

K_{CD} (50-yr)= -0.33i + 0.40

K_{CD} (100-yr)= -0.39i + 0.46

The Glen at Widefield
Developed Condition
Time of Concentration Calculation

Sub-Basin Data					Time of Concentration Estimate										Min. Tc in Urban		Final t_c
					Initial/Overland Time (t_i)			Travel Time (t_t)						Comp.	Tc Check (urban)		
Basin	Design Point	Contributing Basins	Area	C_5	Length	Slope	t_i	Length	Slope	Land Type	Cv	Velocity	t_t	t_c	Total Length	t_c Check	
E-1	DP 95		5.27ac	0.15	100lf	2.3%	13.2 min.	1800lf	1.9%	GW	15	2.1 ft/sec	14.5 min.	27.7 min.	1900lf	20.6 min.	**20.6 min.**
E-2	DP 96		0.50ac	0.28	100lf	1.5%	13.0 min.	675lf	0.8%	PV	20	1.8 ft/sec	6.3 min.	19.3 min.	775lf	14.3 min.	**14.3 min.**
E-3	DP 97		1.60ac	0.15	70lf	1.2%	13.7 min.	260lf	0.5%	PV	20	1.4 ft/sec	3.1 min.	16.8 min.	330lf	11.8 min.	**11.8 min.**
E-4	DP 98		1.17ac	0.25	50lf	2.4%	8.2 min.	160lf	1.9%	PV	20	2.8 ft/sec	1.0 min.	9.1 min.	210lf	11.2 min.	**9.1 min.**
E-5	DP 99		1.32ac	0.21	100lf	4.0%	10.2 min.	200lf	1.9%	PV	20	2.8 ft/sec	1.2 min.	11.4 min.	300lf	11.7 min.	**11.4 min.**

Equations:

t_i (Overland) = $0.395(1.1-C_5)L^{0.5} S^{-0.333}$
- C_5 = Runoff coefficient for 5-year
- L = Length of overland flow (ft)
- S = Slope of flow path (ft/ft)

tc Check = (L/180)+10 (Developed Cond. Only)
- L = Overall Length

Velocity (Travel Time) = $CvS^{0.5}$
- Cv = Conveyance Coef (see Table RO-2)
- S = Watercourse slope (ft/ft)

Land Surface Type	**Type**	**Cv**
Grassed Waterway	GW	15
Heavy Meadow	HM	2.5
Nearly Bare Ground	NBG	10
Paved Area	PV	20
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Tillage/Fields	TF	5

The Glen at Widefield
Developed Condition
Time of Concentration Calculation

Sub-Basin Data					Time of Concentration Estimate										Min. Tc in Urban			
					Initial/Overland Time (t_i)			Travel Time (t_t)						Comp.	Tc Check (urban)		Final t_c	
Basin	Design Point	Contributing Basins	Area	C_5	Length	Slope	t_i	Length	Slope	Land Type	Cv	Velocity	t_t	t_c	Total Length	t_c Check		
D-1	DP 68		1.40ac	0.28	100lf	2.4%	11.2 min.	600lf	3.5%	PV	20	3.7 ft/sec	2.7 min.	13.9 min.	700lf	13.9 min.	**13.9 min.**	
D-2			1.45ac	0.28	85lf	1.5%	12.1 min.	655lf	0.9%	PV	20	1.9 ft/sec	5.8 min.	17.8 min.	740lf	14.1 min.	**14.1 min.**	
D-3	DP 70		1.69ac	0.28	100lf	2.4%	11.2 min.	600lf	3.5%	PV	20	3.7 ft/sec	2.7 min.	13.9 min.	700lf	13.9 min.	**13.9 min.**	
D-4			2.07ac	0.34	50lf	1.0%	9.9 min.	610lf	0.9%	PV	20	1.9 ft/sec	5.4 min.	15.3 min.	660lf	13.7 min.	**13.7 min.**	
D-5	DP 72		1.56ac	0.34	60lf	2.0%	8.6 min.	790lf	0.5%	PV	20	1.4 ft/sec	9.3 min.	17.9 min.	850lf	14.7 min.	**14.7 min.**	
D-6	DP 73		0.41ac	0.34	90lf	1.0%	13.3 min.	140lf	0.8%	PV	20	1.8 ft/sec	1.3 min.	14.6 min.	230lf	11.3 min.	**11.3 min.**	
D-7			2.98ac	0.34	100lf	1.5%	12.2 min.	430lf	1.3%	PV	20	2.3 ft/sec	3.1 min.	15.4 min.	530lf	12.9 min.	**12.9 min.**	
D-8			1.62ac	0.34	100lf	1.0%	14.0 min.	330lf	1.5%	PV	20	2.4 ft/sec	2.2 min.	16.2 min.	430lf	12.4 min.	**12.4 min.**	
D-9	DP 77		2.11ac	0.28	100lf	2.0%	11.9 min.	300lf	1.3%	PV	20	2.3 ft/sec	2.2 min.	14.1 min.	400lf	12.2 min.	**12.2 min.**	
D-10			2.99ac	0.34	100lf	1.5%	12.2 min.	660lf	1.1%	PV	20	2.1 ft/sec	5.2 min.	17.5 min.	760lf	14.2 min.	**14.2 min.**	
D-11	DP 80		3.96ac	0.34	70lf	1.5%	10.2 min.	1095lf	1.2%	PV	20	2.2 ft/sec	8.3 min.	18.6 min.	1165lf	16.5 min.	**16.5 min.**	
D-12			1.39ac	0.34	100lf	1.3%	12.8 min.	450lf	1.2%	PV	20	2.2 ft/sec	3.4 min.	16.3 min.	550lf	13.1 min.	**13.1 min.**	
D-13			2.06ac	0.34	55lf	1.0%	10.4 min.	660lf	0.6%	PV	20	1.5 ft/sec	7.1 min.	17.5 min.	715lf	14.0 min.	**14.0 min.**	
D-14			3.30ac	0.34	100lf	1.8%	11.5 min.	980lf	1.6%	PV	20	2.5 ft/sec	6.5 min.	18.0 min.	1080lf	16.0 min.	**16.0 min.**	
D-15	DP 84		2.80ac	0.28	100lf	2.0%	11.9 min.	185lf	2.0%	PV	20	2.8 ft/sec	1.1 min.	13.0 min.	285lf	11.6 min.	**13.0 min.**	Backyard IRF
D-16			2.27ac	0.34	100lf	2.0%	11.1 min.	660lf	0.8%	PV	20	1.8 ft/sec	6.1 min.	17.3 min.	760lf	14.2 min.	**17.3 min.**	Backyard IRF
D-16.1			2.08ac	0.34	100lf	1.4%	12.5 min.	360lf	0.8%	PV	20	1.8 ft/sec	3.4 min.	15.9 min.	460lf	12.6 min.	**15.9 min.**	Backyard IRF
D-17			3.45ac	0.34	60lf	1.5%	9.5 min.	410lf	1.5%	PV	20	2.4 ft/sec	2.8 min.	12.3 min.	470lf	12.6 min.	**12.6 min.**	Backyard IRF
D-18			2.13ac	0.34	60lf	1.5%	9.5 min.	510lf	2.2%	PV	20	3.0 ft/sec	2.9 min.	12.3 min.	570lf	13.2 min.	**13.2 min.**	Backyard IRF
D-19			2.97ac	0.34	100lf	2.6%	10.2 min.	510lf	1.1%	PV	20	2.1 ft/sec	4.1 min.	14.2 min.	610lf	13.4 min.	**14.2 min.**	Backyard IRF
D-19.1			0.17ac	0.34	45lf	2.0%	7.5 min.	36lf	1.1%	PV	20	2.1 ft/sec	0.3 min.	7.7 min.	81lf	10.5 min.	**7.7 min.**	
D-20a	DP 92a		0.81ac	0.38	100lf	3.3%	8.8 min.	1300lf	0.8%	PV	20	1.8 ft/sec	12.1 min.	20.9 min.	1400lf	17.8 min.	**17.8 min.**	
D-20b	DP 92b		0.47ac	0.68	100lf	3.3%	5.1 min.	1300lf	0.8%	PV	20	1.8 ft/sec	12.1 min.	17.2 min.	1400lf	17.8 min.	**17.2 min.**	
D-20c	DP 92d		0.36ac	0.38	100lf	3.3%	8.8 min.	1300lf	0.8%	PV	20	1.8 ft/sec	12.1 min.	20.9 min.	1400lf	17.8 min.	**17.8 min.**	
D-21	DP 91		4.02ac	0.28	50lf	2.0%	8.4 min.	610lf	2.1%	PV	20	2.9 ft/sec	3.5 min.	11.9 min.	660lf	13.7 min.	**11.9 min.**	
D-22	DP 90		1.15ac	0.28	50lf	2.0%	8.4 min.	610lf	2.1%	PV	20	2.9 ft/sec	3.5 min.	11.9 min.	660lf	13.7 min.	**11.9 min.**	
D-23			0.28ac	0.67	100lf	2.5%	5.7 min.	660lf	1.0%	PV	20	2.0 ft/sec	5.5 min.	11.2 min.	760lf	14.2 min.	**11.2 min.**	
D-24			10.18ac	0.20	100lf	4.9%	9.8 min.	800lf	0.5%	GW	15	1.1 ft/sec	12.6 min.	22.3 min.	900lf	15.0 min.	**22.3 min.**	Mostly Historic
Combined Design Point Summary																		
	DP 69	D1, D2	2.85ac	0.28	100lf	2.4%	11.2 min.	1385lf	2.0%	PV	20	2.8 ft/sec	8.2 min.	19.3 min.	1485lf	18.3 min.	**18.3 min.**	
	DP 71	D3, D4	3.76ac	0.28	100lf	2.4%	11.2 min.	1370lf	2.0%	PV	20	2.8 ft/sec	8.1 min.	19.3 min.	1470lf	18.2 min.	**18.2 min.**	
	DP 74	D3, D4, D6	4.17ac	0.34	100lf	2.4%	10.5 min.	1370lf	2.0%	PV	20	2.8 ft/sec	8.1 min.	18.5 min.	1470lf	18.2 min.	**18.2 min.**	
	DP 75	D1-D4, D6, D7	10.01ac	0.34	100lf	2.4%	10.5 min.	1970lf	1.8%	PV	20	2.7 ft/sec	12.2 min.	22.7 min.	2070lf	21.5 min.	**21.5 min.**	
	DP 76	D1-D4, D6-D8	11.63ac	0.34	100lf	2.4%	10.5 min.	2110lf	1.8%	PV	20	2.7 ft/sec	13.1 min.	23.6 min.	2210lf	22.3 min.	**22.3 min.**	
	DP 78	D1-D4, D6-D9	13.74ac	0.34	100lf	2.4%	10.5 min.	2110lf	1.8%	PV	20	2.7 ft/sec	13.1 min.	23.6 min.	2210lf	22.3 min.	**22.3 min.**	
	DP 79	D1-D4, D6-D10	16.73ac	0.34	100lf	2.4%	10.5 min.	2770lf	1.6%	PV	20	2.5 ft/sec	18.2 min.	28.7 min.	2870lf	25.9 min.	**25.9 min.**	
	DP 81	D11, D12	5.34ac	0.34	70lf	1.5%	10.2 min.	1545lf	1.2%	PV	20	2.2 ft/sec	11.8 min.	22.0 min.	1615lf	19.0 min.	**19.0 min.**	
	DP 82	D5, D13	3.62ac	0.34	60lf	2.0%	8.6 min.	1590lf	0.6%	PV	20	1.5 ft/sec	17.7 min.	26.3 min.	1650lf	19.2 min.	**19.2 min.**	
	DP 83	D5, D13, D14	6.93ac	0.34	60lf	2.0%	8.6 min.	2640lf	0.9%	PV	20	1.9 ft/sec	23.2 min.	31.8 min.	2700lf	25.0 min.	**25.0 min.**	
	DP 85	D15,D16, D16.1	7.15ac	0.34	100lf	2.0%	11.1 min.	847lf	0.6%	PV	20	1.5 ft/sec	9.3 min.	20.5 min.	947lf	15.3 min.	**20.5 min.**	Backyard IRF
	DP 86	D15 - D17	10.60ac	0.34	100lf	2.0%	11.1 min.	1035lf	0.8%	PV	20	1.8 ft/sec	9.6 min.	20.8 min.	1135lf	16.3 min.	**20.8 min.**	Backyard IRF
	DP 87	D15 - D18	12.74ac	0.34	100lf	2.0%	11.1 min.	1320lf	0.7%	PV	20	1.7 ft/sec	13.1 min.	24.3 min.	1420lf	17.9 min.	**24.3 min.**	Backyard IRF
	DP 88	D15 - D19	15.70ac	0.34	100lf	2.0%	11.1 min.	2080lf	1.0%	PV	20	2.0 ft/sec	17.3 min.	28.4 min.	2180lf	22.1 min.	**28.4 min.**	Backyard IRF
	DP 92a	D20a	0.81ac	1.73	100lf	2.0%	-9.1 min.	2080lf	1.0%	PV	20	2.0 ft/sec	17.3 min.	8.2 min.	2180lf	22.1 min.	**28.4 min.**	Backyard IRF
	DP 92b	D21,D22,D23	5.46ac	0.34	124lf	2.5%	11.5 min.	825lf	1.0%	PV	20	2.0 ft/sec	6.9 min.	18.4 min.	949lf	15.3 min.	**15.3 min.**	
	DP 93a	D1 -D19.1	44.87ac	0.34	168lf	2.5%	13.4 min.	2820lf	1.0%	PV	20	2.0 ft/sec	23.5 min.	36.9 min.	2988lf	26.6 min.	**36.9 min.**	Cumulative Reduction
	DP 93b	D20b,D20c,D23	1.12ac	0.40	14lf	2.4%	3.6 min.	56lf	1.6%	PV	20	2.5 ft/sec	0.4 min.	5.0 min.	70lf	10.4 min.	**5.0 min.**	
	DP 94	**ULTIMATE**	**62.15ac**	0.32	100lf	2.4%	10.7 min.	3110lf	1.0%	PV	20	2.0 ft/sec	25.9 min.	36.6 min.	3210lf	27.8 min.	**27.8 min.**	

Equations:

t_i (Overland) = $0.395(1.1-C_5)L^{0.5}S^{-0.333}$

C_5 = Runoff coefficient for 5-year

L = Length of overland flow (ft)

S = Slope of flow path (ft/ft)

tc Check = (L/180)+10 (Developed Cond. Only)

L = Overall Length

Velocity (Travel Time) = $CvS^{0.5}$

Cv = Conveyance Coef (see Table RO-2)

S = Watercourse slope (ft/ft)

Land Surface Type	Type	Cv
Grassed Waterway	GW	15
Heavy Meadow	HM	2.5
Nearly Bare Ground	NBG	10
Paved Area	PV	20
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Tillage/Fields	TF	5

The Glen at Widefield
Developed Condition
Runoff Calculation

Basin	Design Point	Contributing Basins	Drainage Area	C_5	C_{100}	Time of Concentration	Rainfall Intensity i_{WQCV}	i_2	i_5	i_{10}	i_{25}	i_{50}	i_{100}	Runoff Q_5	Q_{100}	Basin / DP
E-1	DP 95		5.27 ac	0.15	0.50	20.6 min.	1.2 in/hr	2.4 in/hr	3.0 in/hr	3.6 in/hr	4.1 in/hr	4.6 in/hr	5.1 in/hr	**2.4 cfs**	**13.5 cfs**	E-1
E-2	DP 96		0.50 ac	0.28	0.49	14.3 min.	1.4 in/hr	2.9 in/hr	3.6 in/hr	4.2 in/hr	4.8 in/hr	5.4 in/hr	6.0 in/hr	**0.5 cfs**	**1.5 cfs**	E-2
E-3	DP 97		1.60 ac	0.15	0.41	11.8 min.	1.5 in/hr	3.1 in/hr	3.9 in/hr	4.5 in/hr	5.2 in/hr	5.8 in/hr	6.5 in/hr	**0.9 cfs**	**4.3 cfs**	E-3
E-4	DP 98		1.17 ac	0.25	0.55	9.1 min.	1.7 in/hr	3.4 in/hr	4.3 in/hr	5.0 in/hr	5.7 in/hr	6.4 in/hr	7.2 in/hr	**1.3 cfs**	**4.6 cfs**	E-4
E-5	DP 99		1.32 ac	0.21	0.53	11.4 min.	1.6 in/hr	3.1 in/hr	3.9 in/hr	4.6 in/hr	5.2 in/hr	5.9 in/hr	6.6 in/hr	**1.1 cfs**	**4.6 cfs**	E-5
													Summ:	**6.2 cfs**	**28.5 cfs**	

Equations (taken from Fig 6-5, City of Colorado Springs DCM):

i_2=-1.19 ln(T_c) + 6.035
i_5=-1.50 ln(T_c) + 7.583
i_{10}=-1.75 ln(T_c) + 8.847
i_{25}=-2.00 ln(T_c) + 10.111
i_{50}=-2.25 ln(T_c) + 11.375
i_{100}=-2.52 ln(T_c) + 12.735

Q = CiA
Q = Peak Runoff Rate (cubic feet/second)
C = Runoff coef representing a ration of peak runoff rate to ave rainfall intensity for a duration equal to the runoff time of concentration.
i = average rainfall intensity in inches per hour
A = Drainage area in acres

P1	Inches
WQCV	0.60 in
2 yr	1.19 in
5 yr	1.50 in
10 yr	1.75 in
25 yr	2.00 in
50 yr	2.25 in
100 yr	2.52 in

The Glen at Widefield
Developed Condition
Runoff Calculation

Basin	Design Point	Contributing Basins	Drainage Area	C_5	C_{100}	Time of Concentration	Rainfall Intensity i_5	i_{100}	Runoff Q_5	Q_{100}	Basin / DP
D-1	DP 68		1.40 ac	0.28	0.49	13.9 min.	3.6 in/hr	6.1 in/hr	**1.4 cfs**	**4.2 cfs**	D-1
D-2			1.45 ac	0.28	0.49	14.1 min.	3.6 in/hr	6.1 in/hr	**1.5 cfs**	**4.3 cfs**	D-2
D-3	DP 70		1.69 ac	0.28	0.49	13.9 min.	3.6 in/hr	6.1 in/hr	**1.7 cfs**	**5.0 cfs**	D-3
D-4			2.07 ac	0.34	0.58	13.7 min.	3.7 in/hr	6.1 in/hr	**2.5 cfs**	**7.4 cfs**	D-4
D-5	DP 72		1.56 ac	0.34	0.58	14.7 min.	3.5 in/hr	6.0 in/hr	**1.9 cfs**	**5.4 cfs**	D-5
D-6	DP 73		0.41 ac	0.34	0.58	11.3 min.	3.9 in/hr	6.6 in/hr	**0.5 cfs**	**1.6 cfs**	D-6
D-7			2.98 ac	0.34	0.58	12.9 min.	3.7 in/hr	6.3 in/hr	**3.7 cfs**	**10.8 cfs**	D-7
D-8			1.62 ac	0.34	0.58	12.4 min.	3.8 in/hr	6.4 in/hr	**2.1 cfs**	**6.0 cfs**	D-8
D-9	DP 77		2.11 ac	0.28	0.49	12.2 min.	3.8 in/hr	6.4 in/hr	**2.3 cfs**	**6.6 cfs**	D-9
D-10			2.99 ac	0.34	0.58	14.2 min.	3.6 in/hr	6.0 in/hr	**3.6 cfs**	**10.5 cfs**	D-10
D-11	DP 80		3.96 ac	0.34	0.58	16.5 min.	3.4 in/hr	5.7 in/hr	**4.5 cfs**	**13.0 cfs**	D-11
D-12			1.39 ac	0.34	0.58	13.1 min.	3.7 in/hr	6.3 in/hr	**1.7 cfs**	**5.0 cfs**	D-12
D-13			2.06 ac	0.34	0.58	14.0 min.	3.6 in/hr	6.1 in/hr	**2.5 cfs**	**7.3 cfs**	D-13
D-14			3.30 ac	0.34	0.58	16.0 min.	3.4 in/hr	5.7 in/hr	**3.8 cfs**	**11.0 cfs**	D-14
D-15	DP 84		2.80 ac	0.28	0.49	13.0 min.	3.7 in/hr	6.3 in/hr	**3.0 cfs**	**8.6 cfs**	D-15
D-16	DP84.1		2.27 ac	0.34	0.58	17.3 min.	3.3 in/hr	5.6 in/hr	**2.5 cfs**	**7.3 cfs**	D-16
D-16.1			2.08 ac	0.34	0.58	15.9 min.	3.4 in/hr	5.8 in/hr	**2.4 cfs**	**6.9 cfs**	D-16.1
D-17			3.45 ac	0.34	0.58	12.6 min.	3.8 in/hr	6.3 in/hr	**4.4 cfs**	**12.7 cfs**	D-17
D-18			2.13 ac	0.34	0.58	13.2 min.	3.7 in/hr	6.2 in/hr	**2.7 cfs**	**7.7 cfs**	D-18
D-19			2.97 ac	0.34	0.58	14.2 min.	3.6 in/hr	6.0 in/hr	**3.6 cfs**	**10.4 cfs**	D-19
D-19.1	DP 89		0.17 ac	0.34	0.58	7.7 min.	4.5 in/hr	7.6 in/hr	**0.3 cfs**	**0.7 cfs**	D-19.1
D-20a	DP 92a		0.81 ac	0.38	0.60	17.8 min.	3.3 in/hr	5.5 in/hr	**1.0 cfs**	**2.6 cfs**	D-20a
D-20b	DP 92b		0.47 ac	0.68	0.79	17.2 min.	3.3 in/hr	5.6 in/hr	**1.1 cfs**	**2.1 cfs**	D-20b
D-20c	DP 92d		0.36 ac	0.38	0.60	17.8 min.	3.3 in/hr	5.5 in/hr	**0.5 cfs**	**1.2 cfs**	D-20c
D-21	DP 91		4.02 ac	0.28	0.49	11.9 min.	3.9 in/hr	6.5 in/hr	**4.4 cfs**	**12.7 cfs**	D-21
D-22	DP 90		1.15 ac	0.28	0.49	11.9 min.	3.9 in/hr	6.5 in/hr	**1.3 cfs**	**3.6 cfs**	D-22
D-23			0.28 ac	0.67	0.78	11.2 min.	4.0 in/hr	6.6 in/hr	**0.8 cfs**	**1.5 cfs**	D-23
D-24			10.18 ac	0.20	0.52	22.3 min.	2.9 in/hr	4.9 in/hr	**5.8 cfs**	**26.2 cfs**	D-24
Combined Design Point Summary							**Direct Summation:**		**67.3 cfs**	**202.0 cfs**	
	DP 69	D1, D2	2.85 ac	0.28	0.49	18.3 min.	3.2 in/hr	5.4 in/hr	**2.6 cfs**	**7.5 cfs**	DP 69
	DP 71	D3, D4	3.76 ac	0.28	0.49	18.2 min.	3.2 in/hr	5.4 in/hr	**3.4 cfs**	**9.9 cfs**	DP 71
	DP 74	D3, D4, D6	4.17 ac	0.34	0.58	18.2 min.	3.2 in/hr	5.4 in/hr	**4.5 cfs**	**13.1 cfs**	DP 74
	DP 75	D1-D4, D6, D7	10.01 ac	0.34	0.58	21.5 min.	3.0 in/hr	5.0 in/hr	**10.0 cfs**	**29.0 cfs**	DP 75
	DP 76	D1-D4, D6-D8	11.63 ac	0.34	0.58	22.3 min.	2.9 in/hr	4.9 in/hr	**11.4 cfs**	**33.0 cfs**	DP 76
	DP 78	D1-D4, D6-D9	13.74 ac	0.34	0.58	22.3 min.	2.9 in/hr	4.9 in/hr	**13.5 cfs**	**39.0 cfs**	DP 78
	DP 79	D1-D4, D6-D10	16.73 ac	0.34	0.58	25.9 min.	2.7 in/hr	4.5 in/hr	**15.1 cfs**	**43.8 cfs**	DP 79
	DP 81	D11, D12	5.34 ac	0.34	0.58	19.0 min.	3.2 in/hr	5.3 in/hr	**5.7 cfs**	**16.4 cfs**	DP 81
	DP 82	D5, D13	3.62 ac	0.34	0.58	19.2 min.	3.2 in/hr	5.3 in/hr	**3.8 cfs**	**11.1 cfs**	DP 82
	DP 83	D5, D13, D14	6.93 ac	0.34	0.58	25.0 min.	2.8 in/hr	4.6 in/hr	**6.4 cfs**	**18.5 cfs**	DP 83
	DP 85	D15,D16, D16.1	7.15 ac	0.34	0.58	20.5 min.	3.1 in/hr	5.1 in/hr	**7.3 cfs**	**21.2 cfs**	DP 85
	DP 86	D15 - D17	10.60 ac	0.34	0.58	20.8 min.	3.0 in/hr	5.1 in/hr	**10.8 cfs**	**31.2 cfs**	DP 86
	DP 87	D15 - D18	12.74 ac	0.34	0.58	24.3 min.	2.8 in/hr	4.7 in/hr	**12.0 cfs**	**34.6 cfs**	DP 87
	DP 88	D15 - D19	15.70 ac	0.34	0.58	28.4 min.	2.6 in/hr	4.3 in/hr	**13.5 cfs**	**39.0 cfs**	DP 88
	DP 92a	D20a	0.81 ac	1.73	1.69	28.4 min.	2.6 in/hr	4.3 in/hr	**3.6 cfs**	**5.9 cfs**	DP 92a
	DP 92b	D21,D22,D23	5.46 ac	0.34	0.58	15.3 min.	3.5 in/hr	5.9 in/hr	**6.4 cfs**	**18.5 cfs**	DP 92b
	DP 93a	D1 -D19.1	44.87 ac	0.34	0.58	36.9 min.	2.2 in/hr	3.6 in/hr	**32.7 cfs**	**94.5 cfs**	DP 93a
	DP 93b	D20b,D20c,D23	1.12 ac	0.40	0.60	5.0 min.	5.2 in/hr	8.7 in/hr	**2.3 cfs**	**5.9 cfs**	DP 93b
	DP 94	**ULTIMATE**	**62.15 ac**	**0.32**	**0.57**	**27.8 min.**	2.6 in/hr	4.4 in/hr	**51.3 cfs**	**154.8 cfs**	**FINAL**

Equations (taken from Fig 6-5, City of Colorado Springs DCM):

i_2=-1.19 ln(T_c) + 6.035
i_5=-1.50 ln(T_c) + 7.583
i_{10}=-1.75 ln(T_c) + 8.847
i_{25}=-2.00 ln(T_c) + 10.111
i_{50}=-2.25 ln(T_c) + 11.375
i_{100}=-2.52 ln(T_c) + 12.735

Q = CiA
Q = Peak Runoff Rate (cubic feet/second)
C = Runoff coef representing a ration of peak runoff rate to ave rainfall intensity for a duration equal to the runoff time of concentration.
i = average rainfall intensity in inches per hour
A = Drainage area in acres

P1	Inches
WQCV	0.60 in
2 yr	1.19 in
5 yr	1.50 in
10 yr	1.75 in
25 yr	2.00 in
50 yr	2.25 in
100 yr	2.52 in

