The Learning Experience
Address: TBD

Lot 1, Block 1, Horseshoe Ridge Subdivision, 1st Amendment
A Parcel of Land Located in the SE ¼ of Section 28, Township 6 South, Range 66 West of the 6th Principal Meridian
Town of Parker, County of Douglas, State of Colorado

Final Drainage Report

Prepared by: Brad Anderson
Reviewed by: Mike Beach, P.E.

Date: February 18, 2020

RIDGETOP
ENGINEERING & CONSULTING

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Project Location

Project Name: The Learning Experience

Location: Southwest corner of Triple Crown Drive and Pardee Street

Address: T.B.D.

Parcels/Tax Lots: 2233-284-23-004

Zoning: PD Commercial (Horseshoe Ridge)

Site Area: Total = ±1.111 Acres

City, County, State: Town of Parker, Douglas County, Colorado

Governing Agency: Town of Parker

Design Criteria: "Storm Drainage and Environmental Criteria Manual", Town of Parker, Colorado, Revised and Adopted February 2014

Engineer's Certification

This report for the stormwater design of The Learning Experience 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.

Signature

45088

Colorado P.E. License No.

Seal and Date

Section 1 – Project Overview

This report accompanies The Learning Experience plans to construct a new commercial area within the Town of Parker.

The subject site (Lot 1, Block 1, as shown on the predeveloped basin drainage map, Appendix G) contains native grasses and is surrounded by public roads on the east and north, existing vacant lot to the south, and existing residential to the west. The property is +\-1.111-acres and has two access points to the public right of way. The property is located in the Southwest corner of corner of the intersection of Triple Crown Drive and Pardee Street.

The proposed onsite improvements include rough grading to provide a building pad, construction of a new building along with a playground. Other improvements include asphalt parking, concrete sidewalks, landscaping, water and sewer connections, storm drainage improvements, and temporary & permanent erosion control facilities. The existing regional stormwater detention pond will be regraded and resized to contain the new amount of runoff from the subject site.

Section 2 – Pre-Developed Conditions

The site is located on FEMA MAP 08035C0182G and does not contain any mapped floodplain areas. (See Appendix A – FIRM Flood Plain Panel).

The subject lot was included in the original Horseshoe Subdivisions Stormwater Report prepared by Tetra Tech, dated Sept. 2005, revised January 17, 2006, for calculation purposes only, however it does not appear to have been included in the detention pond sizing calculations for the regional facility located along Motsenbocker Road.

The existing stormwater pond currently collects runoff from the Triple Crown Drive along north portion of the lot as well as portions of the residential subdivision just north of the site. Majority of the site slopes towards the east at roughly 1% to 3%. Current stormwater runoff would flow over the curb into the right of way of Triple Crown or Pardee. There is an existing Type R structure located in the Northeast corner of the property. Based on drainage flow arrows from previous stormwater reports, it appears the intention of this Type R was to connect this sites stormwater runoff to that Type R. The runoff from the Type R is conveyed to the existing Regional Detention Pond. The conveyance pipe is primarily located along the north side of Triple Crown Drive.

The NRCS classifies soils on all of Lot 1 as hydrologic group “B”. See Appendix C for more NRCS information.

Existing conditions for the site show an overall percent imperviousness of 2.4%, an existing Conditions Basin Map is included in the Appendix. See Appendix E for the calculations.

Section 3 – Post-Developed Conditions

Site improvements will include, but are not limited to, constructing a new commercial building, asphalt parking lot, concrete sidewalks, outdoor playground area, landscaping, water and sewer connections, storm drainage improvements, and temporary & permanent erosion control facilities. The existing regional stormwater detention pond will also be regraded and resized to contain the new amount of runoff on the site.

The post-developed drainage area for this site is roughly 1.111 acres. There is an existing regional stormwater detention pond located at the southwest corner of the intersection of Triple Crown Drive and Motsenbocker Road. This pond will be reconstructed to hold runoff from the proposed developments. More runoff will be directed to this area than existing conditions.

The proposed basins have been analyzed and divided into 2 subbasins. Subbasin descriptions are as follows: (See Appendix G for the Existing and Proposed Basin Maps).

Subbasin 1 – The 1.100-acre subbasin is primarily proposed asphalt parking, some landscaping and sidewalk areas. Runoff from this subbasin is collected via curb & gutter, then deposited into a new Type R catch basin that will convey the stormwater to the existing regional detention pond. The calculated detention volume (including WQ) is described in Appendix E – Calculations. The proposed percent imperviousness for this basin is 61.4%.

Subbasin OS1 – This 0.160-acre subbasin contributes due to the proposed grading on the site. Since the existing site if fairly steep across it, it is necessary to keep the shared driveway included into this conveyance system. This subbasin contains asphaltic concrete and sidewalk areas. Runoff from this subbasin will be directed towards the northeast into a Type R Inlet. Flows will then travel into the conveyance piping and eventually to the existing regional detention pond. The percent imperviousness for this basin is 83.4%.

Flow Rates/Conveyance Table:

Subbasin	Area (acres)	5-year Coeff.	5-year Developed Flow	10-year Coeff.	10-year Developed Flow	100-year Coeff.	100-year Developed Flow
1	1.100	0.51	2.1	0.55	2.7	0.71	5.5
OS1	0.160	0.71	0.4	0.73	0.6	0.82	1.2

Pipe Flow Analysis:

All pipes on site will be constructed as 18" reinforced concrete pipe. All pipes have been designed at a 0.5% slope. This pipe will be able to carry stormwater up to 7.92 cfs. The total site will contribute about 6.7 cfs.

Precipitation data is obtained from the Storm Drainage and Environmental Criteria Manual from the Town of Parker.

TABLE 5.1
ONE-HOUR POINT RAINFALL

Frequency of Design Event (yr)	One-hour Point Rainfall, P_1 (in)
2	0.99
5	1.39
10	1.64
25	1.98
50	2.31
100	2.60

Peak discharge flow rates from this project are included in the Appendix. All conveyance for the project is provided via overland flow, new storm pipes, and detention ponds.

Section 4 - Hydrologic Calculations

Water Quality & Detention Design:

Within the original storm report, Horseshoe Ridge Subdivision Drainage Report by Tetra Tech, Dated Sept. 2005, Revised January 17, 2006, Stormwater quality treatment was provided within the original Detention Pond III, located at the SE corner of Triple Crown Dr. and N. Motsenbocker Rd. There is currently an existing outlet structure built today that treats the existing Water Quality for Pond III. The additional flows from Lot 1 will be calculated into the total detention of the pond III. Please see Appendix D and E for Calculations.

Detention Pond III Design:

Modifications will need to be done with this project to the existing Detention Pond III within the Horseshoe Ridge Subdivision at the SE corner of Triple Crown Dr. and N. Motsenbocker Rd. Using UDFCD Detention Basin Design Workbook, Lot 1 (1.111 acres) is required to detain a total of 0.147 ac/ft, this includes water quality. The existing Pond III, as it sits today, has a total volume of 4.9 ac/ft. A portion of the pond will be dug out to increase the volume to 5.047 ac/ft to help accommodate the additional detention needed. Retaining walls will be put in place at the 100-yr mark to help diminish the amount of dirt work needed in this area.

All calculations can be found in the Appendix section.

Conveyance Analysis:

In review of the Tetra Tech Report we understand the existing storm drainage infrastructure located along Triple Crown Drive was analyzed for the 2-year and 100-year event. The HGL's per that report is included in the appendix of this report. We have analyzed this existing storm line with the 10-year event and the 100-year event included flows from this project and the previous project. The 10-year event HGL is contained within the pipe, however the 100-year event as shown within this report has one structure where the HGL is at the rim of the structure. Based on a site visit, this specific structure is located whereas any structure flooding would overflow and would be directed into the street and be conveyed via curb and gutter to the next Type R located within Triple Crown, where it would then make its way to the detention facility.

Section 5 – Design and Placement of Construction BMP's

Temporary Erosion and Sediment Control:
All erosion and sediment control measures shall be governed by the requirements of the Town of Parker. A combination of silt fence, temporary conveyance swales, slope protection, rock socks, constructions fences, and temporary sediment pond will be implemented to prevent offsite discharge of sediment. An engineered temporary erosion and sedimentation control plan was prepared to direct the contractor in complying with these requirements.

Temporary swales will be installed along the property lines at certain locations to prevent sediment laden storm water from discharging offsite. Temporary slope protection will be installed along permanent slopes equal to 3:1 horizontal to vertical. Slope protection may include surface roughening, temporary erosion control blankets or other approved equivalent.

A construction entrance will be installed at the proposed entrance. This construction entrance will be relocated as necessary to accommodate the proposed site improvements.

Permanent Erosion and Sediment Control:
Permanent erosion and sediment control will be provided onsite to minimize long term erosion impacts and minimize the amount of sediment that discharges offsite. All areas of the natural ground surface which are not covered in impervious surfaces will be resurfaced with landscaping or native vegetation. The owner will maintain the grounds to ensure there are no areas of erosion.

References

- *Town of Parker, "Storm Drainage and Environmental Criteria Manual", Revised February 2014.*
- *Urban Drainage & Flood Control District Drainage Criteria Manual*
- *FEMA Flood Insurance Rate Map, Community Panel #*08035C0182G*; March 16, 2016.*
- *USDA Natural Resources Conservation Service Web Soil Survey (WSS) aka NRCS Soils Map*
- *Survey prepared by PLS Group., dated 1/15/2019*
- *Horseshoe Ridge Subdivision Drainage Report by Tetra Tech, Dated Sept. 2005, Revised January 17, 2006*

Appendix

Appendix A – FIRM Floodplain Panel

Appendix B – Vicinity Map

Appendix C – NRCS Soils Data

Appendix D – Criteria

Appendix E – Calculations

Appendix F – Detention Pond Volumes

Appendix G – Basin Map/Grading & Drainage Plan

Appendix H – Existing Pond

Appendix A – FIRM Floodplain Panel

Site Location

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

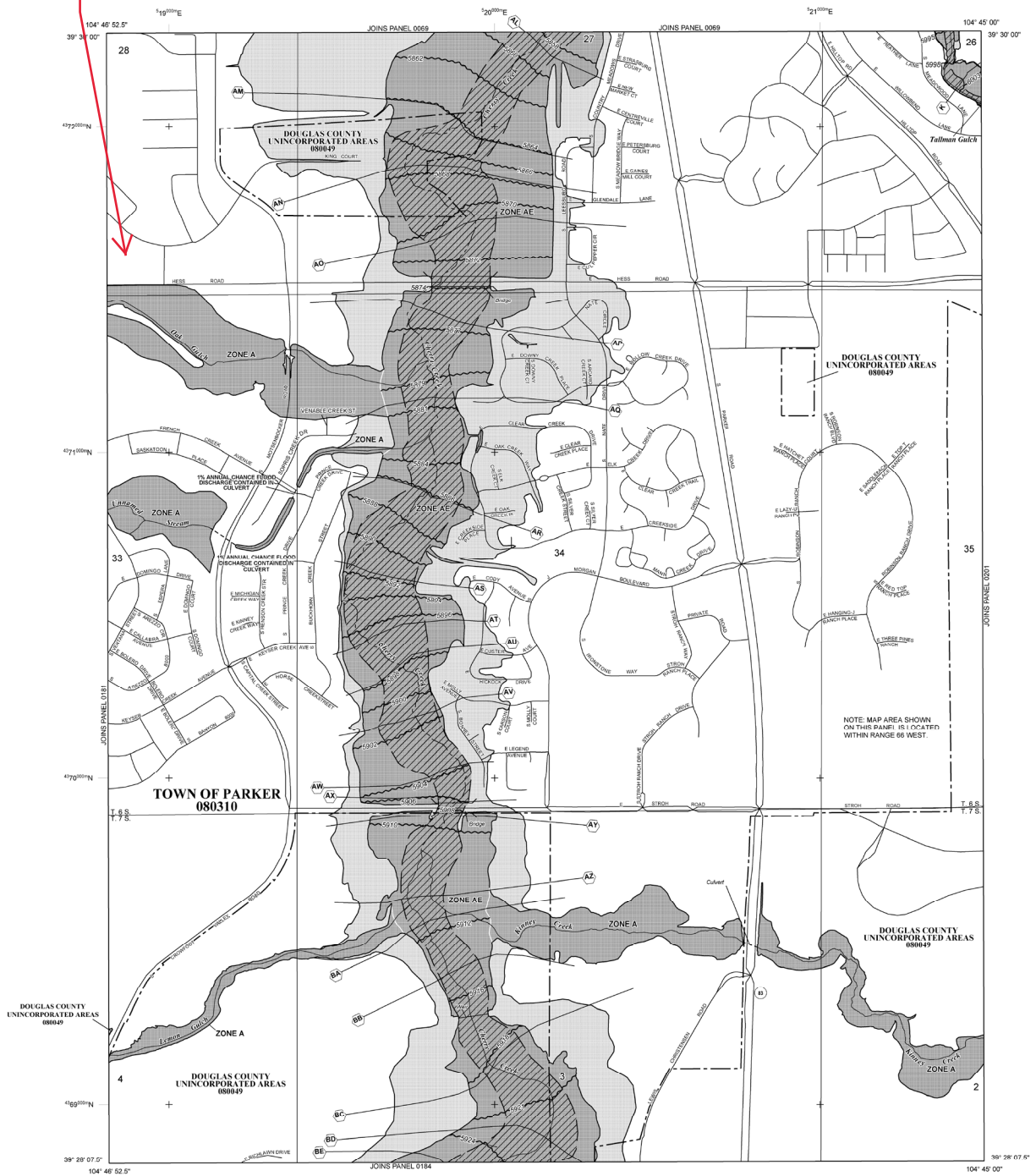
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The base flood elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A — Cross section line
23 — 23 — Transect line
45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4439000mN — 1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2000

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0182G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 182 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

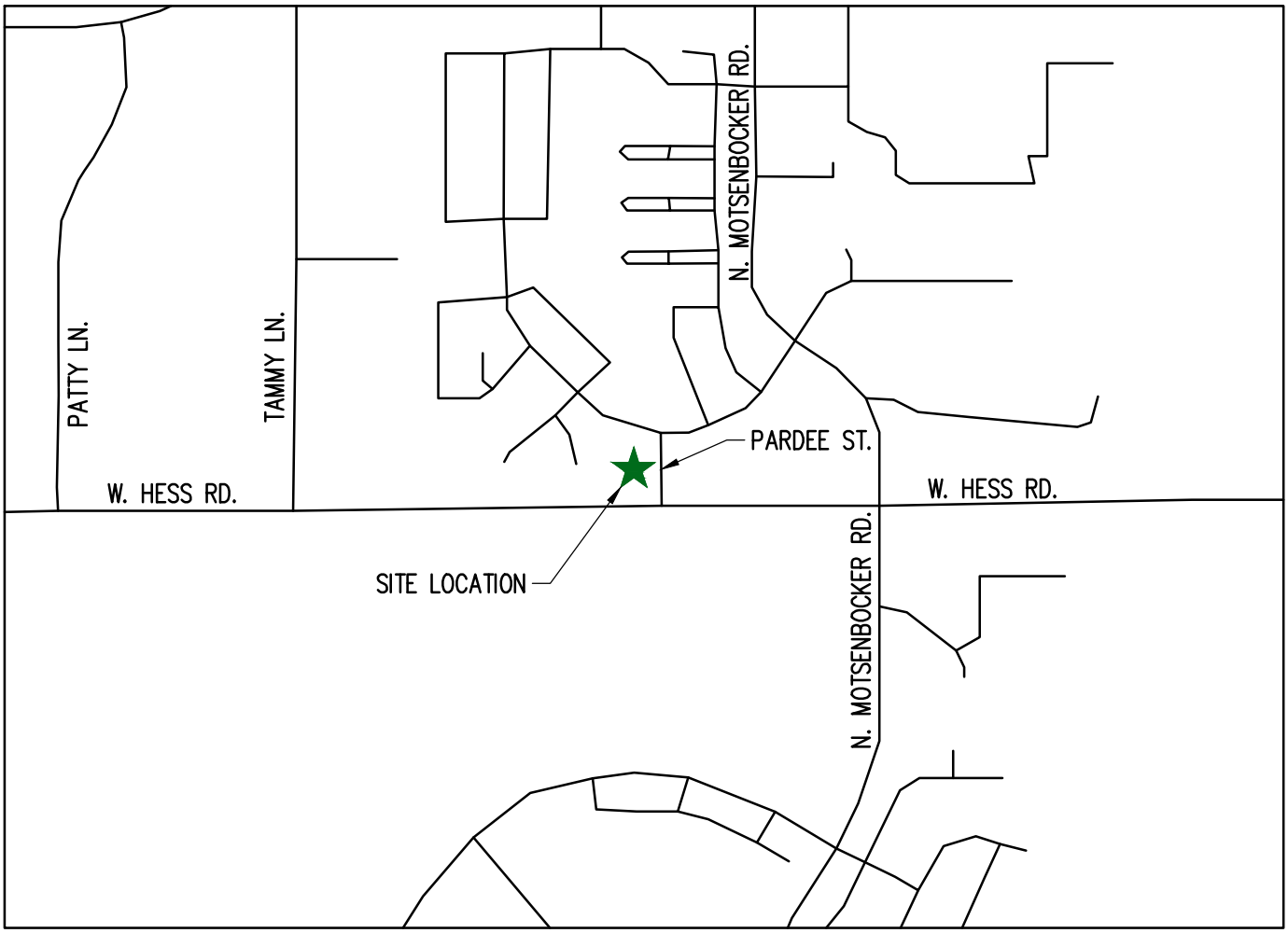
COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0182	G
PARKER, TOWN OF	080310	0182	G

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
08035C0182G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

Appendix B – Vicinity Map

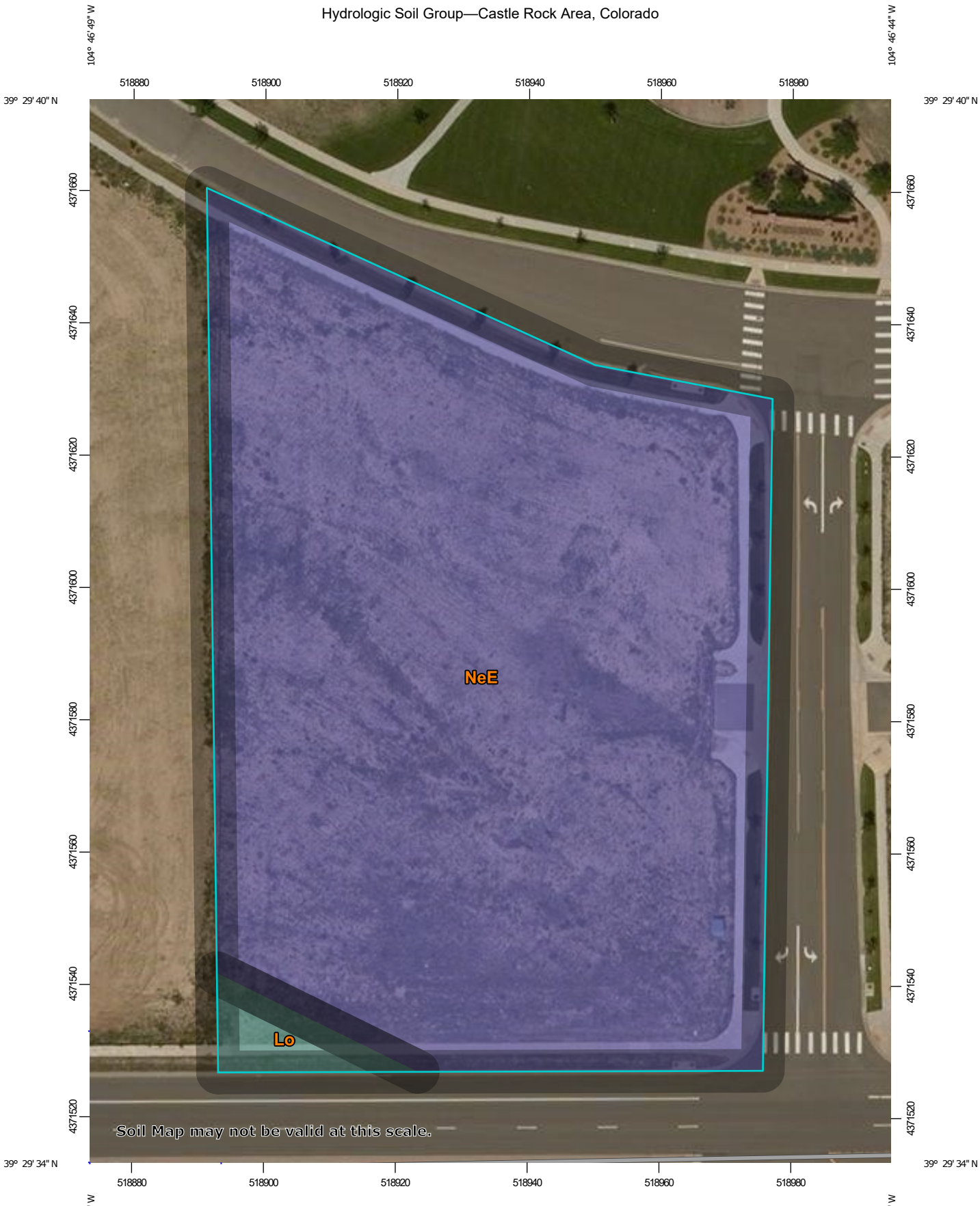


SCALE 1:1000

NORTH

VICINITY MAP

Appendix C – NRCS Soils Data



Map Scale: 1:783 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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 Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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 11, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 10, 2014—Aug 21, 2014

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Lo	Loamy alluvial land	C	0.1	2.3%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	2.3	97.7%
Totals for Area of Interest			**2.4**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D – Criteria

UDFCD Intensity-Duration Calculations:

Equation 5-1

I = (28.5*P1) / ((10+Tc)^0.786)

Where: I = rainfall intensity (inches per hour)
P1 = 1-hour point rainfall depth (inches)
Tc= Time of Concentration (minutes)

Duration	P1	5	10	15	20	25	30	Tc	Rainfall
2-year	0.99	3.36	2.68	2.25	1.95	1.73	1.55		Enter Td
5-year	1.39	4.71	3.76	3.16	2.73	2.42	2.18		Enter Td
10-year	1.64	5.56	4.44	3.72	3.23	2.86	2.57		Enter Td
100-year	2.6	8.82	7.03	5.90	5.11	4.53	4.08		Enter Td

Notes:
Visit NOAA Atlas 14 to obtain 1-hour point rainfall depths (P1)
https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

5. HYDROLOGIC CRITERIA

5.1 INTRODUCTION

This section presents the criteria and methodology for determining storm runoff design peaks and volumes to be used in the Town of Parker for preparation of storm drainage plans and facility design. In general, hydrologic analysis of the initial and major storm events for both the historic and fully developed site conditions is required. In addition to the hydrologic analysis for a site, a hydrologic analysis should be performed for all off site basins that impact the proposed site. The Town of Parker adopts procedures prescribed by the Urban Drainage and Flood Control District (UDFCD) for performing hydrologic analysis. These procedures may be found in the Rainfall and Runoff sections of the MANUAL. Standards and technical criteria found in the MANUAL should be followed except where superseded by specific requirements of this manual.

