Drainage Report

Compark Village South, Filing No. 3 – Belford Ave East
Parker, Colorado

P.N. CLCPKC3

Prepared for:
Belford North Metropolitan District
8390 East Crescent Parkway
Greenwood Village, CO 80111

Prepared By:

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303-708-0500

Submitted: March 15, 2021
Revised:

This drainage report for Compark South, Filing No, 3 – Belford Ave East was prepared by me or under my direct supervision in accordance with the provisions of the *Town of Parker Storm Drainage and Environmental Criteria Manual*. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

_____

Gary T. Iwata, P.E.
Registered Professional Engineer
State of Colorado No. 37642

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I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This project is part of the Compark Village South development. The purpose of this report is to demonstrate the feasibility of the proposed storm drainage system planned to control the stormwater associated with a portion of Belford Avenue and a future development. Drainage criteria are in accordance with the *Town of Parker Storm Drainage and Environmental Criteria Manual* (*Town Criteria*) *and Urban Drainage and Flood Control District Criteria Manual* (*Urban Drainage Criteria*).

B. Location

Compark Village South Filing No, 3 – Belford Ave East lies within the south half of Section 6, Township 6 South, Range 66 West of the Sixth Principal Meridian, Town of Parker, Colorado. General project area boundaries include Highway E-470 to the north, the future Compark Village South Filing No. 3 residential development to the south, Compark Village South Filing No. 1 to the north, and Happy Canyon Creek to the east (see vicinity map in Appendix A). The project lies within drainage basin F as described in the Compark Village South Filing No. 1 drainage report (see map in Appendix D). The project includes a 1,585-foot continuation of a major collector road, Belford Avenue, running east-west connecting South Peoria Street to South Chambers Road.

C. Description of Property

The Compark Village South Filing No. 3 – Belford Ave Development Site consists of approximately 5.5 acres, and is mostly vacant with ground cover consisting of native grasses and shrubs. Onsite soils consist of Newlin gravelly sandy loam, Satanta loam and Loamy alluvial land in the area of the proposed bridge crossing. These soils are classified as hydrologic group B. Refer to Appendix A of this report for excerpts of the SCS soil survey summary.

D. Floodplain Information

Compark Village South Filing No. 3 – Belford Ave is located within the Happy Canyon Creek major drainage basin which has a regulatory 100-year floodplain. Firm Map No 08035C0062G, Effective date: March 16, 2016 reflects a Zone AE and Zone X floodplain across the eastern edge of the site. Refer to Appendix A for FIRMETTE copies of the FIRM Map. A

Floodplain Development Permit from the Town of Parker will be required for any construction within the documented floodplains on the property.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The entirety of this project lies within the Happy Canyon Creek drainage basin, which has been studied by the Urban Drainage and Flood Control District under the following studies:

- UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County, prepared by Kiowa Consultants, June 1993. Urban Drainage in conjunction with sponsor partners Town of Parker and Douglas County are planning on updating the Happy Canyon Creek OSP.

- Green Acres Tributary is a part of the Happy Canyon Creek watershed. The upstream area of the Green Acres Tributary contains several existing and proposed development projects that contain features for which drainage studies have been prepared. All current upstream drainage features are part of the Meridian Office Park, Filings 4 & 5 (reference 5) master drainage analysis.

- Happy Canyon Creek Major Drainageway Plan, prepared by Muller Engineering Company, March 2014.

- Amendment to Happy Canyon Creek Major Drainageway Plan, March 2014, prepared by Manhard Consulting, February 2016.

The project area has further been described in the Compark Village Filing No. 1 Drainage Report as Basin F, comprised of 45 total acres. See Appendix D for the drainage map of this area.

B. Sub-Basin Description

The proposed site will be divided into several drainage sub-basins. These sub-basins have been determined based on land use, area, roadway slopes, storm sewer locations and inlet capacities. The developed site will generally follow the existing drainage patterns and runoff will be conveyed via overland flow and storm sewer to a proposed detention basin located directly south of the east side of the site.

BEL-E1

Drainage basin BEL-E1 is composed of landscaped area, sidewalk, and the south half of a portion of Belford Avenue. Storm water will flow northeast toward Design Point 1 where it will be collected by Inlet A. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.08 cfs excess runoff will bypass Inlet A and Inlet B and flow into sub basin BEL-E3 where it will be intercepted by Inlet C at Design Point 3.

BEL-E2

Drainage basin BEL-E2 is composed of landscaped area, sidewalk, and the south half of a portion of Belford Avenue. Storm water will flow east toward Design Point 2 where it will be collected by Inlet B. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.21 cfs excess runoff will bypass Inlet B and flow into sub basin BEL-E3 where it will be intercepted by Inlet C at Design Point 3.

BEL-E3

Drainage basin BEL-E3 is composed of landscaped area, sidewalk, and a continuation of the south half of Belford Avenue. Storm water will flow from the northwest and southeast towards Design Point 3 where it will be collected by Inlet C. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event plus the bypass from basins BEL-E1 and BEL-E2. Inlet C is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek.

BEL-E4

Drainage basin BEL-E4 is composed of landscaped area, sidewalk, and a continuation of the south half of Belford Avenue, as well as, the south half of the proposed bridge over Happy Canyon Creek. This drainage basin also includes approximately 150' of Belford Avenue located within the proposed Chambers Highpoint project. Storm water will flow from the southeast towards Design Point 3 where it will be collected by Inlet C. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event for BEL-E3 and BEL-E4 plus the bypass from basins BEL-E1 and BEL-E2. This inlet will also collect 0.1 cfs from Chambers Highpoint in the 5 yr storm and 3.0 cfs in the 100 yr storm. Inlet C is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek.

BEL-E5

Drainage basin BEL-E5 is composed of future landscaped area, sidewalk, and the north half of a portion of Belford Avenue. Storm water will flow northeast toward Design Point 4 where it will be collected by Inlet D. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.36 cfs excess runoff will bypass Inlet D and flow into sub basin BEL-E6 where it will be intercepted by Inlet E at Design Point 5.

BEL-E6

Drainage basin BEL-E6 is composed of future landscaped area, sidewalk, and the north half of a portion of Belford Avenue. Storm water will flow east toward Design Point 5 where it will be collected by Inlet E. This is an on grade 10' Type R inlet with the capacity to handle the runoff from a 5 year storm event. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek. In the 100 year storm event, 0.67 cfs excess runoff will bypass Inlet E and flow

into sub basin BEL-E7 where it will be intercepted by Inlet F at Design Point 6.

BEL-E7

Drainage basin BEL-E7 is composed of future landscaped area, sidewalk, and the north half of a portion of Belford Avenue Storm water will flow from the northwest towards Design Point 6 where it will be collected by Inlet F. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event plus the bypass from basin BEL-E5 and BEL-E6. Inlet F is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality pond just southeast of Belford Avenue via storm sewer. This pond discharges directly to Happy Canyon Creek.

BEL-E8

Drainage basin BEL-E8 is composed of landscaped area, sidewalk, and a continuation of the north half of Belford Avenue, as well as, the north half of the proposed bridge over Happy Canyon Creek. This drainage basin also includes approximately 150' of Belford Avenue located within the proposed Chambers Highpoint project. Storm water will flow from the southeast towards Design Point 6 where it will be collected by Inlet F. This is a 10' Type R inlet in sump with the capacity to handle the runoff from a 100 year storm event for BEL-E3 and BEL-E4. Inlet F is in a 500-foot sag vertical curve. Street capacity for this inlet has been analyzed at 100-feet from the low point, showing adequate street capacity and conformance to section 6.3.2 of the Town Criteria. From there, storm water will be conveyed to the proposed detention/water quality basin just southeast of Belford Avenue via storm sewer. This detention basin discharges directly to Happy Canyon Creek.

POND

The drainage for the portion of Belford Avenue being constructed, as well as, future construction of Belford Avenue, and a future residential development, will all drain to the proposed detention basin. The pond is comprised of landscape area with drainage features such as a trickle channel, forebays, and an outlet structure. The detention basin has been designed with the 7.2 acres of Belford Avenue drainage, 1.08 acres from the pond area itself, and 6.5 acres of drainage from the development that will follow in the future, indicated by basin F3. The detention basin has been

designed for the areas described and shown on the attached drainage map in appendix D. Any areas outside of the basins shown have not been included in the detention basin volume calculation. The detention basin discharges directly to Happy Canyon Creek.

F3

Drainage basin F3 in its existing state is composed of undeveloped land and drains directly to Happy Canyon Creek. In developed conditions, it was assumed that the drainage basin would be 6.5 acres, making the total drainage area to the pond 14.77 acres. The imperviousness of the F3 subbasin was assumed to be 75%. The imperviousness of the basin was assumed to be 61% over the entire 14.77 acres. In developed conditions, there will be a need for an inlet to capture the runoff from basin F3. Since walls are being constructed inside the detention basin, an inlet will be installed with pipe to the detention basin that will be used in the future development of the basin. The drainage for the development of this basin will be addressed by a separate drainage report.

The Compark Village Filing No. 1 Drainage Report identifies the area as Basin F, which totals 45 acres. The detention basin has been designed to accommodate the 14.77 acres tributary to the detention basin, leaving the remaining 30+/- acres draining to Happy Canyon Creek as it had in the existing condition.

III. DRAINAGE CHANNELS

A. Happy Canyon Creek

Happy Canyon Creek is a major basin that is tributary to Cherry Creek. The portion of Happy Canyon Creek thalweg that extends through the proposed site is a natural sandy bottom channel. The thalweg has an existing natural meander bend located near the southwest corner of the site. No apparent head cutting exists within this channel reach. The active channel is a dry stream bed that experiences active flows during wet seasonal conditions.

As discussed earlier, a Zone AE and Zone X floodplain exist along Happy Canyon Creek. It is anticipated that bank stabilization will be required along the outer edges of the existing meander bends. No major channel improvements are contemplated for Happy Canyon Creek, except the construction of a roadway bridge crossing needed for Belford Avenue and installation of grade control structures. This bridge structure will span the existing floodplain. Floodplain mitigation is anticipated through the thalweg. Felsburg Holt & Ullevig (FHU) has been contracted to perform the proposed

bridge design and floodplain mitigation. All proposed improvements to Happy Canyon Creek will be addressed in a separate drainage report.

A CLOMR has been obtained from FEMA to construct the proposed bridge crossing and proposed improvements to Happy Canyon Creek. The CLOMR was issued November 20, 2019 and the Case No. is 19-08-0690R.

Verification has been obtained from the USACOE that the proposed Happy Canyon improvements are authorized by Nationwide Permit (NWP) 29, Residential Developments.

A floodplain development permit will be required from the Town of Parker for the proposed bridge and channel improvements.

UDFCD and the Town of Parker have sponsored an update to the existing Happy Canyon Creek Outfall Systems Plan (OSP) and the 2014 Happy Canyon Creek Major Drainageway Plan (MDP). Any recommendations to channel upgrades to this reach of Happy Canyon Creek need to meet the recommendations of the OSP and 2014 MDP. Channel design and the Happy Canyon Creek bridge design must be reviewed and approved by UDFCD prior to the approval of associated drawings.

Note: All channel improvement design and construction shall meet the minimum requirements of the UDFCD maintenance eligibility program.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

The regulations, guidelines, and drainage design criteria to be used are those contained within the *Town of Parker Storm Drainage Design and Environmental Criteria* and the *Urban Storm Drainage Criteria Manual*. The general drainage concept is to construct a detention basin to provide detention and water quality before releasing runoff from Belford Avenue and future residential development into Happy Canyon Creek.

B. Hydrologic Criteria

The Town of Parker *Storm Drainage and Environmental Criteria Manual* and the Urban Drainage and Flood Control District (UDFCD) *Urban Storm Drainage Criteria Manual* were used for the storm drainage system design.

The following criteria was utilized in developing the proposed drainage system:

- The proposed drainage system is designed to match, as best as possible, the historic drainage patterns occurring at the site.
- The proposed drainage system attempts to limit the diversion of storm runoff from one basin to another (basin transfer).
- Runoff generated from drainage sub-basins is conveyed via the proposed storm sewer system into the proposed detention and water quality pond.

Design Rainfall: UDFCD rainfall data is used to determine peak runoff values. The 5-year and 100-year frequency storms are used as the minor and major design storms respectively.

Runoff Calculation: Peak storm runoff is determined using the rational formula,

Q = CIA (CFS)
C = Runoff coefficient based on surface impermeability
I = Rainfall intensity in inches per hour
A = Drainage basin area in acres

UDFCD Imperviousness Values (Table 6-3) and Runoff Coefficients (Table 6-5) were used to develop basin runoff coefficients. These tables can be found in Appendix B. The runoff coefficients are weighted for each applicable sub-basin to more accurately reflect the runoff characteristics of the site.

Time of Concentration is determined using the criteria in Sections 3.4.1 and 3.4.2 of the UDFCD Criteria Manual. These calculations are included in Appendix B.

Rainfall intensities are determined using the Town of Parker's *Storm Drainage and Environmental Criteria Manual* Point Rainfall data and Intensity-Duration curves.

C. Hydraulic Criteria

The following *Town Criteria* were utilized in determining allowable street flow.

Minor Storm (5-yr) from Table 2.4

- Collector Street – No curb overtopping. Flow Spread must leave at least a 10 foot width free of water. (5-feet on each side of crown for roads without median. 10-feet on each side of median for roads with a median.)

Major Storm (100-yr) from table 2.5

- Local and Collector Streets – The depth of water at the gutter flowline shall not exceed 12 inches. A minimum of 18-inches must be provided from the water surface elevation to the lowest floor elevation or window well opening elevation for structures that are adjacent to the roadway (this includes residential dwellings, public, commercial and industrial buildings).

For the major and minor storm events, allowable capacity was determined using UD-Inlet version 4.06 by UDFCD.

V. DRAINAGE FACILITY DESIGN

A. General Concept

Stormwater runoff from the proposed improvements will generally follow existing drainage patterns from northwest to southeast on the site. Overland flow and a proposed storm sewer system will route the runoff to the proposed detention and water quality basin. This detention basin will release restricted flows directly into Happy Canyon Creek.

B. Specific Details

As mentioned previously in this report, the site will be divided into several drainage sub-basins. The onsite runoff will be routed through the site via the proposed roadways and gutters where it will be intercepted by a number of on-grade inlets and inlets located in roadway sumps. This runoff will be routed, via storm sewer, directly to the proposed detention/water quality basin. The detention basin has been sized to accommodate the flows resulting from the areas shown on the drainage map. Any area outside of the basins depicted on the drainage map and described in this report have not been considered as tributary to the proposed detention basin.

The proposed detention/water quality basin has been sized to intercept surface runoff from a portion of Belford Avenue, as shown on the drainage map, and a developed residential area, referred to as F3 in the sub-basin descriptions, for a total of approximately 14.77 acres (Full Buildout). The detention basin will release attenuated flows into the existing natural drainageway of Happy Canyon Creek via an outlet structure. The outlet structure has been designed to release controlled WQCV, EURV, and 100-

year volume flows, allowing for sediment and trash removal and decreasing adverse downstream impacts. Required detention volumes were calculated using the UDFCD UD-Detention spreadsheet as described in the Town of Parker Storm Drainage and Environmental Criteria Manual. Basin tables and charts used in the rational method analysis, along with calculation sheets, are provided in Appendix B.

VI. ENVIRONMENTAL PROTECTION CRITERIA

A. General

Site drainage improvements are intended to minimize the impact to the environment.

B. Construction BMP Plan

Construction BMPs shall be placed during the appropriate construction phases to minimize soil erosion and the movement of sediment offsite. Construction BMPs shall be placed in two phases (Phase A and Phase B). The intent of the Phase A BMPs are to fulfill water quality objectives during the overlot and roadway rough grading phase of the project. Once Phase A rough grading and earthmoving is completed, Phase B BMP placement will commence. Phase B includes fine grading, utility construction, and street construction. Construction Plans will contain all appropriate Stormwater Management Details. In addition, a Stormwater Management Plan will be prepared to meet the town of Parker, State of Colorado, and Environmental Protection Agency criteria.

VI. CONCLUSION

This drainage report is intended to comply with all major standards of the Town of Parker and the Urban Drainage Flood Control District. This overall plan for the site's drainage design is effective and economical for controlling damage due to excess storm runoff and minimizing erosive discharges. This plan is intended to integrate into the future basin planning efforts by UDFCD, Douglas County and the Town of Parker when the Happy Canyon Creek Outfall System Planning study is updated.

