BANNER SCOTTSDALE MEDICAL CENTER

Preliminary Water Report

Dibble Project No. 112452

1st Submittal Date: July 14, 2025

DIBBLE

BANNER SCOTTSDALE MEDICAL CENTER

Preliminary Water Report

Scottsdale, AZ

City of Scottsdale Case No.
Dibble Project No. 112452

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May 19, 2025

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1. INTRODUCTION

This report is prepared for Banner Health to support the entitlements of a 29-acre Banner Scottsdale Medical Center in Scottsdale, Maricopa County, AZ (a portion of Parcel 215-07-209H). The site is located on the northeast corner of Miller Rd. and Mayo Blvd. The new phased development will consist of a hospital and parking land uses. This development is divided into multiple phases:

- **Phase 1** includes a new 4-story 348,500-sf 106 bed hospital with adjoining 2-story diagnostic treatment building, loading dock, central utility plant, parking areas, ground mounted helipad and associated hardscape and utility improvements. Access drives into the medical center from Mayo Blvd, and Miller Rd will be constructed during Phase 1.
- **Future Phases** include hospital expansion of a new 5-story 145,000sf patient tower, expansion to the diagnostic and treatment centers encompassing an addition 72,000sf, a new 4-story 52,500sf NICU/Patient tower, and a new parking structure to support 300 licensed patient beds.

The purpose of this Preliminary Water Report is to provide analysis and results for the existing and proposed wastewater distribution system at the hospital site for the full buildout with a total bed count of 300.

1.1 Project Location

The new Banner Scottsdale Medical Center site is approximately 29-acres in size and is located at the northeast corner of the intersection of Miller Rd. and Mayo Blvd in Scottsdale, AZ. The majority of the site is in the northwest quadrant of Township 4 North, Range 4 East, Section 35, with a small portion of the site in the southeast quadrant of Township 4 North, Range 4 East, Section 26. The site is bounded by Arizona State Route 101 to the north, Banner NexCore Health Center Plus to the east, Mayo Blvd and residential properties to the south, and Miller Rd to the west. See **Figure 1** below for a Vicinity Map.

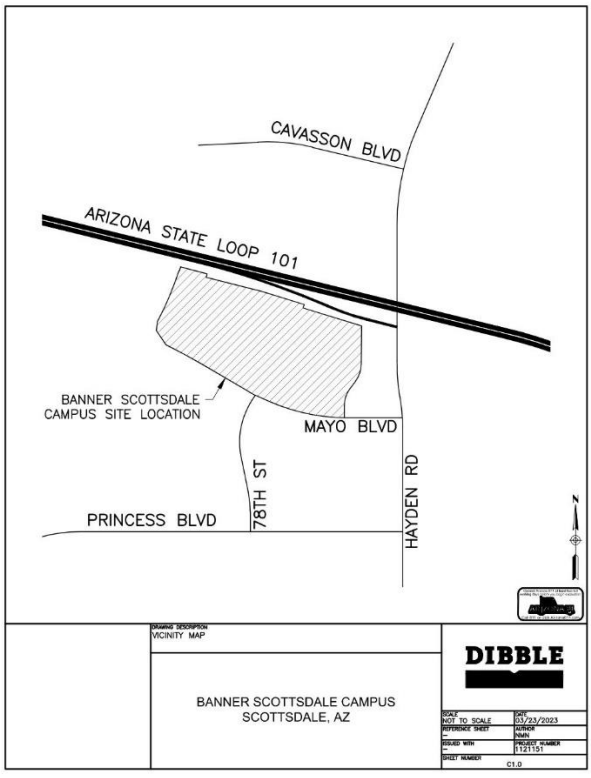


Figure 1 - Vicinity Map

2. EXISTING CONDITIONS

The new Banner Scottsdale Medical Center lies in Parcel 215-07-209H which is located on a portion of the Arizona State Land Department (ASLD) Crossroads East Planning Unit VI. The site project requires a land use modification and a conditional use permit. Parcel 215-07-209H is contained within Pressure Zone 4, as shown in **Appendix A,** and is planned to be zoned C-O. The project site is undeveloped desert that drains from northwest to southeast.

An existing 16-inch ductile iron pipe (DIP) public water main is located north of Parcel 215-07-209H, along Arizona State Route 101. A portion of the 16-inch public water main travels through the new footprint of the proposed hospital site. Additionally, there is a 16-inch DIP public water main in Hayden Road, east of the project site, and a 16-inch DIP public water main in Mayo Boulevard, south of the new Banner Scottsdale Medical Center.

A fire flow test was conducted in December 2023 to determine the flow and pressure in the existing water distribution system. The results provided in **Appendix B** show the existing system meets current fire flow requirements. **Section 4.2.2** addresses the fire flow requirements for the new medical center.

3. DESIGN CRITERIA

All new public water mains will be submitted to the City of Scottsdale and Maricopa County Environmental Service Division for review. New water mains and services at the site will be designed to meet City of Scottsdale *Design Standards and Policies Manual (2018)*, Maricopa Association of Governments (MAG) standards and details, *Arizona Administrative Code (AAC) Title 18*, *Arizona Department of Environmental Quality (ADEQ) Bulletins 8 and 10*, and the *2018 International Fire Code (IFC)*. Key design criteria include the following:

- Pipe material shall be ductile iron pipe (DIP) with a pressure class of 350 and polyethylene encasement (polywrap).
- To provide appropriate water pressure, water circulation and redundancy, all new water mains must be designed in a looped configuration.
- All water mains must maintain 3 feet of horizontal clearance to dry utilities. Water mains and sewer mains shall run parallel to each other with 9 feet of separation to pipe centerlines and maintain 6 feet of clearance at manholes.
- All water mains must maintain a 1-foot vertical clearance to dry utilities. Water mains above sewer mains shall maintain 1 to 2 feet of vertical separation with extra protection, greater than 2 feet of separation with no protection. Water mains below sewer mains shall maintain a minimum of 2 feet of vertical separation and always require protection.
- Static pressure in the distribution system shall not exceed 120 pounds per square-inch (psi) and have a minimum of 50 psi at the highest finished floor elevation.
- A minimum cover of 36 inches shall be maintained over lines smaller than 12 inches in diameter, 48 inches of cover shall be maintained over 12-inch lines, and 60 inches of cover shall be maintained over lines larger than 12 inches in diameter.
- All new commercial, industrial, parking area structures, and multi-family residential structures require building sprinkler systems.
- The system shall be designed to maintain 30 psi minimum pressure at the hydrant tee/tap under design fire flow requirements.

4. PROPOSED CONDITIONS

4.1 Water Design

4.1.1 Proposed Water Improvements

The new Banner Scottsdale hospital building will be served by a new 8-inch water service line connected to a new 8-inch water meter vault. A second new 8-inch water service line will also serve the new hospital as a redundant water service. These water services will connect to a new public 12-inch water main located within a 20-foot City of Scottsdale water easement, which will connect into the 16" stub from a future 24-inch DIP water main in Mayo Boulevard at the south end and the existing 16-inch DIP water main along Arizona State Route 101 at the north end. A water exhibit is provided in **Appendix C** for reference.

The existing 16-inch water main in Mayo Boulevard, east of 78th Street, will be extended west with a 24-inch main, within the future Mayo Boulevard alignment. Additionally, a 24-inch water main will be constructed north-south within Miller Road, between Mayo Boulevard and Arizona State Route 101. This water main extension and water main construction within Miller Road will be completed as a part of the Crossroads East Planning Unit VI master plan, that will occur concurrently with the Banner Scottsdale Medical Center – Phase 1 construction. A *Master Water Report for Crossroads East Planning Unit VI* has been prepared by Kimley-Horn & Associates, Inc., and is included in **Appendix D** for reference.

4.1.2 Building Water Demand

The design manual does not specify demand values for hospitals; therefore, the City of Scottsdale has assigned a design demand of 450 GPD (0.3 GPM) per hospital bed (including outdoor use) for this project. This design demand is consistent with the Master Plan and previous hospital developments within the City of Scottsdale. A maximum day peaking factor of 2.0 and peak hour peaking factor of 3.5 is used for analysis of the water system. The water demand generated by the full buildout of the new Banner Scottsdale Medical Center is provided in **Table 1**. below. A full breakdown of each calculation can be found in **Appendix E**.

Table 1: Full Build Out Water Demands

FACILITY	NUMBER OF UNITS	UNIT	AVERAGE DAY DEMAND		MAXIMUM DAY DEMAND		PEAK HOUR DEMAND	
			GPD	GPM	GPD	GPM	GPD	GPM
Hospital	**300**	**Beds**	**135,000**	**93.75**	**270,000**	**187.5**	**472,500**	**328.13**

4.2 Fire Design

4.2.1 Proposed Fire Improvements

The new Banner Scottsdale hospital building will be served by a new private 8-inch fire line. The City of Scottsdale *Design Standards and Policies Manual* (2018) requires fire hydrant spacing to be no more than 660 feet apart measured along the roadway in which a fire hose would be laid. City of Scottsdale also requires all hydrants to be within 330 feet of structures. New fire hydrants will be constructed within the Banner Scottsdale Medical Center to comply with these requirements.

4.2.2 Building Fire Flow Demand

The *International Fire Code (2018)*, adopted by the City of Scottsdale, specifies required fire flow demands based on Table B105.1(2) and Table B105.2 in **Appendix F**. The new Banner Scottsdale Hospital is planned as Type 1A Construction with total building area of 618,000 square feet at full build out, resulting in a fire flow demand of 6,000 GPM according to the IFC Table B105.1(2). The new Banner Scottsdale Hospital will be constructed to have an approved building sprinkler system per the City of Scottsdale standards. As a result, the fire flow demand can be reduced by 75% according to Section B105.2 of the *International Fire Code (IFC)*. The resulting required fire flow demand is 1,500 GPM for a duration of four hours. See **Table 2** for fire flow demands.

Table 2: Fire Flow Demands

FACILITY	CONSTRUCTION TYPE	NUMBER OF UNITS	UNIT	FIRE FLOW REQUIRED	REDUCED FIRE FLOW
				GPM	GPM
Hospital	1A	300	BED	6,000	1,500

5. HYDRAULIC ANALYSIS

5.1 Methodology

Water system demands for the Banner Scottsdale Medical Center are calculated based on the specified design demands from the City of Scottsdale, discussed in **Section 6.1.2**. Four hydraulic scenarios, including the average daily demand, peak hour demand, maximum day plus fire flow demand, and the initial service line design flow were modeled according to the City of Scottsdale *Design Standards and Policies Manual (DS&PM) (2018)*. Model Scenarios 1-3 used the Phase 2 hospital demands calculated in **Section 6.1.2,** and Model Scenario 4 used the water meter demand provided by the MEP Engineer. Each scenario also has an irrigation demand of 3.68 GPM applied to it which was provided by the Landscape Architect. The pump and reservoir characteristics were calibrated for the residual, static, and flowing pressure for the 10% safety factor with the pump elevation being set to represent the invert elevation of the existing 24-inch water main along Hayden Road. The scenarios were modeled in EPANET 2.2 to determine if adequate pressure is provided in the water system, and their minimum requirements are outlined below:

- Model Scenario 1: Average Day Demand
  - 93.75 GPM applied at demand node BLDG_P2_4FF (average day)
  - 3.68 GPM applied at demand node LSCP_P2 (irrigation)
  - 126 GPM applied at demand node Optima (Optima development average day)
  - Minimum 50 psi at finished floor per City of Scottsdale *DS&PM*
- Model Scenario 2: Peak Hour Demand
  - 328.13 GPM applied at demand node BLDG_P2_4FF (peak hour)
  - 3.68 GPM applied at demand node LSCP_P2 (irrigation)
  - 451 GPM applied at demand node Optima (Optima development peak day)
  - Minimum 50 psi at finished floor per City of Scottsdale *DS&PM*
- Model Scenario 3: Maximum Day Demand plus the Worst-case Fire Flow Demand
  - 187.5 GPM applied at demand node BLDG_P2_4FF (max day)
  - 1,500 GPM applied at demand node F2-P2 (worst case hydrant)
  - 3.68 GPM applied at demand node LSCP_P2 (irrigation)
  - 252 GPM applied at demand node Optima (Optima development maximum day)
  - Minimum 30 psi at hydrant supply line and 15 psi at all domestic demand nodes per City of Scottsdale *DS&PM*
- Model Scenario 4: Initial Service Line Design Flow
  - The MEP Engineer provided an estimated number of water supply future units as 892 which corresponds to a water meter demand of 194 GPM using the 2015 International Plumbing Code, Appendix E, Table E103.3(3) as provided in **Appendix D**. The City of Scottsdale's Initial Service Line Design flow requirements as outlined in section 6.1.202.G.6.d.ii of the Design Standards & Policies Manual requires 10 GPM to be added to the normal operating flow. This would bring the water demand up to 204 GPM (194 GPM + 10 GPM). Additionally, a safety factor of 1.5 is to be included which brings this demand to 306 GPM (204 GPM X 1.5). Therefore, a demand of 306 GPM is applied at node BLDG_P2_4FF (initial service line)
  - 3.68 GPM applied at demand node Junction 14 (irrigation)
  - 252 GPM applied at demand node Optima (Optima development maximum day)

- Minimum 50 psi at highest floor per City of Scottsdale *DS&PM*

The water model was calibrated using the fire flow test provided in **Appendix B**. The finished floor elevation of the building is 1603.70 and Node BLDG_2P represented the hospital service connection which had the different domestic demands applied to it.

6. RESULTS

The four model scenarios outlined in the previous section were modelled in EPANET 2.2 to determine if adequate pressure is provided in the water distribution system to meet City of Scottsdale standards. Results from the model are provided in **Appendix G**. The following **Table 3** shows the City of Scottsdale's minimum requirements compared to the lowest pressures produced in the water model.

Table 3: Water Model Results

SCENARIO	MINIMUM CITY PRESSURE REQUIREMENT	LOWEST MODELED PRESSURE	PRESSURE AT BUILDING CONNECTION POINT
	PSI	PSI	PSI
1	50	53.42	60
2	50	53.31	58.84
3	30 (Hydrant Supply Line) 15 (All Demand Nodes)	51.20	56.93
4	50 (Highest Floor)	35.24	35.24

Model scenarios 1 through 3 meet the City of Scottsdale standards by maintain the minimum pressures required for each scenario at the finished floor elevation. The lowest modelled pressures were experienced at the irrigation connection. The City of Scottsdale requires a minimum 50 psi pressure at the highest floor elevation for scenario 4, and the pressure at the first-floor elevation is 58.97 psi for this scenario. Since the highest floor in the hospital building is approximately 54-feet higher than the first-floor elevation, the domestic waterline would need to overcome this elevation difference, and the pressure at the highest floor would be less than 50 psi. To meet the 50 psi requirement at the highest floor, a booster pump will be provided on the domestic line, inside the hospital building.

7. CONCLUSIONS

The proposed water distribution system for the Banner Scottsdale Medical Center will support the development of the new Banner Scottsdale hospital while adhering to City of Scottsdale design standards. The addition of new 12-inch public water mains through the site will service the new development. The highest modeled pressures in the water system are experienced within the 16-inch public water main in Mayo Boulevard. The lowest pressures modeled are experienced at the building connection. Although the initial service line design flow condition does not meet the minimum pressure requirement per the City of Scottsdale standards, a booster pump will be installed inside the building for domestic flows to maintain a minimum 50 psi pressure.

8. REFERENCES

Arizona Administrative Code (AAC) Title 18, September 2016.

Arizona Department of Environmental Quality (ADEQ) Bulletins 8 and 10, July 1978.

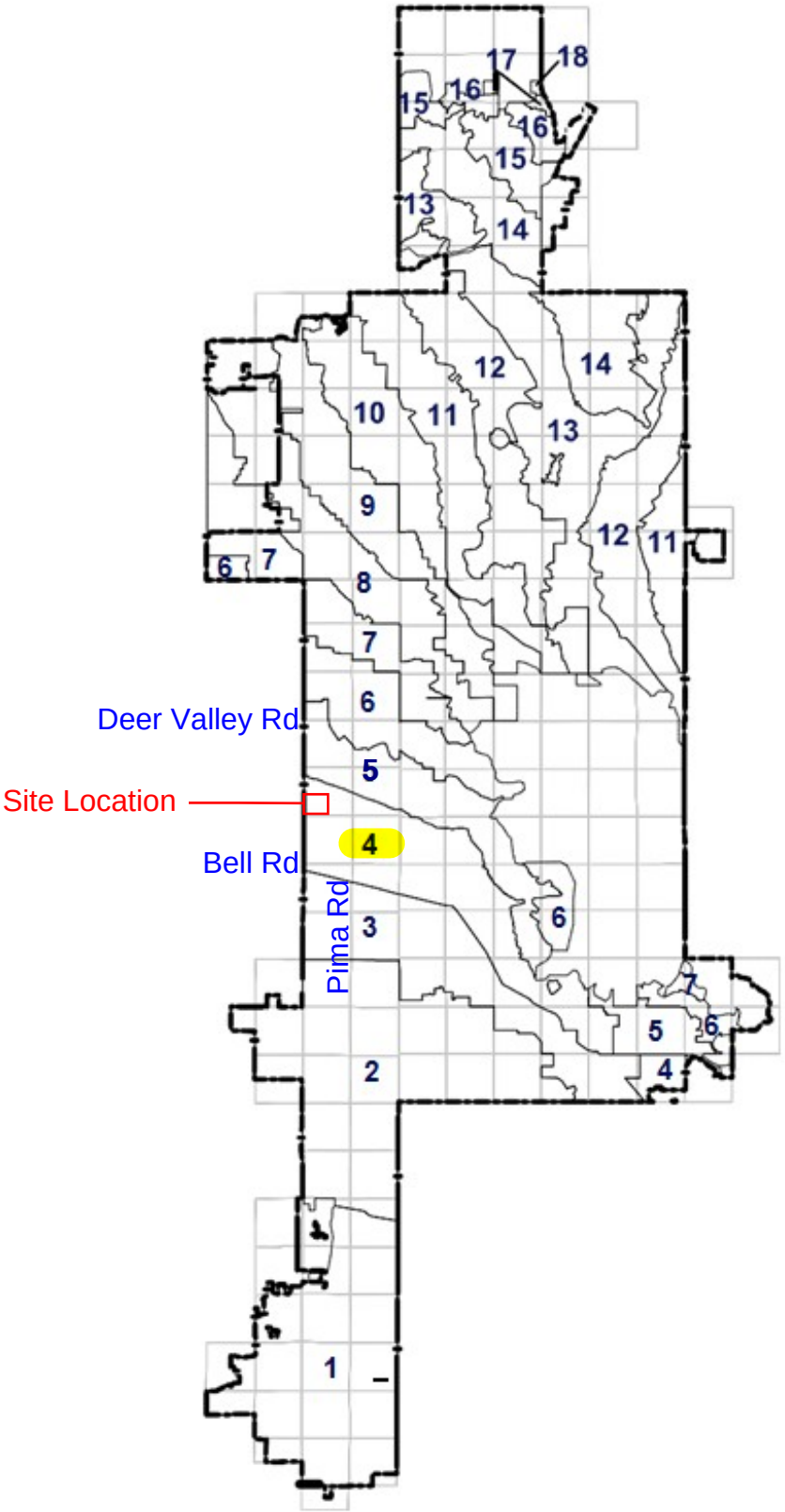
City of Scottsdale. *Design Standards and Policies Manual*, 2018.

International Code Council. *International Fire Code*, 2018.

Kimley-Horn & Associates, Inc. *Master Water Report for Crossroads East Planning Unit VI*, 2023.

Maricopa Association of Governments. *Uniform Standard Details for Public Works Construction*, 2021.

Appendix A Pressure Zone Map



Zone	Ground Elevation Range (Ft.)
1	1250-1330
1A	1280-1330
2A	
2	1510-1650
3	
4	
4E	1550-1650
5	1650-1790
5E	1650-1750
6	1790-1920
6E	1750-1934
7	1920-2050
7E	1934-2065
8	2050-2180
8E	2065-2200
9	2180-2310
10	2310-2440
11,11E	2440-2570
12,12E	2570-2700
13	2700-2830
14	2830-2960
15	2960-3090

6-1.3 CITY PRESSURE ZONE MAP

Appendix B Fire Flow Test

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	Banner Healthcare
Project Address:	Mayo Boulevard & Hayden Road, Scottsdale, Arizona 85255
Client Project No.:	1121151.AS01
Flow Test Permit No.:	C74006
Arizona Flow Testing Project No.:	23949
Date and Time flow test conducted:	December 19, 2023 at 7:15 AM
Data is current and reliable until:	June 19, 2024
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Witnessed by:	Ray Padilla – City of Scottsdale-Inspector (602-541-0586)

Raw Test Data

Static Pressure: **76.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **67.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **28.0 PSI Hyd A**
35.0 PSI Hyd B Each
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One 4-inch Pollard Diffuser
(Measured in inches) Two 2.5-inch Pollard Diffusers

Coefficient of Diffuser: 0.9

Flowing GPM: **4,260 GPM**
(Measured in gallons per minute)
2,274 GPM + 993 GPM + 993 GPM = 4,260 GPM

GPM @ 20 PSI: **11,432 GPM**

Data with 10 % Safety Factor

Static Pressure: **68.4 PSI**
(Measured in pounds per square inch)

Residual Pressure: **59.4 PSI**
(Measured in pounds per square inch)

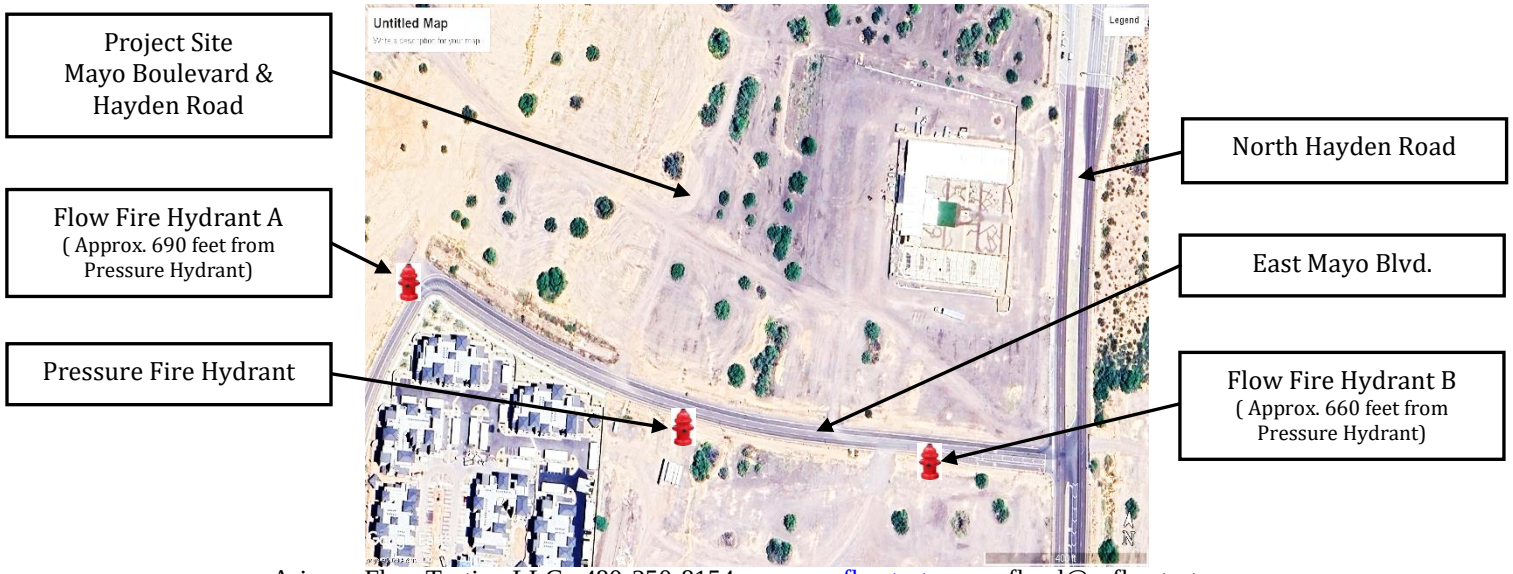
Approx. distance between hydrants: See below