5.2 DESIGN RAINFALL

For any storm runoff technique, design rainfall must first be established. The design rainfall data to be used for the Town of Parker were obtained from NOAA Atlas 2, Precipitation– Frequency Atlas of the Western United States, Volume III– Colorado. The design storm events developed and utilized are the same as those used by UDFCD.

The one-hour point rainfall depths for different frequency events are shown in Table 5.1 herein. Rainfall intensity as a function of the one-hour point rainfall and the time of concentration can be approximated by the following equation which appears in the MANUAL as Equation RA-5.

$$I = (28.5P_1)/(10+t_c)^{0.786}$$

Where, I = rainfall intensity (in/hr)
P_1 = one-hour point rainfall depth (in)
t_c = time of concentration (min)

Graphical presentation of the equation is shown as the Time-Intensity-Frequency curves in Figure 5.1 herein. Rainfall intensity for use in the Rational Method may be taken from Figure 5.1 or calculated using the equation.

TABLE 5.1
ONE-HOUR POINT RAINFALL

Frequency of Design Event (yr)	One-hour Point Rainfall, P_1 (in)
2	0.99
5	1.39
10	1.64
25	1.98
50	2.31
100	2.60

5.3 FLOOD HYDROLOGY OVERVIEW

Various methods exist to determine appropriate flood peaks or hydrographs for storm drainage planning and design. Methods for determining flood peaks or hydrographs are the Rational Method, the Colorado Urban Hydrograph Procedure (CUHP), and Urban Drainage Stormwater Management (UDSWM) model. The Town of Parker discourages the use of computer models other than CUHP and UDSWM since these programs are preferred, if not required, by UDFCD for studies involving major drainageways where UDFCD approval is sought or where maintenance eligibility is requested.

The three methods are briefly described in this section, and a discussion of their applicability to the Town of Parker is discussed. UDSWM is mostly used to combine and route the hydrographs generated using CUHP.

In general, the Rational Method is the most widely used and accepted technique for determining peak flows in urban areas for small basins. Within the constraints outlined in the MANUAL, use of the Rational Method provides a relatively simple but effective way to analyze storm runoff.

CUHP is somewhat more complicated than the Rational Method. It allows a manual computation of a runoff hydrograph which may be used for further hydraulic routing through channels and/or detention ponds. Historically, CUHP is best used in urban areas for which runoff coefficients have been derived. However, recent improvements by UDFCD include consideration for different soil types, thus CUHP is now more applicable to rural areas. The reader is referred to UDFCD for the latest version of CUHP.

UDSWM is a computer model that generates runoff hydrographs and routes and combines these hydrographs. UDSWM is a modified version of the Runoff Block of the Environmental Protection Agency's Storm Water Management Model (SWMM). It has been modified to be used in conjunction with CUHP. Table 5.2 herein provides guidance on selecting the appropriate method for a given project.

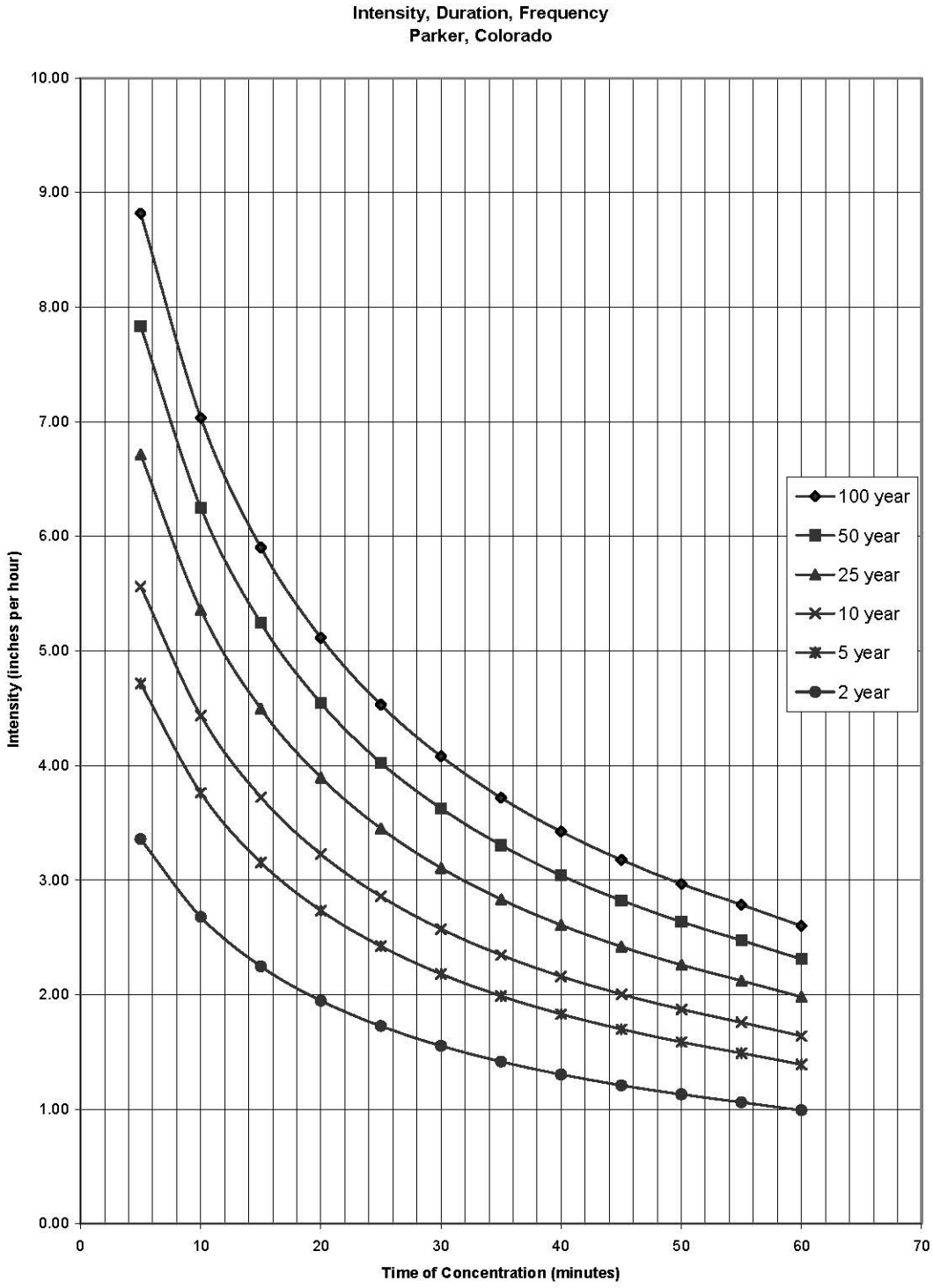


FIGURE 5.1
RAINFALL INTENSITY VERSUS DURATION CURVES FOR PARKER, COLORADO

Appendix E – Calculations

Weighted Runoff Coefficients - TOTAL BASIN

Project - Lot 1 TLE

Job Number: 18-066-001

Calculated By: BSA
Checked By: MRB
Date: 5/28/2019

Proposed/ Existing		IMP%
	Roof	90
	Concrete Drive/Walk	90
	Landscaping	2
	Multi-family (attached)	75
	Gravel	40
	Commercial	95
	Undeveloped Historical	2

Soil Types: Loamy Alluvial Land
Newlin Gravelly Sandy loam, 8 to 30 percent slopes

Hydrologic Grouping: Type B

Runoff Coefficients: C = Kc
Kc(2year) = 0.84i^1.169
Kc(5year) =0.86i^1.088
Kc(10year) = 0.81i+.057
Kc(100year) = 0.47i+0.426

Existing Basins (current conditions) — **Land Use (Acres)** — **Weighted Runoff Coefficient**

Basin	Total Area	Roof	Concrete Drive/Walk	Landscape	Gravel	Historical	Commercial	C2	C5	C10	C100	%Imp
1.00	1.111	0.000	0.005	0.000	0.000	1.106	0.000	0.01	0.01	0.08	0.44	2.4

Proposed Basins (proposed conditions) — **Land Use (Acres)** — **Weighted Runoff Coefficient**

Subbasin	Total Area	Roof	Concrete Drive/Walk	Landscape Native Grass	Undeveloped Historical	Gravel	Commercial	C2	C5	C10	C100	%Imp
1.00	1.111	0.000	0.005	0.000	1.106	0.000	0.000	0.01	0.01	0.08	0.44	2.4

TOTAL AREA: 1.111 ACRES
TOTAL IMPERVIOUS: 2.40 percent

STANDARD FORM SF-2

TIME OF CONCENTRATION - TOTAL BASIN

SUBDIVISION: LOT 1 - TLE

CALCULATED BY: BSA DATE: 5/28/2019

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)			FINAL t_c	REMARKS
DESIG:	C10	AREA Ac	LENGTH Ft	SLOPE %	t_i Min	LENGTH Ft	SLOPE %	VEL. FPS	t_t Min	COMP. t_c	TOT. LENGTH Ft	tc=(L/180)+10 Min	Min	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
1.00	0.08	1.11	25	3.1	6.3	290	3.7	1.5	3.2	9.5	315	11.8	9.5	

CALCULATED BY : BSA
DATE: 5/28/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 5-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.11	0.01	9.5	0.02	3.84	0.1													

CALCULATED BY : BSA
DATE: 5/28/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 10-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.11	0.08	9.5	0.08	4.53	0.4													

CALCULATED BY : BSA
DATE: 5/28/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 100-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.11	0.44	9.5	0.49	7.18	3.5													

Weighted Runoff Coefficients - TOTAL BASIN

Project - Lot 1 TLE

Job Number: 18-066-001

Calculated By: BSA

Checked By: MRB

Date: 10/29/2019

Proposed/ Existing	IMP%
Roof	90
Concrete Drive/Walk	90
Landscaping	2
Multi-family (attached)	75
Gravel	40
Commercial	95
Undeveloped Historical	2

Soil Types: Loamy Alluvial Land
Newlin Gravelly Sandy loam, 8 to 30 percent slopes

Hydrologic Grouping: Type B

Runoff Coefficients: C = Kc
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Kc(100year) = 0.47i+0.426

Existing Basins (current conditions) — **Land Use (Acres)** — **Weighted Runoff Coefficient**

Basin	Total Area	Roof	Concrete Drive/Walk	Landscape	Gravel	Historical	Commercial	C2	C5	C10	C100	%Imp
1.00	1.111	0.000	0.005	0.000	0.000	1.106	0.000	0.01	0.01	0.08	0.44	2.4

Proposed Basins (proposed conditions) — **Land Use (Acres)** — **Weighted Runoff Coefficient**

Subbasin	Total Area	Roof	Concrete Drive/Walk	Landscape Native Grass	Undeveloped Historical	Gravel	Commercial	C2	C5	C10	C100	%Imp
1.00	1.100	0.233	0.509	0.358	0.000	0.000	0.000	0.47	0.51	0.55	0.71	61.4
OS1	0.160	0.000	0.148	0.012	0.000	0.000	0.000	0.68	0.71	0.73	0.82	83.4

TOTAL AREA: 1.260 ACRES
TOTAL IMPERVIOUS: 64.16 percent

STANDARD FORM SF-2

TIME OF CONCENTRATION - TOTAL BASIN

SUBDIVISION: LOT 1 - TLE

CALCULATED BY: BSA DATE: 10/29/2019

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)			FINAL t_c	REMARKS
DESIG:	C10	AREA Ac	LENGTH Ft	SLOPE %	t_i Min	LENGTH Ft	SLOPE %	VEL. FPS	t_t Min	COMP. t_c	TOT. LENGTH Ft	tc=(L/180)+10 Min	Min	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
1.00	0.55	1.10	100	5.0	5.7	384	2.5	1.5	4.3	10.0	484	12.7	10.0	
OS1	0.73	0.16	30	2.0	2.9	90	1.5	1.5	1.0	3.9	120	10.7	5.0	

CALCULATED BY : BSA
DATE: 10/29/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 5-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.10	0.51	10.0	0.56	3.76	2.1													
OS1			0.16	0.71	5.0	0.11	3.36	0.4													

CALCULATED BY : BSA
DATE: 10/29/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 10-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.10	0.55	10.0	0.61	4.44	2.7													
OS1			0.16	0.73	5.0	0.12	4.71	0.6													

CALCULATED BY : BSA
DATE: 10/29/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 100-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.10	0.71	10.0	0.79	7.03	5.5													
OS1			0.16	0.82	5.0	0.13	8.82	1.2													

MANNING'S EQUATION FOR PIPE FLOW

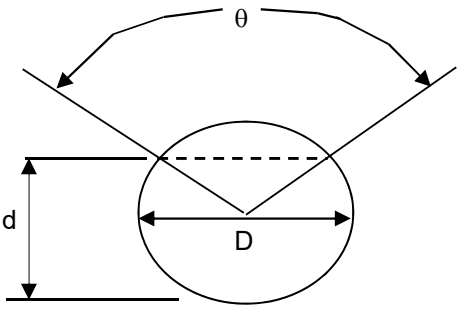
Project: TLE - PARKER Location: All Pipes

By: BSA Date: ########

Chk. By: Date:

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	18	inches
d=	16.2	inches
n=	0.013	mannings coeff
θ=	73.7	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

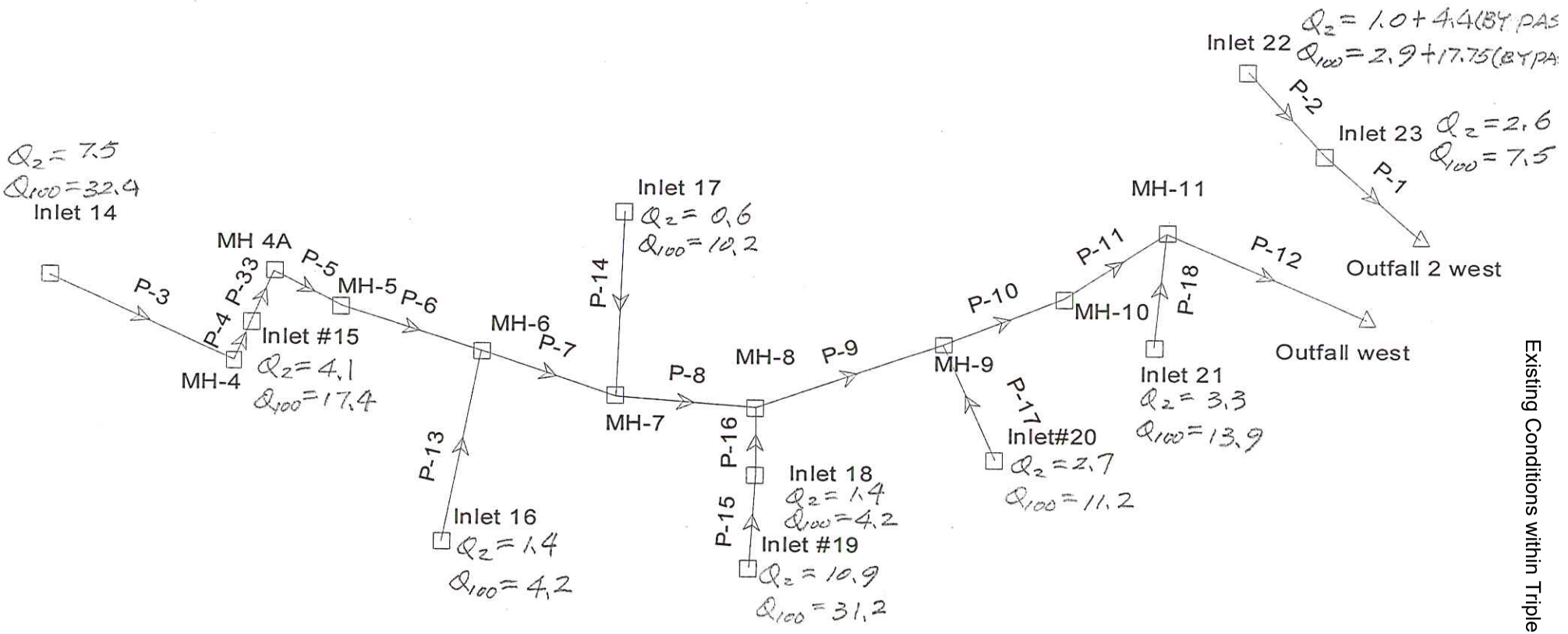
Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
1.68	3.75	0.45	4.73	7.92

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

Scenario: Southern System-100-year



Existing Conditions within Triple Crown Drive.

