FINAL DRAINAGE REPORT

FOR

CENTURA PARKER NHC

January 8, 2024

Prepared For:

CENTURA HEALTH
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Prepared By:

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Registered Professional Engineer
State of Colorado No. **33854**

ENGINEER'S STATEMENT

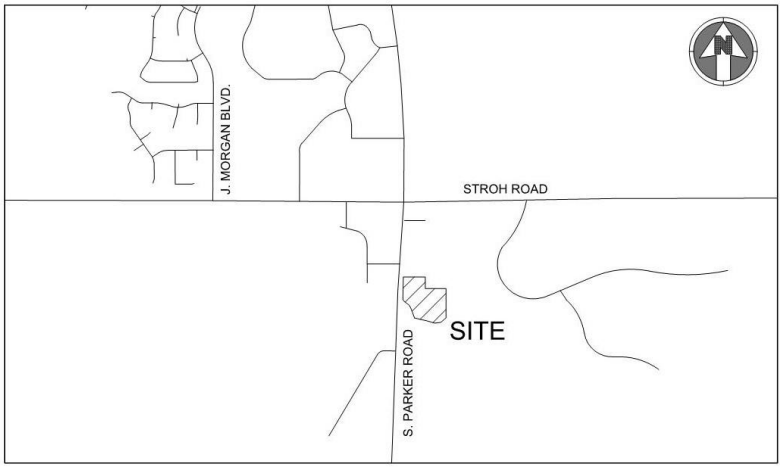
This report for the final design of Centura Parker NHC was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage and Environmental Criteria Manual. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

Jason D. Carr, P.E.
State of Colorado
No. 33854

Table of Contents

I. GENERAL LOCATION AND DESCRIPTION

A. Location



Vicinity Map

The proposed Centura Parker NHC (Project) is located southeast of the intersection of Stroh Road and South Parker Road. More specifically, the Project is located within Filing No. 1, Lots 9-10 Parker Pointe Subdivision. The parcel is in the northeast 1/4 of Section 3, Township 3 South, Range 66 West of the Sixth Principal Meridian in the Town of Parker, Douglas County, and State of Colorado.

Locally, the project is located in a moderately developed area. Parker Road and retail development are located to the west while open space and large lot single family development is located to the east. Kinney Creek and open space/undeveloped areas are south of the Site.

B. Description of Property

The subject property is regionally located southeast of the intersection of Parker Road and Stroh Road in Parker, Colorado and has a total area of 4.08 acres. The property is currently undeveloped, covered with natural grasses and weeds.

Based on recent site survey and site observations, the general topography of the property and immediate surrounding area slopes to the west and southwest at slopes ranging from approximately 2% to 5%. Elevations on the property range from approximately 5977 to 5965 feet. The property naturally slopes to the south and southwest towards Kinney Creek.

According to the Natural Resource Conservation Service (NRCS) mapping, on site soils are predominantly Bresser-Tructon Sandy Loam (BtE) and Loamy Alluvial Land (Lu). These soils are categorized as Hydrologic Soil Group B.

C. PROPOSED DEVELOPMENT

The Project includes the construction of 2 story neighborhood health center, surface parking lot, walking trails, utilities, drainage infrastructure, and associated landscaping and hardscape improvements. The facility will provide primary care, radiology, laboratory space, pharmacy, and general support spaces.

D. FLOODPLAIN

The Flood Insurance Rate Map Number 08035C0182G, dated October 2020, shows that the project site is located within FEMA Unshaded Zone X except the south portion of the property which is within Zone A. Zone A is defined as no base flood elevations determined. The base flood is defined as the flood that has a 1% chance of being equaled or exceeded in any given year (100-year), while unshaded Zone X is defined as areas determined to be outside of the 0.2% annual chance (500-year) floodplain.

A LOMR is currently being processed by the Master Developer to adjust the current mapping and take the property completely out of the 100-year floodplain.

The Master Developer will make all improvements to the stream. This project will not impact it. See the approved Master Development plans for the stream and floodplain modifications and how they comply with the Town`s Stream Preservation standards.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

According to the "Final Drainage Report" prepared by Perception design Group, inc. dated November 28, 2018, (Master Report), The site falls within two major drainage basins. The southerly portion of the site is tributary to Kinney Creek while areas north of the site's existing high point ridge are tributary to Stroh Gulch. The southerly line of basin H1 defines the historic break between the two basins. Per the Town of Parker, most of this historic runoff to Stroh Gulch is captured and conveyed via storm sewer to the new regional detention pond located immediately east of the property and ultimately released to Kinney Creek. A final drainage report was prepared for Stroh Crossing Filing No. 1 by Calibre Engineering. This is the development on the north side of Stroh Road. This report identifies runoff from the Parker Pointe property and made allowance to handle the flow. Basin ST-2b from the Calibre report quantifies 18.9 cfs for the basin. Basin SR2 in this report indicates 4.1 cfs tributary to Stroh Road downstream of the newly placed inlet on Stroh Road for Basin SR1plus carryover from Inlet SR1 of 3.2 cfs for a total tributary to Stroh Gulch of 7.3 cfs.

Kinney Creek was studied by WRC Engineering Inc. in a report entitled "Flood Hazard Area Delineation for Kinney Creek Fonder Draw and Tributaries" dated April 2004. A floodplain was delineated along the southwest corner of the site. Minor grading is proposed in the floodplain along Parker Road. Roadway widening encroaches upon and places fill in the floodplain. To mitigate this the shoulder, borrow ditch is shifted east in similar size to replace filled floodplain with like volume and shape.

B. Sub-Basin Description

To facilitate design, the site is divided into multiple sub-basins described as follows and are delineated on the final drainage map.

Basins A1, A2 and A3 are used to represent developed on-site basins that will drain to the regional pond. Basins O1 and O2 are on-site basins comprised of landscape and open space that drain directly off site, flowing south directly to Kinney Creek. runoff from O2 goes west initially, then south to the Creek in the swale adjacent to Parker Road as shown in the master drainage report by perception. Stormwater runoff from the proposed development will be captured by roof drains or overland flow to curb inlets and area inlets. Captured flows will be conveyed east to an existing storm sewer network which conveys runoff to the regional pond.

III. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

1.Town of Parker Storm Drainage and Environmental Drainage Criteria Manual.

2. Urban Drainage Storm Drainage Criteria Manual Volumes 1 through 3.

B. Development Criteria Reference and Constrains

The MASTER drainage report has been defined as the development criteria for the proposed site improvements as follows:

1- Drainage Studies, Outfall System Plans:

The Final Drainage Report for Stroh Crossing Filing No. 1 by Calibre Engineering is used to identify allowable site discharge to Stroh Gluch. The WRC Engineering Inc. report entitled “Flood Hazard Area Delineation for Kinney Creek Fonder Draw and Tributaries” dated April 2004 was utilized to map the floodplain elevations along the south property line. This study has negligible impact on the design presented.

2- Hydrology:

Runoff is calculated for both the 5 year and 100-year storms using rational method. On-site basins utilize a 5-minute time of concentration with 5-year intensity of 4.7 in/hr and 100-year at 8.85 in/hr. Detention storage volumes are calculated using the UDFCD version 3.07 UD-Detention spreadsheet. This spreadsheet is also utilized to calculate allowable release rates.

3- Hydraulics:

Storm sewer capacities are calculated using the Bentley Storm CAD hydraulic modeling software. The system is designed to provide minimal surcharge for the 100-year event, and no surcharge for the 5-year event. The Hydraflow software is also used to calculate hydraulic grade lines for the storm sewer.

4- Water Quality Enhancement:

Water quality is achieved in an extended detention facility designed to EURV specifications using UDFCD version 3.07 UD-Detention spreadsheet. This is provided in the existing regional detention pond.

C. Hydrologic Criteria

The proposed drainage system is designed in accordance with the CRITERIA and the MANUAL. Per the CRITERIA, the minor and major storms were considered to have a 5-year and 100-year recurrence interval, respectively. The Rational Method was used to quantify rainfall and peak runoff values for the project site. The one-hour point rainfall depths were determined from the CRITERIA and are summarized in the table below:

Table 1 - One-Hour Point Rainfall Depths

Return Period	One-Hour Point Rainfall (inches)
Minor (5-Year)	1.39
Major (100-Year)	2.60

Developed flow rates were calculated using composite imperviousness coefficients from the MANUAL. Refer to Appendix B for detailed calculations and design aids.

D. Hydraulic Criteria

Final storm sewer sizes and water surface profiles were analyzed using the Bentley Storm CAD hydraulic modeling software. Per the CRITERIA, the minor and major storms were considered to have a 5-year and 100-year return period, respectively.

All proposed inlets are designed in accordance with the MHFD CRITERIA and the MANUAL. Proposed sump inlets will accommodate flows analyzed under the 100-year storm event. Supporting hydraulic calculations and MHFD-Inlet (Version 5.02) Sizing worksheets are provided in Appendix C.

E. WAIVER/VARIANCE FROM CRITERIA

There are no variances requested for this site.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

Proposed drainage patterns across the project site remain consistent with conveyance patterns described in the MASTER report. Developed on-site runoff will be captured by a Type R sump inlet in the southern part of the parking lot. The landscape areas to the east of the proposed building will be captured by sump area inlets. Roof drains will collect rainwater and internally route flows to a roof drain connection. Captured flows will be conveyed via storm sewer to the east of the project site to the regional detention and water quality facility. A proposed drainage plan is provided in Appendix D. The proposed storm sewer system will adequately convey fully developed runoff for the 5-year and 100-year design storms. Basins along the perimeter of the project site are landscape and open space and runoff will drain directly into Kinney Creek and then to the west crossing parker road via existing box culvert.

B. Specific Details

The project site is comprised of three on-site sub-basins, and two off-site sub-basins consisting of approximately 4.11 acres with a composite impervious value of 46%. The future planned phase of this project, the southern area adjacent to Kenney Creek, has an anticipated composite imperviousness of 60%. A proposed drainage plan is provided in Appendix D for reference. The MASTER DRAINAGE report assumed a future composite impervious value of approximately 95% for the entire project limits. The regional detention and water quality pond east of this site was sized using an impervious value of 95%, therefore it will be oversized as the proposed imperviousness is only 46% for the basins that will drain to the regional facility.

The sub-basins associated with the proposed development are described as follows:

Basin A:

Basin A is approximately a total of 2.10 acres and consists of the proposed NHC building, the parking lot, drives, and most of the proposed landscaping. The areas within Basin A slope from west to east and are routed via overland flow, swales, curb and gutter, and proposed drainage infrastructure to area inlets, grated manholes, and a curb inlet. The developed peak runoff for the basin is Q5=6.99 cfs and Q100=14.44 cfs. Stormwater within this basin will be routed to the proposed Type R inlet within Sub-basin A3 before connecting to existing City stormwater infrastructure east of the site that ultimately outfalls to the regional stormwater detention and water quality pond.

RUNOFF SUMMARY									
BASIN	DESIGN POINT	AREA (ACRES)	% IMP.	C_5	C_{100}	DIRECT RUNOFF 5YR (CFS)	TOTAL RUNOFF 5YR (CFS)	DIRECT RUNOFF 100YR (CFS)	TOTAL RUNOFF 100YR (CFS)
A1	A1	0.37	90%	0.77	0.84	1.34	1.34	2.73	2.73
A2	A2	0.24	94%	0.80	0.86	0.84	0.84	1.68	1.68
A3	A3	1.52	85%	0.74	0.83	4.03	4.81	8.46	10.03

Off-site Sub-Basins:

Basins O1 and O2 are approximately a total of 1.98 acres that lie along the south and west perimeter of the site and consist entirely of landscaping. The areas within the O Basins are constrained by existing site grades that force the flows to drain off-site without being captured by proposed stormwater infrastructure. The proposed drainage patterns mimic existing site conditions in that the area is entirely landscaped cover, is conveyed via overland flow, and discharges west of the site where existing stormwater infrastructure ultimately routes flows within Kenney Creek and under South Parker Road. The peak runoff for Basins O1 and O2 is Q5=0.38 cfs and Q100=6.08 cfs.

Future development is planned for Basin O1. The below table shows the runoff summary for the current off-site basins and the run-off for basin O1 after future development which will be captured by our proposed storm system and routed to the regional detention and water quality facility (see appendix B and C).

RUNOFF SUMMARY							
BASIN	DESIGN POINT	AREA (ACRES)	% IMP.	C_5	C_{100}	Q_5 (CFS)	Q_{100} (CFS)
O1	O1	1.31	2%	0.05	0.49	0.19	3.45
O2	O2	0.67	4%	0.07	0.50	0.19	2.63
O1 Future Development	O1	1.31	54%	0.81	0.86	2.25	6.17

Required Storage For Basin O1 , O2 and O1 Future Development:

The required storage for undeveloped off-site basin O1 based on MHFD detention Worksheet for 100-Year is 0.022 acre-feet. The required 100-year storage volume for off-site basin O2 is 0.015 acre-feet. The required storage volume for basin O1 Future Developed is 0.114 acre-feet which will go to the regional detention and water quality pond through the proposed stormwater network.

After full development of the site, Basin O2 will continue to discharge un-detained to the west and into the grass swale along Parker Road. From there it is conveyed directly into Kenney Creek. Basin O2 is comprised only of landscaping, is small in area and has no impervious hardscape. There will be no negative impacts to downstream infrastructure resulting from basin O2 discharging from the site un-detained. The regional detention pond was sized assuming this entire site has a composite imperviousness of 95%, however the actual composite imperviousness is 46%, with basin O2 only being 4% impervious. The regional pond is significantly oversized and will have extra available volume.

C. DETENTION AND WATER QUALITY

According to the MASTER report, water quality and detention for the project site is provided in the regional detention pond located east project site. This extended detention basin has been sized to accommodate tributary flows for the fully developed condition. The proposed use for the property is consistent with those uses anticipated in the master report, therefore, no additional on-site water quality treatment or detention storage is required. In fact, as previously mentioned, the proposed site imperviousness is significantly lower than what was planned for in the MASTER report. According to the MASTER report, this regional drainage facility has been adequately sized to treat and detain all developed flows prior to discharging into Kinney Creek.

V. ENVIRONMENTAL PROTECTION CRITERIA

The project will include disturbance of approximately 4.11 acres. The overall site will be overlot graded by the Master Developer prior to this development. The soils on site belong primarily to NRCS Hydrologic Group B and exhibit a moderate hazard of erosion by water. The site consists of native vegetation including native grasses and weeds. The construction plans include detailed Construction BMP Plans to mitigate and prevent erosion and sediment transportation. Final locations of erosion control measures are to be determined by the Contractor and Erosion Control Inspector and updated as necessary during construction. Further, the project will require an application to the State of Colorado, Colorado Dept. of Health for a Construction Activities Stormwater permit, prior to land disturbance.