Main size: Not Provided

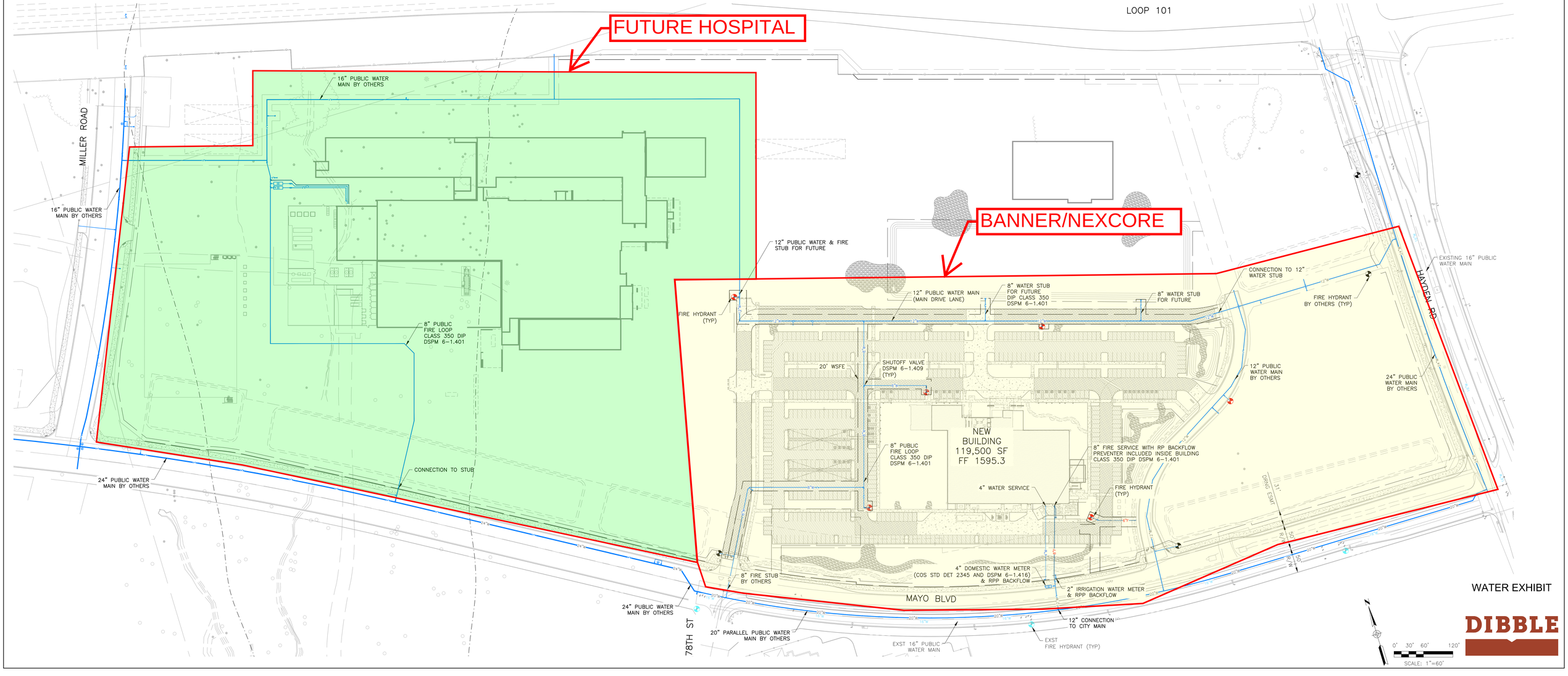
Flowing GPM: **4,260 GPM**

GPM @ 20 PSI**:** **10,566 GPM**

Flow Test Location **North**



Appendix C Water Exhibit


FUTURE HOSPITAL
BANNER/NEXCORE
LOOP 101
MILLER ROAD
HAYDEN RD
78TH ST
MAYO BLVD
16" PUBLIC WATER MAIN BY OTHERS
16" PUBLIC WATER MAIN BY OTHERS
8" PUBLIC FIRE LOOP CLASS 350 DIP DSPM 6-1.401
CONNECTION TO STUB
24" PUBLIC WATER MAIN BY OTHERS
12" PUBLIC WATER & FIRE STUB FOR FUTURE
FIRE HYDRANT (TYP)
12" PUBLIC WATER MAIN (MAIN DRIVE LANE)
8" WATER STUB FOR FUTURE DIP CLASS 350 DSPM 6-1.401
8" WATER STUB FOR FUTURE
CONNECTION TO 12" WATER STUB
FIRE HYDRANT BY OTHERS (TYP)
EXISTING 16" PUBLIC WATER MAIN
20' WSFE
SHUTOFF VALVE DSPM 6-1.409 (TYP)
12" PUBLIC WATER MAIN BY OTHERS
24" PUBLIC WATER MAIN BY OTHERS
NEW BUILDING 119,500 SF FF 1595.3
8" PUBLIC FIRE LOOP CLASS 350 DIP DSPM 6-1.401
8" FIRE SERVICE WITH RP BACKFLOW PREVENTER INCLUDED INSIDE BUILDING CLASS 350 DIP DSPM 6-1.401
4" WATER SERVICE
FIRE HYDRANT (TYP)
31' DRNG ESMT
50' R/W
50' R/W
8" FIRE STUB BY OTHERS
4" DOMESTIC WATER METER (COS STD DET 2345 AND DSPM 6-1.416) & RPP BACKFLOW
2" IRRIGATION WATER METER & RPP BACKFLOW
24" PUBLIC WATER MAIN BY OTHERS
20" PARALLEL PUBLIC WATER MAIN BY OTHERS
12" CONNECTION TO CITY MAIN
EXST 16" PUBLIC WATER MAIN
EXST FIRE HYDRANT (TYP)
WATER EXHIBIT
DIBBLE
0' 30' 60' 120'
SCALE: 1"=60'

Appendix D Master Water Report for Crossroads East Planning Unit VI

FINAL Basis of Design Report
☐ APPROVED
☑ APPROVED AS NOTED
☐ REVISE AND RESUBMIT

CITY OF SCOTTSDALE
SCOTTSDALE WATER
9379 E San Salvador Dr, Scottsdale, AZ 85259

Disclaimer: If approved; the approval is granted under the condition that the final construction documents submitted for city review will match the information herein. Any subsequent changes in the water or sewer design that materially impact design criteria or standards will require re-analysis, re-submittal, and approval of a revised basis of design report prior to the plan review submission.; this approval is not a guarantee of construction document acceptance.
For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY apritchard DATE 9/25/2024

MASTER WATER REPORT

Infrastructure associated with Water Infrastructure Improvement Plan W-IIP-020 and the 12-inch internal water main from Hayden Rd to Mayo Blvd is to be constructed by the Master Developer for this project, Hayden Loop 101 Investors, LLC. Water demands for Phase 1 of the ASM development (3-DR-2024) and the Banner Medical Office Building (6-DR-2024) will not be served until construction and County acceptance of this infrastructure has been completed. Prior to issuance of certificate of occupancy for Phase I of the development project these offsite improvements must be completed and accepted by the City of Scottsdale and Maricopa County Environmental Services Department per SRC Sec 48-103 and SRC Sec 49-92.

CROSSROADS EAST PLANNING UNIT VI AND PORTION OF PLANNING UNIT III

CASE 37-SA-2023

For all future phases beyond ASM Phase 1 (3-DR-2024) and Banner Medical Office Building (6-DR-2024), the following off site water infrastructure (constructed by others) must be completed and accepted by the City of Scottsdale and Maricopa County Environmental Services Department per SRC Sec 48-103 and SRC Sec 49-92:

- 36-inch water transmission main between COS Booster Pump Station 55A and Hayden Rd;
- COS Booster Pump Station 55A capacity upgrades.

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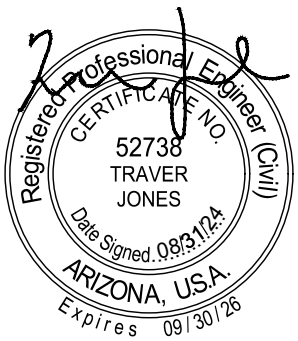

291268016
August 2024
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Crossroads East Planning Unit VI and Portion of Planning Unit III

MASTER WATER REPORT

AUGUST 2024

Prepared By:

Kimley»Horn

Kimley»Horn

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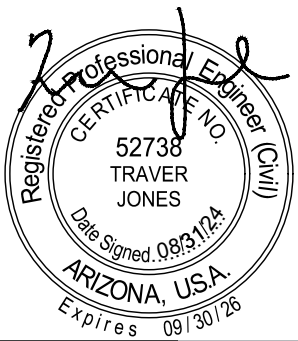
The 16-inch diameter water main crossing the ASM site must remain in service until replacement infrastructure is constructed by Hayden/Loop 101 Investors, LLC and accepted by the City.



Appendices

Appendix A – Vicinity Map

Appendix B – Land Use Map, Planning Unit Layout, and ASLD Proposed Zoning Districts

Appendix C – Existing Conditions Water Infrastructure Exhibit and City of Scottsdale Quarter Section Maps

Appendix D – Proposed Conditions Water Infrastructure Exhibit

Appendix E – Crossroads East Preliminary Planning Analysis by Coe and Van Loo Consultants, June 2009

Appendix F – Crossroads East Planning Unit VII Master Water Report

Appendix G – Fire Flow Test Results and WaterCAD Analysis Results

Appendix H – City of Scottsdale IIP

Appendix I – Monitoring Well Layout

Appendix J – Phasing Exhibit

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

A new development will be located on a portion of Arizona State Land Department (ASLD) Crossroads East Planning Unit VI and a portion of Planning Unit III that was purchased at public auction on April 13, 2022. The project will include a mixed-use development as well as supporting roadway, utility, drainage, and site infrastructure.

1.2 SITE LOCATION

Planning Unit VI encompasses approximately 61 gross acres in north Scottsdale, near the northwest corner of Hayden Road and Mayo Boulevard. The project site also includes approximately 24 acres of Planning Unit III, located at the northwest corner of the Mayo Boulevard alignment and the Miller Road alignment. The combined parcels encompass approximately 85 gross acres (hereinafter known as the Sale Parcel) and were purchased from ASLD by Hayden Loop 101 Investors LLC. The Sale Parcel is located in the North Half of Section 35 and the South Half of Section 26, Township 4 North, Range 4 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. See **Appendix A** for the Vicinity Map. The Sale Parcel is zoned PCD. More specifically, the Sale Parcel is bounded by the future Mayo Boulevard alignment and vacant undeveloped desert to the south, Hayden Road to the east, the Loop 101 freeway to the north, and vacant undeveloped desert to the west. The site slopes from the northeast to the southwest at approximately 1.8%. Refer to **Appendix B** for the Land Use Map.

1.3 PURPOSE

This Master Water Report for Crossroads East Planning Unit VI is intended to satisfy the City of Scottsdale water master planning requirement of the Development Agreement recorded against the property (19-ZN-2002#2) for Planning Unit VI, as well as more specific guidelines for the Sale Parcel development in accordance with the City of Scottsdale water guidelines and standards. It provides a description of the water system requirements (demands), infrastructure location and sizing, and phasing for the Sale Parcel.

1.4 OBJECTIVES

This Master Water Report provides an infrastructure plan for the development of the Sale Parcel that will meet the City of Scottsdale guidelines. The report will demonstrate the following:

1. Water demands for the Sale Parcel development.

2. Location and size of proposed water infrastructure improvements necessary to serve the Sale Parcel development and future development of the surrounding parcels.

2.0 DESIGN DOCUMENTATION

2.1 DESIGN PROCEDURES, POLICIES, AND METHODOLOGIES

The existing and proposed water network surrounding the Sale Parcel was analyzed using the computer program WaterCAD by Bentley. The water analysis utilizes the Hazen-Williams equation for pressurized pipes. The existing water system pressures and flows are based on two fire flow tests performed on December 13, 2022. After calibration of the water system to the flow tests, the average daily demand, maximum daily demand, peak hour demand, and maximum daily demand plus fire flow were analyzed to determine the size of the water infrastructure in accordance with the following standards as outlined in Chapter 6 of the 2018 City of Scottsdale Design Standards and Policy Manual (DS&PM).

Refer to **Appendix G** for the Fire Flow Test Results.

2.2 PREVIOUS STUDIES

Previous studies of the area include the Crossroads East Preliminary Planning Analysis prepared by Coe and Van Loo, dated June 2009 (CVL Study). This study examined the Crossroads East land area, which includes the Sale Parcel. The Crossroads East Planning Units cover approximately 900 acres; and the limits of this area are depicted on the Planning Unit Layout in **Appendix B**. This study calculated the demands of the parcels based upon maximum floor area ratios and rates determined in the City of Scottsdale Integrated Wastewater Report. See **Appendix E** for the Crossroads East Preliminary Planning Analysis by Coe and Van Loo Consultants, Inc.

A Master Water Report for Crossroads East Planning Unit VII was prepared in July 2018 by Kimley-Horn & Associates. Crossroads East Planning Unit VII encompasses approximately 111 acres and is bounded by Mayo Boulevard on the north, Hayden Road on the east, Princess Boulevard on the south, and Miller Road on the west. This report recommended a 16-inch water main in Mayo Boulevard between Miller Road and Hayden Road, and a 12-inch water main in Miller Road between Mayo Boulevard and Princess Boulevard. Refer to **Appendix F** for the Crossroads East Planning Unit VII Master Water Report.

The City of Scottsdale commissioned a regional water study from Carollo Engineers. The intention of this study was to recommend improvements needed at the Scottsdale Water Campus and in surrounding water mains to provide adequate water supply for this site and the surrounding region. Based on the results of this study, several of the water mains within the project area are recommended to be larger diameter than would be typical. Refer to **Appendix H** for the North Airpark Water Study Results.

The City of Scottsdale has an Infrastructure Improvement Plan (IIP) in place to cover portions of the water main construction in the adjacent portions of Mayo Boulevard, Hayden Road, Miller Road, and the water main north of the Loop 101 freeway. This is known as W-IIP-020 and includes 3.5 miles of pipeline and pressure reducing valve stations west of Hayden Road and north of Princess Boulevard. This IIP includes the 24-inch water main in Mayo Boulevard between Miller Road and 78th Street, the 20-inch water main in Mayo Boulevard between 78th Street and Hayden Road, the 24-inch and 30-inch water main in Hayden Road, the 24-inch water main to be bored under the Loop 101 freeway, and the 24-inch water main on the north side of the Loop 101 freeway between Miller Road and Claret Drive. The 24-inch main in Hayden Road will terminate as a 30-inch stub near the Loop 101 intersection for future connection. The total

reimbursement allocated to the entire W-IIP-20 is $6,100,000. This is detailed in a Development Agreement that is currently scheduled to be presented to City Council in September 2024. The 16-inch water main in Mayo Boulevard between 73rd Place and Miller Road, the 24-inch water main in Miller Road between Mayo Boulevard and the Loop 101 freeway, ~~and~~ the 16-inch water main connection to the east of Miller Road will be funded by the developer and will not be a part of the reimbursement program.

Water infrastructure that is covered in the IIP documents will be eligible for reimbursement from the City following construction up to the proportionate amount of available funding. Infrastructure will need to be installed in accordance with applicable Arizona Revised Statutes Title 34 requirements for design, bidding, and construction.

and the 12-inch water main internal to the master development from Hayden Rd to Mayo Blvd

3.0 DESCRIPTION OF EXISTING WATER INFRASTRUCTURE

3.1 EXISTING WATER INFRASTRUCTURE

The Sale Parcel currently consists of vacant desert and a gravel parking area that has previously been used for regional event parking. A 16-inch ACP water main crosses the northern portion of the site and runs parallel with the Loop 101 right-of-way to Hayden Road.

A 16-inch DIP water main is located in Hayden Road along the east side of Planning Unit VI. This 16-inch water main decreases to a 12-inch DIP main south of the Axon Drive alignment.

A 16-inch DIP water main is located in Mayo Boulevard between 78th Street and Hayden Road. This water main continues south in 78th Street and connects to water infrastructure in Princess Boulevard.

A 16-inch DIP water main is located in Mayo Boulevard to the west of 73rd Place.

A 24-inch DIP water main is located along the north side of the Loop 101 freeway between Hayden Road and Claret Drive. This water main is stubbed to the west side of Claret Drive.

A 30-inch steel casing is in place under the Loop 101 freeway to the east of the Miller Road underpass.

There is an existing City of Scottsdale well site at the southeast corner of the Loop 101 freeway and the Miller Road alignment. Based on discussions with City Staff, this well site is used for monitoring and testing and is not a water production facility. Access to this well site will need to be maintained with the proposed development.

The water main infrastructure surrounding the Sale Parcel is within Pressure Zone 4 of the City of Scottsdale water system. Refer to **Appendix C** for the Existing Conditions Water Infrastructure Exhibit and the City of Scottsdale Quarter Section Maps.

4.0 DEMANDS

4.1 GENERAL

The projected water demands for the Sale Parcel will be determined based on parcel size, the anticipated land uses, and the anticipated densities. This report will review the demands for the Sale Parcel, which encompasses approximately 85 gross acres. Per the ASLD Proposed Zoning Districts shown in **Appendix B**, permitted zoning categories for the Sale Parcel include I-1, PRC, PCP, C-2, C-3, C-O, and R-5.

For the purposes of this report, assumptions regarding the land uses and densities have been made and are depicted on the Land Use Map in **Appendix B**.

The Average Daily Demand (ADD), Maximum Daily Demand (MDD), and Peak Hour Demand (PHD) will be calculated for each parcel in accordance with Chapter 6 of the DS&PM and the assumptions noted above. Based on Section 6-1.501 of the DSPM, the water system needs to be designed to provide a minimum fire flow based on Appendix B of the International Fire Code (IFC). This report will assume a maximum fire flow demand of 4,000 gallons per minute (gpm) at 30 psi, and it will assume that all buildings include a fire sprinkler system. The 4,000 gpm fire flow demand is for the hydrants and is independent of the sprinkler needs. It is anticipated that any buildings which are large enough to require a fire flow greater than 4,000 gpm will provide a building fire pump to supplement the flow. Per Section 6-1.406 of the DS&PM, fire hydrants shall maintain a minimum pressure of 30 psi.

The Research & Development parcel is anticipated to include a unique user with non-standard water demands. The developer of this parcel has coordinated with City staff to determine the appropriate demands for the Research & Development parcel, and these demands are included in **Appendix G**. For the purposes of this master report, the water demands have been increased by approximately 10% to account for potential future changes to the water demands.

4.2 SALE PARCEL WATER DEMANDS

As noted above, the assumptions for the Sale Parcel land uses are shown on the Land Use Map in **Appendix B.** Table 1 below provides the design water demands for the Sale Parcel per Figure 6-1.2 of the DS&PM:

Table 1: Sale Parcel Water Demands

Zoning	Net Area	Land Use	Density	Unit	Units or Area		Average Daily Demand		Maximum Daily Demand		Peak Hour Demand[3]	
	(Acres)						GPD	GPM	GPD	GPM	GPD	GPM
I-1 PCD	21.1	R&D Office + Cafeteria	-	-	260,600	SF	138,560	192	277,120	385	520,360	723
I-1 PCD		R&D Lab + CUP	-	-	406,300	SF	203,144	282	406,287	564	711,003	988
I-1 PCD		R&D Irrigation	-	-	1,010,000	SF	4,435	6	8,870	12	15,523	22
C-2 PCD	27.3	Hospital	0.63	FAR	320	Beds	144,000	200	288,000	400	504,000	700
C-2 PCD	-	Cooling Tower	-	-	-	-	99,360	69	99,360	69	99,360	69
C-2 PCD	9.9	Medical Office	0.20	FAR	85,000	SF	51,000	71	102,000	142	178,500	248
C-2 PCD	10.9	Health Center	0.37	FAR	175,000	SF	105,000	146	210,000	292	367,500	510
C-2	2.5	Office	0.30	FAR	32,670	SF	19,602	27	39,204	54	68,607	95
C-2	5.8	Restaurant	0.12	FAR	30,000	SF	39,000	54	78,000	108	234,000	325
	77.5						804,101	1,048	1,508,853	2,027	2,698,853	3,679

Notes:

1. Demands for Research & Development Parcel are based on correspondence with City Staff, refer to **Appendix G**. Demands shown in Table 1 have been increased by 10%.
2. ADD for Commercial is 0.8 GPD/SF based on Figure 6-1.2 of the DS&PM and includes Inside Use and Outside Use.
3. ADD for Restaurant is 1.3 GPD/SF based on Figure 6-1.2 of the DS&PM and includes Inside Use and Outside Use.
4. ADD for Hospital is assumed to be 450 GPD/Bed and includes Inside Use and Outside Use.
5. ADD for Medical Office/Health Center is assumed to be 0.6 GPD/SF and includes Inside Use and Outside Use (based on "Office" use.
6. ADD for office is 0.6 GPD/SF based on Figure 6-1.2 of the DS&PM and includes Inside Use and Outside Use.
7. MDD is 2.0 times the ADD.
8. PHD is 3.5 times the ADD for all uses except restaurant; PHD for restaurant is 6 times ADD.
9. GPM demands are based on a 12-hour active water use period. GPM = GPD / (12 hrs x 60 minutes).

5.0 DATA ANALYSIS METHODS

5.1 DESIGN CRITERIA

In addition to the domestic and landscape water demands outlined in Section 4, the proposed water system model will consider a demand that is the sum of the MDD and the fire flow demand for each parcel. To be conservative, the demands will be placed at the most hydraulically remote locations in the model.

The existing water system pressure and available flow is based on the fire flow tests performed on December 13, 2022. A reservoir and pump system was calibrated into the model to simulate the available water flow and pressure at the connection points. The elevations for all nodes are included in the model to account for elevation changes over the development area. Refer to **Appendix G** for the Fire Flow Test Results and WaterCAD Analysis.

The following design criteria will be used for the proposed water system:

- Minimum pressure of 50 psi for ADD, MDD, and PHD model scenarios
- Minimum pressure of 30 psi for MDD + Fire Flow model scenario
- Maximum pipe velocity of five feet per second for ADD, MDD, and PHD scenarios
- Maximum pressure of 120 psi for all scenarios
- Minimum of 15 psi at the highest floor elevation for MDD + Fire Flow scenario. This requirement will be addressed with future Basis of Design report submittals, as the elevations of the highest floors are not known at this time. A booster pump may be required for larger/taller buildings.

As previously noted, the Optima development is underway to the west of the Sale Parcel. Domestic water flows for the Optima development will also be included in the model, since the fire flow tests were taken prior to the Optima development. Based on correspondence with City staff, the Optima water demands are as follows:

- ADD of 479 GPM
- MDD of 865 GPM
- PHF of 1,510 GPM

Section 6-1.400 of the DS&PM provides general requirements for water main sizes based on mile and half-mile streets, and the North Airpark Water Study recommends pipe sizing to accommodate demands from this site and other regional development.

The proposed water system layout will have a looped configuration which allows for multiple points of connection and redundancy for individual users, including the hospital use. Isolation valves will be provided on the proposed water transmission mains at every mile section line. Valve spacing between mile section lines will not exceed 1,320 feet.

6.0 RESULTS

6.1 PROPOSED WATER SYSTEM LAYOUT

As previously noted, 16-inch water mains are present within Mayo Boulevard to the west and to the east of the project. This project will connect the existing 16-inch DIP water mains with a new 16-inch DIP water main in Mayo Boulevard between 73rd Place and Miller Road and a new 24-inch DIP water main between Miller Road and 78th Street. This project will also include a new 24-inch DIP water main in Miller Road between Mayo Boulevard and the Loop 101 freeway and a new 24-inch DIP water main to within a new 36-inch sleeve under the Loop 101 freeway.

This project will also install a new 24-inch DIP water main along the north side of the Loop 101 freeway between the Miller Road underpass and Claret Drive. This water main will connect to the existing 24-inch water main along the north side of the Loop 101 freeway that is located east of Claret Drive. The City of Scottsdale will work with Nationwide to provide land rights to construct this water main across private property (a portion of the Cavasson development).

Additionally, this project will include two new water transmission mains, parallel to the existing water infrastructure in Mayo Boulevard and Hayden Road. A new 20-inch water main will be installed in Mayo Boulevard between 78th Street and Hayden Road, and a new 24-inch water main will be installed in Hayden Road between Mayo Boulevard and the Loop 101 freeway. The 24-inch main in Hayden Road will connect to the existing 16-inch water main located along the northern Sale Parcel frontage and the existing 16-inch stub in Hayden Road near the Loop 101 interchange. A 30-inch stub will extend to the north for future connection under the Loop 101 freeway.

The new parallel water transmission mains in Mayo Boulevard and Hayden Road will be connected via a new 12-inch DIP water main. This 12-inch water main will be installed across a portion of the Sale Parcel, within Tract A. The proposed water system layout is depicted in **Appendix D**. The existing 16-inch water main that runs east-west across the western portion of the Sale Parcel will be relocated to the northern edge of the property to the east of Miller Road. The existing 16-inch water main that crosses the site west of Miller Road will be removed and replaced with the proposed 16-inch water main in Mayo Boulevard. The removal of the existing 16-inch water main will take place after the installation, testing, and acceptance of the new water main connections.

In summary, the project will include the following water infrastructure improvements:

- New 24-inch water main located north of the Loop 101 freeway from Claret Drive to Miller Road within the Cavasson development property. This will connect to the existing ~~16-inch~~ 24-inch water main in Claret Drive and will include:
    - A 12-inch tee near the connection to the existing water main west of Claret Drive for future Cavasson development.
    - A 24-inch stub to the north on Miller Road.
    - A 16-inch tee at the location of the existing 30-inch steel casing under the Loop 101 freeway.

- New 24-inch water main in Miller Road from the north side of the Loop 101 freeway south to Mayo Boulevard. This water main will connect to the new 16-inch (west) and 24-inch (east) water mains to be constructed in Mayo Boulevard. This water main will also include a 24-inch stub to the south at the intersection of Mayo Boulevard and Miller Road.