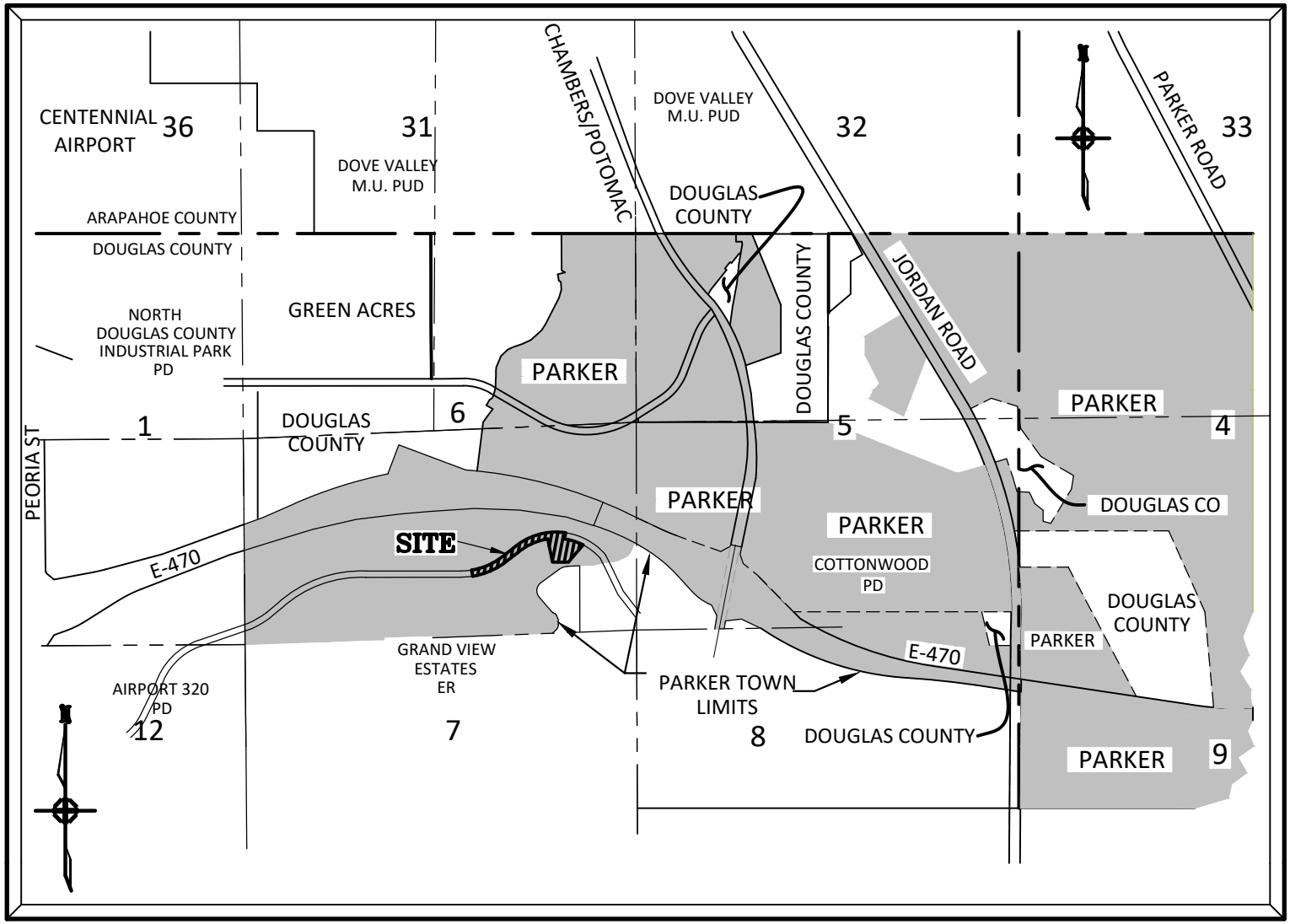
VII.REFERENCES

1. *Soil Survey of Castle Rock Area*, US Department of Agriculture Soil Conservation Service, September 23, 2014.
2. *Town of Parker Storm Drainage and Environmental Criteria Manual*, last revised February 2014.
3. *Urban Storm Drainage Criteria Manual*, Volumes 1–3, Urban Drainage and Flood Control District, 2010, with current revisions.
4. *UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County*, prepared by Kiowa Consultants, June 1993.
5. UDFCD – Happy Canyon Creek Master Drainage Plan, Muller Engineering March 2014.
6. Amendment to Happy Canyon Creek Major Drainageway Plan, March 2014, prepared by Manhard Consulting, February 2016.

APPENDIX A

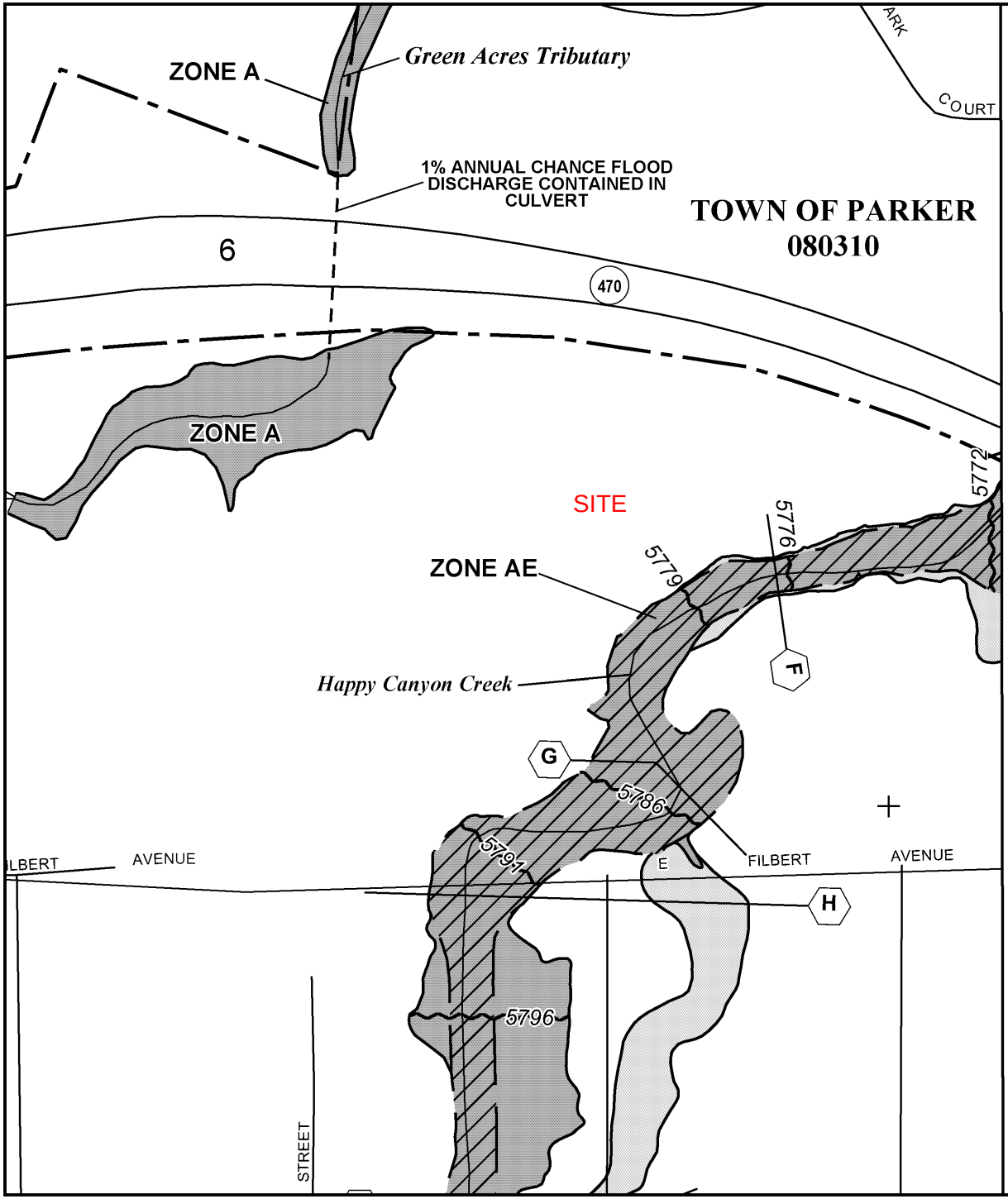
Maps

- Vicinity Map
- FEMA Flood Information Rate Map
- Soils Map



VICINITY MAP

N.T.S.



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0062G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 62 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

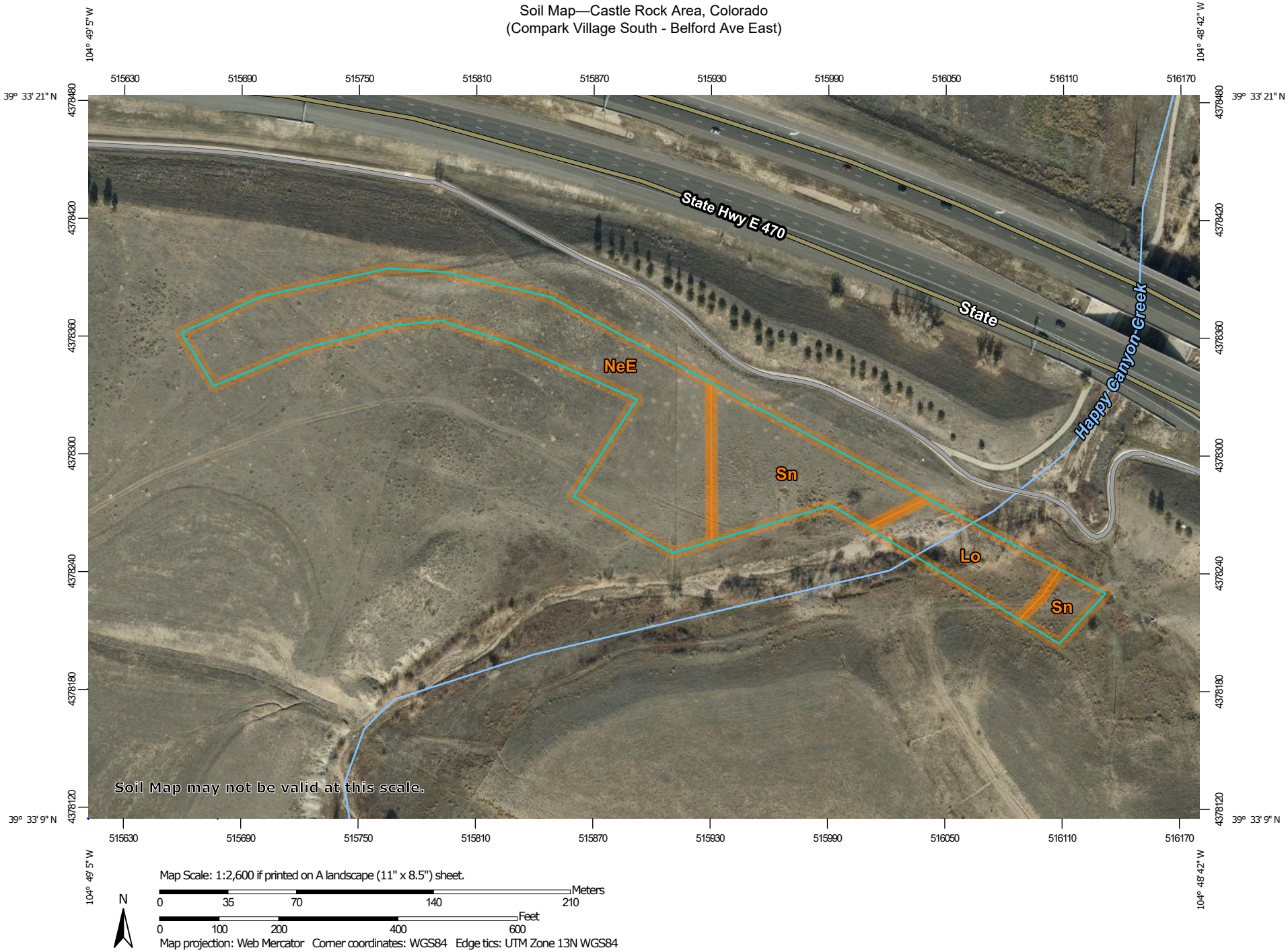
COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0062	G
LONE TREE, CITY OF	080319	0062	G
PARKER, TOWN OF	080310	0062	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0062G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

Soil Map—Castle Rock Area, Colorado
(Compark Village South - Belford Ave East)



Map Scale: 1:2,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 13, Jun 5, 2020

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

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Lo	Loamy alluvial land	0.6	13.3%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	2.8	59.6%
Sn	Satanta loam	1.3	27.1%
Totals for Area of Interest		**4.8**	**100.0%**

APPENDIX B

Hydrologic Analysis

- UDFCD Table 6-3
- UDFCD Table 6-4
- UDFCD Table 6-5
- UDFCD Figures 6-1, 6-2 & 6-3
- Composite C Calculations
- Time of Concentration Calculations
- Storm Runoff Calculations

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only)**:**	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group		Storm Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

The values for various catchment imperviousness and storm return periods are presented graphically in Figures 6-1 through 6-3, and are tabulated in Table 6-5. These coefficients were developed for the Denver region to work in conjunction with the time of concentration recommendations in Section 2.4. Use of these coefficients and this procedure outside of the semi-arid climate found in the Denver region may not be valid. The UD-Rational Excel workbook performs all the needed calculations to find the runoff coefficient given the soil type and imperviousness and the reader may want to take advantage of this macro-enabled Excel workbook that is available for download from the UDFCD's website www.udfcd.org.

See Examples 7.1 and 7.2 that illustrate the Rational Method.

Table 6-5. Runoff coefficients, *c*

Total or Effective % Impervious	NRCS Hydrologic Soil Group A						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.01	0.01	0.04	0.13	0.27
5%	0.02	0.02	0.02	0.03	0.07	0.15	0.29
10%	0.04	0.05	0.05	0.07	0.11	0.19	0.32
15%	0.07	0.08	0.08	0.1	0.15	0.23	0.35
20%	0.1	0.11	0.12	0.14	0.2	0.27	0.38
25%	0.14	0.15	0.16	0.19	0.24	0.3	0.42
30%	0.18	0.19	0.2	0.23	0.28	0.34	0.45
35%	0.21	0.23	0.24	0.27	0.32	0.38	0.48
40%	0.25	0.27	0.28	0.32	0.37	0.42	0.51
45%	0.3	0.31	0.33	0.36	0.41	0.46	0.54
50%	0.34	0.36	0.37	0.41	0.45	0.5	0.58
55%	0.39	0.4	0.42	0.45	0.49	0.54	0.61
60%	0.43	0.45	0.47	0.5	0.54	0.58	0.64
65%	0.48	0.5	0.51	0.54	0.58	0.62	0.67
70%	0.53	0.55	0.56	0.59	0.62	0.65	0.71
75%	0.58	0.6	0.61	0.64	0.66	0.69	0.74
80%	0.63	0.65	0.66	0.69	0.71	0.73	0.77
85%	0.68	0.7	0.71	0.74	0.75	0.77	0.8
90%	0.73	0.75	0.77	0.79	0.79	0.81	0.84
95%	0.79	0.81	0.82	0.83	0.84	0.85	0.87
100%	0.84	0.86	0.87	0.88	0.88	0.89	0.9
Total or Effective % Impervious	**NRCS Hydrologic Soil Group B**						
	2-Year	**5-Year**	**10-Year**	**25-Year**	**50-Year**	**100-Year**	**500-Year**
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.1	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.5	0.59
20%	0.13	0.15	0.22	0.38	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.2	0.23	0.3	0.44	0.49	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.5	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.7
50%	0.37	0.4	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.5	0.6	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.5	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.6	0.63	0.66	0.72	0.75	0.78	0.81
80%	0.64	0.67	0.7	0.75	0.77	0.8	0.83
85%	0.69	0.72	0.74	0.78	0.8	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.9

Table 6-5. Runoff coefficients, *c* (continued)

Total or Effective % Impervious	NRCS Hydrologic Soil Group C						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.5	0.6
10%	0.06	0.12	0.21	0.37	0.44	0.52	0.62
15%	0.1	0.16	0.24	0.4	0.47	0.55	0.64
20%	0.14	0.2	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.51	0.57	0.63	0.7
40%	0.3	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.4	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.5	0.6	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.65	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.6	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.7	0.73	0.76	0.79	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.83	0.85	0.87	0.88	0.89	0.89	0.9