The Glen at Widefield
Inlet Summary and Calculations

Inlet ID	Design Flow (Basin or DP)	Flow to Inlet			Upstream Inlet(s)	Carry Over Flow		Flow to Inlet including Carry Over		Street Flow Depth		Street Section Capacity		Inlet Type	Inlet Condition	Inlet Capacity		Flow Not Captured by Inlet		to
		2yr	5yr	100yr		5yr	100yr	5yr	100yr	5yr	100yr	5yr	100yr			5yr	100yr	5yr	100yr	
A-1	DP 84		3.0cfs	8.6cfs	None	0.0cfs	0.0cfs	3.0cfs	8.6cfs	6.0in	6.2in	8.2cfs	11.3cfs	10' Type R	On Grade	3.0 cfs	6.9 cfs	0.0cfs	1.7cfs	to B-1
A-4	'A-4' (Temp)		4.4cfs	12.7cfs	A-1	0.0cfs	1.7cfs	4.4cfs	14.4cfs	6.0in	12.0in	10.0cfs	24.0cfs	Temp. Grate at MH	In Sump	10.0 cfs	24.0 cfs	0.0cfs	0.0cfs	to C-1
B-1	D-16		2.5cfs	7.3cfs	A-1	0.0cfs	1.7cfs	2.5cfs	9.0cfs	6.0in	6.2in	8.2cfs	11.3cfs	10' Type R	On Grade	5.0 cfs	9.6 cfs	0.0cfs	0.0cfs	to C-1
C-1	DP 85		2.4cfs	6.9cfs	A-1, B-1	0.0cfs	0.0cfs	2.4cfs	6.9cfs	6.0in	6.2in	8.2cfs	11.3cfs	10' Type R	On Grade	2.4 cfs	5.8 cfs	0.0cfs	1.1cfs	to D-1
D-1	DP 86		4.4cfs	12.7cfs	A-1, B-1, C-1	0.0cfs	1.1cfs	4.4cfs	13.8cfs	6.0in	6.2in	10.3cfs	14.2cfs	10' Type R	On Grade	4.3 cfs	8.1 cfs	0.1cfs	5.7cfs	to G-2
D-4	DP 82		3.8cfs	11.1cfs	A-1, B-1, C-1	0.0cfs	0.0cfs	3.8cfs	11.1cfs	6.0in	6.2in	8.2cfs	11.3cfs	15' Type R	On Grade	3.8 cfs	9.9 cfs	0.0cfs	1.2cfs	to G-4
G-1	DP 89		0.3cfs	0.7cfs	None	0.0cfs	15.5cfs	0.3cfs	16.3cfs	6.0in	6.2in	11.1cfs	11.1cfs	20' Type R	In Sump	10.8 cfs	19.9 cfs	0.0cfs	0.0cfs	N/A
G-2	DP 88		6.2cfs	18.1cfs	A-1 thru D-1	0.1cfs	5.7cfs	6.3cfs	23.7cfs	6.0in	6.2in	7.7cfs	10.6cfs	15' Type R	On Grade	6.3 cfs	13.6 cfs	0.0cfs	10.1cfs	to G-1
G-3	DP 81		5.7cfs	16.4cfs	None	0.0cfs	0.0cfs	5.7cfs	16.4cfs	6.0in	6.2in	11.1cfs	11.1cfs	20' Type R	In Sump	10.8 cfs	19.9 cfs	0.0cfs	0.0cfs	N/A
G-4	DP 83		3.8cfs	11.0cfs	D-4	0.0cfs	1.2cfs	3.8cfs	12.2cfs	6.0in	6.2in	9.1cfs	12.8cfs	15' Type R	On Grade	3.8 cfs	7.1 cfs	0.0cfs	5.1cfs	J-1
E-1	DP 71		3.4cfs	9.9cfs	None	0.0cfs	0.0cfs	3.4cfs	9.9cfs	6.0in	6.2in	10.2cfs	14.1cfs	10' Type R	On Grade	3.4 cfs	8.5 cfs	0.0cfs	1.4cfs	to E-6
E-2	DP 69		2.6cfs	7.5cfs	None	0.0cfs	0.0cfs	2.6cfs	7.5cfs	6.0in	6.2in	10.2cfs	14.1cfs	10' Type R	On Grade	2.6 cfs	6.1 cfs	0.0cfs	1.4cfs	to E-6
E-6	DP 75		3.7cfs	10.8cfs	E-1, E-2	0.0cfs	2.9cfs	3.8cfs	13.7cfs	6.0in	6.2in	11.6cfs	16.0cfs	15' Type R	On Grade	3.9 cfs	11.1 cfs	0.0cfs	2.6cfs	to H-2
F-1	DP 77		2.3cfs	6.6cfs	None	0.0cfs	0.0cfs	2.3cfs	6.6cfs	6.0in	6.2in	11.1cfs	11.1cfs	10' Type R	In Sump	8.7 cfs	11.2 cfs	0.0cfs	0.0cfs	to H-2
H-2	DP 79		5.4cfs	15.5cfs	A thru H	0.0cfs	5.5cfs	5.4cfs	21.0cfs	6.0in	6.2in	11.1cfs	11.1cfs	20' Type R	In Sump	18.2 cfs	19.9 cfs	0.0cfs	1.1cfs	to J-2
J-1	DP 92a		1.0cfs	2.6cfs	DP 20 Only + Overtopping	0.0cfs	5.1cfs	1.0cfs	7.7cfs	6.0in	6.2in	11.1cfs	11.1cfs	10' Type R	In Sump	8.7 cfs	8.7 cfs	0.0cfs	0.0cfs	to J-1
J-2	DP 92b		0.8cfs	1.5cfs	DP 23 Only + Overtopping	0.0cfs	1.1cfs	0.8cfs	2.6cfs	6.0in	6.2in	11.1cfs	11.1cfs	10' Type R	In Sump	8.7 cfs	8.7 cfs	0.0cfs	0.0cfs	G-1

G-2	BYPASSES	0.0cfs	10.1cfs
G-3	BYPASSES	0.0cfs	0.0cfs
G-4	BYPASSES	0.0cfs	5.1cfs
H-2	BYPASSES	0.0cfs	1.1cfs
	SUB TOTAL:	0.0cfs	16.3cfs
G-1	RECEIVES	0.0cfs	10.1cfs
J-1	RECEIVES	0.0cfs	5.1cfs
J-2	RECEIVES	0.0cfs	1.1cfs

Note: Street Capacity Exceeded at Inlets G-2, G-4, and H-2
Per Design, Flow Depth in excess of five inches (5")
will overtop to surrounding inlets:
G-1, J-1 & J-2 to accomplish 100% inlet capture (as Backflow).

The Glen at Widefield
Pipe Diameter Calculations

Pipe #	5yr Rat'l	100yr Rat'l	5yr Capture	100yr Capture	Contributing Flows	Manning 'n'	Pipe Slope	Calculated Pipe Diameter	Pipe Diameter	Minimum Slope of Pipe	A (sf)	Wp (ft)	Rh (ft)	Full Pipe Flow Velocity	Head above Pipe Flowline	H	Pipe Inlet Control Capacity	Mannings Pipe Capacity	Capacity Check	Notes		Length (2D Center-to-Center)
Golden Buffs Drive Trunkline																						
A1-A2	**3.0 cfs**	**8.6 cfs**	3.0 cfs	6.9 cfs	N/A	0.013	**0.70%**	16-inch	**18-inch**	0.43%	1.77 sf	4.7 ft	0.4 ft	5.0 ft/sec		----	----	**8.8 cfs**	OK	DP84	Future	**33.67**
A2-A3	**3.0 cfs**	**8.6 cfs**	3.0 cfs	6.9 cfs	N/A	0.013	**0.60%**	17-inch	**18-inch**	0.43%	1.77 sf	4.7 ft	0.4 ft	4.6 ft/sec		----	----	**8.2 cfs**	OK	DP84	Future	**124.91**
A3-A4	**3.0 cfs**	**8.6 cfs**	3.0 cfs	6.9 cfs	N/A	0.013	**0.60%**	17-inch	**18-inch**	0.43%	1.77 sf	4.7 ft	0.4 ft	4.6 ft/sec		----	----	**8.2 cfs**	OK	DP84	Future	**125.80**
A4-B2	**3.0 cfs**	**8.6 cfs**	3.0 cfs	6.9 cfs	N/A	0.013	**0.60%**	17-inch	**18-inch**	0.43%	1.77 sf	4.7 ft	0.4 ft	4.6 ft/sec		----	----	**8.2 cfs**	OK	DP84		**153.59**
B1-B2	**2.5 cfs**	**7.3 cfs**	5.0 cfs	9.0 cfs	A1 Bypass	0.013	**1.00%**	17-inch	**18-inch**	0.73%	1.77 sf	4.7 ft	0.4 ft	6.0 ft/sec		----	----	**10.5 cfs**	OK			**29.70**
B2-B3	**7.3 cfs**	**21.2 cfs**	8.0 cfs	15.9 cfs	N/A	0.013	**0.70%**	22-inch	**24-inch**	0.49%	3.14 sf	6.3 ft	0.5 ft	6.0 ft/sec		----	----	**19.0 cfs**	OK			**168.24**
B3-B4	**7.3 cfs**	**21.2 cfs**	8.0 cfs	15.9 cfs	N/A	0.013	**0.70%**	22-inch	**24-inch**	0.49%	3.14 sf	6.3 ft	0.5 ft	6.0 ft/sec		----	----	**19.0 cfs**	OK			**80.62**
B4-C2	**7.3 cfs**	**21.2 cfs**	8.0 cfs	15.9 cfs	N/A	0.013	**0.70%**	22-inch	**24-inch**	0.49%	3.14 sf	6.3 ft	0.5 ft	6.0 ft/sec		----	----	**19.0 cfs**	OK			**77.97**
C1-C2	**7.3 cfs**	**21.2 cfs**	2.4 cfs	5.8 cfs	B1 Bypass	0.013	**2.00%**	18-inch	**18-inch**	0.31%	1.77 sf	4.7 ft	0.4 ft	8.4 ft/sec		----	----	**14.9 cfs**	OK	DP85		**29.14**
C2-C3	**10.8 cfs**	**31.2 cfs**	10.4 cfs	21.7 cfs	N/A	0.013	**0.60%**	26-inch	**30-inch**	0.28%	4.91 sf	7.9 ft	0.6 ft	6.5 ft/sec		----	----	**31.9 cfs**	OK	DP85		**92.14**
C3-D2	**10.8 cfs**	**31.2 cfs**	10.4 cfs	21.7 cfs	N/A	0.013	**0.60%**	26-inch	**30-inch**	0.28%	4.91 sf	7.9 ft	0.6 ft	6.5 ft/sec		----	----	**31.9 cfs**	OK			**177.80**
D1-D2	**1.4 cfs**	**4.2 cfs**	4.3 cfs	8.1 cfs	C1 Bypass	0.013	**2.00%**	14-inch	**18-inch**	0.60%	1.77 sf	4.7 ft	0.4 ft	8.4 ft/sec		----	----	**14.9 cfs**	OK			**27.71**
D2-D4	**12.0 cfs**	**34.6 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.60%**	33-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	6.9 ft/sec		----	----	**41.1 cfs**	OK			**212.13**
D4-D5	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.80%**	31-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	8.0 ft/sec		----	----	**47.4 cfs**	OK	DP86		**161.24**
D5-D6	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**1.10%**	29-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	9.4 ft/sec		----	----	**55.6 cfs**	OK			**216.49**
D6-D7	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.90%**	30-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	8.5 ft/sec		----	----	**50.3 cfs**	OK			**85.26**
D7-D8	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.90%**	30-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	8.5 ft/sec		----	----	**50.3 cfs**	OK			**78.72**
D8-D9	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**1.00%**	30-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	8.9 ft/sec		----	----	**53.0 cfs**	OK	DP87		**83.20**
D9-D10	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.80%**	31-inch	**33-inch**	0.56%	5.94 sf	8.6 ft	0.7 ft	8.0 ft/sec		----	----	**47.4 cfs**	OK			**80.51**
D10-D11	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.40%**	35-inch	**36-inch**	0.35%	7.07 sf	9.4 ft	0.8 ft	6.0 ft/sec		----	----	**42.3 cfs**	OK			**78.14**
D11-D12	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	N/A	0.013	**0.40%**	35-inch	**36-inch**	0.35%	7.07 sf	9.4 ft	0.8 ft	6.0 ft/sec		----	----	**42.3 cfs**	OK			**155.35**
D12-H1	**15.8 cfs**	**45.7 cfs**	18.5 cfs	39.7 cfs	C1, D1 & D2 Bypass	0.013	**0.40%**	35-inch	**36-inch**	0.35%	7.07 sf	9.4 ft	0.8 ft	6.0 ft/sec		----	----	**42.3 cfs**	OK			**94.06**
H1-H2	**32.9 cfs**	**77.9 cfs**	46.1 cfs	86.0 cfs		0.013	**0.50%**	45-inch	**48-inch**	0.36%	12.57 sf	12.6 ft	1.0 ft	8.1 ft/sec		----	----	**101.8 cfs**	OK			**55.96**
PennyCress Drive Trunkline																						
E1-E2	**4.5 cfs**	**13.1 cfs**	3.4 cfs	8.5 cfs	N/A	0.013	**0.60%**	18-inch	**21-inch**	0.29%	2.41 sf	5.5 ft	0.4 ft	5.1 ft/sec		----	----	**12.3 cfs**	OK			**37.39**
E2-E3	**7.1 cfs**	**20.6 cfs**	6.0 cfs	14.6 cfs	N/A	0.013	**0.90%**	21-inch	**21-inch**	0.85%	2.41 sf	5.5 ft	0.4 ft	6.3 ft/sec		----	----	**15.1 cfs**	OK			**29.61**
E3-E4	**7.1 cfs**	**20.6 cfs**	6.0 cfs	14.6 cfs	N/A	0.013	**1.00%**	20-inch	**21-inch**	0.85%	2.41 sf	5.5 ft	0.4 ft	6.6 ft/sec		----	----	**15.9 cfs**	OK			**189.40**
E4-E5	**7.1 cfs**	**20.6 cfs**	6.0 cfs	14.6 cfs	N/A	0.013	**1.00%**	20-inch	**21-inch**	0.85%	2.41 sf	5.5 ft	0.4 ft	6.6 ft/sec		----	----	**15.9 cfs**	OK			**189.25**
E5-E6	**7.1 cfs**	**20.6 cfs**	6.0 cfs	14.6 cfs	E1, E2 Bypass	0.013	**1.20%**	20-inch	**21-inch**	0.85%	2.41 sf	5.5 ft	0.4 ft	7.2 ft/sec		----	----	**17.4 cfs**	OK			**150.07**
E6-E7	**10.0 cfs**	**29.0 cfs**	9.9 cfs	25.7 cfs	N/A	0.013	**0.80%**	26-inch	**30-inch**	0.39%	4.91 sf	7.9 ft	0.6 ft	7.5 ft/sec		----	----	**36.8 cfs**	OK	DP75		**100.41**
F1-F2	**2.3 cfs**	**6.6 cfs**	2.3 cfs	6.6 cfs	N/A	0.013	**4.00%**	12-inch	**18-inch**	0.39%	1.77 sf	4.7 ft	0.4 ft	11.9 ft/sec		----	----	**21.1 cfs**	OK	DP77		**197.94**
F2-F3	**2.3 cfs**	**6.6 cfs**	2.3 cfs	6.6 cfs	N/A	0.013	**0.50%**	17-inch	**18-inch**	0.39%	1.77 sf	4.7 ft	0.4 ft	4.2 ft/sec		----	----	**7.4 cfs**	OK	DP77		**292.03**
E7-F3	**10.0 cfs**	**29.0 cfs**	12.2 cfs	32.3 cfs	N/A	0.013	**0.80%**	29-inch	**30-inch**	0.62%	4.91 sf	7.9 ft	0.6 ft	7.5 ft/sec		----	----	**36.8 cfs**	OK			**64.32**
F3-F4	**13.5 cfs**	**39.0 cfs**	12.2 cfs	32.3 cfs	N/A	0.013	**0.80%**	29-inch	**30-inch**	0.62%	4.91 sf	7.9 ft	0.6 ft	7.5 ft/sec		----	----	**36.8 cfs**	OK	DP78		**63.47**
F4-F5	**5.4 cfs**	**39.0 cfs**	12.2 cfs	32.3 cfs	N/A	0.013	**0.80%**	29-inch	**30-inch**	0.62%	4.91 sf	7.9 ft	0.6 ft	7.5 ft/sec		----	----	**36.8 cfs**	OK			**250.09**
F5-F6	**5.4 cfs**	**39.0 cfs**	12.2 cfs	32.3 cfs	N/A	0.013	**0.40%**	33-inch	**33-inch**	0.37%	5.94 sf	8.6 ft	0.7 ft	5.6 ft/sec		----	----	**33.5 cfs**	OK			**189.19**
F6-F7	**5.4 cfs**	**39.0 cfs**	12.2 cfs	32.3 cfs	N/A	0.013	**0.40%**	33-inch	**33-inch**	0.37%	5.94 sf	8.6 ft	0.7 ft	5.6 ft/sec		----	----	**33.5 cfs**	OK			**75.03**
F7-H2	**5.4 cfs**	**15.5 cfs**	12.2 cfs	32.3 cfs	N/A	0.013	**0.40%**	33-inch	**33-inch**	0.37%	5.94 sf	8.6 ft	0.7 ft	5.6 ft/sec		----	----	**33.5 cfs**	OK	DP 79		**106.99**
G1-G2	**0.3 cfs**	**0.7 cfs**	15.7 cfs	16.3 cfs	G-2, G3, H2 Bypass	0.013	**0.60%**	23-inch	**24-inch**	0.52%	3.14 sf	6.3 ft	0.5 ft	5.6 ft/sec		----	----	**17.6 cfs**	OK	DP 89		**36.18**
G2-H1	**6.2 cfs**	**18.1 cfs**	21.9 cfs	29.9 cfs	N/A	0.013	**1.00%**	27-inch	**30-inch**	0.53%	4.91 sf	7.9 ft	0.6 ft	8.4 ft/sec		----	----	**41.1 cfs**	OK	DP 88		**29.60**
G3-G4	**3.8 cfs**	**12.8 cfs**	5.7 cfs	16.4 cfs	N/A	0.013	**1.10%**	21-inch	**24-inch**	0.53%	3.14 sf	6.3 ft	0.5 ft	7.6 ft/sec		----	----	**23.8 cfs**	OK	DP 83		**10.28**
G4-H1	**5.7 cfs**	**16.4 cfs**	9.5 cfs	23.5 cfs	N/A	0.013	**1.10%**	24-inch	**24-inch**	1.08%	3.14 sf	6.3 ft	0.5 ft	7.6 ft/sec		----	----	**23.8 cfs**	OK	DP 81		**37.88**
H2-H3	**45.8 cfs**	**94.5 cfs**	64.3 cfs	99.7 cfs	E6 Bypass	0.013	**0.60%**	46-inch	**48-inch**	0.48%	12.57 sf	12.6 ft	1.0 ft	8.9 ft/sec		----	----	**111.6 cfs**	OK			**45.54**
Pair at Inflow 'J'																						
J2-J1	**1.0 cfs**	**2.6 cfs**	1.0 cfs	3.7 cfs	G-2, G3, H2 Bypass	0.013	**0.50%**	14-inch	**24-inch**	0.03%	3.14 sf	6.3 ft	0.5 ft	5.1 ft/sec		----	----	**16.0 cfs**	OK			**35.87**
J1-End	**1.8 cfs**	**4.1 cfs**	2.8 cfs	8.7 cfs	G-2, G3, H2 Bypass	0.013	**0.60%**	18-inch	**24-inch**	0.15%	3.14 sf	6.3 ft	0.5 ft	5.6 ft/sec		----	----	**17.6 cfs**	OK			**76.59**

Pipe #	5yr Rat'l	100yr Rat'l	5yr Capture	100yr Capture	Contributing Flows	Manning 'n'	Pipe Slope	Calculated Pipe Diameter	Pipe Diameter	Minimum Slope of Pipe	A (sf)	Wp (ft)	Rh (ft)	Full Pipe Flow Velocity	Head above Pipe Flowline	H	Pipe Inlet Control Capacity	Mannings Pipe Capacity	Capacity Check	Notes		Length (2D Center-to-Center)
Box Culvert Poa Annua Street																						
PA1-PA2		**102.1 cfs**	N/A	102.1 cfs	OS-2	0.013	**0.50%**	48-inch	**50-inch**	0.50%	13.64 sf	13.1 ft	1.0 ft	8.3 ft/sec		----	----	**113.6 cfs**	OK			**90.00**

APPENDIX A.1

Supporting Hydrologic Tables and Figures

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

3.2 Time of Concentration

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

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

Table 6-7. Conveyance Coefficient, C_v

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

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

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

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

Table 6-2. Rainfall Depths for Colorado Springs

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

Where Z= 6,840 ft/100

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

2.2 Design Storms

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

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

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

APPENDIX B

Detention Basin Calculations

Full Spectrum Detention Basin/Extended Detention Basin
Detention Volume and Emergency Spillway
Outlet Structure Calculations
Trickle Channel Capacity and Outlet Structure Sizing
Trash Rack and Safety Grate Sizing
Forebay Sizing Calculations

Detention Basin 'D' Earthwork (November 27, 2019)

Elevation	Area (A)	Avg. Area	Volume	Depth	Cumulative Volume		Elev.
5670.35	26sf						
5671	26sf	26sf	17cf	0.6 ft	**17cf**	**0.00ac-ft**	5671
5672	4,698sf	2,362sf	2,362cf	1.6 ft	**2,379cf**	**0.05ac-ft**	5672
5673	24,450sf	14,574sf	14,574cf	2.6 ft	**16,953cf**	**0.39ac-ft**	5673
5674	46,873sf	35,662sf	35,662cf	3.6 ft	**52,614cf**	**1.21ac-ft**	5674
5675	58,751sf	52,812sf	52,812cf	4.6 ft	**105,426cf**	**2.42ac-ft**	5675
5676	66,008sf	62,380sf	62,380cf	5.6 ft	**167,806cf**	**3.85ac-ft**	5676
5677	73,878sf	69,943sf	69,943cf	6.6 ft	**237,749cf**	**5.46ac-ft**	5677
5678	82,194sf	78,036sf	78,036cf	7.6 ft	**315,785cf**	**7.25ac-ft**	5678

Average End Area Formula: V = (A1+A2)/2 x Elev Difference

WQCV =	34,800 cf	0.99 ac-ft	5685.73 ft
100yr Volume =	158,123 cf	3.63 ac-ft	5676.00 ft
100yr Volume + 1/2 WQCV =	178,160 cf	4.09 ac-ft	5676.38 ft
Detention Freeboard Depth =			1.62 ft
Spillway Crest =	211,050 cf	4.85 ac-ft	5677.00 ft

OrigInal Detention Basin 'D' Earthwork (Preliminary)

Elevation	Area (A)	Avg. Area	Volume	Depth	Cumulative Volume		Elev.
5665.7	0sf						
5667	39,170sf	19,585sf	25,461cf	-3.4 ft	**25,461cf**	**0.58ac-ft**	5667
5668	42,246sf	40,708sf	40,708cf	-2.4 ft	**66,169cf**	**1.52ac-ft**	5668
5669	45,423sf	43,835sf	43,835cf	-1.4 ft	**110,004cf**	**2.53ac-ft**	5669
5670	48,700sf	47,062sf	47,062cf	-0.4 ft	**157,065cf**	**3.61ac-ft**	5670
5671	52,078sf	50,389sf	50,389cf	0.6 ft	**207,454cf**	**4.76ac-ft**	5671
5672	55,556sf	53,817sf	53,817cf	1.6 ft	**261,271cf**	**6.00ac-ft**	5672
5673	59,134sf	57,345sf	57,345cf	2.6 ft	**318,616cf**	**7.31ac-ft**	5673

Average End Area Formula: V = (A1+A2)/2 x Elev Difference

WQCV =	34,800 cf	0.99 ac-ft	5667.23 ft
100yr Volume =	158,123 cf	3.63 ac-ft	5670.02 ft
100yr Volume + 1/2 WQCV =	178,160 cf	4.09 ac-ft	5670.42 ft
Detention Freeboard Depth =			2.58 ft
Spillway Crest =	308,232 cf	7.08 ac-ft	5673.00 ft

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	M Kahnke
Company:	Kiowa Engineering
Date:	January 5, 2021
Project:	The Glen at Widefield - Filing No 11
Location:	Widefield, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 32.9 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.329

C) Contributing Watershed Area — Area = 62.150 ac

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

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

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

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

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

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= 0.827 ac-ft

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

J) Excess Urban Runoff Volume (EURV) Design Volume — $EURV_{DESIGN}$ = 1.871 ac-f t
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

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

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

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 6.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations: — 2 Presedimentation Forebays ('Inflow H' and 'Inflow J')

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.025 ac-ft

B) Actual Forebay Volume — V_F = 0.025 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 30.0 in

D) Forebay Discharge
- i) Undetained 100-year Peak Discharge — Q_{100} = 100.40 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 2.01 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 = 7.8 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**M Kahnke**
Company:	**Kiowa Engineering**
Date:	**January 5, 2021**
Project:	**The Glen at Widefield - Filing No 11**
Location:	**Widefield, CO**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom **FOR A CONCRETE TRICKLE CHANNEL, SLOPE SHOULD BE BETWEEN 0.004 AND 0.010 FT/FT.**
F) Slope of Trickle Channel	S = 0.0025 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 = 17 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 10.00 inches
E) Total Outlet Area	A_{ot} = 240.00 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 108 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 5.7 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 3,573 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 4" O.C.*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 4641 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 3.66 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 71.92 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 64.5 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**M Kahnke**
Company:	**Kiowa Engineering**
Date:	**January 5, 2021**
Project:	**The Glen at Widefield - Filing No 11**
Location:	**Widefield, CO**

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	10' Width Earthen Berm where elevated above grade with buried riprap spillway, per criteria.
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One: (●) Irrigated ( ) Not Irrigated — AVOID PLACING IRRIGATION HEADS IN THE BOTTOM OF THE BASIN
12. Access	
A) Describe Sediment Removal Procedures	Sedimentation forebays will capture light sediment. Detention basin planned with access road. Perimeter maintenance road is drivable. Concrete trickle channel throughout low-flow section. Outlet structure has trash rack, per criteria. O & M Manual provided, per criteria.