- New 24-inch water main in Hayden Road extending from the existing 16-inch stub near the Loop 101 intersection south to Mayo Boulevard (parallel to the existing 16-inch water main). A new 30-inch stub will extend towards the north from this junction. The new 24-inch water main will also connect to the existing 16-inch water main crossing APN 215-07-209H and the new 20-inch water main in Mayo Boulevard. and the existing 16" water main in Mayo Blvd.

- New 20-inch water main in Mayo Boulevard between 78th Street and Hayden Road (parallel to the existing 16-inch water main). This will connect to the new 24-inch water main in Hayden Road to the east. West of 78th Street, this new 20-inch main and the existing 16-inch main will combine to a new 24-inch water main. This new 24-inch main will extend west along Mayo Boulevard and connect to the new 24-inch water main in Miller Road.

- Relocation of the existing 16-inch water main crossing APN 215-07-209K to Mayo Boulevard between Miller Road and 73rd Place. This new 16-inch water main will connect to the existing 16-inch water main in Mayo Boulevard west of 73rd Place and the new 24-inch water main in Miller Road.

- Relocation of the existing 16-inch water main crossing APN 215-07-209H, leaving a 75-foot buffer around the existing groundwater monitoring well located near the southeast corner of Miller Road and the Loop 101 freeway. This 16-inch main will connect to the new 24-inch water main in Miller Road and will serve the Hospital/Medical Campus parcel and the Office.

- New 12-inch water main within a tract traversing the southeast portion of the Sale Parcel. This water main will connect the new 24-inch water main in Hayden Road to the new 20-inch water main in Mayo Boulevard. The 12-inch water main will follow the alignment of a proposed road within the tract.

Refer to **Appendix D** for the Proposed Conditions Water Infrastructure Exhibit.

As previously noted, there are multiple City IIP and reimbursement programs that will be used to finance portions of the water main improvements. Each IIP requires a separate plan set and permit. The new 36-inch casing and 24-inch water main under the Loop 101 freeway will need to be reviewed, approved, and permitted by ADOT, and this process is anticipated to take much longer than other portions of the water system design and permitting. For these reasons, it is anticipated that the water system construction will be broken out into multiple phases. See Section 6.6 for project phasing and financing information.

Many of the water main improvements will be made to improve the regional water system. The City of Scottsdale has engaged Carollo Engineers to analyze the impact of regional developments with respect to required water distribution system infrastructure. The recommended water system improvements are shown in **Appendix H**.

6.2 WATER SYSTEM ANALYSIS RESULTS

The aforementioned water system was modeled using the WaterCAD computer program. The existing system pressure and flow was based on the fire flow test results from December 13, 2022. The following demand scenarios were modeled: Average Daily Demand (ADD), Maximum Daily Demand (MDD), Peak

Hour Demand (PHD), and Maximum Daily Demand plus Fire Flow. Flow demands were placed at the midpoint of each land use designation. These demands are conservative, and it is anticipated that actual future demands will be less than those used in this model. Refer to Table 2 for the Water System Model Results.

Table 2: Water System Model Results

Demand Node	ADD		MDD		PHD		MDD + Fire Flow	
	Flow (GPM)	Pressure (PSI)	Flow (GPM)	Pressure (PSI)	Flow (GPM)	Pressure (PSI)	Flow (GPM)	Pressure (PSI)
R&D Lab	282	59	564	57	988	51	4,564	30
R&D Office	198	59	397	57	745	50	4,397	30
Hospital	269	59	469	57	769	50	4,469	30
Medical Office	71	58	142	56	248	50	4,142	30
Health Center	146	59	292	57	510	50	4,292	30
Office	27	58	54	56	95	50	4,054	35
Restaurant	54	59	108	57	325	51	4,108	36

Refer to **Appendix G** for the WaterCAD Analysis Results.

6.3 CONFORMANCE TO PREVIOUS STUDIES

As previously noted, the Sale Parcel was part of the CVL Study in 2009. Since the CVL Study was completed, ASLD has revised the configuration, size, and location of the various planning units within Crossroads East. Additionally, the future roadway alignments of Mayo Boulevard, Miller Road, and others have changed since the CVL Study was completed.

The CVL Study recommended a 16-inch water main in the future Mayo Boulevard alignment which is consistent with the recommendations presented herein. Additionally, these water mains conform to City of Scottsdale requirements for 12-inch water mains in mile and half-mile alignment streets.

The CVL did not provide recommendations for water mains within Princess Boulevard or the future 78th Street alignment. Refer to **Appendix E** for the CVL Study.

Kimley-Horn prepared a Master Water Report for Crossroads East Planning Unit VII in July 2018. This report covered the area bounded by Hayden Road, Mayo Boulevard, 78th Street, and Princess Boulevard. This report supports the findings of the Planning Unit VII Master Water Report.

The City of Scottsdale released the Integrated Water Resources Master Plan (IWRMP) in August 2022. The IWRMP updates and integrates the City's water resources, water system and wastewater system master plans using a common framework that establishes the same growth and planning assumptions for all systems. The report outlines water use demand projections based on historic and projected population growth estimates across different areas of the City. The proposed site is within an area that is designated as "Development Intensity Area" in the IWRMP. This area was modeled as having an anticipated growth rate that is higher than the baseline rate across other parts of the City. The IWRP presented recommendations for budgets of future water and wastewater projects across the City.

The previous Kimley-Horn study recommended that a 16-inch water main be installed in Mayo Boulevard between Hayden Road and the Miller Road alignment. A 16-inch water main was installed in Mayo Boulevard between Hayden Road and 78th Street as part of the Mark-Taylor project in 2019. This report includes the extension of this 16-inch main in Mayo Boulevard between 78th Street and 73rd Place. Refer to **Appendix F** for the Crossroads East Planning Unit VII Master Water Report.

The City of Scottsdale has engaged Carollo Engineers to analyze the impact of regional developments with respect to required water distribution system infrastructure. The recommended water system improvements are shown in **Appendix H**.

6.4 CITY INFRASTRUCTURE IMPROVEMENT PLANS

The City of Scottsdale has an Infrastructure Improvement Plan (IIP) in place to cover portions of the water main construction in the adjacent portions of Mayo Boulevard, Hayden Road, Miller Road, and the water main north of the Loop 101 freeway. This is known as W-IIP-020 and includes 3.5 miles of pipeline and pressure reducing valve stations west of Hayden Road and north of Princess Boulevard. This IIP includes the 24-inch water main in Mayo Boulevard between Miller Road and 78th Street, the 20-inch water main in Mayo Boulevard between 78th Street and Hayden Road, the 24-inch and 30-inch water main in Hayden Road, the 24-inch water main to be bored under the Loop 101 freeway, and the 24-inch water main on the north side of the Loop 101 freeway between Miller Road and Claret Drive. The 24-inch main in Hayden

Road will terminate as a 30-inch stub near the Loop 101 intersection for future connection. The total cost allocated to the entire W-IIP-20 is $6,100,000. This is detailed in a Development Agreement that is currently scheduled to be presented to City Council in September 2024. The 16-inch water main in Mayo Boulevard between 73rd Place and Miller Road, the 24-inch water main in Miller Road between Mayo Boulevard and the Loop 101 freeway, and the 16-inch water main connection to the east of Miller Road will be funded by the developer and will not be a part of the reimbursement program. The maximum City funds available is

Water infrastructure that is covered in the IIP documents will be eligible for partial reimbursement from the City following construction. Infrastructure will need to be installed in accordance with applicable Arizona Revised Statutes Title 34 requirements for design, bidding, and construction.

As previously noted, the City of Scottsdale engaged Carollo Engineers to study the regional water system. The North Airpark Water Study produced by Carollo showed that the regional system, including infrastructure at the City's water campus, was inadequate to support the anticipated regional developments. The report recommended upgrades to several water mains, including construction of new water main and parallel water main, to support the regional water system as well as increased demands from future on-site developments. Portions of those regional water system improvements are adjacent to the Sale Parcel and will be eligible for reimbursement following construction by the developer.

Refer to **Appendix H** for City of Scottsdale IIP documents and the recommended improvements from the North Airpark Water Study.

6.5 PROPOSED SPECIAL WATER FACILITIES

The Research & Development parcel will include a unique use that has non-typical demands that would not be appropriate to calculate based on the DS&PM tables used for other demands. The Research & Development user has engaged in discussions with City staff and has determined the appropriate water demands for the site. These demands are included in **Appendix G**. Refer to **Appendix G** for the Research & Development parcel water demands that have been used herein. A buffer has been added to these demands so that the values shown in this report are conservative; the intention is to provide flexibility for future changes to the parcel's water demands.

Portions of the water main may need to be constructed with extra protection due to drainage culvert or other utility crossings as specified by Maricopa Association of Governments (MAG) Standard Detail 404 and COS Standard Detail 2401. Any crossings of washes will need to comply with DSPM requirements from Sections 6-1.414, 6-1.415, 6-1.410, and 6-1.202. In general, the requirements for wash crossings include greater bury depths based on the 100-year flow rate of the wash crossing. Dipped sections of water main will require hydrants or air release valves per COS requirements.

The regional water infrastructure recommended by the Carollo regional water study includes a new 24-inch water main under the Loop 101 freeway to support demands from this development and regional water demands. This will need to be installed in a new 36-inch casing that will be jack and bored under the freeway. This will require close coordination with ADOT for the design and construction of this facility.

As part of the overall development, several >50 cfs washes will be adjusted. These modifications are outlined in a separate Master Drainage Report for Crossroads East Planning Unit VI and Portion of Planning Unit III. Most water mains outlined in this report will be located under public streets (Mayo Boulevard,

Hayden Road, and Miller Road) and any drainage crossings will be channelized through a culvert for the roadway crossings. The 24-inch water main on the north side of the Loop 101 freeway, the 16-inch water main on the south side of the Loop 101 freeway, and the 12-inch water main crossing the southeast portion of the Sale Parcel will be located within undeveloped areas and may require wash crossings that comply with the DSPM requirements noted above.

Any well modifications will

A City of Scottsdale monitoring well is located near the southeast corner of the Loop 101 freeway and the Miller Road underpass. This monitoring well will remain in place post-development, and access to the monitoring well will be provided from Miller Road. This will require authorization from the Arizona Department of Water Resources (ADWR). The elevation of the well will need to be lowered so that it can be accessed from Miller Road. Refer to **Appendix I** for a layout of the monitoring well site. Dedications of easements for access and maintenance for the well will be required. Any monitoring well improvements shall be via City-approved contractor.

and the well site and associated yard DSPM 6-1.202.

Water easements will need to be dedicated for public water mains that fall outside of the right-of-way. Additionally, a 10-foot-wide water easement will need to be dedicated adjacent to the ADOT right-of-way where there is an existing 16-inch water main within the ADOT right-of-way. Refer to the Proposed Conditions Water Infrastructure Exhibit in **Appendix D** for schematic locations of proposed easements.

6.6 PROJECT PHASING

As previously noted, there are multiple City IIP and reimbursement programs that will be used to finance portions of the water main improvements. The aforementioned water system improvements will be broken up into four phases, each of which requires a separate plan set and permit. A detailed water system analysis for each phase will be provided with a subsequent Basis of Design Report.

The Phase I water main improvements will include:

- Relocation of the existing 16-inch water main crossing APN 215-07-209K to Mayo Boulevard between 73rd Place and Miller Road
- The new 24-inch main in Miller Road south of the Loop 101
- Relocation of the existing 16-inch main crossing APN 215-07-209H

The proposed Phase I improvements are included in W-IIP-020, but the owner of the Sale Parcel has requested to remove this portion of the project from the IIP. Per this request, Phase I will be entirely developer-funded.

The Phase II water main improvements will include:

- The new 24-inch water main in Mayo Boulevard between Miller Road and 78th Street
- The new 20-inch water main in Mayo Boulevard between 78th Street and Hayden Road
- The new 24-inch water main in Hayden Road between Mayo Boulevard and the Loop 101
- The new 30-inch stub near the Hayden Road-Loop 101 interchange

The proposed Phase II improvements are also included in W-IIP-020. This phase will be both developer- and IIP-funded. The Phase III water main improvements will include:

- The new Miller Road 24-inch water main within a new 36-inch sleeve under the Loop 101 freeway
- The new 24-inch water main north of the Loop 101 freeway from Miller Road to Claret Drive (within the Cavasson development property)

The proposed Phase III improvements are also included in W-IIP-020. This phase will be both developer- and IIP-funded.

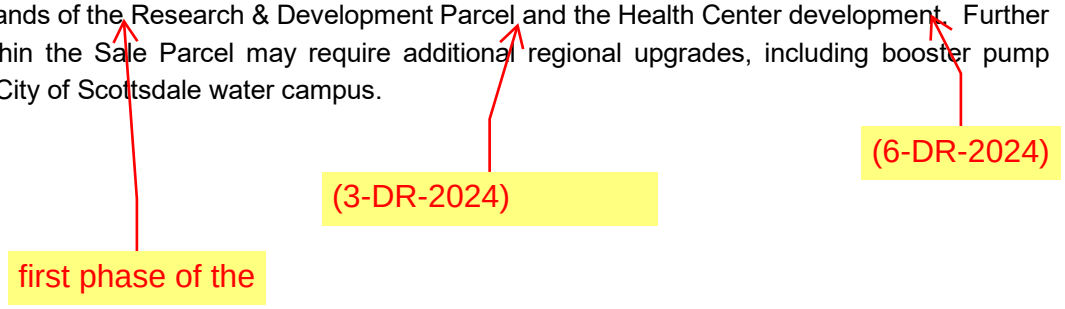
The Phase IV water main improvements will include:

- The new 12-inch water main crossing the southeast corner of the Sale Parcel

Phase IV will be developer-funded. Refer to **Appendix J** for the Phasing Exhibit.

Subsequent on-site developments will be phased based on market demand. Individual developments within the Sale Parcel will need to provide site-specific water system modelling to justify site demands and infrastructure sizing. The individual developments will provide Basis of Design (BOD) reports with their entitlement packages that demonstrate consistency with this Master Water Report.

Based on discussions with City staff, construction of the Phases I-IV water infrastructure will be sufficient to meet the demands of the Research & Development Parcel and the Health Center development. Further development within the Sale Parcel may require additional regional upgrades, including booster pump upgrades at the City of Scottsdale water campus.



7.0 CONCLUSION

7.1 OVERALL PROJECT

Based on the results of this Water Master Report, the following can be concluded:

- This project will include phased water main improvements, some of which are partially reimbursed by City of Scottsdale IIP funds. The water main improvements will be to the benefit of the Sale Parcel as well as the region.
- Construction of the Phases I-IV water infrastructure will be sufficient to meet the demands of the Research & Development Parcel and the Health Center development. Further development within the Sale Parcel may require additional regional upgrades, including booster pump upgrades at the City of Scottsdale water campus.
- Additional regional water main improvements will be constructed by the developer based on the North Airpark Water Study, and proportional costs for these improvements will be reimbursed up to the amount of available funding if IIP requirements are satisfied.
- The water demand calculations are based on conservative land use assumptions, and the actual water demands will likely be less than the demands presented in this report.
- The water demands for the Research & Development parcel are unique to the anticipated user and are based on correspondence between the user and the City.
- The timing of subsequent on-site developments within the Sale Parcel will be based on market demand and water infrastructure improvements being constructed to meet required demands. Individual developments within the Sale Parcel will provide site-specific BOD reports that include water system modelling, justify site water demands, verify infrastructure sizing, and demonstrate consistency with this Master Water Report.
- This Water Master Plan is generally consistent with the CVL Study that was prepared in 2009 for Crossroads East and the Master Water Report for Crossroads Planning Unit VII prepared in 2018 by Kimley-Horn.

This Water Master Report is intended to provide a level of assurance that water service can be provided to the Sale Parcel. It is also intended to provide guidance for future developments adjacent to the Sale Parcel.

8.0 REFERENCES

City of Scottsdale, *Design Standards and Policies Manual, Chapter 6: Water,* January 2018.

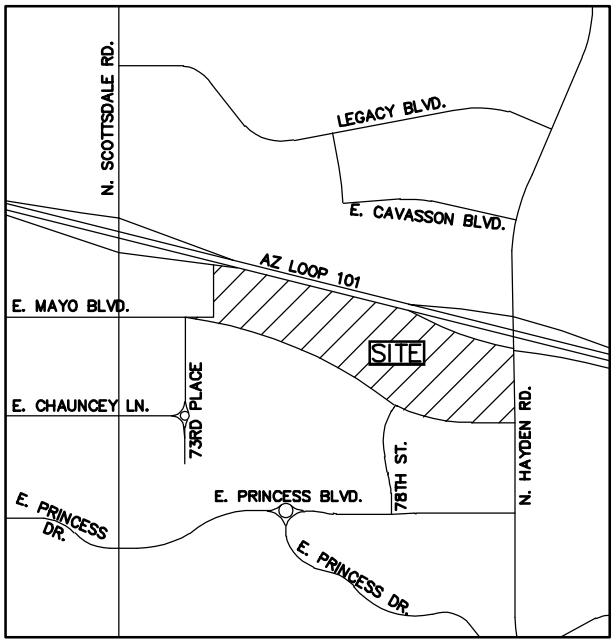
Coe and Van Loo Consultants, Inc, *Crossroads East Preliminary Planning Analysis,* June 2009.

Kimley-Horn & Associates, Inc, *Master Water Report for Crossroads East Planning Unit VII*, July 2018.

WaterCAD v8i, Bentley Systems, Inc. and *WaterCAD User's Guide,* 2022

Carollo Engineers, *City of Scottsdale Integrated Water Resources Master Plan,* August 2022.

Appendix A – Vicinity Map



VICINITY MAP

CITY OF SCOTTSDALE

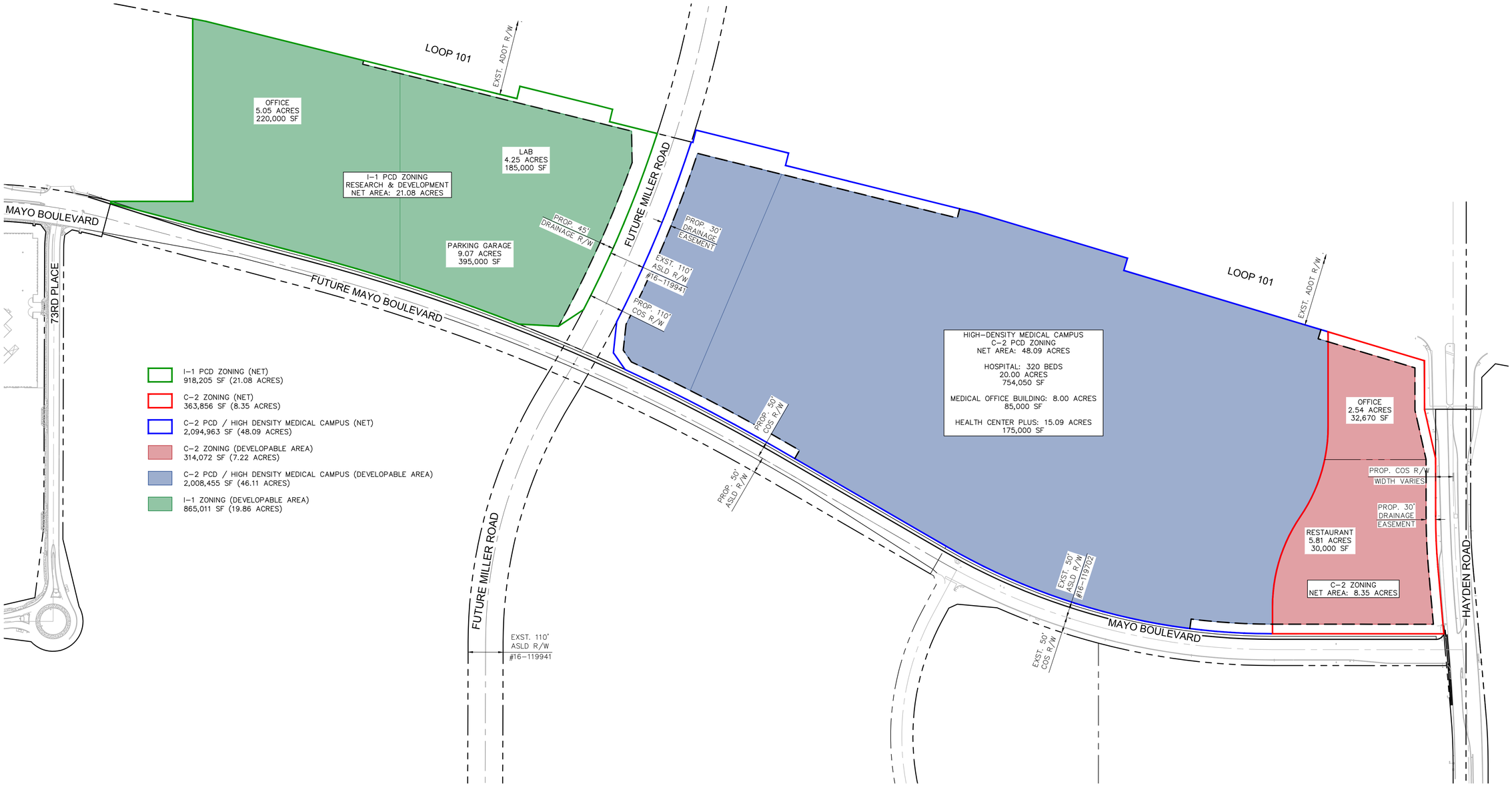
N.T.S.

NORTH

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\Vicinity Map.dwg Feb 28, 2024 Laurel.Wright

Appendix B – Land Use Map, Planning Unit Layout, and ASLD Proposed Zoning Districts



NORTH

GRAPHIC SCALE IN FEET
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LAND USE MAP
SWC - HAYDEN ROAD & LOOP 101 FREEWAY

Kimley»Horn

4/11/2024

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2023-07-27 Land Use Map.dwg Apr 11, 2024 Laurel.Wright

Crossroads East

Planned Community District & Vicinity

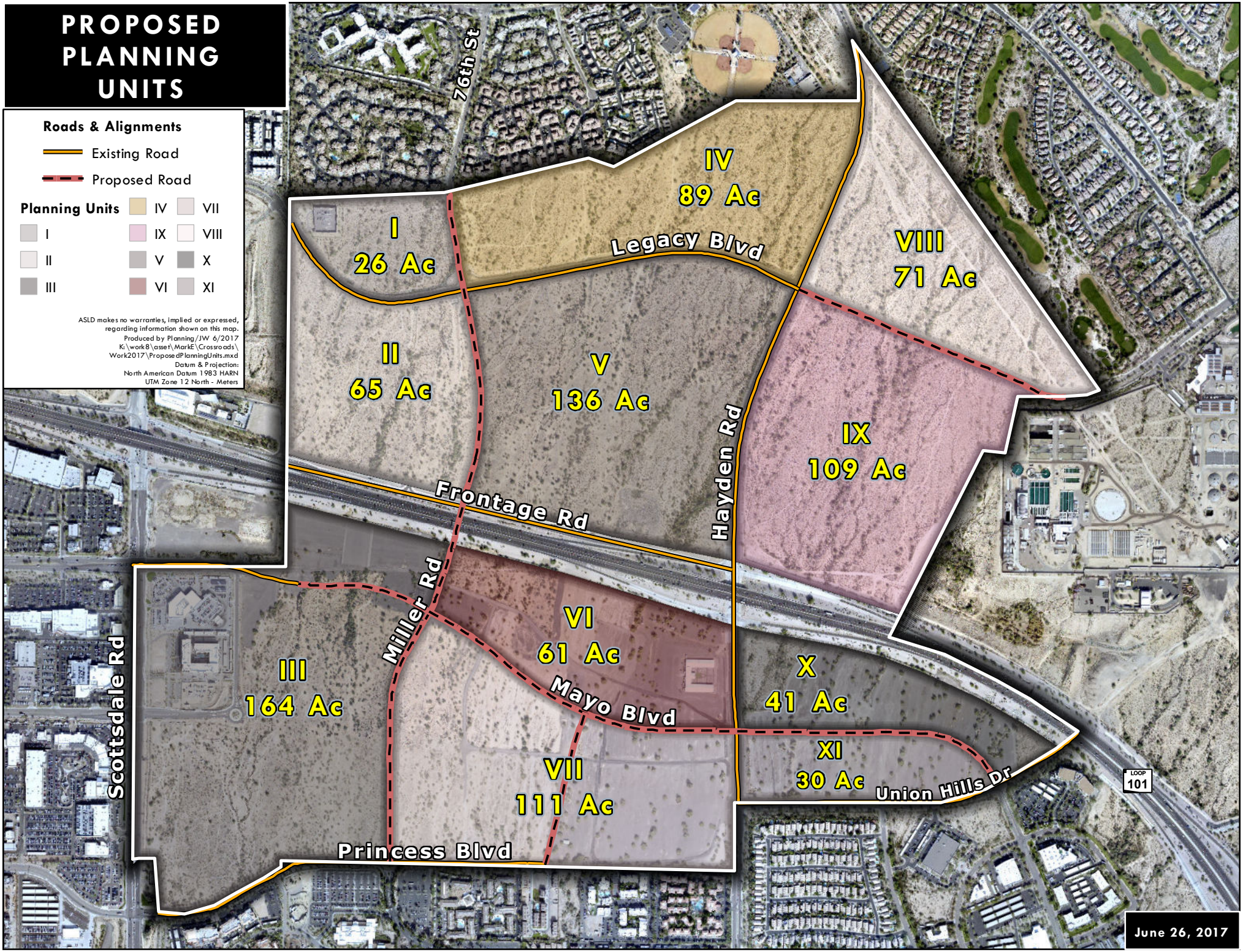
Arizona State Land Department
1616 W Adams Street Phoenix, AZ 85007

1" = 500'

The Arizona State Land Department makes no warranties, expressed or implied, with respect to the information shown on this map.