This project anticipates having no impact to existing wetlands or threatened and/or endangered species.

The erosion control measures are placed on the site to reduce the on-site erosion, prevent sediment from entering the storm sewer system, and to eliminate sediment deposit off-site. Vehicle tracking control pads will be placed at all access locations for the site. Diversion ditches connecting to temporary sediment basins, silt fences will be used around the perimeter of the site. Inlet protection per the Town of Parker standard details will be constructed around all inlets shown on plans. Erosion control matting will be used on all slopes steeper than 4:1. All disturbed areas not being covered by asphalt, concrete, or landscaping will be seeded with an approved seeding mixture as soon as practical after final grading occurs or for any areas of disturbed land that will be exposed for longer than 30 days. All erosion control measures shall be inspected weekly at a minimum and maintained and repaired by the Contractor during construction as needed. The Contractor shall also inspect and repair all erosion control measures as needed following each heavy precipitation or snowmelt.

VI. SUMMARY

A. COMPLIANCE WITH STANDARDS

This report conforms to the Town of Parker Storm Drainage and Environmental Criteria Manual, the Urban Drainage and Flood Control District Manual, and the associated MASTER drainage report. The proposed drainage system will provide adequate conveyance of developed stormwater runoff to

downstream, existing stormwater infrastructure and ultimately the water quality and detention facility without adversely affecting downstream facilities.

B. SUMMARY OF CONCEPT

The Centura Parker Neighborhood Health Center drainage and stormwater infrastructure improvements will provide stormwater conveyance for the minor and major storm events and will safely and efficiently route flows to the downstream receiving drainageways. Fully developed flows will be conveyed via overland flow and curb and gutter to proposed inlets. The proposed storm sewer system will discharge into the existing storm sewer infrastructure to the east of the project site which remains in conformance with the approved MASTER drainage report.

The hydraulic grade line for the minor year storm will remain within the proposed storm sewer while the hydraulic grade line for the major year storm will remain one foot below finished grade. These measures will effectively control runoff from proposed development and minimize adverse impacts to downstream facilities.

VII. REFERENCES

1. “Geotechnical Engineering Report for Proposed Centura Parker NHC”, Ground Engineering, Inc., Dated November 14, 2022.
2. “Final Drainage Report Parker Pointe”, Perception design group, inc., Dated November 28, 2018.
3. “Storm Drainage and Environmental Criteria Manual”, Town of Parker, Revised and Adopted February 2014.
4. “Urban Storm Drainage Criteria Manual”. Latest revision.

VIII. APPENDIX

Appendix A: MAPS & DESIGN AIDS

FEMA Firm Maps
Town of Parker Rainfall Values
Web Soil Survey

National Flood Hazard Layer FIRMette

FEMA

104°45'46"W 39°28'42"N

104°45'9"W 39°28'14"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/8/2023 at 3:10 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

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.

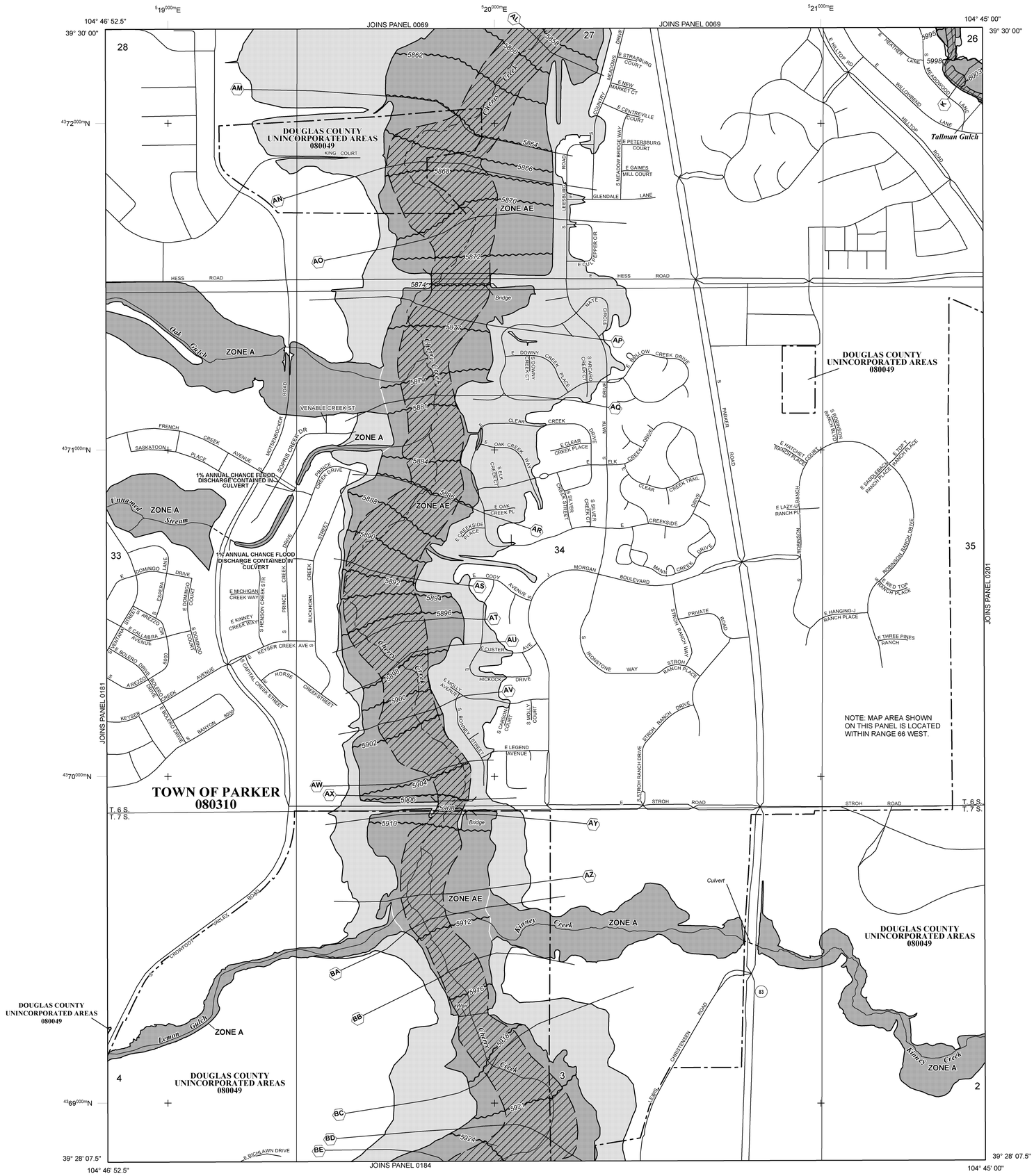
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood 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
4988000m N	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, 2005

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

NFIP
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

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.

Map Scale: 1:3,840 if printed on A portrait (8.5" x 11") sheet.

N

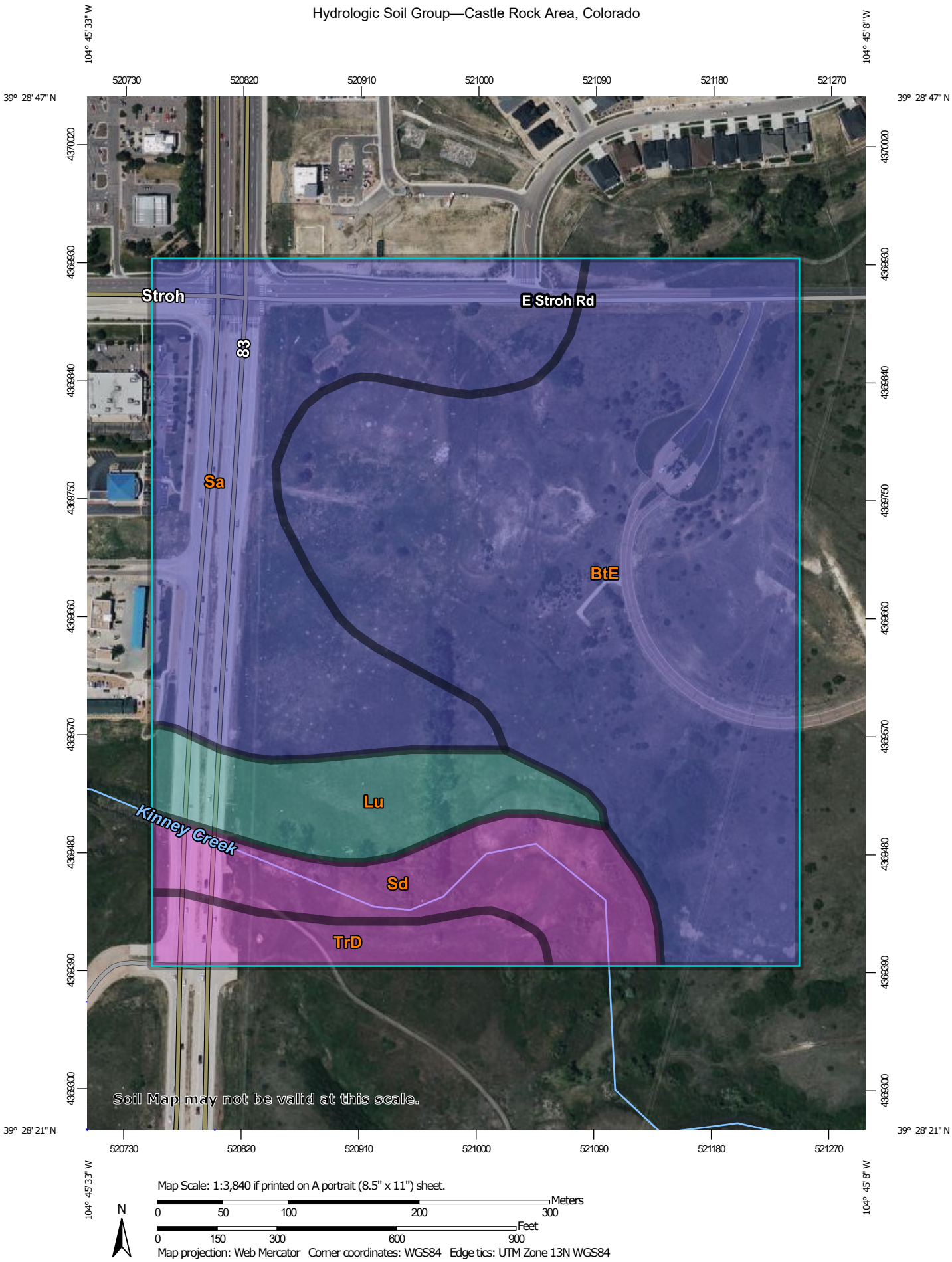
Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	33.8	50.9%
Lu	Loamy alluvial land, dark surface	5.3	8.0%
Sa	Sampson loam	18.0	27.1%
Sd	Sandy alluvial land	6.3	9.5%
TrD	Truckton sandy loam, 3 to 9 percent slopes	3.0	4.5%
Totals for Area of Interest		**66.4**	**100.0%**



Map Scale: 1:3,840 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	33.8	50.9%
Lu	Loamy alluvial land, dark surface	C	5.3	8.0%
Sa	Sampson loam	B	18.0	27.1%
Sd	Sandy alluvial land	A	6.3	9.5%
TrD	Truckton sandy loam, 3 to 9 percent slopes	A	3.0	4.5%
Totals for Area of Interest			**66.4**	**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.

Appendix B

Hydrologic Calculations

Composite C Calculations

Project Information

Project Name:	**Parker NHC**
Miro Project No:	**22057**
Revised Date:	**12/14/2023**
Calculated By:	**FKF**

Jurisdiction Impervious Value

Pond Area	100%
Landscape Area	2%
Paved Area	100%
Roof Area	90%

Coefficient Equations

$C_{CD\ (2)}$ =0.83I^1.122

$C_{CD\ (5)}$ = 0.82i+0.035

$C_{CD\ (10)}$ = 0.74i+0.132

$C_{CD\ (100)}$ = 0.4i+0.484

*NOTE: C_{CD} Equations from UDFCD Criteria Manual updated March 2017

Basin Designation	A_{pond} (ft^2)	$A_{landscape}$ (ft^2)	A_{paved} (ft^2)	A_{roof} (ft^2)	A_{total} (acres)	Impervious-ness	C_{CD} 02 yr	C_{CD} 05 yr	C_{CD} 10 yr	C_{CD} 100 yr
A1				15,986	0.37	90%	0.74	0.77	0.80	0.84
A2		654	9,616		0.24	94%	0.77	0.80	0.83	0.86
A3		9,817	56,489		1.52	85%	0.70	0.74	0.76	0.83
O1		57,103			1.31	2%	0.01	0.05	0.15	0.49
O2		28,652	571		0.67	4%	0.02	0.07	0.16	0.50
O1 FUTURE		26,820	30,283		1.31	54%	0.42	0.48	0.53	0.70
TOTAL		96,225	66,676	15,986	4.11	46%	0.35	0.42	0.48	0.67
TOTAL FUTURE		65,942	96,959	0	3.74	60%	0.47	0.53	0.58	0.73

TIME OF CONCENTRATION

Project Information

Project Name: Parker NHC
S.A. Project No: 22057
Revised Date: 12/14/2023
Calculated By: FKF

Conveyance Coefficient Value

Grassed Waterway	15
Heavy Meadow	2.5
Nearly Bare Ground	10
Paved Areas and Shallow Paved Swales	20
Short Pasture and Lawns	7
Tillage / Field	5

Time of Concentration Equations

$t_i = 0.395(1.1 - C_5)L^{1/2} / S^{1/3}$ $t_t = (L/v)/60$
t_c check: $t_c = (26-17i) +(L/(60(14i+19)S^{\wedge 1/2})$

*NOTE: Cv Values, T_i, T_t, & T_c Equations from UDFCD Criteria Manual updated March 2017

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)						$t_i + t_t$	t_c CHECK (urbanized basins)	FINAL t_c USED
Basin Designation	Area (acres)	C_{CD} 05 yr	length (ft)	slope %	t_i (min)	length (ft)	slope %	Type of Land Surface	Conveyance Coefficient Cv	velocity (ft/sec)	t_t (min)	t_c (min)	Total Length (ft)	t_c (min)
A1	0.37	0.77	64	0.88%	5.00	0	0.00%	Paved areas and shallow paved swales	20	0.00	0.00	5.00	64	**5.00**
A2	0.24	0.80	90	1.50%	4.50	231	1.30%	Paved areas and shallow paved swales	20	2.28	1.69	6.19	321	**6.19**
A3	1.52	0.74	270	1.50%	9.58	208	1.20%	Paved areas and shallow paved swales	20	2.19	1.58	11.16	478	**11.16**
O1	1.31	0.05	65	0.70%	17.48	99	1.00%	Paved areas and shallow paved swales	20	2.00	0.83	18.31	165	**18.31**
O2	0.67	0.07	60	7.9%	7.37	0	0.00%	Paved areas and shallow paved swales	20	0.00	0.00	7.37	60	**7.37**
O1 FUTURE	1.31	0.48	65	0.7%	10.36	99	1.00%	Paved areas and shallow paved swales	20	2.00	0.83	11.19	164	**11.19**