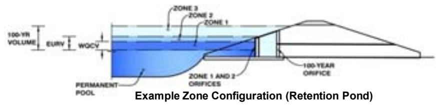
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: The Glen at Widefield Filing No. 10

Basin ID: Detention Basin "D"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	62.07	acres		
Watershed Length =	1,660	ft		
Watershed Slope =	0.017	ft/ft		
Watershed Imperviousness =	32.80%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.827	acre-feet	Optional User Override	
Excess Urban Runoff Volume (EURV) =	1.862	acre-feet	1-hr Precipitation	
2-yr Runoff Volume (P1 = 1.19 in.) =	1.715	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.783	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.904	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	6.004	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	7.506	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	9.404	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.2 in.) =	13.341	acre-feet	3.20	inches
Approximate 2-yr Detention Volume =	1.607	acre-feet		
Approximate 5-yr Detention Volume =	2.628	acre-feet		
Approximate 10-yr Detention Volume =	3.033	acre-feet		
Approximate 25-yr Detention Volume =	3.385	acre-feet		
Approximate 50-yr Detention Volume =	3.536	acre-feet		
Approximate 100-yr Detention Volume =	4.277	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.827	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.035	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	2.828	acre-feet
Total Detention Basin Volume =	4.690	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	26	0.001		
	--	0.65	--	--	--	26	0.001	17	0.000
	--	1.00	--	--	--	4,698	0.108	797	0.018
	--	2.00	--	--	--	24,450	0.561	15,174	0.348
	--	3.00	--	--	--	46,873	1.076	51,079	1.173
	--	4.00	--	--	--	58,751	1.349	103,891	2.385
	--	5.00	--	--	--	66,008	1.515	166,270	3.817
	--	6.00	--	--	--	73,878	1.696	236,213	5.423
	--	7.00	--	--	--	82,194	1.887	314,249	7.214
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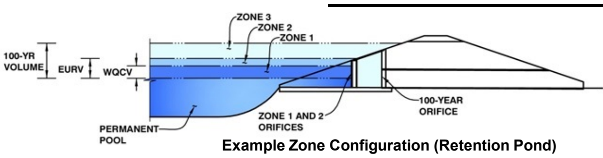
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: The Glen at Widefield Filing 10,11 & Designeated Future Area

Basin ID: D'



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.65	0.827	Orifice Plate
Zone 2 (EURV)	3.60	1.035	Orifice Plate
(100+1/2WQCV)	5.56	2.828	Weir&Pipe (Rect.)
		4.690	Total

0

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 =	3.86	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	1.50	sq. inches (diameter = 1-3/8 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.042E-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	0.50	1.00	1.50	2.00	2.50		
Orifice Area (sq. inches)	1.50	1.50	1.50	1.50	1.50	1.50		

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	2.72	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.85	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	8.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	0.35	N/A	ft^2
Vertical Orifice Centroid =	0.33	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.86	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.25	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	5.00	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 =	5.11	N/A	feet
Over Flow Weir Slope Length =	5.15	N/A	feet
Grate Open Area / 100-yr Orifice Area =	13.53	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	22.55	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.27	N/A	ft^2

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

	Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)
Rectangular Orifice Width =	24.00	N/A	inches
Rectangular Orifice Height =	10.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Rectangular	Not Selected	
Outlet Orifice Area =	1.67	N/A	ft^2
Outlet Orifice Centroid =	0.42	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	24.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.49	feet
Stage at Top of Freeboard =	8.49	feet
Basin Area at Top of Freeboard =	1.89	acres

Routed Hydrograph Results

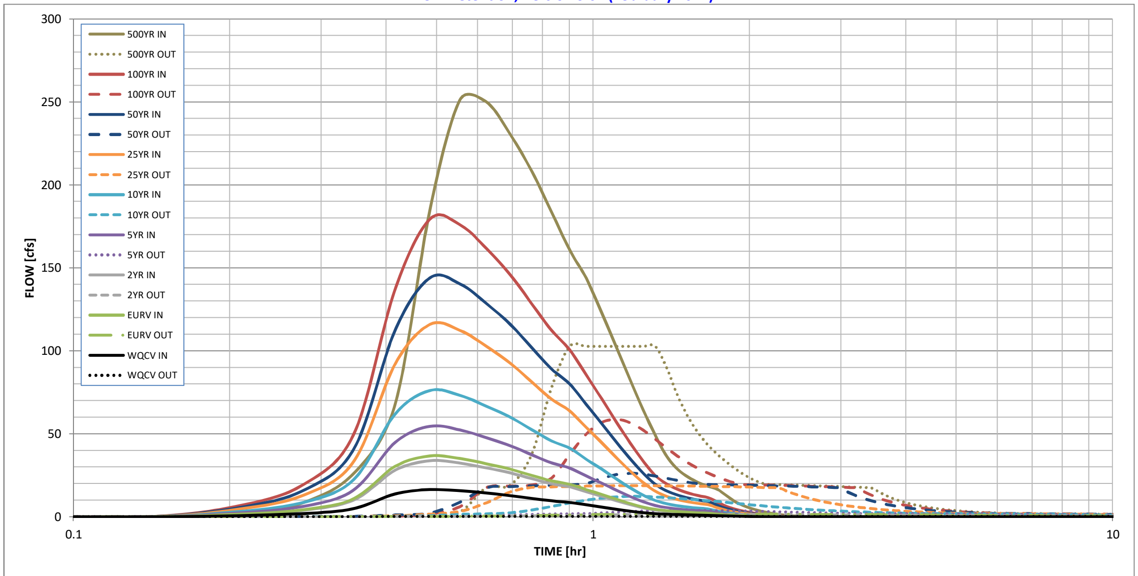
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.20
Calculated Runoff Volume (acre-ft) =	0.827	1.862	1.715	2.783	3.904	6.004	7.506	9.404	13.341
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.827	1.862	1.714	2.783	3.904	6.002	7.501	9.404	13.337
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.16	0.43	0.98	1.29	1.67	2.45
Predevelopment Peak Q (cfs) =	0.0	0.0	1.2	9.9	26.7	60.7	80.1	103.5	152.3
Peak Inflow Q (cfs) =	16.5	36.7	33.8	54.6	76.1	115.9	144.1	179.4	251.4
Peak Outflow Q (cfs) =	0.3	1.5	1.4	3.5	11.7	18.7	26.4	59.6	102.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.4	0.3	0.3	0.6	0.7
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway	Spillway	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	0.7	0.7	0.7	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	45	61	60	63	61	57	55	51	45
Time to Drain 99% of Inflow Volume (hours) =	**48**	65	64	68	68	67	66	65	61
Maximum Ponding Depth (ft) =	2.60	3.48	3.37	4.09	4.60	5.52	6.20	6.63	7.00
Area at Maximum Ponding Depth (acres) =	0.87	1.20	1.18	1.36	1.45	1.61	1.73	1.82	1.89
Maximum Volume Stored (acre-ft) =	0.783	1.708	1.589	2.493	3.210	4.629	5.748	6.529	7.214

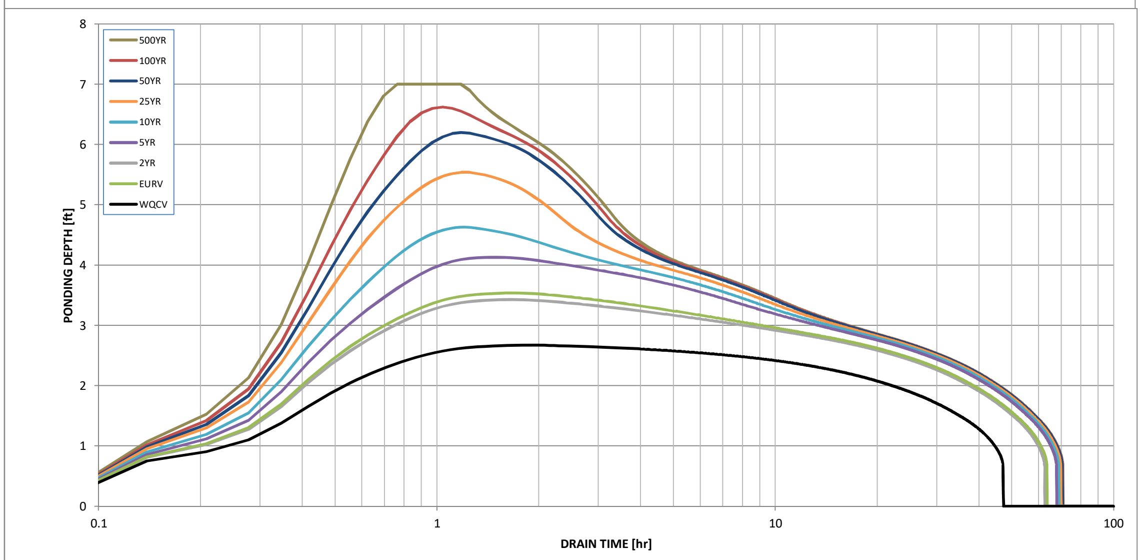
Detention Basin Outlet Structure Design

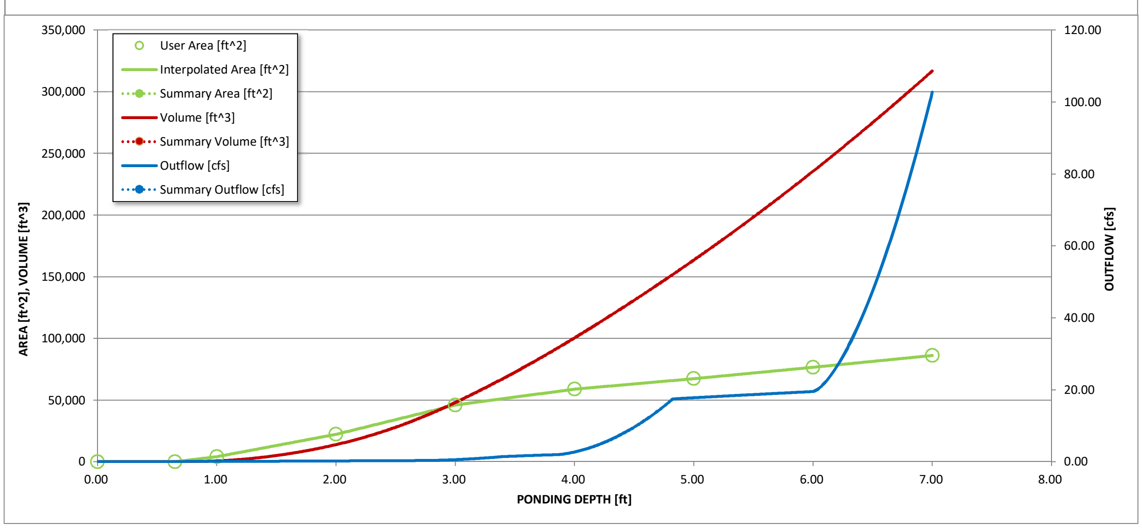
Dete

UD-Detention, Version 3.07 (February 2017)

Outflow Hy







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

Storm Inflow Hydrographs UD-Dete

The user can override the calculated inflow hyd

Time Interval
4.16 min

Hydrograph Constant
1.202

SOURCE	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]
0:00:00	0.00	0.00
0:04:10	0.00	0.00
0:08:19	0.00	0.00
0:12:29	0.73	1.58
0:16:38	1.96	4.32
0:20:48	5.03	11.08
0:24:58	13.82	30.42
0:29:07	16.46	36.71
0:33:17	15.72	35.14
0:37:26	14.31	31.99
0:41:36	12.80	28.71
0:45:46	11.07	24.95
0:49:55	9.64	21.67
0:54:05	8.73	19.65
0:58:14	7.22	16.38
1:02:24	5.91	13.50
1:06:34	4.57	10.57
1:10:43	3.42	8.05
1:14:53	2.47	5.91
1:19:02	1.91	4.49
1:23:12	1.57	3.66
1:27:22	1.33	3.09
1:31:31	1.17	2.70
1:35:41	1.05	2.42
1:39:50	0.97	2.22
1:44:00	0.71	1.64
1:48:10	0.52	1.20
1:52:19	0.38	0.88
1:56:29	0.28	0.65
2:00:38	0.20	0.47
2:04:48	0.14	0.34
2:08:58	0.10	0.24
2:13:07	0.07	0.17
2:17:17	0.04	0.10
2:21:26	0.02	0.06
2:25:36	0.01	0.02
2:29:46	0.00	0.00
2:33:55	0.00	0.00
2:38:05	0.00	0.00
2:42:14	0.00	0.00
2:46:24	0.00	0.00
2:50:34	0.00	0.00
2:54:43	0.00	0.00
2:58:53	0.00	0.00
3:03:02	0.00	0.00
3:07:12	0.00	0.00
3:11:22	0.00	0.00
3:15:31	0.00	0.00
3:19:41	0.00	0.00
3:23:50	0.00	0.00
3:28:00	0.00	0.00
3:32:10	0.00	0.00
3:36:19	0.00	0.00
3:40:29	0.00	0.00
3:44:38	0.00	0.00
3:48:48	0.00	0.00
3:52:58	0.00	0.00
3:57:07	0.00	0.00
4:01:17	0.00	0.00
4:05:26	0.00	0.00
4:09:36	0.00	0.00
4:13:46	0.00	0.00
4:17:55	0.00	0.00
4:22:05	0.00	0.00
4:26:14	0.00	0.00
4:30:24	0.00	0.00
4:34:34	0.00	0.00
4:38:43	0.00	0.00
4:42:53	0.00	0.00
4:47:02	0.00	0.00
4:51:12	0.00	0.00
4:55:22	0.00	0.00
4:59:31	0.00	0.00

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	4.16 min
Hydrograph Constant	1.202

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:04:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:08:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:12:29	0.73	1.58	1.46	2.32	3.18	4.63	5.57	6.67	8.68
0:16:38	1.96	4.32	3.98	6.37	8.80	13.10	16.01	19.55	26.39
0:20:48	5.03	11.08	10.23	16.35	22.60	33.64	41.12	50.21	67.85
0:24:58	13.82	30.42	28.08	44.87	61.97	92.15	112.53	137.27	185.10
0:29:07	16.46	36.71	33.83	54.55	76.12	115.94	144.06	179.41	251.40
0:33:17	15.72	35.14	32.38	52.31	73.18	112.32	140.35	176.01	249.89
0:37:26	14.31	31.99	29.47	47.61	66.62	102.61	128.49	161.53	230.36
0:41:36	12.80	28.71	26.44	42.82	60.01	92.50	115.88	145.75	208.01
0:45:46	11.07	24.95	22.96	37.33	52.47	81.14	101.82	128.29	183.59
0:49:55	9.64	21.67	19.95	32.51	45.79	70.94	89.10	112.33	160.88
0:54:05	8.73	19.65	18.09	29.42	41.36	63.86	80.04	100.70	143.70
0:58:14	7.22	16.38	15.07	24.58	34.64	53.76	67.61	85.38	122.62
1:02:24	5.91	13.50	12.41	20.32	28.69	44.63	56.19	71.02	102.14
1:06:34	4.57	10.57	9.71	16.01	22.71	35.57	44.93	57.00	82.44
1:10:43	3.42	8.05	7.38	12.28	17.53	27.61	34.98	44.48	64.58
1:14:53	2.47	5.91	5.41	9.10	13.08	20.76	26.38	33.67	49.15
1:19:02	1.91	4.49	4.12	6.87	9.82	15.47	19.59	24.91	36.30
1:23:12	1.57	3.66	3.36	5.56	7.90	12.37	15.61	19.77	28.60
1:27:22	1.33	3.09	2.84	4.69	6.65	10.39	13.10	16.56	23.88
1:31:31	1.17	2.70	2.48	4.09	5.79	9.02	11.35	14.33	20.60
1:35:41	1.05	2.42	2.23	3.66	5.18	8.05	10.12	12.77	18.31
1:39:50	0.97	2.22	2.04	3.36	4.74	7.36	9.25	11.65	16.68
1:44:00	0.71	1.64	1.51	2.49	3.53	5.55	7.02	8.93	13.00
1:48:10	0.52	1.20	1.10	1.81	2.56	4.01	5.07	6.44	9.36
1:52:19	0.38	0.88	0.81	1.33	1.89	2.97	3.76	4.78	6.95
1:56:29	0.28	0.65	0.60	0.99	1.41	2.21	2.79	3.55	5.15
2:00:38	0.20	0.47	0.43	0.72	1.03	1.62	2.06	2.62	3.82
2:04:48	0.14	0.34	0.31	0.52	0.74	1.17	1.49	1.90	2.77
2:08:58	0.10	0.24	0.22	0.37	0.54	0.85	1.08	1.37	2.00
2:13:07	0.07	0.17	0.15	0.26	0.37	0.60	0.76	0.98	1.43
2:17:17	0.04	0.10	0.09	0.16	0.24	0.39	0.50	0.65	0.96
2:21:26	0.02	0.06	0.05	0.09	0.14	0.23	0.29	0.38	0.58
2:25:36	0.01	0.02	0.02	0.04	0.06	0.11	0.14	0.19	0.29
2:29:46	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.06	0.10
2:33:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:38:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:42:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:46:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:50:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:54:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:58:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:03:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:07:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:11:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:15:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:19:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:23:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:28:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:32:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:36:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:44:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:48:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:52:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:57:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:01:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:09:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:13:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:17:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:22:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:26:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:34:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:38:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:42:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:47:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:51:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:59:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Presedementation / Forebay Sizing

Forebay	100 Yr Flow	Detention WQCV	Total Req'd Forebay Vol 3.0% WQCV	Tributary Area	% Total Trib Area	Required Forebay Volume	Forebay Design Area	Forebay Design Depth	Forebay Design Volume	Discharge Design Flow 1.0% 100yr	Calc'd Open Width (1" min)	Design Width
H	94.5cfs	36,285cf	1,089cf	44.87ac	97.6%	1,062cf	556sf	1.92-ft	1,068 cf	0.94 cfs	5.4-inch	**5.5-inch**
J	5.9cfs			1.12ac	2.4%	26cf	413sf	1.00-ft	413 cf	0.06 cfs	2.7-inch	**2.5-inch**
					0.0%							
Totals		36,285cf	1,089cf	45.99ac	100.0%				1,480 cf			

Opening Width Equation for Rectangular Opening

$L = Q / (CH^{1.5}) \times 12 + 0.2xHx12$ (UD-BMP Spreadsheet -- EDB tab)

C =	Forebay
5.5	H
2.5	J

Forebay Overflow Calculation

Forebay	Water Surf Elev	Crest Elev	Crest Length	Flow Depth	**Calc'd Flow**
H	5,673.53	5,673.3	14.0 ft	0.25 ft	5.3 cfs
J	5,672.49	5,672.2	8.0 ft	0.25 ft	3.0 cfs

Weir Equation:

$Q = CLH^{1.5}$ C = 3.0

C = Weir coefficient (dimensionless), C = 3.0 (most cases)

L = Length of weir at Crest, in ft. Not including sideslopes.

Trickle Channel Calculation

Location	100yr Flow	Req'd Flow 1.0% 100yr	Bottom Width	Flow Depth	Side Slope	Slope	Manning 'n'	Top Width	Flow Area	Wetted Perimeter	Hydraulic Radius	Flow Velocity	**Capacity**
H	94.5cfs	0.9cfs	2.0 ft	0.50 ft	0.0:1	0.4%	0.013	2.0 ft	1.00 sf	3.0 ft	0.33 ft	3.4 ft/sec	**3.4 cfs**
J	5.9cfs	0.1cfs	2.0 ft	0.50 ft	0.0:1	0.5%	0.013	2.0 ft	1.00 sf	3.0 ft	0.33 ft	3.9 ft/sec	**3.9 cfs**

Equations:

Area $(A) = b(d)+zd^2$
b = width
d = depth

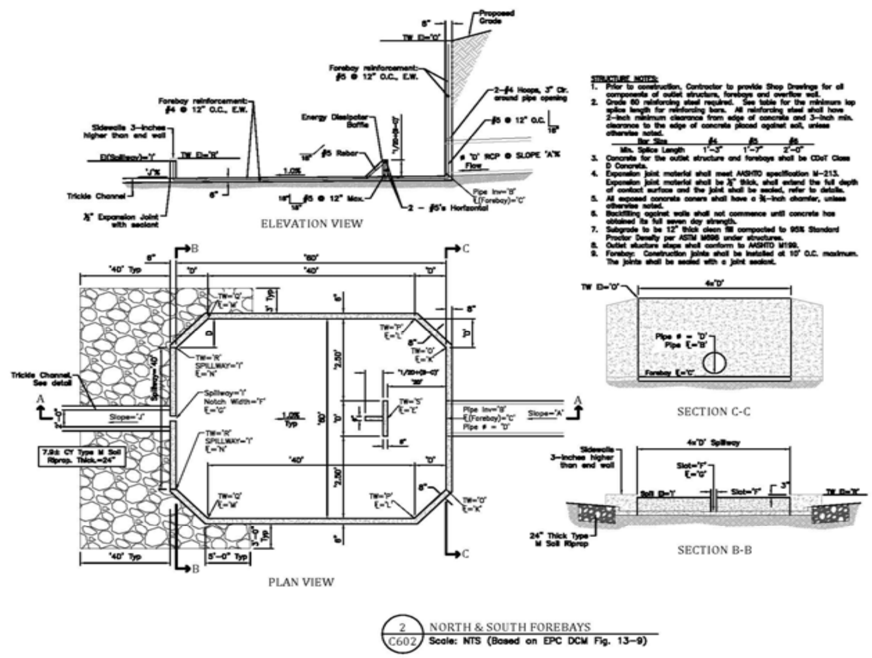
Perimeter $(P) = b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity $= (1.49/n)R_n^{2/3} S^{1/2}$
S = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)

Flow $= (1.49/n)AR_n^{2/3} S^{1/2}$

Variable	Presedimentation Forebay	Trunkline H	Trunkline J
A	Pipe Slope%	0.60	0.50
B	Pipe Inv In	5672.32	5672.11
C	Forebay Inv In	5671.82	5671.61
D	Pipe Size (ft)*	3.50	2.00
E	Baffle Face Inv	5671.75	5671.57
F	Slot Width	5.50	2.50
G	Forebay Inv Out	5671.61	5671.49
H	Spillway Inv	5672.86	5672.74
I	Spillway Top	5673.11	5672.99
J	Trickle Pan Slope	0.38	0.50
K	Toe of Wall	5671.82	5671.61
L	Toe of Wall	5671.81	5671.60
M	Toe of Wall	5671.75	5671.56
N	Toe of Wall	5671.74	5671.55
O	Top of Wall	5676.82	5675.11
P	Top of Wall	5675.58	5673.85
Q	Top of Wall	5673.53	5672.49
R	Top of Wall	5673.53	5672.49
S	Baffle Wall Top*	5675.25	5673.57

*Idealized. Pipes are HERCP.



APPENDIX B.1
Supporting Detention Basin Tables and Figures

beneficial if a project is being phased or when adequate land is not available to combine all of the elements in one facility.

4.1.1 Flood Control Volume

UDFCD has developed empirical equations for estimating the total required storage volume that can be applied to on-site, multi-level ponds or to on-site or sub-regional FSD ponds. The empirical equations include:

$$V_i = K_i A \qquad \text{Equation 13-1}$$

For NRCS soil types B, C and D.

$$K_{100} = (1.78 \cdot I - 0.002\, I^2 - 3.56) / 900 \qquad \text{Equation 13-2}$$

$$K_5 = (0.77 \cdot I - 2.65) / 1{,}000 \qquad \text{Equation 13-3}$$

For NRCS soil Type A:

$$K_{100A} = (-0.00005501 \cdot I^2 + 0.030148 \cdot I - 0.12) / 12 \qquad \text{Equation 13-4}$$

Where:

V_i = required volume, with i= year storm, acre-feet

K_i = empirical volume coefficient, with i= year storm

i = return period for storm event, years

I = fully developed tributary basin imperviousness, %

A = tributary drainage basin area, acres

These equations can be applied to calculate the total detention storage for drainage basins up to about 130 acres. When more than one soil type or land use is present in the drainage basin, the storage volume must be weighted by the proportionate areas of each soil type and/or land use. For FSDs, the EURV need not be added to this volume. See UDFCD Manual Volume 2, Storage Chapter for a full description of this method.

4.1.2 EURV

UDFCD has developed empirical equations for estimating the EURV portion of the storage volume that can be applied to on-site, sub-regional or regional FSD ponds.

The empirical equations are as follows:

For NRCS Soil Group A:

$$EURV_A = 1.1\,(2.0491(I/100) - 0.1113) \qquad \text{Equation 13-5}$$

For NRCS Soil Group B:

$$EURV_B = 1.1\,(1.2846(I/100) - 0.0461) \qquad \text{Equation 13-6}$$

For NRCS Soil Group C/D:

$$EURV_{CD} = 1.1\ (1.1381(I/100) - 0.0339) \qquad \text{Equation 13-7}$$

Where:

$EURV_K$ = Excess Urban Runoff Volume in watershed inches, K=A, B or C/D soil group

I = drainage basin imperviousness, %

These equations apply to all FSDs and the EURV need not be added to the flood control volume or to the WQCV. When more than one soil type or land use is present in the drainage basin, the EURV must be weighted by the proportionate areas of each soil type and/or land use. If hydrologic routing is used to size the flood control volume, the EURV remains the same as calculated by these equations and is included in the pond's stage/storage configuration for modeling.

4.1.3 Initial Surcharge Volume

The initial surcharge volume is at least 0.3 percent of the WQCV and should be 4- to 12-inches deep. The initial surcharge volume is included in the WQCV and does not increase the required total storage volume.

4.1.4 Design Worksheets

The Full Spectrum Worksheet in the UD-Detention Spreadsheet performs all of these calculations for the standard designs. For multi-level ponds, the flood control volumes are calculated for the two design storm frequencies: the major storm and the minor storm.

4.2 Allowable Release Rates

Allowable release rates from detention facilities vary with the type of facility and with the storage volume type, as follows:

- **Flood Storage Volume**: The flood storage release rates are determined by the allowable release rates that are intended to approximate storm event runoff rates from the undeveloped upstream drainage basin.

- **EURV**: The EURV release rate is determined based on a72-hour drain time. The purpose of this slow release rate is to mitigate the impacts of increased runoff volumes due to development by reducing the potential for downstream erosion.

- **WQCV**: The WQCV release rate is determined based on a 40-hour drain time for extended detention basins. The purpose of this slow release rate is to provide time for pollutants to settle, The WQCV is incorporated into the EURV and works with it to release less erosive flows. The method for determining this design rate is described in Chapter 3 of Volume 2 of this Manual.

4.2.1 Flood Storage Release Rates

Allowable releases rates from the flood storage element of detention may be based on generalized average unit runoff rates or estimates of pre-development runoff rates. Allowable unit release rates (cfs/ac) may be used for any type of detention, however, when a hydrograph routing method is applied (for regional or

Safety Grates

Safety grates are intended to keep people and animals from inadvertently entering a storm drain. They are sometimes required even when debris entering a storm drain is not a concern. The grate on top of the outlet drop box is considered a safety grate and should be designed accordingly. The danger associated with outlet structures is the potential associated with pinning a person or animal to unexposed outlet pipe or grate. See the *Culverts and Bridges* chapter of Volume 2 of this manual for design criteria related to safety grates.