K:\work8\asset\MarkE\Crossroads\Work2017\BigCrossroadsRevisionsMap2017.mxd

Proposed roadway alignments shown are approximate and have not been officially adopted into the City of Scottsdale's Transportation Master Plan

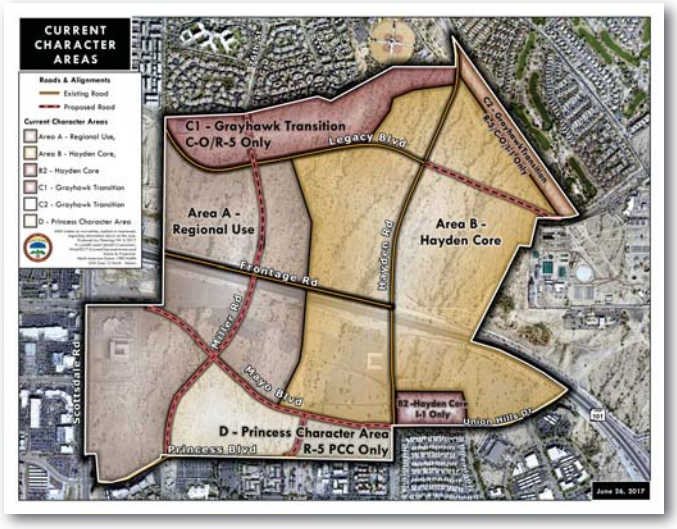

PROPOSED PLANNING UNITS
Roads & Alignments
Existing Road
Proposed Road
Planning Units
I
II
III
IV
IX
V
VI
VII
VIII
X
XI
ASLD makes no warranties, implied or expressed, regarding information shown on this map.
Produced by Planning/JW 6/2017
K:\work8\asset\MarkE\Crossroads\Work2017\ProposedPlanningUnits.mxd
Datum & Projection:
North American Datum 1983 HARN
UTM Zone 12 North - Meters
76th St
I
26 Ac
IV
89 Ac
VIII
71 Ac
Legacy Blvd
II
65 Ac
V
136 Ac
IX
109 Ac
Hayden Rd
Frontage Rd
Miller Rd
VI
61 Ac
III
164 Ac
X
41 Ac
Mayo Blvd
Scottsdale Rd
XI
30 Ac
Union Hills Dr
VII
111 Ac
Princess Blvd
LOOP
101
June 26, 2017

WHERE ZONING CAN BE USED AT CROSSROADS EAST

JUNE 2017

2002

CURRENT/EXISTING CHARACTER AREAS



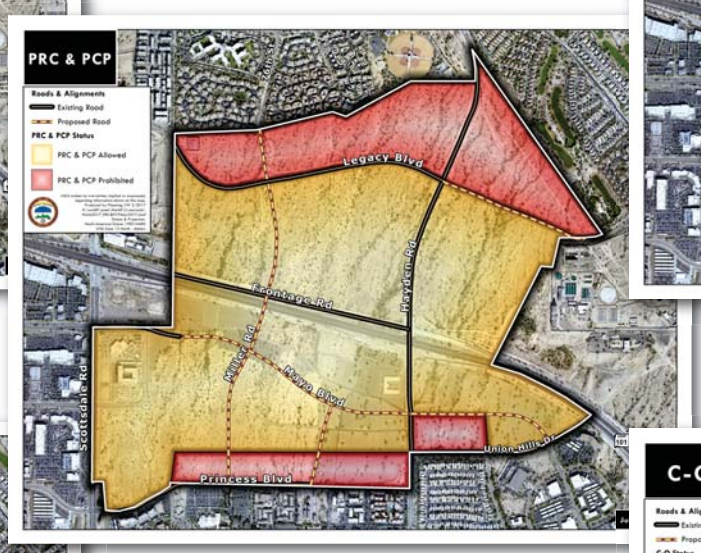
TODAY

PROPOSED ZONING DISTRICTS

LAND USE INDEX: PRC/PCP - REGIONAL CENTER C-2/C-3 COMMERCIAL
R-5 MULTIFAMILY RESIDENTIAL I-1 INDUSTRIAL PARK C-O COMMERCIAL OFFICE

LIMITED TO ALLOWED PROHIBITED











Appendix C – Existing Conditions Water Infrastructure Exhibit and City of Scottsdale Quarter Section Maps

AZ LOOP 101

EXST. 24" DIP WATER MAIN

EXST. 16" DIP WATER MAIN

MAYO BLVD

EXST. WELL LOCATION

EXST. 10' PUE

EXST. 12" DIP NON-POTABLE WATER MAIN

EXST. 16" ACP WATER MAIN TO BE REMOVED

EXST. 16" ACP WATER MAIN TO REMAIN

73RD PLACE

SALE PARCEL BOUNDARY

EXST. 16" DIP WATER MAIN

CHAUNCEY LANE

SCOTTSDALE ROAD

EXST. 16" DIP WATER MAIN

78TH STREET

AXON DRIVE

EXST. 16" DIP WATER MAIN

EXST. 12" DIP WATER MAIN

EXST. 12" WATER MAIN, MATERIAL UNKNOWN

EXST. 12" PVC WATER MAIN

EXST. 60" SCP RAW WATER MAIN

PRINCESS BLVD

EXST. 12" DIP WATER MAIN

EXST. 8" DIP WATER MAIN

PRINCESS DRIVE

COTTAGE TERRACE

HAYDEN ROAD

NORTH

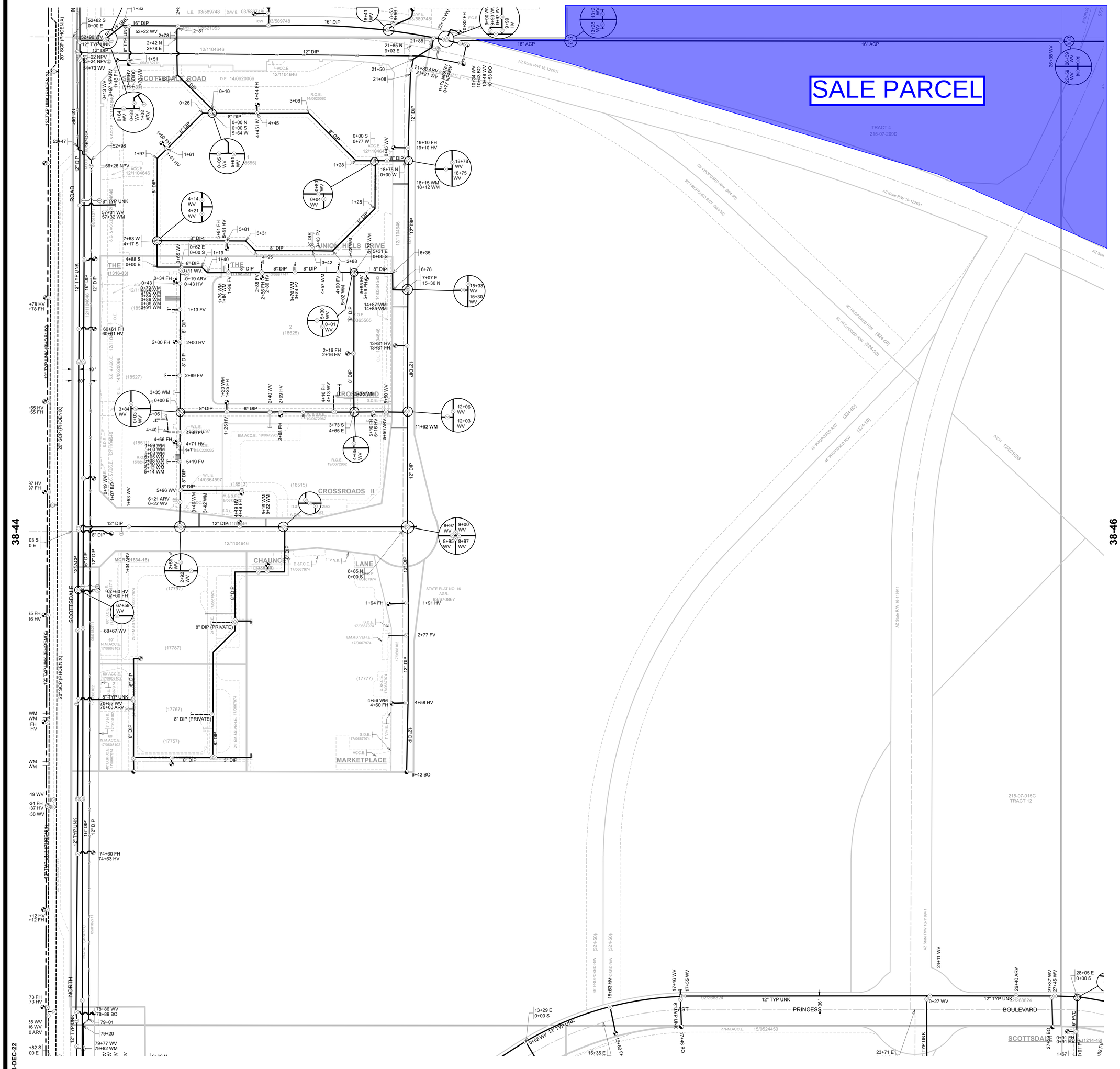
GRAPHIC SCALE IN FEET
0 100 200 400

EXISTING WATER INFRASTRUCTURE

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2022-12-07 Exst Water Exhibit.dwg Jul 27, 2023 Laurel.Wright

39-45



38-44

38-46

04-DEC-22

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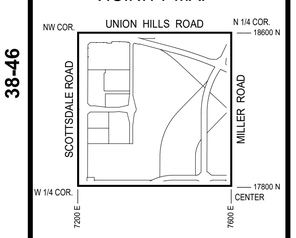
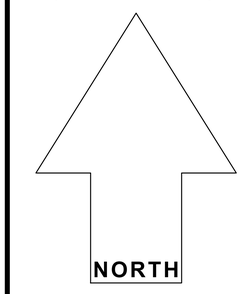
LEGEND:

- Air Release Valve
- Non-potable Air Release Valve
- Blowoff
- Cap
- Cathodic Protection
- Fill Drain
- Fire Hydrant
- Non-GPS Point
- Pressure Reducing Valve
- Pump
- Reducer
- Sample Station
- Water Manhole
- Non-Potable Manhole
- Well
- Valve
- Non-potable Valve
- Vault
- Water Main
- Non-Potable Main
- Fire / Private Main
- Non-Scottsdale Main

VICINITY MAP





SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

WATER

QUARTER SECTION MAP

38-45

NW 1/4 SEC. 35 T4N R4E

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

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THE CITY OF SCOTTSDALE

39-46

38-45

38-47

SALE PARCEL

TRACT 10A
215-07-209D

PARCEL
I.L.-AP./C.O.S.
88/568473

STATE PLAT NO. 16
AGR.
93/670867

A/CH 12/521053

A/CH 12/521053

SOUTH

HAYDEN 50
(1214-40)

NORTH

(17800)

(17900)

1
(17800)
AV.E.
21/0339746

1
(17900)
AV.E.
21/0339746

92/268824

87/228061

86/629084

18/0196527

19/0196527

04/932570

00/589276

22/0503808

05/441597

W.L.E.
22/0522066

20' W.E. & S.E. 19/1023980

16' W.E. & S.E. 19/1023980

16' W.S.F.E. 21/0339746

N.M.ACC.E.
19/1023980

10' N.M.ACC.E.
19/1023980

33' X 33' S.D.E.
19/1023980

R.O.E.
21/0011543

R.O.E.
89/419001

50' D.&F.C.E.

28' D.&F.C.E.

12' D.&F.C.E.

ACC. E.
87/0605551

ROAD

HAYDEN

PRINCESS

BOULEVARD

SCOTTSDALE VILLA

SCOTTSDALE

PINNACLE

EAST

EVARD

OTTSDALE

68824

AZ State R/W 16-122631

PROPOSED 8" DIP

16" ACP

16" DIP

12" DIP

12" PVC

8" DIP

6" PVC

4" DIP

60" SCP

20"

36"

26+38 WV

26+59 WV

26+69 WV

37+33 WV

42+61 ARV

48+67 WV

52+83 WV

52+93 BO

49+67 WV

49+58 WV

49+30 WV

48+09 WV

47+58 WM

47+56 ARV

47+41 FH

47+41 HV

47+41 WV

47+36 WV

47+32 WV

50+36 N
0+00 E

13+07

12+48 W

12+27 WV

16" TLP JUNK

16" DIP

28+05 E
0+00 S

27+37 WV

27+45 WV

32+11 E
0+00 S

36+27 E
0+00 S

0+91 FH

0+91 HV

0+73 FH

0+73 HV

1+67

0+50

0+19 WV

0+64 WV

0+61 FH

0+67 WM

0+62 HV

0+67 WM

0+00 E
22+60 FH
22+62 HV

0+00
WV

0+85

2+09

2+03 WM

3+34
FV

0+00 E

0+67

0+74

0+88 E
0+00 S

0+01
WV

5+75 N
6+72 E

5+41 FV

33+57
WV

33+51
WV

33+44
WV

33+60
WV

33+54
WV

33+47
WV

33+41
WV

1+13 BO

1+10 WV

1+07 WV

1+04 WV

34+05 N
0+00 E

33+18 FH

33+18 HV

V.R.

15+59 HV

15+59 FH

8" DIP

20" DIP

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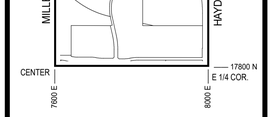
LEGEND:

- Air Release Valve
- Non-potable Air Release Valve
- Blowoff
- Cap
- Cathodic Protection
- Fill Drain
- Fire Hydrant
- Non-GPS Point
- Pressure Reducing Valve
- Pump
- Reducer
- Sample Station
- Water Manhole
- Non-Potable Manhole
- Well
- Valve
- Non-potable Valve
- Vault
- Water Main
- Non-Potable Main
- Fire / Private Main
- Non-Scottsdale Main

VICINITY MAP



NORTH

SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

WATER

QUARTER SECTION MAP

38-46

NE 1/4 SEC. 35 T4N R4E

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

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THE CITY OF SCOTTSDALE

04-DEC-22

40-45

39-44

39-46

04-DEC-22

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LEGEND:

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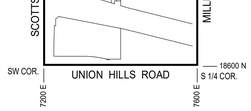
- Non-potable Air Release Valve (NPARV)
- Blowoff
- Cap (CPT)
- Cathodic Protection (FSD)
- Fill Drain
- Fire Hydrant
- Non-GPS Point
- Pressure Reducing Valve (PRV)
- Pump (WP)
- Reducer
- Sample Station (SPS)
- Water Manhole (WMH)
- Non-Potable Manhole (NPMH)
- Well (WELL)
- Valve
- Non-potable Valve (NPV)
- Vault (WVT)
- Water Main
- Non-Potable Main (NP)
- Fire / Private Main
- Non-Scottsdale Main

VICINITY MAP



NORTH

SCALE: 1" = 100'

0 50 100 200

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WATER

QUARTER SECTION MAP

39-45

SW 1/4 SEC. 26 T4N R4E

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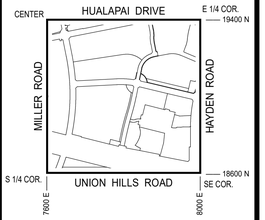
LEGEND:

- Air Release Valve (ARV)
- Non-potable Air Release Valve (NPARV)
- Blowoff
- Cap (CPT)
- Cathodic Protection
- Fill Drain (FSD)
- Fire Hydrant
- Non-GPS Point
- Pressure Reducing Valve (PRV)
- Pump (WP)
- Reducer
- Sample Station
- Water Manhole (WMH)
- Non-Potable Manhole (NPMH)
- Well (WELL)
- Valve
- Non-potable Valve (NPV)
- Vault (WVT)
- Water Main
- Non-Potable Main (NP)
- Fire / Private Main
- Non-Scottsdale Main

VICINITY MAP



NORTH

SCALE: 1" = 100'

0 50 100 200

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WATER

QUARTER SECTION MAP

39-46

SE 1/4 SEC. 26 T4N R4E

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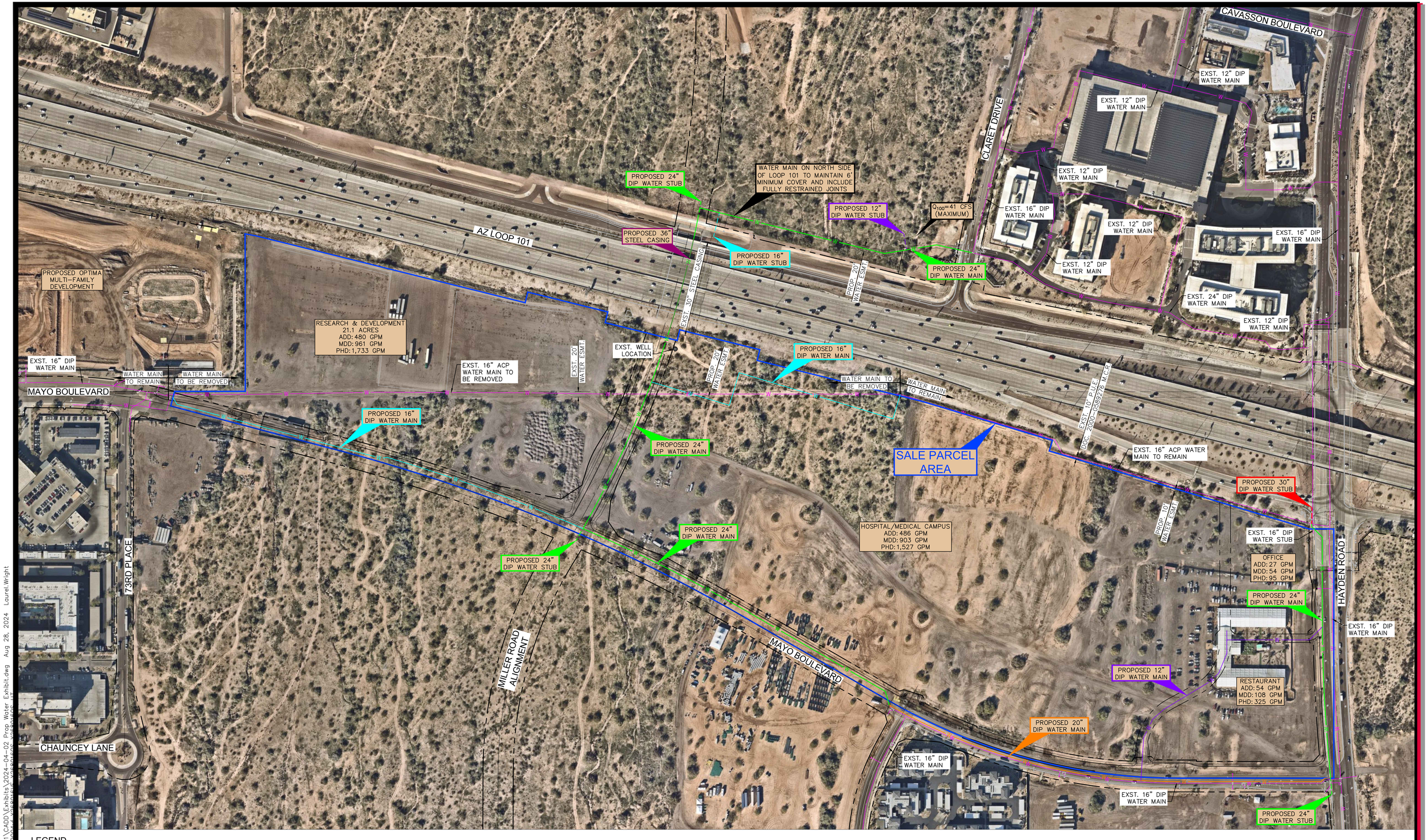
THE CITY OF SCOTTSDALE

04-DEC-22

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS
3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

Appendix D – Proposed Conditions Water Infrastructure Exhibit



LEGEND

- EXISTING WATER MAIN
- PROPOSED 12" DIP WATER MAIN
- PROPOSED 16" DIP WATER MAIN
- PROPOSED 20" DIP WATER MAIN
- PROPOSED 24" DIP WATER MAIN
- PROPOSED 30" DIP WATER MAIN
- SALE PARCEL BOUNDARY

WATER CROSSING NOTES:

1. WATER MAIN CROSSINGS OF WASHES SHALL COMPLY WITH DSPM SECTION 6-1.414.
2. WATER MAIN CROSSINGS OF CULVERTS AND OTHER UTILITIES SHALL COMPLY WITH DSPM SECTION 6-1.415 AND COS STANDARD DETAIL 2401.

NORTH

GRAPHIC SCALE IN FEET
0 75 150 300

PROPOSED CONDITIONS WATER INFRASTRUCTURE EXHIBIT

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2024-04-02 Prop Water Exhibit.dwg Aug 28, 2024 Laurel.Wright

Kimley»Horn

Appendix E – Crossroads East Preliminary Planning Analysis by Coe and Van Loo Consultants, June 2009

COE & VAN LOO
CONSULTANTS, INC.

CROSSROADS EAST

PRELIMINARY PLANNING ANALYSIS

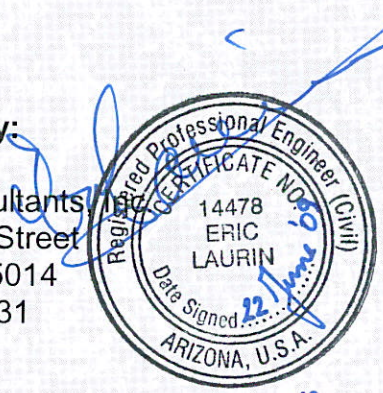
JUNE 22TH, 2009

Prepared for:

Arizona State Land Department
1616 W. Adams
Phoenix, AZ 85007

Prepared by:

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, AZ 85014
(602) 264-6831



Expires: 6/30/12

CVL Project No.: 1.07.0220002

www.cvlci.com

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4550 N. 12th St.
Phoenix, AZ 85014
Phone: 602.264.6831
Fax: 602.264.0928

LAS VEGAS
6280 S. Valley View Blvd., Ste. 200
Las Vegas, NV 89118
Phone: 702.368.3008
Fax: 702.368.0047

DENVER
7901 E. Belleview, Ste. 150
Englewood, CO 80111
Phone: 720.482.9526
Fax: 720.482.9546

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1.3 Previous Studies 5
1.4 Current Study 6

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3.2 Unit Factors 9
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Appendix E: CVL Correspondence
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1.0 INTRODUCTION

Ideally positioned on both sides of the dynamic Loop 101/Pima Freeway corridor, Crossroads East (the "Site") represents a long-term opportunity for significant commercial, office and mixed use development. The Site is owned and held in trust by the Arizona State Land Department ("ASLD"), which is responsible for the management and ultimate disposition of the land on behalf of ASLD's institutional beneficiaries. The Site encompasses approximately 900 gross acres and features excellent visibility and access.

1.1 Site Context and Circulation

As shown in Figure 1 ("Site Conditions"), the Site is bisected by State Route Loop 101 ("SR101"). The existing Hayden Road traffic interchange is in the center of the Site, which is located approximately one mile east of Scottsdale Road. While the Hayden Road interchange provides freeway access, there are other significant arterials and collectors serving the property.

The recent completion of Hayden Road through the Site provides continuous north-south arterial access between Thompson Peak Parkway to the north and Frank Lloyd Wright Boulevard to the south. Between Hayden and Scottsdale Roads is the north-south alignment of Miller Road, which, when complete, will provide collector access on the northern portion of the Site from Thompson Peak Parkway to the SR101 westbound frontage road. The proposed Miller Road alignment also curves through the southern portion of the Site and will connect to Scottsdale Road on the south. The stipulations contained in the 2002 Crossroads East rezoning approval (discussed below in Section 1.2) require ASLD and the City of Scottsdale to enter into a future agreement that would specify sources of funding and repayment mechanisms for a Miller Road undercrossing at the SR101. The City of Scottsdale is currently rebuilding Scottsdale Road in the project area to install drainage culverts and expand the roadway to full arterial profile. Completion of this project is anticipated in the summer of 2009.

In addition to the east-west access through the Site provided by SR101, the north half of the Site is served by Legacy Boulevard, a minor arterial whose completion between Scottsdale and Hayden roads is scheduled for the summer of 2009. Future construction on Legacy Boulevard will extend the road eastward from Hayden Road to the alignment of Union Hills Drive, where it will connect with Pima Road. East-west access through the southern half of the Site will be provided by Union Hills Drive from its connection with Scottsdale Road and Mayo Boulevard to Hayden Road. Union Hills Drive currently exists as a half-street between Hayden Road and SR101 and does not access or cross the freeway. The future developer(s) of the adjacent portion of the Site may be required to complete the north half of Union Hills Drive in this area.