Scenario: Southern System-100-year

Combined Pipe\Node Report

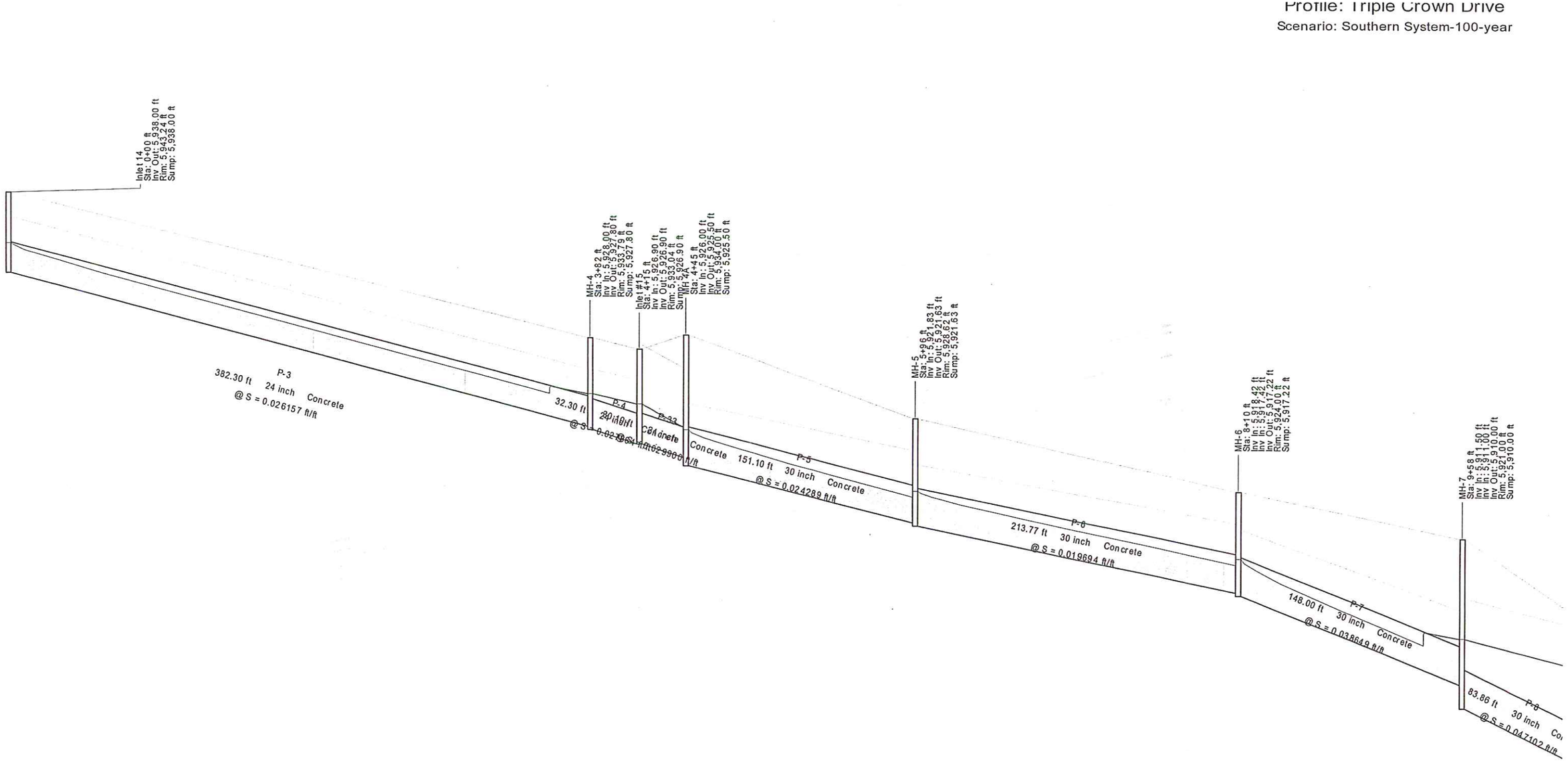
Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Depth In (ft)	Depth Out (ft)	Velocity Out (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Inlet 23	Outfall 2 we	48.20	30 inch	5,880.46	5,880.00	0.009544	28.15	40.07	4.77	5.00	5.73	5,885.23	5,885.00
P-2	Inlet 22	Inlet 23	57.30	24 inch	5,881.50	5,880.96	0.009424	20.65	21.96	4.20	4.27	6.57	5,885.70	5,885.23
P-3	Inlet 14	MH-4	382.30	24 inch	5,938.00	5,928.00	0.026157	32.40	36.59	1.89	2.11	10.31	5,939.89	5,930.11
P-4	MH-4	Inlet #15	32.30	24 inch	5,927.80	5,926.90	0.027864	32.40	37.76	2.31	2.55	10.31	5,930.11	5,929.45
P-5	MH 4A	MH-5	151.10	30 inch	5,925.50	5,921.83	0.024289	49.80	63.92	2.30	1.70	14.04	5,927.80	5,923.53
P-6	MH-5	MH-6	213.77	30 inch	5,921.63	5,917.42	0.019694	49.80	57.56	2.30	1.80	13.17	5,923.93	5,919.22
P-7	MH-6	MH-7	148.00	30 inch	5,917.22	5,911.50	0.038649	54.00	80.63	2.34	2.97	11.00	5,919.56	5,914.47
P-8	MH-7	MH-8	83.86	30 inch	5,910.00	5,906.05	0.047102	64.20	89.01	4.47	6.37	13.08	5,914.47	5,912.42
P-9	MH-8	MH-9	145.70	30 inch	5,905.85	5,901.33	0.031023	99.60	72.24	6.57	2.49	20.31	5,912.42	5,903.82
P-10	MH-9	MH-10	102.70	30 inch	5,901.13	5,891.76	0.091237	110.80	123.89	2.49	2.01	26.24	5,903.62	5,893.77
P-11	MH-10	MH-11	208.60	36 inch	5,889.61	5,882.78	0.032742	110.80	120.68	4.25	5.32	15.67	5,893.86	5,888.10
P-12	MH-11	Outfall west	201.91	42 inch	5,882.28	5,880.00	0.011292	124.70	106.91	5.82	5.00	12.96	5,888.10	5,885.00
P-13	Inlet 16	MH-6	78.60	18 inch	5,920.30	5,918.42	0.023919	4.20	16.24	0.79	1.14	2.90	5,921.09	5,919.56
P-14	Inlet 17	MH-7	34.20	18 inch	5,912.00	5,911.00	0.029240	10.20	17.96	2.79	3.47	5.77	5,914.79	5,914.47
P-15	Inlet #19	Inlet 18	88.70	24 inch	5,907.58	5,906.70	0.009921	31.20	22.53	6.92	6.12	9.93	5,914.50	5,912.82
P-16	Inlet 18	MH-8	16.30	24 inch	5,906.50	5,906.35	0.009202	35.40	21.70	6.32	6.07	11.27	5,912.82	5,912.42
P-17	Inlet#20	MH-9	44.00	18 inch	5,902.60	5,902.13	0.010682	11.20	10.86	1.48	1.49	6.34	5,904.08	5,903.62
P-18	Inlet 21	MH-11	40.00	18 inch	5,885.00	5,884.28	0.018000	13.90	14.09	3.80	3.82	7.87	5,888.80	5,888.10
P-33	Inlet #15	MH 4A	30.10	24 inch	5,926.90	5,926.00	0.029900	49.80	39.12	2.55	1.98	15.88	5,929.45	5,927.98

Scenario: Southern System-2-year

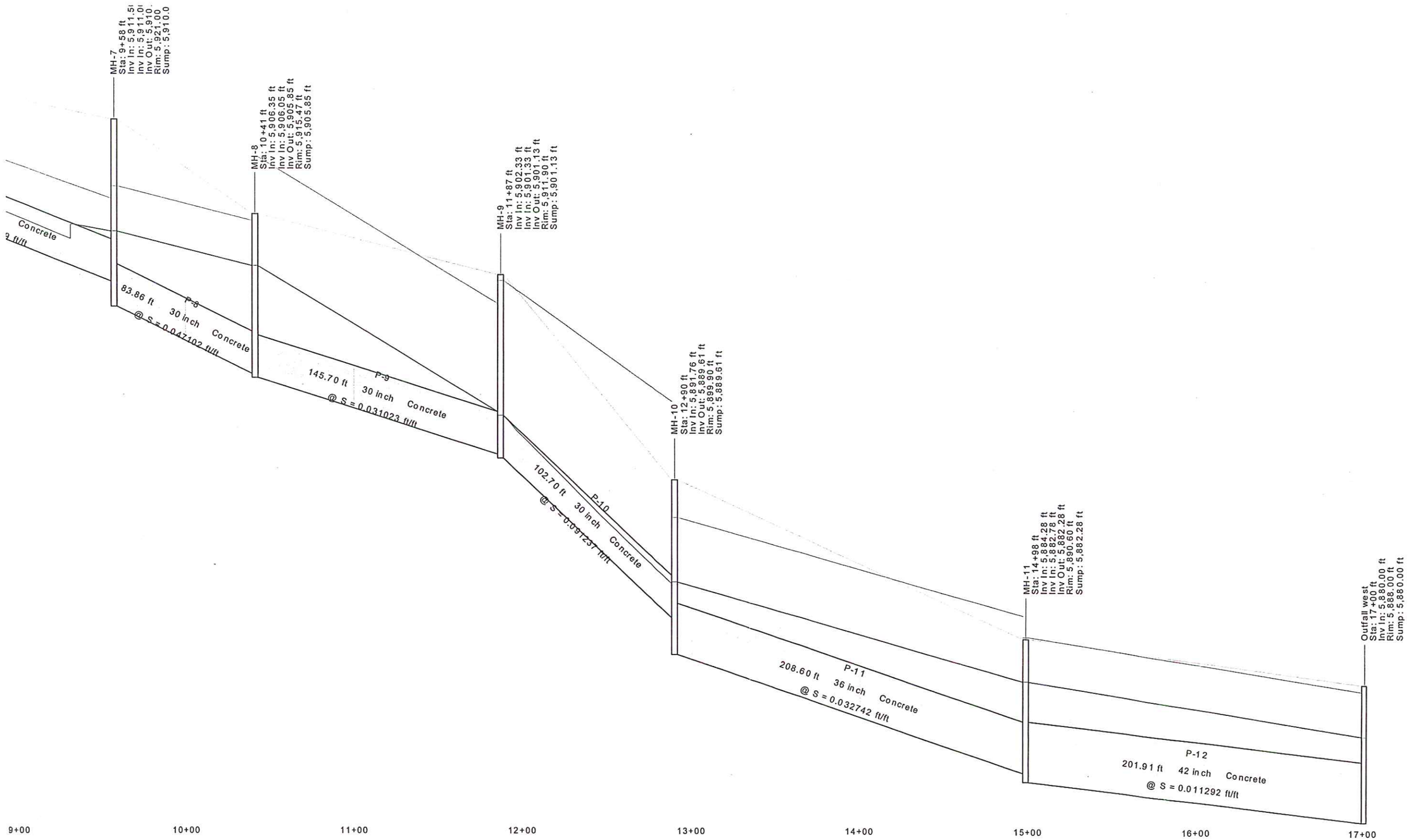
Combined Pipe\Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Depth In (ft)	Depth Out (ft)	Velocity Out (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Inlet 23	Outfall 2 we	48.20	30 inch	5,880.46	5,880.00	0.009544	8.00	40.07	0.94	0.77	6.26	5,881.40	5,880.77
P-2	Inlet 22	Inlet 23	57.30	24 inch	5,881.50	5,880.96	0.009424	5.40	21.96	0.82	0.68	5.78	5,882.32	5,881.64
P-3	Inlet 14	MH-4	382.30	24 inch	5,938.00	5,928.00	0.026157	7.50	36.59	0.97	1.02	4.64	5,938.97	5,929.02
P-4	MH-4	Inlet #15	32.30	24 inch	5,927.80	5,926.90	0.027864	11.60	37.76	1.22	1.43	4.83	5,929.02	5,928.33
P-5	MH 4A	MH-5	151.10	30 inch	5,925.50	5,921.83	0.024289	15.70	63.92	1.34	0.84	10.77	5,926.84	5,922.67
P-6	MH-5	MH-6	213.77	30 inch	5,921.63	5,917.42	0.019694	15.70	57.56	1.34	0.89	9.99	5,922.97	5,918.31
P-7	MH-6	MH-7	148.00	30 inch	5,917.22	5,911.50	0.038649	17.10	80.63	1.40	0.78	13.04	5,918.62	5,912.28
P-8	MH-7	MH-8	83.86	30 inch	5,910.00	5,906.05	0.047102	17.70	89.01	1.42	1.65	5.17	5,911.42	5,907.70
P-9	MH-8	MH-9	145.70	30 inch	5,905.85	5,901.33	0.031023	29.30	72.24	1.85	1.12	13.75	5,907.70	5,902.45
P-10	MH-9	MH-10	102.70	30 inch	5,901.13	5,891.76	0.091237	31.50	123.89	1.91	0.89	20.05	5,903.04	5,892.65
P-11	MH-10	MH-11	208.60	36 inch	5,889.61	5,882.78	0.032742	31.50	120.68	1.82	1.05	14.36	5,891.43	5,883.83
P-12	MH-11	Outfall west	201.91	42 inch	5,882.28	5,880.00	0.011292	36.00	106.91	1.86	1.40	10.02	5,884.14	5,881.40
P-13	Inlet 16	MH-6	78.60	18 inch	5,920.30	5,918.42	0.023919	1.40	16.24	0.44	0.30	5.63	5,920.74	5,918.72
P-14	Inlet 17	MH-7	34.20	18 inch	5,912.00	5,911.00	0.029240	0.60	17.96	0.29	0.42	1.46	5,912.29	5,911.42
P-15	Inlet #19	Inlet 18	88.70	24 inch	5,907.58	5,906.70	0.009921	10.90	22.53	1.18	0.98	7.11	5,908.76	5,907.68
P-16	Inlet 18	MH-8	16.30	24 inch	5,906.50	5,906.35	0.009202	12.30	21.70	1.26	1.35	5.47	5,907.76	5,907.70
P-17	Inlet#20	MH-9	44.00	18 inch	5,902.60	5,902.13	0.010682	2.70	10.86	0.62	0.91	2.40	5,903.22	5,903.04
P-18	Inlet 21	MH-11	40.00	18 inch	5,885.00	5,884.28	0.018000	3.30	14.09	0.69	0.50	6.40	5,885.69	5,884.78
P-33	Inlet #15	MH 4A	30.10	24 inch	5,926.90	5,926.00	0.029900	15.70	39.12	1.43	1.00	10.02	5,928.33	5,927.00

Profile
Scenario: Southern System-100-year



Profile
Scenario: Southern System-100-year



Title: Horseshoe Ridge
I:\...\08 reports\final drainage\pond3-rev.stm
01/05/06 10:53:26 AM

Tetra Tech RMC
 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

Project Engineer: Vera Stepanek
StormCAD v5.5 [5.5003]

Lot 1 - 10-year Event added to existing Storm Flows in Triple Crown Rd.

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... 10-yr SSA.SPF

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date MAY-28-2019 00:00:00
Ending Date MAY-28-2019 01:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of subbasins 0
Number of nodes 18
Number of links 17

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
INLET 19	JUNCTION	5907.58	5911.00	0.00	Yes
INLET14	JUNCTION	5938.00	5943.24	0.00	Yes
INLET15	JUNCTION	5926.90	5933.04	0.00	Yes
INLET16	JUNCTION	5920.30	5924.93	0.00	Yes
INLET17	JUNCTION	5912.00	5915.00	0.00	Yes
INLET18	JUNCTION	5906.50	5915.47	0.00	Yes
INLET20	JUNCTION	5902.60	5912.00	0.00	Yes
INTLET21	JUNCTION	5885.00	5890.00	0.00	Yes
MH-10	JUNCTION	5889.61	5899.90	0.00	
MH-11	JUNCTION	5882.28	5890.60	0.00	
MH-4	JUNCTION	5927.80	5933.79	0.00	
MH-4A	JUNCTION	5925.50	5934.00	0.00	
MH-5	JUNCTION	5921.63	5928.62	0.00	
MH-6	JUNCTION	5917.22	5924.00	0.00	
MH-7	JUNCTION	5910.00	5921.00	0.00	
MH-8	JUNCTION	5905.85	5915.47	0.00	
MH-9	JUNCTION	5901.13	5911.90	0.00	
OUTFALLWEST	OUTFALL	5880.00	5883.50	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
P-10	MH-9	MH-10	CONDUIT	102.7	9.1237	0.0130
P-11	MH-10	MH-11	CONDUIT	208.6	3.2742	0.0130
P-12	MH-11	OUTFALLWEST	CONDUIT	201.9	1.1292	0.0130
P-13	INLET16	MH-6	CONDUIT	78.6	2.3919	0.0130
P-14	INLET17	MH-7	CONDUIT	34.2	2.9240	0.0130
P-15	INLET 19	INLET18	CONDUIT	88.7	0.9921	0.0130
P-16	INLET18	MH-8	CONDUIT	16.3	0.9202	0.0130
P-17	INLET20	MH-9	CONDUIT	44.0	1.0682	0.0130
P-18	INTLET21	MH-11	CONDUIT	40.0	1.8000	0.0130
P-3	INLET14	MH-4	CONDUIT	382.3	2.6157	0.0130
P-33	INLET15	MH-4A	CONDUIT	30.1	2.9900	0.0130
P-4	MH-4	INLET15	CONDUIT	32.3	2.7864	0.0130
P-5	MH-4A	MH-5	CONDUIT	151.1	2.4289	0.0130
P-6	MH-5	MH-6	CONDUIT	213.8	1.9694	0.0130
P-7	MH-6	MH-7	CONDUIT	148.0	3.8649	0.0130
P-8	MH-7	MH-8	CONDUIT	83.9	4.7102	0.0130
P-9	MH-8	MH-9	CONDUIT	145.7	3.1023	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
P-10	CIRCULAR	2.50	2.50	1	4.91	0.63	123.89
P-11	CIRCULAR	3.00	3.00	1	7.07	0.75	120.69
P-12	CIRCULAR	3.50	3.50	1	9.62	0.88	106.91
P-13	CIRCULAR	1.50	1.50	1	1.77	0.38	16.25
P-14	CIRCULAR	1.50	1.50	1	1.77	0.38	17.96
P-15	CIRCULAR	2.00	2.00	1	3.14	0.50	22.53
P-16	CIRCULAR	2.00	2.00	1	3.14	0.50	21.70
P-17	CIRCULAR	1.50	1.50	1	1.77	0.38	10.86
P-18	CIRCULAR	1.50	1.50	1	1.77	0.38	14.09

P-3	CIRCULAR	2.00	2.00	1	3.14	0.50	36.59
P-33	CIRCULAR	2.00	2.00	1	3.14	0.50	39.12
P-4	CIRCULAR	2.00	2.00	1	3.14	0.50	37.76
P-5	CIRCULAR	2.50	2.50	1	4.91	0.63	63.92
P-6	CIRCULAR	2.50	2.50	1	4.91	0.63	57.56
P-7	CIRCULAR	2.50	2.50	1	4.91	0.63	80.64
P-8	CIRCULAR	2.50	2.50	1	4.91	0.63	89.02
P-9	CIRCULAR	2.50	2.50	1	4.91	0.63	72.24

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	5.983	1.950
External Outflow	5.862	1.910
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.121	0.039
Continuity Error (%)	0.000	

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss
INLET 19	1.36	1.36	5908.94	0	00:00	0	0	0:00:00
INLET14	1.02	1.02	5939.02	0	00:00	0	0	0:00:00
INLET15	1.27	1.29	5928.19	0	00:01	0	0	0:00:00
INLET16	0.63	0.63	5920.93	0	00:00	0	0	0:00:00
INLET17	0.35	0.35	5912.35	0	00:00	0	0	0:00:00
INLET18	1.68	8.97	5915.47	0	00:01	0.01	1	0:00:00
INLET20	0.84	0.84	5903.44	0	00:00	0	0	0:00:00
INTLET21	0.81	0.81	5885.81	0	00:00	0	0	0:00:00
MH-10	3.41	3.44	5893.05	0	00:02	0	0	0:00:00
MH-11	2.81	2.87	5885.15	0	00:01	0	0	0:00:00
MH-4	1.21	1.22	5929.02	0	00:08	0	0	0:00:00
MH-4A	1.77	1.78	5927.28	0	00:01	0	0	0:00:00
MH-5	1.37	1.38	5923.01	0	00:02	0	0	0:00:00
MH-6	1.82	1.87	5919.09	0	00:01	0	0	0:00:00
MH-7	2.63	2.65	5912.65	0	00:02	0	0	0:00:00
MH-8	2.05	2.45	5908.30	0	00:01	0	0	0:00:00
MH-9	1.89	1.91	5903.04	0	00:02	0	0	0:00:00
OUTFALLWEST	2.07	2.12	5882.12	0	00:03	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
INLET 19	JUNCTION	18.10	18.10	0	00:00	0.00		
INLET14	JUNCTION	18.80	18.80	0	00:00	0.00		
INLET15	JUNCTION	10.10	29.26	0	00:01	0.00		
INLET16	JUNCTION	5.90	5.90	0	00:00	0.00		
INLET17	JUNCTION	2.20	2.20	0	00:00	0.00		
INLET18	JUNCTION	2.50	22.94	0	00:01	0.62	0	00:01
INLET20	JUNCTION	6.50	6.50	0	00:00	0.00		
INTLET21	JUNCTION	8.00	8.00	0	00:00	0.00		
MH-10	JUNCTION	0.00	65.12	0	00:02	0.00		
MH-11	JUNCTION	0.00	72.87	0	00:03	0.00		
MH-4	JUNCTION	0.00	18.80	0	00:08	0.00		
MH-4A	JUNCTION	0.00	28.99	0	00:01	0.00		
MH-5	JUNCTION	0.00	28.97	0	00:02	0.00		
MH-6	JUNCTION	0.00	35.28	0	00:02	0.00		
MH-7	JUNCTION	0.00	37.23	0	00:02	0.00		
MH-8	JUNCTION	0.00	58.09	0	00:02	0.00		
MH-9	JUNCTION	0.00	65.11	0	00:02	0.00		
OUTFALLWEST	OUTFALL	0.00	72.68	0	00:03	0.00		