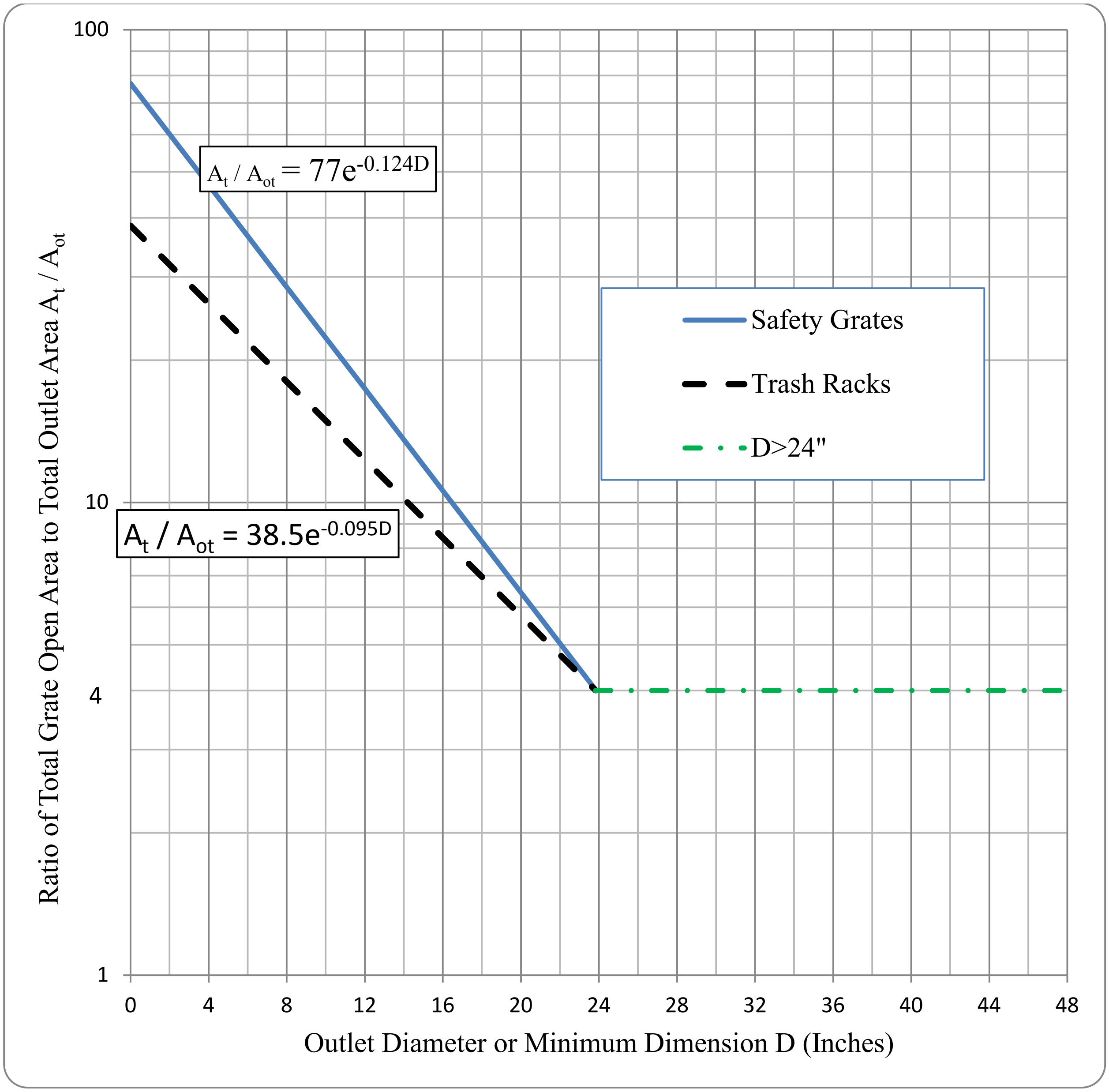
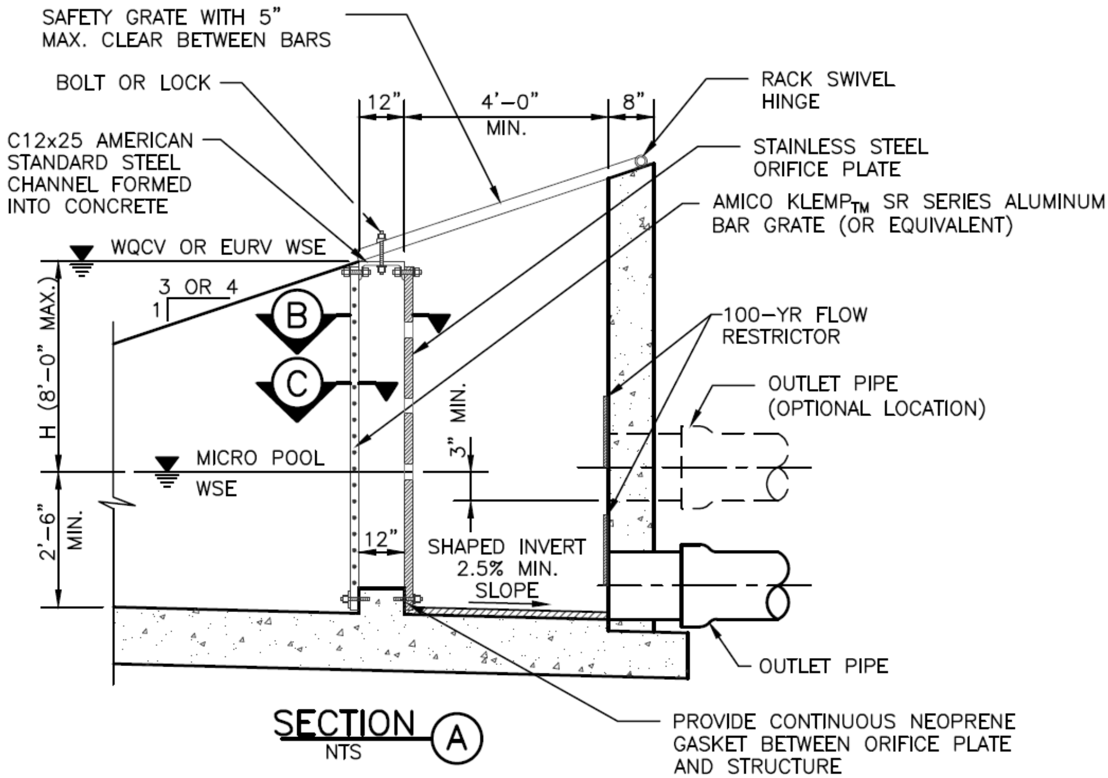
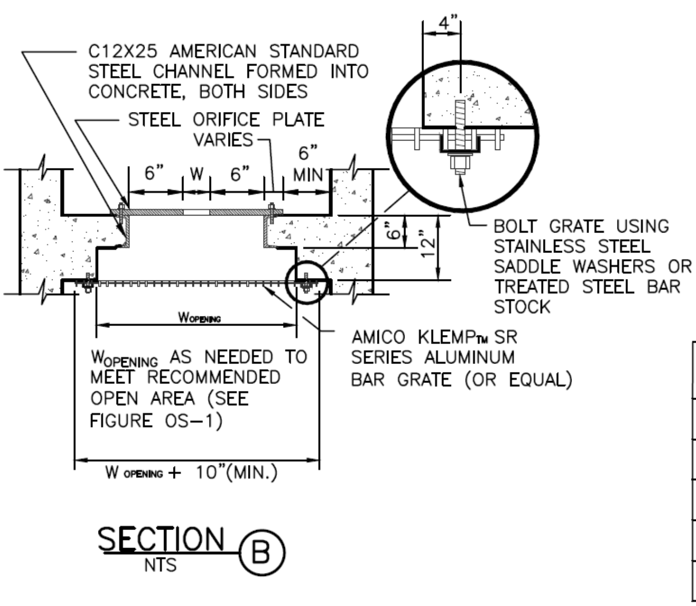


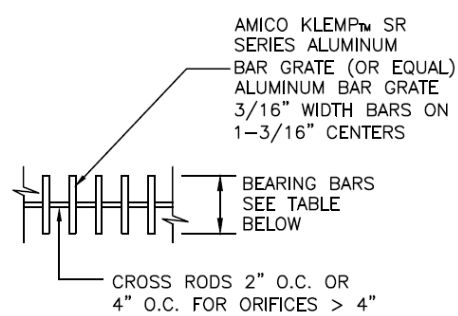
Figure OS-1. Trash Rack Sizing

Table OS-2. Thickness of steel water quality plate

Steel plate thickness (in inches) based on design depth and span of plate											
		Head (feet)									
		3	4	5	6	7	8	9	10	11	12
Span (feet)	1	0.1875	0.1875	0.1875	0.1875	0.1875	0.1875	0.1875	0.1875	0.1875	0.1875
	2	0.1875	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
	3	0.2500	0.2500	0.3750	0.3750	0.3750	0.3750	0.3750	0.3750	0.3750	0.5000
	4	0.2500	0.3750	0.3750	0.3750	0.3750	0.5000	0.5000	0.5000	0.5000	0.5000







WATER DEPTH ABOVE LOWEST OPENING, H	MINIMUM BEARING BAR SIZE, BARS ALIGNED VERTICALLY
2.0 FT.	1" x 3/16"
3.0 FT.	1-1/4" x 3/16"
4.0 FT.	1-3/4" x 3/16"
5.0 FT.	2" x 3/16"
6.0 FT.	2-1/4" x 3/16"

R VALUE=(NET OPEN AREA)/GROSS RACK AREA)
=0.71 FOR CROSS RODS ON 2" CENTERS
=0.77 FOR CROSS RODS ON 4" CENTERS

SECTION C
NTS

Figure OS-6. Typical outlet structure with bar grate trash rack

Figure 13-9. Concept for Integral Forebay at Pipe Outfall

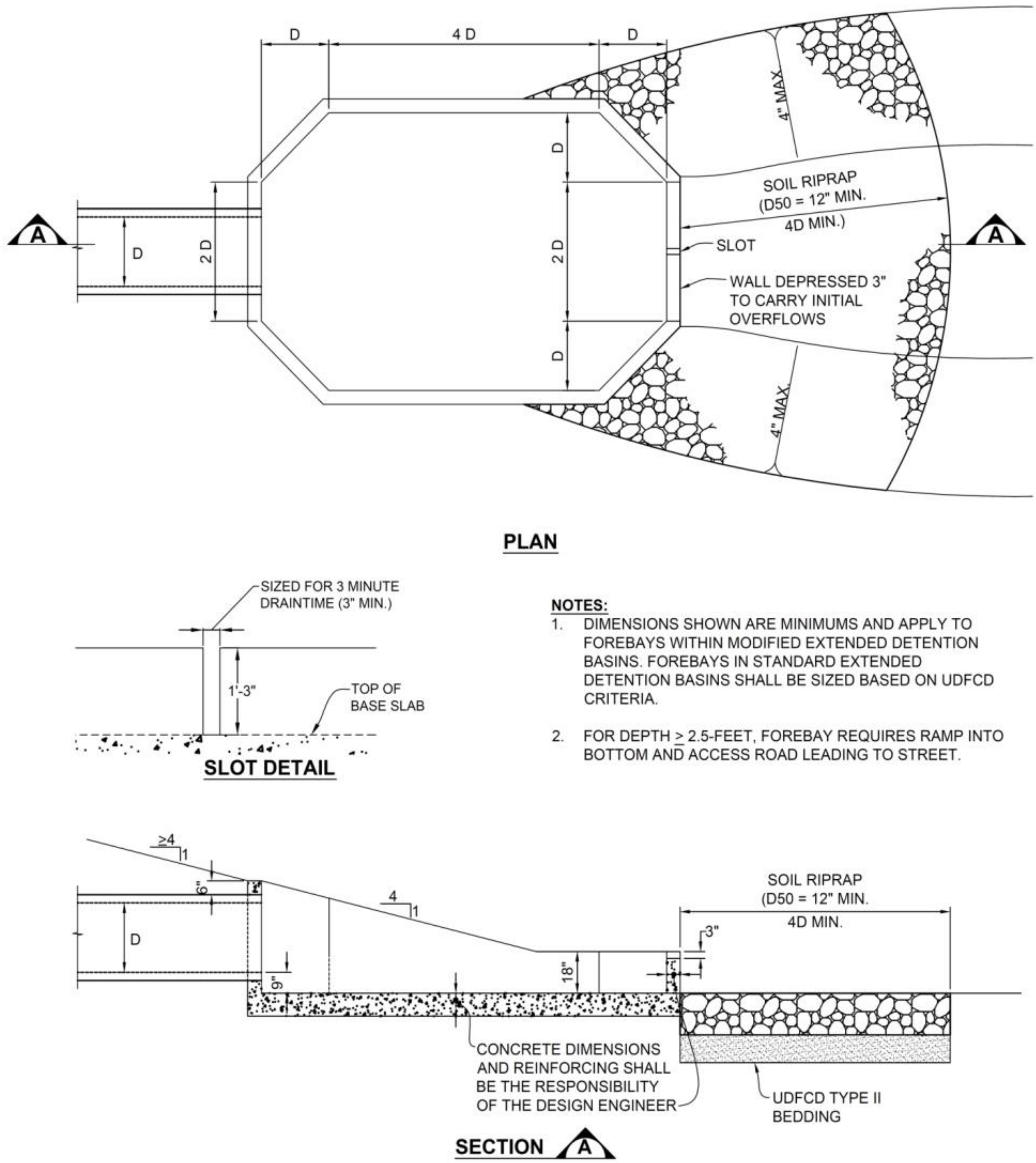


Figure 13-11. Concept for Outlet Structure with Flared Wingwalls and Handrail
(Integral Micropool Shown)

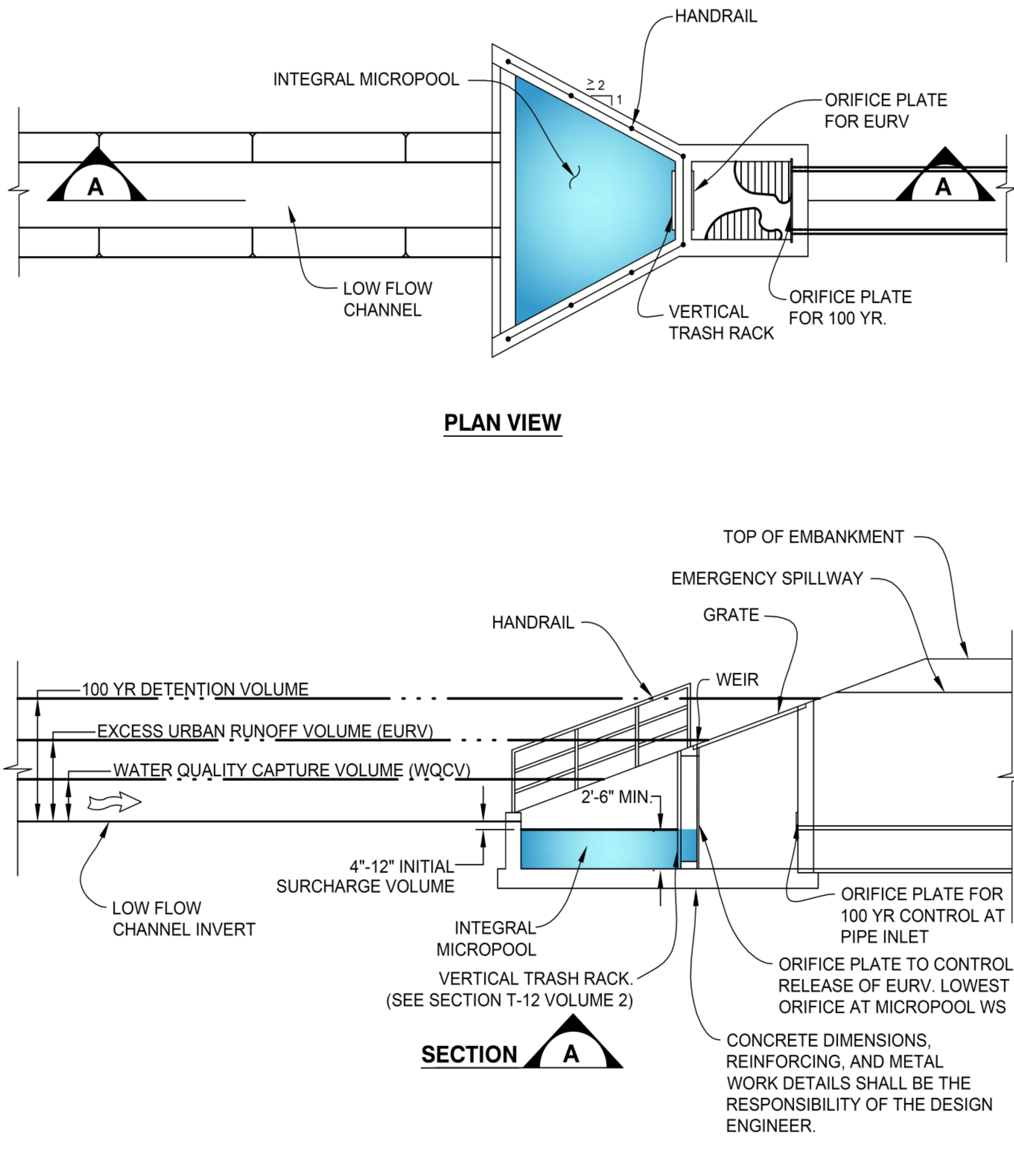


Figure 13-12c. Emergency Spillway Protection

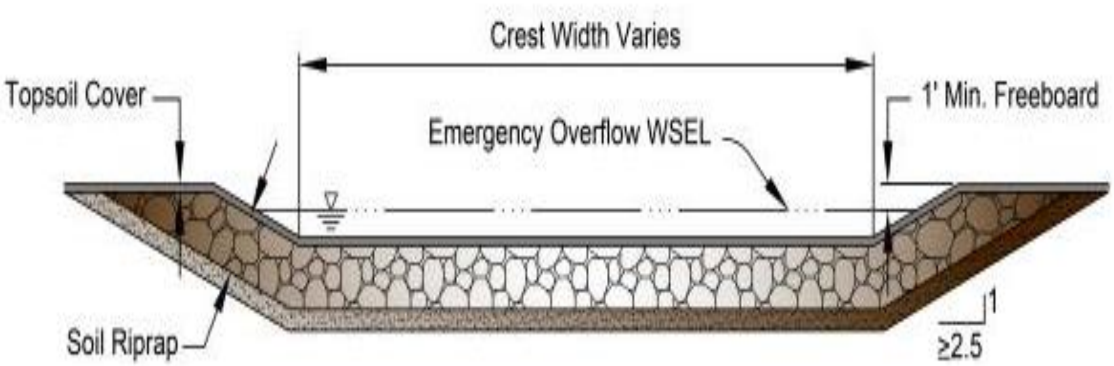
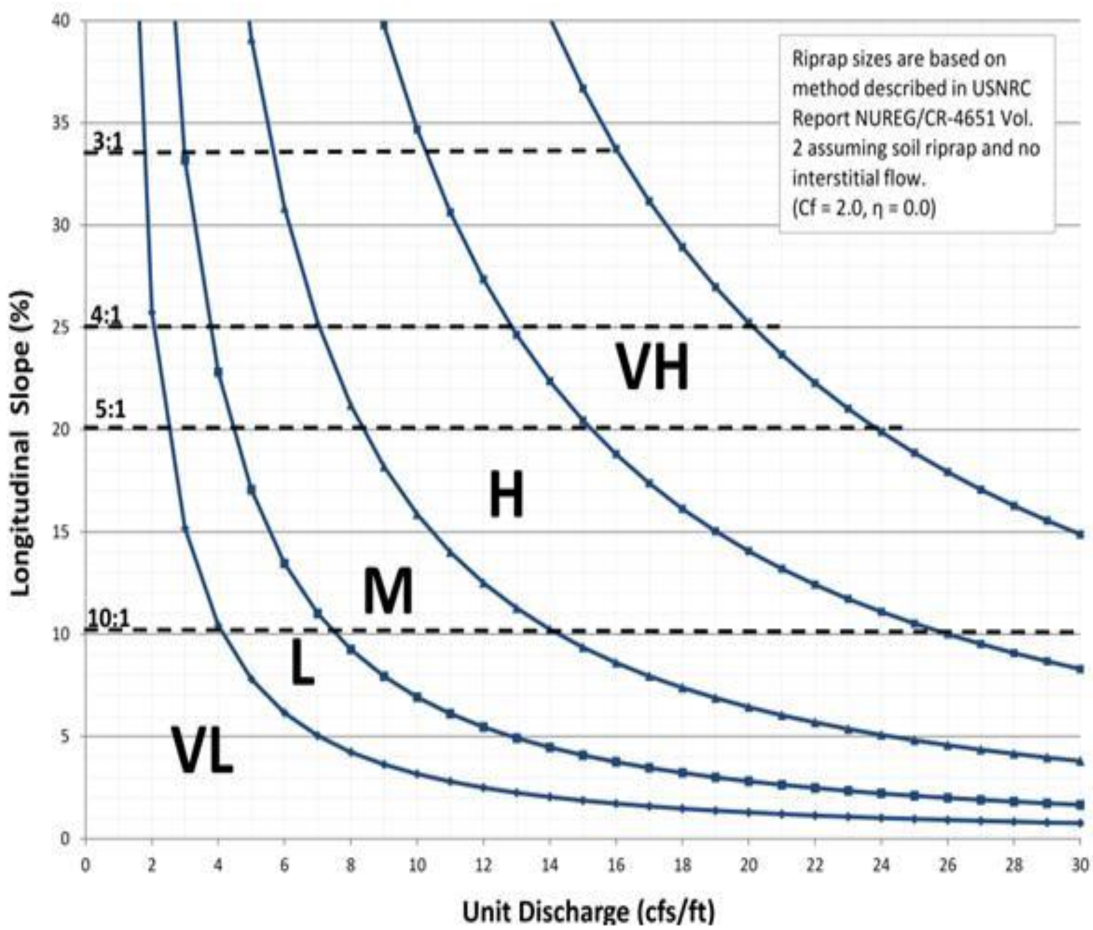


Figure 13-12d. Riprap Types for Emergency Spillway Protection



APPENDIX C

Hydraulic Calculations

EPA-SWMM HGL/EGL Open Channel and Pipe System Report
UD_Sewer HGL Analysis and Report
MHFD Inlet Summaries & Calculations

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 30 2020

Culvert Crossing at Poa Annua

Invert Elev Dn (ft)	=	5677.36
Pipe Length (ft)	=	90.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	5677.81
Rise (in)	=	24.0
Shape	=	Box
Span (in)	=	36.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

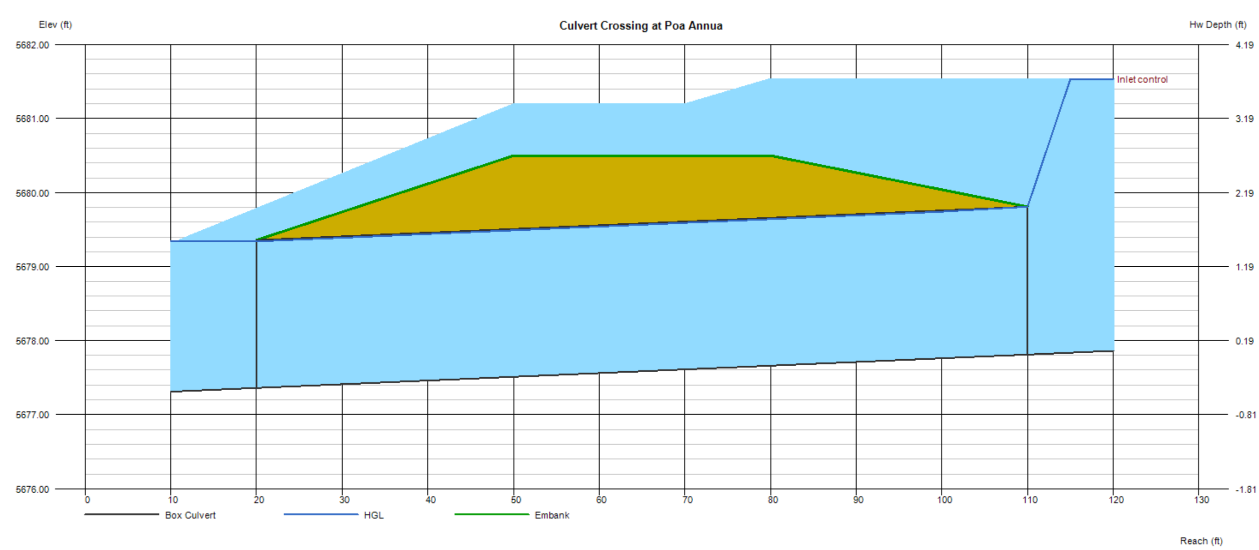
Top Elevation (ft)	=	5680.50
Top Width (ft)	=	30.00
Crest Width (ft)	=	2.00

Calculations

Qmin (cfs)	=	48.00
Qmax (cfs)	=	102.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

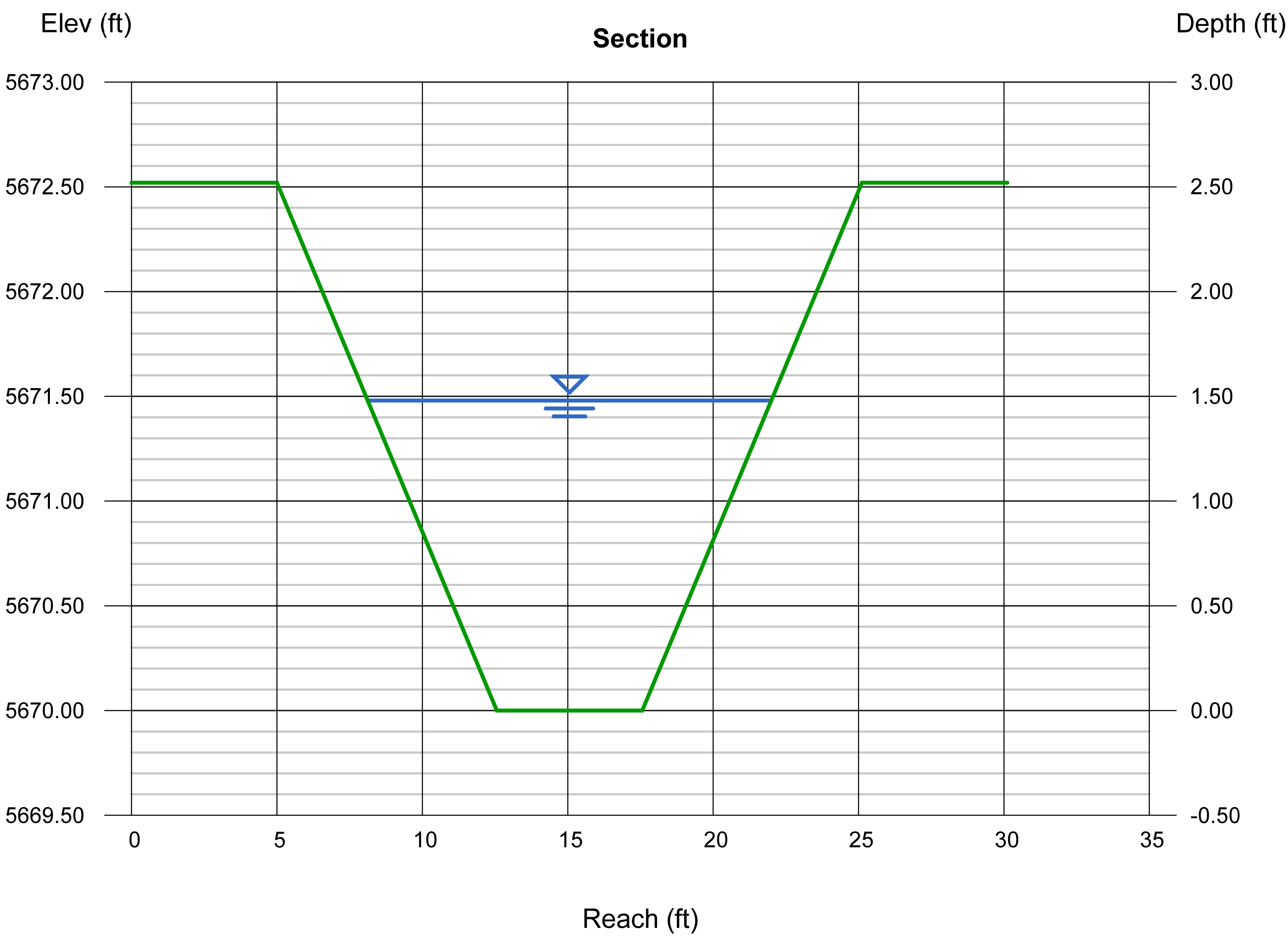
Qtotal (cfs)	=	100.00
Qpipe (cfs)	=	93.58
Qovertop (cfs)	=	6.42
Veloc Dn (ft/s)	=	7.87
Veloc Up (ft/s)	=	7.87
HGL Dn (ft)	=	5679.34
HGL Up (ft)	=	5679.79
Hw Elev (ft)	=	5681.54
Hw/D (ft)	=	1.86
Flow Regime	=	Inlet Control



Channel Report

Detention Basin D Outfall Channel

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 5.00	Depth (ft)	= 1.48
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 59.60
Total Depth (ft)	= 2.52	Area (sqft)	= 13.97
Invert Elev (ft)	= 5670.00	Velocity (ft/s)	= 4.27
Slope (%)	= 0.50	Wetted Perim (ft)	= 14.36
N-Value	= 0.024	Crit Depth, Yc (ft)	= 1.27
		Top Width (ft)	= 13.88
Calculations		EGL (ft)	= 1.76
Compute by:	Known Q		
Known Q (cfs)	= 59.60		



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INLET MANAGEMENT

Worksheet Protected

INLET NAME	B-1	C-1	D-1	D-4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	5.5	2.4	4.4	3.8
Major Q_{Known} (cfs)	15.9	6.9	12.7	11.1

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	A-1	B-1	C-1	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	1.3	5.7	2.9	0.0

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type	C	C	C	C

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**5.5**	**2.4**	**4.4**	**3.8**
Major Total Design Peak Flow, Q (cfs)	**17.2**	**12.6**	**15.6**	**11.1**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	5.7	2.9	4.4	0.5

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	G-1	G-2	G-3	G-4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.3	6.2	3.8	5.7
Major Q_{Known} (cfs)	0.7	14.5	10.9	16.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	D-1	D-4	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	4.4	0.5	0.0

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type	C	C	C	C

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.3**	**6.2**	**3.8**	**5.7**
Major Total Design Peak Flow, Q (cfs)	**0.7**	**18.9**	**11.4**	**16.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.1	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	7.0	2.2	N/A

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	E-1	E-2	E-6	H-2
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	In Sump
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.4	2.6	3.9	15.1
Major Q_{Known} (cfs)	9.9	7.5	11.3	43.8

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	User-Defined	E-6
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	1.8	3.1

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type	C	C	C	C

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.4**	**2.6**	**3.9**	**15.1**
Major Total Design Peak Flow, Q (cfs)	**9.9**	**7.5**	**13.1**	**46.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	1.4	0.4	3.1	N/A

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	J-1	J-2	F-1	A-1
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump	On Grade
Inlet Type	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.0	0.8	2.3	3.0
Major Q_{Known} (cfs)	2.6	1.5	6.6	8.6

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	User-Defined	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)			0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	8.2	9.5	0.0	0.9