Development is encroaching on all sides. The Princess Resort, single family homes and the Perimeter Center business park are on the south. The Grayhawk master-planned community is located to the north and north-east. An existing APS power line easement is on the east boundary. Significant public infrastructure facilities are also located to the east, including City of Scottsdale water and wastewater plants and a solid waste transfer station. On the west, the Site north of SR101 is immediately adjacent to "One Scottsdale," a mixed-use project currently being developed by DMB. South of SR101, the site abuts the growing and active Scottsdale Road, including the future site of Lund Cadillac at the north-east corner of Scottsdale Road and Mayo Boulevard/Union Hills Drive. Scottsdale Road in this area straddles the shared municipal

boundaries of Phoenix and Scottsdale. The Phoenix (west) side of Scottsdale Road south of SR101 has been extensively developed in recent years with several auto dealerships and two retail "power centers."

1.2 Site History

The project area is part of two larger state plats, known as Core North and Core South, which were originally planned and zoned in the mid-1980s. In 2002, ASLD and the City of Scottsdale combined the remaining portions of these state plats in a single rezoning case (19-ZN-2002) which renamed the project area as "Crossroads East." As part of the Crossroads East rezoning approval, the City of Scottsdale and ASLD entered into a Development Agreement (Agreement No. 2002-141-COS, recorded 11/22/02), which vested the Site's entitlements, provided a framework for the implementation of "Character Areas" in Crossroads East (described below), and outlined the terms of reimbursement for City-installed roadway and infrastructure improvements by ASLD's future buyers and lessees.

This zoning and the resulting Development Agreement assigned the "Planned Community" ("PC") zoning district to the Site and created a "bank" of allowable land uses, as defined by zoning districts and allowable acreages of each. The rezoning stipulations divided the Site into four "Planning Unit" quadrants, allotted a variety of uses over approximately 1,000 gross acres, and created Character Areas. The "Grayhawk Transition" and "Princess" Character Areas were established to create a buffer for existing residential and resort land uses adjacent to the Site's northern and southern boundaries by only allowing compatible land uses and restricting building heights. The "Regional Use" Character Area is intended to group more intense commercial and mixed-use areas close to existing and proposed commercial and mixed-use development in the Scottsdale Road corridor, while the "Hayden Core" Character Area is intended for less-intense office, commercial and residential uses. Development standards were modified. The list of uses and standards is attached in Appendix C. This approval also provided for allowable Floor Area Ratios (FAR) for each commercial and office zoning district and a total of 3,443 residential dwelling units ("DU").

1.3 Previous Studies

In 2005, URS was commissioned to study Site land use, drainage and water/wastewater requirements. This study caused confusion by alternately identifying a gross land area of both 906.1 and 879.6 acres. As ASLD's internal records indicate a gross site acreage of 905.76 acres (not including approximately 81 acres within the SR101 right-of-way), it can be surmised that the two acreage references in the URS report (906.1 and 879.6) refer to gross and net acreage, respectively. This draft plan varied from the Crossroads East zoning approval, especially in the difference of dwelling counts from the 2002 rezoning case. It should also be noted that URS derived their floor area and dwelling unit numbers by combining similar zoning districts into broad general plan-type land use categories (i.e., "Commerce Park/Business Park," "Retail," and "High Density Residential") and then multiplying the acreage in each category by respective FARs and DU densities that were greater than those allowed by the individual zoning districts. URS' methodology produced Commerce/Business Park building area of 12,142,120 square feet ("SF"), Retail building area of 4,533,110 SF and 6,473 DU.

In 2007, Coe and Van Loo Consultants, Inc. was asked to prepare a revised land use plan. This plan utilized a land area close to the URS study and FARs and DU densities based on the approved zoning. The result was an allowable total SF of buildings of 14,545,555 SF (all uses) and a total of 2,670 dwelling units.

After the 2007 study was complete, discrepancies remained in the understanding of the City of Scottsdale's ability to serve the site with water and wastewater.

1.4 Current Study

This most recent study updates the land plan and the water/wastewater system capabilities and requirements. The land plan, shown in Figure 2, has been updated based upon recent development activity and plans along the SR101 corridor and guidance from City of Scottsdale.

The plan envisions the primary mixed-use areas (PRC zoning district) on the west side adjacent to or near Scottsdale Road, as are the Commercial-Office (C-O) zoning districts. Higher density residential uses (R-5 zoning district) are placed on the north and south edges of the site to provide transition from existing residential areas. A node of commercial activity is shown at the SR101/Hayden Road traffic interchange to take advantage of this excellent exposure and access. The balance of the site is primarily I-1 zoning, which is well suited to office uses.

The final chart of land use allocations, square footage and dwelling distribution is shown in Table 1.

2.0 LAND DEVELOPMENT / LAND USE

Land planning is based upon the original land use budget and character areas per the zoning and development agreement approved in November 2002. This allocation places the PRC or mixed use districts proximate to the Scottsdale Road corridor. Residential uses (R-5) are placed to the north and south to provide transitions from existing lower density residential uses. The final concept places commercial uses (C-2) at the Hayden/101 intersection to provide a node of commercial activity at this important junction.

Land areas are based upon the base map shown in Figure 2 (see Appendix F). There is a discrepancy between the zoning land use budget totaling 1,000 acres and the gross planning area, calculated at 882.5 acres (see acreage discussion in Section 1.3, above).

For purposes of calculating the yield, the FAR ratios approved in the zoning development agreement were used. Calculations are based on net parcel area, which is gross area less proposed street rights-of-way. Table 1 lists the proposed land use calculations.

Figure 1 is a site conditions map chronicling current planned and proposed uses and development in the immediate vicinity (see Appendix F).

Table 1: Proposed Land Use Plan

Parcel	Zoning	Area (Gr) [ac]	Area (Net) [ac]	Non-Res. [sf]	Res. Area [ac]	Res. DU	Total Area [ac]
North							
P5	C-O	25.5	22.7	593,287			25.5
P6	R-5	84.2	77.7		77.7	1,291	
P6	PCoC	2.0	1.2	15,682			86.2
P7	I-1	72.6	64.2	1,398,276			72.6
P8	PRC	60.0	55.8	972,259		543	60.0
P9	I-1	96.3	89.1	1,940,598			
P9	C-2	34.2	32.4	423,403			130.5
P10	C-2	28.7	26.9	351,529			
P10	I-1	74.1	69.9	1,522,422			102.8
Subtotal	-	**477.6**	**439.9**	**7,217,456**	**77.7**	**1,834**	**477.6**
South							
P11	C-2	29.8	26.6	347,609			29.8
P12	I-1	70.4	66.2	1,441,836			
P12	C-2	38.8	35.2	459,994			109.2
P13	I-1	69.6	67.6	1,472,328			69.6
P14	PRC	108.3	94.8	1,651,795		981	108.3
P15	PCC	12.0	10.2	133,294		48	
P15	R-5	37.8	35.7		35.7	580	
P15	C-O	38.2	35.0	914,760			88.0
Subtotal	-	**404.9**	**371.3**	**6,421,615**	**35.7**	**1,609**	**404.9**
Grand Total		**882.5**	**811.2**	**13,639,072**	**113.4**	**3,443**	**882.5**

		max allowed (based on net area, less ROW's)	
Notes: Yield per Dev Agree.	I-1	0.5 FAR	
	C-0	0.6 FAR	
	C-2	0.3 FAR	
	PCC	0.3 FAR	
	PCoC	0.3 FAR	
	PRC	0.8 FAR	50% of FAR is for Non-Res
	R-5	15 DU/ac	

3.0 WATER SYSTEM

3.1 Existing Infrastructure

The area's existing infrastructure is identified in Figure 3, Appendix F. The existing waterlines shown on the map are based on conversations and correspondence with the City of Scottsdale (the "City"), as-builts, and quarter-section map research. Information regarding additional extended area infrastructure can be reviewed in the City's Integrated Water Master Plan maps included in Appendix A. A sketch of the project area infrastructure, given to CVL from the City, is included in Appendix B.

Crossroads East is planned to include four major internal collector roadways: Legacy Boulevard, Hayden Road, Miller Road, and Union Hills Drive. Only Hayden Road and Legacy Boulevard contain existing waterlines, which are 16-inch transmission mains. The existing system is strengthened by a 16-inch waterline that parallels the SR101. This parallel waterline links the 16-inch Scottsdale Road waterline to the City water campus. The existing water treatment plant has a design capacity of 50 mgd, with plans to increase its capacity to 70 mgd in 2009. Plans for further expansion forecast its capacity to rise to 80 mgd by 2015.

Crossroads East is located in the City's South Central water service region along the upper border of Pressure Zone 4. Since the development is located at the top of the pressure zone, the northern edge of the project will be provided with the lowest zonal pressure. This may require portions of Parcels 6 and 7 to be served in the bottom of Pressure Zone 5. Correspondence with the City estimates a Zone 4 hydraulic grade line (HGL) of 1,750 ft MSL and a Zone 5 HGL of 1,860 ft MSL (see Appendix E).

3.2 Unit Factors

The proposed development's water use estimates are based on information found within the City's Integrated Water Master Plan, Table 2.2 (see Appendix C). These unit demand estimates represent data taken from various City land use utility billing records (2006). As recommended by the City, Table 2 lists unit factors that have been interpreted to be representative of the proposed land use allocations shown in Table 1.

Table 2: Water Use Unit Factors

Parcel Zoning Designations	City Land Use Type Designations	ADDMM [gpapd]	MDD [gpapd]	PHD [gpapd]
C-2	Business - General	1,749	1,924	2,693
C-O	Office - Minor	1,694	1,863	2,609
I-1	Industrial - Minor	915	1,007	1,409
R-5	Residential MF	3,957	4,353	6,094
PRC	Regional Center	1,080	1,188	1,663
PCC	Community Center	1,074	1,181	1,654
PCoC	Retail - Community	1,074	1,181	1,654

[1] ADDMM = Average Day Demand of Maximum Month, MDD = Maximum Day Demand, PHD = Peak Hour Demand

[2] MDD = ADDMM x 1.10 and PHD = MD x 1.40

The City's Integrated Water Master Plan explains that the "High Use" utility data water usage rates were established from summer demand observations, representing the maximum usage month of the year (July 2006). Peaking factors were also established through billing data observations.

Typically, water use estimates for proposed developments within the City of Scottsdale are calculated using demand criteria from the City's Design Standards & Policies Manual (DSPM). This approach was evaluated by CVL in May of 2008 and compared to the criteria from the City's Integrated Master Plan. CVL's assessment showed a large discrepancy between the estimated water usages derived from each set of criteria. The DSPM criteria yielded flow rates that seemed extraordinarily high, while the Integrated Master Plan criteria produced flow rates that were lower but similar to design flow rates used by Arizona American Water Company and Global Water Resources.

In December 2008, CVL sought direction from the City to specify which set of criteria was more realistic and recommendable for Crossroads East preliminary infrastructure planning. The City offered CVL a chronological list of water use estimates that have been performed for this development over the past eight years (see Appendix B), and recommended using the Integrated Master Plan criteria.

In February 2009, CVL received additional direction from the City in regards to applying the unit factor criteria from the Integrated Master Plan to the Crossroads East project. The City stated that all the unit factors found within the design criteria are correlated with a FAR ratio of 0.25. Since the design criteria unit factors use gross parcel area as a basis for determining water demand and wastewater flows, each non-residential area must be adjusted to an equivalent area. This applies to all non-residential parcels with FARs unequal to 0.25 (see Appendix D).

3.3 Water Use Estimates & Modeling Results

Water demand estimates for the entire development, as based on the Integrated Master Plan usage rates, are summarized in Table 3.

Table 3: Water Use Estimates

Section	Adjusted Area[2] [ac]	ADMM [gpm]	MDD [gpm]	PHD [gpm]		ADMM [mgd]	MDD [mgd]	PHD [mgd]
North	901	850	935	1,308		1.22	1.35	1.88
South	853	760	836	1,771		1.09	1.20	1.69
Total	1,754	1,610	1,771	2,479		2.32	2.55	3.57

[1] Calculated Storage = One Average Day Demand = 2.32 MG
[2] See Table 1 and Section 3.2: Adjust Area = Gross Parcel Area x Parcel FAR / 0.25

The City's list of historical water use estimates cites an average day demand of 5.6 mgd, as calculated by Community Development in 2008. Note that this estimate is approximately 2.4 times larger than the water estimate derived from the recommended usage rate criteria.

Results of the water modeling simulation, using the water use estimates listed above and the infrastructure shown in Figure 3, are presented in Table 4. See Appendix D for the complete CVL water modeling data.

The City requires that all daily scenarios meet a minimum pressure requirement of 50 psig. Using the Pressure Zone 4 HGL of 1,750 ft, the modeling analysis indicates that all of the proposed Parcels meet this requirement except Parcels 6 and 7. Inspection of the model's maximum velocity and headloss data indicates that these areas of sub-50 psig pressure are not the result of high headloss rates, but rather from insufficient source pressure. Pressure testing is recommended to determine how much of Parcels 6 & 7 should be included within the next higher zone, Pressure Zone 5.

Table 4: Water Modeling Results

Demand Scenario	Water Demand (gpm)	Pressure (psig)				Maximum Velocity (fps)	Pipe ID
		Minimum	Node	Maximum	Node		
Average Day	1,610	40	10-A	86	J-2	1.22	P-39
Maximum Day	1,771	40	10-A	86	J-2	1.35	P-39
Peak Hour	2,479	40	10-A	85	J-2	1.88	P-39
Max. Day + Fire Flow[1]	5,479	40	10-A	63	J-2	N/A	N/A

[1] Simulated with a fire flow rate of 3,500 gpm.

As indicated by the water modeling results, the existing and planned infrastructure in Pressure Zone 4 has demonstrated maximum day plus a 3,500 gpm fire flow adequacy above 30 psig.

3.4 Recommendations

Per CVL's analysis and coordination with the City of Scottsdale, the following lists this study's site recommendations.

1) Unit Factors: The water demand calculations performed in this study are based on unit factors recommended by the City.
2) Water Campus Capacity: The City has stated that each project, as it comes closer to realization, is considered and prepared for on a priority basis. The City has been aware of the Crossroads East development's pending water needs since 2002, and is willing to work with ASLD to make sure its water demands are met with their northern water campus. The City would not comment on how much excess capacity is currently available at the water treatment plant.
3) Pressure Zone Service: CVL recommends that flow testing be performed along the Legacy Boulevard to obtain current and accurate area pressure data. Per HGL information given by the City, portions of Parcels 6 & 7 may need to be serviced by Pressure Zone 5 to meet the City's minimum pressure requirements. Preliminary modeling indicates that the current existing infrastructure installed within Hayden and Miller Roads is sufficient to serve Parcels 6 & 7 with no undue transmission losses.
4) The Parcels that require the minimal additional infrastructure to obtain adequate City water service are Parcels 4, 5, 6, 7, 10, 11, and 13.

4.0 WASTEWATER SYSTEM

4.1 Existing Infrastructure

The area's existing infrastructure is identified in Appendix F, Figure 4. The wastewater collection lines shown in the map are based on conversations and correspondence with the City of Scottsdale (the "City"), as-builts, and quarter-section map research. Information regarding additional extended area infrastructure may be found in the City's Integrated Wastewater Master Plan maps included in Appendix A. A sketch of the project area infrastructure, given to CVL from the City, is also included in Appendix B.

Crossroads East is planned to include four major internal collector roadways: Legacy Boulevard, Hayden Road, Miller Road, and Union Hills Drive. Of these four roadways, only Hayden Road contains existing infrastructure that is ready for use (dry 12-inch sewer). Legacy Boulevard contains existing dry 8 and 12-inch sewer lines that are constructed to flow into the future Miller Road sewer. All of the wastewater generated from the proposed development will be treated at the City's wastewater reclamation facility at Union Hills Drive and Pima Road. The current average annual capacity of the plant is 20 mgd, and upgrades to 25 mgd are forecasted to begin in 2014.

Crossroads East is within the City's Sub-basin 4 collection area. The area's surrounding existing wastewater collection system flows to the south as it follows the area's natural topography. All of the wastewater in Sub-basin 4 flows to the North Pumpback Station (NPS) or is bypassed to the 91st Avenue WWTP. The NPS has a current pumping capacity of 34 mgd and is forecasted to have an ultimate capacity of 47 mgd. Two 18-inch force mains convey wastewater from the NPS to the wastewater reclamation facility. One of the force mains typically handles all flows up to 18 mgd, while the other is activated when NPS flows consistently exceed 20 mgd. The Integrated Master Plan has indicated that the NPS normally pumps approximately 16 – 18 mgd during peak periods.

4.2 Unit Factors

The proposed development's wastewater generation estimates are based on information found in the City's Integrated Wastewater Master Plan, Table 2.2 (see Appendix C). As recommended by the City, Table 5 lists unit factors interpreted to be representative of the proposed land use allocations shown in Table 1.

Table 5: Wastewater Generation Unit Factors

CVL Land Use Designations	City Land Use Type Designations	ADDMM [gpapd]	Peak Flow [gpapd]
C-2	Business - General	1,173	2,346
C-O	Office - Minor	878	1,756
I-1	Industrial - Minor	561	1,122
R-5	Res. MF	2,060	4,120
PRC	Regional Center	680	1,360
PCC	Community Center	656	1,312
PCoC	Retail - Community	656	1,312

[1] ADDMM = Average Day Demand of Maximum Month
2 Peak Flow = ADDMM x 2.0

4.3 Wastewater Generation Estimates

Wastewater generation estimates for the entire development, as based on the Integrated Master Plan usage rates, are summarized in Table 6.

Table 6: Wastewater Generation Estimates

Section	Adjusted Area[2] [ac]	ADDMM [gpm]	Peak Flow [gpm]		ADDMM [mgd]	Peak Flow [mgd]
North	901	500	1,001		0.72	1.44
South	853	456	913		0.66	1.31
Total	1,754	957	1,913		1.38	2.76

[2] See Table 1 and Section 3.2: Adjust Area = Gross Area x Parcel FAR / 0.25

CVL assessed four alternatives for conveying the development's effluent to the wastewater reclamation facility. Below is a description of each option.

4.3.1 Option 1: Gravity Flow to Hayden Rd and Union Hills Dr.

Original planning for the Crossroads East site entailed the construction of a wastewater collection system that would flow by gravity to the NPS. Wastewater from northern section of the project would drain into collection sewers within Miller and Hayden Roads, as depicted in Figure 4 of Appendix F. These two main collection sewers would converge into an existing 21-inch sewer at the intersection of Hayden Road and Union Hills Drive in route to the NPS.

4.3.2 Option 2: Northern Lift Station

Option 2 uses a lift station to convey flows generated north of the SR101 to the wastewater reclamation facility, while the southern portion of the project flows by gravity to the City's collection system.

The northern lift station system layout is mapped in Figure 5 of Appendix F. Notice that the Miller Road sewer flows to the east at the SR101. It parallels the Freeway and collects the Hayden Road flows with a drop manhole in route to the proposed lift station within Parcel 10. The manhole's flow line is estimated to be 20-feet deep, which is 10-feet under the existing Hayden Road sewer. The lift station is estimated to have an ultimate capacity of 650 gpm with dual 8-inch forcemains (one redundant). The southern portion of the project is designed exactly as described within the gravity flow option.

4.3.3 Option 3: Lift Station serving the West half of Crossroads North

Similar to Option 2, Option 3 uses a lift station to convey flows generated from the western half of the portion of Crossroads north of the SR101 to the wastewater reclamation facility, while the southern portion of the project flows by gravity to the City's collection system. This option utilizes the existing capacity of a 12-inch sewer within Hayden that is able to service the entire eastern half of the portion of Crossroads East.

The northern lift station system layout is mapped in Figure 6 of Appendix F. Notice that the Miller Road sewer flows to the east at SR101 Freeway. The lift station is estimated to have an ultimate capacity of 450 gpm with dual 6-inch forcemains (one redundant). The southern portion of the project is designed exactly as described within the gravity flow option.

4.3.4 Option 4: Gravity Flow to Pima Rd

This option entails draining the portion of Crossroads north of the SR101 by gravity to an existing 21-inch sewer located south of Pima Road along the east side of the 101. The 21-inch then crosses under the 101 Freeway and continues south to the NPS. The southern portion of the project is designed exactly as described within the gravity flow option. Refer to Figure 7 of Appendix F.

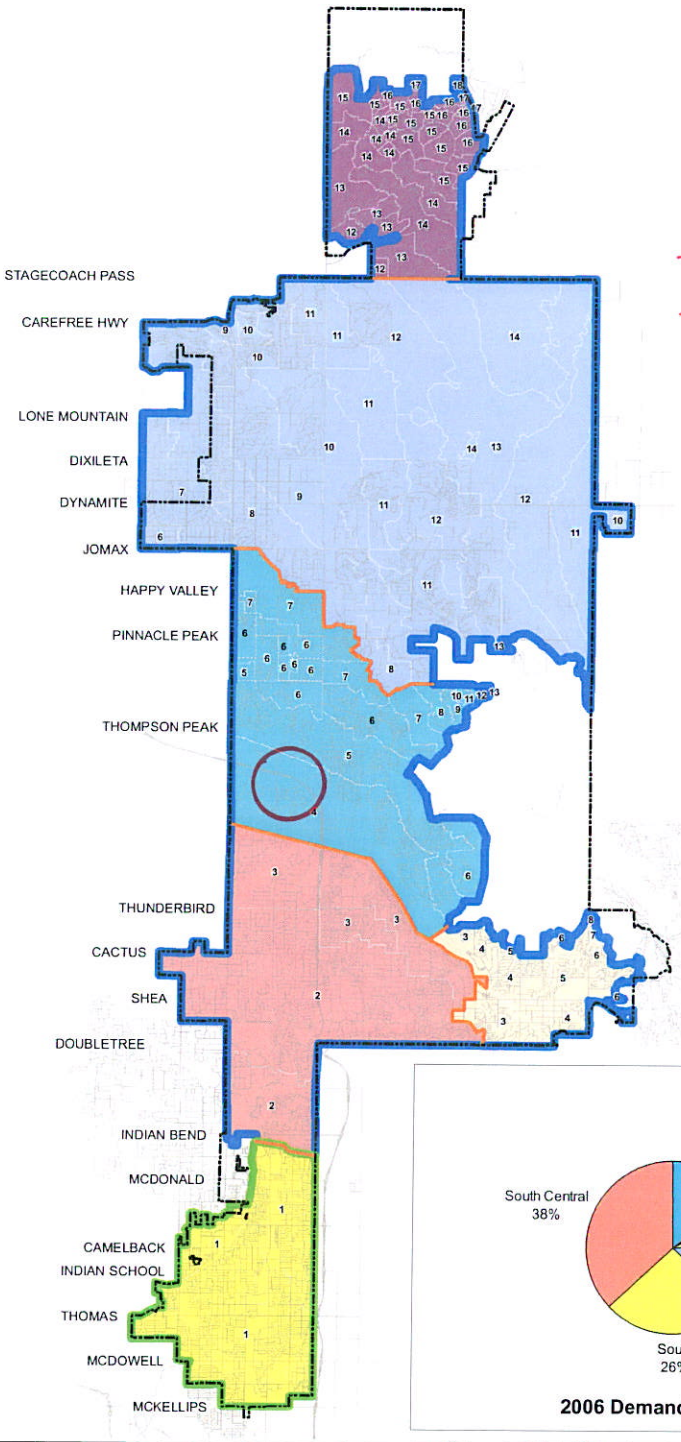
4.4 Recommendations

Per CVL's analysis and coordination with the City of Scottsdale, the following lists this study's site recommendations.

1) Unit Factors: The wastewater generation calculations performed in this study are based on unit factors recommended by the City. They are consistent with the unit factors used to estimate water use for this project.
2) Wastewater Reclamation Facility Capacity: The City has stated that each project, as it comes closer to realization, is considered and prepared for on a priority basis. The City has been aware of this project area's development pending water needs since 2001, and is willing to work with ASLD to ensure that sufficient capacity exists to treat wastewater flows at their northern wastewater reclamation facility. The City would not comment on how much excess capacity is currently available at the wastewater reclamation facility.
3) Parcel 6: Due to adverse topography and insufficient pipe capacity, Parcel 6 can not be served by the existing 8-inch Greyhawk collection line along Parcel 6's northern border. The eastern portion of Parcel 6 can be collected by the existing 12-inch sewer within Hayden Road, while the western portion is expected to ultimately drain into the future Miller Road sewer. Should Parcel 6 be developed before the Miller Road sewer is built, wastewater generated from the west side of Parcel 6 could be pumped into the existing Hayden Road sewer.
4) Hayden Road contains the sole existing sewer, ready for use, within the project boundary. Parcels that border the Hayden Road 12-inch sewer are the most developable, as they would require the least amount of additional conveyance infrastructure to bring online. It shall be noted that there is an existing 12-inch sewer sleeve just east of the Miller Road alignment under the SR101 freeway.
5) In order to evaluate which option is in the best interest of State Trust Land, a Sewer Conceptual Master Plan is recommended and each option will be evaluated based on costs, viability of construction, additional sewer easements needed, and the City of Scottsdale's approval per the City's master planning requirements.