Runoff Calculations (Rational Method)

Project Information

Project Name: **Parker NHC**
S.A. Project No: **22057**
Revised Date: **12/14/2023**
Calculated By: **FKF**

Intensity Equation

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

*NOTE: P & Intensity Equation from UDFCD Criteria Manual

Basin Designation	Area (ac.)	'c'	cA	t_c (min)	P_1	intensity (in/hr)	Q (cfs)	
A1	0.37	0.74	0.27	5.00	0.99	3.36	0.91	02 YR
		0.77	0.28		1.39	4.71	1.34	05 YR
		0.80	0.29		1.64	5.56	1.63	10 YR
		0.84	0.31		2.60	8.82	2.73	100 YR
A2	0.24	0.77	0.18	6.19	0.99	3.16	0.58	02 YR
		0.80	0.19		1.39	4.44	0.84	05 YR
		0.83	0.19		1.64	5.24	1.02	10 YR
		0.86	0.20		2.60	8.31	1.68	100 YR
A3	1.52	0.70	1.06	11.16	0.99	2.56	2.72	02 YR
		0.74	1.12		1.39	3.60	4.03	05 YR
		0.76	1.16		1.64	4.24	4.94	10 YR
		0.83	1.26		2.60	6.73	8.46	100 YR
O1	1.31	0.01	0.01	18.31	0.99	2.04	0.03	02 YR
		0.05	0.07		1.39	2.86	0.19	05 YR
		0.15	0.19		1.64	3.38	0.65	10 YR
		0.49	0.64		2.60	5.35	3.45	100 YR
O2	0.67	0.02	0.01	7.37	0.99	2.99	0.04	02 YR
		0.07	0.05		1.39	4.20	0.19	05 YR
		0.16	0.11		1.64	4.96	0.54	10 YR
		0.50	0.34		2.60	7.86	2.63	100 YR
O1 FUTURE	1.31	0.42	0.54	11.19	0.99	2.56	1.39	02 YR
		0.48	0.63		1.39	3.59	2.25	05 YR
		0.53	0.70		1.64	4.24	2.95	10 YR
		0.70	0.92		2.60	6.72	6.17	100 YR

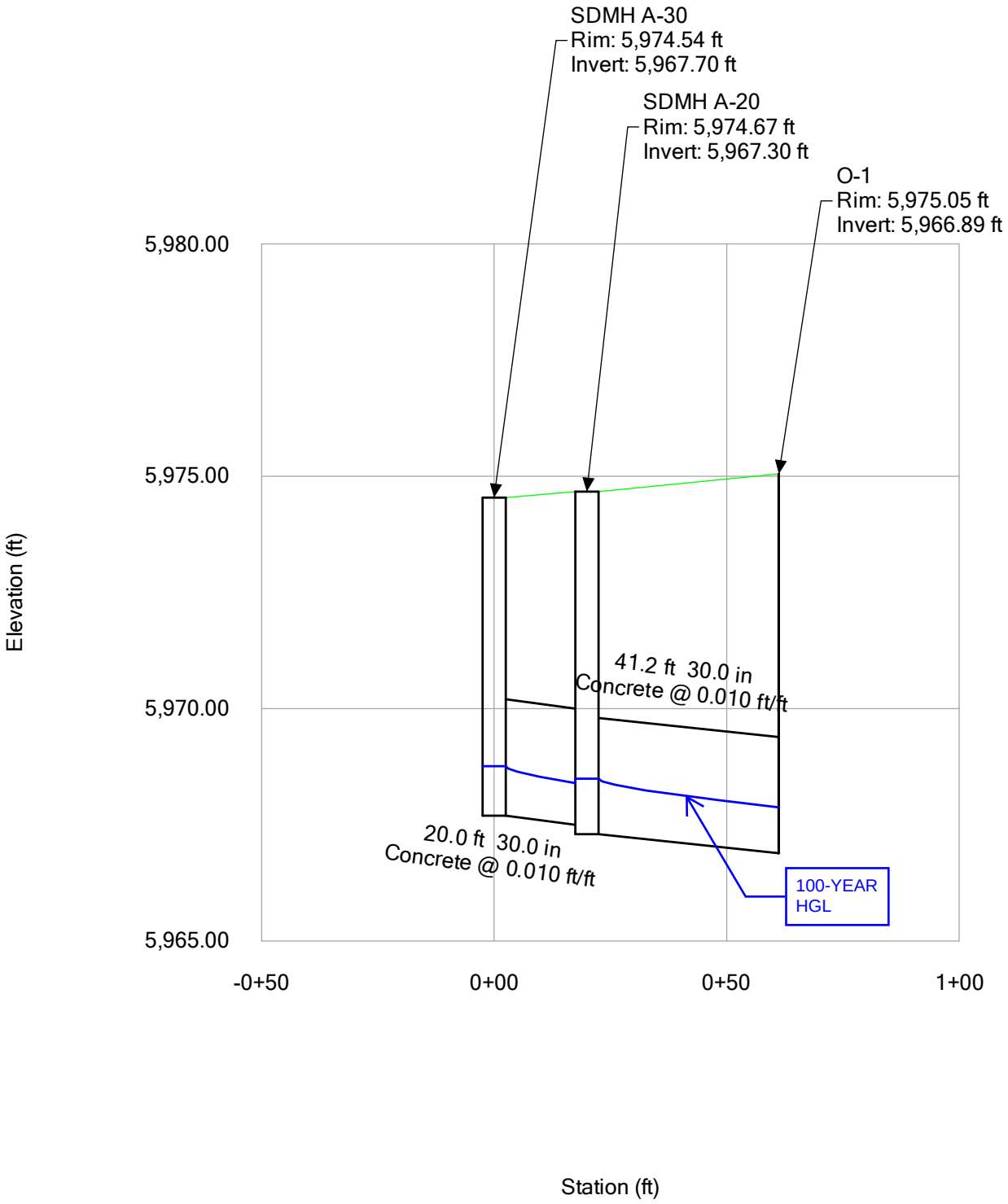
Appendix C
Hydraulic Calculations

StormCAD Results

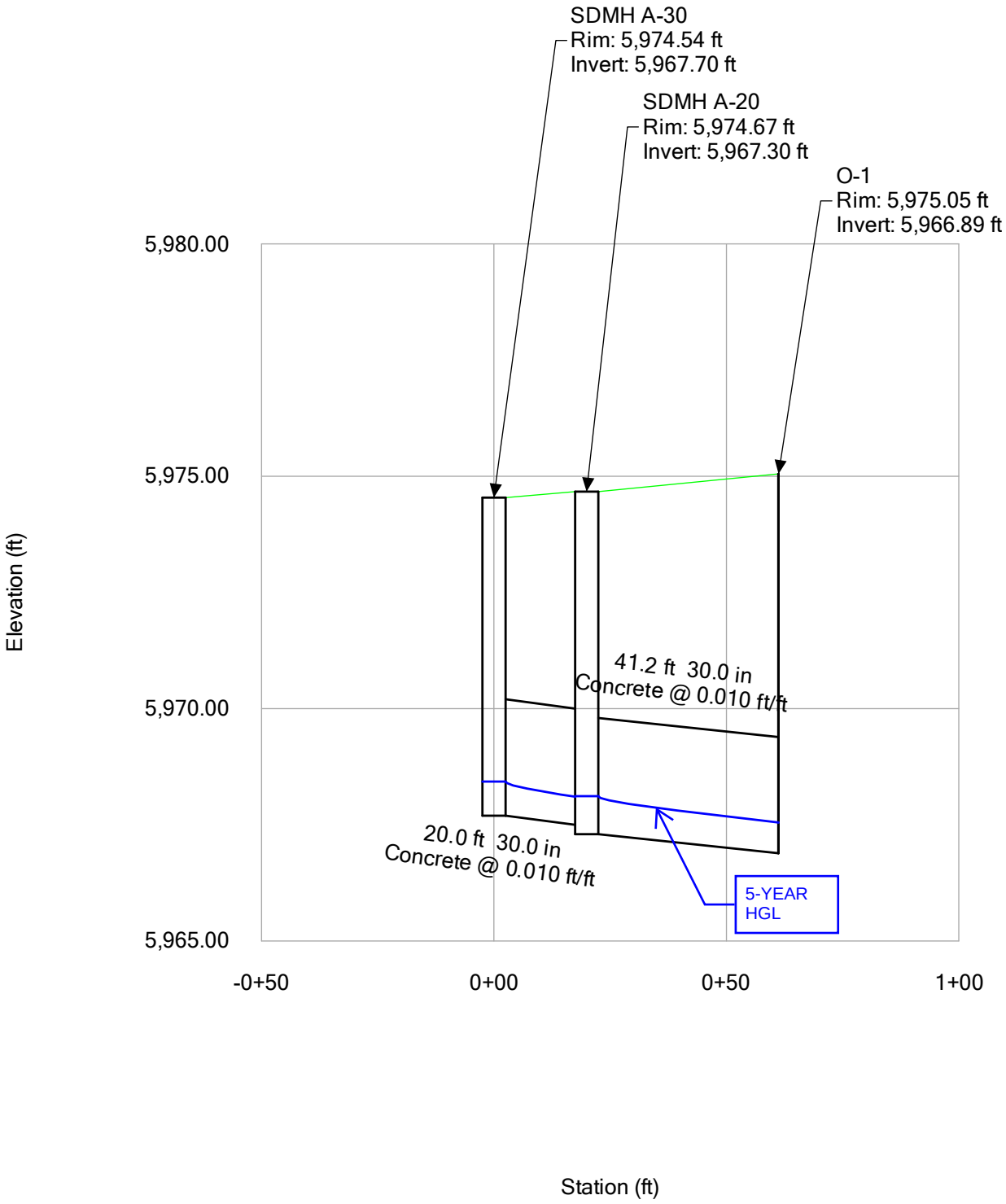
Inlet Capacity

STORMCAD PLAN VIEW

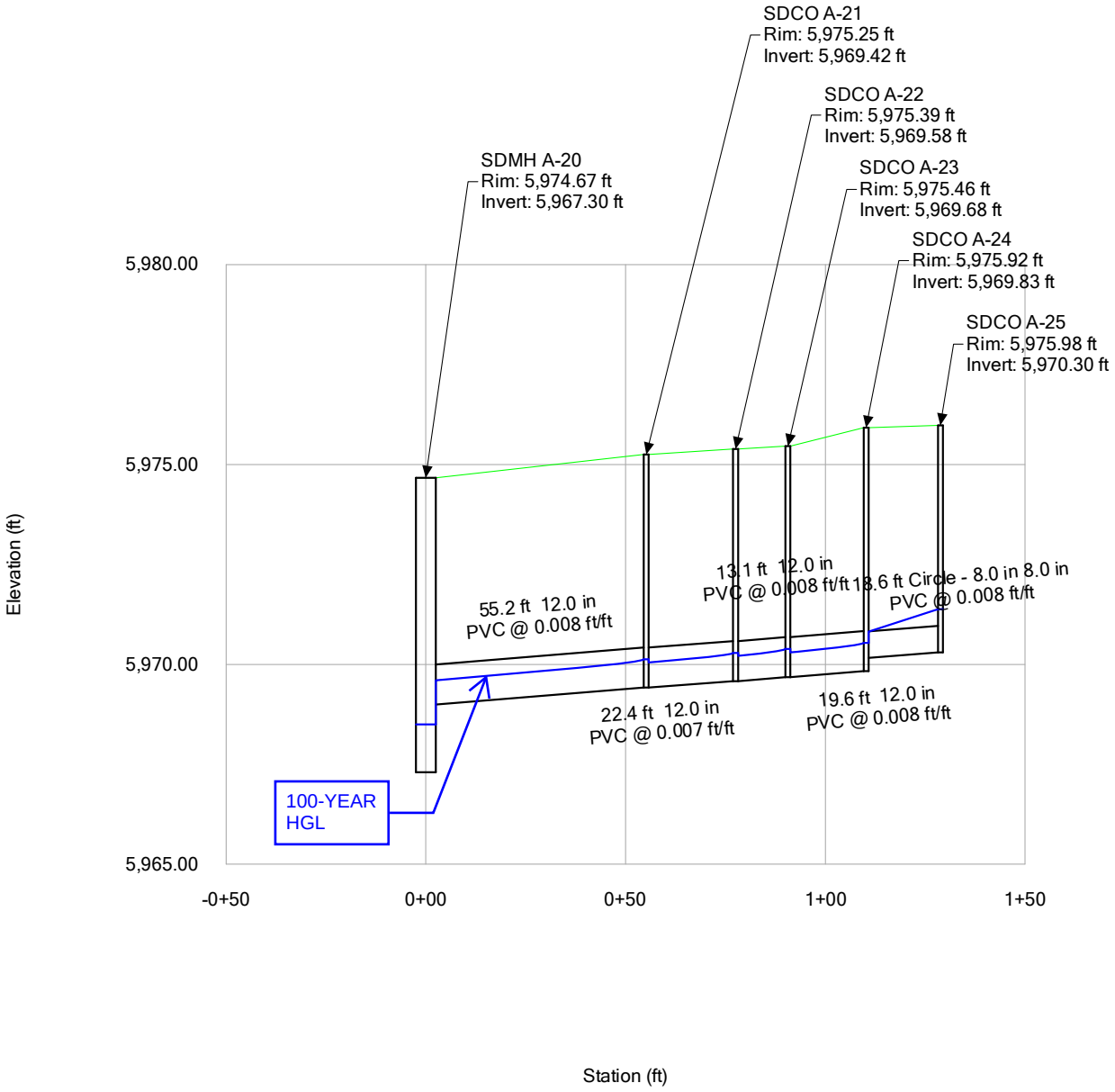
Profile Report
Engineering Profile - STORM LINE A (100-YEAR)