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type	C	C	C	C

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
C_1				
C_2				
C_3				
User-defined C				
User-defined 5-yr C_5				
User-defined T_c				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.0**	**0.8**	**2.3**	**3.0**
Major Total Design Peak Flow, Q (cfs)	**10.8**	**11.0**	**6.6**	**9.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A	1.3

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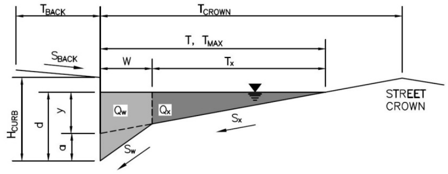
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: The Glen at Widefield Filing No 11

Inlet ID: B-1



Gutter Geometry (Enter data in the blue cells)

Parameter	Symbol	Value	Units
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	**0.0057**	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	**17.0**	**17.0**	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	**6.0**	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**8.2**	**23.7**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

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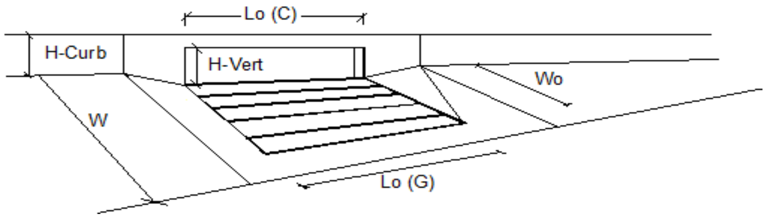


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.5**	**11.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**5.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**67**	**%**

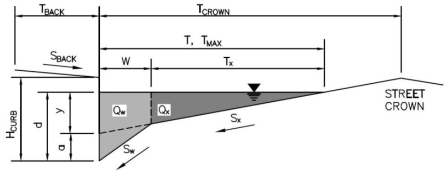
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: C-1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.006	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

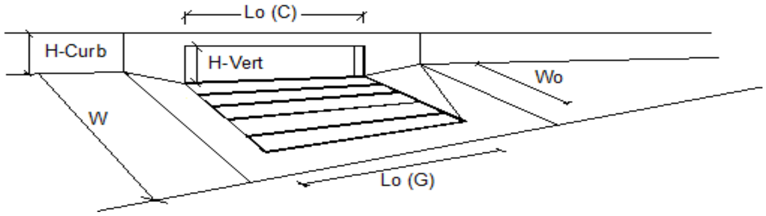
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.2**	**23.7**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.4**	**9.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**77**	**%**

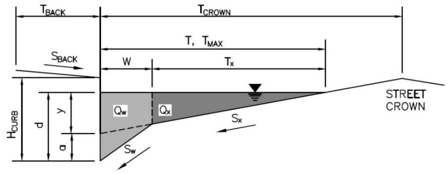
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: D-1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

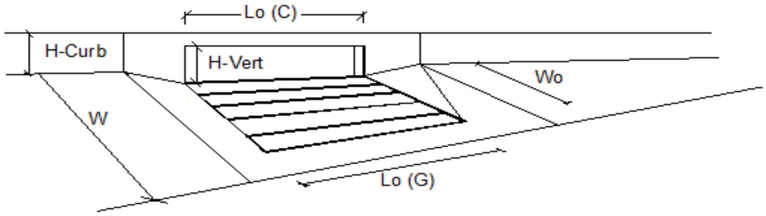
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**11.0**	**18.2**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**4.1**	**8.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.3**	**7.6**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**92**	**51**	**%**

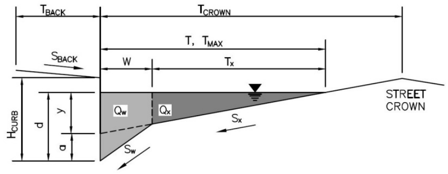
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: D-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.006	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

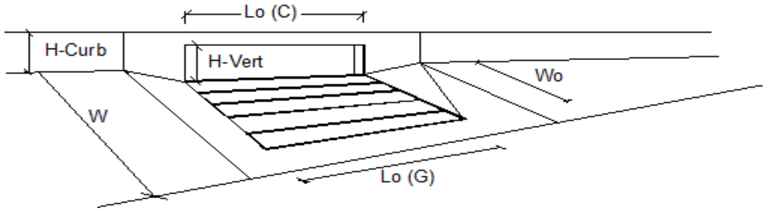
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.2**	**23.8**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	4	4	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.8**	**10.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**95**	**%**

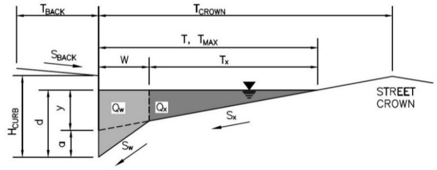
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: G-1



Gutter Geometry (Enter data in the blue cells)

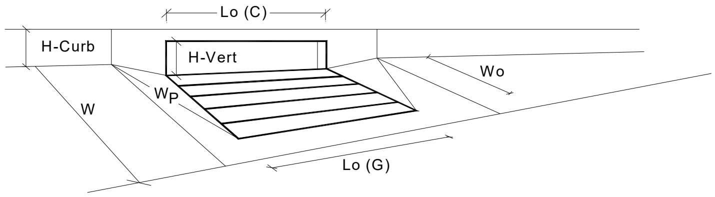
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.3	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.36	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.60	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.81	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	9.7	11.2	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.3	0.7	cfs

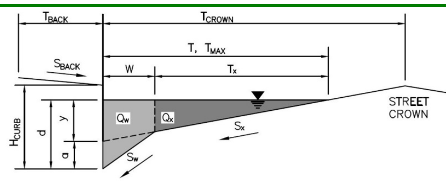
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: G-2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

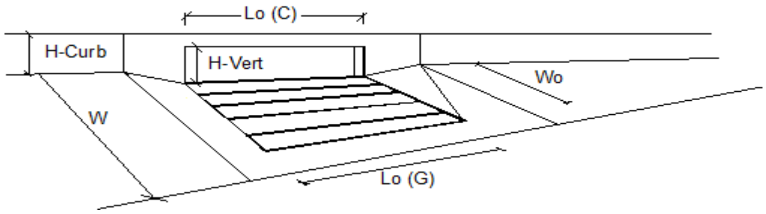
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**7.7**	**22.3**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



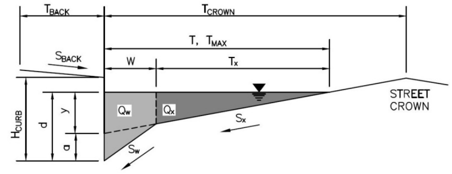
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.3**	**12.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**9.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**97**	**58**	**%**

(Dropdown selection: Colorado Springs D-10-R)

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

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

Project: The Glen at Widefield Filing No 11
Inlet ID: G-3



Gutter Geometry (Enter data in the blue cells)

Description	Parameter	Value	Units
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	**20.0**	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.007	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

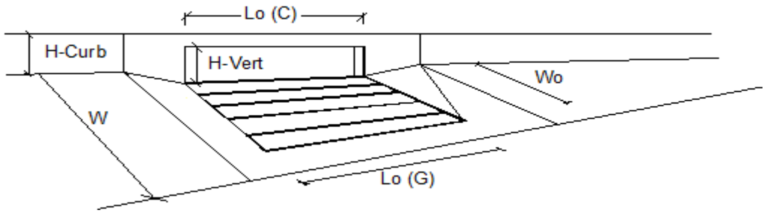
Description	Parameter	Minor Storm	Major Storm	Units
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.8**	**25.6**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**3.8**	**9.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.2**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**81**	**%**

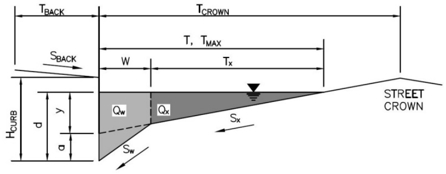
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: G-4



Gutter Geometry (Enter data in the blue cells)

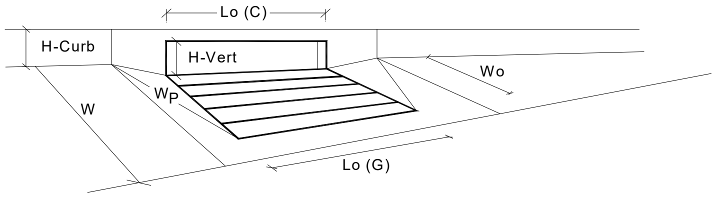
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	4	4	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	6.3	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	4.00	4.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.35	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.59	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.80	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**13.1**	**17.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.7	16.4	cfs

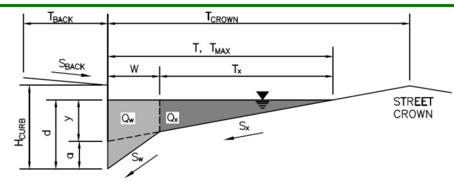
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: E-1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

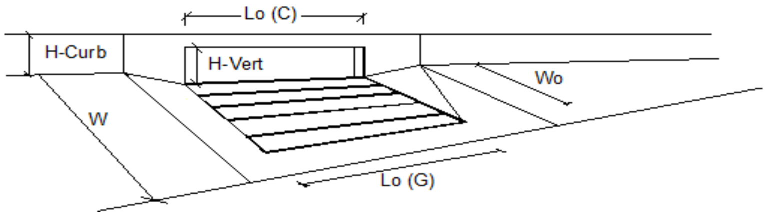
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**10.2**	**29.7**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.4**	**8.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**86**	**%**

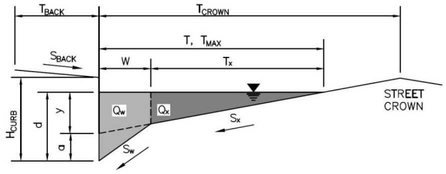
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: E-2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

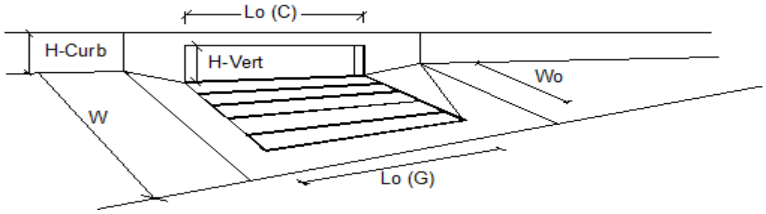
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**10.2**	**29.7**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.6**	**7.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**94**	**%**

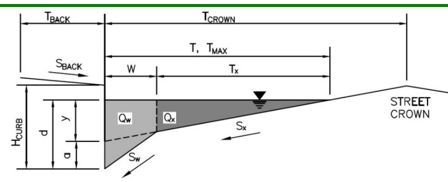
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: E-6



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

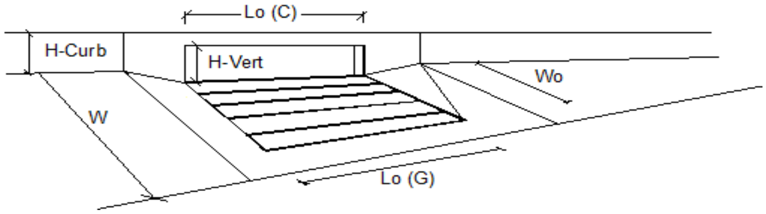
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**11.6**	**33.7**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Colorado Springs D-10-R)	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.9**	**10.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**76**	**%**

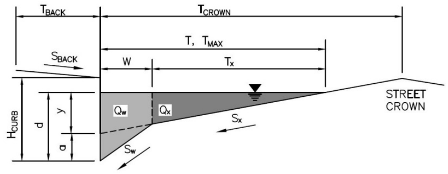
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: H-2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

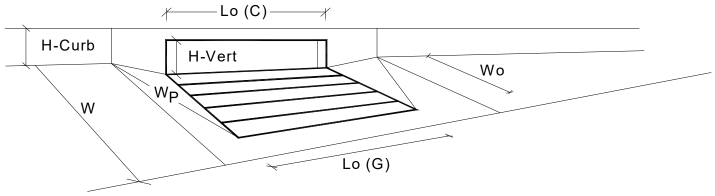
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	26.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	24.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.224	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	0.0	0.0	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	4	4	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.8	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	4.00	4.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**16.0**	**31.2**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	15.1	46.9	cfs

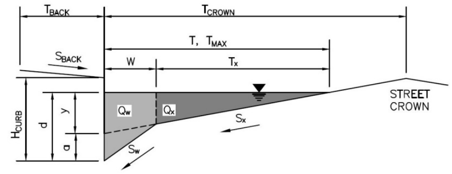
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: J-1



Gutter Geometry (Enter data in the blue cells)

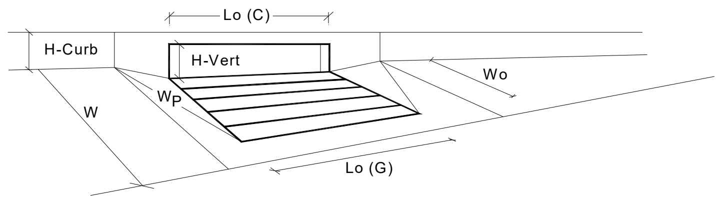
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	4.00	4.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.84	0.84	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.8**	**10.8**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	1.0	10.8	cfs

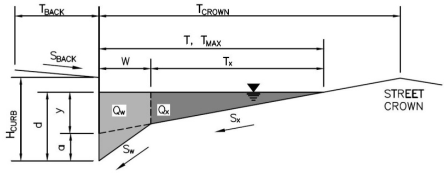
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: J-2



Gutter Geometry (Enter data in the blue cells)

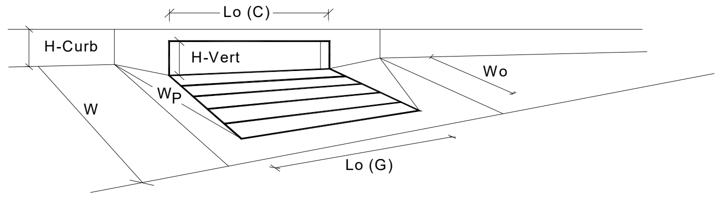
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	4.00	4.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.84	0.84	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

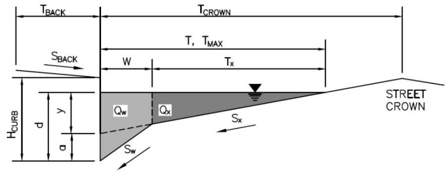
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**10.8**	**10.8**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	0.8	11.0	cfs

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: F-1



Gutter Geometry (Enter data in the blue cells)

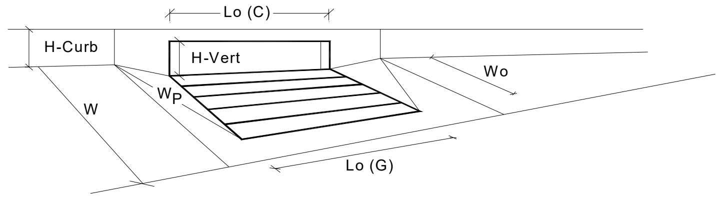
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	4.00	4.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.56	0.56	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.99	0.99	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.3**	**8.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.3	6.6	cfs

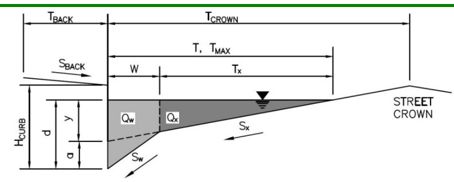
Version 4.05 Released March 2017

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

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

Project: The Glen at Widefield Filing No 11

Inlet ID: A-1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.006	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

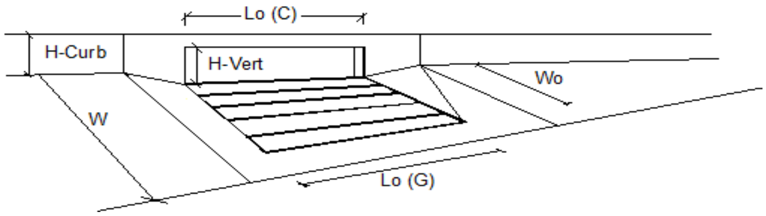
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**8.2**	**23.1**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — Colorado Springs D-10-R	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.0**	**8.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

Program:
UDSEWER Math Model Interface 2.1.1.4
Run Date:
3/16/2021 9:01:47 AM

UDSewer Results Summary

Project Title: The Glen Filing No 11
Project Description: Major Storm Event (100 Year)

Table of Contents

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

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

Sizer Constraints

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

Backwater Calculations:

Tailwater Elevation (ft): 5673.90

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
'H-3' (Forebay)	5677.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'H2-H3'	5678.00	125.40	125.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'H1-H2'	5677.87	93.10	93.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'G2-H1'	5678.15	29.90	29.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'G1-G2'	5678.05	16.30	16.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'G4-H1'	5678.18	23.50	23.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'G3-G4'	5678.01	16.40	16.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D12-H1	5678.59	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D11-D12	5679.14	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D10-D11	5680.36	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D9-D10	5681.07	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D8-D9	5681.86	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D7-D8	5682.66	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'D6-D7'	5683.51	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'D5-D6'	5685.92	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'D4-D5'	5688.05	39.70	39.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'D2-D4'	5689.10	29.80	29.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'D1-D2'	5689.37	8.10	8.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3-D2	5690.13	21.70	21.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'C2-C3'	5690.68	21.70	21.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'C2-C1'	5690.98	5.80	5.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'B4-C2'	5691.16	15.90	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'B3-B4'	5691.63	15.90	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'B2-B3'	5692.59	15.90	15.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'A4-B2'	5693.47	6.90	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'A3-A4'	5694.20	6.90	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'A2-A3'	5694.93	6.90	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'A1-A2'	5695.28	6.90	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'B1-B2'	5692.87	9.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F7-H2'	5678.30	32.30	32.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F6-F7'	5678.82	32.30	32.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F5-F6'	5680.22	32.30	32.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F4-F5'	5682.10	32.30	32.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F3-F4'	5682.55	32.30	32.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E7-F3'	5683.01	25.70	25.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E6-E7'	5684.32	25.70	25.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E5-E6'	5685.80	14.60	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E4-E5'	5687.95	14.60	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E3-E4'	5690.10	14.60	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E2-E3'	5690.58	14.60	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'E1-E2'	5690.53	8.50	8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F2-F3'	5684.32	6.60	6.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
'F1-F2'	5693.28	6.60	6.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
'H-3' (Forebay)	0.00	0.00	0.00	0.00	0.00	10.72	11.70	0.07	125.40	
'H2-H3'	0.00	0.00	0.00	0.00	125.40	0.00	0.00	0.00	125.40	
'H1-H2'	0.00	0.00	0.00	0.00	93.10	0.00	0.00	0.00	93.10	
'G2-H1'	0.00	0.00	0.00	0.00	29.90	0.00	0.00	0.00	29.90	Surface Water Present (Downstream)
'G1-G2'	0.00	0.00	0.00	0.00	16.30	0.00	0.00	0.00	16.30	Surface Water Present (Downstream)
'G4-H1'	0.00	0.00	0.00	0.00	23.50	0.00	0.00	0.00	23.50	Surface Water Present (Downstream)
'G3-G4'	0.00	0.00	0.00	0.00	16.40	0.00	0.00	0.00	16.40	Surface Water Present (Downstream)
D12-H1	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
D11-D12	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
D10-D11	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
D9-D10	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
D8-D9	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
D7-D8	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
'D6-D7'	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
'D5-D6'	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
'D4-D5'	0.00	0.00	0.00	0.00	39.70	0.00	0.00	0.00	39.70	
'D2-D4'	0.00	0.00	0.00	0.00	29.80	0.00	0.00	0.00	29.80	
'D1-D2'	0.00	0.00	0.00	0.00	8.10	0.00	0.00	0.00	8.10	
C3-D2	0.00	0.00	0.00	0.00	21.70	0.00	0.00	0.00	21.70	
'C2-C3'	0.00	0.00	0.00	0.00	21.70	0.00	0.00	0.00	21.70	
'C2-C1'	0.00	0.00	0.00	0.00	5.80	0.00	0.00	0.00	5.80	
'B4-C2'	0.00	0.00	0.00	0.00	15.90	0.00	0.00	0.00	15.90	
'B3-B4'	0.00	0.00	0.00	0.00	15.90	0.00	0.00	0.00	15.90	
'B2-B3'	0.00	0.00	0.00	0.00	15.90	0.00	0.00	0.00	15.90	
'A4-B2'	0.00	0.00	0.00	0.00	6.90	0.00	0.00	0.00	6.90	
'A3-A4'	0.00	0.00	0.00	0.00	6.90	0.00	0.00	0.00	6.90	
'A2-A3'	0.00	0.00	0.00	0.00	6.90	0.00	0.00	0.00	6.90	
'A1-A2'	0.00	0.00	0.00	0.00	6.90	0.00	0.00	0.00	6.90	
'B1-B2'	0.00	0.00	0.00	0.00	9.00	0.00	0.00	0.00	9.00	
'F7-H2'	0.00	0.00	0.00	0.00	32.30	0.00	0.00	0.00	32.30	
'F6-F7'	0.00	0.00	0.00	0.00	32.30	0.00	0.00	0.00	32.30	
'F5-F6'	0.00	0.00	0.00	0.00	32.30	0.00	0.00	0.00	32.30	
'F4-F5'	0.00	0.00	0.00	0.00	32.30	0.00	0.00	0.00	32.30	
'F3-F4'	0.00	0.00	0.00	0.00	32.30	0.00	0.00	0.00	32.30	
'E7-F3'	0.00	0.00	0.00	0.00	25.70	0.00	0.00	0.00	25.70	
'E6-E7'	0.00	0.00	0.00	0.00	25.70	0.00	0.00	0.00	25.70	
'E5-E6'	0.00	0.00	0.00	0.00	14.60	0.00	0.00	0.00	14.60	
'E4-E5'	0.00	0.00	0.00	0.00	14.60	0.00	0.00	0.00	14.60	
'E3-E4'	0.00	0.00	0.00	0.00	14.60	0.00	0.00	0.00	14.60	
'E2-E3'	0.00	0.00	0.00	0.00	14.60	0.00	0.00	0.00	14.60	
'E1-E2'	0.00	0.00	0.00	0.00	8.50	0.00	0.00	0.00	8.50	
'F2-F3'	0.00	0.00	0.00	0.00	6.60	0.00	0.00	0.00	6.60	
'F1-F2'	0.00	0.00	0.00	0.00	6.60	0.00	0.00	0.00	6.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
'H2-H3'	45.54	5672.32	0.6	5672.59	0.013	0.03	0.00	ELLIPSE	38.00 in	60.00 in
'H1-H2'	55.96	5672.59	0.5	5672.87	0.013	0.05	0.00	ELLIPSE	38.00 in	60.00 in
'G2-H1'	29.60	5673.60	0.7	5673.81	0.013	1.32	0.25	CIRCULAR	24.00 in	24.00 in
'G1-G2'	36.18	5674.07	0.6	5674.29	0.013	0.29	0.00	CIRCULAR	18.00 in	18.00 in
'G4-H1'	10.28	5673.60	0.8	5673.68	0.013	1.32	0.25	CIRCULAR	24.00 in	24.00 in
'G3-G4'	37.88	5673.80	0.8	5674.10	0.013	0.29	0.00	CIRCULAR	24.00 in	24.00 in
D12-H1	94.06	5673.04	0.5	5673.51	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
D11-D12	155.35	5673.56	0.5	5674.34	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
D10-D11	78.14	5674.34	0.5	5674.73	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
D9-D10	80.51	5674.74	0.6	5675.22	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
D8-D9	83.20	5675.26	1.2	5676.26	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
D7-D8	78.70	5676.30	1.2	5677.24	0.013	0.08	0.00	CIRCULAR	36.00 in	36.00 in
'D6-D7'	85.26	5677.46	1.0	5678.31	0.013	0.05	0.00	CIRCULAR	33.00 in	33.00 in
'D5-D6'	216.49	5678.31	1.0	5680.47	0.013	0.05	0.00	CIRCULAR	33.00 in	33.00 in
'D4-D5'	161.24	5680.40	0.8	5681.69	0.013	0.05	0.00	CIRCULAR	33.00 in	33.00 in
'D2-D4'	212.13	5681.69	0.6	5682.96	0.013	0.05	0.00	CIRCULAR	33.00 in	33.00 in
'D1-D2'	27.71	5683.72	0.7	5683.91	0.013	1.32	0.25	CIRCULAR	21.00 in	21.00 in
C3-D2	177.80	5683.20	0.6	5684.27	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
'C2-C3'	92.14	5684.27	0.6	5684.82	0.013	0.08	0.00	CIRCULAR	30.00 in	30.00 in
'C2-C1'	29.13	5685.58	2.0	5686.16	0.013	1.32	0.25	CIRCULAR	21.00 in	21.00 in
'B4-C2'	77.97	5685.36	0.7	5685.91	0.013	0.08	0.00	CIRCULAR	27.00 in	27.00 in
'B3-B4'	80.62	5685.88	0.8	5686.52	0.013	0.08	0.00	CIRCULAR	27.00 in	27.00 in
'B2-B3'	168.24	5686.60	0.7	5687.78	0.013	0.05	0.00	CIRCULAR	27.00 in	27.00 in
'A4-B2'	153.59	5688.03	0.6	5688.95	0.013	0.05	0.00	CIRCULAR	21.00 in	21.00 in
'A3-A4'	125.80	5688.95	0.6	5689.70	0.013	0.05	0.00	CIRCULAR	21.00 in	21.00 in
'A2-A3'	124.91	5689.95	0.6	5690.70	0.013	0.05	0.00	CIRCULAR	21.00 in	21.00 in
'A1-A2'	33.67	5690.70	1.0	5691.04	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in
'B1-B2'	29.70	5688.14	1.6	5688.62	0.013	1.32	0.25	CIRCULAR	18.00 in	18.00 in
'F7-H2'	107.50	5672.60	0.5	5673.14	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
'F6-F7'	75.03	5673.24	0.5	5673.62	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
'F5-F6'	189.19	5673.61	0.5	5674.56	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
'F4-F5'	250.09	5674.89	0.7	5676.64	0.013	0.05	0.00	CIRCULAR	33.00 in	33.00 in
'F3-F4'	63.47	5676.65	0.8	5677.16	0.013	0.05	0.00	CIRCULAR	33.00 in	33.00 in
'E7-F3'	64.32	5677.42	0.8	5677.93	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
'E6-E7'	117.29	5677.96	0.8	5678.90	0.013	0.08	0.00	CIRCULAR	30.00 in	30.00 in
'E5-E6'	156.79	5679.45	1.0	5681.02	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
'E4-E5'	189.25	5681.02	1.0	5682.91	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
'E3-E4'	189.40	5682.92	1.0	5684.81	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
'E2-E3'	29.61	5684.80	2.3	5685.48	0.013	1.06	0.00	CIRCULAR	24.00 in	24.00 in
'E1-E2'	37.39	5685.50	1.8	5686.17	0.013	1.06	0.00	CIRCULAR	21.00 in	21.00 in
'F2-F3'	292.03	5677.47	0.7	5679.51	0.013	1.32	0.25	CIRCULAR	18.00 in	18.00 in
'F1-F2'	197.94	5679.61	4.0	5687.53	0.013	0.25	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
'H2-H3'	111.59	10.24	38.00	11.51	38.00	11.51	0.00	Pressurized	125.40	45.54	
'H1-H2'	101.86	9.35	34.92	9.33	35.19	9.25	0.98	Pressurized	93.10	55.96	
'G2-H1'	18.98	6.04	24.00	9.52	24.00	9.52	0.00	Pressurized	29.90	29.60	
'G1-G2'	8.16	4.62	18.00	9.22	18.00	9.22	0.00	Pressurized	16.30	36.18	
'G4-H1'	20.29	6.46	24.00	7.48	24.00	7.48	0.00	Pressurized	23.50	10.28	
'G3-G4'	20.29	6.46	17.52	6.67	16.36	7.19	1.14	Pressurized	16.40	37.88	
D12-H1	47.29	6.69	24.61	7.71	25.25	7.49	0.95	Pressurized	39.70	94.06	
D11-D12	47.29	6.69	24.61	7.71	25.25	7.49	0.95	Pressurized	39.70	155.35	
D10-D11	47.29	6.69	24.61	7.71	25.25	7.49	0.95	Pressurized	39.70	78.14	
D9-D10	51.80	7.33	24.61	7.71	23.62	8.08	1.08	Pressurized	39.70	80.51	
D8-D9	73.26	10.36	24.61	7.71	18.88	10.57	1.66	Pressurized	39.70	83.20	
D7-D8	73.26	10.36	24.61	7.71	18.88	10.57	1.66	Supercritical Jump	39.70	40.28	
'D6-D7'	53.03	8.93	25.15	8.17	21.30	9.79	1.39	Supercritical	39.70	0.00	
'D5-D6'	53.03	8.93	25.15	8.17	21.30	9.79	1.39	Supercritical	39.70	0.00	
'D4-D5'	47.43	7.99	25.15	8.17	23.10	8.94	1.19	Supercritical	39.70	0.00	
'D2-D4'	41.08	6.92	21.77	7.17	20.84	7.54	1.09	Supercritical Jump	29.80	5.16	
'D1-D2'	13.29	5.53	12.67	5.34	11.84	5.80	1.14	Pressurized	8.10	27.71	
C3-D2	31.86	6.49	19.00	6.62	18.16	6.98	1.09	Supercritical	21.70	0.00	
'C2-C3'	31.86	6.49	19.00	6.62	18.16	6.98	1.09	Supercritical	21.70	0.00	
'C2-C1'	22.47	9.34	10.64	4.74	7.28	7.83	2.07	Supercritical Jump	5.80	3.55	
'B4-C2'	25.98	6.53	16.69	6.16	15.26	6.86	1.19	Supercritical	15.90	0.00	
'B3-B4'	27.78	6.99	16.69	6.16	14.64	7.22	1.28	Supercritical	15.90	0.00	
'B2-B3'	25.98	6.53	16.69	6.16	15.26	6.86	1.19	Supercritical	15.90	0.00	
'A4-B2'	12.31	5.12	11.65	5.04	11.24	5.26	1.07	Supercritical	6.90	0.00	
'A3-A4'	12.31	5.12	11.65	5.04	11.24	5.26	1.07	Supercritical	6.90	0.00	
'A2-A3'	12.31	5.12	11.65	5.04	11.24	5.26	1.07	Supercritical	6.90	0.00	
'A1-A2'	10.53	5.96	12.20	5.41	10.62	6.36	1.31	Supercritical	6.90	0.00	
'B1-B2'	13.32	7.54	13.93	6.13	10.84	8.09	1.64	Pressurized	9.00	29.70	
'F7-H2'	47.29	6.69	22.13	7.09	21.84	7.20	1.03	Pressurized	32.30	107.50	
'F6-F7'	47.29	6.69	22.13	7.09	21.84	7.20	1.03	Pressurized	32.30	75.03	
'F5-F6'	47.29	6.69	22.13	7.09	21.84	7.20	1.03	Pressurized	32.30	189.19	
'F4-F5'	44.37	7.47	22.69	7.42	20.89	8.15	1.17	Pressurized	32.30	250.09	
'F3-F4'	47.43	7.99	22.69	7.42	19.98	8.59	1.28	Supercritical Jump	32.30	11.17	
'E7-F3'	36.79	7.49	20.73	7.10	18.47	8.10	1.25	Supercritical	25.70	0.00	
'E6-E7'	36.79	7.49	20.73	7.10	18.47	8.10	1.25	Supercritical	25.70	0.00	
'E5-E6'	22.68	7.22	16.52	6.33	14.01	7.67	1.38	Supercritical	14.60	0.00	
'E4-E5'	22.68	7.22	16.52	6.33	14.01	7.67	1.38	Supercritical	14.60	0.00	
'E3-E4'	22.68	7.22	16.52	6.33	14.01	7.67	1.38	Supercritical	14.60	0.00	
'E2-E3'	34.40	10.95	16.52	6.33	10.92	10.50	2.22	Supercritical	14.60	0.00	
'E1-E2'	21.32	8.86	12.99	5.44	9.22	8.36	1.93	Supercritical Jump	8.50	16.11	
'F2-F3'	8.81	4.99	11.93	5.31	11.62	5.47	1.05	Pressurized	6.60	292.03	
'F1-F2'	21.07	11.92	11.93	5.31	6.92	10.54	2.84	Supercritical Jump	6.60	16.43	