APPENDIX A

2008 City of Scottsdale Integrated Master Planning Exhibits



Zone	Ground Elevation Range (Ft.)
1	1180-1280
1A	1250-1330
2A	1280-1330
2	1330-1440
3	1440-1550
4	1510-1650
4E	1550-1650
5	1650-1790
5E	1650-1750
6	1790-1920
6E	1750-1934
7	1920-2050
7E	1934-2065
8	2050-2180
8E	2065-2200
9	2180-2310
10	2310-2440
11,11E	2440-2570
12,12E	2570-2700
13	2700-2830
14	2830-2960
15	2960-3090
16	3090-3220
17	3220-3350
18	3350-3480

2006 Demand Distribution

Water Service Regions

Region
- Desert Mountain
- North Central
- Central
- East Shea
- South Central
- South

- Water Service Region Divisions
- City Boundary
- CAP Service Area
- SRP Service Area
- 2 Pressure Zone Delineation

This GIS map is a limited representation of facilities, intended for planning purposes only. It is not intended for construction or other purposes requiring greater positional accuracy.

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0 2.5 5

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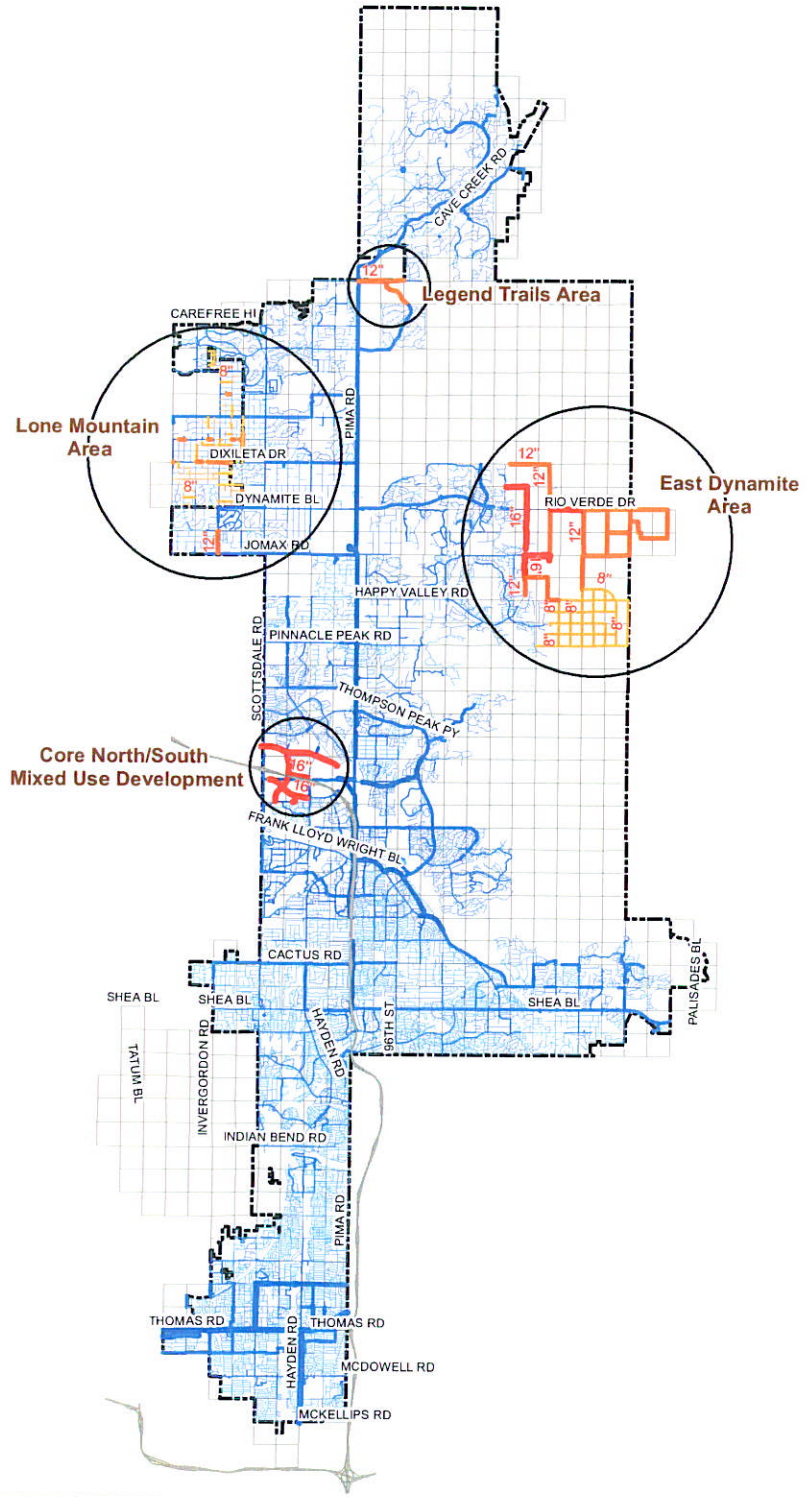
Page 4-26

Figure 4.2

WATER SERVICE AND DROUGHT STUDY REGIONS

2008 Scottsdale Integrated Water Master Plan

M:\Client\Scottsdale\7265b00 Scottsdale Asset Management Project\Analysis\GIS\Maps\Water Chapter 4\Figure 4_2 Pressure Zones and Drought Study Regions.mxd



Future Water Main Diameter
- 6"
- 8"
- 12"
- 16"
- 20"

Existing Water Main Diameter
- 45" - 72"
- 30" - 42"
- 16" - 24"
- 10" - 14"
- 8"
- Less than 8"

- Future Tank
- City Boundary
- Quarter Sections

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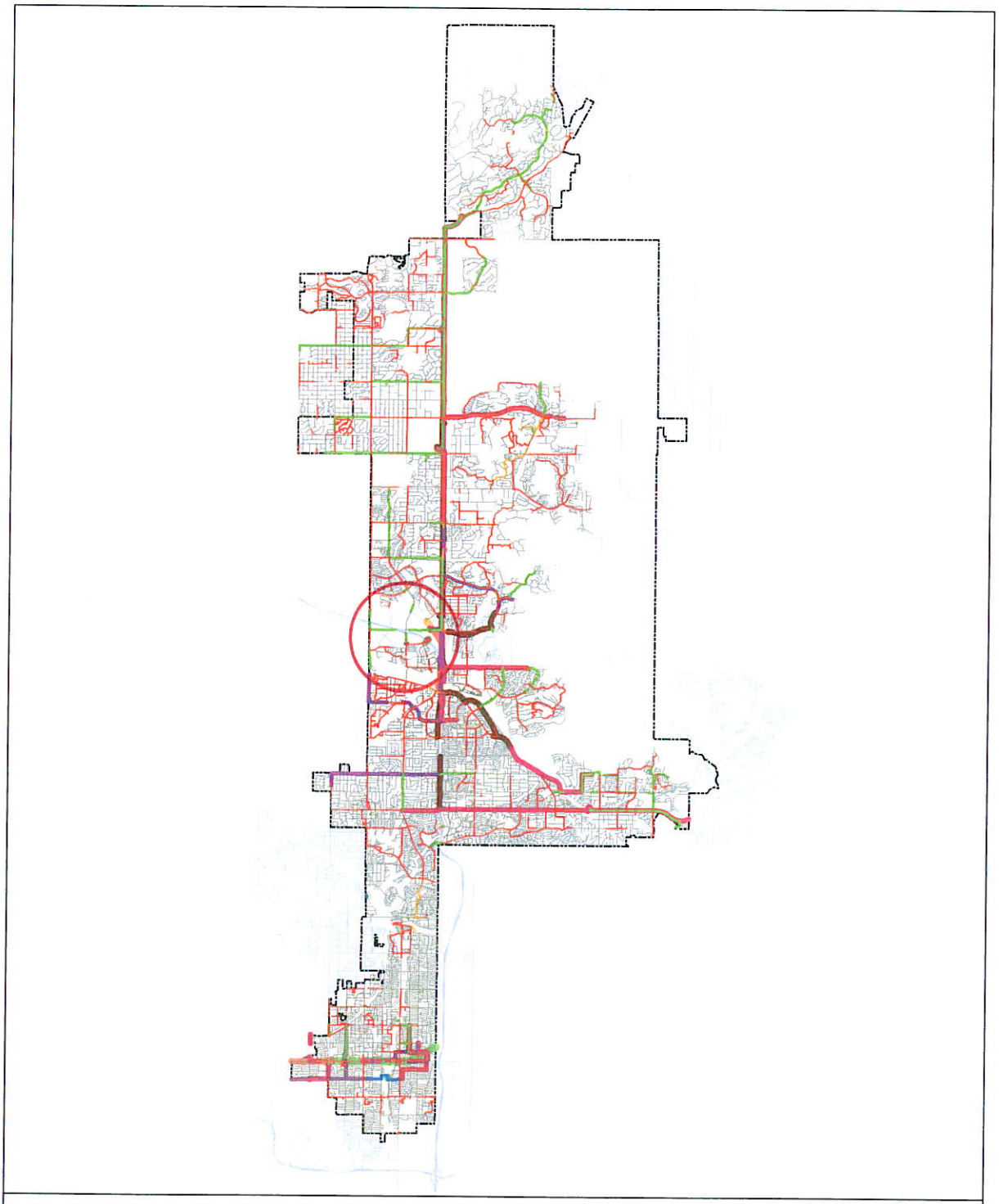
WATER DISTRIBUTION SYSTEM INFRASTRUCTURE TO SERVE NEW DEVELOPMENT

2008 Scottsdale Integrated Water Master Plan

Figure 1.4
Page 1-19

M:\Client\Scottsdale\7265b00 Scottsdale Asset Management Project\Analysis\GIS\Maps\Figure 1_4 W CIP for new dev.mxd



Pipes
Diameter
< 12"
12"
14"
16"
18"
20"
24"
30"
36"
42"
60"
City Boundary
Streets

This GIS map is a limited representation of facilities, intended for planning purposes only. It is not intended for construction or other purposes requiring greater positional accuracy.

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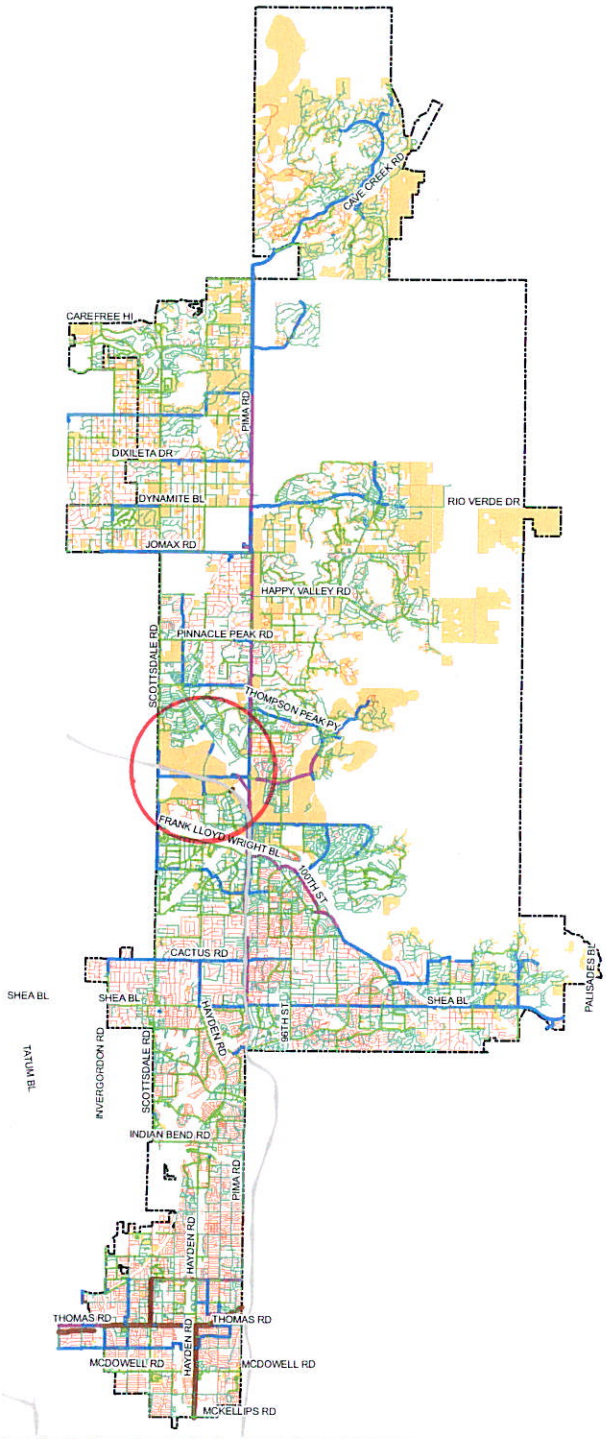
Page 4-25

Figure 4.1

WATER DISTRIBUTION SYSTEM

2008 Scottsdale Integrated Water Master Plan

M:\Client\Scottsdale\7265b00 Scottsdale Asset Management Project\Analysis\GIS\Maps\Water Chapter 4\Figure 4_1 Water Distribution System.mxd



CITY OF SCOTTSDALE ARIZONA

Existing Water Main Diameter

- 45" - 60"
- 30" - 42"
- 16" - 24"
- 10" - 14"
- 8"
- Less than 8"

- City Limits
- Quarter Sections
- Undeveloped Parcels

This GIS map is a limited representation of facilities, intended for planning purposes only. It is not intended for construction or other purposes requiring greater positional accuracy.

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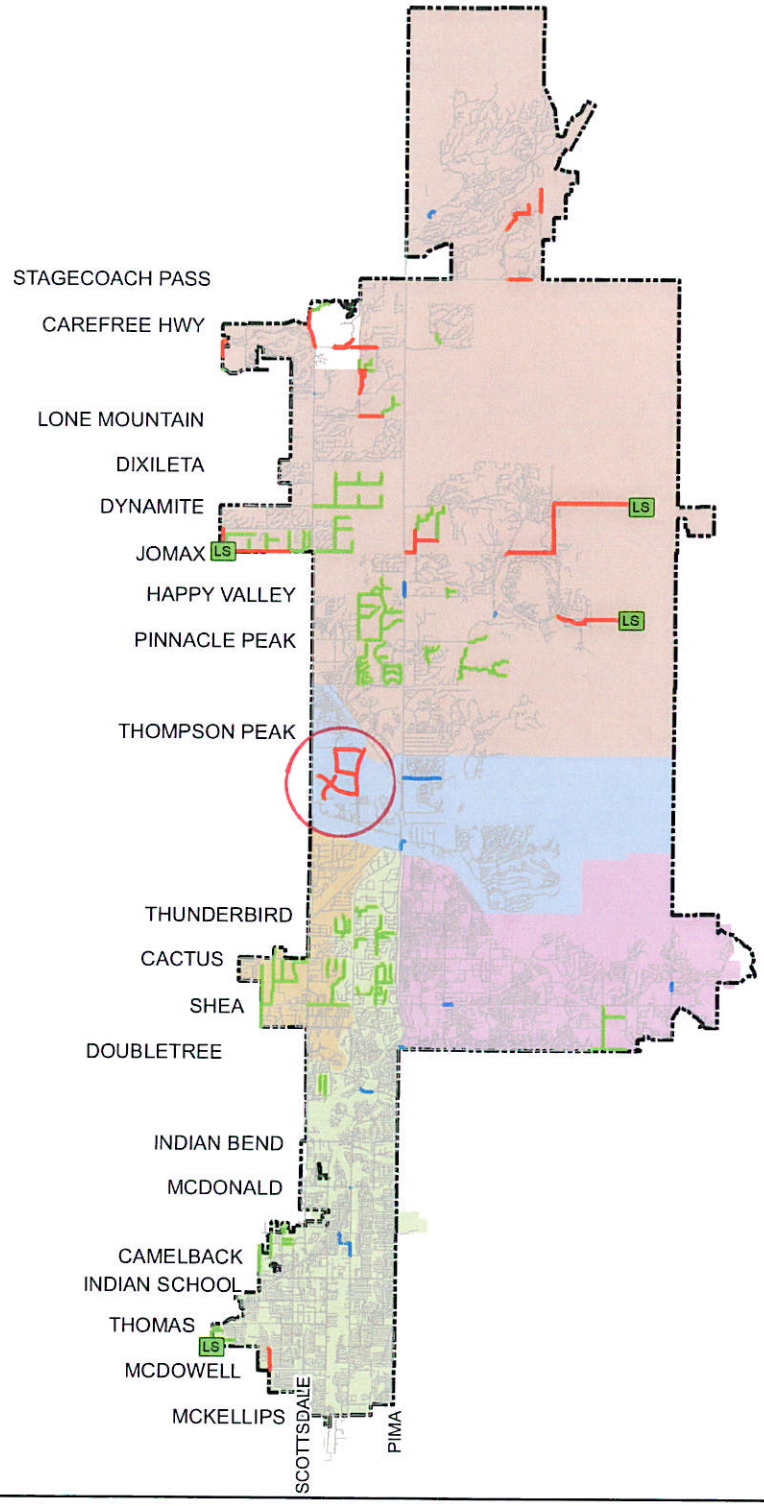
Page 4-30

Figure 4.5

EXISTING WATER DISTRIBUTION SYSTEM AND UNDEVELOPED PARCELS

2008 Scottsdale Integrated Water Master Plan

M:\Client\Scottsdale\7265b00 Scottsdale Asset Management Project\Analysis\GIS\Maps\Water Chapter 4\Figure 4_5 Existing Water Distribution System and Undeveloped Parcels



Proposed Pipes: Undeveloped Areas
Proposed Pipes: Septic Areas
Proposed Pipes: Needing Larger Diameter
Existing Pipes

Sub-Basins
1
2
3
4
5

LS Proposed Lift Stations
Scottsdale Boundary

N

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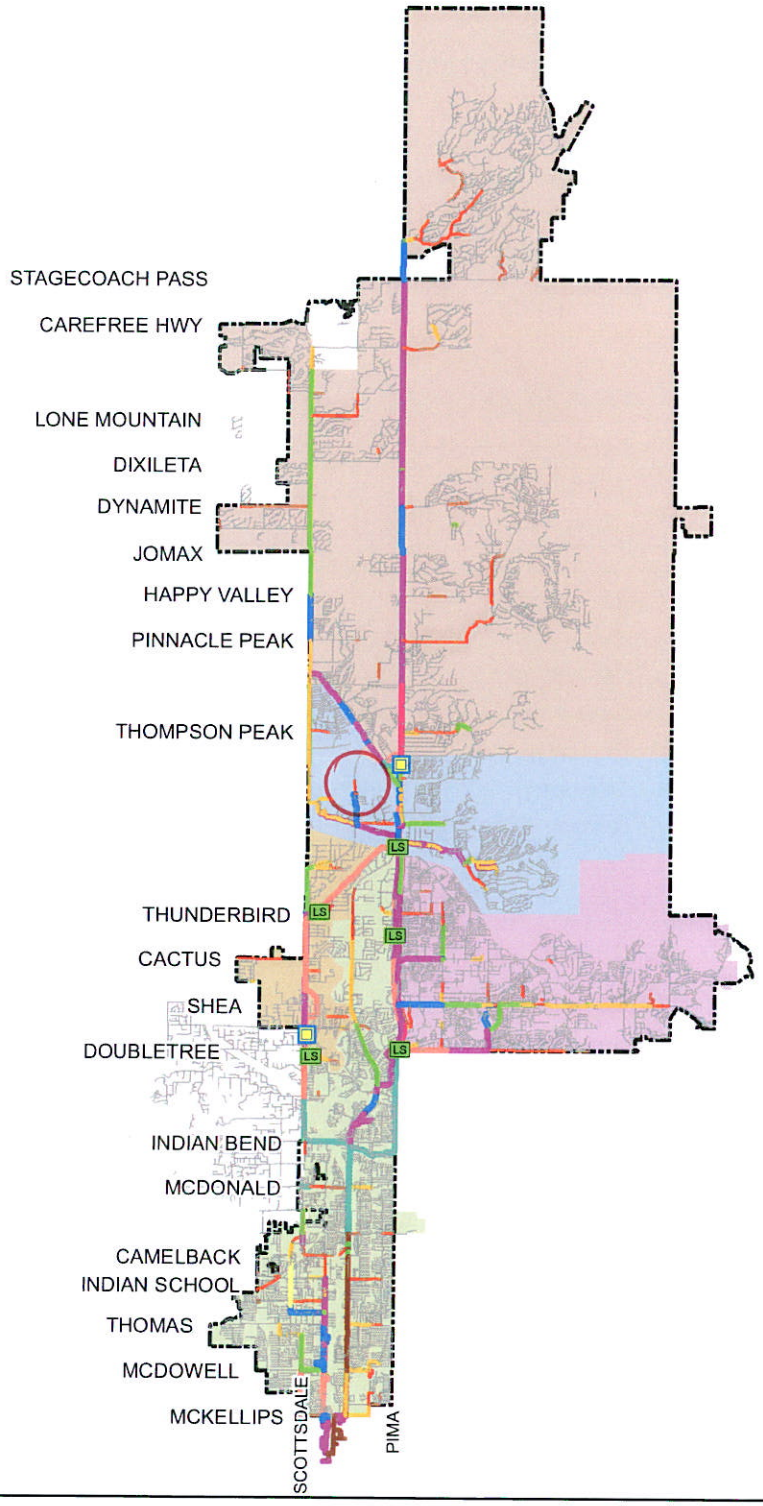
PLANNED WASTEWATER COLLECTION SYSTEM INFRASTRUCTURE AND SEPTIC SYSTEM CONNECTIONS TO SERVE FUTURE GROWTH

2008 Scottsdale Integrated Wastewater Master Plan

Figure 1.5

M:\Client\Scottsdale\7265b00 Scottsdale Asset Management Project\Analysis\GIS\Maps\Wastewater\Figure 1_2 WW Planned Infastr Future.mxd



CITY OF SCOTTSDALE ARIZONA

WRP
LS Pumpback Stations
Scottsdale Boundary

Interceptors Diameter
< 12"
12"
15"
16"
18"
21"
24"
27"
30"
33"
36"
39"
42"

Sub-Basins
1
2
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WASTEWATER COLLECTION SYSTEM AND SUB-BASINS

2008 Scottsdale Integrated Wastewater Master Plan

carollo

Figure 1.2
Page 1-14

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APPENDIX B

City of Scottsdale Coordination Documents

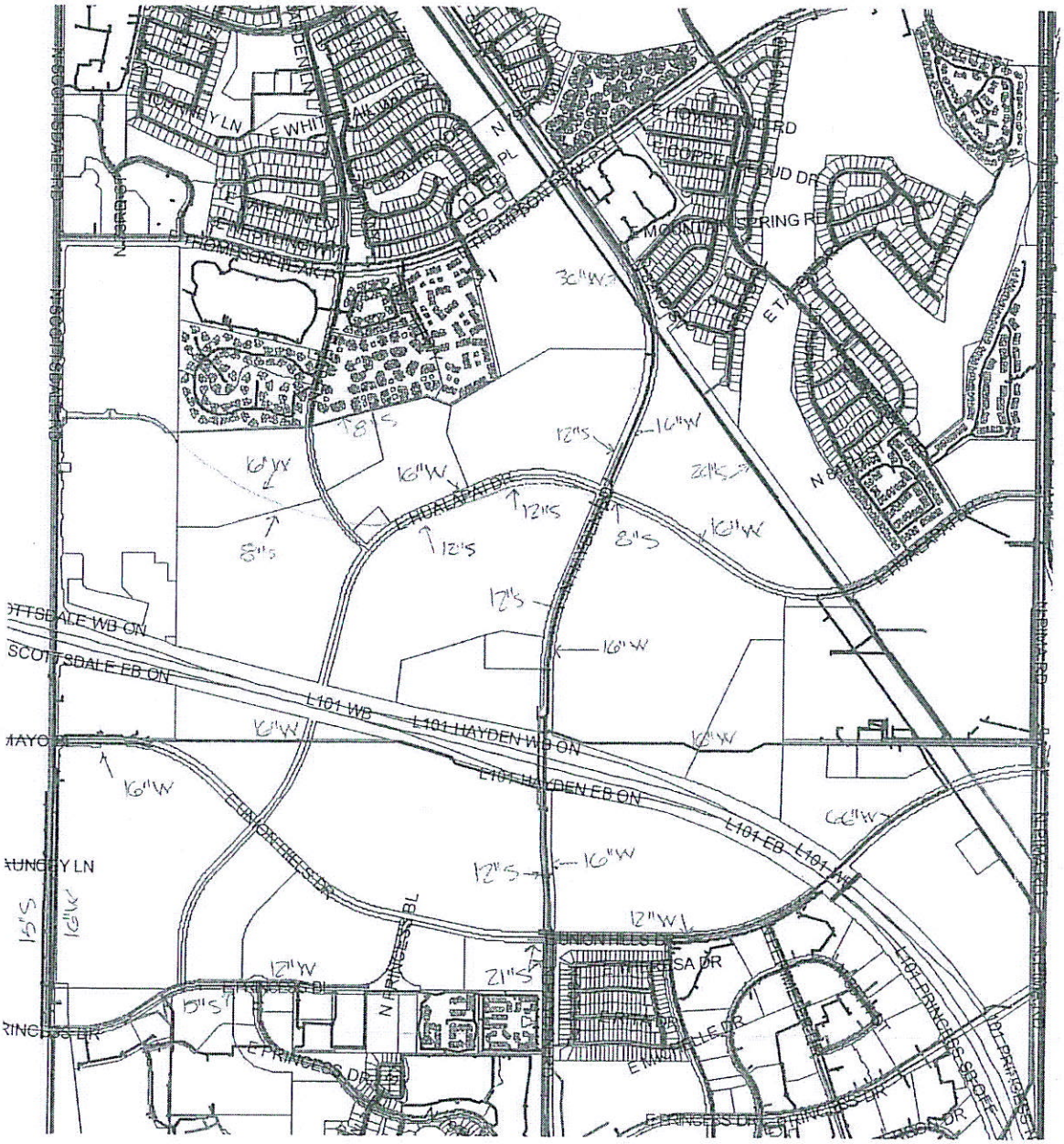
Average Day Core North/South Water and Sewer Demand Estimates
(including One Scottsdale - except as noted) January 2009