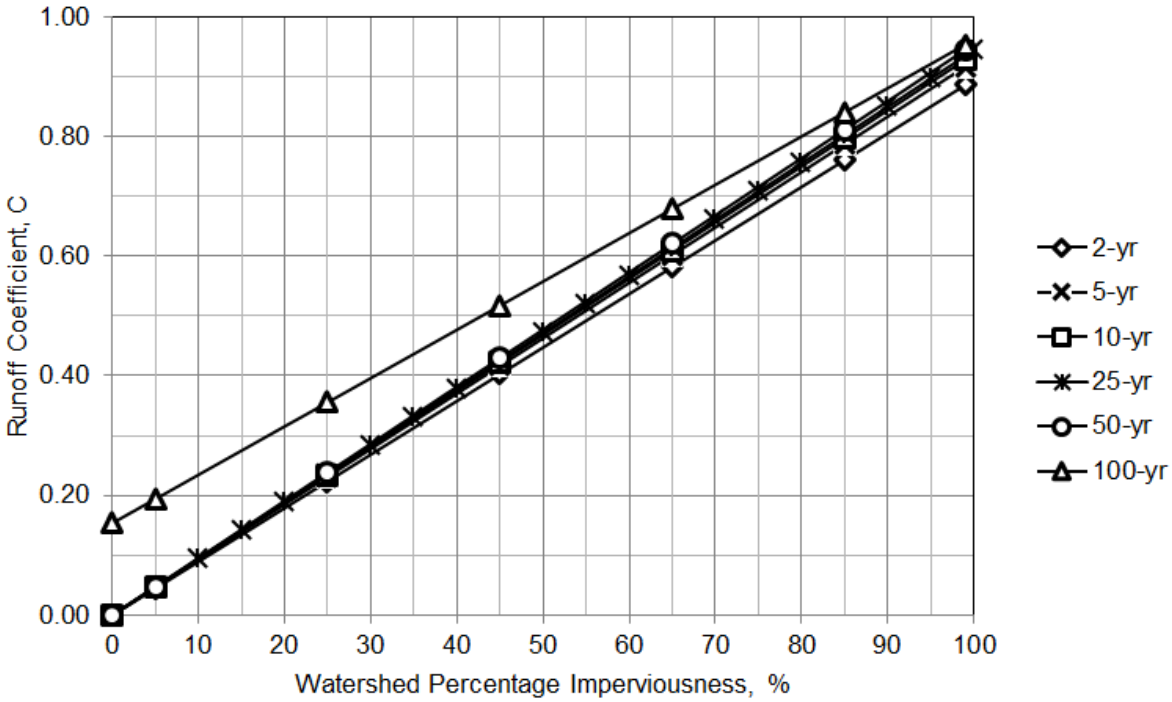


Figure 6-1. Runoff coefficient vs. watershed imperviousness NRCS HSG A

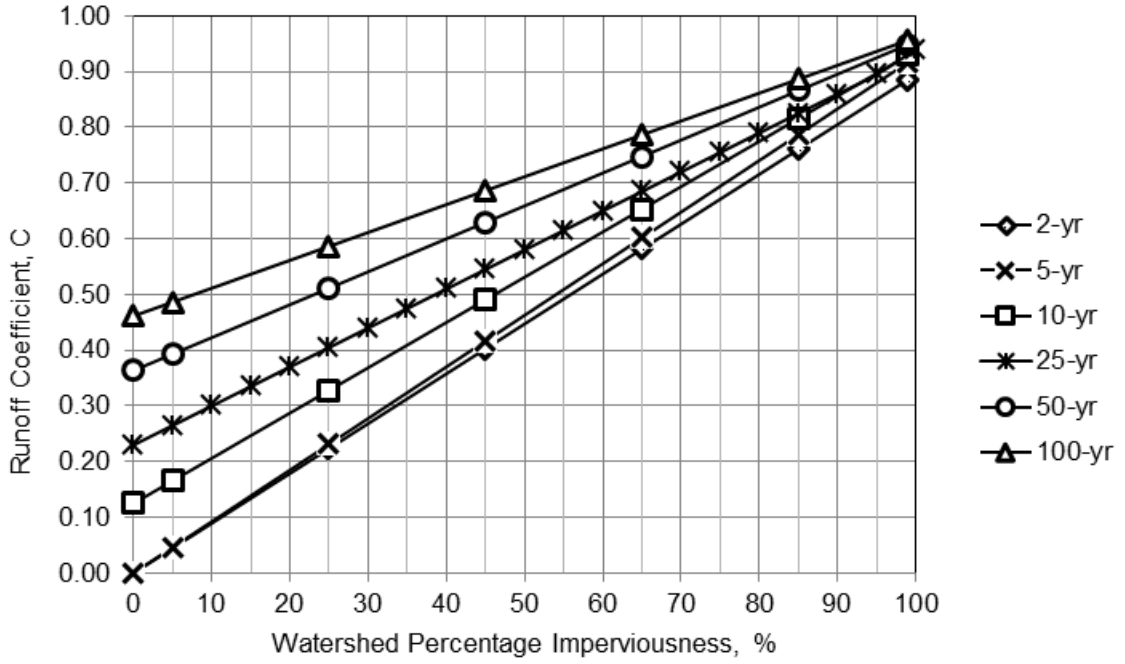


Figure 6-2. Runoff coefficient vs. watershed imperviousness NRCS HSG B

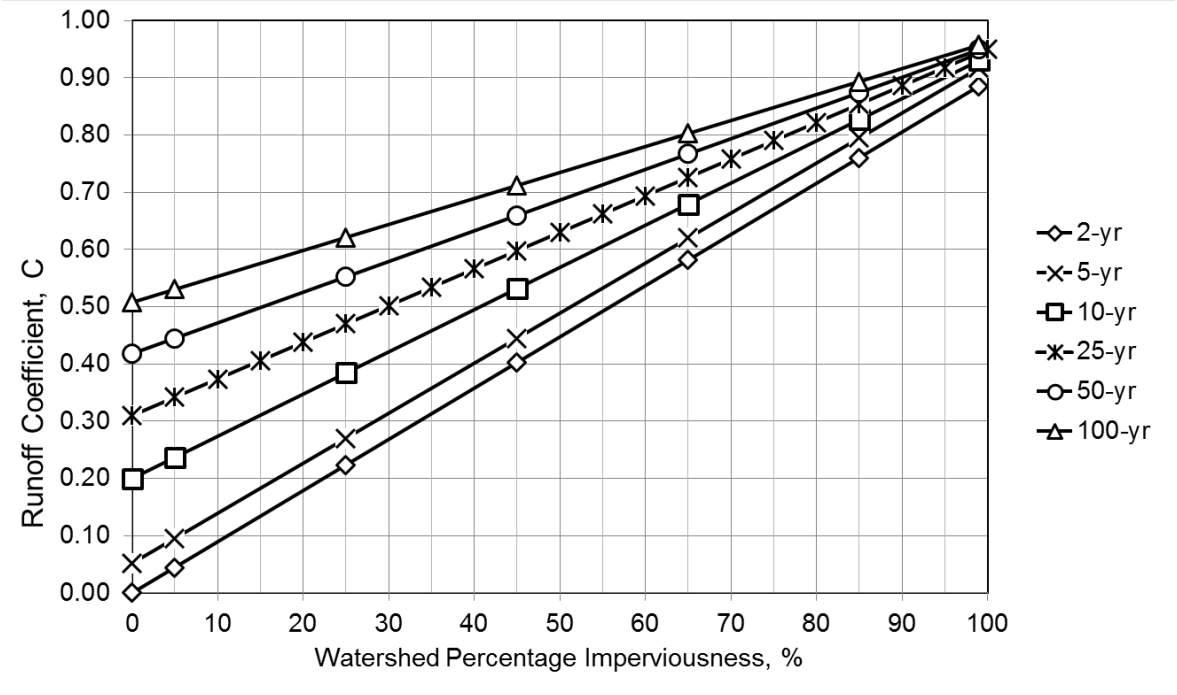


Figure 6-3. Runoff coefficient vs. watershed imperviousness NRCS HSG C and D

COMPOSITE C CALCULATION

PROJECT MANE: Compark Village South - Belford Avenue East
PROJECT NO: CLCPKC3
LOCATION: Town of Parker, Colorado

*Calculations on this sheet come from UDFCD: Urban Storm Drainage Criteria Manual (V.1) (2017)

NRCS Hydrologic Soil Group: B

Lawns, clayey soil			2% Impervious	
2 yr = 0.01	5 yr = 0.01	10 yr = 0.07	100 yr = 0.44	
Paved			100% Impervious	
2 yr = 0.84	5 yr = 0.86	10 yr = 0.87	100 yr = 0.90	
Roofs			90% Impervious	
2 yr = 0.74	5 yr = 0.77	10 yr = 0.79	100 yr = 0.85	
Drive and walks			90% Impervious	
2 yr = 0.74	5 yr = 0.77	10 yr = 0.79	100 yr = 0.85	

PROPOSED DRAINAGE AREA

BASIN ID	A_{total} (ft²)		Lawns, clayey soil (ft²)	Paved (ft²)	Roofs (ft²)	Drive and walks (ft²)	A_{total} (Ac)	COMPOSITE C 2 yr	5 yr	10 yr	100 yr	Percent Impervious
BEL-E1	39980		15597	21487		2896	0.92	0.51	0.52	0.55	0.72	61%
BEL-E2	44557		16404	24917		3236	1.02	0.53	0.54	0.57	0.73	63%
BEL-E3	20774		5594	13365		1815	0.48	0.61	0.62	0.65	0.77	73%
BEL-E4	18344		1654	15850		840	0.42	0.76	0.78	0.79	0.86	91%
BEL-E5	55481		27615	25139		2727	1.27	0.42	0.43	0.47	0.67	51%
BEL-E6	87902		61489	23215		3198	2.02	0.26	0.26	0.31	0.58	31%
BEL-E7	23254		6437	14722		2095	0.53	0.60	0.62	0.64	0.77	72%
BEL-E8	22712		4343	17384		985	0.52	0.68	0.69	0.71	0.81	81%
F3 (Tract G	283303		70948	212355			6.50	0.60	0.65	0.69	0.79	75%
POND	47171		47171				1.08	0.01	0.01	0.07	0.44	2%
Subtotals:	643,478	0	257,252	368,434	0	17,792						61%

Drainage Area= 14.77

TIME OF CONCENTRATION (Rational Method)

PROJECT NAME: Compark Village South - Belford Avenue East
PROJECT NO: CLCPKC3
LOCATION: Town of Parker, Colorado

*Calculations on this sheet come from UDFCD: Urban Storm Drainage Criteria Manual (V.1) (2017)

SUB-BASIN DATA			INITIAL TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)		FINAL t_c	REMARKS
BASIN ID	C_5	AREA Ac	LENGTH (ft)	SLOPE (ft/ft)	t_i (min)	LENGTH (ft)	SLOPE (ft/ft)	C_v	t_t (min)	TRAVEL LENGTH (ft)	$T_{c\ Reg}$ (min)	(min)	
BEL-E1	0.52	0.92	41	0.020	5.32	540	0.030	20.00	2.60	540.00	18.58	7.92	
BEL-E2	0.54	1.02	51	0.020	5.74	505	0.032	20.00	2.35	505.00	17.89	8.09	
BEL-E3	0.62	0.48	51	0.020	4.89	825	0.033	20.00	3.78	825.00	17.58	8.67	
BEL-E4	0.78	0.42	150	0.034	4.76	222	0.020	20.00	1.31	222.00	11.79	6.07	
BEL-E5	0.43	1.27	58	0.020	7.30	527	0.030	20.00	2.54	527.00	20.53	9.84	
BEL-E6	0.26	2.02	149	0.020	14.69	517	0.030	20.00	2.49	517.00	24.44	17.18	
BEL-E7	0.62	0.53	40	0.020	4.39	824	0.033	20.00	3.78	824.00	17.73	8.17	
BEL-E8	0.69	0.52	150	0.034	6.03	235	0.020	20.00	1.38	235.00	13.62	7.42	
POND	0.01	1.08	75	0.250	5.89	10	0.010	20.00	0.08	10.00	25.84	5.97	

RUNOFF COMPUTATIONS

(RATIONAL METHOD)

PROJECT NAME: Compark Village South - Belford Avenue East
PROJECT NO: CLCPKC3
LOCATION: Town of Parker, Colorado

Manhard CONSULTING

*Calculations on this sheet come from UDFCD: Urban Storm Drainage Criteria Manual (V.1) (2017)

BASIN ID	DESIGN POINT	AREA Ac	COMPOSITE C				A*C				t_c (min)	INTENSITY (in/hr)				Q (cfs)			
			2 yr	5 yr	10 yr	100 yr	2 yr	5 yr	10 yr	100 yr		2 yr	5 yr	10 yr	100 yr	2 yr	5 yr	10 yr	100 yr
BEL-E1	1	0.92	0.51	0.52	0.55	0.72	0.47	0.48	0.51	0.66	7.92	2.45	3.22	3.92	6.81	1.14	1.54	1.99	4.48
BEL-E2	2	1.02	0.53	0.54	0.57	0.73	0.54	0.55	0.58	0.74	8.09	2.43	3.19	3.89	6.76	1.31	1.76	2.27	5.03
BEL-E3	3	0.48	0.61	0.62	0.65	0.77	0.29	0.30	0.31	0.37	8.67	2.37	3.11	3.80	6.60	0.69	0.93	1.17	2.43
BEL-E4	3	0.42	0.76	0.78	0.79	0.86	0.32	0.33	0.33	0.36	6.07	2.67	3.50	4.27	7.42	0.85	1.15	1.43	2.68
BEL-E5	4	1.27	0.42	0.43	0.47	0.67	0.54	0.55	0.60	0.85	9.84	2.26	2.97	3.62	6.29	1.21	1.63	2.16	5.36
BEL-E6	5	2.02	0.26	0.26	0.31	0.58	0.52	0.53	0.62	1.16	17.18	1.76	2.32	2.83	4.91	0.91	1.23	1.75	5.71
BEL-E7	6	0.53	0.60	0.62	0.64	0.77	0.32	0.33	0.34	0.41	8.17	2.42	3.18	3.88	6.74	0.78	1.05	1.33	2.76
BEL-E8	6	0.52	0.68	0.69	0.71	0.81	0.35	0.36	0.37	0.42	7.42	2.50	3.29	4.01	6.97	0.88	1.19	1.49	2.94
POND	7	1.08	0.01	0.01	0.07	0.44	0.01	0.01	0.08	0.48	5.97	2.68	3.52	4.29	7.46	0.03	0.04	0.33	3.55
																	10.51		31.39

Designer: JMP Date: 3/18/2021, 8:28 AM

APPENDIX C

Hydraulic Analysis

- Inlet Capacity Calculations
- StormCAD Storm Sewer Design
    - 5-Year Storm Table and Profiles
    - 100-Year Storm Table and Profiles
- Full Spectrum Detention Basin Design

5 yr Capacity Calculations (Rational Method)

PROJECT NAME: Compark Village South - Belford Avenue East
PROJECT NO: CLCPKC3
LOCATION: Town of Parker, Colorado

*Calculations on this sheet come from UDFCD: Urban Storm Drainage Criteria Manual (V.1) (2017)

FLOWS					STREET CAPACITY			INLET CAPACITY AND CARRY-OVER						
Basin ID Number	Design Point	Direct Flow Qd (cfs)	Carry-over flow Qco (cfs)	Total Flow Qt (cfs)	Minimum Street Slope (%)	Maximum Street Capacity (cfs)	Capacity Check	Inlet ID	Type	Condition	Inlet Capacity (cfs)	Intercepted Flow (cfs)	Carry-Over Flow (cfs)	Carry-Over to Design
BEL-E1	1	1.54	0.00	1.54	3.12	17.1	OK	A	10' Type R	On Grade	1.60	1.54	-	N/A
BEL-E2	2	1.76	0.00	1.76	3.12	17.5	OK	B	10' Type R	On Grade	1.80	1.76	-	N/A
BEL-E3	3	0.93	0.00	0.93	0			C						
BEL-E4	3	1.15	1.03	2.18	0	16.9	OK	C	10' Type R	In Sump	10.50	2.18	-	N/A
BEL-E5	4	1.63	0.00	1.63	3.12	17.5	OK	D	10' Type R	On Grade	1.63	1.63	0.00	N/A
BEL-E6	5	1.23	0.00	1.23	3.12	17.5	OK	E	10' Type R	On Grade	1.23	1.23	-	N/A
BEL-E7	6	1.05	0.00	1.05	0			F					-	
BEL-E8	6	1.19	0.00	1.19	0	16.9	OK	F	10' Type R	In Sump	10.50		-	N/A
													-	
CHAMBERS	3	0.00	0.10	0.10				C						3
HP														
													-	
													-	
													-	
													-	
													-	
													-	
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													-	

100 yr Capacity Calculations (Rational Method)

PROJECT NAME: Compark Village South - Belford Avenue East
PROJECT NO: CLCPKC3
LOCATION: Town of Parker, Colorado

*Calculations on this sheet come from UDFCD: Urban Storm Drainage Criteria Manual (V.1) (2017)

FLOWS					STREET CAPACITY			INLET CAPACITY AND CARRY-OVER						
Basin ID Number	Design Point	Direct Flow Qd (cfs)	Carry-over flow Qco (cfs)	Total Flow Qt (cfs)	Minimum Street Slope (%)	Maximum Street Capacity (cfs)	Capacity Check	Inlet ID	Type	Condition	Inlet Capacity (cfs)	Intercepted Flow (cfs)	Carry-Over Flow (cfs)	Carry-Over to Design
BEL-E1	1	4.48	0.00	4.48	3.12	139	OK	A	10' Type R	On Grade	4.40	4.40	0.08	2
BEL-E2	2	5.03	0.08	5.11	3.12	139	OK	B	10' Type R	On Grade	4.80	4.80	0.31	3
BEL-E3	3	2.43	0.31	2.74	0			C						
BEL-E4	3	2.68	5.64	8.32	0	164.9	OK	C	10' Type R	In Sump	23.80	8.32	-	N/A
BEL-E5	4	5.36	0.00	5.36	3	139	OK	D	10' Type R	In Sump	5.00	5.00	0.36	5
BEL-E6	5	5.71	0.36	6.07	3	139	OK	E	10' Type R	On Grade	5.40	5.40	0.67	6
BEL-E7	6	2.76	0.67	3.43			OK	F					-	6
BEL-E8	6	2.94	3.43	6.37	0	164.9	OK	F	10' Type R	In Sump	23.80	6.37	-	
													-	
HAMBERS H	6	0.00	3.00	3.00				C						3
HP														
													-	
													-	
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Version 4.06 Released August 2018

INLET MANAGEMENT

Worksheet Protected

INLET NAME	INL-A	INL-B	INL-C	INL-D	INL-E	INL-F
Site Type (Urban or Rural)						
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.5	1.8	2.1	1.6	1.2	2.2
Major Q_{Known} (cfs)	4.5	5.0	5.1	5.4	5.7	5.7

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	INL-A	User-Defined	No Bypass Flow Received	INL-D	INL-E
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.1	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.1	3.3	0.0	0.4	0.7

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

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)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.5**	**1.8**	**2.2**	**1.6**	**1.2**	**2.2**
Major Total Design Peak Flow, Q (cfs)	**4.5**	**5.1**	**8.4**	**5.4**	**6.1**	**6.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	N/A	0.0	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.1	0.3	N/A	0.4	0.7	N/A

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

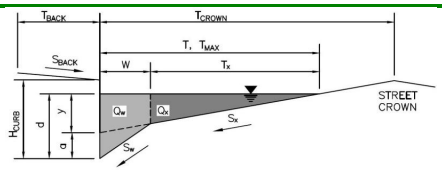
Version 4.06 Released August 2018

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

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

Project: Compark Village South - Belford Ave East

Inlet ID: INL-A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	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} =	37.0	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 =	0.031	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} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

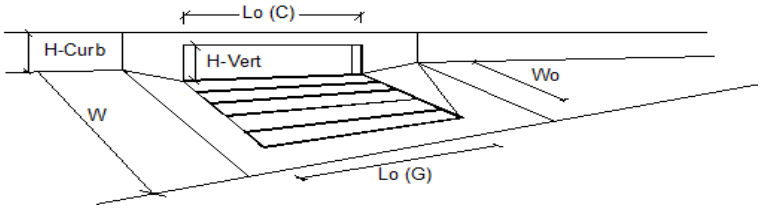
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**17.5**	**139.0**	**cfs**

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 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**4.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**97**	**%**