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALLWEST	100.00	70.64	72.68
System	100.00	70.64	72.68

Link Flow Summary

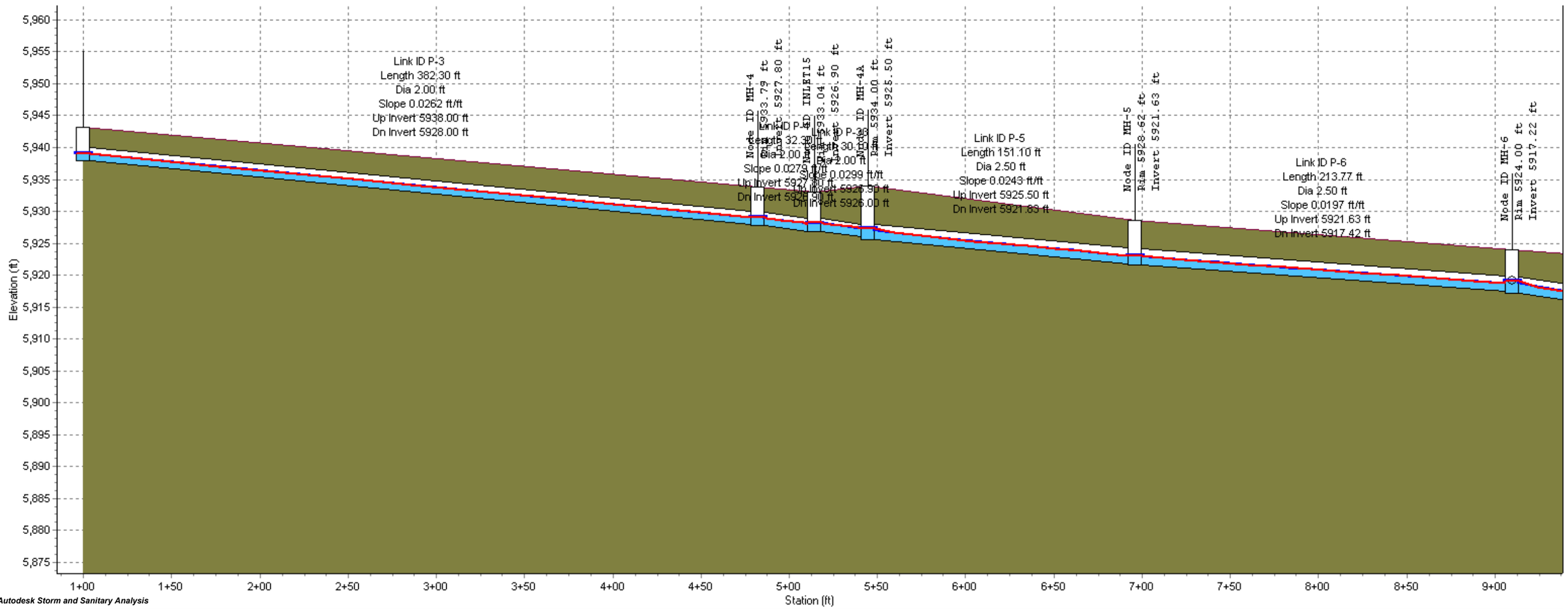
Link ID	Element Type	Time of Peak Flow Occurrence days	hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
P-10	CONDUIT	0	00:02	25.55	1.00	65.12	123.89	0.53	0.52	0	Calculated
P-11	CONDUIT	0	00:03	17.45	1.00	64.81	120.69	0.54	0.52	0	Calculated
P-12	CONDUIT	0	00:03	11.96	1.00	72.68	106.91	0.68	0.61	0	Calculated
P-13	CONDUIT	0	00:01	9.20	1.00	6.76	16.25	0.42	0.43	0	Calculated
P-14	CONDUIT	0	00:01	7.41	1.00	2.46	17.96	0.14	0.24	0	Calculated
P-15	CONDUIT	0	00:01	8.53	1.00	20.44	22.53	0.91	0.71	0	Calculated
P-16	CONDUIT	0	00:01	7.87	1.00	22.48	21.70	1.04	0.99	0	> CAPACITY
P-17	CONDUIT	0	00:01	6.91	1.00	7.36	10.86	0.68	0.58	0	Calculated
P-18	CONDUIT	0	00:01	8.79	1.00	8.92	14.09	0.63	0.56	0	Calculated
P-3	CONDUIT	0	00:08	11.72	1.00	18.80	36.59	0.51	0.51	0	Calculated
P-33	CONDUIT	0	00:01	13.65	1.00	28.99	39.12	0.74	0.64	0	Calculated
P-4	CONDUIT	0	00:01	12.21	1.00	19.16	37.76	0.51	0.50	0	Calculated
P-5	CONDUIT	0	00:02	12.75	1.00	28.97	63.92	0.45	0.47	0	Calculated
P-6	CONDUIT	0	00:02	11.82	1.00	29.27	57.56	0.51	0.50	0	Calculated
P-7	CONDUIT	0	00:02	15.92	1.00	35.06	80.64	0.43	0.46	0	Calculated
P-8	CONDUIT	0	00:02	17.40	1.00	37.48	89.02	0.42	0.45	0	Calculated
P-9	CONDUIT	0	00:02	16.46	1.00	58.67	72.24	0.81	0.68	0	Calculated

****
Highest Flow Instability Indexes
****
Link P-33 (16)
Link P-5 (15)
Link P-4 (13)
Link P-6 (13)
Link P-16 (11)

Analysis began on: Tue May 28 16:30:13 2019
Analysis ended on: Tue May 28 16:30:13 2019
Total elapsed time: < 1 sec

Profile Plot

Main Street Storm Sewer



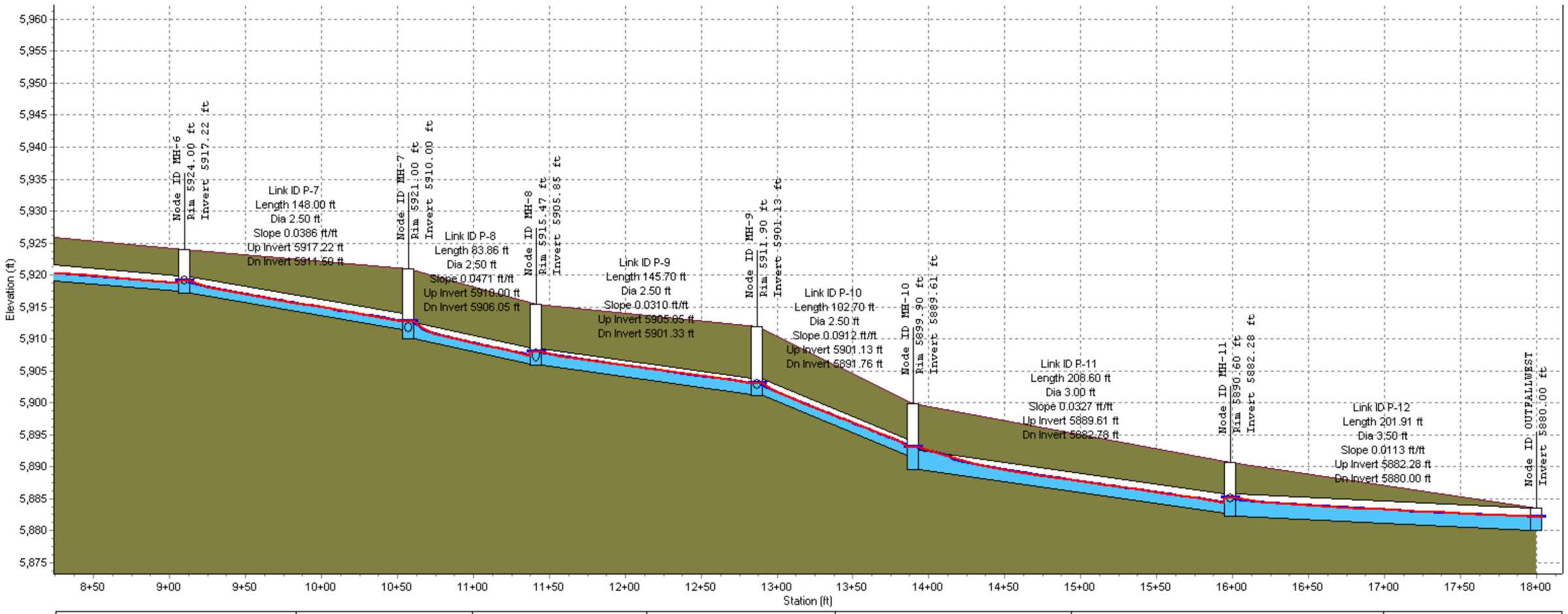
Autodesk Storm and Sanitary Analysis

Node ID:	INLET14	MH-4	INLET15	MH-4A	MH-5	MH-6
Rim (ft):	5943.24	5933.79	5933.04	5934.00	5928.62	5924.00
Invert (ft):	5938.00	5927.80	5926.90	5925.50	5921.63	5917.22
Min Pipe Cover (ft):	3.24	3.79	4.14	6.00	4.29	4.08
Max HGL (ft):	5939.02	5929.02	5928.19	5927.28	5923.01	5919.09

Link ID:	P-3	P-4	P-33	P-5	P-6
Length (ft):	382.30	32.30	30.10	151.10	213.77
Dia (ft):	2.00	2.00	2.00	2.50	2.50
Slope (ft/ft):	0.0262	0.0279	0.0299	0.0243	0.0197
Up Invert (ft):	5938.00	5927.80	5926.90	5925.50	5921.63
Dn Invert (ft):	5928.00	5926.90	5926.00	5921.83	5917.42
Max Q (cfs):	18.80	19.16	28.99	28.97	29.27
Max Vel (ft/s):	11.72	12.21	13.65	12.75	11.82
Max Depth (ft):	1.02	1.00	1.28	1.18	1.25

Profile Plot

Main Street Storm Sewer



Node ID:	MH-6	MH-7	MH-8	MH-9	MH-10	MH-11	
Rim (ft):	5924.00	5921.00	5915.47	5911.90	5899.90	5890.60	
Invert (ft):	5917.22	5910.00	5905.85	5901.13	5889.61	5882.28	5880.00
Min Pipe Cover (ft):	4.08	7.00	6.92	8.07	5.64	4.82	
Max HGL (ft):	5919.09	5912.65	5908.30	5903.04	5893.05	5885.15	5882.12

Link ID:	P-7	P-8	P-9	P-10	P-11	P-12
Length (ft):	148.00	83.86	145.70	102.70	208.60	201.91
Dia (ft):	2.50	2.50	2.50	2.50	3.00	3.50
Slope (ft/ft):	0.0386	0.0471	0.0310	0.0912	0.0327	0.0113
Up Invert (ft):	5917.22	5910.00	5905.85	5901.13	5889.61	5882.28
Dn Invert (ft):	5911.50	5906.05	5901.33	5891.76	5882.78	5880.00
Max Q (cfs):	35.06	37.48	58.67	65.12	64.81	72.68
Max Vel (ft/s):	15.92	17.40	16.46	25.55	17.45	11.96
Max Depth (ft):	1.15	1.12	1.69	1.28	1.56	2.11

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)

****
Project Description
****
File Name ..... 100-yr SSA.SPF

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Kinematic Wave
Storage Node Exfiltration.. None
Starting Date MAY-28-2019 00:00:00
Ending Date MAY-28-2019 01:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of subbasins 0
Number of nodes 18
Number of links 17

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
INLET 19	JUNCTION	5907.58	5911.00	0.00	Yes
INLET14	JUNCTION	5938.00	5943.24	0.00	Yes
INLET15	JUNCTION	5926.90	5933.04	0.00	Yes
INLET16	JUNCTION	5920.30	5924.93	0.00	Yes
INLET17	JUNCTION	5912.00	5915.00	0.00	Yes
INLET18	JUNCTION	5906.50	5915.47	0.00	Yes
INLET20	JUNCTION	5902.60	5912.00	0.00	Yes
INTLET21	JUNCTION	5885.00	5890.00	0.00	Yes
MH-10	JUNCTION	5889.61	5899.90	0.00	
MH-11	JUNCTION	5882.28	5890.60	0.00	
MH-4	JUNCTION	5927.80	5933.79	0.00	
MH-4A	JUNCTION	5925.50	5934.00	0.00	
MH-5	JUNCTION	5921.63	5928.62	0.00	
MH-6	JUNCTION	5917.22	5924.00	0.00	
MH-7	JUNCTION	5910.00	5921.00	0.00	
MH-8	JUNCTION	5905.85	5915.47	0.00	
MH-9	JUNCTION	5901.13	5911.90	0.00	
OUTFALLWEST	OUTFALL	5880.00	5883.50	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
P-10	MH-9	MH-10	CONDUIT	102.7	9.1237	0.0130
P-11	MH-10	MH-11	CONDUIT	208.6	3.2742	0.0130
P-12	MH-11	OUTFALLWEST	CONDUIT	201.9	1.1292	0.0130
P-13	INLET16	MH-6	CONDUIT	78.6	2.3919	0.0130
P-14	INLET17	MH-7	CONDUIT	34.2	2.9240	0.0130
P-15	INLET 19	INLET18	CONDUIT	88.7	0.9921	0.0130
P-16	INLET18	MH-8	CONDUIT	16.3	0.9202	0.0130
P-17	INLET20	MH-9	CONDUIT	44.0	1.0682	0.0130
P-18	INTLET21	MH-11	CONDUIT	40.0	1.8000	0.0130
P-3	INLET14	MH-4	CONDUIT	382.3	2.6157	0.0130
P-33	INLET15	MH-4A	CONDUIT	30.1	2.9900	0.0130
P-4	MH-4	INLET15	CONDUIT	32.3	2.7864	0.0130
P-5	MH-4A	MH-5	CONDUIT	151.1	2.4289	0.0130
P-6	MH-5	MH-6	CONDUIT	213.8	1.9694	0.0130
P-7	MH-6	MH-7	CONDUIT	148.0	3.8649	0.0130
P-8	MH-7	MH-8	CONDUIT	83.9	4.7102	0.0130
P-9	MH-8	MH-9	CONDUIT	145.7	3.1023	0.0130

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
P-10	CIRCULAR	2.50	2.50	1	4.91	0.63	123.89
P-11	CIRCULAR	3.00	3.00	1	7.07	0.75	120.69
P-12	CIRCULAR	3.50	3.50	1	9.62	0.88	106.91
P-13	CIRCULAR	1.50	1.50	1	1.77	0.38	16.25
P-14	CIRCULAR	1.50	1.50	1	1.77	0.38	17.96
P-15	CIRCULAR	2.00	2.00	1	3.14	0.50	22.53
P-16	CIRCULAR	2.00	2.00	1	3.14	0.50	21.70
P-17	CIRCULAR	1.50	1.50	1	1.77	0.38	10.86
P-18	CIRCULAR	1.50	1.50	1	1.77	0.38	14.09

P-3	CIRCULAR	2.00	2.00	1	3.14	0.50	36.59
P-33	CIRCULAR	2.00	2.00	1	3.14	0.50	39.12
P-4	CIRCULAR	2.00	2.00	1	3.14	0.50	37.76
P-5	CIRCULAR	2.50	2.50	1	4.91	0.63	63.92
P-6	CIRCULAR	2.50	2.50	1	4.91	0.63	57.56
P-7	CIRCULAR	2.50	2.50	1	4.91	0.63	80.64
P-8	CIRCULAR	2.50	2.50	1	4.91	0.63	89.02
P-9	CIRCULAR	2.50	2.50	1	4.91	0.63	72.24

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	10.904	3.553
External Outflow	7.940	2.588
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.161	0.053
Continuity Error (%)	-0.001	

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss
INLET 19	3.42	3.42	5911.00	0	00:00	8.63	61	0:00:00
INLET14	1.46	1.46	5939.46	0	00:00	0	0	0:00:00
INLET15	6.10	6.14	5933.04	0	00:01	10.51	60	0:00:00
INLET16	0.90	0.90	5921.20	0	00:00	0	0	0:00:00
INLET17	0.81	0.81	5912.81	0	00:00	0	0	0:00:00
INLET18	8.97	8.97	5915.47	0	00:00	4.98	61	0:00:00
INLET20	9.40	9.40	5912.00	0	00:00	0.34	61	0:00:00
INTLET21	1.21	1.21	5886.21	0	00:00	0	0	0:00:00
MH-10	3.64	3.65	5893.26	0	00:02	0	0	0:00:00
MH-11	3.21	3.50	5885.78	0	00:01	0	0	0:00:00
MH-4	1.66	1.66	5929.46	0	00:08	0	0	0:00:00
MH-4A	2.49	2.50	5928.00	0	00:01	0	0	0:00:00
MH-5	1.61	1.65	5923.28	0	00:01	0	0	0:00:00
MH-6	2.10	2.18	5919.40	0	00:01	0	0	0:00:00
MH-7	2.91	2.96	5912.96	0	00:02	0	0	0:00:00
MH-8	9.50	9.62	5915.47	0	00:01	9.44	60	0:00:00
MH-9	2.69	2.70	5903.83	0	00:02	0	0	0:00:00
OUTFALLWEST	2.59	2.62	5882.62	0	00:03	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
INLET 19	JUNCTION	31.20	31.20	0	00:00	8.67	0	00:01
INLET14	JUNCTION	32.40	32.40	0	00:00	0.00		
INLET15	JUNCTION	17.40	50.55	0	00:01	10.75	0	00:03
INLET16	JUNCTION	10.90	10.90	0	00:00	0.00		
INLET17	JUNCTION	10.20	10.20	0	00:00	0.00		
INLET18	JUNCTION	4.20	26.73	0	00:01	5.03	0	00:01
INLET20	JUNCTION	11.20	11.20	0	00:00	0.34	0	00:01
INTLET21	JUNCTION	13.90	13.90	0	00:00	0.00		
MH-10	JUNCTION	0.00	83.36	0	00:02	0.00		
MH-11	JUNCTION	0.00	97.43	0	00:02	0.00		
MH-4	JUNCTION	0.00	32.40	0	00:08	0.00		
MH-4A	JUNCTION	0.00	39.12	0	00:01	0.00		
MH-5	JUNCTION	0.00	40.79	0	00:01	0.00		
MH-6	JUNCTION	0.00	51.11	0	00:02	0.00		
MH-7	JUNCTION	0.00	62.21	0	00:02	0.00		
MH-8	JUNCTION	0.00	83.94	0	00:02	10.68	0	00:02
MH-9	JUNCTION	0.00	83.41	0	00:02	0.00		
OUTFALLWEST	OUTFALL	0.00	97.31	0	00:03	0.00		

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALLWEST	100.00	95.69	97.31
System	100.00	95.69	97.31