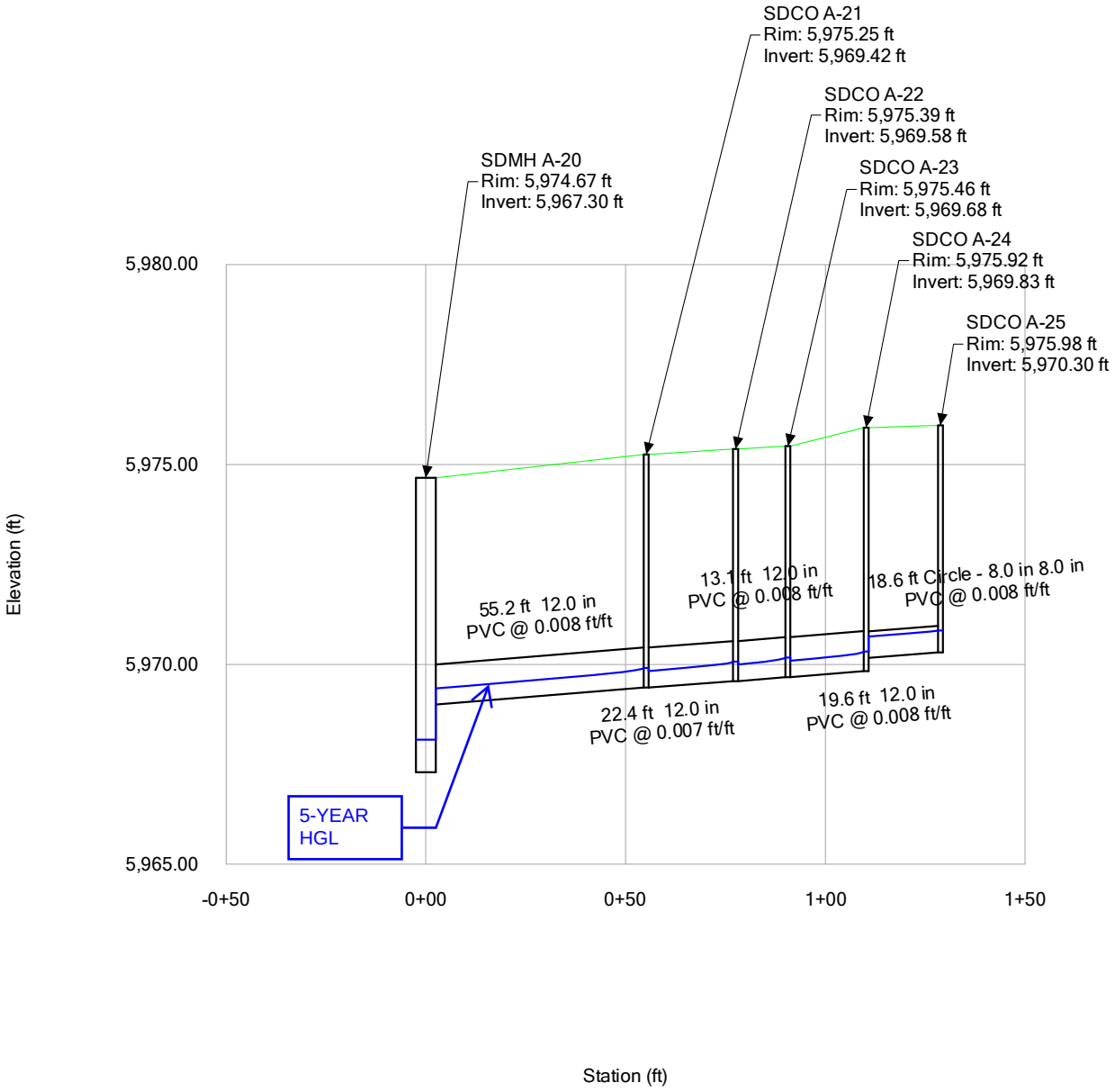
Profile Report
Engineering Profile - STORM LINE A (5-YEAR)



Profile Report
Engineering Profile - STORM LINE A-20 (100-YEAR)

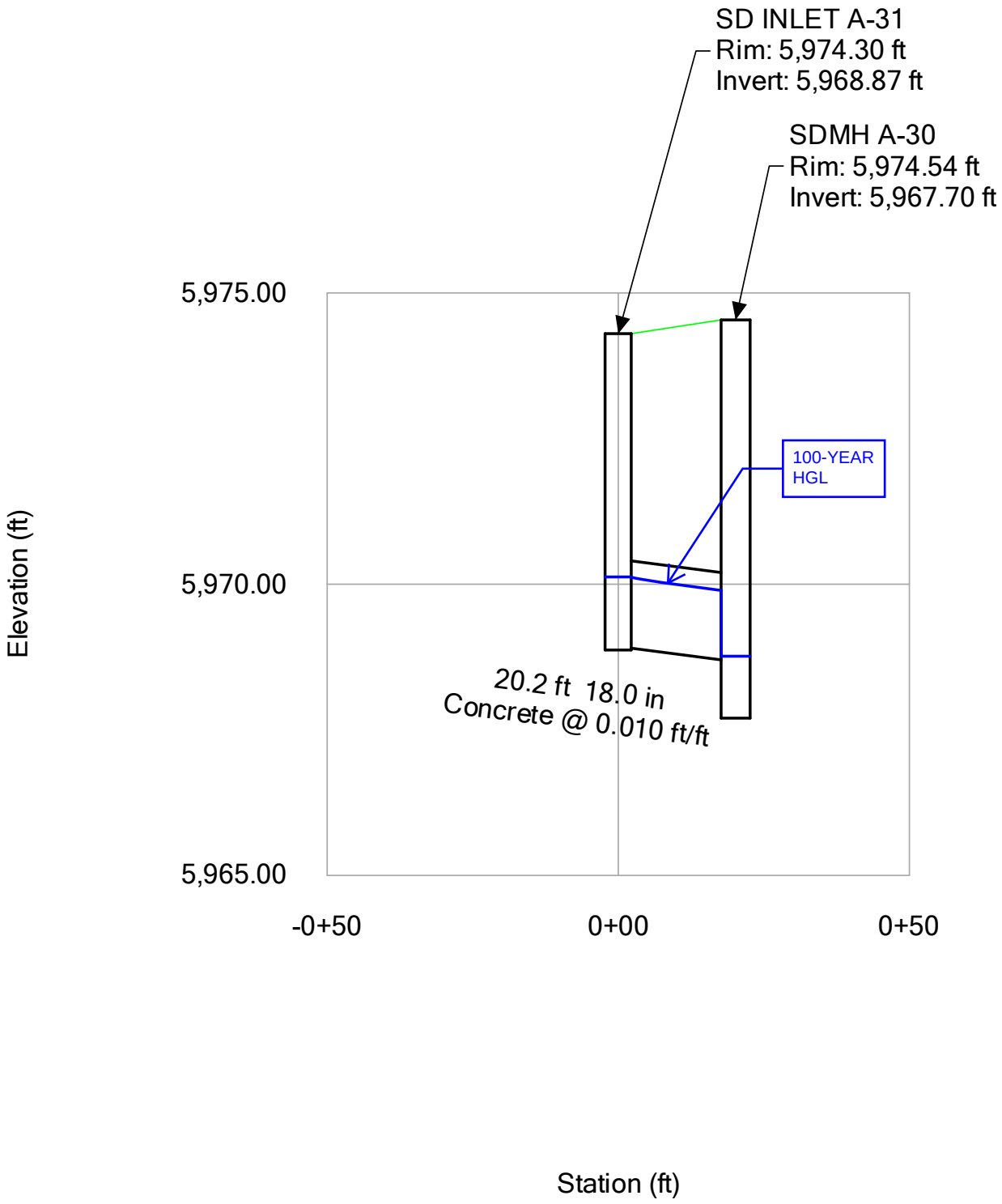


Profile Report
Engineering Profile - STORM LINE A-20 (5-YEAR)



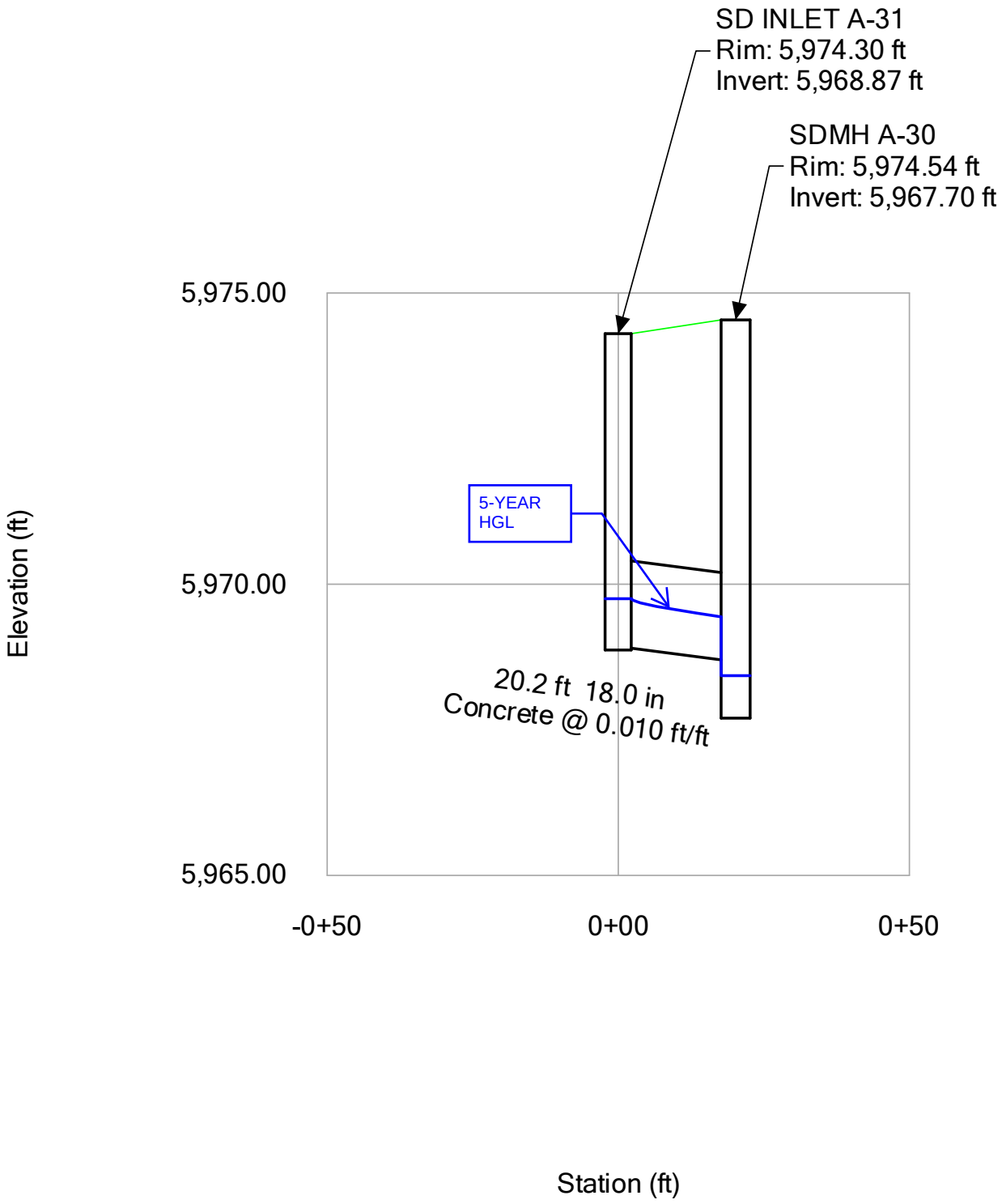
Profile Report

Engineering Profile - STORM LINE A-30 (100-YEAR)



Profile Report

Engineering Profile - STORM LINE A-30 (5-YEAR)



Scenario 100-Year
FlexTable Conduit

Start Node	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Material
SDMH A-20	O-1	5,966.89	41.2	0.01	30	12.68	7.35	40.9	Concrete
SDCO A-25	SDCO A-24	5,970.16	18.6	0.008	8	2.73	7.82	1.36	PVC
SDCO A-24	SDCO A-23	5,969.68	19.6	0.008	12	2.73	5.54	4.05	PVC
SDCO A-22A	SDCO A-22	5,970.25	23.1	0.01	4	0	0	0.25	PVC
SDCO A-23	SDCO A-22	5,969.58	13.1	0.008	12	2.73	5.53	4.04	PVC
SDCO A-22	SDCO A-21	5,969.42	22.4	0.007	12	2.73	5.39	3.92	PVC
SDCO A-21	SDMH A-20	5,969.00	55.2	0.008	12	2.73	5.52	4.04	PVC
SD INLET A-31	SDMH A-30	5,968.70	20.2	0.01	18	10.15	6.74	10.46	Concrete
SDMH A-30	SDMH A-20	5,967.50	20	0.01	30	10.15	6.93	41.07	Concrete

Scenario 5-Year
FlexTable Conduit

Start Node	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Material
SDMH A-20	O-1	5,966.89	41.2	0.01	30	6.12	5.99	40.9	Concrete
SDCO A-25	SDCO A-24	5,970.16	18.6	0.008	8	1.34	4.45	1.36	PVC
SDCO A-24	SDCO A-23	5,969.68	19.6	0.008	12	1.34	4.63	4.05	PVC
SDCO A-22A	SDCO A-22	5,970.25	23.1	0.01	4	0	0	0.25	PVC
SDCO A-23	SDCO A-22	5,969.58	13.1	0.008	12	1.34	4.62	4.04	PVC
SDCO A-22	SDCO A-21	5,969.42	22.4	0.007	12	1.34	4.52	3.92	PVC
SDCO A-21	SDMH A-20	5,969.00	55.2	0.008	12	1.34	4.62	4.04	PVC
SD INLET A-31	SDMH A-30	5,968.70	20.2	0.01	18	4.92	5.83	10.46	Concrete
SDMH A-30	SDMH A-20	5,967.50	20	0.01	30	4.92	5.64	41.07	Concrete