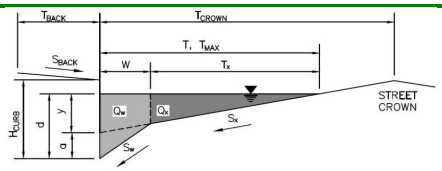
Version 4.06 Released August 2018

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

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

Project: Compark Village South - Belford Ave East

Inlet ID: INL-B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	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} =	37.0	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 =	0.031	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} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

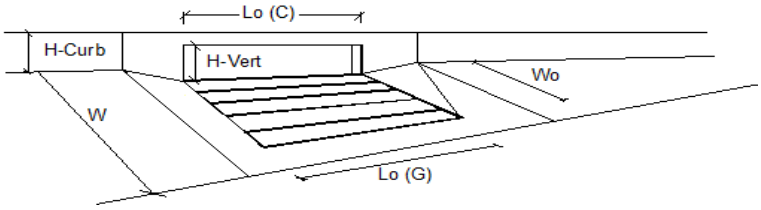
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**17.5**	**139.0**	**cfs**

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 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.8**	**4.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**94**	**%**

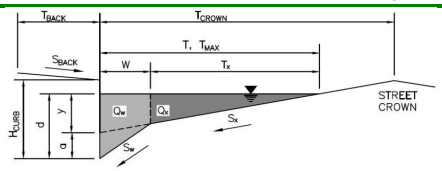
Version 4.06 Released August 2018

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

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

Project: Compark Village South - Belford Ave East

Inlet ID: INL-C



Gutter Geometry (Enter data in the blue cells)

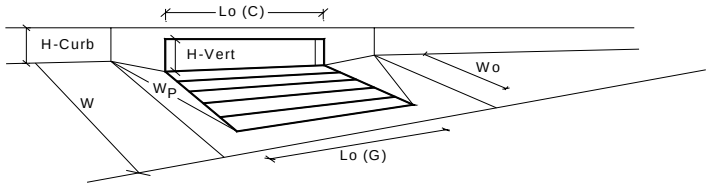
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	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} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.4	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.70	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.98	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.5**	**23.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	8.4	cfs

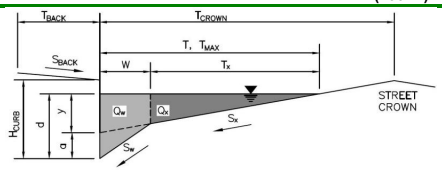
Version 4.05 Released March 2017

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

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

Project: Belford Avenue

Inlet ID: INL-C (100FT)



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	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} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.9**	**164.9**	**cfs**

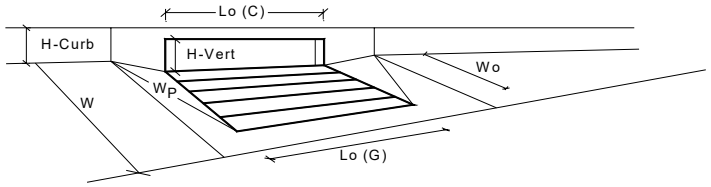
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

Per the requirements of *Town Criteria* Section 6.3.2, this sheet is provided to show the street drainage capacity at 100' from the lowpoint where inlet-C is located. Street slopes are equal at 100' on either side of the inlet.

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 =	2	2
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	10.4 inches
Grate Information			MINOR	MAJOR ☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A feet
Width of a Unit Grate		W_o =	N/A	N/A feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A
Curb Opening Information			MINOR	MAJOR
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00 feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00 inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00 inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40 degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00 feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67
Low Head Performance Reduction (Calculated)			MINOR	MAJOR
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.70 ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.98
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A
			MINOR	MAJOR
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**10.5**	**23.8** **cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	5.5	13.2 cfs

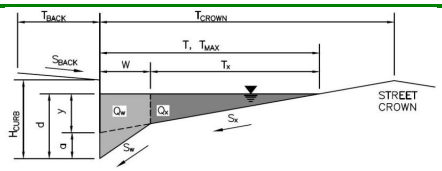
Version 4.06 Released August 2018

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

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

Project: Compark Village South - Belford Ave East

Inlet ID: INL-D



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	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} =	37.0	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 =	0.031	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} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

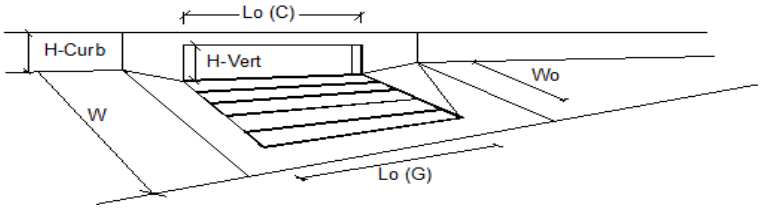
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**17.5**	**139.0**	**cfs**

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 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.6**	**5.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**93**	**%**

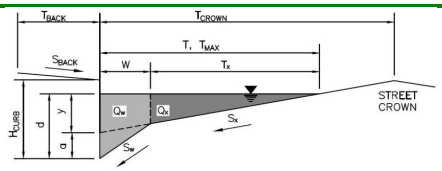
Version 4.06 Released August 2018

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

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

Project: Compark Village South - Belford Ave East

Inlet ID: INL-E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	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} =	37.0	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 =	0.031	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} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

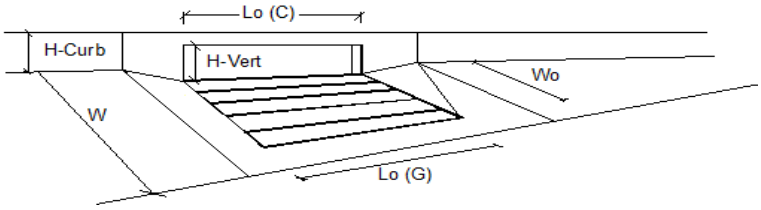
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**17.5**	**139.0**	**cfs**

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 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.2**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**89**	**%**

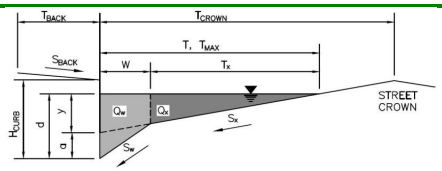
Version 4.06 Released August 2018

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

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

Project: Compark Village South - Belford Ave East

Inlet ID: INL-F



Gutter Geometry (Enter data in the blue cells)

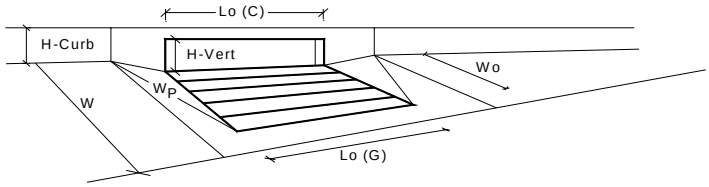
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	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} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.4	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.70	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.98	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.5**	**23.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	6.4	cfs

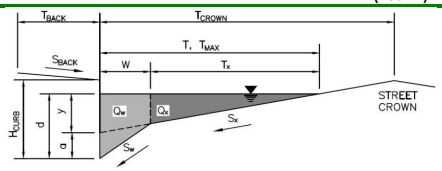
Version 4.05 Released March 2017

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

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

Project: Belford Avenue

Inlet ID: INL-F (100FT)



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	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} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	32.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**16.9**	**164.9**	**cfs**

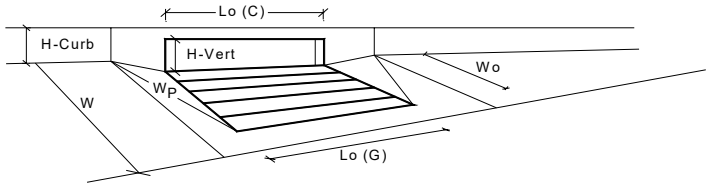
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

Per the requirements of *Town Criteria* Section 6.3.2, this sheet is provided to show the street drainage capacity at 100' from the lowpoint where inlet-F is located. Street slopes are equal at 100' on either side of the lowpoint.

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 =	2	2
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	10.4 inches
Grate Information			MINOR	MAJOR ☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A feet
Width of a Unit Grate		W_o =	N/A	N/A feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A
Curb Opening Information			MINOR	MAJOR
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00 feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00 inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00 inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40 degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00 feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67
Low Head Performance Reduction (Calculated)			MINOR	MAJOR
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.70 ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.98
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A
			MINOR	MAJOR
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**10.5**	**23.8** **cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	5.1	13.7 cfs

Catch Basin Table

Compark Village South - Belford Avenue East

Active Scenario: 5 Year

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Captured) (cfs)	Flow (Total Out) (cfs)	Velocity (In) (ft/s)	Velocity (Out) (ft/s)	Hydraulic Grade Line (In) (ft)	Notes
INL-A	5,811.23	5,805.52	1.54	1.54	3.29	3.29	5,805.99	10' TYPE R
INL-B	5,792.88	5,787.93	1.76	1.76	3.42	3.42	5,788.43	10' TYPE R
INL-C	5,783.55	5,779.41	5.50	5.50	2.22	2.22	5,780.88	10' TYPE R
INL-D	5,811.23	5,806.21	1.63	1.63	3.35	3.35	5,806.69	10' TYPE R
INL-E	5,791.99	5,787.93	1.23	1.23	3.09	3.09	5,788.34	10' TYPE R
INL-F	5,783.55	5,779.41	5.06	5.06	2.04	2.04	5,780.88	10' TYPE R

Manhole Table

Compark Village South - Belford Avenue East

Active Scenario: 5 Year

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Velocity (In) (ft/s)	Velocity (Out) (ft/s)	Bolted Cover?	Notes
STMH-1	5,811.31	5,804.47	3.17	6.19	4.09	False	4'
STMH-2	5,801.84	5,793.90	3.17	8.08	4.09	False	6'
STMH-3	5,793.13	5,786.87	6.16	4.10	4.64	False	5'
STMH-4	5,788.18	5,776.45	16.72	1.96	2.37	False	5'
STMH-5	5,784.35	5,778.78	10.56	1.70	2.00	True	5'

Pipe Table

Compark Village South - Belford Avenue East

Active Scenario: 5 Year

Start Node	Stop Node	Diameter (in)	Material	Length (Unified) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Slope (Calculated) (ft/ft)	Manning's n	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
INL-A	STMH-1	18.0	Concrete	27.4	5,805.52	5,804.69	1.54	18.28	6.29	0.030	0.013	5,805.99	5,804.99
STMH-1	STMH-2	18.0	Concrete	305.1	5,804.47	5,794.10	3.17	19.36	8.08	0.034	0.013	5,805.15	5,794.51
INL-D	STMH-1	18.0	Concrete	50.8	5,806.21	5,804.69	1.63	18.16	6.37	0.030	0.013	5,806.69	5,804.99
STMH-2	STMH-3	18.0	Concrete	272.0	5,793.90	5,787.37	3.17	16.28	7.14	0.024	0.013	5,794.58	5,787.82
STMH-3	STMH-4	24.0	Concrete	142.6	5,786.87	5,777.45	6.16	58.13	12.04	0.066	0.013	5,787.75	5,780.84
INL-B	STMH-3	18.0	Concrete	28.0	5,787.93	5,787.37	1.76	14.85	5.64	0.020	0.013	5,788.43	5,787.72
INL-E	STMH-3	18.0	Concrete	51.6	5,787.93	5,787.37	1.23	10.94	4.10	0.011	0.013	5,788.34	5,787.71
STMH-5	STMH-4	36.0	Concrete	253.2	5,778.78	5,776.75	10.56	59.72	6.37	0.008	0.013	5,780.88	5,780.84
STMH-4	FES-01	36.0	Concrete	82.9	5,776.45	5,775.62	16.72	66.73	2.37	0.010	0.013	5,780.84	5,780.79
INL-C	STMH-5	24.0	Concrete	39.0	5,779.41	5,779.08	5.50	20.80	5.59	0.008	0.013	5,780.88	5,780.88
INL-F	STMH-5	24.0	Concrete	39.2	5,779.41	5,779.08	5.06	20.76	5.45	0.008	0.013	5,780.88	5,780.88

Outfall Table

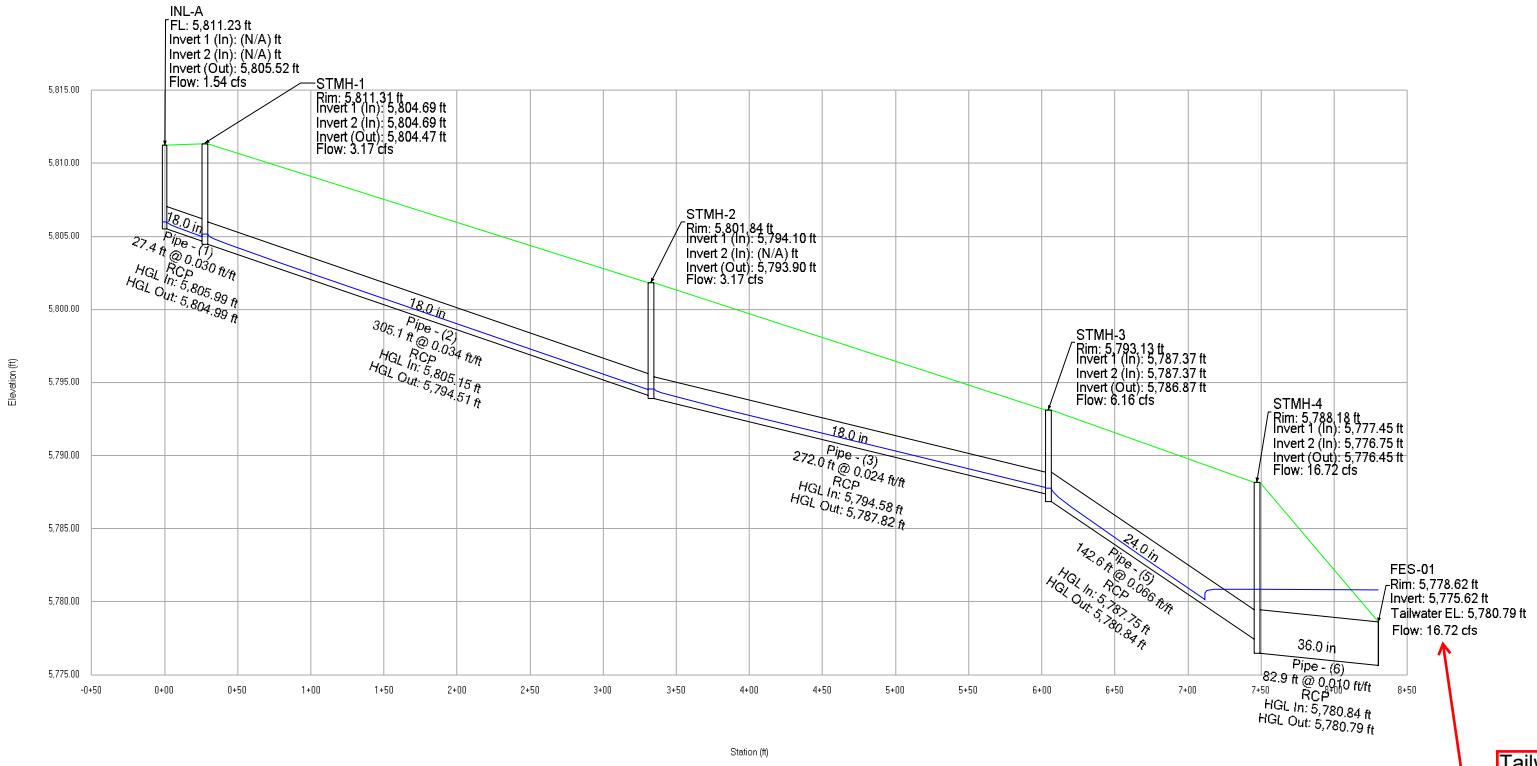
Compark Village South - Belford Avenue East

Active Scenario: 5 Year

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
FES-01	5,778.62	5,775.62	User Defined Tailwater	5,780.79	5,780.79	16.72	36"

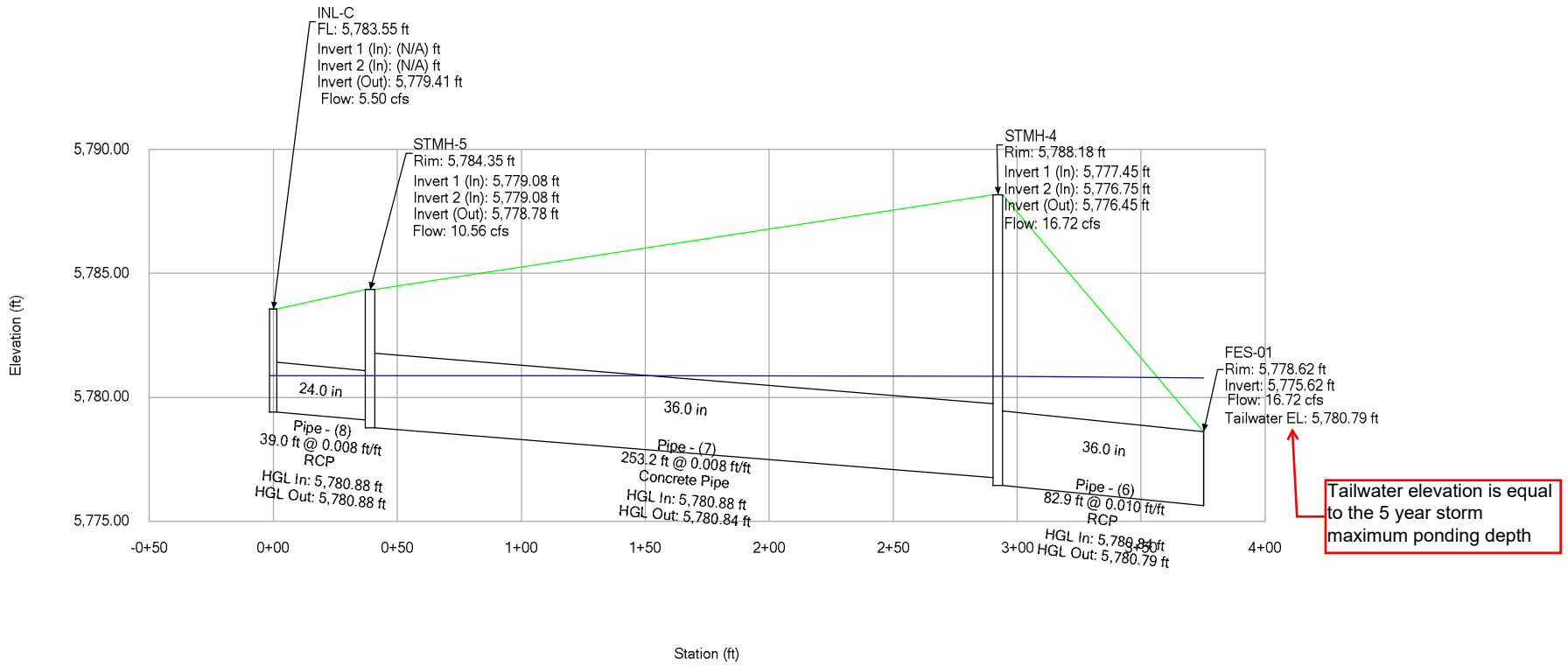
Compark Village South - Belford Avenue East