Link Flow Summary

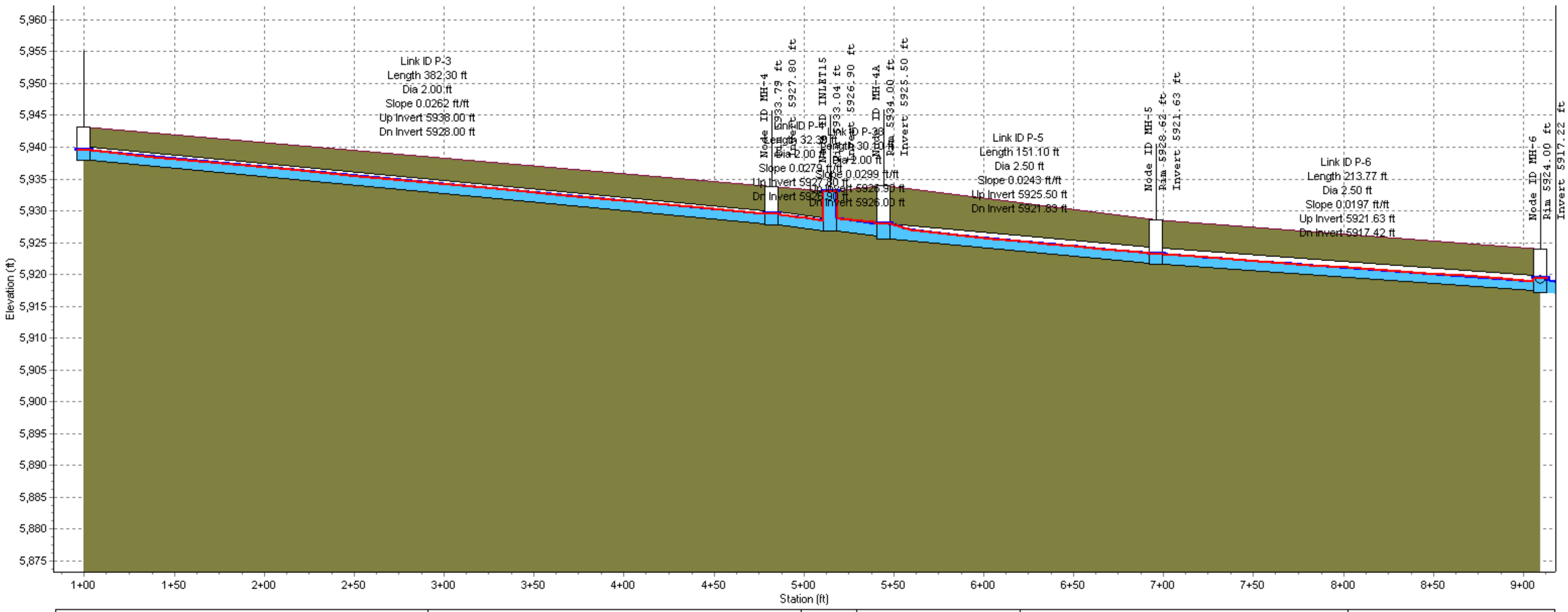
Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
P-10	CONDUIT	0 00:02	27.08	1.00	83.36	123.89	0.67	0.60	0	Calculated
P-11	CONDUIT	0 00:02	18.44	1.00	83.50	120.69	0.69	0.61	0	Calculated
P-12	CONDUIT	0 00:03	12.60	1.00	97.31	106.91	0.91	0.75	0	Calculated
P-13	CONDUIT	0 00:01	10.63	1.00	12.40	16.25	0.76	0.63	0	Calculated
P-14	CONDUIT	0 00:01	11.04	1.00	11.10	17.96	0.62	0.55	0	Calculated
P-15	CONDUIT	0 00:01	7.17	1.00	22.53	22.53	1.00	1.00	60	SURCHARGED
P-16	CONDUIT	0 00:01	6.91	1.00	21.70	21.70	1.00	1.00	60	SURCHARGED
P-17	CONDUIT	0 00:01	6.35	1.00	11.20	10.86	1.03	1.00	1	SURCHARGED
P-18	CONDUIT	0 00:01	9.14	1.00	14.09	14.09	1.00	0.90	0	> CAPACITY
P-3	CONDUIT	0 00:08	13.14	1.00	32.40	36.59	0.89	0.73	0	Calculated
P-33	CONDUIT	0 00:01	12.45	1.00	39.12	39.12	1.00	1.00	60	SURCHARGED
P-4	CONDUIT	0 00:01	13.73	1.00	33.15	37.76	0.88	0.72	0	Calculated
P-5	CONDUIT	0 00:01	14.02	1.00	40.79	63.92	0.64	0.57	0	Calculated
P-6	CONDUIT	0 00:02	12.83	1.00	40.00	57.56	0.69	0.61	0	Calculated
P-7	CONDUIT	0 00:02	17.51	1.00	51.74	80.64	0.64	0.58	0	Calculated
P-8	CONDUIT	0 00:02	19.61	1.00	62.24	89.02	0.70	0.62	0	Calculated
P-9	CONDUIT	0 00:02	15.32	1.00	72.24	72.24	1.00	1.00	59	SURCHARGED

****
Highest Flow Instability Indexes
****
Link P-17 (26)
Link P-4 (18)
Link P-14 (15)
Link P-10 (11)
Link P-11 (11)

Analysis began on: Tue May 28 16:32:01 2019
Analysis ended on: Tue May 28 16:32:01 2019
Total elapsed time: < 1 sec

Profile Plot

Main Street Storm Sewer

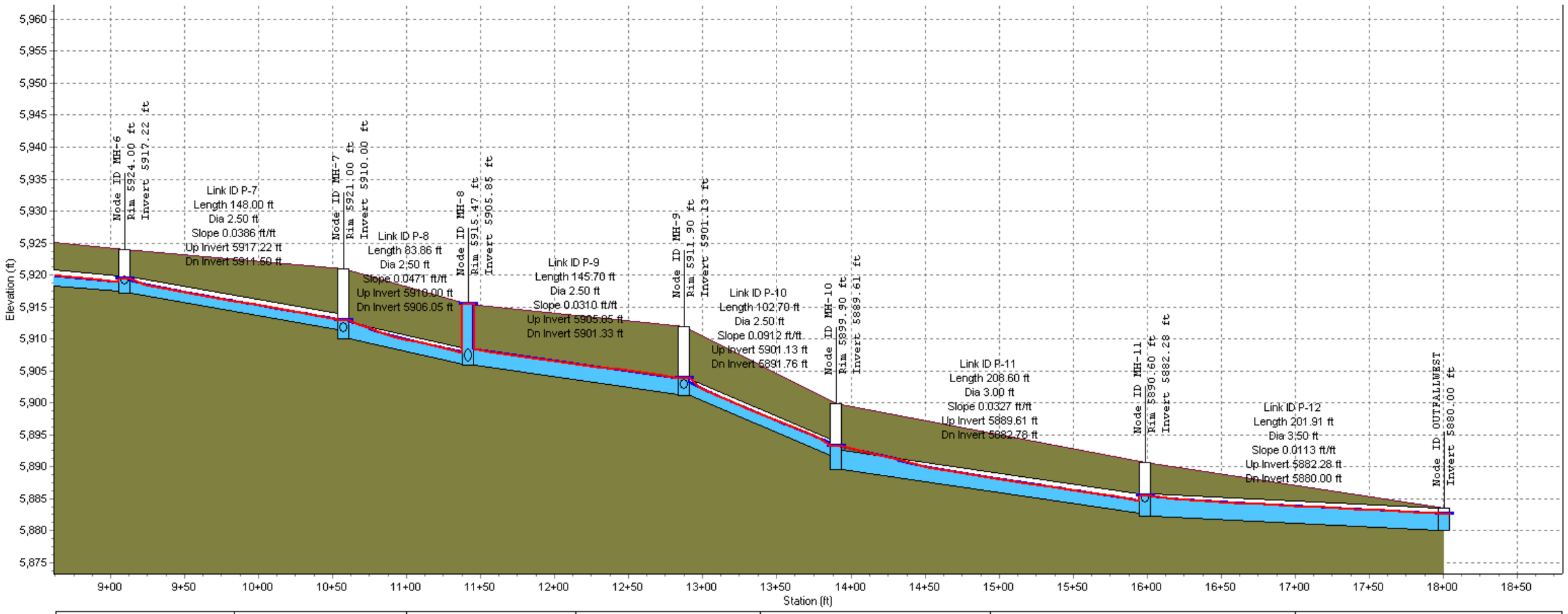


Node ID:	INLET14	MH-4	INLET15	MH-4A	MH-5	MH-6
Rim (ft):	5943.24	5933.79	5933.04	5934.00	5928.62	
Invert (ft):	5938.00	5927.80	5926.90	5925.50	5921.63	
Min Pipe Cover (ft):	3.24	3.79	4.14	6.00	4.29	4.08
Max HGL (ft):	5939.46	5929.46	5933.04	5928.00	5923.28	

Link ID:	P-3	P-4	P-33	P-5	P-6
Length (ft):	382.30	32.30	30.10	151.10	213.77
Dia (ft):	2.00	2.00	2.00	2.50	2.50
Slope (ft/ft):	0.0262	0.0279	0.0299	0.0243	0.0197
Up Invert (ft):	5938.00	5927.80	5926.90	5925.50	5921.63
Dn Invert (ft):	5928.00	5926.90	5926.00	5921.83	5917.42
Max Q (cfs):	32.40	33.15	39.12	40.79	40.00
Max Vel (ft/s):	13.14	13.73	12.45	14.02	12.83
Max Depth (ft):	1.46	1.43	2.00	1.41	1.51

Profile Plot

Main Street Storm Sewer



Node ID:	MH-6	MH-7	MH-8	MH-9	MH-10	MH-11	OUTFALLWEST
Rim (ft):	5924.00	5921.00	5915.47	5911.90	5899.90	5890.60	
Invert (ft):	5917.22	5910.00	5905.85	5901.13	5889.61	5882.28	5880.00
Min Pipe Cover (ft):	4.08	7.00	6.92	8.07	5.64	4.82	
Max HGL (ft):	5919.40	5912.96	5915.47	5903.83	5893.26	5885.78	5882.62

Link ID:	P-7	P-8	P-9	P-10	P-11	P-12
Length (ft):	148.00	83.86	145.70	102.70	208.60	201.91
Dia (ft):	2.50	2.50	2.50	2.50	3.00	3.50
Slope (ft/ft):	0.0386	0.0471	0.0310	0.0912	0.0327	0.0113
Up Invert (ft):	5917.22	5910.00	5905.85	5901.13	5889.61	5882.28
Dn Invert (ft):	5911.50	5906.05	5901.33	5891.76	5882.78	5880.00
Max Q (cfs):	51.74	62.24	72.24	83.36	83.50	97.31
Max Vel (ft/s):	17.51	19.61	15.32	27.08	18.44	12.60
Max Depth (ft):	1.43	1.51	2.50	1.50	1.83	2.62

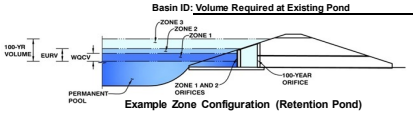
Appendix F – Detention Pond Volumes

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: TLE Parker

Basin ID: Volume Required at Existing Pond



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	1.26	acres
Watershed Length =	484	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	64.16%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - Town Hall	
Water Quality Capture Volume (WQCV) =	0.026	acre-feet
Excess Urban Runoff Volume (EURV) =	0.088	acre-feet
2-yr Runoff Volume (P1 = 0.99 in.) =	0.061	acre-feet
5-yr Runoff Volume (P1 = 1.39 in.) =	0.090	acre-feet
10-yr Runoff Volume (P1 = 1.64 in.) =	0.118	acre-feet
25-yr Runoff Volume (P1 = 1.98 in.) =	0.161	acre-feet
50-yr Runoff Volume (P1 = 2.31 in.) =	0.194	acre-feet
100-yr Runoff Volume (P1 = 2.6 in.) =	0.231	acre-feet
500-yr Runoff Volume (P1 = 3.08 in.) =	0.291	acre-feet
Approximate 2-yr Detention Volume =	0.057	acre-feet
Approximate 5-yr Detention Volume =	0.085	acre-feet
Approximate 10-yr Detention Volume =	0.110	acre-feet
Approximate 25-yr Detention Volume =	0.125	acre-feet
Approximate 50-yr Detention Volume =	0.135	acre-feet
Approximate 100-yr Detention Volume =	0.147	acre-feet

Optional User Override 1-hr Precipitation

0.99	inches
1.39	inches
1.64	inches
1.98	inches
2.31	inches
2.60	inches
	inches

Stage-Storage Calculation

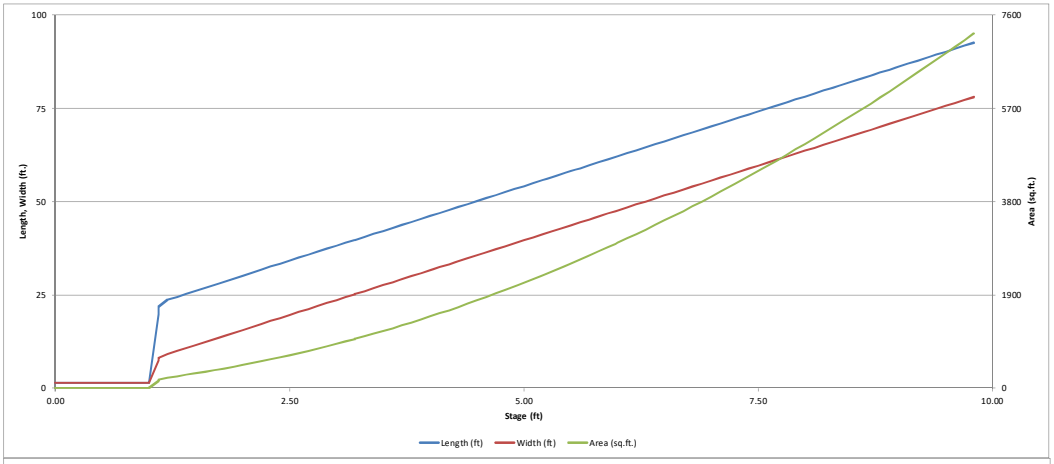
Zone 1 Volume (WQCV) =	0.026	acre-feet
Zone 2 Volume (10-year - Zone 1) =	0.083	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.037	acre-feet
Total Detention Basin Volume =	0.147	acre-feet
Initial Surcharge Volume (ISV) =	1	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	3	
Initial Surcharge Area (A_{ISV}) =	2	ft^2
Surcharge Volume Length (L_{ISV}) =	1.4	ft
Surcharge Volume Width (W_{ISV}) =	1.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.11	ft
Length of Basin Floor (L_{FLOOR}) =	23.0	ft
Width of Basin Floor (W_{FLOOR}) =	8.5	ft
Area of Basin Floor (A_{FLOOR}) =	195	ft^2
Volume of Basin Floor (V_{FLOOR}) =	8	ft^3
Depth of Main Basin (H_{MAIN}) =	4.89	ft
Length of Main Basin (L_{MAIN}) =	62.2	ft
Width of Main Basin (W_{MAIN}) =	47.6	ft
Area of Main Basin (A_{MAIN}) =	2,960	ft^2
Volume of Main Basin (V_{MAIN}) =	6,385	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.147**	acre-feet

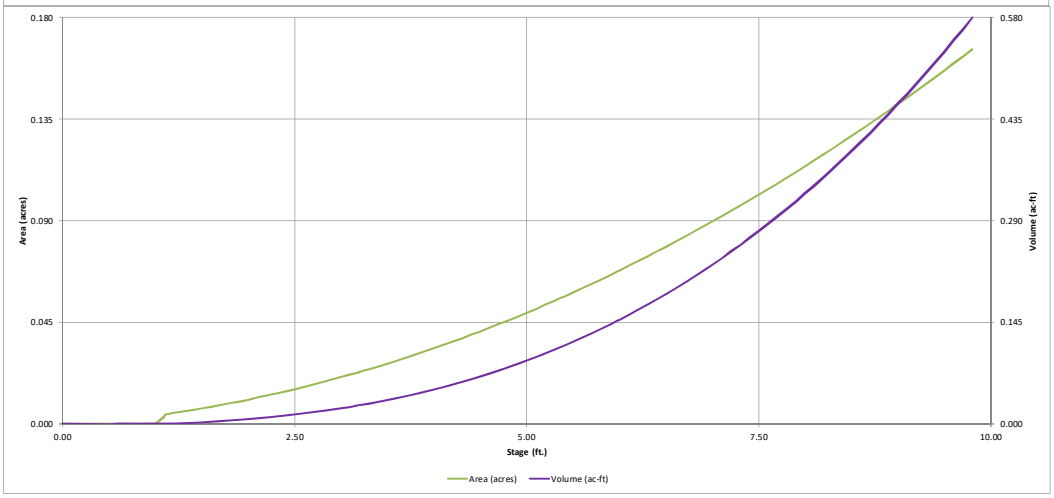
Depth Increment = 0.1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		1.4	1.4	2		0.000		
ISV	0.50		1.4	1.4	2		0.000	1	0.000
	0.60		1.4	1.4	2		0.000	1	0.000
	0.70		1.4	1.4	2		0.000	1	0.000
	0.80		1.4	1.4	2		0.000	2	0.000
	0.90		1.4	1.4	2		0.000	2	0.000
	1.00		1.4	1.4	2		0.000	2	0.000
	1.10		19.8	7.4	147		0.003	7	0.000
Floor	1.11		21.8	8.1	176		0.004	9	0.000
	1.20		23.7	9.1	216		0.005	27	0.001
	1.30		24.5	9.9	243		0.006	50	0.001
	1.40		25.3	10.7	271		0.006	76	0.002
	1.50		26.1	11.5	301		0.007	104	0.002
	1.60		26.9	12.3	332		0.008	136	0.003
	1.70		27.7	13.1	364		0.008	171	0.004
	1.80		28.5	13.9	397		0.009	209	0.005
	1.90		29.3	14.7	431		0.010	250	0.006
	2.00		30.1	15.5	467		0.011	295	0.007
	2.10		31.0	16.4	508		0.012	349	0.008
	2.20		31.8	17.2	547		0.013	401	0.009
	2.30		32.6	18.0	587		0.013	458	0.011
	2.40		33.4	18.8	628		0.014	519	0.012
	2.50		34.2	19.6	670		0.015	584	0.013
	2.60		35.0	20.4	714		0.016	653	0.015
	2.70		35.8	21.2	759		0.017	726	0.017
	2.80		36.6	22.0	805		0.018	805	0.018
	2.90		37.4	22.8	852		0.020	887	0.020
	3.00		38.2	23.6	901		0.021	975	0.022
	3.10		39.0	24.4	951		0.022	1,068	0.025
Zone 1 (WQCV)	3.19		39.7	25.1	997		0.023	1,155	0.027
	3.20		39.8	25.2	1,003		0.023	1,165	0.027
	3.30		40.6	26.0	1,055		0.024	1,268	0.029
	3.40		41.4	26.8	1,109		0.025	1,376	0.032
	3.50		42.2	27.6	1,164		0.027	1,490	0.034
	3.60		43.0	28.4	1,221		0.028	1,609	0.037
	3.70		43.8	29.2	1,278		0.029	1,734	0.040
	3.80		44.6	30.0	1,337		0.031	1,865	0.043
	3.90		45.4	30.8	1,398		0.032	2,002	0.046
	4.00		46.2	31.6	1,459		0.034	2,145	0.049
	4.10		47.0	32.4	1,522		0.035	2,294	0.053
	4.20		47.8	33.2	1,586		0.036	2,449	0.056
	4.30		48.6	34.0	1,652		0.038	2,611	0.060
	4.40		49.4	34.8	1,718		0.039	2,780	0.064
	4.50		50.2	35.6	1,786		0.041	2,955	0.068
	4.60		51.0	36.4	1,856		0.043	3,137	0.072
	4.70		51.8	37.2	1,926		0.044	3,326	0.076
	4.80		52.6	38.0	1,998		0.046	3,522	0.081
	4.90		53.4	38.8	2,071		0.048	3,726	0.086
	5.00		54.2	39.6	2,146		0.049	3,936	0.090
	5.10		55.0	40.4	2,221		0.051	4,155	0.095
	5.20		55.8	41.2	2,298		0.053	4,381	0.101
	5.30		56.6	42.0	2,376		0.055	4,614	0.106
Zone 2 (10-year)	5.37		57.1	42.6	2,432		0.056	4,783	0.110
	5.40		57.4	42.8	2,456		0.056	4,856	0.111
	5.50		58.2	43.6	2,537		0.058	5,106	0.117
	5.60		59.0	44.4	2,619		0.060	5,363	0.123
	5.70		59.8	45.2	2,702		0.062	5,629	0.129
	5.80		60.6	46.0	2,787		0.064	5,904	0.136
	5.90		61.4	46.8	2,873		0.066	6,187	0.142
Zone 3 (100-year)	5.98		62.0	47.5	2,942		0.068	6,419	0.147
	6.00		62.2	47.6	2,960		0.068	6,478	0.149
	6.10		63.0	48.4	3,048		0.070	6,779	0.156
	6.20		63.8	49.2	3,138		0.072	7,088	0.163
	6.30		64.6	50.0	3,229		0.074	7,406	0.170
	6.40		65.4	50.8	3,321		0.076	7,734	0.178
	6.50		66.2	51.6	3,415		0.078	8,071	0.185
	6.60		67.0	52.4	3,510		0.081	8,417	0.193
	6.70		67.8	53.2	3,606		0.083	8,773	0.201
	6.80		68.6	54.0	3,703		0.085	9,138	0.210
	6.90		69.4	54.8	3,802		0.087	9,513	0.218
	7.00		70.2	55.6	3,902		0.090	9,899	0.227
	7.10		71.0	56.4	4,003		0.092	10,294	0.236
	7.20		71.8	57.2	4,106		0.094	10,699	0.246
	7.30		72.6	58.0	4,209		0.097	11,115	0.255
	7.40		73.4	58.8	4,315		0.099	11,541	0.265
	7.50		74.2	59.6	4,421		0.101	11,978	0.275
	7.60		75.0	60.4	4,529		0.104	12,425	0.285
	7.70		75.8	61.2	4,638		0.106	12,884	0.296
	7.80		76.6	62.0	4,748		0.109	13,353	0.307
	7.90		77.4	62.8	4,859		0.112	13,833	0.318
	8.00		78.2	63.6	4,972		0.114	14,325	0.329
	8.10		79.0	64.4	5,086		0.117	14,828	0.340
	8.20		79.8	65.2	5,201		0.119	15,342	0.352
	8.30		80.6	66.0	5,318		0.122	15,868	0.364
	8.40		81.4	66.8	5,436		0.125	16,406	0.377
	8.50		82.2	67.6	5,555		0.128	16,955	0.389
	8.60		83.0	68.4	5,676		0.130	17,517	0.402
	8.70		83.8	69.2	5,797		0.133	18,090	0.415
	8.80		84.6	70.0	5,920		0.136	18,676	0.429
	8.90		85.4	70.8	6,045		0.139	19,275	0.442
	9.00		86.2	71.6	6,170		0.142	19,885	0.457
	9.10		87.0	72.4	6,297		0.145	20,509	0.471
	9.20		87.8	73.2	6,425		0.148	21,145	0.485
	9.30		88.6	74.0	6,555		0.150	21,794	0.500
	9.40		89.4	74.8	6,685		0.153	22,456	0.516
	9.50		90.2	75.6	6,817		0.157	23,131	0.531
	9.60		91.0	76.4	6,951		0.160	23,819	0.547
	9.70		91.8	77.2	7,085		0.163	24,521	0.563
	9.80		92.6	78.0	7,221		0.166	25,236	0.579