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
'H2-H3'	125.40	ELLIPSE	38.00 in	60.00 in	54.00 in	54.00 in	38.00 in	60.00 in	10.90	
'H1-H2'	93.10	ELLIPSE	38.00 in	60.00 in	48.00 in	48.00 in	38.00 in	60.00 in	10.90	**
'G2-H1'	29.90	CIRCULAR	24.00 in	24.00 in	30.00 in	30.00 in	24.00 in	24.00 in	3.14	**
'G1-G2'	16.30	CIRCULAR	18.00 in	18.00 in	24.00 in	24.00 in	18.00 in	18.00 in	1.77	**
'G4-H1'	23.50	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	**
'G3-G4'	16.40	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
D12-H1	39.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
D11-D12	39.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
D10-D11	39.70	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
D9-D10	39.70	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
D8-D9	39.70	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
D7-D8	39.70	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
'D6-D7'	39.70	CIRCULAR	33.00 in	33.00 in	30.00 in	30.00 in	33.00 in	33.00 in	5.94	
'D5-D6'	39.70	CIRCULAR	33.00 in	33.00 in	30.00 in	30.00 in	33.00 in	33.00 in	5.94	
'D4-D5'	39.70	CIRCULAR	33.00 in	33.00 in	33.00 in	33.00 in	33.00 in	33.00 in	5.94	
'D2-D4'	29.80	CIRCULAR	33.00 in	33.00 in	30.00 in	30.00 in	33.00 in	33.00 in	5.94	
'D1-D2'	8.10	CIRCULAR	21.00 in	21.00 in	18.00 in	18.00 in	21.00 in	21.00 in	2.41	
C3-D2	21.70	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
'C2-C3'	21.70	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
'C2-C1'	5.80	CIRCULAR	21.00 in	21.00 in	18.00 in	18.00 in	21.00 in	21.00 in	2.41	
'B4-C2'	15.90	CIRCULAR	27.00 in	27.00 in	24.00 in	24.00 in	27.00 in	27.00 in	3.98	
'B3-B4'	15.90	CIRCULAR	27.00 in	27.00 in	24.00 in	24.00 in	27.00 in	27.00 in	3.98	
'B2-B3'	15.90	CIRCULAR	27.00 in	27.00 in	24.00 in	24.00 in	27.00 in	27.00 in	3.98	
'A4-B2'	6.90	CIRCULAR	21.00 in	21.00 in	18.00 in	18.00 in	21.00 in	21.00 in	2.41	
'A3-A4'	6.90	CIRCULAR	21.00 in	21.00 in	18.00 in	18.00 in	21.00 in	21.00 in	2.41	
'A2-A3'	6.90	CIRCULAR	21.00 in	21.00 in	18.00 in	18.00 in	21.00 in	21.00 in	2.41	
'A1-A2'	6.90	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
'B1-B2'	9.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
'F7-H2'	32.30	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
'F6-F7'	32.30	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
'F5-F6'	32.30	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
'F4-F5'	32.30	CIRCULAR	33.00 in	33.00 in	30.00 in	30.00 in	33.00 in	33.00 in	5.94	
'F3-F4'	32.30	CIRCULAR	33.00 in	33.00 in	30.00 in	30.00 in	33.00 in	33.00 in	5.94	
'E7-F3'	25.70	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
'E6-E7'	25.70	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
'E5-E6'	14.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
'E4-E5'	14.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
'E3-E4'	14.60	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
'E2-E3'	14.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
'E1-E2'	8.50	CIRCULAR	21.00 in	21.00 in	18.00 in	18.00 in	21.00 in	21.00 in	2.41	
'F2-F3'	6.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
'F1-F2'	6.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- **Existing height is smaller than the suggested height. Exceeds max. Depth/Rise

Grade Line Summary: Tailwater Elevation (ft): 5673.90

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
'H2-H3'	5672.32	5672.59	0.00	0.00	5675.48	5675.83	5677.54	0.35	5677.88
'H1-H2'	5672.59	5672.87	0.06	0.00	5676.81	5677.04	5677.94	0.23	5678.18
'G2-H1'	5673.60	5673.81	1.86	0.78	5679.68	5680.19	5681.09	0.51	5681.60
'G1-G2'	5674.07	5674.29	0.38	0.00	5680.66	5681.53	5681.98	0.87	5682.85
'G4-H1'	5673.60	5673.68	1.15	0.92	5679.37	5679.48	5680.24	0.11	5680.35
'G3-G4'	5673.80	5674.10	0.12	0.00	5680.05	5680.25	5680.47	0.20	5680.67
D12-H1	5673.04	5673.51	0.04	0.00	5677.72	5678.06	5678.21	0.33	5678.55
D11-D12	5673.56	5674.34	0.04	0.00	5678.10	5678.64	5678.59	0.55	5679.13
D10-D11	5674.34	5674.73	0.04	0.00	5678.68	5678.96	5679.17	0.28	5679.45
D9-D10	5674.74	5675.22	0.02	0.00	5678.98	5679.27	5679.47	0.28	5679.76
D8-D9	5675.26	5676.26	0.04	0.00	5679.30	5679.60	5679.79	0.29	5680.09
D7-D8	5676.30	5677.24	0.04	0.00	5679.64	5679.64	5680.13	0.18	5680.30
'D6-D7'	5677.46	5678.31	0.03	0.00	5679.67	5680.41	5680.72	0.72	5681.44
'D5-D6'	5678.31	5680.47	0.03	0.00	5680.44	5682.57	5681.57	2.03	5683.60
'D4-D5'	5680.40	5681.69	0.03	0.00	5682.86	5683.79	5683.64	1.19	5684.82
'D2-D4'	5681.69	5682.96	0.02	0.00	5684.45	5684.77	5684.84	0.73	5685.57
'D1-D2'	5683.72	5683.91	0.23	0.35	5685.98	5686.05	5686.15	0.07	5686.22
C3-D2	5683.20	5684.27	0.02	0.00	5685.15	5685.85	5685.59	0.95	5686.53
'C2-C3'	5684.27	5684.82	0.02	0.00	5686.01	5686.40	5686.56	0.53	5687.08
'C2-C1'	5685.58	5686.16	0.12	0.28	5687.39	5687.39	5687.48	0.07	5687.55
'B4-C2'	5685.36	5685.91	0.02	0.00	5686.64	5687.30	5687.37	0.52	5687.89
'B3-B4'	5685.88	5686.52	0.02	0.00	5687.49	5687.91	5687.91	0.59	5688.50
'B2-B3'	5686.60	5687.78	0.01	0.00	5687.92	5689.17	5688.61	1.16	5689.76
'A4-B2'	5688.03	5688.95	0.01	0.00	5689.63	5689.92	5689.77	0.55	5690.31
'A3-A4'	5688.95	5689.70	0.01	0.00	5690.00	5690.67	5690.32	0.74	5691.06
'A2-A3'	5689.95	5690.70	0.01	0.00	5690.89	5691.67	5691.32	0.75	5692.06
'A1-A2'	5690.70	5691.04	0.01	0.00	5691.68	5692.06	5692.22	0.30	5692.51
'B1-B2'	5688.14	5688.62	0.53	0.15	5690.04	5690.25	5690.44	0.22	5690.66
'F7-H2'	5672.60	5673.14	0.02	0.00	5677.58	5677.83	5677.90	0.25	5678.15
'F6-F7'	5673.24	5673.62	0.02	0.00	5677.84	5678.02	5678.17	0.18	5678.34
'F5-F6'	5673.61	5674.56	0.02	0.00	5678.04	5678.48	5678.36	0.44	5678.80
'F4-F5'	5674.89	5676.64	0.02	0.00	5678.50	5679.43	5678.96	0.93	5679.89
'F3-F4'	5676.65	5677.16	0.02	0.00	5679.45	5679.45	5679.91	0.12	5680.03
'E7-F3'	5677.42	5677.93	0.02	0.00	5679.53	5679.66	5680.05	0.39	5680.44
'E6-E7'	5677.96	5678.90	0.03	0.00	5679.69	5680.63	5680.52	0.89	5681.41
'E5-E6'	5679.45	5681.02	0.02	0.00	5680.64	5682.40	5681.53	1.49	5683.02
'E4-E5'	5681.02	5682.91	0.02	0.00	5682.41	5684.29	5683.10	1.81	5684.91
'E3-E4'	5682.92	5684.81	0.02	0.00	5684.30	5686.19	5685.00	1.81	5686.81
'E2-E3'	5684.80	5685.48	0.36	0.00	5686.54	5686.86	5687.42	0.06	5687.48
'E1-E2'	5685.50	5686.17	0.21	0.00	5687.49	5687.49	5687.68	0.10	5687.79
'F2-F3'	5677.47	5679.51	0.29	0.41	5680.50	5681.65	5680.72	1.15	5681.87
'F1-F2'	5679.61	5687.53	0.05	0.00	5681.71	5688.52	5681.92	7.04	5688.96

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

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
'H2-H3'	45.54	6.00	8.00	9.00	9.03	5.85	1.02	10.49	6.58	1.74	94.78	Sewer Too Shallow
'H1-H2'	55.96	6.00	8.00	9.00	10.49	6.58	1.74	9.67	6.17	1.33	119.54	Sewer Too Shallow
'G2-H1'	29.60	3.00	4.00	5.50	7.53	4.85	2.02	7.68	4.92	2.09	30.68	
'G1-G2'	36.18	2.50	4.00	4.92	7.65	4.62	2.37	7.02	4.30	2.05	31.38	
'G4-H1'	10.28	3.00	4.00	5.50	7.54	4.86	2.02	8.00	5.08	2.25	10.90	
'G3-G4'	37.88	3.00	4.00	5.50	7.77	4.97	2.13	6.82	4.49	1.66	37.70	Sewer Too Shallow
D12-H1	94.06	4.00	6.00	6.67	7.66	5.66	1.50	8.16	5.91	1.75	135.84	Sewer Too Shallow
D11-D12	155.35	4.00	6.00	6.67	8.05	5.86	1.69	7.60	5.63	1.47	222.44	Sewer Too Shallow
D10-D11	78.14	4.00	6.00	6.67	7.60	5.63	1.47	9.26	6.46	2.30	119.45	Sewer Too Shallow
D9-D10	80.51	4.00	6.00	6.67	9.25	6.46	2.29	9.70	6.68	2.52	136.51	
D8-D9	83.20	4.00	6.00	6.67	9.62	6.64	2.48	9.20	6.43	2.27	140.13	
D7-D8	78.70	4.00	6.00	6.67	9.13	6.40	2.23	8.84	6.25	2.09	126.85	
'D6-D7'	85.26	3.75	6.00	6.38	8.66	6.02	2.14	8.65	6.01	2.14	125.16	
'D5-D6'	216.49	3.75	6.00	6.38	8.66	6.02	2.14	9.15	6.26	2.39	326.80	
'D4-D5'	161.24	3.75	6.00	6.38	9.29	6.33	2.46	10.97	7.17	3.30	279.17	
'D2-D4'	212.13	3.75	6.00	6.38	10.98	7.18	3.30	10.53	6.95	3.08	391.54	
'D1-D2'	27.71	2.75	4.00	5.21	10.02	5.95	3.40	10.17	6.02	3.48	38.11	
C3-D2	177.80	3.50	6.00	6.08	10.29	6.69	3.11	10.22	6.65	3.07	295.88	
'C2-C3'	92.14	3.50	6.00	6.08	10.23	6.65	3.07	10.22	6.65	3.07	152.74	
'C2-C1'	29.13	2.75	4.00	5.21	9.46	5.67	3.12	8.89	5.38	2.84	35.30	
'B4-C2'	77.97	3.25	6.00	5.79	9.38	6.09	2.79	9.25	6.02	2.73	110.22	
'B3-B4'	80.62	3.25	6.00	5.79	9.32	6.06	2.76	8.97	5.88	2.59	111.63	
'B2-B3'	168.24	3.25	6.00	5.79	8.81	5.80	2.51	8.37	5.58	2.29	217.58	
'A4-B2'	153.59	2.75	4.00	5.21	8.37	5.12	2.58	8.29	5.08	2.54	165.07	
'A3-A4'	125.80	2.75	4.00	5.21	8.30	5.09	2.55	8.25	5.06	2.52	134.11	
'A2-A3'	124.91	2.75	4.00	5.21	7.75	4.81	2.27	7.71	4.79	2.25	123.06	
'A1-A2'	33.67	2.50	4.00	4.92	7.95	4.77	2.52	7.98	4.78	2.53	32.18	
'B1-B2'	29.70	2.50	4.00	4.92	8.39	4.99	2.74	8.00	4.79	2.54	29.41	
'F7-H2'	107.50	4.00	6.00	6.67	8.80	6.23	2.06	8.32	5.99	1.83	165.85	Sewer Too Shallow
'F6-F7'	75.03	4.00	6.00	6.67	8.11	5.89	1.72	8.40	6.03	1.87	112.20	Sewer Too Shallow
'F5-F6'	189.19	4.00	6.00	6.67	8.41	6.04	1.87	9.32	6.49	2.33	301.56	Sewer Too Shallow
'F4-F5'	250.09	3.75	6.00	6.38	8.91	6.14	2.27	9.17	6.27	2.40	383.06	
'F3-F4'	63.47	3.75	6.00	6.38	9.15	6.26	2.39	9.03	6.20	2.33	97.71	
'E7-F3'	64.32	3.50	6.00	6.08	8.77	5.93	2.34	8.66	5.87	2.29	89.61	
'E6-E7'	117.29	3.50	6.00	6.08	8.60	5.84	2.26	9.34	6.21	2.63	168.43	
'E5-E6'	156.79	3.00	4.00	5.50	8.74	5.45	2.62	8.56	5.36	2.53	187.10	
'E4-E5'	189.25	3.00	4.00	5.50	8.57	5.37	2.53	9.08	5.62	2.79	231.28	
'E3-E4'	189.40	3.00	4.00	5.50	9.07	5.62	2.78	9.58	5.87	3.04	247.42	
'E2-E3'	29.61	3.00	4.00	5.50	9.60	5.88	3.05	9.20	5.68	2.85	39.07	
'E1-E2'	37.39	2.75	4.00	5.21	9.42	5.65	3.10	7.97	4.92	2.38	42.50	
'F2-F3'	292.03	2.50	4.00	4.92	9.67	5.63	3.38	9.12	5.35	3.10	346.30	
'F1-F2'	197.94	2.50	4.00	4.92	8.92	5.25	3.00	11.00	6.29	4.04	256.56	

Total earth volume for sewer trenches = 6443 cubic yards.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

The Glen Filing No 11
100-Year HGL/EGL Analysis

WARNING 10: crest elevation raised to downstream invert for regulator Link H2-HighPtS
WARNING 02: maximum depth increased for Node HighPtN
WARNING 02: maximum depth increased for Node 68
WARNING 02: maximum depth increased for Node 73
WARNING 02: maximum depth increased for Node 76
WARNING 02: maximum depth increased for Node 87
WARNING 02: maximum depth increased for Node 80
WARNING 02: maximum depth increased for Node 72

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units .... CFS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO
  Snowmelt .... NO
  Groundwater .... NO
  Flow Routing .... YES
  Ponding Allowed .... YES
  Water Quality .... NO
Flow Routing Method ...... DYNWAVE
Surcharge Method .... EXTRAN
Starting Date 03/16/2021 00:00:00
Ending Date 03/16/2021 03:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step .... 30.00 sec
Variable Time Step .... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance .... 0.005000 ft

**************************	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	62.847	20.480
External Outflow	33.918	11.053
Flooding Loss	25.749	8.391
Evaporation Loss	0.000	0.000

Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.001 0.000
Final Stored Volume 0.416 0.136
Continuity Error (%) 4.400

****
Highest Continuity Errors
****
Node G1 (41.52%)
Node F5 (7.58%)
Node D9 (5.32%)
Node D2 (-3.17%)
Node C3 (2.77%)

****
Time-Step Critical Elements
****
Link H2-H3 (1810.24%)
Link G4-H1 (83.73%)
Link H1-H2 (2.36%)
Link G2-H1 (1.84%)

****
Highest Flow Instability Indexes
****
Link G4-G3-Gutter (9)
Link H2-G3-Overtopping (9)
Link G2-H1 (9)
Link G4-H1 (9)
Link G3-G4 (7)

****
Routing Time Step Summary
****
Minimum Time Step : 0.12 sec
Average Time Step : 0.65 sec
Maximum Time Step : 1.79 sec
Percent in Steady State : 97.69
Average Iterations per Step : 2.71
Percent Not Converging : 7.09
Time Step Frequencies :
30.000 - 13.228 sec : 0.00 %
13.228 - 5.833 sec : 0.00 %
5.833 - 2.572 sec : 0.00 %
2.572 - 1.134 sec : 14.55 %
1.134 - 0.500 sec : 85.45 %

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
H2	JUNCTION	3.39	3.47	5676.06	0 00:04	3.47
H1	JUNCTION	3.62	3.69	5676.60	0 00:04	3.69
F7	JUNCTION	3.12	4.63	5677.76	0 00:03	3.21
D12	JUNCTION	3.26	3.44	5676.89	0 00:02	3.34
D11	JUNCTION	3.00	3.10	5677.27	0 00:04	3.10
D10	JUNCTION	2.80	2.91	5677.49	0 00:04	2.90
D9	JUNCTION	2.36	2.44	5677.76	0 00:04	2.44
D8	JUNCTION	1.96	2.02	5678.30	0 00:04	2.02
D7	JUNCTION	1.85	1.90	5678.99	0 00:04	1.90
D6	JUNCTION	1.84	1.89	5679.85	0 00:04	1.89
D5	JUNCTION	1.74	1.78	5682.22	0 00:04	1.78
D4	JUNCTION	1.95	2.00	5683.83	0 00:03	1.98
D2	JUNCTION	1.73	1.84	5685.09	0 00:03	1.75
D1	JUNCTION	0.95	1.12	5685.45	0 00:00	0.95
C3	JUNCTION	1.32	1.48	5685.92	0 00:03	1.34
C2	JUNCTION	1.50	1.59	5686.68	0 00:02	1.52
B4	JUNCTION	1.36	1.46	5687.37	0 00:02	1.38
B3	JUNCTION	1.41	1.49	5688.04	0 00:02	1.43
B2	JUNCTION	1.39	1.46	5689.29	0 00:02	1.40
B1	JUNCTION	1.11	1.39	5689.77	0 00:00	1.12
A4	JUNCTION	1.05	1.21	5690.21	0 00:01	1.07
A3	JUNCTION	1.04	1.14	5690.99	0 00:01	1.05
A2	JUNCTION	1.05	1.11	5691.81	0 00:00	1.05
A1	JUNCTION	0.99	1.19	5692.23	0 00:00	0.99
E1	JUNCTION	1.06	1.30	5687.01	0 00:00	1.06
E2	JUNCTION	1.31	1.59	5686.86	0 00:00	1.31
E3	JUNCTION	1.17	1.54	5686.35	0 00:00	1.17
E4	JUNCTION	1.16	1.21	5684.12	0 00:01	1.17
E5	JUNCTION	1.10	1.19	5682.11	0 00:01	1.12
E6	JUNCTION	1.56	1.67	5680.29	0 00:02	1.58
E7	JUNCTION	1.52	1.63	5679.27	0 00:02	1.54
F3	JUNCTION	1.64	1.76	5678.76	0 00:02	1.67
F2	JUNCTION	1.05	1.07	5680.15	0 00:02	1.07
F1	JUNCTION	0.58	0.58	5688.11	0 00:00	0.58
F4	JUNCTION	1.64	1.88	5678.27	0 00:02	1.68
F5	JUNCTION	2.43	2.51	5676.80	0 00:04	2.51
F6	JUNCTION	3.03	5.24	5678.67	0 00:03	3.12
G3	JUNCTION	2.53	2.58	5676.68	0 00:04	2.58
G4	JUNCTION	2.93	2.98	5676.64	0 00:04	2.98
G2	JUNCTION	2.99	3.05	5676.65	0 00:04	3.05
G1	JUNCTION	2.39	2.43	5676.66	0 00:04	2.43
C1	JUNCTION	0.73	0.77	5686.95	0 00:02	0.73
J2	JUNCTION	0.67	0.98	5673.75	0 00:00	0.67
J1	JUNCTION	0.99	1.12	5673.61	0 00:00	0.99
PA1	JUNCTION	1.83	2.00	5679.81	0 00:00	1.83
PA2	JUNCTION	1.99	2.00	5679.36	0 00:00	2.00
HighPtN	JUNCTION	0.00	0.00	5677.88	0 00:00	0.00
HighPtS	JUNCTION	0.00	0.00	5677.88	0 00:00	0.00
68	JUNCTION	0.00	0.00	5698.00	0 00:00	0.00

70	JUNCTION	0.00	0.00	5698.00	0	00:00	0.00
84	JUNCTION	0.00	0.00	5695.00	0	00:00	0.00
73	JUNCTION	0.00	0.00	5690.25	0	00:00	0.00
76	JUNCTION	0.00	0.00	5682.75	0	00:00	0.00
87	JUNCTION	0.00	0.00	5682.00	0	00:00	0.00
80	JUNCTION	0.00	0.00	5680.75	0	00:00	0.00
72	JUNCTION	0.00	0.00	5692.00	0	00:00	0.00
H3	OUTFALL	2.41	2.45	5674.70	0	00:04	2.45
Forebay-J	OUTFALL	0.00	0.00	5671.61	0	00:00	0.00

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Node Inflow Summary

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Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
H2	JUNCTION	13.70	127.30	0	00:04	1.11	10.2	1.383
H1	JUNCTION	0.00	77.12	0	00:04	0	6.17	0.252
F7	JUNCTION	0.00	31.99	0	00:03	0	2.43	0.022
D12	JUNCTION	0.00	37.06	0	00:04	0	2.96	0.471
D11	JUNCTION	0.00	38.17	0	00:04	0	3.04	0.118
D10	JUNCTION	0.00	38.77	0	00:03	0	3.03	-0.181
D9	JUNCTION	0.00	40.15	0	00:04	0	3.2	5.615
D8	JUNCTION	0.00	40.68	0	00:04	0	3.25	1.407
D7	JUNCTION	0.00	40.78	0	00:04	0	3.26	0.297
D6	JUNCTION	0.00	41.20	0	00:04	0	3.29	1.120
D5	JUNCTION	0.00	41.24	0	00:04	0	3.3	0.233
D4	JUNCTION	9.90	41.53	0	00:03	0.8	3.21	-2.594
D2	JUNCTION	0.00	31.89	0	00:03	0	2.34	-3.072
D1	JUNCTION	8.10	8.10	0	00:00	0.654	0.654	0.014
C3	JUNCTION	0.00	22.96	0	00:03	0	1.73	2.847
C2	JUNCTION	0.00	22.66	0	00:02	0	1.74	0.356
B4	JUNCTION	0.00	16.69	0	00:02	0	1.27	0.092
B3	JUNCTION	0.00	16.50	0	00:02	0	1.28	0.175
B2	JUNCTION	0.00	16.62	0	00:01	0	1.28	0.393
B1	JUNCTION	9.00	9.00	0	00:00	0.727	0.727	0.052
A4	JUNCTION	0.00	7.40	0	00:01	0	0.555	0.080
A3	JUNCTION	0.00	7.24	0	00:01	0	0.556	0.212
A2	JUNCTION	0.00	7.89	0	00:00	0	0.557	0.227
A1	JUNCTION	6.90	6.90	0	00:00	0.557	0.557	0.060
E1	JUNCTION	8.50	8.50	0	00:00	0.687	0.687	0.047
E2	JUNCTION	6.10	15.82	0	00:00	0.493	1.18	0.052
E3	JUNCTION	0.00	17.06	0	00:00	0	1.18	0.105
E4	JUNCTION	0.00	18.21	0	00:00	0	1.18	0.371
E5	JUNCTION	0.00	15.10	0	00:01	0	1.17	0.144
E6	JUNCTION	11.10	26.69	0	00:02	0.897	2.07	0.196
E7	JUNCTION	0.00	27.33	0	00:02	0	2.06	0.090
F3	JUNCTION	0.00	34.18	0	00:02	0	2.59	0.127
F2	JUNCTION	0.00	6.64	0	00:00	0	0.532	0.441
F1	JUNCTION	6.60	6.60	0	00:00	0.533	0.533	0.177
F4	JUNCTION	0.00	33.99	0	00:02	0	2.59	0.019
F5	JUNCTION	0.00	35.76	0	00:02	0	2.59	8.202
F6	JUNCTION	0.00	35.80	0	00:03	0	2.39	-1.256