	Demands (MGD)		Unit Demand
Source	Water	Sewer	Source
2001 Master Plan	2.1	2.0	MP/Land Use
2002 Comm. Dev.	2.6	2.4	MP/Land Use
2005 MP Update	3.4		MP/Land Use
2008 Comm. Dev.	7.9	6.5	DS+PM/LU
2008 C+VL	9.4	8.0	DS+PM /LU
2008 Comm. Dev.	5.6*		MP/Zoning

* does not include One Scottsdale (~0.25 mgd)

1.7 demand factor (average day to maximum day)

1C


E MOUNTAIN SPRING RD
E THUNDERBIRD RD
E CHUCKWAGON LN
E WHITTEN DR
E HIGHLAND AVE
E HIGHLAND PL
N 56TH ST
N 54TH ST
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N 50TH ST
N 48TH ST
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N 22ND ST
N 20TH ST
N 18TH ST
N 16TH ST
N 14TH ST
N 12TH ST
N 10TH ST
E CAMELBACK RD
E INDIAN SCHOOL RD
E THUNDERBIRD RD
E CHURCHILL DR
E PRINCESS DR
E PRINCESS BL
E PRINCESS CIR
E PRINCESS PL
E PRINCESS WAY
E UNION HILLS DR
E UNION HILLS CT
E WINDSONG DR
E WINDSONG PL
E WINDSONG TRL
E WINDSONG WAY
E WINDSONG CIR
E WINDSONG LN

APPENDIX C

2008 City of Scottsdale Zoning District Definitions and

Integrated Master Planning Unit Factors

Zoning District Definitions

District	Title	Purpose	Development Standards *
R – 5	Multiple Family Residential	Provide for development of multifamily residential neighborhoods as well as hotel and healthcare facilities	23 Du/Ac Max 1,871 Total Dwelling Units Allotted
C – 2	Central Business District	Provide all uses allowed in to C – 1 district as well as uses usually associated with the central business district and shopping facilities not ordinarily compatible with residential development	30% Floor Area Ratio
C – O	Commercial Office	Provide an environment desirable for and conducive to development of office and related uses adjacent to the central business district or other major commercial course	60% Floor Area Ratio
PCC	Planned Community Center	Provide a large variety of goods and is normally found in a typical neighborhood shopping center	30% Floor Area Ratio 50% of FAR will go to Non-Residential 4 Du/Ac Max 48 Total Dwelling Units Allotted
PCoC	Planned Convenience Center	Provide a basic convenience goods and services within walking distance of nearby residences	30% Floor Area Ratio
PRC	Planned Regional Center	Provide for a broad variety of general merchandise, and services in full depth and variety within a planned commercial center; may include office and residential uses carefully interrelated by design	80% Floor Area Ratio 50% of FAR will go to Non-Residential 2,000 sq/ft min gross lot size per dwelling unit 1,524 Total Dwelling Units Allotted
I – 1	Industrial Park	Promote the development of employment in aeronautical activities and an active, landscaped industrial park	50% Floor Area Ratio

*Per Approved Development Agreement

assumed to be the end of the planning period for the City of Scottsdale. The population estimate in the previous master plan was 285,000 by the year 2020. The relatively small increase in population from the previous master plan is primarily due to revitalization and the extended planning period.

Table 2.1 Scottsdale SAZ Population Projections by MAG
2008 Scottsdale Integrated Water Master Plan

Planning Period	Population	Employee Population
2000	204,317	152,116
2005	228,692	166,692
2010	253,066	181,267
2020	287,312	205,887
2025	289,619	210,364
2030	292,706	214,841

Figure 2.1 shows the growth rates for City of Scottsdale Planning Zones A through E within the Scottsdale service area through Year 2030. These planning zones are used by the City for the purposes of developing population growth projections. The population growth rates by planning zones in Figure 2.1 were then used to develop the percent growth or percent buildout in each water service region shown in Figure 2.2. The water service regions shown in Figure 2.2 were established to evaluate water transfers across the system involving major transmission lines, pump stations, and valves located along region boundaries.

2.2.2 Land Use Plan

Water system demands have been estimated based on the land use element of the City's General Plan, together with unit demands per land use category. The land use plan categorizes property parcels based on the current land use for developed areas, and upon the planned use for undeveloped areas. The acreage of each land use category was multiplied by a unit demand per acre to estimate water demands. Development of unit demands and Citywide demand projections are discussed in Sections 2.2.3 and 2.3.3, respectively. Figure 2.3 shows the land use plan that was used in this study.

2.2.3 Unit Demands

Unit water demands used in the 1999 Water Master Plan and 2001 Integrated Water Master Plan were updated in this Master Plan to reflect changes in land use and water use patterns in different parts of the City. The two previous master plans divided the City into two zones with different water use characteristics, namely Planning Zone A (including downtown districts) and Planning Zones B through E. Unit water demands in this Master Plan apply Citywide, as no significant differences were now found between Planning Zone A and the remaining zones. In addition, a new land use category called "Mixed Use" has been incorporated in the Land Use Plan by the City to designate areas where a higher

density of various residential and non-residential users are allowed, particularly in the downtown districts. It has been determined in this Master Plan that on a per acre basis, the water use rate in "Mixed Use" areas was ranked the third highest among all land use categories.

For this Master Plan, unit demands are calculated for three different time periods of the year: winter (minimum), summer (maximum), and annual average demands. Unit water demands were developed from an analysis of Scottsdale's 2006 Utility Billing database using the months of January, April, and July. Water meters were linked to parcel locations through the meter address, and correlated to land use categories.

Table 2.2 summarizes the unit water demand estimates by land use category. The acreage shown in the table represents all the parcels with water meter data used in the analysis. Approximately 63 percent of the accounts in the Utility Billing database were matched to parcels by address resulting in a satisfactory sample size that was used to develop the unit water demands in this Master Plan. The 2006 unit water demands are summarized in terms of gallons per acre per day (gpad) for winter (or low demand), summer (or high demand), and annual average demands.

The April unit demands, originally assumed to be representing the annual average water use, were adjusted by a multiplier of 1.212 to match the actual annual average production in 2006. A comparison with the actual production revealed that the unit demands and the resulting water use in January and July were representative of the minimum and maximum month water demand conditions, respectively, with no adjustments necessary. The unit water demands by land use category shown in Table 2.2 were used to predict the additional water demands from undeveloped parcels by water service area through the Year 2035.

2.2.4 Potable Water Use Peaking Factors

Potable water use peaking factors represent highest water use rates during a day or throughout the year. They are used for long-term planning of water resources to ensure demands are met with adequate redundancy. Peaking factors are also needed for designing and sizing water system infrastructure such as pipelines, pump stations, reservoirs, etc.

Seasonal and diurnal peaking factors for Scottsdale's water system were determined from an analysis of seasonal water use data from the Utility Billing record database, and daily production/pumping records. A global (i.e., applied across all land use categories) multiplier of 1.34 was used in the previous master plan to calculate maximum month demands from annual average demand estimates. A maximum month ratio was not needed in this Master Plan as unit demands for the maximum month (July) were developed from the actual billing data. The multiplier to convert from average month to maximum month demands differs by land use type. A comparison of the average monthly and annual average potable water productions in 2006 yielded a multiplier of approximately 1.25 Citywide.

Table 2.2 Unit Demand Estimates by Land Use Type from 2006 Utility Billing Database

2008 Scottsdale Integrated Water Master Plan

Land Use Type	Subcategory	Area[1] (acres)	Water Use from 2006 Utility Billing (gpad)		
			Low	Average	High
Single Family Residential	1/5 - 1/3 du/ac	2,096	215	285	365
	1/3 - 1/2 du/ac	2,612	312	441	544
	1/2 - 1 du/ac	8,637	624	965	1,269
	1 - 2 du/ac	2,701	1,135	1,652	1,905
	2 - 4 du/ac	8,051	1,459	2,147	2,363
Patio Home and Townhouse Residential	4 - 6 du/ac	1,412	1,711	2,396	2,700
Townhouse Residential	6 - 8 du/ac	1,053	1,870	2,588	2,749
Multi-Family Residential	8 - 12 du/ac	183	2,129	2,591	3,080
	12 - 23 du/ac	1,280	3,030	3,476	3,957
Destination Resort	10 - 25 rm/ac	104	1,024	1,375	1,467
Hotel / Resort	3 - 10 rm/ac	0	1,086	1,230	1,533
	10 - 43 rm/ac	168	4,428	5,015	6,249
Churches	Churches	252	554	592	733
Community Service Facilities	Community Service Facilities	129	383	413	822
Improved Open Spaces	Golf Courses	1,253	140	160	210
	Private Open and Recreation Areas	98	567	820	923
	Public Parks, etc.	298	151	552	1,111
Industrial	Major Industrial	882	884	1,237	1,567
	Minor Industrial	50	660	783	915
Institutional Facilities	Institutional Facilities	39	755	807	744
Mixed Use	Mixed Use	338	2,894	3,857	4,221
Office	Major Office	318	1,206	1,585	2,173
	Minor Office	210	1,058	1,268	1,694
Retail	Community	66	745	960	1,074
	General	726	1,333	1,626	1,749
	Neighborhood	212	570	699	776
	Regional	184	773	904	1,080
	Specialty / Tourism	124	1,250	1,159	1,375
Schools	Schools	630	764	1,411	2,081
Utilities	Utilities	112	1,852	4,155	5,377
TOTAL		**34,220**			

(1) Acreages given here are for parcels that had exact match in the utility billing database by address, and therefore are only a partial representation of the total developed area.

gpad = gallons/acre/day, du/ac = dwelling units per acre, rm/ac = rooms per acre

Planning for water production capacity is based on the annual maximum day demand. For the City of Scottsdale, the maximum day demand is typically about 10 percent greater than the maximum month demand. Therefore, a maximum day to maximum month peaking factor of 1.1 has been used for master planning purposes.

The system-wide peak hour to maximum day factor was determined by analyzing the daily diurnal water use variations from production/pumping records. Figure 2.4 is a summary of diurnal water use patterns for several of Scottsdale's water service areas. Generally, the northern service areas show a much higher peaking factor than the more developed, built out areas in the southern part of the City. This is primarily due to a higher residential/commercial based water use pattern in the north, coupled with a greater influence of construction water use in these developing areas. As these areas are built out, it is expected that the peak hour factor will approach that of the southern area. These observations are consistent with those from the City's previous water master plan. Based on these observations, a peak hour factor of 1.4 was determined to be representative for long-term and Citywide master planning purposes.

The following is a summary of the potable water use peaking factors:

- Maximum Month to Annual Average Day (MM/AAD) = 1.25
- Maximum Day to Maximum Month (MD/MM) = 1.10
- Peak Hour to Maximum Day (PH/MD) = 1.40

2.2.5 Unaccounted For Water

Differences between water production and the Utility Billing records are usually attributable to unaccounted for water (UFW), which reflects system losses such as leaks, fire flows, and other sources of un-metered water losses.

A study that was done in 2004 revealed a UFW factor of approximately 8.9 percent Citywide. This UFW factor was used for the demand projections in this Master Plan considering factors such as the aging of infrastructure, the system expansion, and increasing demands.

It is important to note however, that water use and production records from 2006 show an improvement over the previous years (5.48 percent UFW). This improvement was due to a combination of factors, including the addition of a new meter at the Water Campus, an aggressive meter changeout program conducted by Water Operations, the implementation of a newer and more accurate Utility Billing system, and the ability to track water usage more effectively through implementation of a data warehouse. Should the UFW factor continue to remain at this level, the City should re-evaluate the UFW factor used in future water demand projections.

The population estimate in the previous (2001) master plan was 285,000 people by the year 2020. The increase in population from the previous master plan is primarily due to revitalization and the extended planning period.

Table 2.1 Population Projections
2008 Scottsdale Integrated Wastewater Master Plan

Planning Period	Resident Population	Employee Population	Total Equivalent Population*	Percent Developed
2000	204,317	152,116	255,022	70%
2005	228,692	166,692	284,255	78%
2010	253,066	181,267	313,488	86%
2020	287,312	205,887	355,941	98%
2025	289,619	210,364	359,740	99%
2030	292,706	214,841	364,320	100%

* Total Equivalent Population = Population + 1/3 Employee Population; Based on SAZ 2006 population projections.

2.3.2 Land Use Plan

Wastewater loads have been estimated based on the City's land use element of the General Plan. Unit flows have been defined for each land use category. The land use plan categorizes property parcels based on the current land use for developed areas, and the planned use for undeveloped areas. The acreage of each land use category was multiplied by a unit demand per acre, as defined in the following section, to estimate wastewater loads. Figure 2.4 shows the land use plan that was used in this study.

2.3.3 Unit Loads

Wastewater collection system unit loads were developed based on water consumption from utility billing information, then adjusted to account for the proportion of wastewater that is generated from potable water deliveries. Table 2.2 shows the land use classifications that are used in the City's land use plan. Acreages within each land use classification were correlated directly with water consumption from the utility billing system. January water consumption was used because irrigation water in this month is typically small or negligible. Wastewater load estimates using this method were compared with actual wastewater flows in 2006 to verify that the estimated wastewater loads are consistent with actual annual average day wastewater flows. Additional unit loads and projections for the revitalization area are presented in Appendix A.

Table 2.2 Dry Weather Unit Loads
2008 Scottsdale Integrated Wastewater Master Plan

Land Use Type	Sub-Category	Unit Load Estimate (gpad)
Single Family Residential	1/5 - 1/3 du/ac	92
	1/3 - 1/2 du/ac	134
	1/2 - 1 du/ac	268
	1 - 2 du/ac	488
	2 - 4 du/ac	627
Patio Home and Townhouse Residential	4 - 6 du/ac	1,215
Townhouse Residential	6 - 8 du/ac	1,328
Multi-Family Residential	8 - 12 du/ac	1,448
	12 - 23 du/ac	2,060
Destination Resort	10 - 25 rm/ac	861
Hotel / Resort	3 - 10 rm/ac	977
	10 - 43 rm/ac	3,985
Churches	Churches	277
Community Service Facilities	Community Service Facilities	192
Improved Open Spaces	Golf Courses	0
	Private Open and Recreation Areas	0
	Public Parks, etc.	0
Industrial	Major Industrial	752
	Minor Industrial	561
Institutional Facilities	Institutional Facilities	378
Mixed Use	Mixed Use	1,447
Office	Major Office	1,001
	Minor Office	878
Retail	Community	656
	General	1,173
	Neighborhood	502
	Regional	680
	Specialty/Tourism	1,100
Schools	Schools	382
Utilities	Utilities	1,574

Note:
gpad = gallons/acre/day, du/ac = dwelling units per acre, rm/ac = rooms per acre

2.3.4 Peaking Factors

Scottsdale has a seasonal tourist population that influences the total wastewater load from month to month. Flow data from 2006 was evaluated to determine appropriate seasonal peaking factors. Based on this data, the maximum monthly flow rate was 10 percent above the annual average day flow. The maximum weekly flow rate was 14 percent above the annual average day flow. For planning purposes and to correctly size infrastructure, the maximum month flow (MMF) has been set at 15 percent above the annual average day flow (AADF).

Daily peaking factors were set based on flow monitoring data that was collected in March and April 2006. Appendix E contains a map with the locations where the flow monitoring data was collected and graphs that show the diurnal flow patterns from the field test data for each of the monitored sites. Diurnal flow patterns define the magnitude of the flow peaks that were used in the basin upstream from each flow monitoring point in the City's hydraulic model. The diurnal patterns are different for each basin, and the flow peaks vary between 1.4 and 2.0 times the average daily flow. The flow peaks and diurnal patterns are assumed to be the same in future planning years as was measured in 2006.

2.3.5 Wet Weather Infiltration and Inflow

All wet weather storm simulations used in this Master Plan have been developed in coordination with the "Regional Capacity Management Facilities (RCMF) Project" currently being undertaken by SROG. The purpose of the regional project is to quantify the amount of storm inflow into the SROG interceptors, and then find a way to effectively handle the storm flows, either by constructing SROG flow, equalization or conveyance facilities, or by each community managing the local storm flows independently. Due to the inter-relationship between the SROG system and the Scottsdale system, using a consistent methodology to estimate storm inflows was necessary to ensure a common basis for infrastructure recommendations. In addition, CMOM guidelines elevated the need to evaluate I&I flows when considering collection system capacity. The methodology that was used to estimate the inflow from storms is described in detail in the *"Regional Capacity Management Facilities Project Appendix A4 - City of Scottsdale Rainfall Calibration and 10-Year, 24-Hour Rainfall Event"* report. A brief summary of the methodology is given below.

A 10-year, 24-hour design storm as defined by the Maricopa County Flood Control District was used as the event for which rainfall-derived infiltration and inflow (RDII) was estimated. The definition of this design storm event includes a volume of rainfall and a storm hydrograph. The proportion of rainfall that enters the collection system (RDII) following a storm event was calculated based on a recorded storm event that occurred in Scottsdale on August 2-3, 2005. This storm event was selected because it is the largest storm that has occurred in recent years where recorded flow data is available. The volume of rainfall as measured by a number of rain gauges in and around Scottsdale was compared with the increased volume of wastewater measured at the Water Campus and at the SROG Princess

APPENDIX D

CVL Calculations

Water Use Estimates as based on the City's Integrated Master Plan

Areas North of the SR101												
Parcel	Land Use	Area [ac]	FAR (proposed)	FAR (Eq.)	Adjusted Area [ac]	DU -	ADMM [gpm]	MDD [gpm]	PHD [gpm]	ADMM [gpd]	MDD [gpd]	PHD [gpd]
P5	C-O	25.5	0.6	2.4	61.2	-	72.0	79.2	110.9	103,673	114,040	159,656
P6	R-5	84.2	0.25	1.0	84.2	1,291	231.4	254.5	356.3	333,179	366,497	513,096
P6	PCoC	2.0	0.3	1.2	2.4	-	1.8	2.0	2.8	2,578	2,835	3,970
P7	I-1	72.6	0.5	2.0	145.2	-	92.3	101.5	142.1	132,858	146,144	204,601
P8	PRC	60.0	0.8	3.2	192.0	543	144.0	158.4	221.8	207,360	228,096	319,334
P9	I-1	96.3	0.5	2.0	192.6	-	122.4	134.6	188.5	176,229	193,852	271,393
P9	C-2	34.2	0.3	1.2	41.0	-	49.8	54.8	76.8	71,779	78,957	110,540
P10	C-2	28.7	0.3	1.2	34.4	-	41.8	46.0	64.4	60,236	66,259	92,763
P10	I-1	74.1	0.5	2.0	148.2	-	94.2	103.6	145.0	135,603	149,163	208,829
Subtotal		478	-	-	901	1,834	849.6	934.6	1,308.5	1,223,494	1,345,844	1,884,181

Areas South of the SR101												
Parcel	Land Use	Area [ac]	FAR (proposed)	FAR (Eq.)	Adjusted Area [ac]	DU -	ADMM [gpm]	MDD [gpm]	PHD [gpm]	ADMM [gpd]	MDD [gpd]	PHD [gpd]
P11	C-2	29.8	0.3	1.2	35.8	-	43.4	47.8	66.9	62,544	68,799	96,318
P12	I-1	70.4	0.5	2.0	140.8	-	89.5	98.4	137.8	128,832	141,715	198,401
P12	C-2	38.8	0.3	1.2	46.6	-	56.6	62.2	87.1	81,433	89,577	125,407
P13	I-1	69.6	0.5	2.0	139.2	-	88.5	97.3	136.2	127,368	140,105	196,147
P14	PRC	108.3	0.8	3.2	346.6	981	259.9	285.9	400.3	374,285	411,713	576,399
P15	PCC	12.0	0.3	1.2	14.4	48.0	10.7	11.8	16.5	15,466	17,012	23,817
P15	R-5	37.8	0.25	1.0	37.8	580	103.9	114.3	160.0	149,575	164,532	230,345
P15	C-O	38.2	0.6	2.4	91.7	-	107.9	118.6	166.1	155,306	170,837	239,171
Subtotal		405	-	-	853	1,609	760.3	836.3	1,170.8	1,094,809	1,204,289	1,686,005

Grand Totals		883	-	-	1,754	3,443	1,610	1,771	2,479	2.32	2.55	3.57

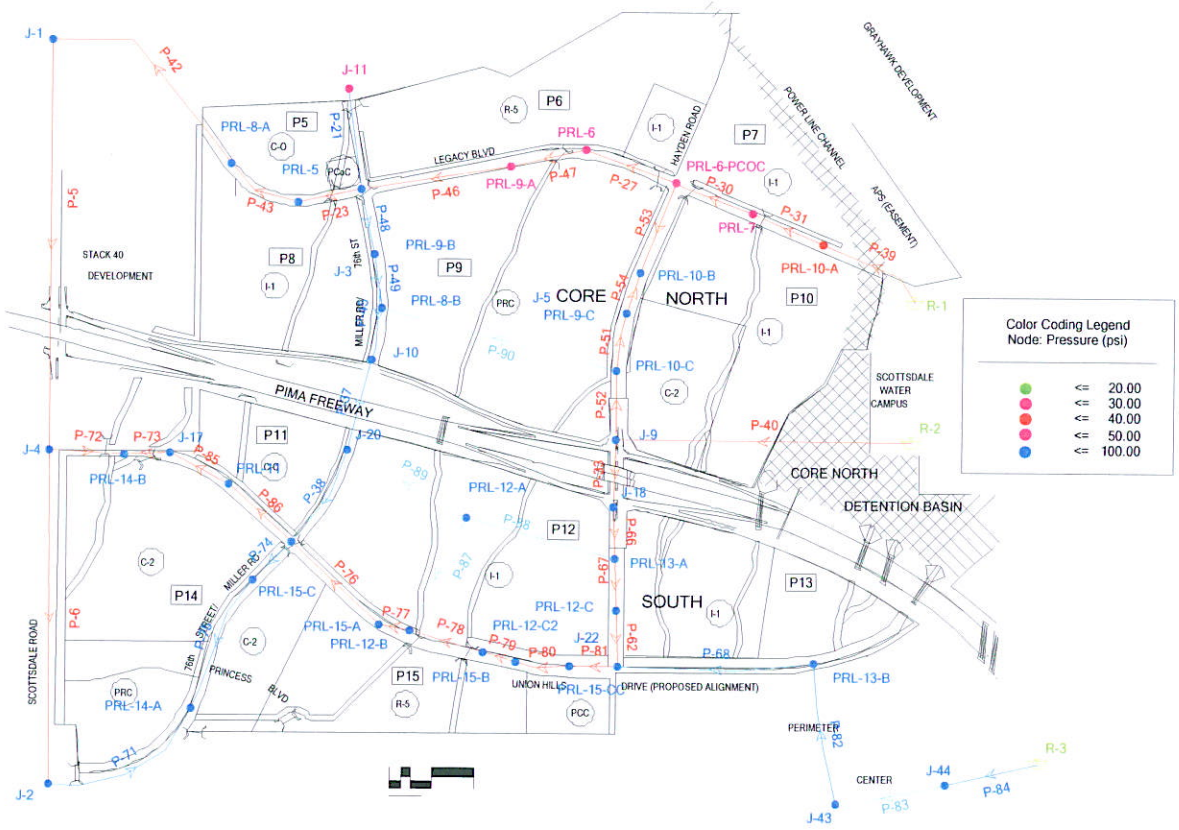
Wastewater Generation Estimates as based on the City's Integrated Master Plan