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



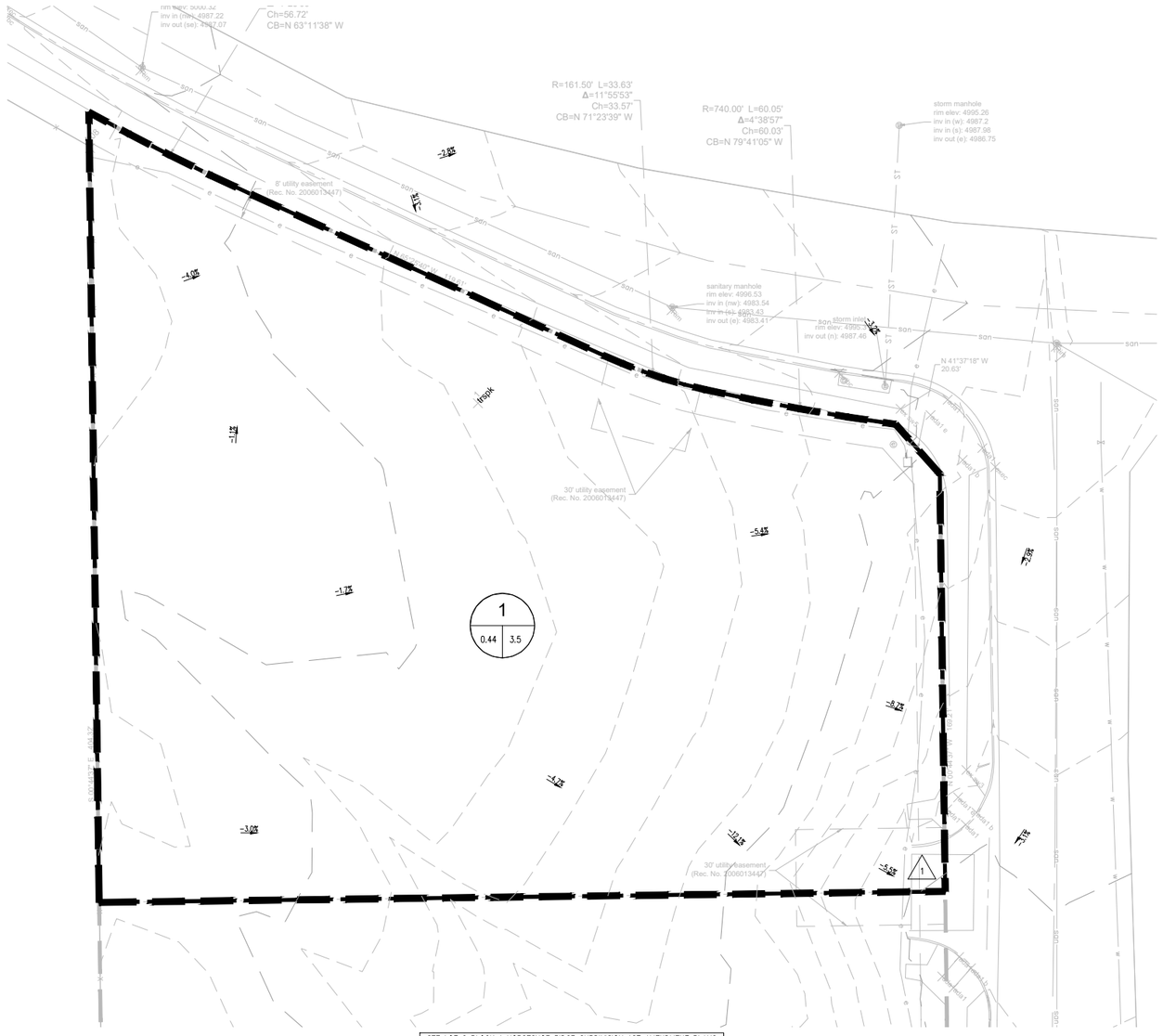


Appendix G – Basin Map/Grading and Drainage Plan

HORSESHOE RIDGE SUBDIVISION 1ST AMENDMENT

LOT 1, BLOCK 1, HORSESHOE RIDGE SUBDIVISION 1ST AMENDMENT
A PARCEL OF LAND LOCATED IN THE SE 1/4 OF SECTION 28, TOWNSHIP 6 SOUTH, RANGE 66 WEST OF THE 6TH PRINCIPAL MERIDIAN

CONSTRUCTION DOCUMENTS



SEE LOT 2 BLOCK 1 HORSESHOE RIDGE SUBDIVISION 1ST AMENDMENT PLANS FOR ADDITIONAL GRADING INFORMATION; IF LOT 2 IS UNABLE TO BE CONSTRUCTED, CONTRACTOR IS TO GRADE FROM EDGE OF PAVEMENT SHOWN ON THESE PLANS BACK TO EXISTING AT NO LESS THAN 3:1 SLOPE.

LEGEND

- 3156 — EXISTING CONTOUR
- PROPERTY LINE
- BASIN LIMITS
- # — BASIN
- X.XX (100-YR COEF) | X.XX (100-YR CFS)
- 1 — DESIGN POINT

SUMMARY RUNOFF TABLE

SUBBASIN # / DESIGN POINT	CONTRIBUTING AREA (ACRES)	RUNOFF 10YR (CFS)	PEAK 100YR (CFS)
1	1.111	0.4	3.5

NORTH
0 10 20 40
1 inch = 20 ft.

Know what's **below.** **Call** before you dig.

The Town of Parker review constitutes general compliance with the Town's Standards and approved variances, subject to these plans being stamped, signed, and dated by the professional engineer of record. Review by the Town does not constitute approval of the plan design or accuracy and correctness of engineering calculations. Errors in the design or calculations remain the responsibility of the registered professional engineer whose stamp and signature are affixed to this document.

This review does not constitute approval of any private on-site improvements which may be shown. Construction cannot commence until all required drainage/traffic report(s), final development plan(s), special review(s), grading permit, and/or other permits are complete, approved and on file with the Town of Parker.

Town of Parker, Director of Engineering — Date

LOGO
RIDGETOP ENGINEERING & SURVEYING
541 E. Garden Drive, Unit N
Windsor, CO 80550
T (970) 663-4632
W ridgetopeng.com

SEAL

PROJECT TITLE
THE LEARNING EXPERIENCE

LOT 1, BLOCK 1
HORSESHOE RIDGE
PARKER, CO 80134

PREPARED FOR
BRYTAR COMPANIES

8117 PRESTON RD. #300
DALLAS, TX 75225

SUBMITTAL
CONSTRUCTION DOCS.

DRAWN BY: BSA
CHECKED BY: MRB
PROJECT NO.: 18-075-001

REVISIONS

DATE
5/28/2019

SHEET TITLE
EXISTING CONDITIONS BASIN MAP

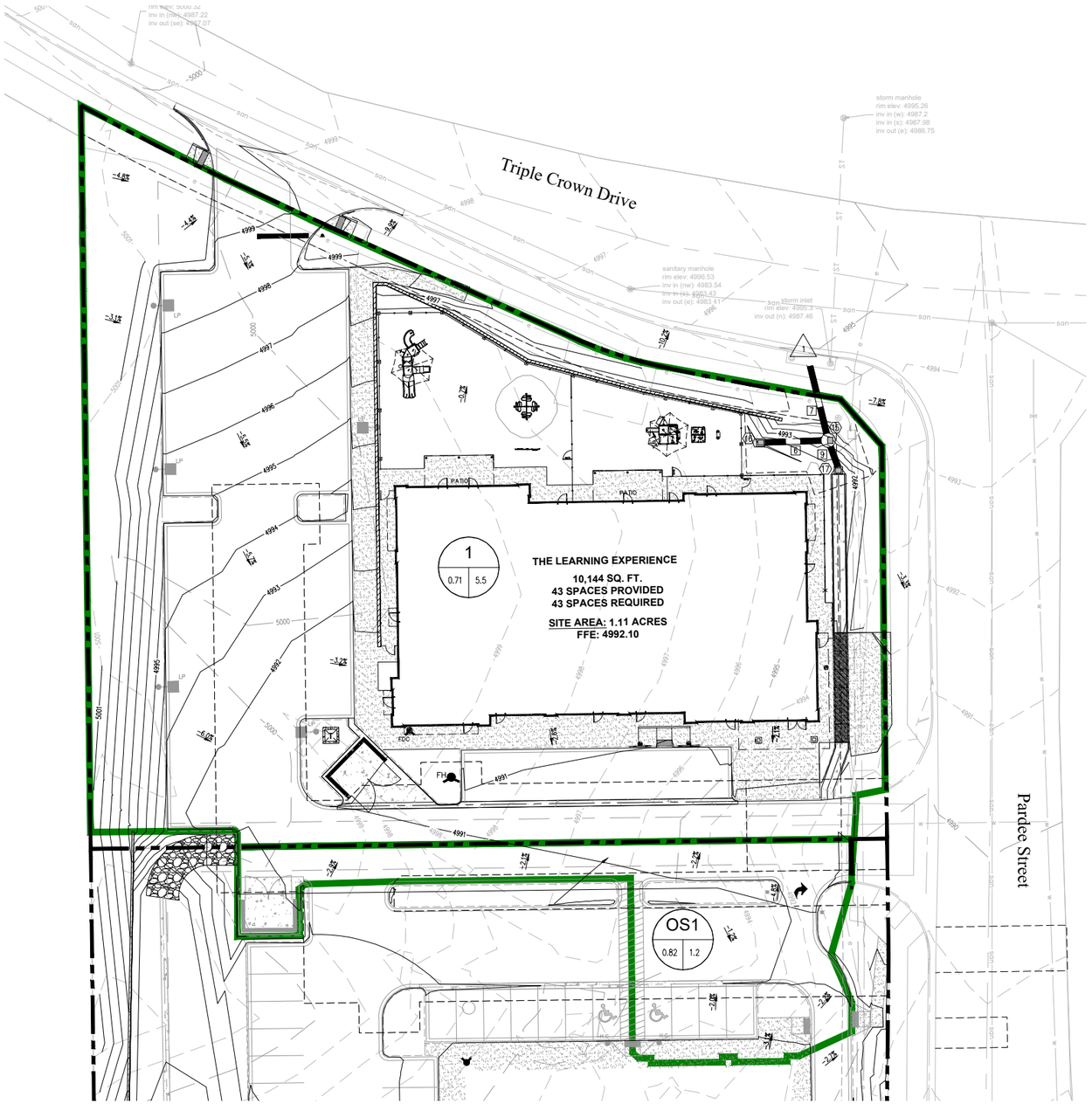
SHEET INFORMATION
BM-2.0

File: TLE - Basin Map EX.dwg Path: P:\Colorado\Parker\Brytar\PARKER TLE - 18-075-001\2 Drawings\ Plotted by: banderson Date: 28-May-19 6:55:40am

HORSESHOE RIDGE SUBDIVISION 1ST AMENDMENT

LOT 1, BLOCK 1, HORSESHOE RIDGE SUBDIVISION 1ST AMENDMENT
A PARCEL OF LAND LOCATED IN THE SE 1/4 OF SECTION 28, TOWNSHIP 6 SOUTH, RANGE 66 WEST OF THE 6TH PRINCIPAL MERIDIAN

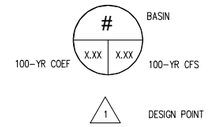
CONSTRUCTION DOCUMENTS



SEE LOT 2 BLOCK 1 HORSESHOE RIDGE SUBDIVISION 1ST AMENDMENT PLANS FOR ADDITIONAL GRADING INFORMATION; IF LOT 2 IS UNABLE TO BE CONSTRUCTED, CONTRACTOR IS TO GRADE FROM EDGE OF PAVEMENT SHOWN ON THESE PLANS BACK TO EXISTING AT NO LESS THAN 3:1 SLOPE.

LEGEND

- 3155 — PROPOSED MAJOR CONTOUR
- 3156 — PROPOSED MINOR CONTOUR
- 3156 — EXISTING CONTOUR
- PROPERTY LINE
- BASIN LIMITS



SUMMARY RUNOFF TABLE

SUBBASIN # / DESIGN POINT	CONTRIBUTING AREA (ACRES)	RUNOFF 10YR (CFS)	PEAK 100YR (CFS)
1	1.100	2.7	5.5
OS1	0.169	0.6	1.2

STRUCTURE TABLE

#	TYPE	RIM	INVERT
15	RT SDMH	RIM = 4993.55	IE IN: 4987.79 18" S IE IN: 4987.79 18" W IE OUT: 4987.69 18" N
16	RT TYPE 13 INLET	RIM = 4991.06	IE OUT: 4987.90 18" E
17	RT TYPE 13 INLET	RIM = 4990.24	IE OUT: 4987.83 18" N

PIPE TABLE

#	SIZE	LENGTH	MATERIAL	SLOPE
6	18"	22'	Concrete Pipe	0.50%
7	18"	25'	Concrete Pipe	0.50%
9	18"	10'	Concrete Pipe	0.50%

NORTH
0 10 20 40
1 inch = 20 ft.

Know what's below. Call before you dig.

The Town of Parker review constitutes general compliance with the Town's Standards and approved variances, subject to these plans being stamped, signed, and dated by the professional engineer of record. Review by the Town does not constitute approval of the plan design or accuracy and correctness of engineering calculations. Errors in the design or calculations remain the responsibility of the registered professional engineer whose stamp and signature are affixed to this document.

This review does not constitute approval of any private on-site improvements which may be shown. Construction cannot commence until all required drainage/traffic report(s), final development plan(s), special review(s), grading permit, and/or other permits are complete, approved and on file with the Town of Parker.

Town of Parker, Director of Engineering — Date

LOGO
RIDGETOP ENGINEERING & SURVEYING
541 E. Garden Drive, Unit N
Windsor, CO 80550
T (970) 663-4632
W ridgetopeng.com

SEAL

PROJECT TITLE
THE LEARNING EXPERIENCE

LOT 1, BLOCK 1
HORSESHOE RIDGE
PARKER, CO 80134

PREPARED FOR
BRYTAR COMPANIES

8117 PRESTON RD. #300
DALLAS, TX 75225

SUBMITTAL
CONSTRUCTION DOCS.

DRAWN BY:	BSA
CHECKED BY:	MRB
PROJECT NO.:	18-075-001

REVISIONS

2ND SUBMITTAL	10/31/2019
3RD SUBMITTAL	02/18/2020

DATE
5/28/2019

SHEET TITLE
PROPOSED BASIN MAP

SHEET INFORMATION
BM-1.0

File: TLE - Basin Map Pro.dwg Path: P:\Colorado\Parker\Bryta\PARKER TLE - 18-075-001\2 Drawings\ Plotted by: Brad Date: 18-Feb-20 1:34:51pm

Appendix H – Existing Pond

STANDARD FORM SF-1
TIME OF CONCENTRATION

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek **RMC Job No.:** 22-4568-002-00

Checked by: Vera Stepanek **Date:** January 4, 2006

Sub-Basin Data				Overland Flow			Travel Time (Tt)					Urban Check			Remarks
Des. Pt. #	Area Design	Area	C 5 yr.			Ti (min)	L (ft)	Slope / Surface Type**	Vel (fps)	Tt (min)	Comp. Tc (min.)	L (ft)	Urban Tc (min)	Final Tc (min)	Tc=Ti+Tt
	D1	2.3	0.38	50	2.0	7.4	570	3.0 / 6	3.4	2.8	10.2	620	13.4	10.2	
	D2	1.6	0.38	80	2.0	9.4	550	3.0 / 6	3.4	2.7	12	630	13.5	12.1	
	D3	2.4	0.38	80	2.0	9.4	560	2.8 / 6	3.3	2.8	12.2	640	13.6	12.2	
	D4	1.7	0.38	50	2.0	7.4	250	2.8 / 6	3.3	1.3	8.7	300	11.7	8.7	
	D5	1.8	0.38	80	2.0	9.4	940	2.8 / 6	3.3	4.8	14.1	1020	15.7	14.1	
	D8	1.4	0.38	50	2.0	7.4	820	1.9 / 6	2.7	5.1	12.5	870	14.8	12.5	
	D6	1.7	0.38	70	2.0	8.8	650	2.6 / 6	3.2	3.4	12.2	720	14.0	12.2	
	D7	1.9	0.38	50	2.0	7.4	840	1.9 / 6	2.7	5.3	12.7	890	14.9	12.7	
	D9	0.6	0.73	10	2.0	1.7	780	2.6 / 6	3.2	4.1	5.8	790	14.4	5.8	
	D10	4.1	0.14	150	25.0	7.4	530	2.0 / 3	1.0	9.1	16.5	680	13.8	13.8	
	D11	0.6	0.73	10	2.0	1.7	660	2.0 / 6	2.7	4.0	5.7	670	13.7	5.7	
				10	2.0	5.1	500	1.2 / 6	2.2	3.8	8.9	510	12.8	8.9	

**Surface Type: 6=Paved Area (Sheet Flow) & Shallow Gutter Flow; 4=Nearly Bare Ground (From Urban Drainage Figure 2)
3=Short Grass Pasture & Lawns.

STANDARD FORM SF-1
TIME OF CONCENTRATION

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek **RMC Job No.:** 22-4568-002-00

Checked by: Vera Stepanek **Date:** January 5, 2006

Sub-Basin Data				Overland Flow			Travel Time (Tt)					Urban Check			Remarks
						Ti (min)	L (ft)	Slope / Surface Type**	Vel (fps)	Tt (min)	Comp. Tc (min.)	L (ft)	Urban Tc (min)	Final Tc (min)	Tc=Ti+Tt
	D12	2.4	0.38	50	2.0	7.4	530	1.1 / 6	2.1	4.2	12	580	13.2	11.6	
	D13	0.7	0.38	50	2.0	7.4	530	1.1 / 6	2.1	4.2	11.6	580	13.2	11.6	
	D14	3.1	0.38	120	2.0	11.5	390	4.3 / 6	4.1	1.6	13.1	510	12.8	12.8	
	D15	0.9	0.38	10	2.0	3.3	390	4.3 / 6	4.1	1.6	4.9	400	12.2	4.9	If Tc<5.0 Use 5.0 min.
	D16	0.4	0.73	10	2.0	1.7	150	1.0 / 6	2.0	1.3	3.0	160	10.9	3.0	If Tc<5.0 Use 5.0 min.
	D17	4.2	0.81	100	2.0	4.2	350	2.0 / 6	2.7	2.1	6.3	450	12.5	6.3	If Tc<5.0 Use 5.0 min.
	D18	1.2	0.73	10	2.0	1.7	1120	2.1 / 6	2.8	6.6	8.3	1130	16.3	8.3	
	D19	0.2	0.73	10	2.0	1.7	210	1.5 / 6	2.3	1.5	3.2	220	11.2	3.2	
	D20	1.7	0.73	10	2.0	1.7	1120	1.5 / 6	2.3	8.0	9.7	1130	16.3	9.7	
	D21	4.4	0.81	150	2.0	5.2	450	1.0 / 6	2.0	3.8	8.9	600	13.3	8.9	
	D22	4.5	0.38	150	2.0	12.8	580	1.0 / 3	0.7	13.8	26.6	730	14.1	14.1	
	D23	0.2	0.73	10	2.0	1.7	260	1.6 / 6	2.4	1.8	3.5	270	11.5	3.5	If Tc<5.0 Use 5.0 min.
		44.0													

**Surface Type: 6=Paved Area (Sheet Flow) & Shallow Gutter Flow; 4=Nearly Bare Ground (From Urban Drainage Figure 2)
3=Short Grass Pasture & Lawns.