G3	JUNCTION	16.40	16.40	0	00:00	1.32	1.32	0.098
G4	JUNCTION	7.10	25.53	0	00:00	0.574	1.57	0.371
G2	JUNCTION	13.60	32.09	0	00:00	1.1	1.68	0.551
G1	JUNCTION	16.30	16.30	0	00:00	1.32	1.32	71.009
C1	JUNCTION	5.80	5.80	0	00:00	0.469	0.469	0.033
J2	JUNCTION	3.70	3.70	0	00:00	0.299	0.299	0.485
J1	JUNCTION	8.70	13.80	0	00:00	0.703	1	-0.115
PA1	JUNCTION	102.00	102.00	0	00:00	8.24	8.24	-0.791
PA2	JUNCTION	0.00	107.99	0	00:00	0	8.3	0.000
HighPtN	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
HighPtS	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
68	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
70	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
84	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
73	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
76	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
87	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
80	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
72	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 gal
H3	OUTFALL	0.00	125.61	0	00:04	0	10.1	0.000
Forebay-J	OUTFALL	0.00	13.58	0	00:01	0	1	0.000

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
H1	JUNCTION	2.95	0.523	1.550
F7	JUNCTION	2.95	1.777	0.000
D12	JUNCTION	2.95	0.339	0.701
D11	JUNCTION	2.93	0.000	0.000
F6	JUNCTION	2.93	2.142	0.000
PA1	JUNCTION	0.01	0.000	0.000
PA2	JUNCTION	3.00	0.000	0.000

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Depth Feet
D11	2.93	1.12	0 00:04	0.089	0.000
G1	2.95	10.91	0 00:03	0.559	0.427
PA1	0.01	84.62	0 00:00	0.007	0.000
PA2	3.00	107.99	0 00:00	8.294	0.000

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
H3	100.00	122.31	125.61	10.050
Forebay-J	100.00	12.37	13.58	1.001
System	100.00	134.68	138.02	11.052

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A1-A2	CONDUIT	7.89	0 00:00	5.83	0.89	0.75
A2-A3	CONDUIT	7.24	0 00:01	5.41	0.89	0.71
A3-A4	CONDUIT	7.40	0 00:01	5.32	0.91	0.74
A4-B2	CONDUIT	7.72	0 00:01	5.23	0.95	0.78
B1-B2	CONDUIT	10.54	0 00:00	7.07	1.00	0.84
B2-B3	CONDUIT	16.50	0 00:02	6.81	0.87	0.72
B3-B4	CONDUIT	16.69	0 00:02	6.73	0.90	0.74
B4-C2	CONDUIT	16.87	0 00:02	6.96	0.87	0.72
C1-C2	CONDUIT	5.87	0 00:00	8.16	0.39	0.62
C2-C3	CONDUIT	22.96	0 00:03	7.06	0.72	0.63
C3-D2	CONDUIT	23.79	0 00:03	7.36	0.58	0.63
D10-D11	CONDUIT	38.17	0 00:04	5.43	0.91	0.98
D11-D12	CONDUIT	37.06	0 00:04	5.24	0.88	1.00
D12-H1	CONDUIT	36.97	0 00:04	5.77	0.67	1.00
D1-D2	CONDUIT	10.48	0 00:00	9.75	0.71	0.76
D2-D4	CONDUIT	31.63	0 00:03	7.54	0.77	0.67
D4-D5	CONDUIT	41.24	0 00:04	8.98	0.87	0.72
D5-D6	CONDUIT	41.20	0 00:04	10.10	0.74	0.65
D6-D7	CONDUIT	40.78	0 00:04	9.39	0.81	0.69
D7-D8	CONDUIT	40.68	0 00:04	9.07	0.76	0.71
D8-D9	CONDUIT	40.15	0 00:04	8.49	0.76	0.79
D9-D10	CONDUIT	38.77	0 00:03	6.95	0.82	0.94
E1-E2	CONDUIT	9.72	0 00:00	5.47	0.64	0.74
E2-E3	CONDUIT	17.06	0 00:00	7.04	0.90	0.75
E3-E4	CONDUIT	18.21	0 00:00	10.81	0.80	0.59
E4-E5	CONDUIT	15.10	0 00:01	7.72	0.67	0.60
E5-E6	CONDUIT	15.59	0 00:02	8.19	0.64	0.59
E6-E7	CONDUIT	27.33	0 00:02	8.03	0.77	0.66
E7-F3	CONDUIT	27.55	0 00:02	8.16	0.75	0.65
F1-F2	CONDUIT	6.64	0 00:00	10.56	0.32	0.39
F2-F3	CONDUIT	6.64	0 00:02	4.69	0.86	0.78
F3-F4	CONDUIT	33.99	0 00:02	8.67	0.72	0.64
F4-F5	CONDUIT	35.76	0 00:02	7.99	0.76	0.74
F5-F6	CONDUIT	35.80	0 00:03	5.64	0.85	0.92

F6-F7	CONDUIT	31.99	0	00:03	5.39	1.17	1.00
F7-H2	CONDUIT	32.06	0	00:03	5.40	0.86	1.00
G1-G2	CONDUIT	18.49	0	00:00	7.01	1.19	1.00
G2-H1	CONDUIT	35.02	0	00:00	9.10	0.88	1.00
G3-G4	CONDUIT	18.43	0	00:00	6.67	0.86	1.00
G4-H1	CONDUIT	27.43	0	00:00	9.12	1.30	1.00
H1-H2	CONDUIT	77.08	0	00:04	9.78	1.41	1.00
H2-H3	CONDUIT	125.61	0	00:04	10.36	1.01	0.89
J1-EDB	CONDUIT	13.58	0	00:01	5.76	0.82	0.66
J2-J1	CONDUIT	5.10	0	00:00	3.13	0.29	0.62
PA1-PA2	CONDUIT	107.99	0	00:00	9.46	0.74	1.00
68-69	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
70-71	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
84-A1	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
80-G3	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
H2-HighPtS	WEIR	0.00	0	00:00			0.00
87-G2	WEIR	0.00	0	00:00			0.00
HighPtN-J2	WEIR	0.00	0	00:00			0.00
D4-G4	WEIR	0.00	0	00:00			0.00
H2-G1-Overtopping	WEIR	2.36	0	00:04			0.11
H2-G3-Overtopping	WEIR	4.09	0	00:04			0.16
73-E6	WEIR	0.00	0	00:00			0.00
76-H2	WEIR	0.00	0	00:00			0.00
HighPtS-J1	WEIR	0.00	0	00:00			0.00
72-D4	WEIR	0.00	0	00:00			0.00
G4-G3-Gutter	WEIR	0.41	0	00:04			0.04
G2-G1-Gutter	WEIR	0.80	0	00:04			0.10
HighPtN-G1	WEIR	0.00	0	00:00			0.00

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
A1-A2	1.00	0.00	0.00	0.00	0.00	0.01	0.00	0.99	0.00	0.00
A2-A3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
A3-A4	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
A4-B2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.00
B1-B2	1.00	0.00	0.00	0.00	0.01	0.96	0.00	0.03	0.00	0.00
B2-B3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
B3-B4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
B4-C2	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
C1-C2	1.00	0.00	0.00	0.00	0.00	0.98	0.00	0.02	0.00	0.00
C2-C3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3-D2	1.00	0.00	0.00	0.00	0.03	0.97	0.00	0.00	0.00	0.00
D10-D11	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00	0.00
D11-D12	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
D12-H1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
D1-D2	1.00	0.00	0.00	0.00	0.95	0.02	0.00	0.02	0.00	0.00
D2-D4	1.00	0.00	0.00	0.00	0.03	0.97	0.00	0.00	0.98	0.00
D4-D5	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
D5-D6	1.00	0.00	0.00	0.00	0.00	0.97	0.00	0.03	0.00	0.00
D6-D7	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

D7-D8	1.00	0.00	0.00	0.00	0.01	0.99	0.00	0.00	0.00	0.00
D8-D9	1.00	0.00	0.00	0.00	0.95	0.02	0.00	0.03	0.00	0.00
D9-D10	1.00	0.00	0.00	0.00	0.98	0.00	0.00	0.02	0.00	0.00
E1-E2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
E2-E3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
E3-E4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.01	0.00
E4-E5	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
E5-E6	1.00	0.00	0.00	0.00	0.01	0.01	0.00	0.98	0.00	0.00
E6-E7	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
E7-F3	1.00	0.00	0.00	0.00	0.00	0.97	0.00	0.03	0.00	0.00
F1-F2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
F2-F3	1.00	0.00	0.00	0.00	0.98	0.00	0.00	0.02	0.99	0.00
F3-F4	1.00	0.00	0.00	0.00	0.00	0.01	0.00	0.99	0.00	0.00
F4-F5	1.00	0.00	0.00	0.00	0.95	0.01	0.00	0.03	0.00	0.00
F5-F6	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00	0.00
F6-F7	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
F7-H2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
G1-G2	1.00	0.00	0.00	0.00	0.96	0.00	0.00	0.04	0.00	0.00
G2-H1	1.00	0.00	0.00	0.00	0.97	0.02	0.00	0.01	0.00	0.00
G3-G4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
G4-H1	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.00	0.00
H1-H2	1.00	0.00	0.00	0.00	0.96	0.00	0.00	0.04	0.00	0.00
H2-H3	1.00	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.00	0.00
J1-EDB	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
J2-J1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
PA1-PA2	1.00	0.00	0.00	0.00	0.01	0.99	0.00	0.00	0.00	0.00
68-69	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70-71	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84-A1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80-G3	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Conduit Surcharge Summary
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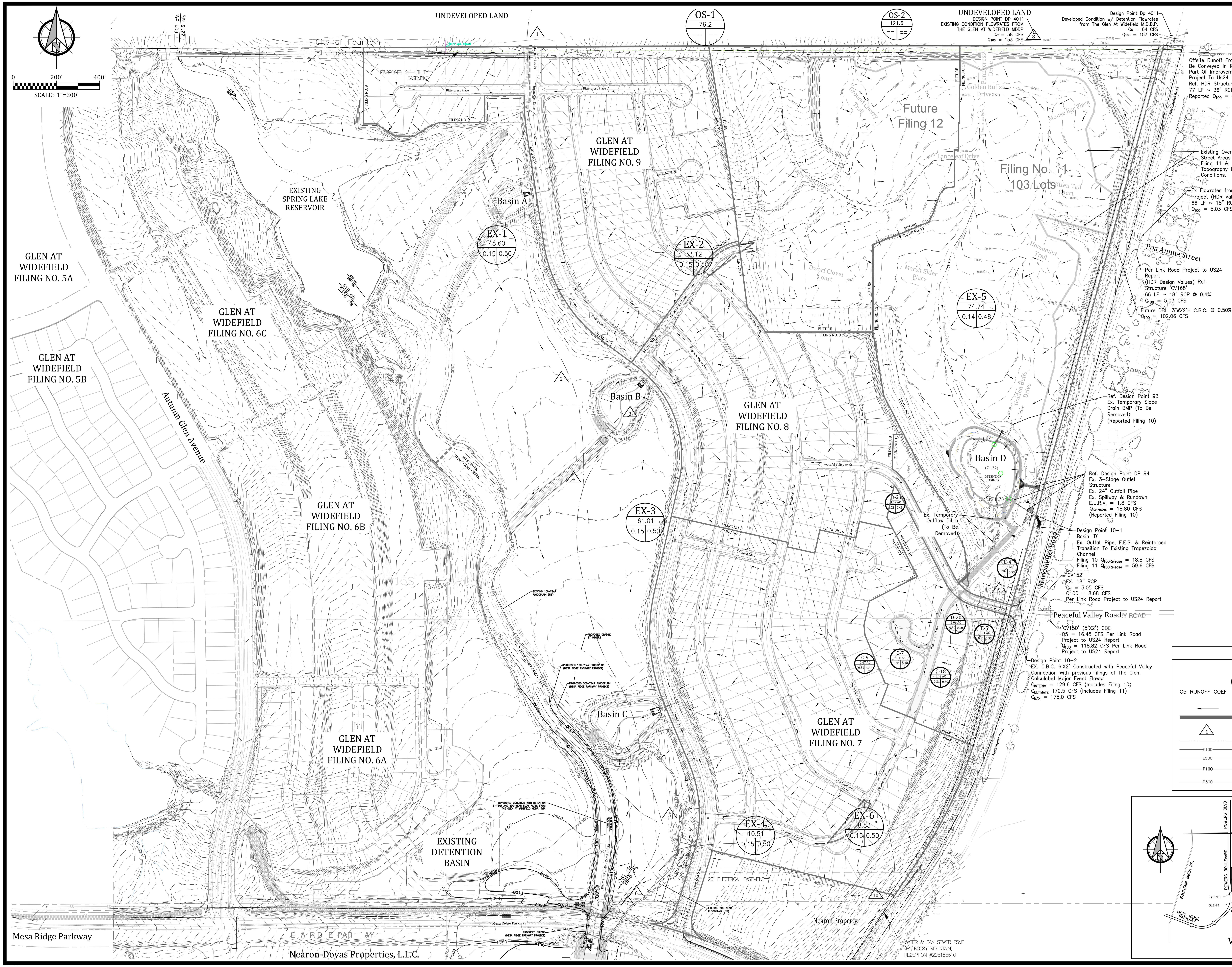
	--------- Hours Full --------			Hours Above Full	Hours Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
D10-D11	0.01	0.01	2.93	0.01	0.01
D11-D12	2.94	2.94	2.95	0.01	0.01
D12-H1	2.95	2.95	2.95	0.01	0.01
D9-D10	0.01	0.01	2.93	0.01	0.01
F5-F6	0.01	0.01	2.93	0.01	0.01
F6-F7	2.95	2.95	2.95	2.95	2.95
F7-H2	2.95	2.95	2.95	0.01	0.01
G1-G2	2.95	2.95	2.95	0.04	0.01
G2-H1	2.95	2.95	2.95	0.01	0.01
G3-G4	2.95	2.95	2.95	0.01	0.01
G4-H1	2.95	2.95	2.95	0.06	0.01
H1-H2	2.95	2.95	2.95	2.96	2.95
H2-H3	0.01	2.95	0.01	2.93	0.01
PA1-PA2	0.01	0.01	3.00	0.01	0.01

Analysis begun on: Wed Apr 14 12:42:25 2021
Analysis ended on: Wed Apr 14 12:42:25 2021

APPENDIX D

Existing and Proposed Drainage Plans

Sheet 1 – Historic Conditions (Overall)
Sheet 2 - Developed Conditions Onsite (South)
Sheet 3 – Developed Conditions Onsite (North)



INTERIM CONDITION (FILING NO. 10)

DETENTION BASIN 'D' DATA

	REQUIRED VOLUME	RELEASE RATE
WQCV	0.192 AC–FT	0.2 CFS
EURV	0.066 AC–FT	0.2 CFS
100–YR	1.525 AC–FT	18.8 CFS
100–YR + ½ WQCV	1.783 AC–FT	18.8 CFS
TOP OF EMBANKMENT ELEVATION: 5679.14		

ULTIMATE CONDITION (FILINGS 10-12)

DETENTION BASIN 'D' DATA

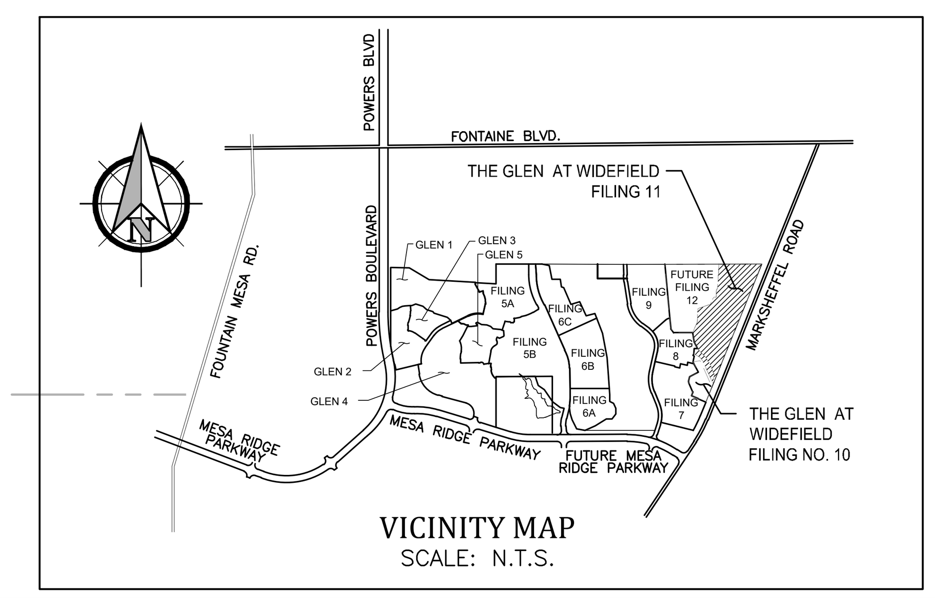
	REQUIRED VOLUME	RELEASE RATE
WQCV	0.827 AC–FT	1.4 CFS
EURV	1.035 AC–FT	1.5 CFS
100–YR	2.414 AC–FT	59.6 CFS
100–YR + ½ WQCV	2.828 AC–FT	59.6 CFS
TOP OF EMBANKMENT ELEVATION: 5679.14		

DESIGN POINT FLOWS

	5-YEAR	100-YEAR
1	48 cfs	163 cfs
2	42 cfs	232 cfs
3	13 cfs	74 cfs
4	48 cfs	268 cfs
5	58 cfs	323 cfs
6	4 cfs	25 cfs
7	55 cfs	310 cfs
8	38 cfs	153 cfs
9	35 cfs	130.4 cfs
10	3 cfs	18 cfs

LEGEND

EX-1 — DRAINAGE BASIN DESIGNATION
48.60 — DRAINAGE BASIN ACRES
C5 RUNOFF COEF 0.15 | 0.50 C100 RUNOFF COEFFICIENT
DIRECTIONAL FLOW ARROW
DRAINAGE BASIN BOUNDARY
DESIGN POINT
TIME OF CONCENTRATION PATH
E100 — EXISTING 100–YEAR FLOODPLAIN (FIS)
E500 — EXISTING 500–YEAR FLOODPLAIN (FIS)
P100 — PROPOSED 100–YEAR FLOODPLAIN (MESA RIDGE PKWY IMPROVEMENTS)
P500 — PROPOSED 500–YEAR FLOODPLAIN (MESA RIDGE PKWY IMPROVEMENTS)



VICINITY MAP
SCALE: N.T.S.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

WIDEFIELD Investment Group

THE GLEN AT WIDEFIELD
FILING NO. 11
HISTORIC DRAINAGE BASINS (WITH CURRENT CONDITIONS)
El Paso, County, Colorado

Project No.:	19016
Date:	April 30, 2021
Design:	MJK
Drawn:	MJK
Check:	AMcC
Revisions:	

SHEET
H-1
1 of 3 Sheets

19016 Filing 11 – Historic Conditions.dwg/Apr 30, 2021

MATCHLINE SEE SHEET D-2
MATCHLINE SEE SHEET D-1

MATCHLINE SEE SHEET D-2
MATCHLINE SEE SHEET D-1

INLET IDENTIFIER (B-1)

Inlet ID	Design Flow (Basin or DP)	Flow to Inlet 2yr	Flow to Inlet 5yr	Flow to Inlet 100yr	Inlet Type	Inlet Condition	Inlet Capacity 5yr	Inlet Capacity 100yr	Flow Not Captured by Inlet 5yr	Flow Not Captured by Inlet 100yr	to
A-1	DP 84		3.0cfs	8.6cfs	10' Type R	On Grade	3.0 cfs	6.9 cfs	0.0cfs	1.7cfs	to B-1
A-4	'A-4' (Temp)		4.4cfs	12.7cfs	Temp. Grate at MH	In Sump	10.0 cfs	24.0 cfs	0.0cfs	0.0cfs	to C-1
B-1	D-16		2.5cfs	7.3cfs	10' Type R	On Grade	5.0 cfs	9.6 cfs	0.0cfs	0.0cfs	to C-1
C-1	DP 85		2.4cfs	6.9cfs	10' Type R	On Grade	2.4 cfs	5.8 cfs	0.0cfs	1.1cfs	to D-1
D-1	DP 86		4.4cfs	12.7cfs	10' Type R	On Grade	4.3 cfs	8.1 cfs	0.1cfs	5.7cfs	to G-2
D-4	DP 82		3.8cfs	11.1cfs	15' Type R	On Grade	3.8 cfs	9.9 cfs	0.0cfs	1.2cfs	to G-4
G-1	DP 89		0.3cfs	0.7cfs	20' Type R	In Sump	10.8 cfs	19.9 cfs	0.0cfs	0.0cfs	N/A
G-2	DP 88		6.2cfs	18.1cfs	15' Type R	On Grade	6.3 cfs	13.6 cfs	0.0cfs	10.1cfs	to G-1
G-3	DP 81		5.7cfs	16.4cfs	20' Type R	In Sump	10.8 cfs	19.9 cfs	0.0cfs	0.0cfs	N/A
G-4	DP 83		3.8cfs	11.0cfs	15' Type R	On Grade	3.8 cfs	7.1 cfs	0.0cfs	5.1cfs	J-1
E-1	DP 71		3.4cfs	9.9cfs	10' Type R	On Grade	3.4 cfs	8.5 cfs	0.0cfs	1.4cfs	to E-6
E-2	DP 69		2.6cfs	7.5cfs	10' Type R	On Grade	2.6 cfs	6.1 cfs	0.0cfs	1.4cfs	to E-6
E-6	DP 75		3.7cfs	10.8cfs	15' Type R	On Grade	3.9 cfs	11.1 cfs	0.0cfs	2.6cfs	to H-2
F-1	DP 77		2.3cfs	6.6cfs	10' Type R	In Sump	8.7 cfs	11.2 cfs	0.0cfs	0.0cfs	to H-2
H-2	DP 79		5.4cfs	15.5cfs	20' Type R	In Sump	18.2 cfs	19.9 cfs	0.0cfs	1.1cfs	to J-2
J-1	DP 92a		1.0cfs	2.6cfs	10' Type R	In Sump	8.7 cfs	8.7 cfs	0.0cfs	0.0cfs	to J-1
J-2	DP 92b		0.8cfs	1.5cfs	10' Type R	In Sump	8.7 cfs	8.7 cfs	0.0cfs	0.0cfs	G-1

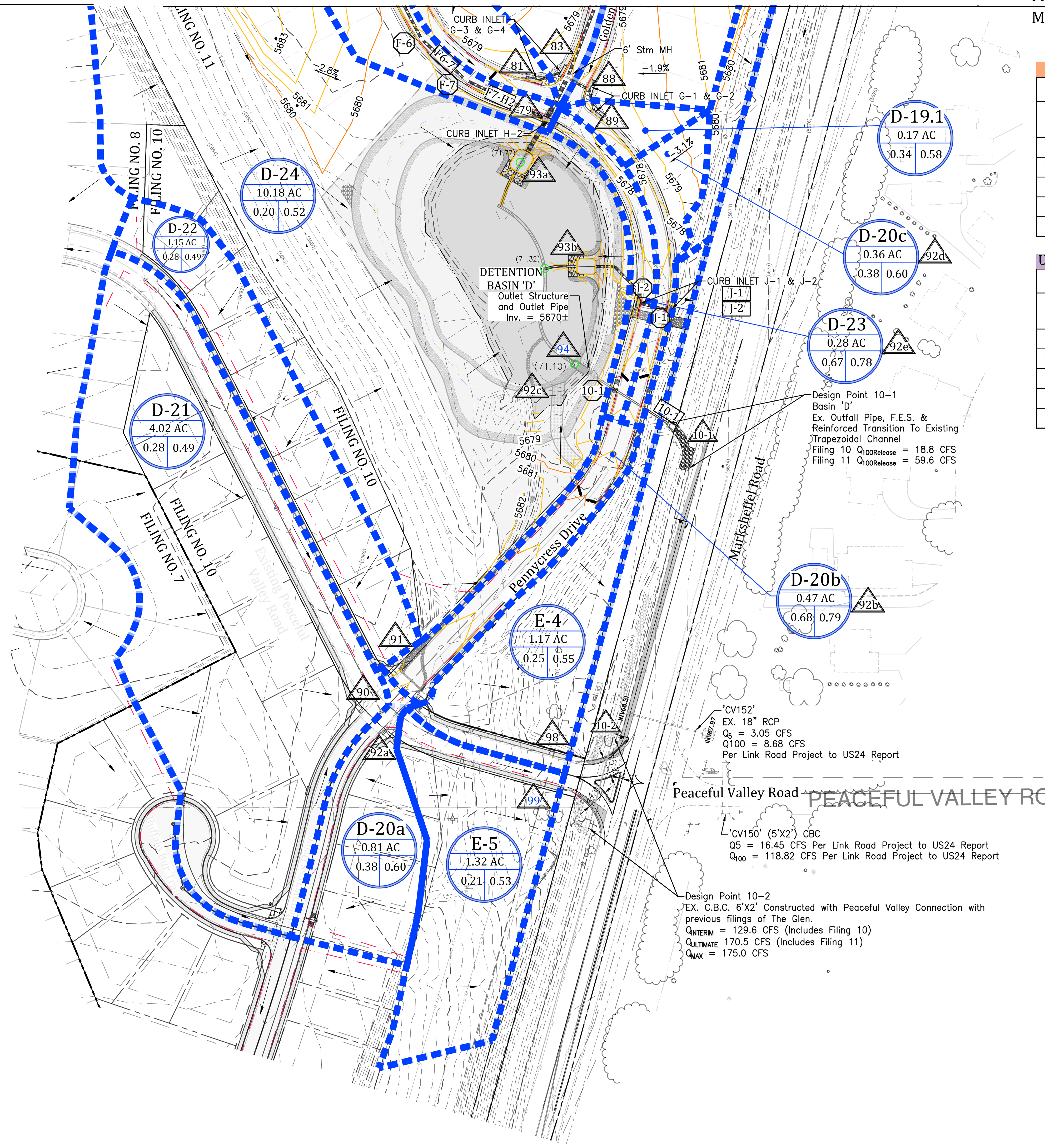
Note: Storm Manholes A–4 and F–2 will serve as interim inlets pending development of Future Filing No. 12 to the west.

Note: Street Capacity Exceeded at Pennycress / Golden Buffs Intersection (DP 79) in Major Storm. Flows in excess of 5" depth will overtop asphalt and feed surrounding inlets G–1 & G–4, then J–1 & J–2.