Active Scenario: 5 Year



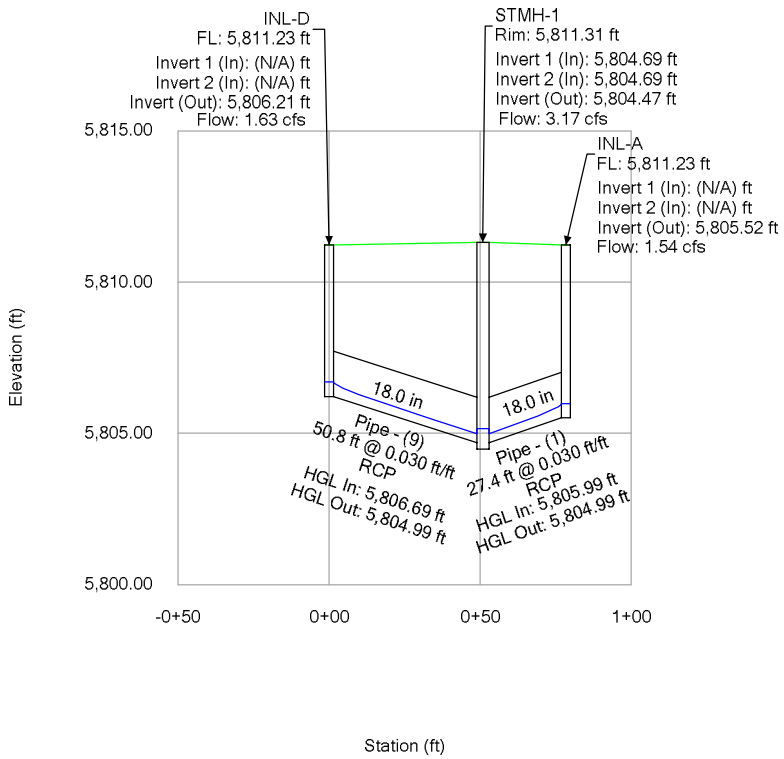
Tailwater elevation is equal to the 5 year storm maximum ponding depth

Compark Village South - Belford Avenue East
Active Scenario: 5 Year



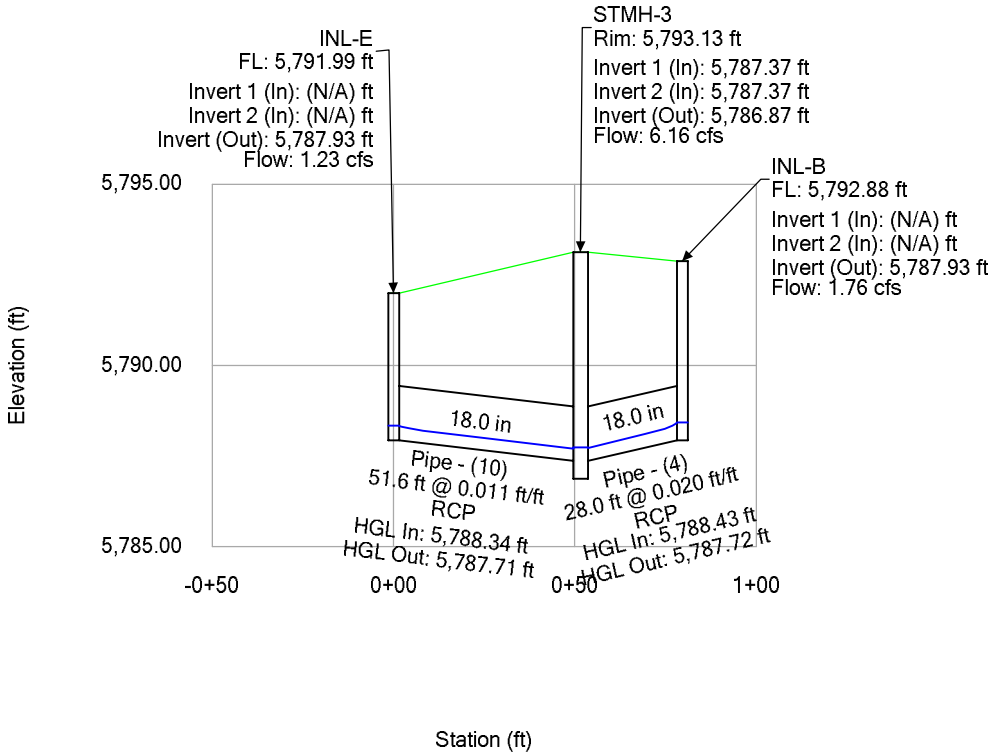
Compark Village South - Belford Avenue East

Active Scenario: 5 Year



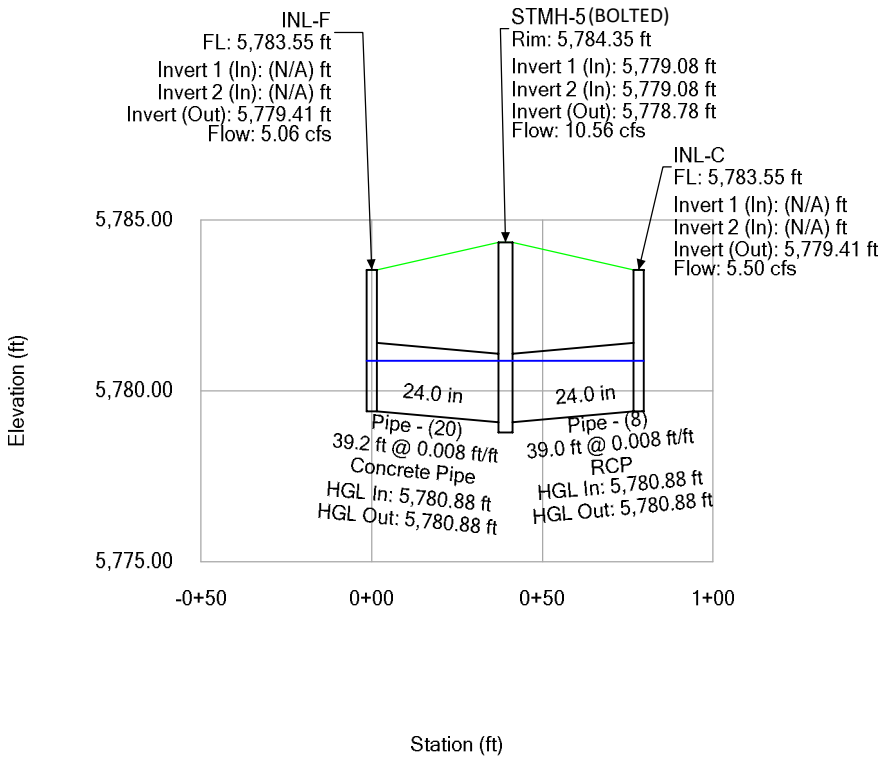
Compark Village South - Belford Avenue East

Active Scenario: 5 Year



Compark Village South - Belford Avenue East

Active Scenario: 5 Year



Catch Basin Table
Compark Village South - Belford Avenue East
Active Scenario: 100 Year

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Captured) (cfs)	Flow (Total Out) (cfs)	Velocity (In) (ft/s)	Velocity (Out) (ft/s)	Hydraulic Grade Line (In) (ft)	Notes
INL-A	5,811.23	5,805.52	4.40	4.40	4.56	4.56	5,806.32	10' TYPE R
INL-B	5,792.88	5,787.93	4.90	4.90	4.73	4.73	5,788.78	10' TYPE R
INL-C	5,783.55	5,779.41	13.08	13.08	4.16	4.16	5,783.55	10' TYPE R
INL-D	5,811.23	5,806.21	5.00	5.00	4.77	4.77	5,807.07	10' TYPE R
INL-E	5,791.99	5,787.93	5.40	5.40	4.91	4.91	5,788.83	10' TYPE R
INL-F	5,783.55	5,779.41	13.62	13.62	4.34	4.34	5,783.55	10' TYPE R

Manhole Table

Compark Village South - Belford Avenue East

Active Scenario: 100 Year

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Velocity (In) (ft/s)	Velocity (Out) (ft/s)	Bolted Cover?	Notes
STMH-1	5,811.31	5,804.47	9.40	4.16	6.28	False	4'
STMH-2	5,801.84	5,793.90	9.40	10.88	6.28	False	6'
STMH-3	5,793.13	5,786.87	19.70	9.54	7.33	False	5'
STMH-4	5,788.18	5,776.45	46.40	6.27	6.56	False	5'
STMH-5	5,784.35	5,778.78	26.70	4.34	3.78	True	5'

Pipe Table

Compark Village South - Belford Avenue East

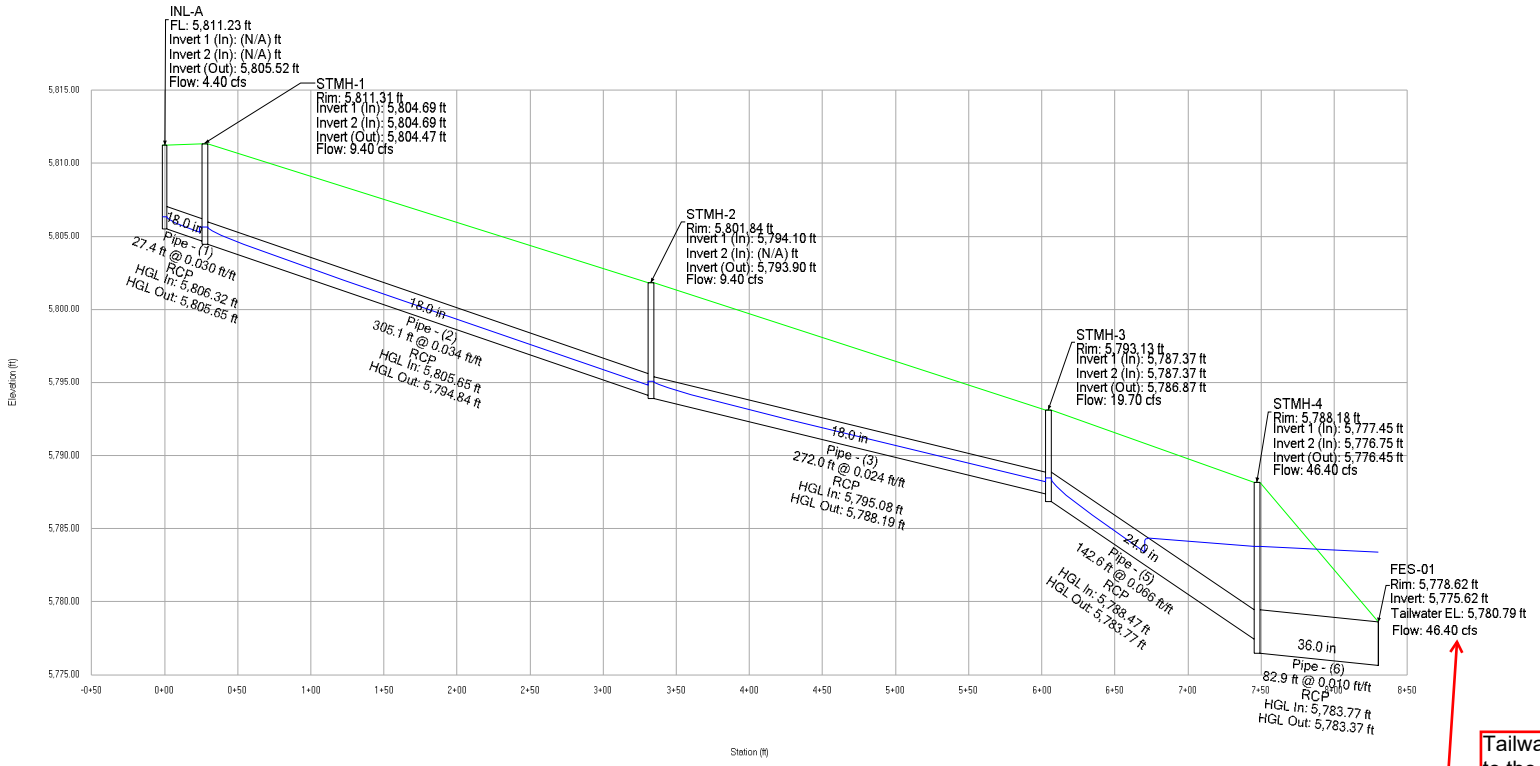
Active Scenario: 100 Year

Start Node	Stop Node	Diameter (in)	Material	Length (Unified) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Slope (Calculated) (ft/ft)	Manning's n	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
INL-A	STMH-1	18.0	Concrete	27.4	5,805.52	5,804.69	4.40	18.28	8.51	0.030	0.013	5,806.32	5,805.65
STMH-1	STMH-2	18.0	Concrete	305.1	5,804.47	5,794.10	9.40	19.36	10.88	0.034	0.013	5,805.65	5,794.84
INL-D	STMH-1	18.0	Concrete	50.8	5,806.21	5,804.69	5.00	18.16	8.78	0.030	0.013	5,807.07	5,805.65
STMH-2	STMH-3	18.0	Concrete	272.0	5,793.90	5,787.37	9.40	16.28	9.54	0.024	0.013	5,795.08	5,788.19
STMH-3	STMH-4	24.0	Concrete	142.6	5,786.87	5,777.45	19.70	58.13	16.72	0.066	0.013	5,788.47	5,783.77
INL-B	STMH-3	18.0	Concrete	28.0	5,787.93	5,787.37	4.90	14.85	7.54	0.020	0.013	5,788.78	5,788.47
INL-E	STMH-3	18.0	Concrete	51.6	5,787.93	5,787.37	5.40	10.94	6.17	0.011	0.013	5,788.83	5,788.47
STMH-5	STMH-4	36.0	Concrete	253.2	5,778.78	5,776.75	26.70	59.72	3.78	0.008	0.013	5,784.18	5,783.77
STMH-4	FES-01	36.0	Concrete	82.9	5,776.45	5,775.62	46.40	66.73	6.56	0.010	0.013	5,783.77	5,783.37
INL-C	STMH-5	24.0	Concrete	39.0	5,779.41	5,779.08	13.08	20.80	4.16	0.008	0.013	5,784.31	5,784.18
INL-F	STMH-5	24.0	Concrete	39.2	5,779.41	5,779.08	13.62	20.76	4.34	0.008	0.013	5,784.32	5,784.18

Outfall Table
Compark Village South - Belford Avenue East
Active Scenario: 100 Year

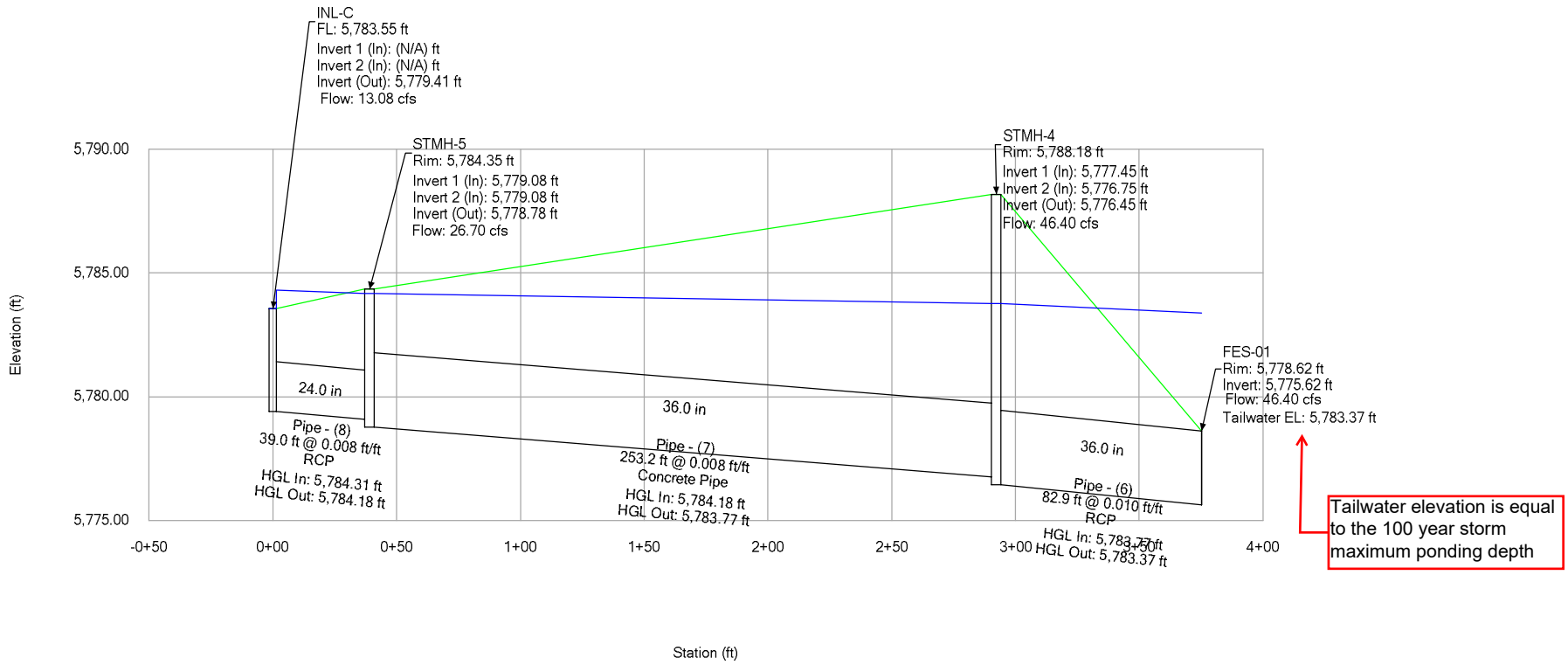
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
FES-01	5,778.62	5,775.62	User Defined Tailwater	5,783.37	5,783.37	46.40	36"