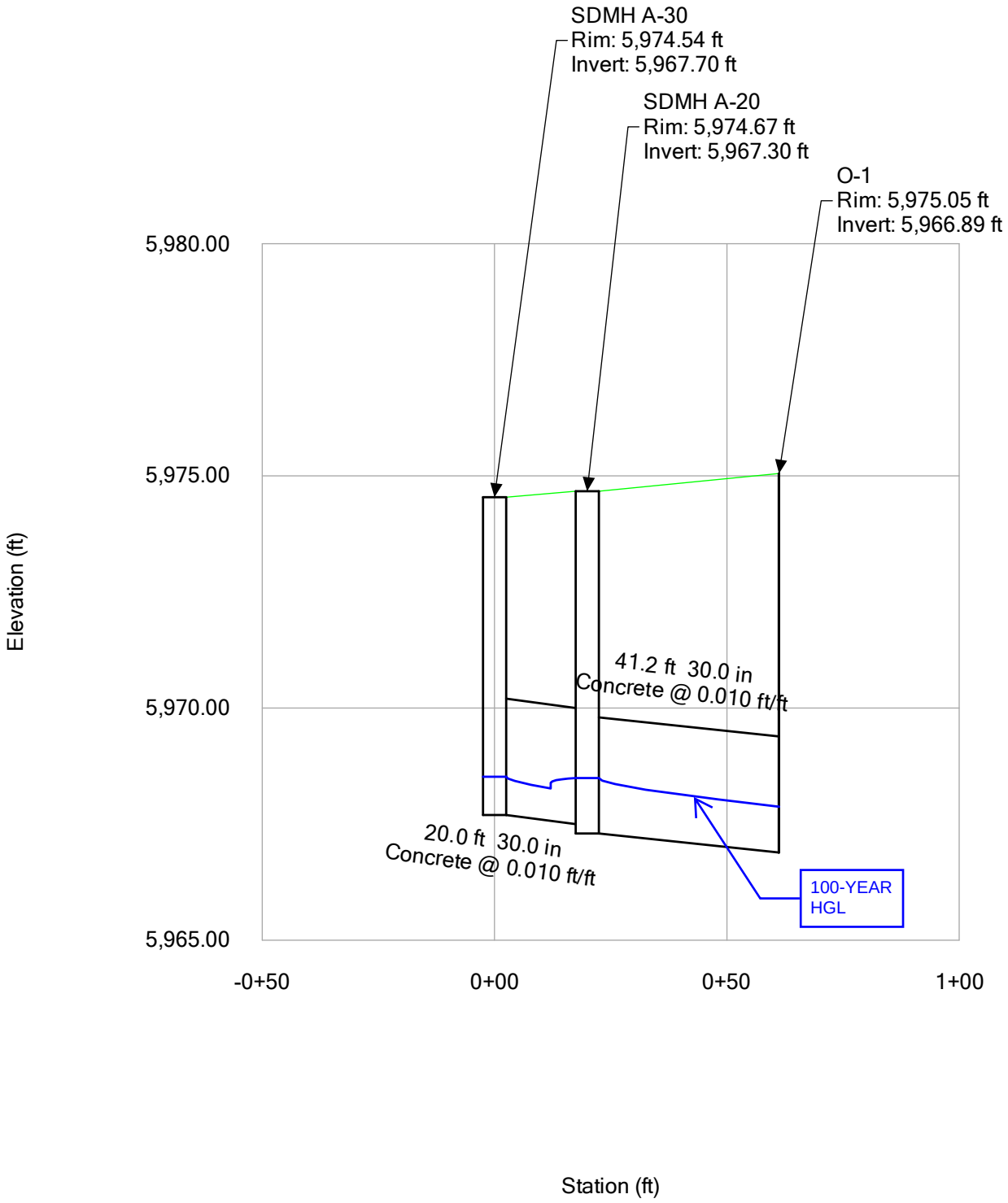
Scenario 100-Year
FlexTable Manhole

Label	Elevation (Rim) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (Out) (ft)	System Flow Time (min)	Notes
SDCO A-25	5,975.98	5,970.30	2.73	5,971.38	5,972.33	0	CLEANOUT
SDCO A-24	5,975.92	5,969.83	2.73	5,970.54	5,970.87	0.04	CLEANOUT
SDCO A-22A	5,975.95	5,970.48	0	5,970.48	5,970.48	0	CLEANOUT
SDCO A-23	5,975.46	5,969.68	2.73	5,970.39	5,970.72	0.099	CLEANOUT
SDCO A-22	5,975.39	5,969.58	2.73	5,970.29	5,970.62	0.138	CLEANOUT
SDCO A-21	5,975.25	5,969.42	2.73	5,970.13	5,970.46	0.207	CLEANOUT
SD INLET A-31	5,974.30	5,968.90	10.15	5,970.13	5,970.80	0	DOUBLE TYPE 16 COMBO
SDMH A-30	5,974.54	5,967.70	10.15	5,968.76	5,969.17	0.05	5' DIA.
SDMH A-20	5,974.67	5,967.30	12.68	5,968.50	5,968.96	0.374	5' DIA.

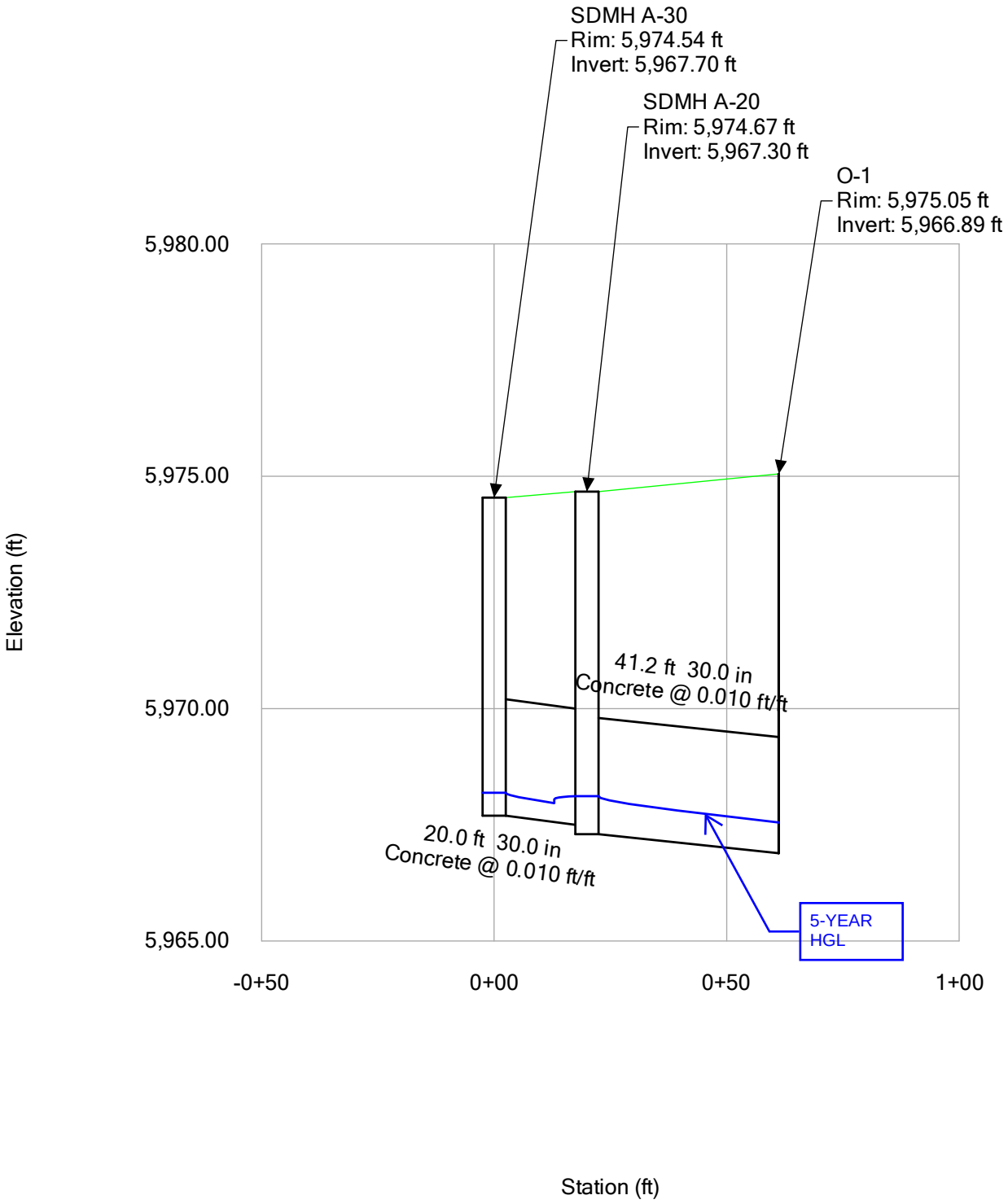
Scenario 5-Year
FlexTable Manhole

Label	Elevation (Rim) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (Out) (ft)	System Flow Time (min)	Notes
SDCO A-25	5,975.98	5,970.30	1.34	5,970.85	5,971.14	0	CLEANOUT
SDCO A-24	5,975.92	5,969.83	1.34	5,970.32	5,970.51	0.07	CLEANOUT
SDCO A-22A	5,975.95	5,970.48	0	5,970.48	5,970.48	0	CLEANOUT
SDCO A-23	5,975.46	5,969.68	1.34	5,970.17	5,970.36	0.14	CLEANOUT
SDCO A-22	5,975.39	5,969.58	1.34	5,970.07	5,970.26	0.187	CLEANOUT
SDCO A-21	5,975.25	5,969.42	1.34	5,969.91	5,970.10	0.27	CLEANOUT
SD INLET A-31	5,974.30	5,968.90	4.92	5,969.75	5,970.10	0	DOUBLE TYPE 16 COMBO
SDMH A-30	5,974.54	5,967.70	4.92	5,968.43	5,968.69	0.058	5' DIA.
SDMH A-20	5,974.67	5,967.30	6.12	5,968.12	5,968.42	0.469	5' DIA.

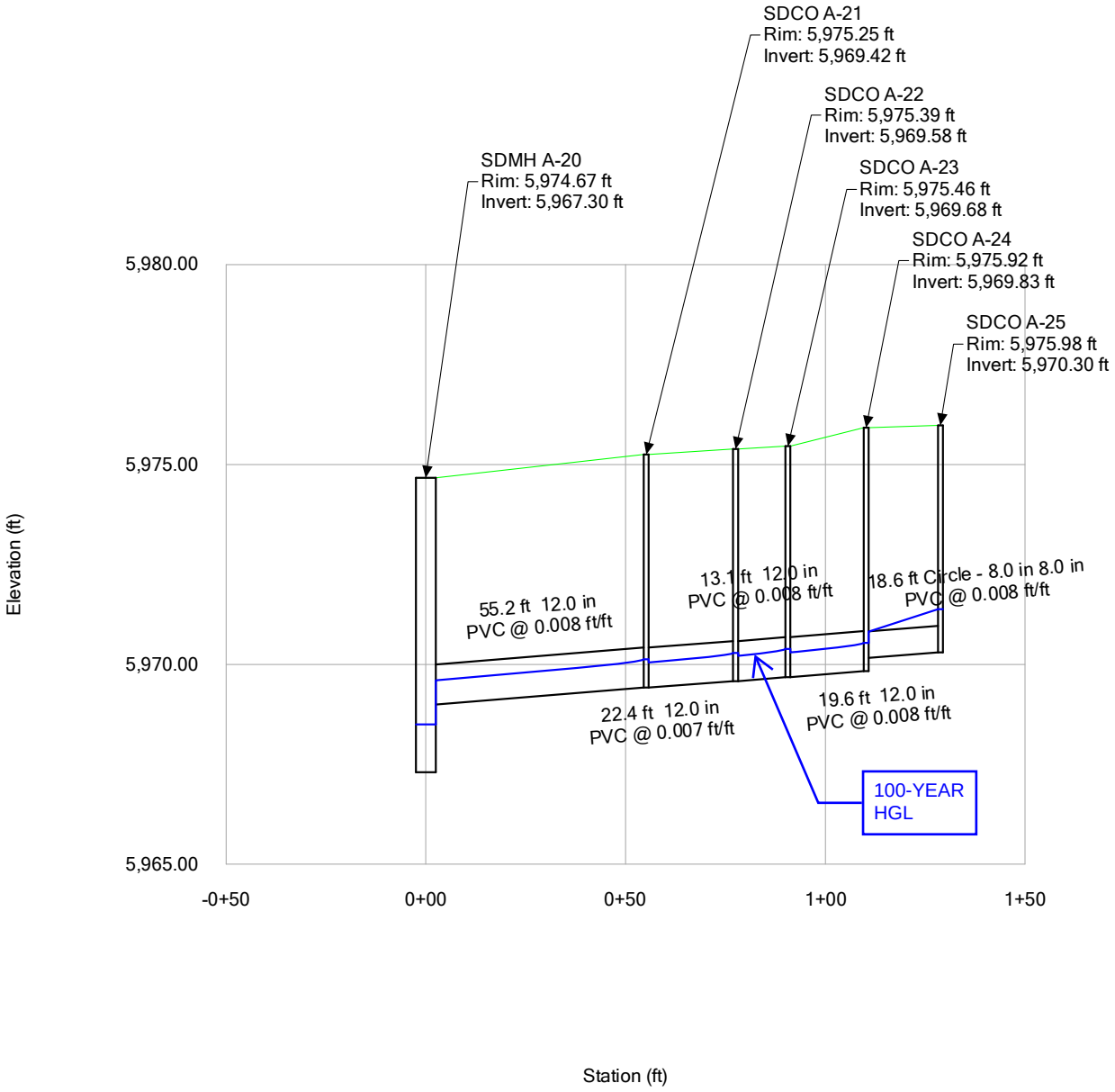
Profile Report
Engineering Profile - STORM LINE A (100-YEAR) FUTURE