STANDARD FORM SF-1
TIME OF CONCENTRATION

Subdivision: Horseshoe Ridge **Basin E (cont.), Basin J**

Calculated by: Vera Stepanek **RMC Job No.:** 22-4568-002-00

Checked by: Vera Stepanek **Date:** January 5, 2006

Sub-Basin Data				Overland Flow			Travel Time (Tt)					Urban Check			Remarks
Des. Pt. #	Area Design	Area (ac)	C 5 yr.	L (ft)	Slope (%)	Ti (min)	L (ft)	Slope / Surface Type**	Vel (fps)	Tt (min)	Comp. Tc (min.)	L (ft)	Urban Tc (min)	Final Tc (min)	Tc=Ti+Tt
	D24	0.5	0.73	10	2.0	1.7	780	3.8 / 6	3.8	3.4	5.1	790	14.4	5.1	
	D25	1.3	0.73	10	2.0	1.7	500	1.2 / 6	2.2	3.8	5.5	510	12.8	5.5	
	D26	0.6	0.73	10	2.0	1.7	420	2.0 / 6	2.7	2.5	4.2	430	12.4	4.2	If Tc<5.0 Use 5.0 min.
	D27	0.6	0.73	10	2.0	1.7	420	2.0 / 6	2.7	2.5	4.2	430	12.4	4.2	
	D28	0.9	0.73	10	2.0	1.7	420	2.0 / 6	2.7	2.5	4.2	430	12.4	4.2	
	D	**47.9**													

**Surface Type: 6=Paved Area (Sheet Flow) & Shallow Gutter Flow; 4=Nearly Bare Ground (From Urban Drainage Figure 2)
3=Short Grass Pasture & Lawns.

STANDARD FORM SF-2
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
2 Year Storm Event **BASIN D**

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek **RMC Job No.:** 24-0302.006.20

Checked by: Vera Stepanek **Date:** 4-Jan-06

Structure Type	Design Pt.	Direct Runoff							Total Runoff				Street Carry Over		Pipe			Travel Time		
		Area Design Point	Area (ac)	Runoff Coeff. (C)	T_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	T_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	S (%)	Q (cfs)	Q (cfs)	S (%)	Pipe Size (in)	L (ft)	V (fps)	T_t (min)
(1)	(2)		(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
gutter	50	D1	2.30	0.33	10.2	0.76	2.8	2.1												
gutter	51	D2	1.60	0.33	12.1	0.53	2.6	1.4												
cross-pan	52	D1,D2	3.90						12.1	1.29	2.6	3.3						270	4.5	1.0
cross-pan	53	D3	2.40	0.33	12.2	0.79	2.6	2.0												
gutter	54	D4	1.70	0.33	8.7	0.56	3.0	1.7	12.2	1.35	2.6	3.5								
cross-pan	55	D1-D4	8.00						13.1	2.64	2.4	6.4								
gutter	56	D5	1.80	0.33	14.1	0.59	2.3	1.4										20	4.5	0.1
Inlet #14	57	D1-D5	9.80						14.2	3.23	2.3	7.5								
gutter	58	D6	1.70	0.33	12.2	0.56	2.6	1.4												
gutter	59	D7	1.90	0.33	12.7	0.63	2.5	1.6												
cross-pan	60	D6,D7	3.60						12.7	1.19	2.5	3.0								
gutter	61	D8	1.40	0.33	12.5	0.46	2.5	1.2												
Inlet #15	62	D6,D7,D8	5.00						12.7	1.65	2.5	4.1								
Inlet #16 Type R	63	D9	0.60	0.71	5.8	0.43	3.3	1.4										750	5.2	2.4
Inlet # 17 Type C	64	D10	4.10	0.06	13.8	0.25	2.4	0.6												
Inlet #18	66	D11	0.60	0.71	5.7	0.43	3.3	1.4												
Inlet #19 Type D	67	D17	4.20	0.79	6.3	3.32	3.3	10.9												
Pipe	**68**	D1-D11, D17							15.1	9.30	2.2	20.5						457	14.8	0.5

STANDARD FORM SF-2
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
2 Year Storm Event- Basin D (cont.)

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek **RMC Job No.:** 22-4568-002-00

Checked by: Vera Stepanek **Date:** 5-Jan-06

Structure Type (Page)	Design Pt.	Direct Runoff: Area Design Point	Area (ac)	Runoff Coeff. (C)	T_C (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total Runoff: T_C (min)	C*A (ac)	I (in/hr)	Q (cfs)	Street Carry Over: S (%)	Street Carry Over: Q (cfs)	Pipe: Q (cfs)	Pipe: S (%)	Pipe: Size (in)	Travel Time: L (ft)	Travel Time: V (fps)	Travel Time: T_t (min)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
gutter	69	D12	2.40	0.33	11.6	0.79	2.6	2.1												
gutter	70	D13	0.70	0.33	11.6	0.23	2.6	0.6												
Inlet#20	71	D12,D13							11.6	1.02	2.6	2.7						280	5.2	0.9
gutter	72	D14	3.10	0.33	12.8	1.02	2.5	2.6												
gutter	73	D15	0.90	0.33	5.0	0.30	3.4	1.0										420	5.2	1.3
Inlet #21	74	D14,D15							12.8	1.32	2.5	3.3								
Inlet#22	75	D16	0.40	0.71	5.0	0.28	3.4	1.0										185	4.5	0.7
Inlet#23	76	D18	1.20	0.71	8.3	0.85	3.0	2.6												
		D16,D18							8.3	1.14	3.0	3.5								
Pipe Flow	77	D1-D15,D17							15.6	11.64	2.2	**25.3**								
	78	D19	0.20	0.71	5.0	0.14	3.4	0.5												
	79	D20	1.70	0.71	9.7	1.21	2.9	3.5												
Exist. Inlet	**80**	**D19, D20**	1.90						9.7	1.35	2.9	**3.9**								
Inlet#26 Type C	81	D21	4.40	0.79	8.9	3.48	3.0	10.4												
Pond area	82	D22	4.50	0.06	14.1	0.27	2.3	0.6												
Inlet #24	83	D23	0.20	0.71	5.0	0.14	3.4	0.5												
Exist.Inlet	83A	D28	0.90	0.71	5.0	0.64	3.4	2.2												
Inlet #25	84	D24	0.50	0.71	5.1	0.36	3.4	1.2												
Pipe Flows	**84A**	D23,D24,D25, D27,D28							8.9	4.88	3.0	**14.5**								
Exist.Inlet	85	D25	1.30	0.51	5.5	0.66	3.3	2.2												
Exist.Inlet	86	D26	0.60	0.51	5.0	0.31	3.4	1.0												
Exist.Inlet	87	D27	0.60	0.57	5.0	0.34	3.4	1.2												
	88	**D**	**47.9**						15.6	20.32	2.2	**44.2**								

STANDARD FORM SF-2
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
100Year Storm Event BASIN D

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek **RMC Job No.:** 22-4568-002-00

Checked by: Vera Stepanek **Date:** January 4, 2006

Structure Type	Design Pt.	Direct Runoff							Total Runoff				Street Carry Over		Pipe			Travel Time		
		Area Design Point	Area (ac)	Runoff Coeff. (C)	T_C (min)	C*A (ac)	I (in/hr)	Q (cfs)	T_C (min)	C*A (ac)	I (in/hr)	Q (cfs)	S (%)	Q (cfs)	Q (cfs)	S (%)	Pipe Size (in)	L (ft)	V (fps)	T_t (min)
(1)	(2)		(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
gutter	50	D1	2.30	0.54	10.2	1.24	7.0	8.7												
gutter	51	D2	1.60	0.54	12.1	0.86	6.6	5.7												
cross-pan	52	D1,D2	3.90						12.1	2.11	6.6	13.8						270	4.5	1.0
cross-pan	53	D3	2.40	0.54	12.2	1.30	6.6	8.5												
	54	D4	1.70	0.54	8.7	0.92	7.5	6.9	12.2	2.21	6.6	14.5								
cross-pan	55	D1-D4	8.00						13.1	4.32	6.3	27.4								
gutter	56	D5	1.80	0.54	14.1	0.97	6.1	5.9												
Inlet #14	57	D1-D5	9.80						14.2	5.29	6.1	32.4						20	4.5	0.1
	58	D6	1.70	0.54	12.2	0.92	6.6	6.0												
	59	D7	1.90	0.54	12.7	1.03	6.5	6.6												
cross-pan	60	D6,D7	3.60						12.7	1.94	6.5	12.5								
gutter	61	D8	1.40	0.54	12.5	0.76	6.5	4.9												
Inlet #15	62	D6,D7,D8	5.00						12.7	2.70	6.5	17.4								
Inlet #16 Type R	63	D9	0.60	0.81	5.8	0.49	8.6	4.2												
Inlet # 17 Type C	64	D10	4.10	0.40	13.8	1.64	6.2	10.2										750	5.2	2.4
Inlet #18	66	D11	0.60	0.81	5.7	0.49	8.6	4.2												
Inlet #19 Type D	67	D17	4.20	0.88	6.3	3.70	8.4	31.2												
Pipe	68	D1-D11, D17							15.1	14.30	5.9	84.4						457	18.3	0.4

STANDARD FORM SF-2
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
100 Year Storm Event - Basin D (cont.)

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek

RMC Job No.: 22-4568-002-00

Checked by: Vera Stepanek

Date: January 5, 2006

Structure Type (Page)	Design Pt.	Direct Runoff: Area Design Point	Area (ac)	Runoff Coeff. (C)	T_C (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total Runoff: T_C (min)	C*A (ac)	I (in/hr)	Q (cfs)	Street Carry Over: S (%)	Street Carry Over: Q (cfs)	Pipe: Q (cfs)	Pipe: S (%)	Pipe: Pipe Size (in)	Travel Time: L (ft)	Travel Time: V (fps)	Travel Time: T_t (min)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
gutter	69	D12	2.40	0.54	11.6	1.30	6.7	8.6												
gutter	70	D13	0.70	0.54	11.6	0.38	6.7	2.5												
Inlet#20	71	D12,D13							11.6	1.67	6.7	11.2						280	5.2	0.9
gutter	72	D14	3.10	0.54	12.8	1.67	6.5	10.8												
gutter	73	D15	0.90	0.54	5.0	0.49	8.8	4.3										420	5.2	1.3
Inlet #21	74	D14,D15							12.8	2.16	6.5	13.9								
Inlet#22	75	D16	0.40	0.81	5.0	0.32	8.8	2.9										185	4.5	0.7
Inlet#23	76	D18 D16,D18	1.20	0.81	8.3	0.97	7.7	7.5	8.3	1.30	7.7	10.0								
Pipe Flow	77	D1-D15,D17							15.5	18.13	5.9	**107.0**								
	78	D19	0.20	0.81	5.0	0.16	8.8	1.4												
	79	D20	1.70	0.81	9.7	1.38	7.2	9.9												
Exist. Inlet	**80**	**D19, D20**	1.90						9.7	1.54	7.2	11.1								
Inlet#26 Type C	81	D21	4.40	0.88	8.9	3.87	7.5	29.2												
Pond area	82	D22	4.50	0.40	14.1	1.80	6.1	11.0										120	2.0	1.0
Inlet #24	83	D23	0.20	0.77	5.0	0.15	8.8	1.4												
Exist.Inlet	83A	D28	0.90	0.81	5.0	0.73	8.8	6.4												
Inlet #25	84	D24	0.50	0.81	5.1	0.41	8.8	3.6												
Pipe Flows	**84A**	D23,D24,D25, D27,D28							8.9	2.39	7.2	17.2								
Exist.Inlet	85	D25	1.30	0.58	8.9	0.75	7.5	5.7												
Exist.Inlet	86	D26	0.60	0.58	5.0	0.35	8.8	3.1												
Exist.Inlet	87	D27	0.60	0.58	5.0	0.35	8.8	3.1												
	88	**D**	**47.90**						9.7	2.39	7.1	17.0						460	2.0	3.8
									15.5	29.38	5.9	**173.3**								

DISCHARGE SUMMARY
DEVELOPED FLOWS - Basin D

Subdivision: Horseshoe Ridge

Calculated by: Vera Stepanek

22-4568-002-00

Checked by: Vera Stepanek

5-Jan-06

Design Point	Contributing Basin	Area (ac)	Runoff Rate		Description
			Minor Storm 2 Year (cfs)	Major Storm 100 Year (cfs)	
50	D1	2.3	2.1	8.7	
51	D2	1.6	1.4	5.7	
52	D1,D2	3.9	3.3	13.8	
53	D3	2.4	2.0	8.5	
54	D4	1.7	1.7	6.9	
55	D1-D4	8.0	6.4	27.4	cross-pan
56	D5	1.8	1.4	5.9	
57	D1-D5	9.8	7.5	32.4	Inlet #14
58	D6	1.7	1.4	6.0	
59	D7	1.9	1.6	6.6	
60	D6,D7	3.6	3.0	12.5	cross-pan
61	D8	1.4	1.2	4.9	
62	D6,D7,D8	5.0	4.1	17.4	Inlet #15
63	D9	0.6	1.4	4.2	Inlet #16
64	D10	4.1	0.6	10.2	Inlet #17
66	D11	0.6	1.4	4.2	Inlet#18
67	D17	4.2	10.9	31.2	Inlet#19
68	D1-D11, D17	4.8	20.5	84.4	Pipe Flow
69	D12	2.4	2.1	8.6	
70	D13	0.7	0.6	2.5	
71	D12,D13	7.9	2.7	11.2	Inlet#20
72	D14	3.1	2.6	10.8	
73	D15	0.9	1.0	4.3	
74	D14,D15	4.0	3.3	13.9	Inlet#21
75	D16	0.4	1.0	2.9	Inlet # 22
76	D18	1.2	2.6	7.5	Inlet #23
77	D1-D15,D17		25.3	107.0	**Pipe Flow**
78	D19	0.2	0.5	1.4	
79	D20	1.7	3.5	9.9	
80	D19, D20	1.9	3.9	11.1	Existing Inlet
81	D21	4.4	10.4	29.2	Inlet#26
82	D22	4.5	0.6	11.0	
83	D23	0.2	0.5	1.4	Inlet # 24
83A	D28	0.9	2.2	6.4	Exist. Inlet
84	D24	0.5	1.2	3.6	Inlet #25
84A	D23,D24,D25, D27,D28		14.5	17.2	Pipe Flows
85	D25	1.3	2.2	5.7	Exist. Inlet
86	D26	0.6	1.0	3.1	Exist.Inlet
87	D27	0.6	1.2	3.1	Exist.Inlet
88	**D**	**47.9**	**44.2**	**173.3**	**Pond III Inflow**

DETENTION POND DESIGN PARAMETERS - Imperviousness

Ponds I and II (Basins A, B, C)

Averaged Single family Residential and open space

Basin A:	28.5 acres with 17 % imperviousness
Basin B:	13.1 acres with 55 % imperviousness
Basin C:C1-C15	26.4 acres with 52 % imperviousness
Basin Off1&Off4:	11.2 acres with 12 % imperviousness
Total:	79.2 acres

Basins A, B, C, Off1 & Off4: Imperviousness **I** = (28.5 x 17) + (13.1 x 55) + (26.4 x 52) +(11.2 x 12)/79.2 = **34.2**

Pond III (Basin D)

Basin D

Single family Residential, Commercial, open space

Sub-basinsD17, D21 (MF)	8.6 ac @ 75%
Sub-basinsD10, D22, (OS)	8.6 ac @ 5%%
Sub-basins D16, D18, D19, D20, D23- D28 (Streets)	7.6 ac @ 90%
Sub-basins D1-D9, D11-D15 (SF)	23.1 ac @ 55%
Total	47.9 acres

Basin D: Imperviousness **I** = (8.6x75) + (8.6 x 5) + (7.6 x 90) + (23.1 x 55)/ 47.9= **55.2**

Basin E

Sub-basin E1:	5.8 acres	open space.....5% imperviousness
Sub-basin E2:	9.6 acres	Commercial.....90%imperviousness
Total:	15.4 acres	

Basin E: Imperviousness **I** = (5.8 x 5) + (9.6 x 90)/ 15.4= **58**

UDFCD Intensity-Duration Calculations:

Equation 5-1

I = (28.5*P1) / ((10+Tc)^0.786)

Where: I = rainfall intensity (inches per hour)
P1 = 1-hour point rainfall depth (inches)
Tc= Time of Concentration (minutes)

Duration	P1	5	10	15	20	25	30	Tc	Rainfall
2-year	0.99	3.36	2.68	2.25	1.95	1.73	1.55	15.5	2.21
5-year	1.39	4.71	3.76	3.16	2.73	2.42	2.18	15.5	3.11
10-year	1.64	5.56	4.44	3.72	3.23	2.86	2.57	15.5	3.67
100-year	2.6	8.82	7.03	5.90	5.11	4.53	4.08	15.5	5.81

Notes:
Visit NOAA Atlas 14 to obtain 1-hour point rainfall depths (P1)
https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

Weighted Runoff Coefficients - TOTAL BASIN

Project - Lot 1 TLE

Job Number: 18-066-001

Calculated By: BSA
Checked By: MRB
Date: 10/30/2019

Proposed/ Existing	IMP%
Roof	90
Concrete Drive/Walk	90
Landscaping	2
Multi-family (attached)	75
Gravel	40
Commercial	95
Undeveloped Historical	2

Soil Types: Loamy Alluvial Land
Newlin Gravelly Sandy loam, 8 to 30 percent slopes

Hydrologic Grouping: Type B

Runoff Coefficients: C = Kc
Kc(2year) = 0.84i^1.169
Kc(5year) =0.86i^1.088
Kc(10year) = 0.81i+.057
Kc(100year) = 0.47i+0.426

Existing Basins (current conditions) — **Land Use (Acres)** — **Weighted Runoff Coefficient**

Basin	Total Area	Roof	Concrete Drive/Walk	Landscape	Gravel	Historical	Commercial	C2	C5	C10	C100	%Imp
1.00	1.111	0.000	0.005	0.000	0.000	1.106	0.000	0.01	0.01	0.08	0.44	2.4

Proposed Basins (proposed conditions) — **Land Use (Acres)** — **Weighted Runoff Coefficient**

Subbasin	Total Area	Roof	Concrete Drive/Walk	Landscape Native Grass	Undeveloped Historical	Gravel	Commercial	C2	C5	C10	C100	%Imp
1.00	1.100	0.233	0.509	0.358	0.000	0.000	0.000	0.47	0.51	0.55	0.71	61.4
OS1	0.160	0.000	0.148	0.012	0.000	0.000	0.000	0.68	0.71	0.73	0.82	83.4
Existing Basins	**Values taken from Appendix D of "Final Drainage Report for Horseshoe Ridge Subdivision, Town of Parker, Colorado" dated September 2005, Revised January 17, 2006											
Basin D	47.900	0.000	0.000	0.000	0.000	0.000	47.900	0.42	0.45	0.50	0.69	55.2

TOTAL AREA: 49.160 ACRES
TOTAL IMPERVIOUS: 55.43 percent

STANDARD FORM SF-2

TIME OF CONCENTRATION - TOTAL BASIN

SUBDIVISION: LOT 1 - TLE

CALCULATED BY: BSA DATE: 10/30/2019

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)			FINAL t_c	REMA
DESIGN: (1)	C10 (2)	AREA Ac (3)	LENGTH Ft (4)	SLOPE % (5)	t_i Min (6)	LENGTH Ft (7)	SLOPE % (8)	VEL. FPS (9)	t_t Min (10)	COMP. t_c (11)	TOT. LENGTH Ft (12)	tc=(L/180)+10 Min (13)	Min (14)	
1.00	0.55	1.10	100	5.0	5.7	384	2.5	1.5	4.3	10.0	484	12.7	10.0	
OS1	0.73	0.16	30	2.0	2.9	90	1.5	1.5	1.0	3.9	120	10.7	5.0	
Basin D	0.50	47.90											15.5	

CALCULATED BY : BSA
DATE: 10/30/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 5-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.10	0.51	10.0	0.56	3.76	2.1													
OS1			0.16	0.71	5.0	0.11	3.36	0.4													
Basin D			47.90	0.45	15.5	21.6	3.11	67.1													
Totals								69.6													

CALCULATED BY : BSA
DATE: 10/30/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 10-YEAR
TOTAL BASIN

SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.10	0.55	10.0	0.61	4.44	2.7													
OS1			0.16	0.73	5.0	0.12	4.71	0.6													
Basin D			47.90	0.50	15.5	24.1	3.67	88.6													
Totals								91.9													