Compark Village South - Belford Avenue East
Active Scenario: 100 Year



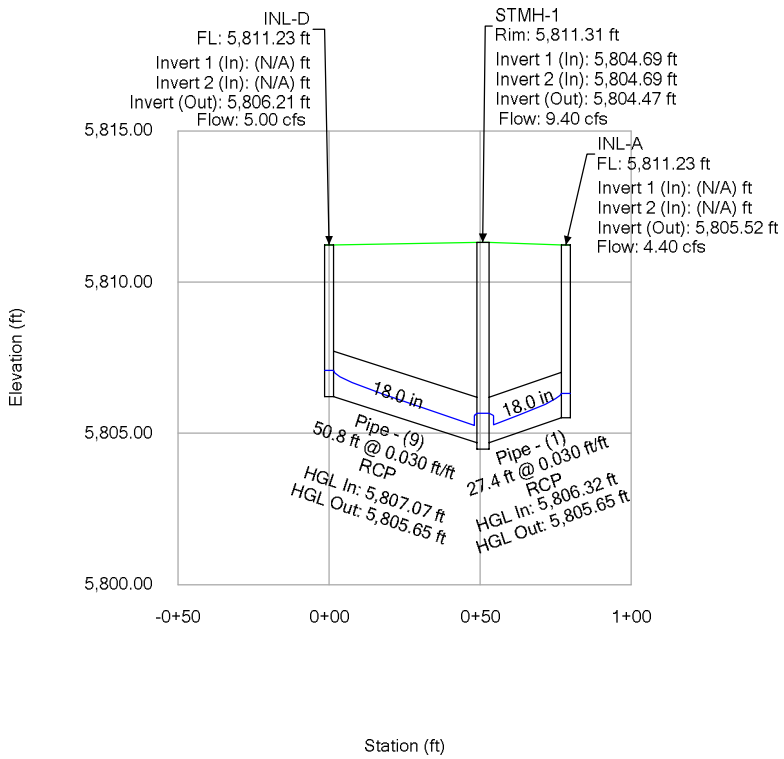
Tailwater elevation is equal to the 100 year storm maximum ponding depth

Compark Village South - Belford Avenue East
Active Scenario: 100 Year



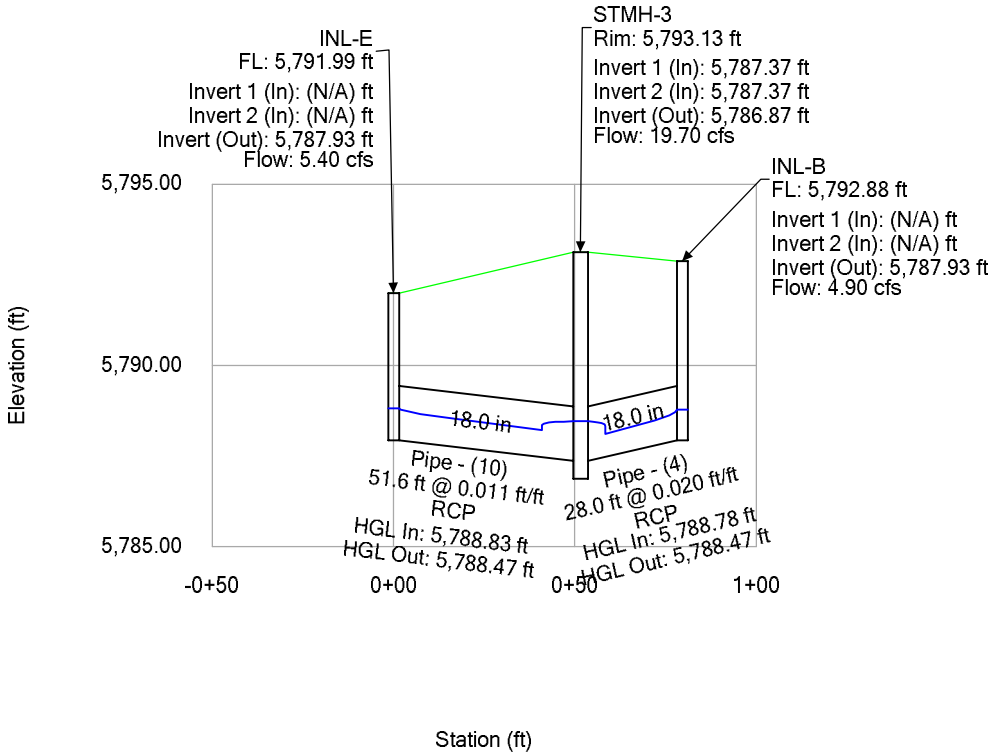
Compark Village South - Belford Avenue East

Active Scenario: 100 Year



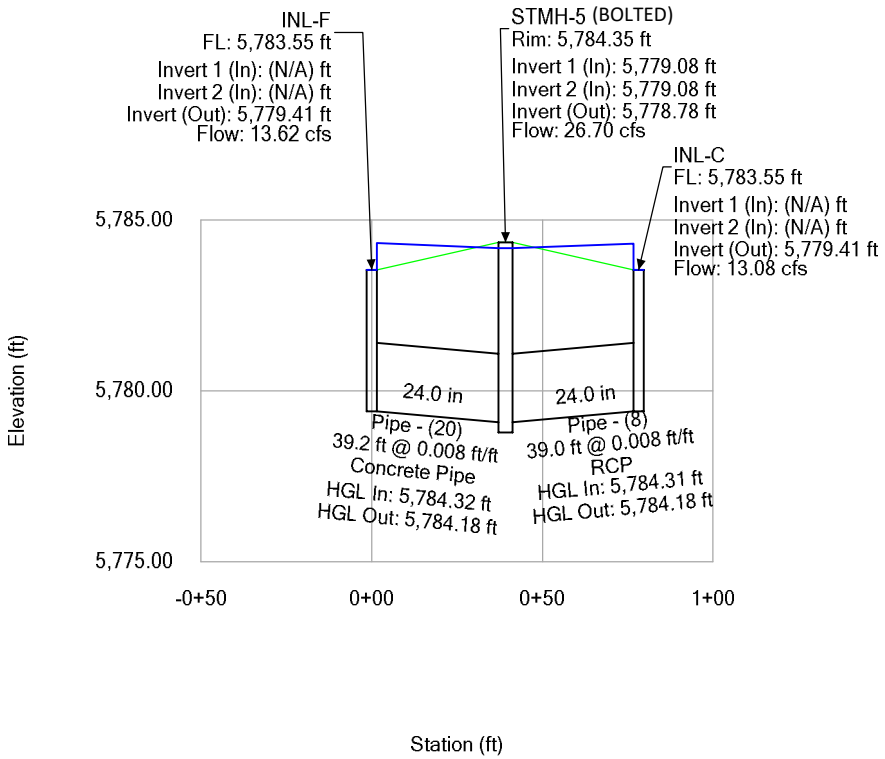
Compark Village South - Belford Avenue East

Active Scenario: 100 Year



Compark Village South - Belford Avenue East

Active Scenario: 100 Year

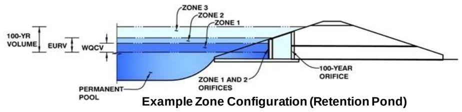


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Compark Village South - Belford Ave East

Basin ID: Happy Canyon Detention Basin



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	14.77	acres
Watershed Length =	1,585	ft
Watershed Length to Centroid =	793	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	61.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - Town Hall	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.295	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.979	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.82 in.) =	0.557	acre-feet		inches
5-yr Runoff Volume (P1 = 1.1 in.) =	0.794	acre-feet		inches
10-yr Runoff Volume (P1 = 1.34 in.) =	1.051	acre-feet		inches
25-yr Runoff Volume (P1 = 1.69 in.) =	1.525	acre-feet		inches
50-yr Runoff Volume (P1 = 1.98 in.) =	1.881	acre-feet		inches
100-yr Runoff Volume (P1 = 2.29 in.) =	2.313	acre-feet		inches
500-yr Runoff Volume (P1 = 3.08 in.) =	3.320	acre-feet		inches
Approximate 2-yr Detention Volume =	0.521	acre-feet		
Approximate 5-yr Detention Volume =	0.745	acre-feet		
Approximate 10-yr Detention Volume =	1.000	acre-feet		
Approximate 25-yr Detention Volume =	1.193	acre-feet		
Approximate 50-yr Detention Volume =	1.295	acre-feet		
Approximate 100-yr Detention Volume =	1.457	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.295	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.684	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.478	acre-feet
Total Detention Basin Volume =	1.457	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = 1.00 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	--	--	--	120	0.003		
5774.28	--	0.45	--	--	--	120	0.003	54	0.001
5775	--	1.17	--	--	--	835	0.019	398	0.009
5776	--	2.17	--	--	--	3,717	0.085	2,674	0.061
5777	--	3.17	--	--	--	9,647	0.221	9,356	0.215
5778	--	4.17	--	--	--	11,356	0.261	19,857	0.456
5779	--	5.17	--	--	--	13,167	0.302	32,119	0.737
5780	--	6.17	--	--	--	15,295	0.351	46,350	1.064
5781	--	7.17	--	--	--	17,616	0.404	62,805	1.442
5782 EURV	--	8.17	--	--	--	20,096	0.461	81,661	1.875
5783.83 100 YR	--	10.00	--	--	--	25,130	0.577	123,043	2.825
5784	--	10.17	--	--	--	25,618	0.588	127,357	2.924
5785	--	11.17	--	--	--	29,798	0.684	155,065	3.560
5786	--	12.17	--	--	--	35,164	0.807	187,546	4.305
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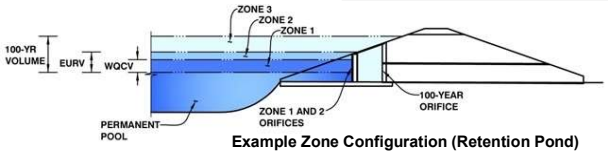
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Compark Village South - Belford Ave East

Basin ID: Happy Canyon Detention Basin



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.53	0.295	Orifice Plate
Zone 2 (EURV)	5.93	0.684	Orifice Plate
Zone 3 (100-year)	7.21	0.478	Weir&Pipe (Restrict)
Total (all zones)		1.457	

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

Underdrain Orifice Invert Depth = [ ] ft (distance below the filtration media surface)

Underdrain Orifice Diameter = [ ] inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = [ ] ft^2

Underdrain Orifice Centroid = [ ] feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 8.17 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = 1.43 sq. inches (diameter = 1-5/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row = 9.931E-03 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	2.70	5.40					
Orifice Area (sq. inches)	1.43	1.43	1.43					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	8.17	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.67	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.92	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	8.17	N/A	feet
Overflow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	10.71	N/A	
Overflow Grate Open Area w/o Debris =	11.52	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.76	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.13	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	9.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.08	N/A	ft^2
Outlet Orifice Centroid =	0.44	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.32	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 10.17 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 23.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.60 feet

Stage at Top of Freeboard = 11.77 feet

Basin Area at Top of Freeboard = 0.76 acres

Basin Volume at Top of Freeboard = 3.99 acre-ft

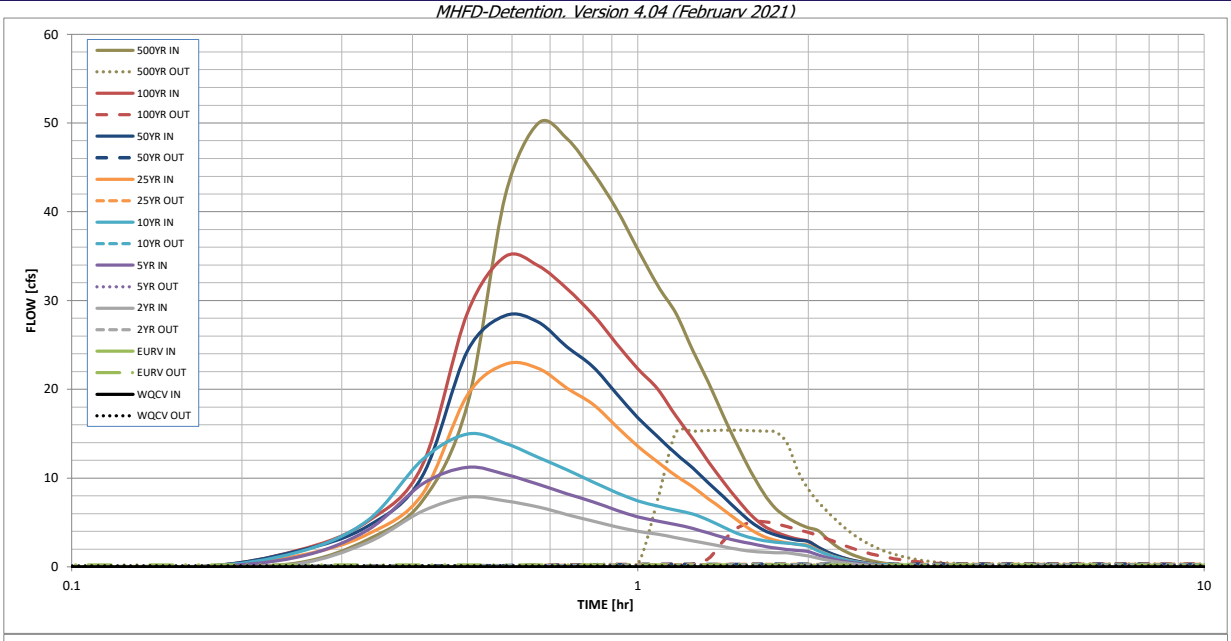
Routed Hydrograph Results

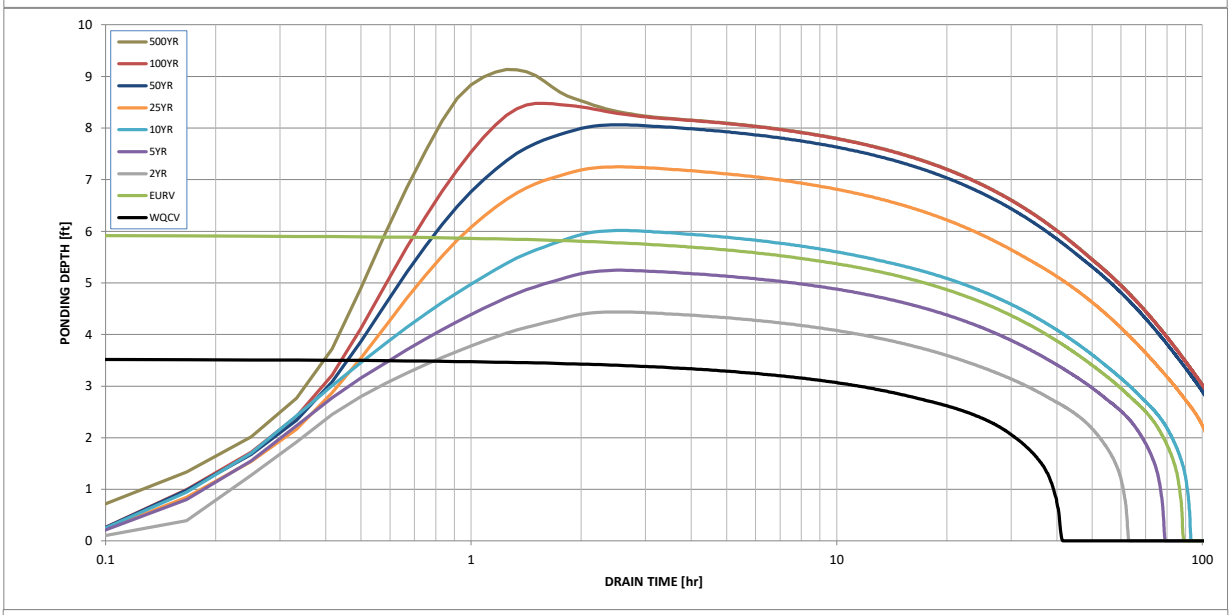
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