PIPE IDENTIFIER B1-B2

Pipe #	5yr Rat'l	100yr Rat'l	5yr Capture	100yr Capture	Pipe Slope	Mannings Pipe Capacity	Length (2D Center-to-Center)
Golden Buffs Drive Trunkline							
A1-A2	3.0 cfs	8.6 cfs	3.0 cfs	6.9 cfs	0.70%	8.8 cfs	33.67
A2-A3	3.0 cfs	8.6 cfs	3.0 cfs	6.9 cfs	0.60%	8.2 cfs	124.91
A3-A4	3.0 cfs	8.6 cfs	3.0 cfs	6.9 cfs	0.60%	8.2 cfs	125.80
A4-B2	3.0 cfs	8.6 cfs	3.0 cfs	6.9 cfs	0.60%	8.2 cfs	153.59
B1-B2	2.5 cfs	7.3 cfs	5.0 cfs	9.0 cfs	1.00%	10.5 cfs	29.70
B2-B3	7.3 cfs	21.2 cfs	8.0 cfs	15.9 cfs	0.70%	19.0 cfs	168.24
B3-B4	7.3 cfs	21.2 cfs	8.0 cfs	15.9 cfs	0.70%	19.0 cfs	80.62
B4-C2	7.3 cfs	21.2 cfs	8.0 cfs	15.9 cfs	0.70%	19.0 cfs	77.97
C1-C2	7.3 cfs	21.2 cfs	2.4 cfs	5.8 cfs	2.00%	14.9 cfs	29.14
C2-C3	10.8 cfs	31.2 cfs	10.4 cfs	21.7 cfs	0.60%	31.9 cfs	92.14
C3-D2	10.8 cfs	31.2 cfs	10.4 cfs	21.7 cfs	0.60%	31.9 cfs	177.80
D1-D2	1.4 cfs	4.2 cfs	4.3 cfs	8.1 cfs	2.00%	14.9 cfs	27.71
D2-D4	12.0 cfs	34.6 cfs	18.5 cfs	39.7 cfs	0.60%	41.1 cfs	212.13
D4-D5	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.80%	47.4 cfs	161.24
D5-D6	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	1.10%	55.6 cfs	216.49
D6-D7	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.90%	50.3 cfs	85.26
D7-D8	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.90%	50.3 cfs	78.72
D8-D9	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	1.00%	53.0 cfs	83.20
D9-D10	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.80%	47.4 cfs	80.51
D10-D11	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.40%	42.3 cfs	78.14
D11-D12	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.40%	42.3 cfs	155.35
D12-H1	15.8 cfs	45.7 cfs	18.5 cfs	39.7 cfs	0.40%	42.3 cfs	94.06
H1-H2	32.9 cfs	77.9 cfs	46.1 cfs	86.0 cfs	0.50%	101.8 cfs	55.96
PennyCress Drive Trunkline							
E1-E2	4.5 cfs	13.1 cfs	3.4 cfs	8.5 cfs	0.60%	12.3 cfs	37.39
E2-E3	7.1 cfs	20.6 cfs	6.0 cfs	14.6 cfs	0.90%	15.1 cfs	29.61
E3-E4	7.1 cfs	20.6 cfs	6.0 cfs	14.6 cfs	1.00%	15.9 cfs	189.40
E4-E5	7.1 cfs	20.6 cfs	6.0 cfs	14.6 cfs	1.00%	15.9 cfs	189.25
E5-E6	7.1 cfs	20.6 cfs	6.0 cfs	14.6 cfs	1.20%	17.4 cfs	150.07
E6-E7	10.0 cfs	29.0 cfs	9.9 cfs	25.7 cfs	0.80%	36.8 cfs	100.41
F1-F2	2.3 cfs	6.6 cfs	2.3 cfs	6.6 cfs	4.00%	21.1 cfs	197.94
F2-F3	2.3 cfs	6.6 cfs	2.3 cfs	6.6 cfs	0.50%	7.4 cfs	292.03
E7-F3	10.0 cfs	29.0 cfs	12.2 cfs	32.3 cfs	0.80%	36.8 cfs	64.32
F3-F4	13.5 cfs	39.0 cfs	12.2 cfs	32.3 cfs	0.80%	36.8 cfs	63.47
F4-F5	5.4 cfs	39.0 cfs	12.2 cfs	32.3 cfs	0.80%	36.8 cfs	250.09
F5-F6	5.4 cfs	39.0 cfs	12.2 cfs	32.3 cfs	0.40%	33.5 cfs	189.19
F6-F7	5.4 cfs	39.0 cfs	12.2 cfs	32.3 cfs	0.40%	33.5 cfs	75.03
F7-H2	5.4 cfs	15.5 cfs	12.2 cfs	32.3 cfs	0.40%	33.5 cfs	106.99
G1-G2	0.3 cfs	0.7 cfs	15.7 cfs	16.3 cfs	0.60%	17.6 cfs	36.18
G2-H1	6.2 cfs	18.1 cfs	21.9 cfs	29.9 cfs	1.00%	41.1 cfs	29.60
G3-G4	3.8 cfs	12.8 cfs	5.7 cfs	16.4 cfs	1.10%	23.8 cfs	10.28
G4-H1	5.7 cfs	16.4 cfs	9.5 cfs	23.5 cfs	1.10%	23.8 cfs	37.88
H2-H3	45.8 cfs	94.5 cfs	64.3 cfs	99.7 cfs	0.60%	111.6 cfs	45.54
Pair at Inflow 'J'							
J2-J1	1.0 cfs	2.6 cfs	1.0 cfs	3.7 cfs	0.50%	16.0 cfs	35.87
J1-End	1.8 cfs	4.1 cfs	2.8 cfs	8.7 cfs	0.60%	17.6 cfs	76.59

Box Culvert Poa Annua Street							
PA1-PA2		102.1 cfs	N/A	102.1 cfs	0.50%	113.6 cfs	90.00



INTERIM CONDITION (FILING NO. 10)

DETENTION BASIN 'D' DATA		
	REQUIRED VOLUME	RELEASE RATE
WQCV	0.192 AC–FT	0.2 CFS
EURV	0.066 AC–FT	0.2 CFS
100–YR	1.525 AC–FT	18.8 CFS
100–YR + ½ WQCV	1.783 AC–FT	18.8 CFS
TOP OF EMBANKMENT ELEVATION: 5679.14		

ULTIMATE CONDITION (FILINGS 10-12)

DETENTION BASIN 'D' DATA		
	REQUIRED VOLUME	RELEASE RATE
WQCV	0.827 AC–FT	1.4 CFS
EURV	1.035 AC–FT	1.5 CFS
100–YR	2.414 AC–FT	59.6 CFS
100–YR + ½ WQCV	2.828 AC–FT	59.6 CFS
TOP OF EMBANKMENT ELEVATION: 5679.14		

LEGEND

D-n 2.67 AC 0.50 0.31 — DRAINAGE BASIN DESIGNATION; DRAINAGE BASIN ACRES; C5 RUNOFF COEF; C100 RUNOFF COEFFICIENT

2.2 cfs / 4.3 cfs — 5–YEAR RUNOFF / 100–YEAR RUNOFF

DIRECTIONAL FLOW ARROW

DRAINAGE BASIN BOUNDARY

(1) DESIGN POINT

TIME OF CONCENTRATION PATH

(10) HYDRAULIC STRUCTURE IDENTIFIER

S10 STORM SEWER IDENTIFIER

PROPOSED STORM SEWER PIPE

(D) PROPOSED STORM SEWER MANHOLE

PROPOSED STORM DRAINAGE CURB INLET

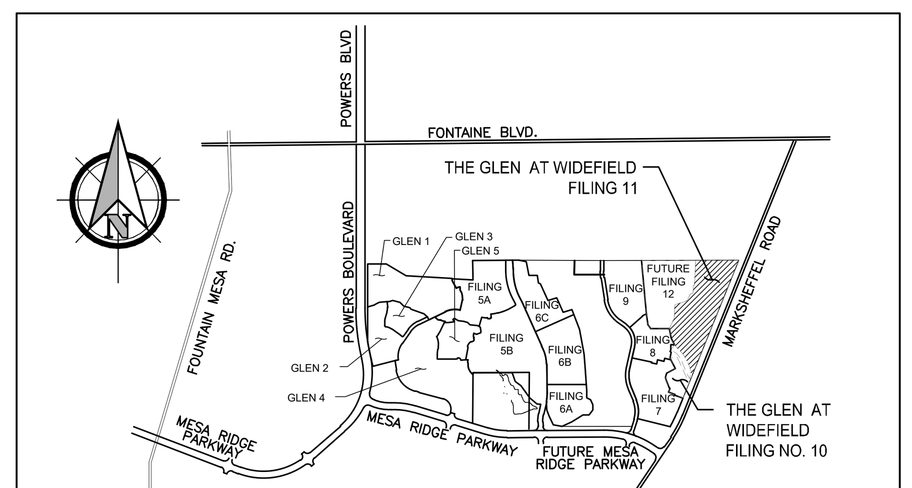
–(6020)– EXISTING CONTOURS

6020 PROPOSED CONTOURS

DESIGN POINT FLOWS

	5-YEAR Filing 10	5-YEAR Filings 10-12	100-YEAR Filing 10	100-YEAR Filings 10-12
79	15.1 cfs	5.4 cfs	43.8 cfs	15.5 cfs
81	5.7 cfs	5.7 cfs	16.4 cfs	16.4 cfs
83	5.4 cfs	6.4 cfs	15.6 cfs	18.5 cfs
88	14.5 cfs	13.5 cfs	42.1 cfs	39.0 cfs
89	0.2 cfs	0.3 cfs	0.7 cfs	0.7 cfs
90	1.3 cfs	1.3 cfs	3.6 cfs	3.6 cfs
91	4.4 cfs	4.4 cfs	12.7 cfs	12.7 cfs
92a	0.9 cfs	3.6 cfs	2.5 cfs	5.9 cfs
92b	0.7 cfs	6.4 cfs	1.9 cfs	18.5 cfs
93a	2.7 cfs	32.7 cfs	7.7 cfs	94.5 cfs
93b	0.2 cfs	2.3 cfs	1.1 cfs	5.9 cfs
94	18.1 cfs	51.3 cfs	86.0 cfs	154.8 cfs
10-1	0.5 cfs	4.0 cfs	18.8 cfs	41.8 cfs
98	0.9 cfs	0.9 cfs	3.8 cfs	3.8 cfs
99	1.1 cfs	1.1 cfs	4.6 cfs	4.6 cfs
10-2			130.4 cfs	152.7 cfs

0 100' 200'
SCALE: 1"=100'



VICINITY MAP
SCALE: N.T.S.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

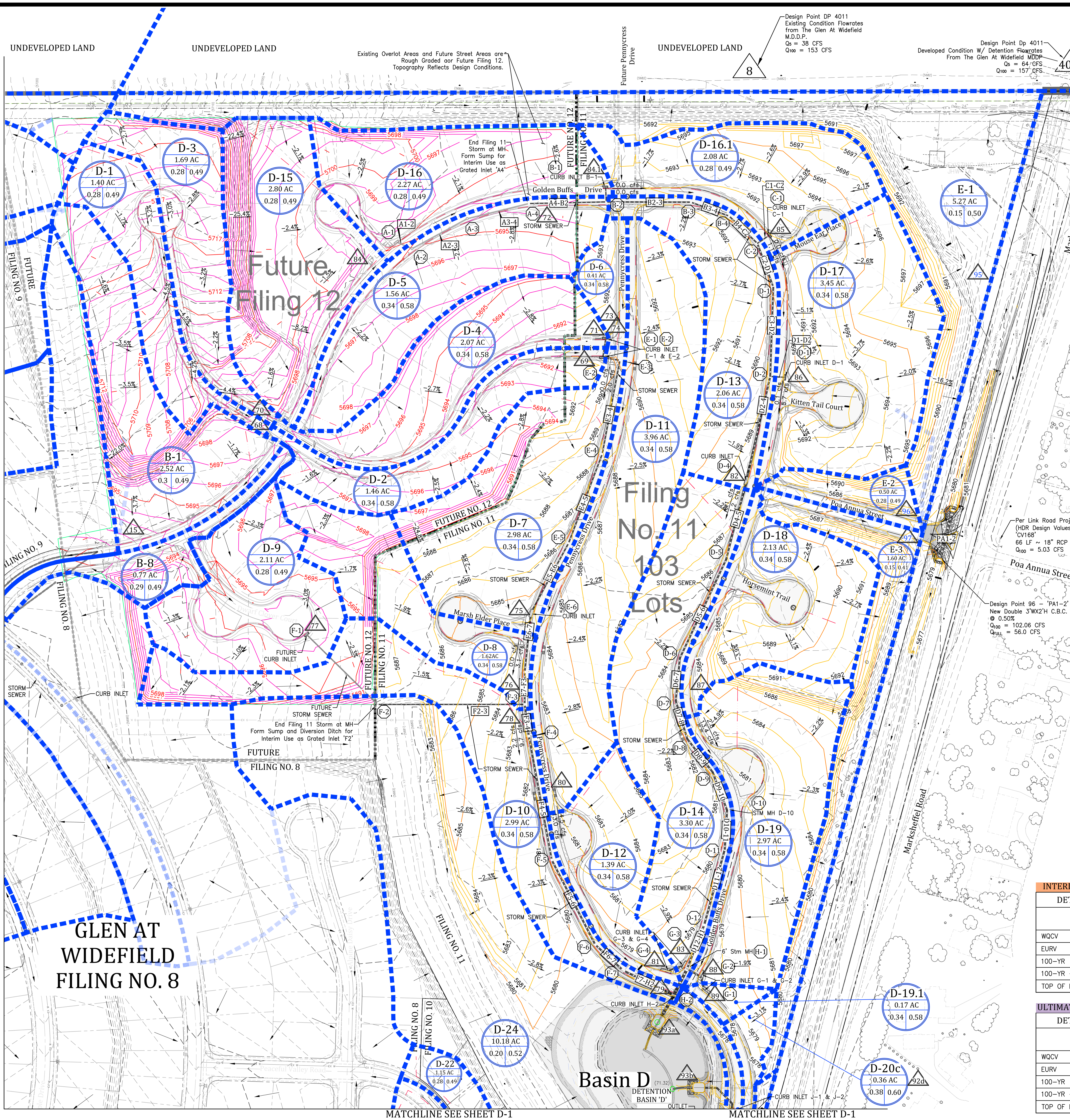
WIDEFIELD Investment Group

THE GLEN AT WIDEFIELD
FILING NO. 11
DEVELOPED DRAINAGE BASINS (ON-SITE)
El Paso, County, Colorado

Project No.:	19016
Date:	April 30, 2021
Design:	MJK
Drawn:	MJK
Check:	AMcC
Revisions:	

SHEET
D-1

19016 Filing 11 – Developed Conditions.dwg



0 100' 200'
SCALE: 1"=100'

LEGEND

C-2.67 AC, 0.50 / 0.31	DRAINAGE BASIN DESIGNATION; DRAINAGE BASIN ACRES; C5 RUNOFF COEF; C100 RUNOFF COEFFICIENT
2.2 cfs / 4.3 cfs	5-YEAR RUNOFF / 100-YEAR RUNOFF
–2.0%	DIRECTIONAL FLOW ARROW AND SLOPE
	DRAINAGE BASIN BOUNDARY
1	DESIGN POINT
	TIME OF CONCENTRATION PATH
10	HYDRAULIC STRUCTURE IDENTIFIER
S10	STORM SEWER IDENTIFIER
	PROPOSED STORM SEWER PIPE
	PROPOSED STORM SEWER MANHOLE
	PROPOSED STORM DRAINAGE CURB INLET
6020	EXISTING CONTOURS
6020	PROPOSED CONTOURS

DESIGN POINT FLOWS

DP	5-YEAR	100-YEAR	DP	5-YEAR	100-YEAR
68	1.4 cfs	4.2 cfs	83	6.4 cfs	18.5 cfs
69	2.6 cfs	7.5 cfs	84	3.0 cfs	8.6 cfs
70	1.7 cfs	5.0 cfs	84.1	2.5 cfs	7.3 cfs
71	3.4 cfs	9.9 cfs	85	7.3 cfs	21.2 cfs
72	1.9 cfs	5.4 cfs	86	10.8 cfs	31.2 cfs
73	0.5 cfs	1.6 cfs	87	12.0 cfs	34.6 cfs
74	4.5 cfs	13.1 cfs	88	13.5 cfs	39.0 cfs
75	10.0 cfs	29.0 cfs	89	0.3 cfs	0.7 cfs
76	11.4 cfs	33.0 cfs	90	1.3 cfs	3.6 cfs
77	2.3 cfs	6.6 cfs	91	4.4 cfs	12.7 cfs
78	13.5 cfs	39.0 cfs	92a	3.6 cfs	5.9 cfs
79	5.4 cfs	15.5 cfs	92b	6.4 cfs	18.5 cfs
80	4.5 cfs	13.0 cfs	93a	32.7 cfs	94.5 cfs
81	5.7 cfs	16.4 cfs	93b	2.3 cfs	5.9 cfs
82	3.8 cfs	11.1 cfs	94	51.3 cfs	154.8 cfs

PIPE IDENTIFIER B1-B2

Pipe #	5yr Rat'l	100yr Rat'l	Pipe Slope	Pipe Diameter	Mannings Pipe Capacity	Length (2D Center-to-Center)
Golden Buffs Drive Trunkline						
A1-A2	3.0 cfs	8.6 cfs	0.70%	18-inch	8.8 cfs	33.67
A2-A3	3.0 cfs	8.6 cfs	0.60%	18-inch	8.2 cfs	124.91
A3-A4	3.0 cfs	8.6 cfs	0.60%	18-inch	8.2 cfs	125.80
A4-B2	3.0 cfs	8.6 cfs	0.60%	18-inch	8.2 cfs	153.59
B1-B2	2.5 cfs	7.3 cfs	1.00%	18-inch	10.5 cfs	29.70
B2-B3	7.3 cfs	21.2 cfs	0.70%	24-inch	19.0 cfs	168.24
B3-B4	7.3 cfs	21.2 cfs	0.70%	24-inch	19.0 cfs	80.62
B4-C2	7.3 cfs	21.2 cfs	0.70%	24-inch	19.0 cfs	77.97
C1-C2	7.3 cfs	21.2 cfs	2.00%	18-inch	14.9 cfs	29.14
C2-C3	10.8 cfs	31.2 cfs	0.60%	30-inch	31.9 cfs	92.14
C3-D2	10.8 cfs	31.2 cfs	0.60%	30-inch	31.9 cfs	177.80
D1-D2	1.4 cfs	4.2 cfs	2.00%	18-inch	14.9 cfs	27.71
D2-D4	12.0 cfs	34.6 cfs	0.60%	33-inch	41.1 cfs	212.13
D4-D5	15.8 cfs	45.7 cfs	0.80%	33-inch	47.4 cfs	161.24
D5-D6	15.8 cfs	45.7 cfs	1.10%	33-inch	55.6 cfs	216.49
D6-D7	15.8 cfs	45.7 cfs	0.90%	33-inch	50.3 cfs	85.26
D7-D8	15.8 cfs	45.7 cfs	0.90%	33-inch	50.3 cfs	78.72
D8-D9	15.8 cfs	45.7 cfs	1.00%	33-inch	53.0 cfs	83.20
D9-D10	15.8 cfs	45.7 cfs	0.80%	33-inch	47.4 cfs	80.51
D10-D11	15.8 cfs	45.7 cfs	0.40%	36-inch	42.3 cfs	78.14
D11-D12	15.8 cfs	45.7 cfs	0.40%	36-inch	42.3 cfs	155.35
D12-H1	15.8 cfs	45.7 cfs	0.40%	36-inch	42.3 cfs	94.06
H1-H2	32.9 cfs	77.9 cfs	0.50%	48-inch	101.8 cfs	55.96
PennyCress Drive Trunkline						
E1-E2	4.5 cfs	13.1 cfs	0.60%	21-inch	12.3 cfs	37.39
E2-E3	7.1 cfs	20.6 cfs	0.90%	21-inch	15.1 cfs	29.61
E3-E4	7.1 cfs	20.6 cfs	1.00%	21-inch	15.9 cfs	189.40
E4-E5	7.1 cfs	20.6 cfs	1.00%	21-inch	15.9 cfs	189.25
E5-E6	7.1 cfs	20.6 cfs	1.20%	21-inch	17.4 cfs	150.07
E6-E7	10.0 cfs	29.0 cfs	0.80%	30-inch	36.8 cfs	100.41
F1-F2	2.3 cfs	6.6 cfs	4.00%	18-inch	21.1 cfs	197.94
F2-F3	2.3 cfs	6.6 cfs	0.50%	18-inch	7.4 cfs	292.03
E7-F3	10.0 cfs	29.0 cfs	0.80%	30-inch	36.8 cfs	64.32
F3-F4	13.5 cfs	39.0 cfs	0.80%	30-inch	36.8 cfs	63.47
F4-F5	5.4 cfs	39.0 cfs	0.80%	30-inch	36.8 cfs	250.09
F5-F6	5.4 cfs	39.0 cfs	0.40%	33-inch	33.5 cfs	189.19
F6-F7	5.4 cfs	39.0 cfs	0.40%	33-inch	33.5 cfs	75.03
F7-H2	5.4 cfs	15.5 cfs	0.40%	33-inch	33.5 cfs	106.99
G1-G2	0.3 cfs	0.7 cfs	0.60%	24-inch	17.6 cfs	36.18
G2-H1	6.2 cfs	18.1 cfs	1.00%	30-inch	41.1 cfs	29.60
G3-G4	3.8 cfs	12.8 cfs	1.10%	24-inch	23.8 cfs	10.28
G4-H1	5.7 cfs	16.4 cfs	1.10%	24-inch	23.8 cfs	37.88
H2-H3	45.8 cfs	94.5 cfs	0.60%	48-inch	111.6 cfs	45.54
Pair at Inflow 'J'						
J2-J1	1.0 cfs	2.6 cfs	0.50%	24-inch	16.0 cfs	35.87
J1-End	1.8 cfs	4.1 cfs	0.60%	24-inch	17.6 cfs	76.59

Box Culvert Poa Annua Street						
PA1-PA2		102.1 cfs	0.50%	50-inch	113.6 cfs	90.00

INLET IDENTIFIER B-1

Inlet ID	Design Flow (Basin or DP)	Flow to Inlet 2yr	Flow to Inlet 5yr	Flow to Inlet 100yr	Inlet Type	Inlet Condition	Inlet Capacity 5yr	Inlet Capacity 100yr	Flow Not Captured by Inlet 5yr	Flow Not Captured by Inlet 100yr	to
A-1	DP 84		3.0cfs	8.6cfs	10' Type R	On Grade	3.0 cfs	6.9 cfs	0.0cfs	1.7cfs	to B-1
A-4	'A-4' (Temp)		4.4cfs	12.7cfs	Temp. Grate at MH	In Sump	10.0 cfs	24.0 cfs	0.0cfs	0.0cfs	to C-1
B-1	D-16		2.5cfs	7.3cfs	10' Type R	On Grade	5.0 cfs	9.6 cfs	0.0cfs	0.0cfs	to C-1
C-1	DP 85		2.4cfs	6.9cfs	10' Type R	On Grade	2.4 cfs	5.8 cfs	0.0cfs	1.1cfs	to D-1
D-1	DP 86		4.4cfs	12.7cfs	10' Type R	On Grade	4.3 cfs	8.1 cfs	0.1cfs	5.7cfs	to G-2
D-4	DP 82		3.8cfs	11.1cfs	15' Type R	On Grade	3.8 cfs	9.9 cfs	0.0cfs	1.2cfs	to G-4
G-1	DP 89		0.3cfs	0.7cfs	20' Type R	In Sump	10.8 cfs	19.9 cfs	0.0cfs	0.0cfs	N/A
G-2	DP 88		6.2cfs	18.1cfs	15' Type R	On Grade	6.3 cfs	13.6 cfs	0.0cfs	10.1cfs	to G-1
G-3	DP 81		5.7cfs	16.4cfs	20' Type R	In Sump	10.8 cfs	19.9 cfs	0.0cfs	0.0cfs	N/A
G-4	DP 83		3.8cfs	11.0cfs	15' Type R	On Grade	3.8 cfs	7.1 cfs	0.0cfs	5.1cfs	J-1
E-1	DP 71		3.4cfs	9.9cfs	10' Type R	On Grade	3.4 cfs	8.5 cfs	0.0cfs	1.4cfs	to E-6
E-2	DP 69		2.6cfs	7.5cfs	10' Type R	On Grade	2.6 cfs	6.1 cfs	0.0cfs	1.4cfs	to E-6
E-6	DP 75		3.7cfs	10.8cfs	15' Type R	On Grade	3.9 cfs	11.1 cfs	0.0cfs	2.6cfs	to H-2
F-1	DP 77		2.3cfs	6.6cfs	10' Type R	In Sump	8.7 cfs	11.2 cfs	0.0cfs	0.0cfs	to H-2
H-2	DP 79		5.4cfs	15.5cfs	20' Type R	In Sump	18.2 cfs	19.9 cfs	0.0cfs	1.1cfs	to J-2
J-1	DP 92a		1.0cfs	2.6cfs	10' Type R	In Sump	8.7 cfs	8.7 cfs	0.0cfs	0.0cfs	to J-1
J-2	DP 92b		0.8cfs	1.5cfs	10' Type R	In Sump	8.7 cfs	8.7 cfs	0.0cfs	0.0cfs	G-1

Note: Storm Manholes A-4 and F-2 will serve as interim inlets pending development of Future Filing No. 12 to the west.

Note: Street Capacity Exceeded at Pennycress / Golden Buffs Intersection (DP 79) in Major Storm. Flows in excess of 5" depth will overtop asphalt and feed surrounding inlets G-1 & G-4, then J-1 & J-2.

INTERIM CONDITION (FILING NO. 10)

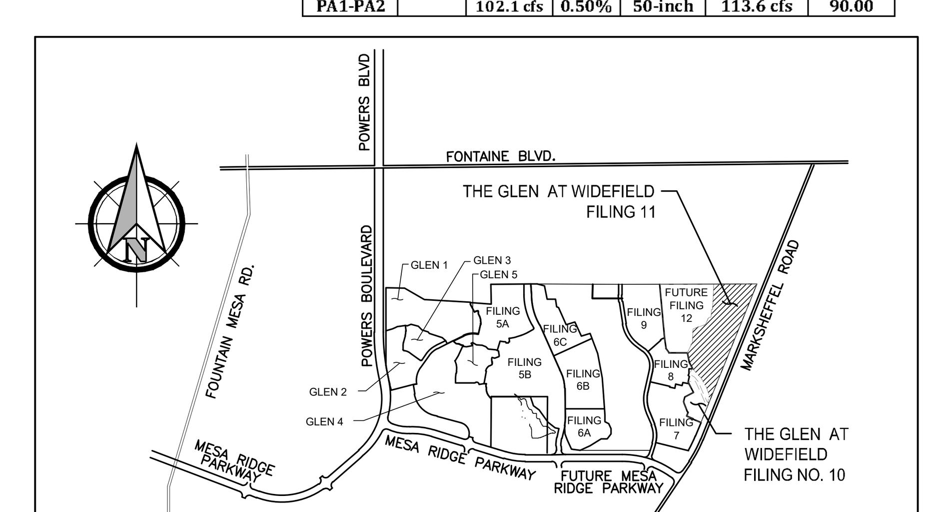
DETENTION BASIN 'D' DATA

	REQUIRED VOLUME	RELEASE RATE
WQCV	0.192 AC-FT	0.2 CFS
EURV	0.066 AC-FT	0.2 CFS
100-YR	1.525 AC-FT	18.8 CFS
100-YR + ½ WQCV	1.783 AC-FT	18.8 CFS
TOP OF EMBANKMENT ELEVATION: 5679.14		

ULTIMATE CONDITION (FILINGS 10-12)

DETENTION BASIN 'D' DATA

	REQUIRED VOLUME	RELEASE RATE
WQCV	0.827 AC-FT	1.4 CFS
EURV	1.035 AC-FT	1.5 CFS
100-YR	2.414 AC-FT	59.6 CFS
100-YR + ½ WQCV	2.828 AC-FT	59.6 CFS
TOP OF EMBANKMENT ELEVATION: 5679.14		



VICINITY MAP
SCALE: N.T.S.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

WIDEFIELD Investment Group

THE GLEN AT WIDEFIELD
FILING NO. 11
DEVELOPED DRAINAGE BASINS (OFF-SITE)
El Paso, County, Colorado

Project No.:	19016
Date:	April 30, 2021
Design:	MJK
Drawn:	MJK
Check:	AMcC
Revisions:	

SHEET
D-2
3 of 3 Sheets

19016 Filing 11 – Developed Conditions.dwg

Kiowa Engineering Corporation
Celebrating 30 years

Memorandum

To: El Paso County

From: Kiowa Engineering

Date: 01-07-2020

Project: The Glen Filing No 11.

Subject: SDI Worksheet Was Migrated to Filing 10

The EDB for all of Basin 'D' is now planned for construction with Filing 10, instead of Filing 11. The SDI Worksheet has been submitted along with Filing 10 documents.

The outlet structure plates will be modified at the time of Filing 11 development, but this does not require a new SDI Process to the best of our knowledge.

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