CALCULATED BY : BSA
DATE: 10/30/2019 **REV:**
CHECKED BY: MRB

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO: 18-066-001
PROJECT: LOT 1 - TLE
DESIGN STORM: 100-YEAR
TOTAL BASIN

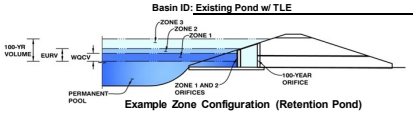
SUBBASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ (C * A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1.00			1.10	0.71	10.0	0.79	7.03	5.5													
OS1			0.16	0.82	5.0	0.13	8.82	1.2													
Basin D			47.90	0.69	15.5	32.8	5.81	190.8													
Total								197.4													

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: TLE Parker

Basin ID: Existing Pond w/ TLE



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	49.16	acres
Watershed Length =	1,120	ft
Watershed Slope =	0.018	ft/ft
Watershed Imperviousness =	55.43%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - Town Hall	
Water Quality Capture Volume (WQCV) =	0.908	acre-feet
Excess Urban Runoff Volume (EURV) =	2.937	acre-feet
2-yr Runoff Volume (P1 = 0.99 in.) =	1.990	acre-feet
5-yr Runoff Volume (P1 = 1.39 in.) =	3.003	acre-feet
10-yr Runoff Volume (P1 = 1.64 in.) =	4.023	acre-feet
25-yr Runoff Volume (P1 = 1.98 in.) =	5.735	acre-feet
50-yr Runoff Volume (P1 = 2.31 in.) =	7.033	acre-feet
100-yr Runoff Volume (P1 = 2.6 in.) =	8.499	acre-feet
500-yr Runoff Volume (P1 = 3.08 in.) =	10.895	acre-feet
Approximate 2-yr Detention Volume =	1.864	acre-feet
Approximate 5-yr Detention Volume =	2.821	acre-feet
Approximate 10-yr Detention Volume =	3.719	acre-feet
Approximate 25-yr Detention Volume =	4.269	acre-feet
Approximate 50-yr Detention Volume =	4.620	acre-feet
Approximate 100-yr Detention Volume =	5.119	acre-feet

Note: L / W Ratio < 1
L / W Ratio = 0.6

Optional User Override 1-hr Precipitation

0.99	inches
1.39	inches
1.64	inches
1.98	inches
2.31	inches
2.60	inches
	inches

Stage-Storage Calculation

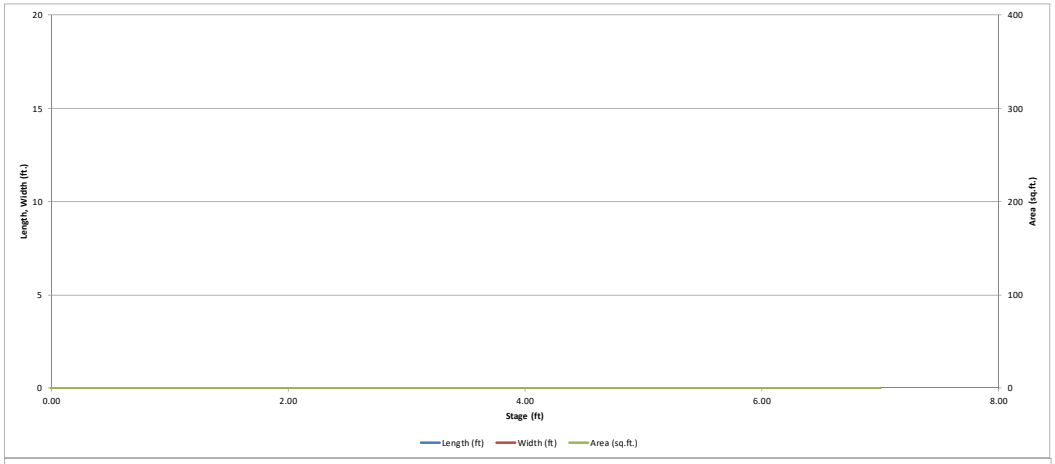
Zone 1 Volume (WQCV) =	0.908	acre-feet
Zone 2 Volume (10-year - Zone 1) =	2.811	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.399	acre-feet
Total Detention Basin Volume =	5.119	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

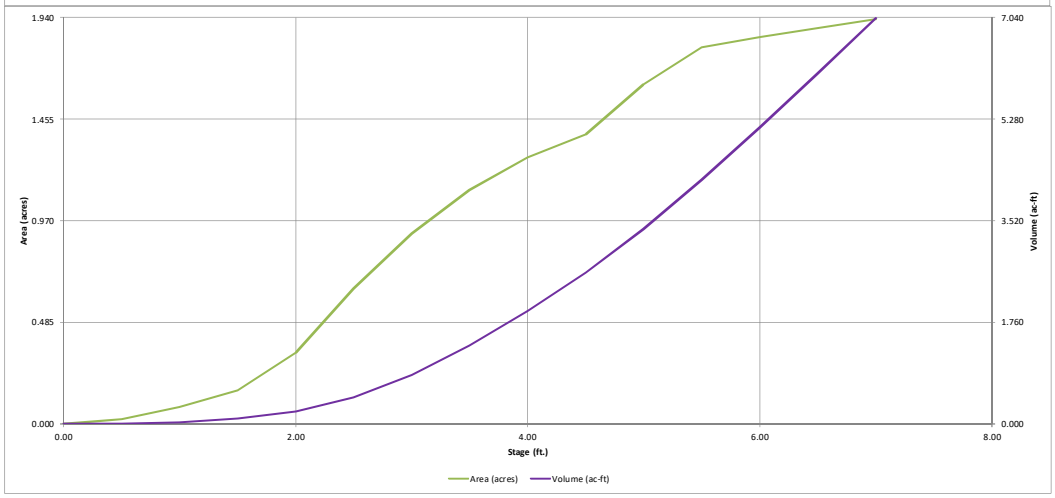
Depth Increment = 0.5 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.50	--	--	--	996	0.023	239	0.005
	--	1.00	--	--	--	3,533	0.081	1,346	0.031
	--	1.50	--	--	--	6,987	0.160	3,942	0.090
	--	2.00	--	--	--	14,812	0.340	9,314	0.214
	--	2.50	--	--	--	28,146	0.646	20,200	0.464
	--	3.00	--	--	--	39,541	0.908	37,122	0.852
	--	3.50	--	--	--	48,595	1.116	59,156	1.358
	--	4.00	--	--	--	55,430	1.272	85,162	1.955
	--	4.50	--	--	--	60,208	1.382	114,072	2.619
	--	5.00	--	--	--	70,539	1.619	146,758	3.369
	--	5.50	--	--	--	78,218	1.796	183,948	4.223
	--	6.00	--	--	--	80,448	1.847	223,614	5.133
	--	6.50	--	--	--	82,299	1.889	264,301	6.068
	--	7.00	--	--	--	84,083	1.930	305,896	7.022

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



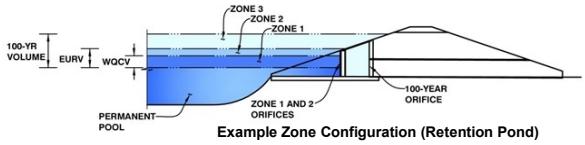


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.07	0.908	Orifice Plate
Zone 2 (10-year)	5.22	2.811	Weir&Pipe (Rect.)
Zone 3 (100-year)	6.00	1.399	Weir&Pipe (Circular)
		5.119	Total

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	8.264E-03	ft^2
Depth at top of Zone using Orifice Plate =	3.10	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.19	sq. inches (diameter = 1-3/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.33	0.66	1.00	1.33	1.66	2.00	2.33
Orifice Area (sq. inches)	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19

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

Calculated Parameters for Vertical Orifice

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

	Zone 2 Weir	Zone 3 Weir			Zone 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	3.10	4.90	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.35	5.90	feet
Overflow Weir Front Edge Length =	6.00	6.00	feet	Over Flow Weir Slope Length =	5.15	4.12	feet
Overflow Weir Slope =	4.00	4.00	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	18.55	2.45	should be ≥ 4
Horiz. Length of Weir Sides =	5.00	4.00	feet	Overflow Grate Open Area w/o Debris =	21.65	17.32	ft^2
Overflow Grate Open Area % =	70%	70%	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	10.82	8.66	ft^2
Debris Clogging % =	50%	50%	%				

Calculated Parameters for Overflow Weir

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

	Zone 2 Rectangular	Zone 3 Circular			Zone 2 Rectangular	Zone 3 Circular	
Depth to Invert of Outlet Pipe =	0.00	0.00	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.17	7.07	ft^2
Orifice Diameter or Width =	14.00	36.00	inches	Outlet Orifice Centroid =	0.50	1.50	feet
Rectangular Orifice Height =	12.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.99	1.39	1.64	1.98	2.31	2.60	3.08
Calculated Runoff Volume (acre-ft) =	0.908	2.937	1.990	3.003	4.023	5.735	7.033	8.499	10.895
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.908	2.938	1.991	3.004	4.025	5.735	7.035	8.502	10.899
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.25	0.83	1.19	1.59	2.23
Predevelopment Peak Q (cfs) =	0.0	0.0	0.6	1.2	12.2	40.9	58.6	78.4	109.7
Peak Inflow Q (cfs) =	21.5	68.6	46.7	70.1	93.5	132.2	161.3	193.9	246.7
Peak Outflow Q (cfs) =	0.4	10.9	7.3	10.9	11.8	21.4	33.5	49.5	64.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	9.0	0.96	0.5	0.6	0.6	0.6
Structure Controlling Flow =	Plate	Outlet Plate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Overflow Grate 2	Overflow Grate 2	Overflow Grate 2	N/A
Max Velocity through Grate 1 (fps) =	N/A	0.48	0.32	0.5	0.5	0.6	0.6	0.6	0.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	0.5	1.2	2.1	2.9
Time to Drain 97% of Inflow Volume (hours) =	37	39	41	39	38	36	34	33	30
Time to Drain 99% of Inflow Volume (hours) =	**40**	45	45	45	44	44	43	42	41
Maximum Ponding Depth (ft) =	3.01	4.25	3.74	4.29	4.88	5.63	6.07	6.51	7.00
Area at Maximum Ponding Depth (acres) =	0.91	1.33	1.19	1.33	1.56	1.81	1.85	1.89	1.93
Maximum Volume Stored (acre-ft) =	0.861	2.267	1.623	2.320	3.163	4.457	5.263	6.068	7.022

Detention Basin Outlet Structure Design

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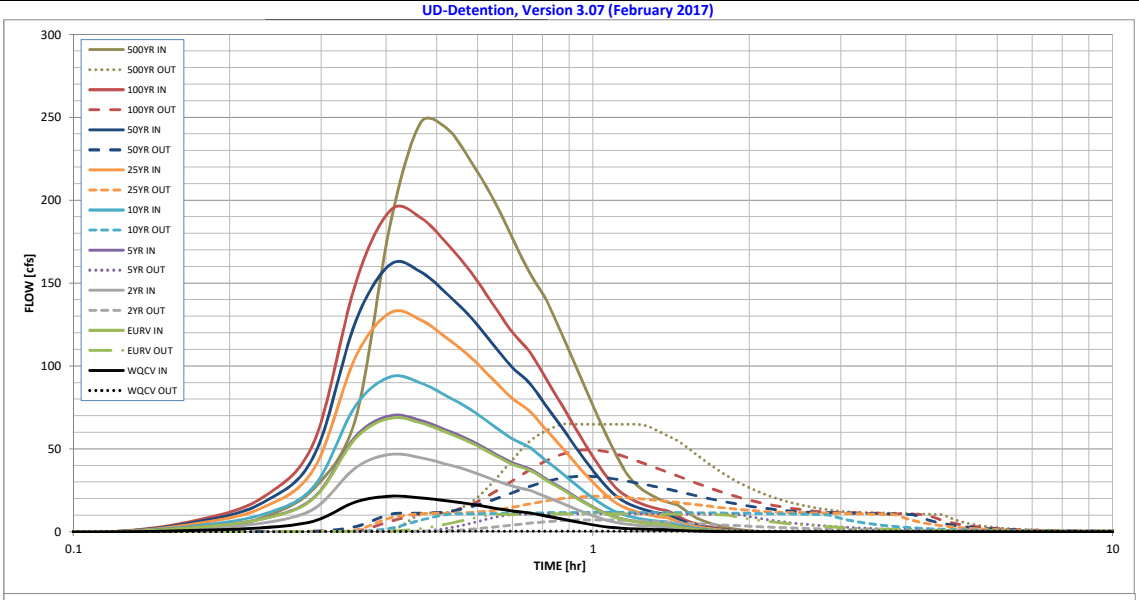

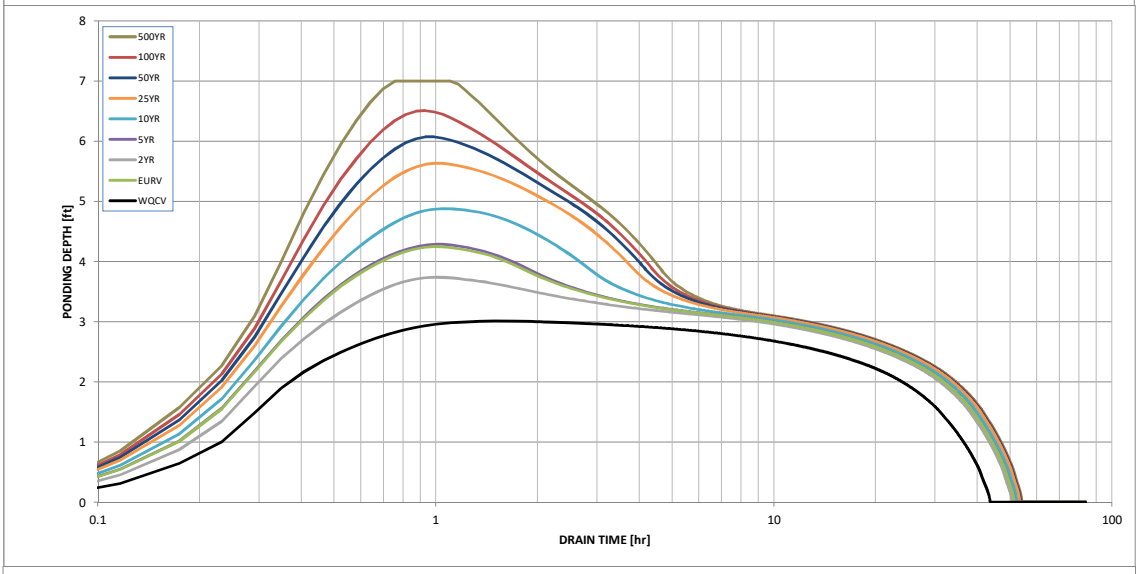

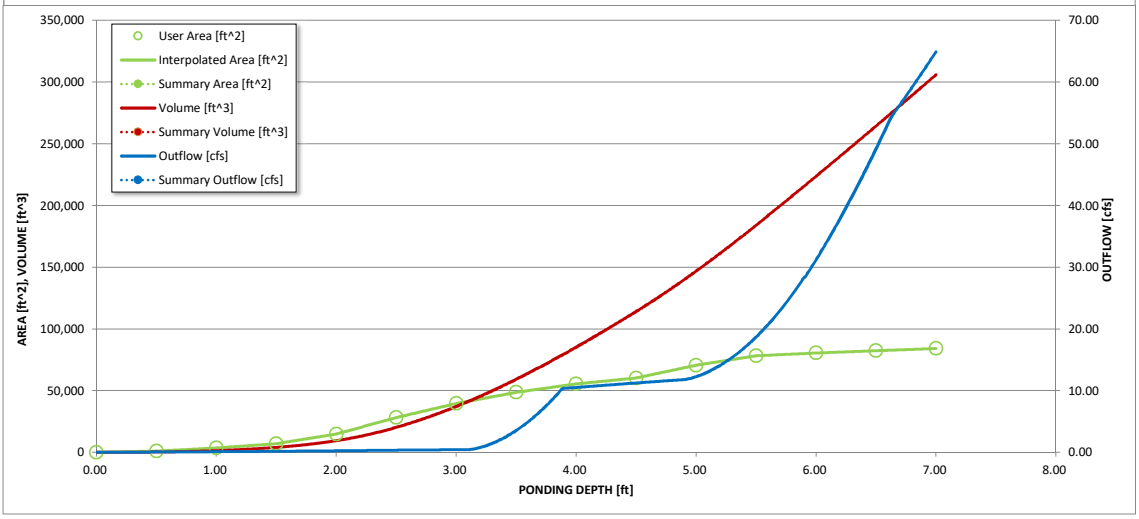

S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
3.49 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:03:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:06:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:10:28	0.95	2.91	2.01	2.97	3.89	5.31	6.30	7.34	8.91
1.433	0:13:58	2.56	8.00	5.49	8.17	10.80	14.98	18.02	21.33	26.48
	0:17:27	6.57	20.54	14.09	20.98	27.72	38.47	46.29	54.78	68.06
	0:20:56	18.05	56.36	38.68	57.56	76.00	105.39	126.70	149.83	185.90
	0:24:26	21.53	68.60	46.73	70.11	93.48	132.19	161.33	193.93	246.71
	0:27:55	20.57	65.80	44.75	67.25	89.91	127.93	156.90	189.64	243.27
	0:31:25	18.73	59.88	40.73	61.20	81.86	116.82	143.55	173.84	223.66
	0:34:54	16.75	53.87	36.57	55.06	73.74	105.30	129.45	156.83	201.88
	0:38:23	14.49	46.99	31.79	48.04	64.50	92.33	113.68	137.93	177.89
	0:41:53	12.62	40.94	27.62	41.86	56.30	80.72	99.46	120.74	155.82
	0:45:22	11.44	37.04	25.05	37.86	50.83	72.68	89.40	108.34	139.48
	0:48:52	9.47	30.95	20.88	31.65	42.59	61.15	75.44	91.70	118.57
	0:52:21	7.76	25.59	17.22	26.17	35.28	50.76	62.68	76.25	98.69
	0:55:50	6.00	20.18	13.50	20.64	27.94	40.42	50.07	61.09	79.39
	0:59:20	4.50	15.49	10.29	15.86	21.57	31.36	38.94	47.62	62.05
	1:02:49	3.25	11.49	7.57	11.77	16.10	23.56	29.35	35.99	47.06
	1:06:19	2.51	8.67	5.74	8.87	12.08	17.57	21.82	26.67	34.73
	1:09:48	2.06	7.01	4.67	7.17	9.72	14.06	17.40	21.21	27.50
	1:13:17	1.75	5.91	3.95	6.04	8.18	11.81	14.60	17.78	23.02
	1:16:47	1.53	5.15	3.45	5.27	7.12	10.26	12.66	15.39	19.90
	1:20:16	1.38	4.61	3.09	4.72	6.37	9.16	11.30	13.72	17.71
	1:23:46	1.27	4.23	2.84	4.32	5.83	8.38	10.32	12.53	16.15
	1:27:15	0.93	3.13	2.10	3.21	4.35	6.30	7.82	9.56	12.46
	1:30:44	0.68	2.27	1.53	2.33	3.15	4.55	5.64	6.89	8.97
	1:34:14	0.50	1.68	1.12	1.72	2.33	3.37	4.18	5.12	6.67
	1:37:43	0.37	1.25	0.83	1.28	1.73	2.51	3.11	3.80	4.95
	1:41:13	0.27	0.91	0.60	0.93	1.27	1.84	2.29	2.80	3.66
	1:44:42	0.19	0.65	0.43	0.67	0.91	1.33	1.65	2.03	2.65
	1:48:11	0.13	0.47	0.31	0.48	0.66	0.96	1.20	1.47	1.92
	1:51:41	0.09	0.33	0.21	0.33	0.46	0.68	0.85	1.04	1.37
	1:55:10	0.05	0.21	0.13	0.21	0.30	0.44	0.56	0.69	0.91
	1:58:40	0.03	0.12	0.07	0.12	0.17	0.26	0.33	0.41	0.54
	2:02:09	0.01	0.05	0.03	0.05	0.08	0.12	0.16	0.20	0.27
	2:05:38	0.00	0.01	0.01	0.01	0.02	0.04	0.05	0.06	0.09
	2:09:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:12:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:16:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:19:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:23:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:26:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:30:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:33:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:37:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:44:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:47:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:51:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:54:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:57:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:01:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:04:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:08:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:11:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:18:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:22:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:29:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:32:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:36:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:39:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:46:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:53:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:57:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:04:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:07:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:11:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Summary Stage-Area-Volume-Discharge Relationships

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

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

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

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

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