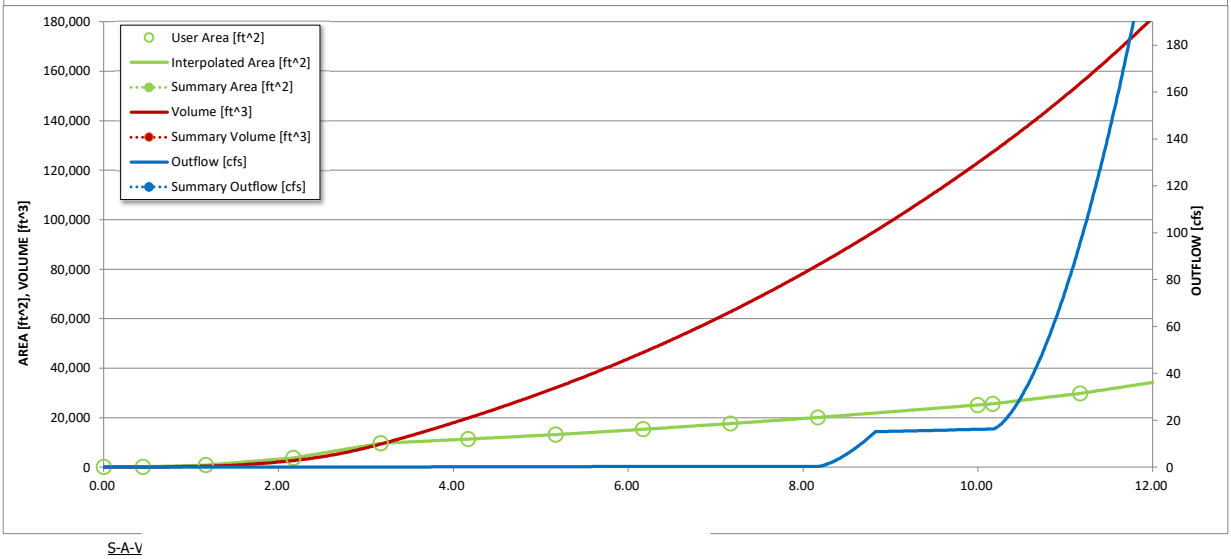
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.82	1.10	1.34	1.69	1.98	2.29	3.08
CUHP Runoff Volume (acre-ft) =	0.295	0.979	0.557	0.794	1.051	1.525	1.881	2.313	3.320
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.557	0.794	1.051	1.525	1.881	2.313	3.320
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	1.9	6.9	9.9	13.9	22.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.13	0.47	0.67	0.94	1.50
Peak Inflow Q (cfs) =	N/A	N/A	7.9	11.2	15.0	22.8	28.3	35.0	50.0
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.2	0.3	0.3	5.1	15.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.1	0.0	0.0	0.4	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.4	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	82	58	73	86	104	116	116	111
Time to Drain 99% of Inflow Volume (hours) =	**40**	86	61	77	90	110	>120	>120	>120
Maximum Ponding Depth (ft) =	3.53	5.93	4.44	5.24	6.01	7.25	8.06	8.48	9.13
Area at Maximum Ponding Depth (acres) =	0.24	0.34	0.27	0.31	0.34	0.41	0.46	0.48	0.52
Maximum Volume Stored (acre-ft) =	0.297	0.981	0.525	0.759	1.008	1.470	1.824	2.016	2.347

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



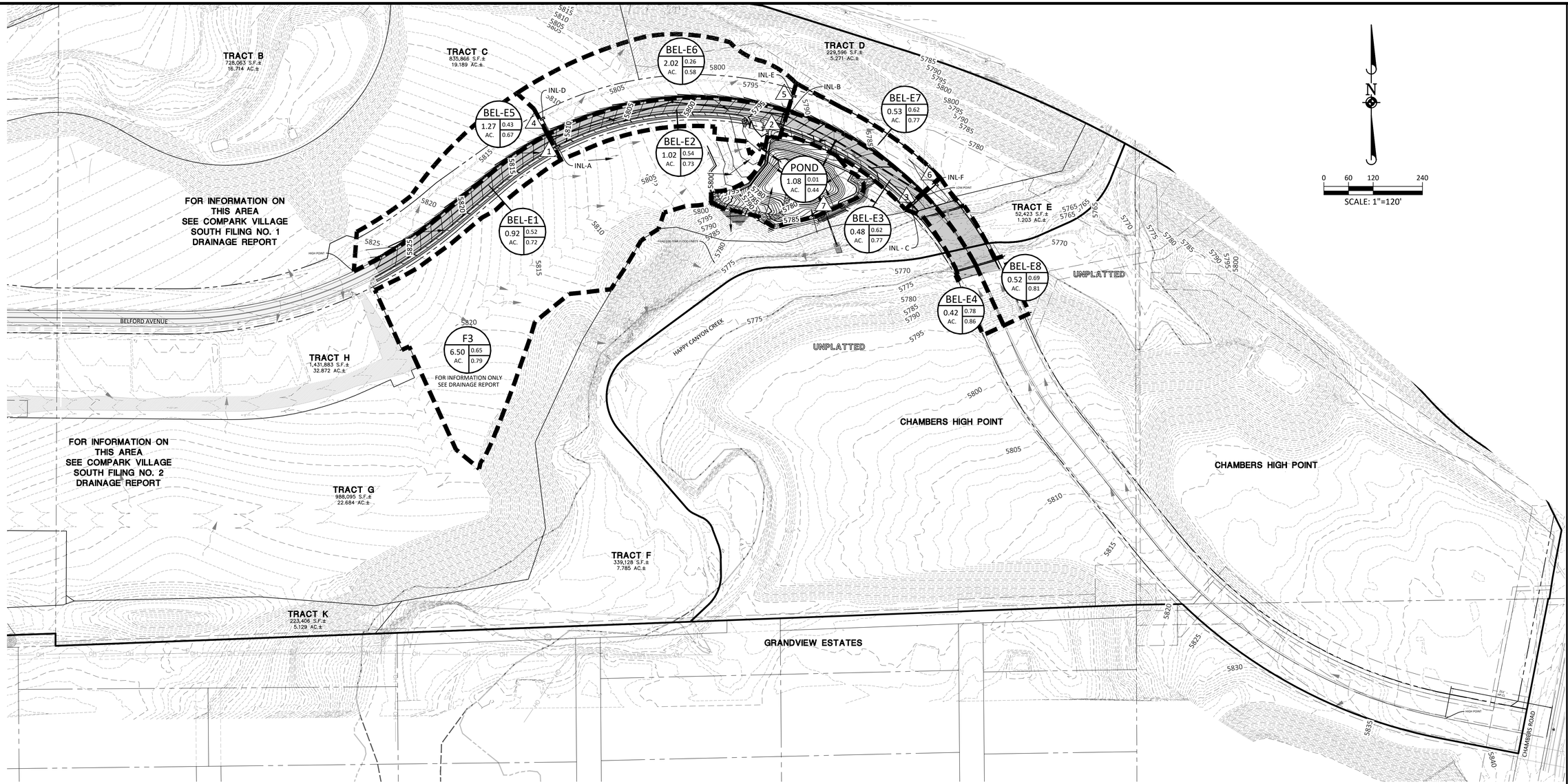




S-A-V

APPENDIX D

- Drainage Basin Map
- Compark Village South Filing No.1 Drainage Report Basin Map



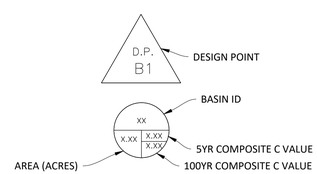
DRAINAGE SUMMARY TABLE

BASIN ID	5 YEAR COMPOSITE C	100 YEAR COMPOSITE C	5 YEAR RUNOFF (CFS)	100 YEAR RUNOFF (CFS)
BEL-E1	0.52	0.72	1.54	4.48
BEL-E2	0.54	0.73	1.76	5.03
BEL-E3	0.62	0.77	0.93	2.43
BEL-E4	0.78	0.86	1.15	2.68
BEL-E5	0.43	0.67	1.63	5.36
BEL-E6	0.26	0.58	1.23	5.71
BEL-E7	0.62	0.77	1.05	2.76
BEL-E8	0.69	0.81	1.19	2.94
F3 (Tract G)	0.65	0.79		
POND	0.01	0.44	0.04	3.55
		TOTAL	10.52	34.94

ROUTED FLOWS TABLE

RECEIVING BASIN	TRIBUTARY DESIGN POINTS	5 YEAR TOTAL FLOW (CFS)	100 YEAR TOTAL FLOW (CFS)
POND	1, 2, 3, 4, 5, 6	10.52	34.94

**ONLY BELFORD AVE RUNOFF SHOWN HERE, NO PROPOSED FLOW FROM TRACT G INCLUDED, TRACT G IS INCLUDED IN DETENTION BASIN SIZING



PREDOMINANT SOIL TYPE IS NRCS HYDROLOGICAL SOIL GROUP B

DRAWN BY | REVISIONS | DATE

Manhard CONSULTING LTD
8008 E. Arapahoe Court, Suite 110, Centennial, CO 80112 ph:303.708.0500 fx:303.708.0400 manhard.com
Civil Engineers • Water Resource Engineers • Surveyors • Water & Wastewater Engineers
Construction Managers • Environmental Scientists • Landscape Architects • Planners

COMPARK VILLAGE SOUTH - BELFORD AVENUE
PARKER, COLORADO
PROPOSED DRAINAGE MAP

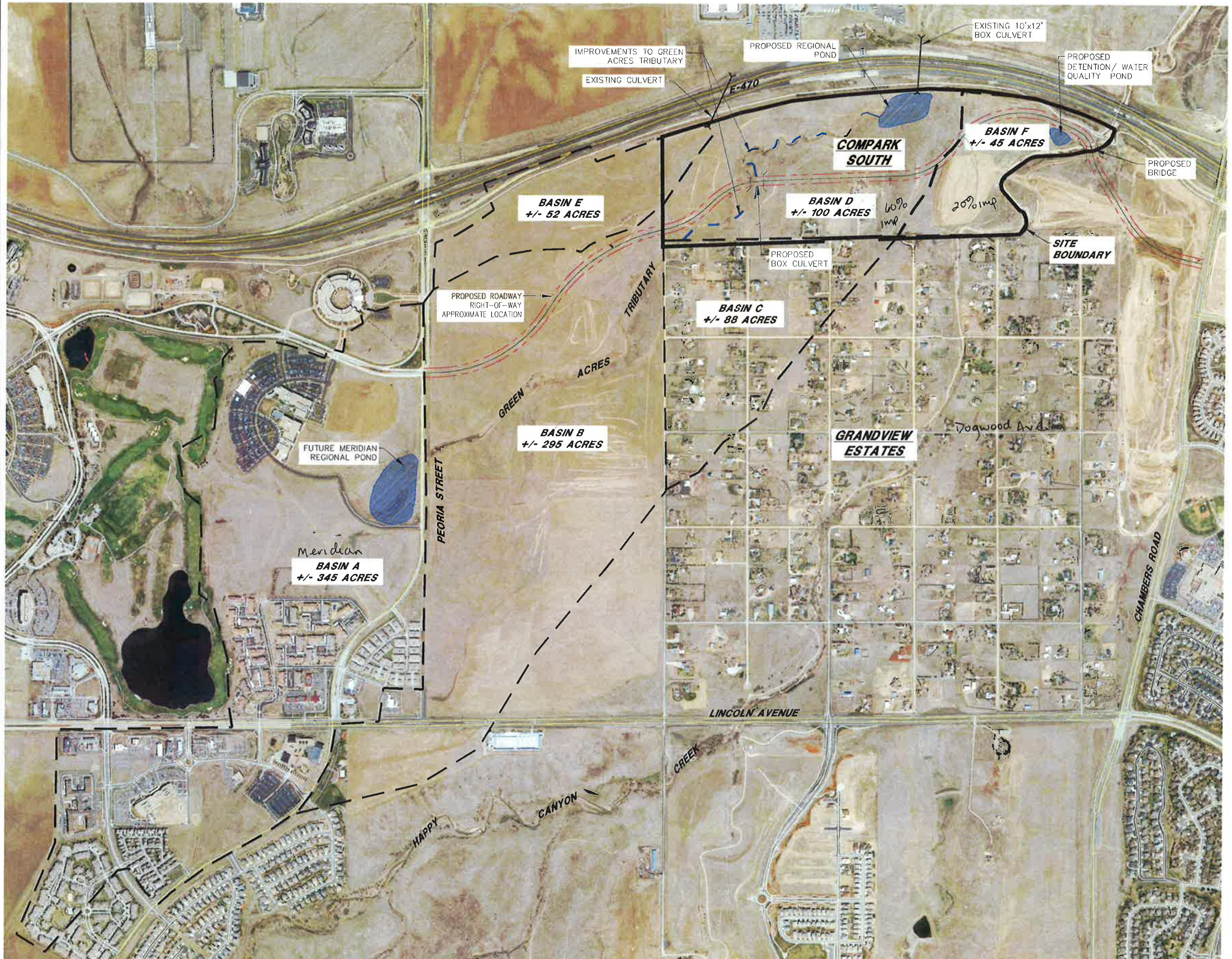
PROJ. MGR.: GTI
PROJ. ASSOC.: ASD
DRAWN BY: JMP
DATE: 03/15/2021

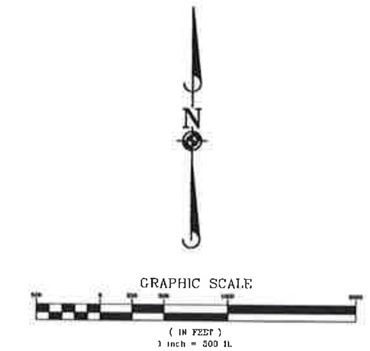
SHEET 1 OF 1

CLCPKC3

DRAINAGE MAP

Plotted: 3/18/2021 9:33 AM Dwg Name: P:\Civilpkc3\ComSouth09 - Belford Ave East\Documents\Engineering\Storm\Water Reports\Drainage Exhibits\Pre-Residential\Drainage Basins.dwg Updated By: ADrucker





CARROLL & LANGE-MANHARD
A MANHARD CONSULTING COMPANY

CHAMBERS CROSSING
PARKER, COLORADO
GREEN ACRES TRIBUTARY DRAINAGE EXHIBIT

PROJ. MGR.:	RB
PROJ. ASSOC.:	JK
DRAWN BY:	JK
DATE:	08/30/11
SCALE:	+/- 1"=500'

EXHIBIT
1

CLCPKC3 110482

APPENDIX E

- CLOMR approval letter
- USACOE NWP verification
- Town of Parker Floodplain Development Application

Federal Emergency Management Agency

Washington, D.C. 20472

November 20, 2019

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Mike Waid
Mayor, Town of Parker
20120 East Main Street
Parker, CO 80138

IN REPLY REFER TO:
Case No.: 19-08-0690R
Community Name: Town of Parker, CO
Community No.: 080310

104

Dear Mayor Waid:

We are providing our comments with the enclosed Conditional Letter of Map Revision (CLOMR) on a proposed project within your community that, if constructed as proposed, could revise the effective Flood Insurance Study (FIS) report and Flood Insurance Rate Map for your community.

If you have any questions regarding the floodplain management regulations for your community, the National Flood Insurance Program (NFIP) in general, or technical questions regarding this CLOMR, please contact the Director, Mitigation Division of the Federal Emergency Management Agency (FEMA) Regional Office in Denver, at (303) 235-4830, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at https://www.fema.gov/national-flood-insurance-program.

Sincerely,

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Enclosure:
Conditional Letter of Map Revision Comment Document

cc: Mr. Tom Williams, P.E.
Director of Public Works/ Engineering
Town of Parker

Ms. Terri Fead, P.E.
Project Manager
Mile High Flood District

Mr. Kevin Houck, P.E., CFM
Chief, Watershed and Flood Protection Section
Colorado Water Conservation Board

Ms. Kendra Gabbert, P.E.
Felsburg Holt & Ullevig

Ms. Amie Drucker, P.E.
Project Manager
Manhard Consulting

Mr. Zachary Grady
Felsburg Holt & Ullevig

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

November 13, 2017

SUBJECT: Nationwide Permit Verification – Corps File No. NWO-2017-01897-DEN, Compark South Project, Douglas County, Colorado

Michael Vickers
Belford South Metropolitan District
8390 East Crescent Parkway, Suite 500
Greenwood Village, CO 80111

Dear Mr. Vickers:

This letter is in reference to the proposed project located at approximately 39.553041°N, -104.821996°W, in Douglas County, Colorado. The work as described in your submittal will consist of constructing a road bridge crossing over Happy Canyon Creek, replacing an existing pedestrian bridge over Happy Canyon Creek, and installing three buried channel stabilization structures in Happy Canyon Creek, all in direct support of a residential development. This project will cause temporary impacts to 0.486 acre of Happy Canyon Creek and to 0.1657 acre of adjacent wetlands, and will cause permanent impacts to 0.049 acre of Happy Canyon Creek.

Based on the information provided, this office has determined that the work is authorized by the **Department of the Army Nationwide Permit (NWP) 29, Residential Developments**, found in the January 6, 2017, Federal Register. Enclosed is a fact sheet, which fully describes this Nationwide Permit and lists the General Conditions, and Colorado Regional Conditions, which must be adhered to for this authorization to remain valid. In addition, the following Special Conditions must be followed:

1. In order for this Nationwide Permit verification to be valid, 0.1657 acre of wetland shall be restored where impacted.
2. The created wetlands will be considered successful and self-sustaining when the following conditions have been met without intervention in the form of irrigation, removal of undesirable vegetation or replanting of desirable vegetation for a period of two consecutive years, as determined by the Corps of Engineers:
    a) At least 80 % (determined by ocular estimate of herbaceous and shrub foliar cover) of the mitigation site is vegetated, with at least 50% of the total number of dominant species present will consist of species rated as facultative or wetter.
    b) Those species shown on the Colorado Noxious Weed Inventory list-A shall be 100% eradicated. Those species shown on list-B shall be no more than 5% or less of the total cover in the mitigation area. The lists can be found at http://www.colorado.gov/cs/Satellite/ag_Conservation/CBON/1251618874438

3. A mitigation monitoring report documenting growing season conditions shall be sent to the Denver Regulatory Office prior to December 31st of each year, for a period of at least three years, or until the Corps of Engineers determines that the 0.1657 acre of wetlands has successfully developed.

4. Annual reports shall be formatted per the attached Annual Mitigation Monitoring Report Formatting Requirements. If the authorized work has not yet started, please state so in the annual mitigation monitoring report.