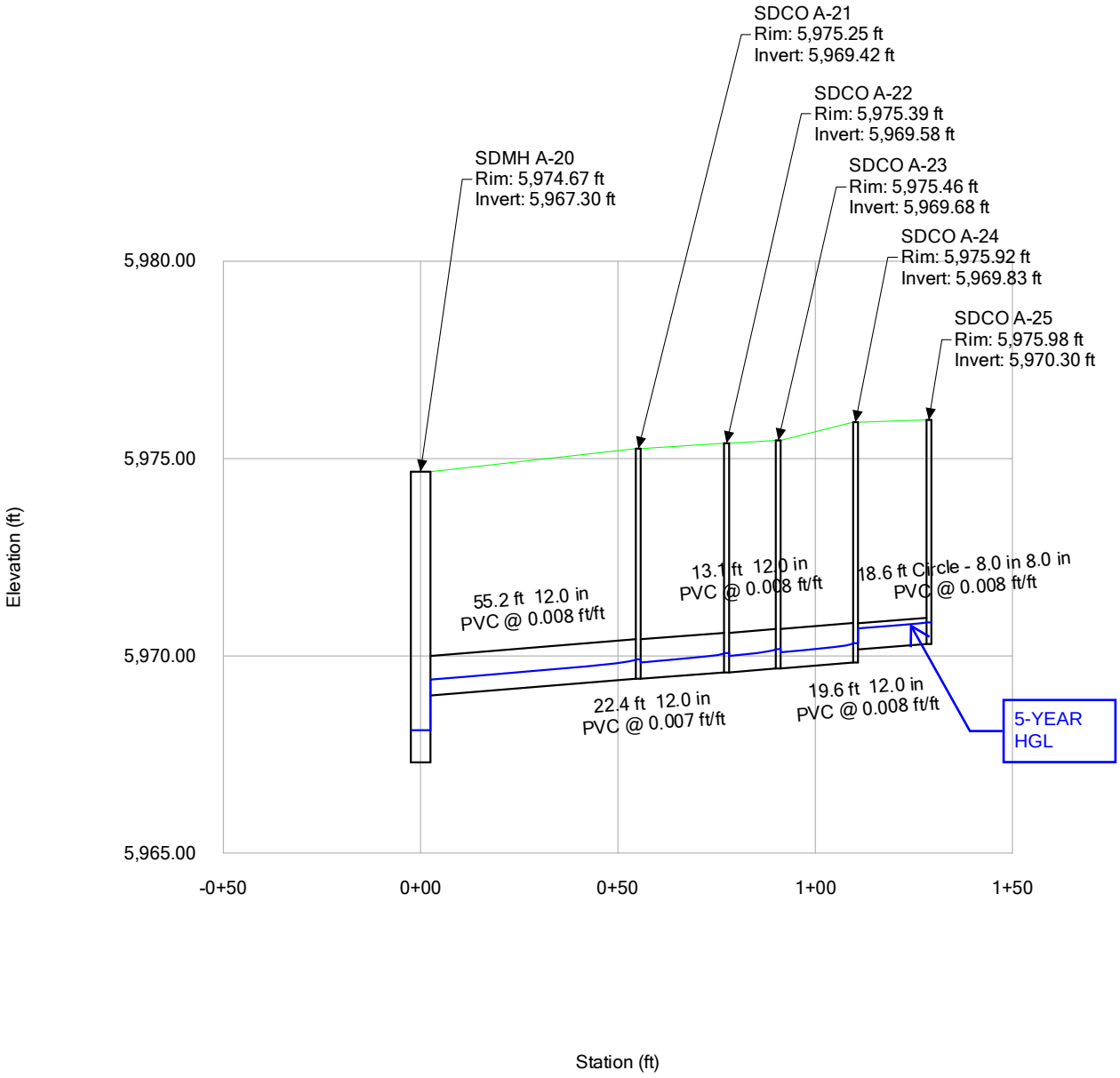
Profile Report
Engineering Profile - STORM LINE A (5-YEAR) FUTURE



Profile Report
Engineering Profile - STORM LINE A-20 (100-YEAR) FUTURE

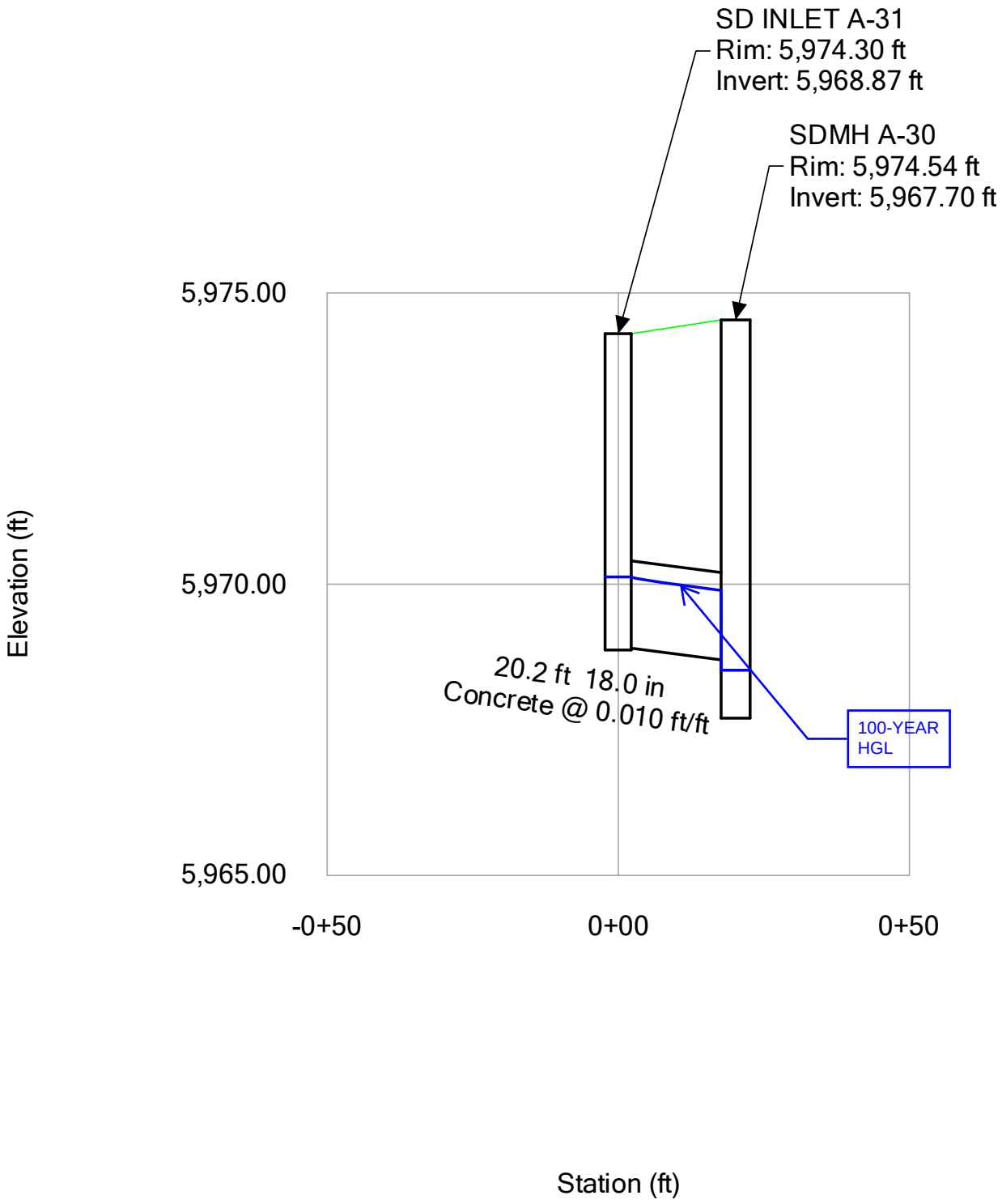


Profile Report
Engineering Profile - STORM LINE A-20 (5-YEAR) FUTURE



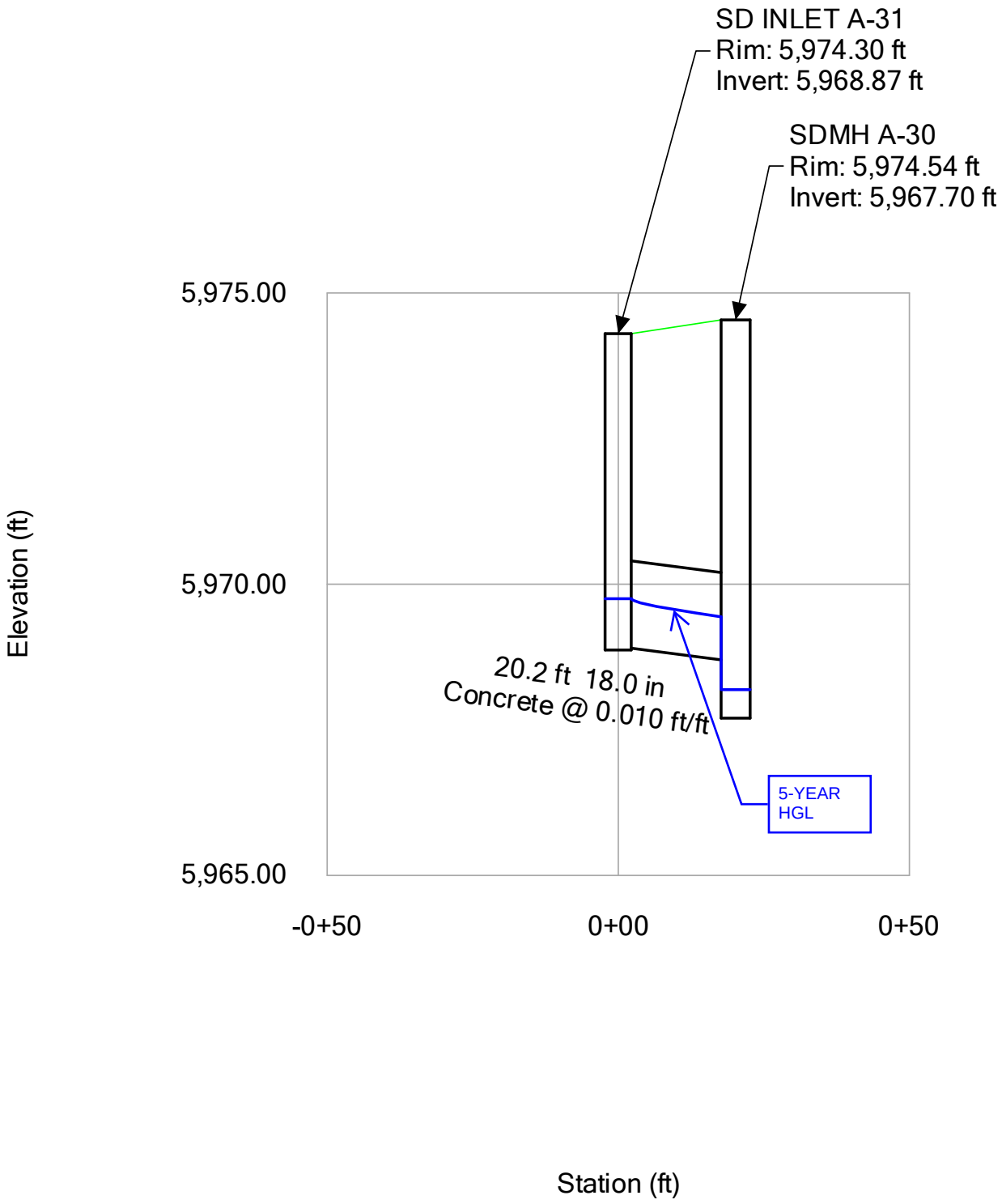
Profile Report

Engineering Profile - STORM LINE A-30 (100-YEAR) FUTURE



Profile Report

Engineering Profile - STORM LINE A-30 (5-YEAR) FUTURE



Scenario 100-Year (Future)
FlexTable Conduit

Start Node	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Material
SDMH A-20	O-1	5,966.89	41.2	0.01	30	12.68	7.35	40.9	Concrete
SDCO A-25	SDCO A-24	5,970.16	18.6	0.008	8	2.73	7.82	1.36	PVC
SDCO A-24	SDCO A-23	5,969.68	19.6	0.008	12	2.73	5.54	4.05	PVC
SDCO A-22A	SDCO A-22	5,970.25	23.1	0.01	4	0	0	0.25	PVC
SDCO A-23	SDCO A-22	5,969.58	13.1	0.008	12	2.73	5.53	4.04	PVC
SDCO A-22	SDCO A-21	5,969.42	22.4	0.007	12	2.73	5.39	3.92	PVC
SDCO A-21	SDMH A-20	5,969.00	55.2	0.008	12	2.73	5.52	4.04	PVC
SD INLET A-31	SDMH A-30	5,968.70	20.2	0.01	18	10.15	6.74	10.46	Concrete
SDMH A-30	SDMH A-20	5,967.50	20	0.01	30	6.17	6.02	41.07	Concrete

Scenario 5-Year (Future)
FlexTable Conduit

Start Node	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Material
SDMH A-20	O-1	5,966.89	41.2	0.01	30	6.12	5.99	40.9	Concrete
SDCO A-25	SDCO A-24	5,970.16	18.6	0.008	8	1.34	4.45	1.36	PVC
SDCO A-24	SDCO A-23	5,969.68	19.6	0.008	12	1.34	4.63	4.05	PVC
SDCO A-22A	SDCO A-22	5,970.25	23.1	0.01	4	0	0	0.25	PVC
SDCO A-23	SDCO A-22	5,969.58	13.1	0.008	12	1.34	4.62	4.04	PVC
SDCO A-22	SDCO A-21	5,969.42	22.4	0.007	12	1.34	4.52	3.92	PVC
SDCO A-21	SDMH A-20	5,969.00	55.2	0.008	12	1.34	4.62	4.04	PVC
SD INLET A-31	SDMH A-30	5,968.70	20.2	0.01	18	4.92	5.83	10.46	Concrete
SDMH A-30	SDMH A-20	5,967.50	20	0.01	30	2.25	4.48	41.07	Concrete

Scenario 100-Year (Future)
FlexTable Manhole

Label	Elevation (Rim) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (Out) (ft)	System Flow Time (min)	Notes
SDCO A-25	5,975.98	5,970.30	2.73	5,971.38	5,972.33	0	CLEANOUT
SDCO A-24	5,975.92	5,969.83	2.73	5,970.54	5,970.87	0.04	CLEANOUT
SDCO A-22A	5,975.95	5,970.48	0	5,970.48	5,970.48	0	CLEANOUT
SDCO A-23	5,975.46	5,969.68	2.73	5,970.39	5,970.72	0.099	CLEANOUT
SDCO A-22	5,975.39	5,969.58	2.73	5,970.29	5,970.62	0.138	CLEANOUT
SDCO A-21	5,975.25	5,969.42	2.73	5,970.13	5,970.46	0.207	CLEANOUT
SD INLET A-31	5,974.30	5,968.90	10.15	5,970.13	5,970.80	0	DOUBLE TYPE 16 COMBO
SDMH A-30	5,974.54	5,967.70	6.17	5,968.52	5,968.82	0.05	5' DIA.
SDMH A-20	5,974.67	5,967.30	12.68	5,968.50	5,968.96	0.374	5' DIA.

Scenario 5-Year (Future)
FlexTable Manhole

Label	Elevation (Rim) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (Out) (ft)	System Flow Time (min)	Notes
SDCO A-25	5,975.98	5,970.30	1.34	5,970.85	5,971.14	0	CLEANOUT
SDCO A-24	5,975.92	5,969.83	1.34	5,970.32	5,970.51	0.07	CLEANOUT
SDCO A-22A	5,975.95	5,970.48	0	5,970.48	5,970.48	0	CLEANOUT
SDCO A-23	5,975.46	5,969.68	1.34	5,970.17	5,970.36	0.14	CLEANOUT
SDCO A-22	5,975.39	5,969.58	1.34	5,970.07	5,970.26	0.187	CLEANOUT
SDCO A-21	5,975.25	5,969.42	1.34	5,969.91	5,970.10	0.27	CLEANOUT
SD INLET A-31	5,974.30	5,968.90	4.92	5,969.75	5,970.10	0	DOUBLE TYPE 16 COMBO
SDMH A-30	5,974.54	5,967.70	2.25	5,968.19	5,968.36	0.058	5' DIA.
SDMH A-20	5,974.67	5,967.30	6.12	5,968.12	5,968.42	0.469	5' DIA.