Although an Individual Department of the Army permit will not be required for this work, this does not eliminate the requirement that any other applicable federal, state, tribal or local permits be obtained as required. Please be advised that deviations from the original plans and specifications of this project could require additional authorization from this office.

The applicant is responsible for all work accomplished in accordance with the terms and conditions of the nationwide permit. If a contractor or other authorized representative will be accomplishing the work authorized by the nationwide permit on behalf of the applicant, it is strongly recommended that they be provided a copy of this letter and the enclosed conditions so that they are aware of the limitations of the applicable nationwide permit. Any activity which fails to comply with all the terms and conditions of the nationwide permit will be considered unauthorized and subject to appropriate enforcement action.

This verification will be valid until March 18, 2022. In compliance with General Condition 30, the enclosed "Certification of Completed Work" form (blue) must be signed and returned to this office upon completion of the authorized work and any required mitigation.

If there are any questions please feel free to contact Angelle Greer at (303) 979-4120 or by e-mail at Angelle.V.Greer@usace.army.mil, and reference **Corps File No. NWO-2017-01897-DEN**.

Sincerely,

Aaron Eilers
Chief, Denver Regulatory Office

Enclosure(s)
Nationwide Permit 29, Residential Developments
Certification of Completed Work
Annual Mitigation Monitoring Report Format Requirements

Copies Furnished:
Esa Crumb, ERO Resources Corporation, 1842 Clarkson Street, Denver, CO/80218

Public Works - Stormwater Division
20120 E. Mainstreet
Parker, Colorado 80138
303.840.9546

PERMIT #: _____

DATE: 03.15.2021

FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

Applicant Information

Owner: Larry Jacobson	Contractor: TBD
Address: 8390 E. Crescent Parkway, Suite 300	Address: TBD
c/o CliftonLarsonAllen LLP Greenwood Village, CO 80111	TBD
Phone: N/A	Phone: TBD
Contact Name: Rick Moore, Manhard Consulting LTD	Contact Name: TBD
Contact Phone and Email: 303.531.3500 rmoore@manhard.com	Contact Phone and Email: TBD

Project Information

Project Location/Directions:

Located at Happy Canyon Creek south of E-470 and west of Chambers Road

☒ Bridge/Culvert	☐ Utility Line	☐ Substantial Improvement >50%
☐ New Structure	☐ Structure Addition	☐ Manufactured (Mobile) Home
☒ Non-Residential	☒ Grading/Fill	☒ Channelization
☐ Levee	☒ Trail Construction	☒ Drainage Infrastructure Improvement

Project Description:

New bridge for Belford Ave. over Happy Canyon Creek, trail improvements and channel grade control structures.

Flood Hazard Data

Watercourse Name: Happy Canyon Creek

The proposed project is in the: ☒ Floodway ☒ Floodway Fringe

Flood Zone: ☐ A ☒ AE ☒ X (Shaded) ☐ Other (Specify) _____

Base Flood (1% Annual Chance Flood) Elevation at project site: 5576

Flood Insurance Rate Map Number: 08035C0062H & 08035C0066H Effective: September 9, 2020

*Attach a copy of FIRM with approximate limits of proposed project shown

Elevation required for lowest floor: N/A Floodproofing: N/A

Proposal Review Checklist

Yes/No	Site development plans are complete/attached and depict flood hazard data
If "No", Explain:	
Yes/No	Engineering data and analysis is attached (Signed/Sealed by a Professional Engineer)
If "No", Explain:	
Yes/No	Floodway Certificate and data documents no increase in base flood elevation
If "No", Explain: N/A - Approved CLOMR from FEMA attached	
Yes/No	Subdivision proposals minimize flood damage and protect utilities
If "No", Explain:	
Yes/No	Lowest floor elevations are two feet above the base (1% Annual Chance) flood level
If "No", Explain: N/A	
Yes/No	Manufactured homes address elevation and anchoring requirements
If "No", Explain: N/A	
Yes/No	Floodproofing certification by a registered Professional Engineer or Architect
If "No", Explain:	

Structure Information

See Attached	Elevation in relation to mean sea level of lowest floor (including basement)*
See Attached	Elevation in relation to mean sea level to which structure has been floodproofed*
*If more than one structure, attach list with respective elevations	

Applicant Signature

Property Owner Name: _____ Title: _____
Property Owner Signature (Required): _____ Date: _____
Owner's Designated Agent: Name:_____ Company:_____
Owner's Designated Agent Signature: _____ Date:_____
**Note: Applicant is responsible for obtaining all other applicable federal, state and local permits*

Permit Action

Recommendation for approval Designated Town Authority: _____ Date:_____	
	Permit Approved: The information submitted for the proposed project was reviewed and is in compliance with Town floodplain regulations.
	Permit Denied: The proposed project does not meet Town floodplain regulations
	Variance Granted: A variance was granted from the base (1% Annual Chance) flood elevations established by FEMA consistent with variance requirements fo NFIP regulations Part 60.6 (variance action documentation is attached)
Floodplain Administrator's Signature: _____ Date:_____	
Comments:_____	

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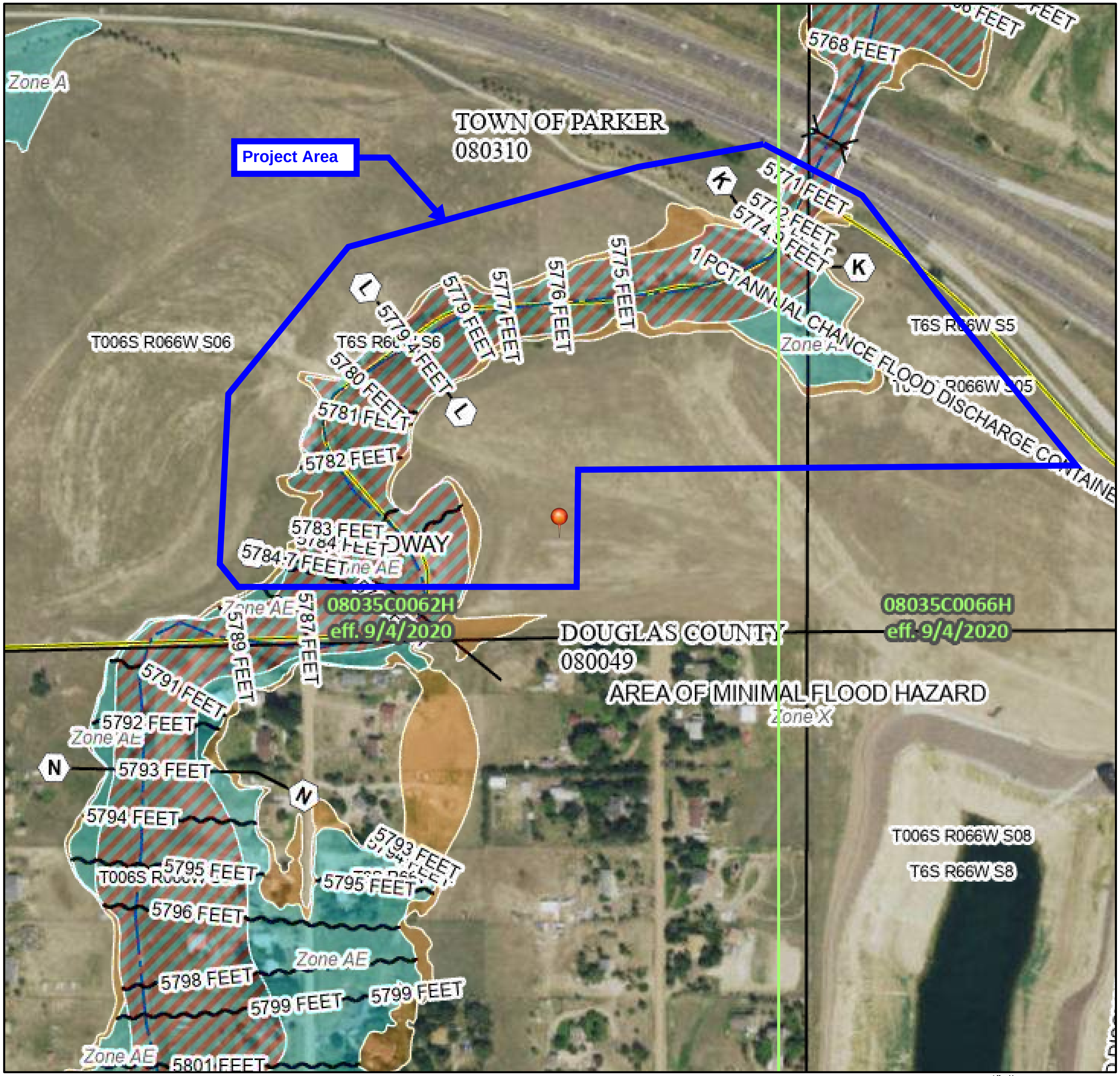
FEMA



%DVHPDS 86*6 1DWLRQDO 0DS 2UWKRLPDJHU\ 'DWD UHIUHVKHG 2FWREHU

Federal Emergency Management Agency

Washington, D.C. 20472

November 20, 2019

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Mike Waid
Mayor, Town of Parker
20120 East Main Street
Parker, CO 80138

IN REPLY REFER TO:
Case No.: 19-08-0690R
Community Name: Town of Parker, CO
Community No.: 080310

104

Dear Mayor Waid:

We are providing our comments with the enclosed Conditional Letter of Map Revision (CLOMR) on a proposed project within your community that, if constructed as proposed, could revise the effective Flood Insurance Study (FIS) report and Flood Insurance Rate Map for your community.

If you have any questions regarding the floodplain management regulations for your community, the National Flood Insurance Program (NFIP) in general, or technical questions regarding this CLOMR, please contact the Director, Mitigation Division of the Federal Emergency Management Agency (FEMA) Regional Office in Denver, at (303) 235-4830, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at https://www.fema.gov/national-flood-insurance-program.

Sincerely,

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Enclosure:
Conditional Letter of Map Revision Comment Document

cc: Mr. Tom Williams, P.E.
Director of Public Works/ Engineering
Town of Parker

Ms. Terri Fead, P.E.
Project Manager
Mile High Flood District

Mr. Kevin Houck, P.E., CFM
Chief, Watershed and Flood Protection Section
Colorado Water Conservation Board

Ms. Kendra Gabbert, P.E.
Felsburg Holt & Ullevig

Ms. Amie Drucker, P.E.
Project Manager
Manhard Consulting

Mr. Zachary Grady
Felsburg Holt & Ullevig

LEGEND

- FHAD FLOODWAY LIMITS
- 100 YR FHAD FLOODPLAIN LIMITS
- 100 YR PRE–PROJECT FLOODPLAIN LIMITS
- PRE–PROJECT FLOODWAY LIMITS
- 100 YR POST–PROJECT FLOODPLAIN LIMITS
- POST–PROJECT FLOODWAY LIMITS
- 500 YR FHAD FLOODPLAIN LIMITS
- 500 YR PRE–PROJECT FLOODPLAIN LIMITS
- 500 YR POST–PROJECT FLOODPLAIN LIMITS
- 100 YR FHAD BFE
- 100 YR POST–PROJECT BFE
- 12541 2014 FHAD CROSS–SECTION
- 12436 FHU ADDED CROSS–SECTION
- 11772 2014 FHAD CROSS–SECTION (TO BE REMOVED)
- EXISTING ROW
- EXISTING EASEMENT
- SURVEYED 1 FT CONTOURS (VERTICAL DATUM =NAVD 88)
- WETLANDS

PROPERTY OF
E470 PUBLIC HIGHWAY AUTHORITY
22470 E 6TH PKWY SUITE 100
AURORA, CO 80018–2425

PROPERTY OF
COTTONWOOD WATER & SANITATION DISTRICT
2 INVERNESS DR E SUITE 200
CENTENNIAL, CO 80112–5509

E–470

HAPPY CANYON TRAIL

DOWNSTREAM CROSS SECTION TIE–IN

PROPOSED BELFORD OVER HAPPY CANYON CREEK CROSSING

PROPERTY OF
PLATTE VALLEY COMMERCIAL GROUP
4900 MAIN STREET
KANSAS CITY, MO 64112–2630

PROPOSED DROP STRUCTURE NO. 1

HAPPY CANYON CREEK HCL

PROPERTY OF
COMPARK BUSINESS CAMPUS METRO DISTRICT
FKA E–470 BUSINESS METRO DISTRICT
8480 E ORCHARD RD SUITE 6200
GREENWOOD VILLAGE, CO 80111

PROPOSED DROP STRUCTURE NO. 2

CHEROKEE TRAIL CROSSING

CHEROKEE TRAIL

PROPERTY OF
470 COMPARK LLC
C/O MPV COMPARK MANAGEMENT LLC
DENVER, CO 80206

PROPOSED DROP STRUCTURE NO. 3

PROPERTY OF
COMPARK 190 LLC
4600 S ULSTER ST SUITE 1400
DENVER, CO 80237–2850

PROPOSED BELFORD AVE.

UPSTREAM CROSS SECTION TIE–IN

PROPERTY OF
COMPARK 190 LLC
4600 S ULSTER ST SUITE 1400
DENVER, CO 80237–2850

CHAMBERS ROAD

FLOW

HAPPY CANYON CREEK

N

HORIZONTAL SCALE: 1"=200'

0' 100' 200' 400'

TOPOGRAPHY SHOWN ON THE WORKMAP REPRESENTS SURVEYED 1 FOOT CONTOURS (NAVD 88) DATUM, COLORADO STATE PLANE, CENTRAL ZONE. THE SURVEY AND AERIAL PHOTOGRAPHY WAS DONE 11/2015. SECTIONS 10775, 10842, 11153, AND 11772 ARE TO BE REMOVED FOR POST–PROJECT CONDITIONS. THE 1 PERCENT ANNUAL–CHANCE FLOODPLAIN HAVE BEEN DELINEATED BASED ON THE SURVEYED 1 FOOT CONTOURS & (NAVD 88) DATUM.

I HEREBY AFFIRM THAT THIS DOCUMENT ENTITLED FLOODPLAIN MODIFICATION STUDY FOR HAPPY CANYON CREEK AT BELFORD AVE WAS PREPARED IN ACCORDANCE WITH APPLICABLE, VIABLE, AND PERTINENT TECHNICAL DATA AND CRITERIA FOR THE COLORADO WATER CONSERVATION BOARD, THE FEDERAL EMERGENCY AGENCY, AND DOUGLAS COUNTY, COLORADO. THE DOCUMENT, REPORT, AND ALL ATTACHMENTS SUBMITTED HEREWITH WERE PREPARED IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHERED AND EVALUATED THE NECESSARY INFORMATION AND ACCURATELY PREPARED THE DOCUMENT. ADDITIONALLY, I HEREBY CERTIFY THAT NO INSURABLE STRUCTURES ARE IMPACTED DUE TO THE REVISIONS DOCUMENTED IN THIS CLOMR REPORT.

KENDRA M. GABBERT, P.E. NO. 45344

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FELSBURG HOLT & ULLEVIG
6400 South Fiddlers Green Circle, Suite 1500
Greenwood Village, CO 80111
Phone: 303.721.1440
www.FHUENG.com

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Sheet Revisions		
Date	Comments	Initials

Manhard CONSULTING LTD
8008 E. Arapahoe Court, Suite 110, Centennial, CO 80112 ph:303.708.0500 fx:303.708.0400 manhard.com
Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
Construction Managers • Environmental Scientists • Landscape Architects • Planners

As Constructed
No Revisions:
Revised:
Void:

BELFORD–HAPPY CANYON CREEK FLOODPLAIN WORK MAP (FOR FHAD)

Designer: CDT
Detailer: ZJG
Subset:
Structure Numbers:
Sheets: 1 of 1

Project No./Code

Sheet Number

LEGEND

- FHAD FLOODWAY LIMITS
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N

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HAPPY CANYON CREEK HCL

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PROPOSED BELFORD AVE.

UPSTREAM CROSS SECTION TIE-IN

CHAMBERS ROAD

FLOW

HAPPY CANYON CREEK

EXISTING TOPOGRAPHY SHOWN ON THE WORKMAPS FROM CROSS-SECTION 10111 TO CROSS-SECTION 12694 REPRESENTS SURVEYED 1 FOOT CONTOURS (NAVD 88). THE SURVEY AND AERIAL PHOTOGRAPHY WAS DONE 11/2015. SECTIONS 10775, 10842, 11153, AND 11772 ARE TO BE REMOVED FOR POST-PROJECT CONDITIONS.

I HEREBY AFFIRM THAT THIS DOCUMENT ENTITLED FLOODPLAIN MODIFICATION STUDY FOR HAPPY CANYON CREEK AT BELFORD AVE WAS PREPARED IN ACCORDANCE WITH APPLICABLE, VIABLE, AND PERTINENT TECHNICAL DATA AND CRITERIA FOR THE COLORADO WATER CONSERVATION BOARD, THE FEDERAL EMERGENCY AGENCY, AND DOUGLAS COUNTY, COLORADO. THIS DOCUMENT, REPORT, AND ALL ATTACHMENTS SUBMITTED HEREWITH WERE PREPARED IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHERED AND EVALUATED THE NECESSARY INFORMATION AND DATA REGARDING THE DOCUMENT. ADDITIONALLY, I HEREBY CERTIFY THAT NO INSURABLE STRUCTURES ARE IMPACTED DUE TO THE REVISIONS DOCUMENTED IN THIS CLOMR REPORT.

COLORADO
KENDRA M. GABBERT
45344
PROFESSIONAL ENGINEER

45344
KENDRA M. GABBERT, P.E. #45344 — 4/23/19

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Horizontal Scale: Vertical Scale:			

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Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
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As Constructed
No Revisions:
Revised:
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BELFORD AVE. - HAPPY CANYON CREEK
FLOODPLAIN WORK MAP

Designer:	CDT	Structure Numbers	
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Subset:		Sheets:	1 of 1

Project No./Code

Sheet Number