INLET CAPACITY FOR SD INLET A-31

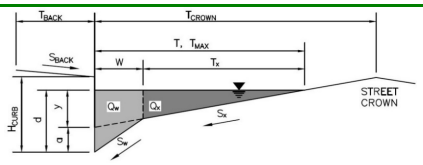
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project:

Inlet ID: **SD Inlet A-31**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.010	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition

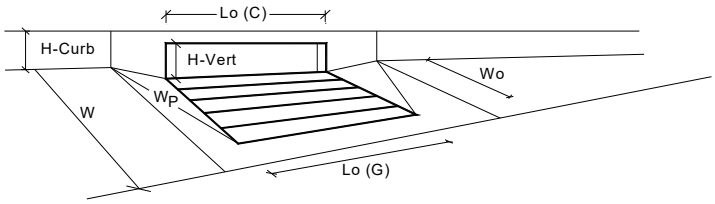
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

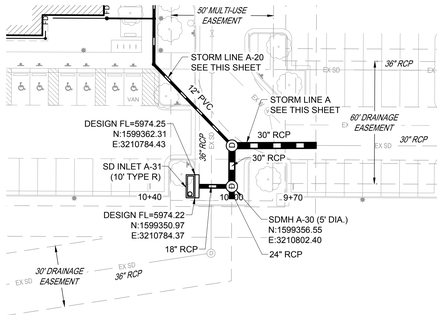
INLET CAPACITY FOR SD INLET A-31

INLET IN A SUMP OR SAG LOCATION

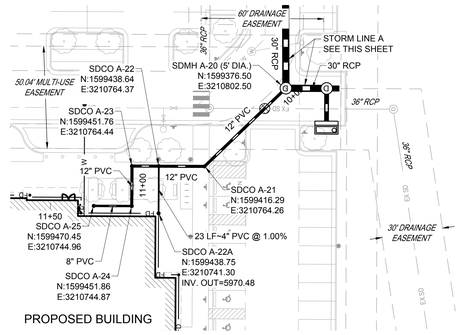
MHFD-Inlet, Version 5.02 (August 2022)



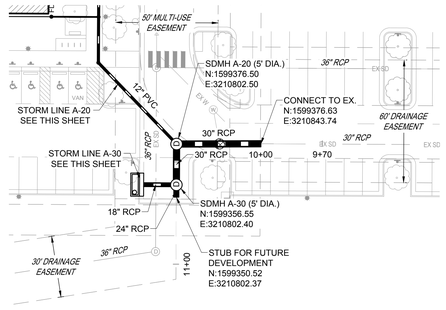
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.9	4.9	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.43	0.43	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.24	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.57	0.57	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.57	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**4.2**	**4.2**	**cfs**
WARNING: Inlet Capacity < Q Peak for Minor and Major Storms	$Q_{PEAK\ REQUIRED}$ =	4.92	10.15	cfs



STORM LINE A-30 PLAN



STORM LINE A-20 PLAN



STORM LINE A PLAN

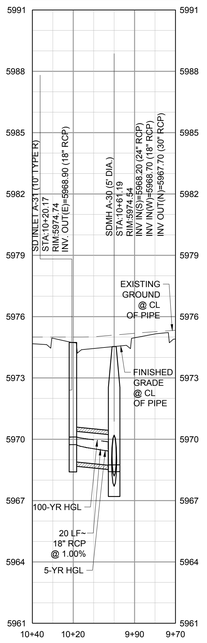
30 0 30

SCALE: 1" = 30'

NOTES:

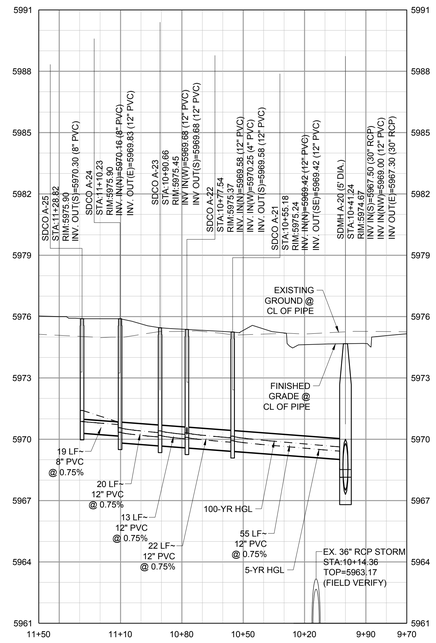
1. SEE SHEET C-001 FOR CIVIL NOTES AND LEGEND.
2. ALL EXISTING DRY UTILITIES ARE ASSUMED TO BE 3' DEEP TO TOP OF PIPE.
3. ALL EXISTING WATER LINES ARE ASSUMED TO BE 4.5' DEEP TO TOP OF PIPE.
4. THE CONTRACTOR SHALL POTHOLE ALL EXISTING UTILITY CROSSINGS PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER OF ANY POTENTIAL CONFLICTS IMMEDIATELY.

VERTICAL SCALE: 1"=3'
HORIZONTAL SCALE: 1"=30'



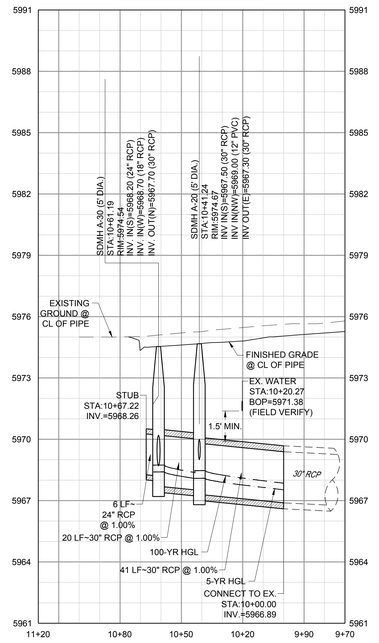
STORM LINE A-30 PROFILE

VERTICAL SCALE: 1"=3'
HORIZONTAL SCALE: 1"=30'

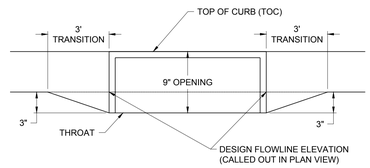


STORM LINE A-20 PROFILE

VERTICAL SCALE: 1"=3'
HORIZONTAL SCALE: 1"=30'



STORM LINE A PROFILE



TYPE R INLET ANNOTATION DETAIL

THE TOWN OF PARKER REVIEW CONSTITUTES GENERAL COMPLIANCE WITH 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.

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Town of Parker, Director of Engineering/Public Works Date

MIRO

S.A. MIRO INC.
CONSULTING ENGINEERS

4582 South Ulster Street
Suite 750, Denver, CO 80237
303-741-3737
www.samiro.com

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

NO.	DESCRIPTION	DATE

PROJECT:
PARKER NHC
PARKER, CO 80134

DRAWING TITLE:
STORM PLAN AND PROFILES

FILE PATH: C:\Users\FKFIA\CCDocs\S. A. Miro, Inc\Civil\obs\#22057 Parker NHC\05 CAD\Plans and Details\C331-STRM-PROF-dwg C331 - 12/12/2023

DESIGNED BY:	SSM
DRAWN BY:	SSM
CHECKED BY:	JDC
MIRO JOB NO.	22057

DRAWING NUMBER:
C-331

BOULDER ASSOCIATES

1426 PEARL STREET, SUITE 300
BOULDER, COLORADO 80302
303.499.7795

MIRO

S.A. MIRO INC.
CONSULTING ENGINEERS

4582 South Ulster Street
Suite 750, Denver, CO 80237
303-741-3737
www.samiro.com

PROJECT 225280.00

PARKER NHC

PARKER POINTE SUBDIVISION LOT 7,8,9,10, PARKER, CO 80134

DESIGN DEVELOPMENT-NOT FOR CONSTR.

DATE 08/04/2023

REVISIONS

NO.	DESCRIPTION	DATE

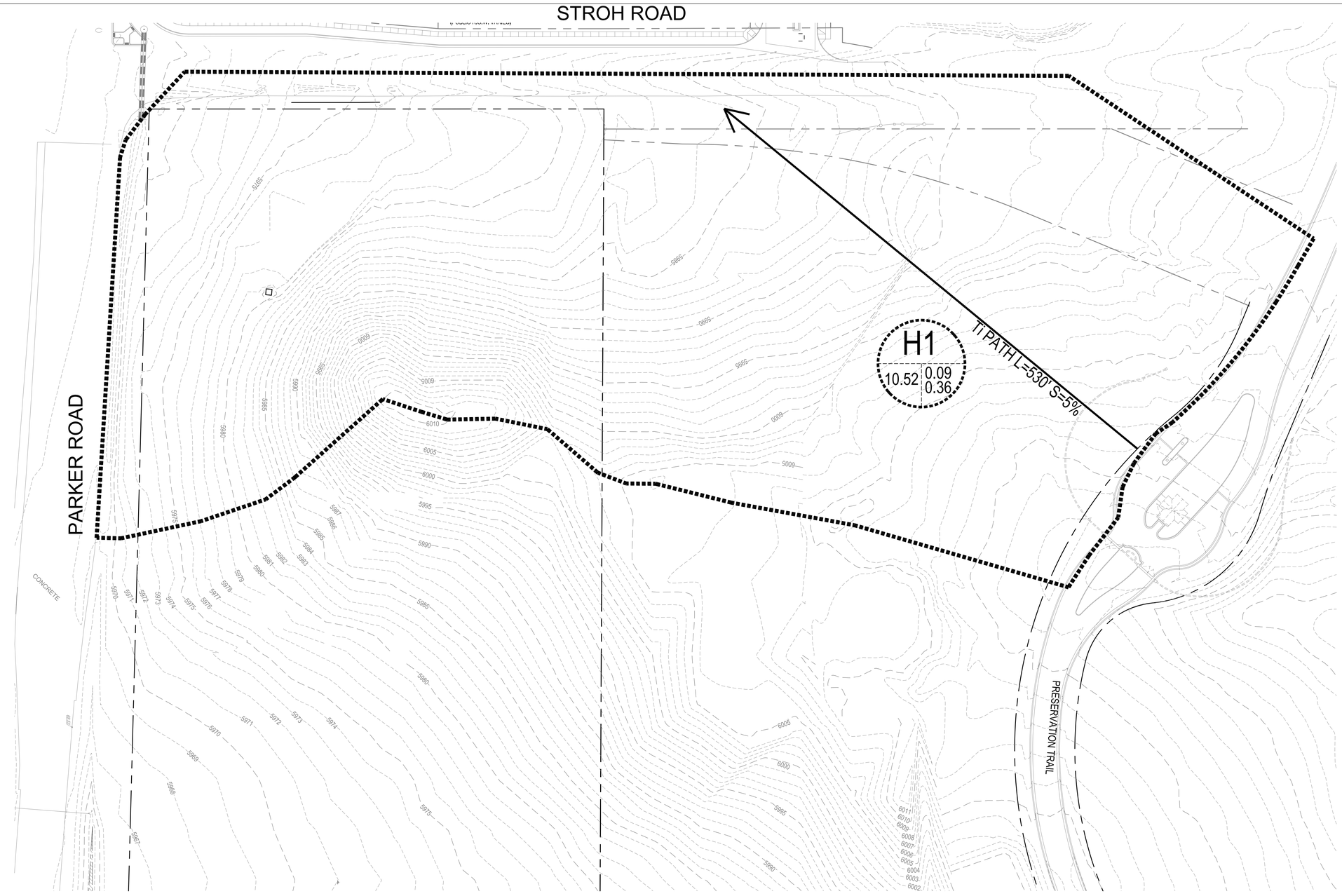
SHEET TITLE
STORM PLAN AND PROFILES

SHEET NUMBER
C-331

Appendix D
DRAINAGE REPORTS AND PLANS

Master Drainage Plan

Proposed Drainage Plan



BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A – 3" DIAMETER DOUGLAS COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US HIGHWAY 83)
ELEVATION: 5970.79 FEET (NAVD 1988 DATUM)

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 Inch = 40 ft.

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TOWN OF PARKER, DIRECTOR OF ENGINEERING DATE

PERCEPTION
DESIGN GROUP, INC.
6901 SOUTH PIERCE STREET, SUITE 315 LITTLETON, CO 80128 303-232-8868
WWW.PERCEPTIONDESIGNGROUP.COM

PREPARED UNDER THE DIRECT SUPERVISION OF
JERRY W. DAVIDSON, P.E.
COLORADO REG # 30226
FOR AND ON BEHALF OF
PERCEPTION DESIGN GROUP, INC.

	DATE	DESCRIPTION
1	10/24/17	INITIAL SUBMITTAL
	02/28/18	SECOND SUBMITTAL
	03/19/18	PWSD SUBMITTAL
	05/25/18	THIRD SUBMITTAL
	08/31/18	FOURTH SUBMITTAL
	11/01/18	SIXTH SUBMITTAL

REVISIONS

HISTORIC DRAINAGE PLAN

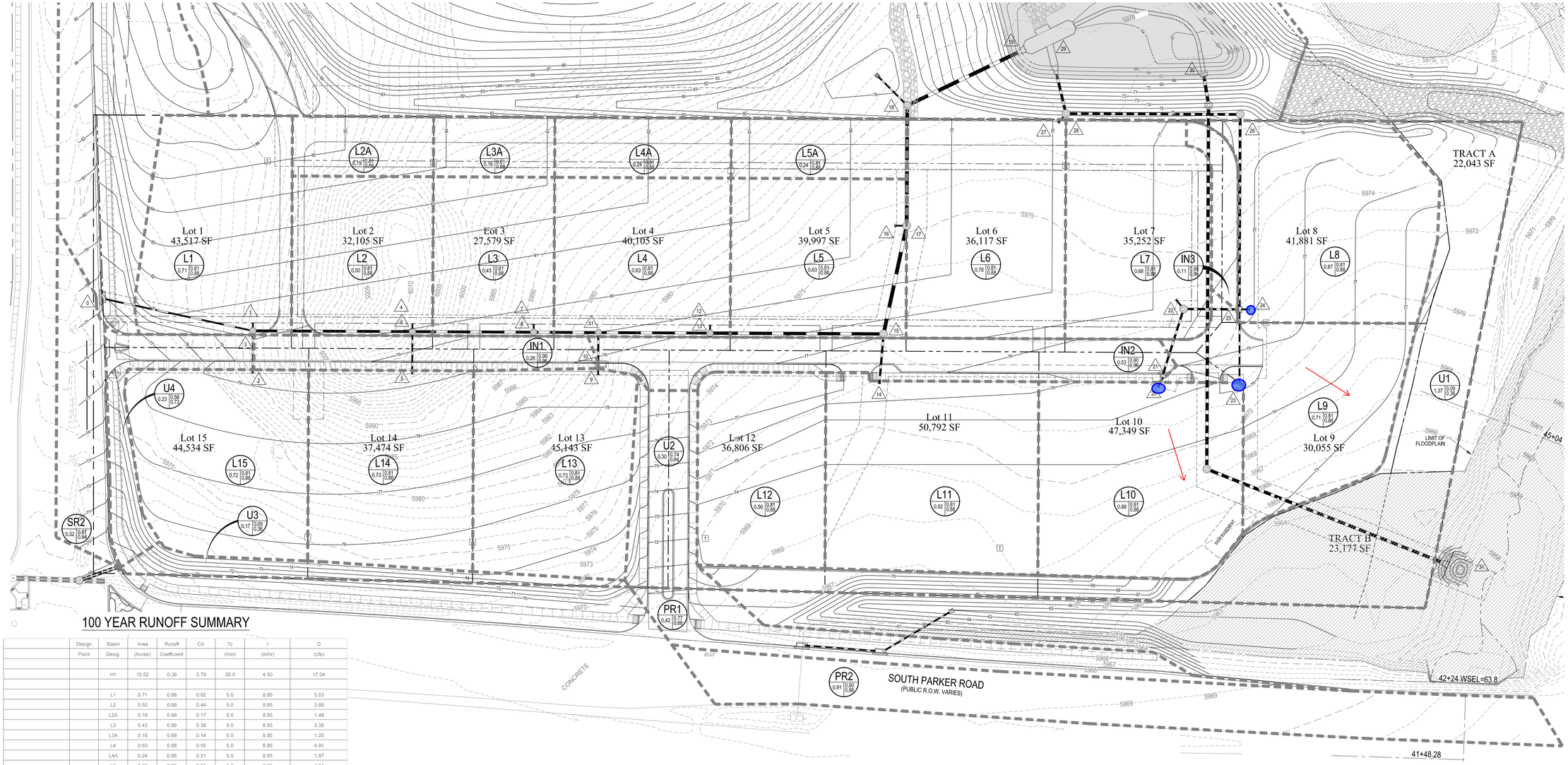
PARKER POINTE
LOTS 1 THRU 15 AND TRACTS A AND B, PARKER POINTE FILING NO. 1
SOUTHEAST CORNER PARKER ROAD AND STROH ROAD
PARKER, COLORADO

design by:	JWD
approved by:	JWD
project no.:	2015-015
date:	10/01/17

SHEET
DP1

SEE SHEET DP3

STROH ROAD



100 YEAR RUNOFF SUMMARY

Design Point	Basin Desig.	Area (Acres)	Runoff Coefficient	CA	Tc (min)	I (in/hr)	Q (cfs)
	H1	10.52	0.36	3.79	26.0	4.50	17.04
	L1	0.71	0.88	0.62	5.0	8.85	5.53
	L2	0.50	0.88	0.44	5.0	8.85	3.89
	L2A	0.19	0.88	0.17	5.0	8.85	1.48
	L3	0.43	0.88	0.38	5.0	8.85	3.35
	L3A	0.16	0.88	0.14	5.0	8.85	1.25
	L4	0.63	0.88	0.55	5.0	8.85	4.91
	L4A	0.24	0.88	0.21	5.0	8.85	1.87
	L5	0.63	0.88	0.55	5.0	8.85	4.91
	L5A	0.24	0.88	0.21	5.0	8.85	1.87
	L6	0.78	0.88	0.69	5.0	8.85	6.07
	L7	0.68	0.88	0.60	5.0	8.85	5.30
	L8	0.87	0.88	0.77	5.0	8.85	6.78
	L9	0.71	0.88	0.62	5.0	8.85	5.53
	L10	0.88	0.88	0.77	5.0	8.85	6.85
	L11	0.92	0.88	0.81	5.0	8.85	7.16
	L12	0.56	0.88	0.49	5.0	8.85	4.36
	L13	0.73	0.88	0.64	5.0	8.85	5.69
	L14	0.73	0.88	0.64	5.0	8.85	5.69
	L15	0.72	0.88	0.63	5.0	8.85	5.61
	IN1	0.26	0.96	0.25	5.0	8.85	2.21
	IN2	0.53	0.96	0.51	5.0	8.85	4.50
	IN3	0.11	0.96	0.11	5.0	8.85	0.93
	SR1	3.75	0.42	1.58	22.4	4.90	7.72
TOTAL FLOW TO FOREBAY							103.45
	OS1	23.34	0.39	9.10	25.5	4.50	40.96
TOTAL TO POND		39.30					144.41
	U1	1.37	0.36	0.49	25.5	4.50	2.22
	U2	0.3	0.84	0.25	25.5	4.50	1.13
	U3	0.17	0.36	0.06	25.5	4.50	0.28
	U4	0.23	0.73	0.17	25.5	4.50	0.76
UN-CAPTURED SITE RUNOFF							4.38
	SR2	0.32	0.94	0.30	5.0	8.85	2.66
	PR1	0.42	0.86	0.36	5.0	8.85	3.20
	PR2	0.91	0.96	0.87	5.0	8.85	7.73

DETENTION SUMMARY

ZONE	VOLUME	ELEVATION	RELEASE RATE
WQCV	0.566 AC-FT		41 HOURS
EURV+WQCV	1.472 AC-FT	5968.03	70 HOURS
100 YEAR	2.753 AC-FT	5970.05	36.7 CFS

LEGEND

- 5340 — EXISTING CONTOUR
- 42 — PROPOSED CONTOUR
- R1 / 0.20 / 0.75 / 0.83 — BASIN DESIGNATION; 5 YR RUNOFF COEFFICIENT; 100 YR RUNOFF COEFFICIENT; BASIN AREA
- BASIN BOUNDARY LINE
- 1 — DESIGN POINT

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.

BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A – 3" DIAMETER DOUGLAS COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US HIGHWAY 83)
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TOWN OF PARKER, DIRECTOR OF ENGINEERING — DATE

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COLORADO REG # 30226
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DATE	DESCRIPTION
11/01/18	SIXTH SUBMITTAL
08/31/18	FOURTH SUBMITTAL
05/25/18	THIRD SUBMITTAL
03/19/18	PWSD SUBMITTAL
02/28/18	SECOND SUBMITTAL
10/24/17	INITIAL SUBMITTAL

REVISIONS

DRAINAGE PLAN WEST

PARKER POINTE
LOTS 1 THRU 15 AND TRACTS A AND B, PARKER POINTE FILING NO. 1
SOUTHEAST CORNER PARKER ROAD AND STROH ROAD
PARKER, COLORADO

design by: JWD
approved by: JWD
project no.: 2015-015
date: 10/01/17

SHEET
DP2

\\PDG-NAS\PUBLIC\PROJECTS\2015-015 PARKER AND STROH\DWG\2015-015 DRAINAGE MAP.DWG 11/28/2018 10:26 AM

SEE SHEET DP2

LEGEND

5340	EXISTING CONTOUR
42	PROPOSED CONTOUR
R1	BASIN DESIGNATION
0.75	5 YR RUNOFF COEFFICIENT
0.83	100 YR RUNOFF COEFFICIENT
0.20	BASIN AREA
	BASIN BOUNDARY LINE
1	DESIGN POINT

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40ft.

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

CAUTION: NOTICE TO CONTRACTOR THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A – 3" DIAMETER DOUGLAS COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US HIGHWAY 83)
ELEVATION: 5970.79 FEET (NAVD 1988 DATUM)

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.

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TOWN OF PARKER, DIRECTOR OF ENGINEERING DATE

PERCEPTION DESIGN GROUP, INC.
6901 SOUTH PIERCE STREET, SUITE 315, LITTLETON, CO 80128 303-232-8088
WWW.PERCEPTIONDESIGNGROUP.COM

PREPARED UNDER THE DIRECT SUPERVISION OF JERRY W. DAVIDSON, P.E. COLORADO REG # 30226 FOR AND ON BEHALF OF PERCEPTION DESIGN GROUP, INC.

△	DATE	DESCRIPTION
	11/01/18	SIXTH SUBMITTAL
	08/31/18	FOURTH SUBMITTAL
	05/25/18	THIRD SUBMITTAL
	03/19/18	PWSD SUBMITTAL
	02/28/18	SECOND SUBMITTAL
	10/24/17	INITIAL SUBMITTAL

REVISIONS

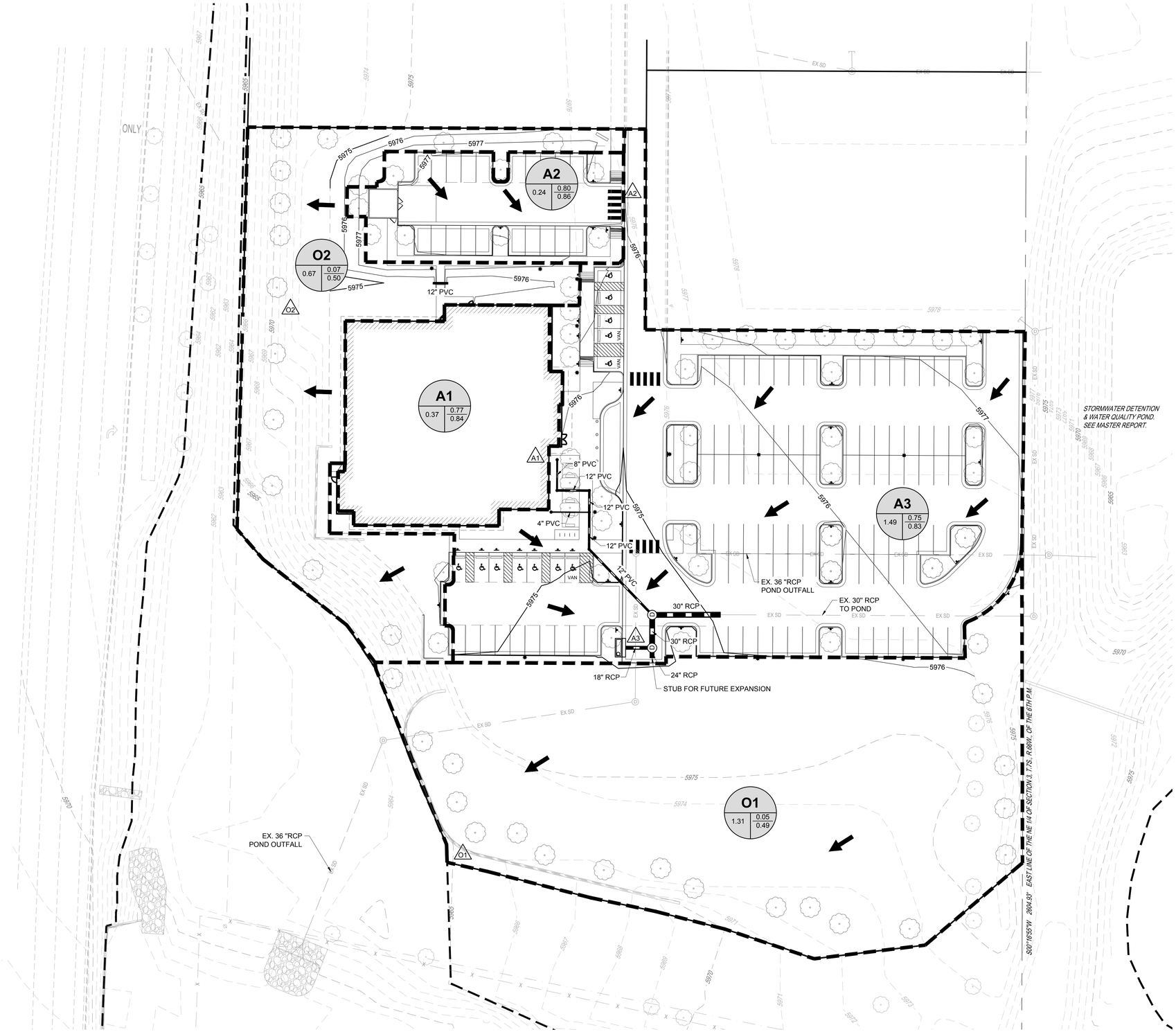
DRAINAGE PLAN EAST

PARKER POINTE
LOTS 1 THRU 15 AND TRACTS A AND B, PARKER POINTE FILING NO. 1
SOUTHEAST CORNER PARKER ROAD AND STROH ROAD
PARKER, COLORADO

design by: JWD
approved by: JWD
project no.: 2015-015
date: 10/01/17

SHEET
DP3

\\PDG-NAS\PUBLIC\PROJECTS\2015-015 PARKER AND STROH\DWG\2015-015 DRAINAGE MAP.DWG 11/28/2018 10:22 AM



30 0 30

SCALE: 1" = 30'

LEGEND:

- EXISTING MINOR CONTOURS
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOURS
- PROPOSED MAJOR CONTOURS
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- BASIN BOUNDARY
- PROPOSED MANHOLE
- PROPOSED INLETS
- FLOW DIRECTION ARROW
- DESIGN POINT DESIGNATION
- BASIN DESIGNATION
- INTERMEDIATE YEAR COMPOSITE C
- 100 YEAR COMPOSITE C
- BASIN AREA (ACRES)

RUNOFF SUMMARY

BASINS	DESIGN POINT	TRIBUTARY AREA (ac.)	DIRECT RUNOFF Q-5YR (cfs)	DIRECT RUNOFF Q-100YR (cfs)	TOTAL RUNOFF Q-5YR (cfs)	TOTAL RUNOFF Q-100YR PEAK(cfs)
A1	A1	0.37	1.34	2.73	1.34	2.73
A2	A2	0.24	0.84	1.68	0.84	1.68
A3	A3	1.49	4.08	8.47	4.92	10.15
O1	O1	1.31	0.19	3.45	0.19	3.45
O2	O2	0.67	0.19	2.63	0.19	2.63

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Town of Parker, Director of Engineering/Public Works Date

MIRO

S.A. MIRO INC.
CONSULTING ENGINEERS

4582 South Ulster Street
Suite 750, Denver, CO 80237
303-741-3737
www.samiro.com

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

NO.	DESCRIPTION	DATE

PROJECT:

PARKER NHC
PARKER, CO 80134

DRAWING TITLE:

DRAINAGE MAP

FILE PATH: C:\Users\FKF\ACCDocs\S. A. Miro, Inc\Civil\Jobs\22057 Parker NHC\05 CAD\Exhibits\Drainage Map.dwg D1 - 1/8/2024

COLORADO REGISTERED 33854 01/16/24 PROFESSIONAL ENGINEER

DESIGNED BY:	SSM
DRAWN BY:	SSM
CHECKED BY:	JDC
MIRO JOB NO.	22057

DRAWING NUMBER:

FIG. 1