Areas North of the SR101											
Parcel	Land Use	Area [ac]	FAR (proposed)	FAR (Eq.)	Adjusted Area [ac]	DU -	AADF [gpm]	PF [gpm]		AADF [gpd]	PF [gpd]
P5	C-O	25.5	0.6	2.4	61.2	-	37.3	74.6		53,734	107,467
P6	R-5	84.2	0.25	1.0	84.2	1,291	120.5	240.9		173,452	346,904
P6	PCoC	2.0	0.3	1.2	2.4	-	1.1	2.2		1,574	3,149
P7	I-1	72.6	0.5	2.0	145.2	-	56.6	113.1		81,457	162,914
P8	PRC	60.0	0.8	3.2	192.0	543	90.7	181.3		130,560	261,120
P9	I-1	96.3	0.5	2.0	192.6	-	75.0	150.1		108,049	216,097
P9	C-2	34.2	0.3	1.2	41.0	-	33.4	66.9		48,140	96,280
P10	C-2	28.7	0.3	1.2	34.4	-	28.1	56.1		40,398	80,796
P10	I-1	74.1	0.5	2.0	148.2	-	57.7	115.5		83,140	166,280
Subtotal		478	-	-	901	1,834	500.4	1,000.7		720,504	1,441,008
Areas South of the SR101											
Parcel	Land Use	Area [ac]	FAR (proposed)	FAR (Eq.)	Adjusted Area [ac]	DU -	AADF [gpm]	PF [gpm]		AADF [gpd]	PF [gpd]
P11	C-2	29.8	0.3	1.2	35.8	-	29.1	58.3		41,946	83,893
P12	I-1	70.4	0.5	2.0	140.8	-	54.9	109.7		78,989	157,978
P12	C-2	38.8	0.3	1.2	46.6	-	37.9	75.9		54,615	109,230
P13	I-1	69.6	0.5	2.0	139.2	-	54.2	108.5		78,091	156,182
P14	PRC	108.3	0.8	3.2	346.6	981	163.7	327.3		235,661	471,322
P15	PCC	12.0	0.3	1.2	14.4	48.0	6.6	13.1		9,446	18,893
P15	R-5	37.8	0.25	1.0	37.8	580	54.1	108.2		77,868	155,736
P15	C-O	38.2	0.6	2.4	91.7	-	55.9	111.8		80,495	160,990
Subtotal		405	-	-	853	1,609	456.3	912.7		657,112	1,314,223
Grand Totals		883	-	-	1,754	3,443	957	1,913		1.38	2.76

Wastewater Collection System Analysis: Depth Calculations – See Figure 5

Start MH	End MH	Length (feet)	Line Diameter (inches)	Sewer Line Slope (ft/ft)	Start NG Rim Elevation (feet)	Start Invert Elevation	Calc End Invert Elevation	Start MH Cover (feet)	Mid-line Bend Drops (ft)	Collector Drop - From Start (ft)
Preliminary Collection System Calculations - See Figure 5										
North										
N1	**N2**	1,750	8	0.0141	1,640	1,632.33	1,607.39	7.0	0.4	
N2	**N3**	1,620	8	0.0053	1,615	1,607.29	1,598.38	7.0	0.3	0.1
N3	**N4**	2,430	12	0.0031	1,615	1,597.95	1,589.92	16.1	0.5	0.1
N4	**LS**	1,115	12	0.0031	1,615	1,589.82	1,586.14	24.2	0.2	0.1
LS	-	-	12	-	1,610	1,586.04	-	23.0	-	0.1
South										
S1	**S2**	1,150	8	0.0084	1,595	1,587.33	1,577.44	7.0	0.2	
S2	**S3**	3,410	12	0.0035	1,585	1,577.01	1,564.53	7.0	0.7	0.1
S3	**S4**	225	21	0.0031	1,583	1,563.68	1,562.94	17.6	0.0	0.1
S4	-	-	21	-	1,581	1,562.94	-	16.3	-	0.0
UH1	**S3**	2,900	8	0.0081	1,600	1,591.33	1,567.40	8.0	0.6	
S3	-	-	21	-	1,583	1,566.22	-	**15.0**	-	0.1

Scenario: PHD



Scenario: PHD
Steady State Analysis
Junction Report

Label	Elevation (ft)	Demand (Calculated) (gpm)	Pressure (psi)	Calculated Hydraulic Grade (ft)
PRL-10-A	1,657.00	72.50	39.85	1,749.10
PRL-7	1,655.00	142.08	40.47	1,748.54
PRL-9-A	1,650.00	94.23	42.14	1,747.40
PRL-6	1,650.00	356.31	42.21	1,747.57
PRL-6-PCOC	1,650.00	2.76	42.44	1,748.08
J-11	1,647.00	0.00	43.33	1,747.15
J-1	1,630.00	0.00	50.63	1,747.02
PRL-8-A	1,630.00	110.88	50.65	1,747.06
J-3	1,630.00	0.00	50.69	1,747.15
PRL-10-B	1,630.00	72.50	51.09	1,748.08
PRL-9-C	1,630.00	76.77	51.09	1,748.08
PRL-5	1,628.00	110.88	51.53	1,747.09
PRL-9-B	1,625.00	94.23	52.83	1,747.11
PRL-10-C	1,620.00	64.42	55.42	1,748.09
J-43	1,620.00	0.00	55.44	1,748.13
J-44	1,620.00	0.00	56.16	1,749.81
PRL-8-B	1,615.00	110.88	57.16	1,747.11
J-10	1,610.00	0.00	59.31	1,747.09
J-9	1,610.00	0.00	59.77	1,748.15
J-20	1,600.00	0.00	63.63	1,747.07
PRL-12-A	1,600.00	45.92	63.68	1,747.19
J-18	1,600.00	0.00	64.01	1,747.94
J-4	1,590.00	0.00	67.91	1,746.96
PRL-13-A	1,590.00	68.11	68.27	1,747.78
PRL-13-B	1,590.00	68.11	68.29	1,747.85
PRL-15-C	1,585.00	166.09	70.05	1,746.91
PRL-11	1,585.00	66.73	70.08	1,746.98
J-5	1,585.00	0.00	70.10	1,747.02
PRL-12-C	1,585.00	45.92	70.39	1,747.70
PRL-14-B	1,580.00	200.14	72.24	1,746.96
J-17	1,580.00	0.00	72.24	1,746.97
PRL-15-B	1,580.00	79.99	72.38	1,747.28
PRL-12-C2	1,580.00	87.09	72.40	1,747.35
PRL-15-CC	1,580.00	16.48	72.47	1,747.49
J-22	1,580.00	0.00	72.52	1,747.62
PRL-15-A	1,570.00	79.99	76.64	1,747.13
PRL-12-B	1,570.00	45.92	76.65	1,747.17
PRL-14-A	1,560.00	200.14	80.85	1,746.87
J-2	1,550.00	0.00	85.20	1,746.93

Scenario: PHD
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Discharge (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-39	1,063.00	16.0	1,180.77	1.88	0.85
P-31	741.00	16.0	-1,108.27	1.77	0.76
P-83	1,088.00	8.0	-262.85	1.68	1.54
P-40	2,784.00	16.0	-1,035.46	1.65	0.67
P-30	777.00	16.0	-966.18	1.54	0.59
P-27	897.00	16.0	-951.72	1.52	0.57
P-66	481.00	16.0	701.40	1.12	0.32
P-33	639.00	16.0	701.40	1.12	0.32
P-81	446.00	16.0	-653.77	1.04	0.28
P-80	525.00	16.0	-637.29	1.02	0.27
P-47	731.00	16.0	-595.41	0.95	0.24
P-79	325.00	16.0	-550.20	0.88	0.21
P-90	2,297.00	8.0	-132.07	0.84	0.43
P-88	1,445.00	8.0	-128.33	0.82	0.41
P-67	485.00	16.0	504.96	0.81	0.18
P-46	1,413.00	16.0	-501.18	0.80	0.17
P-78	719.00	16.0	-470.22	0.75	0.15
P-84	901.00	12.0	-262.85	0.75	0.21
P-82	1,353.00	12.0	-262.85	0.75	0.21
P-74	508.00	12.0	261.68	0.74	0.21
P-62	539.00	16.0	459.03	0.73	0.15
P-77	298.00	16.0	-448.92	0.72	0.14
P-76	1,132.00	16.0	-368.94	0.59	0.10
P-23	606.00	16.0	-359.63	0.57	0.09
P-68	1,852.00	12.0	-194.73	0.55	0.12
P-52	656.00	16.0	-334.05	0.53	0.08
P-48	621.00	12.0	141.55	0.40	0.07
P-43	772.00	16.0	-248.75	0.40	0.05
P-86	814.00	16.0	-233.54	0.37	0.04
P-89	1,297.00	8.0	-57.78	0.37	0.09
P-38	1,020.00	12.0	126.29	0.36	0.05
P-71	1,661.00	12.0	-104.54	0.30	0.04
P-75	1,357.00	12.0	95.59	0.27	0.03
P-73	425.00	16.0	-166.81	0.27	0.02
P-85	637.00	16.0	-166.81	0.27	0.02
P-5	3,887.00	16.0	137.87	0.22	0.02
P-42	2,252.00	16.0	-137.87	0.22	0.02
P-51	543.00	16.0	-137.57	0.22	0.02
P-45	850.00	12.0	68.51	0.19	0.02
P-37	896.00	12.0	68.51	0.19	0.02
P-6	3,162.00	16.0	104.54	0.17	0.01
P-87	1,197.00	8.0	24.63	0.16	0.02
P-49	516.00	12.0	47.32	0.13	0.01
P-54	403.00	16.0	-60.80	0.10	0.00
P-72	704.00	16.0	33.33	0.05	0.00
P-53	911.00	16.0	11.71	0.02	0.00
P-21	951.00	12.0	0.00	0.00	0.00

Scenario: PHD
Steady State Analysis
Reservoir Report

Label	Elevation (ft)	Calculated Hydraulic Grade (ft)	Outflow (gpm)
R-1	1,750.00	1,750.00	1,180.77
R-2	1,750.00	1,750.00	1,035.46
R-3	1,750.00	1,750.00	262.85

Scenario: MD+FF
Fire Flow Analysis
Fire Flow Report

Label	Elevation (ft)	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Total Flow Needed (gpm)	Total Flow Available (gpm)	Minimum Pressure (psi)	Calculated Residual Pressure (psi)
PRL-10-A	1,657.00	true	true	3,551.79	5,051.79	40.03	36.09
PRL-7	1,655.00	true	true	3,601.49	5,101.49	40.76	35.44
PRL-9-A	1,650.00	true	true	3,567.31	5,067.31	42.66	32.31
PRL-6	1,650.00	true	true	3,754.51	5,254.51	42.70	33.75
PRL-6-PCOC	1,650.00	true	true	3,501.97	5,001.97	42.82	36.66
J-11	1,647.00	true	false	3,500.00	3,065.08	43.90	30.00
J-1	1,630.00	true	true	3,500.00	5,000.00	51.23	33.97
PRL-8-A	1,630.00	true	true	3,579.20	5,079.20	51.24	36.25
J-3	1,630.00	true	true	3,500.00	5,000.00	51.26	39.32
PRL-10-B	1,630.00	true	true	3,551.79	5,051.79	51.47	44.39
PRL-9-C	1,630.00	true	true	3,554.83	5,054.84	51.47	44.39
PRL-5	1,628.00	true	true	3,579.20	5,079.20	52.11	38.63
PRL-9-B	1,625.00	true	true	3,567.31	5,067.31	53.41	37.29
PRL-10-C	1,620.00	true	true	3,546.01	5,046.01	55.80	49.09
J-43	1,620.00	true	true	3,500.00	4,299.39	55.81	30.00
J-44	1,620.00	true	true	3,500.00	5,000.00	56.20	43.06
PRL-8-B	1,615.00	true	true	3,579.20	5,079.20	57.74	40.67
J-10	1,610.00	true	true	3,500.00	5,000.00	59.90	40.73
J-9	1,610.00	true	true	3,500.00	5,000.00	60.14	54.24
J-20	1,600.00	true	true	3,500.00	5,000.00	64.22	47.21
PRL-12-A	1,600.00	true	true	3,532.80	4,887.53	64.25	30.00
J-18	1,600.00	true	true	3,500.00	5,000.00	64.42	56.81
J-4	1,590.00	true	true	3,500.00	5,000.00	68.52	52.58
PRL-13-A	1,590.00	true	true	3,548.65	5,048.65	68.71	60.19
PRL-13-B	1,590.00	true	true	3,548.65	5,048.65	68.72	41.65
PRL-15-C	1,585.00	true	true	3,618.64	5,118.64	70.67	50.63
PRL-11	1,585.00	true	true	3,547.66	5,047.66	70.69	55.67
J-5	1,585.00	true	true	3,500.00	5,000.00	70.70	57.38
PRL-12-C	1,585.00	true	true	3,532.80	5,032.80	70.85	61.52
PRL-14-B	1,580.00	true	true	3,642.96	5,142.96	72.85	56.92
J-17	1,580.00	true	true	3,500.00	5,000.00	72.85	57.17
PRL-15-B	1,580.00	true	true	3,557.13	5,057.13	72.92	61.09
PRL-12-C2	1,580.00	true	true	3,562.20	5,062.21	72.94	61.46
PRL-15-CC	1,580.00	true	true	3,511.77	5,011.77	72.97	62.26
J-22	1,580.00	true	true	3,500.00	5,000.00	73.00	63.14
PRL-15-A	1,570.00	true	true	3,557.13	5,057.13	77.21	64.53
PRL-12-B	1,570.00	true	true	3,532.80	5,032.80	77.22	64.87
PRL-14-A	1,560.00	true	true	3,642.96	5,142.96	81.48	54.69
J-2	1,550.00	true	true	3,500.00	5,000.00	85.82	62.90

APPENDIX E

CVL Correspondence

From: Mann, Doug [mailto:DMANN@SCOTTSDALEAZ.GOV]
Sent: Friday, March 20, 2009 8:29 AM
To: Sandy Skidmore; Ekblaw, Kroy; medelman@land.az.gov; mfarley@land.az.gov
Cc: Eric Laurin; Anderson, Scott L.
Subject: RE: Crossroads East Update Memo

We are in agreement with using the unit demands from our city's master plans.

I recommend you use a "FAR adjustment factor" or "density demand factor" to account for the proposed increases in FAR from the baseline 0.25. Adjusting the acreage will lead to confusion.

Please carry out the demand calculations for each parcel (P5 thru P15) so you can evaluate how much water/wastewater needs to move where, and thus verify the necessary infrastructure sizing.

Thanks, Doug

From: Mann, Doug [mailto:DMANN@SCOTTSDALEAZ.GOV]
Sent: Thursday, January 22, 2009 9:41 AM
To: CVL
Subject: RE: Core N/S - Existing Water/Sewer

The sewer in Center pretty much follows the topography (see flow direction arrows on attachment).
The Miller sewer is not in and is only stubbed north and south at Miller.
The sewer east of Hayden in Center is not in; only stubbed out east.

From: Mann, Doug [mailto:DMANN@SCOTTSDALEAZ.GOV]
Sent: Thursday, January 22, 2009 7:03 AM
To: CVL
Subject: RE: Core N/S - Existing Water

- The GIS maps are updated when as-builts become available. The Center Drive (Hualapai alignment) line is not complete as of yet and is in fact still under construction thru the Corrigan property (One Scottsdale). I upsized the line in "Hualapai" from Hayden to the power line corridor at the water campus from 16 to 24 and it was installed as such. The sketch info I gave you is incorrect at that location. It remains a 16 inch line from Scottsdale Road to Hayden though.

- No, the 12 inch line terminates in UHD west of the 101. The 66 inch line is a raw water feed to our plant.

- Wood/Patel used 1764 for the source Zone 4 HGL 1910 for the source Zone 5 HGL in the One Scottsdale master plan. HGLs in the One Scottsdale area generally appeared to be in the 1750 and 1860 range for the peak hour analysis.

From: Mann, Doug [mailto:DMANN@SCOTTSDALEAZ.GOV]
Sent: Friday, January 09, 2009 4:57 PM
To: CVL
Subject: RE: ASLD Follow Up Question

I am guessing you are eluding to excess plant capacity, as we certainly will have capacity for the planned development of the Crossroads East area as it occurs.

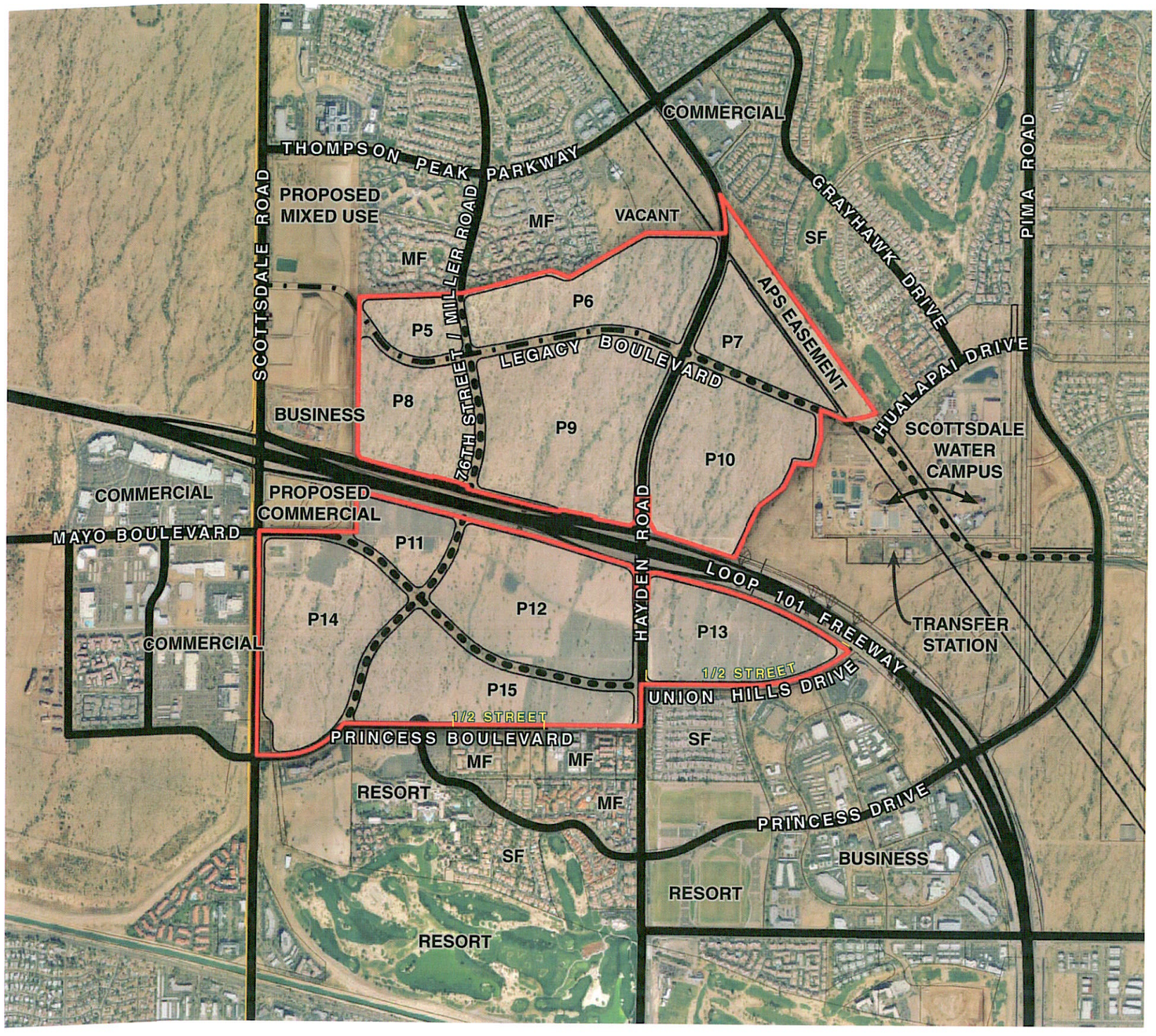
Excess capacity is not a yes/no type question by any means. Both the water treatment and wastewater reclamation plant have planned expansions to meet increasing demand as it is projected to occur. Recent economic indicators have deferred some of these timelines. Additionally, we are studying areas of potential redevelopment within Scottsdale along with any impacts that changes in land use or zoning may have on our system. I cannot state that there is "x" amount of excess plant capacity for any specific project.

The best way to approach this is to understand that the City feels confident that we can provide quality water and wastewater service to development and redevelopment as it may occur in the years to come. If the Crossroads East area, Airpark area, or other portions of our service area realize growth or density increases in excess of our current master planning efforts, we will need to address them as they become apparent and make the necessary adjustments to our water and wastewater programs. And do keep in mind that will impact other city services as well.

As for pipe capacity I would use the 2 to 8 feet per second rule for average and max day demands.

APPENDIX F

Report Figures



LEGEND

- PROJECT BOUNDARY
- EXISTING ROADWAY ALIGNMENT
- ROADWAY ALIGNMENTS UNDER CONSTRUCTION
- PROPOSED ROADWAY ALIGNMENT

N

CVL

0" 400" 800" 1600"

TO SCALE AT 11X17

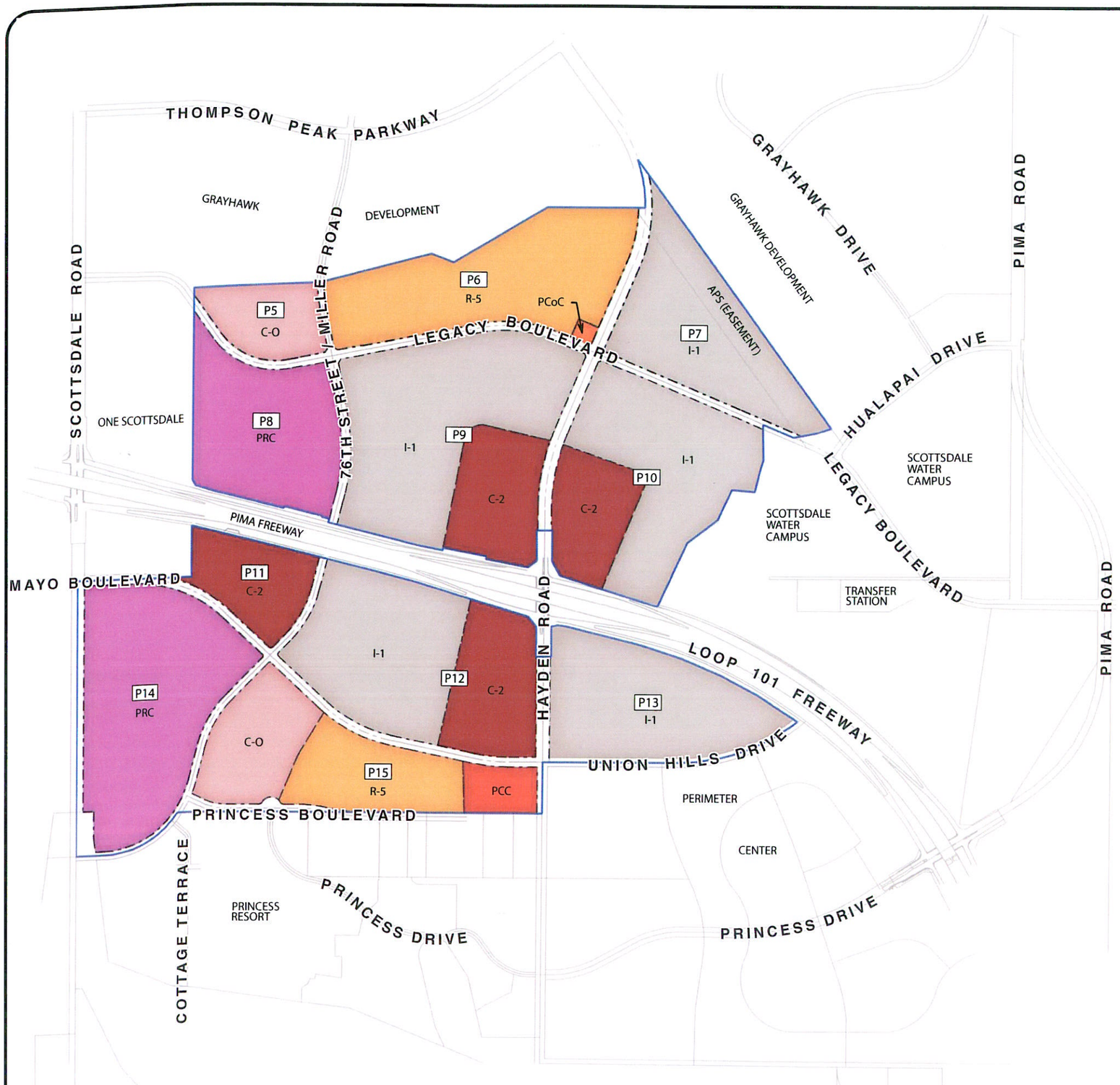
CROSSROADS EAST

SITE CONDITIONS

COE & VAN LOO
PLANNING ENGINEERING LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO
07-0133901

FIGURE
1



ZONING/LAND USE PLAN

- R-5 MULTIPLE FAMILY
- C-2 CENTRAL BUSINESS
- C-0 COMMERCIAL/OFFICE
- PCC PLANNED COMMUNITY CENTER
- PCoC PLANNED CONVENIENCE CENTER
- PRC PLANNED REGIONAL CENTER (MIXED USE)
- I-1 INDUSTRIAL PARK
- PARCEL BOUNDARY (NET)
- PROJECT BOUNDARY (GROSS)
- P8 PARCEL NUMBER

N

CVL

0" 600" 1200" 2400"

TO SCALE AT 11X17

CROSSROADS EAST

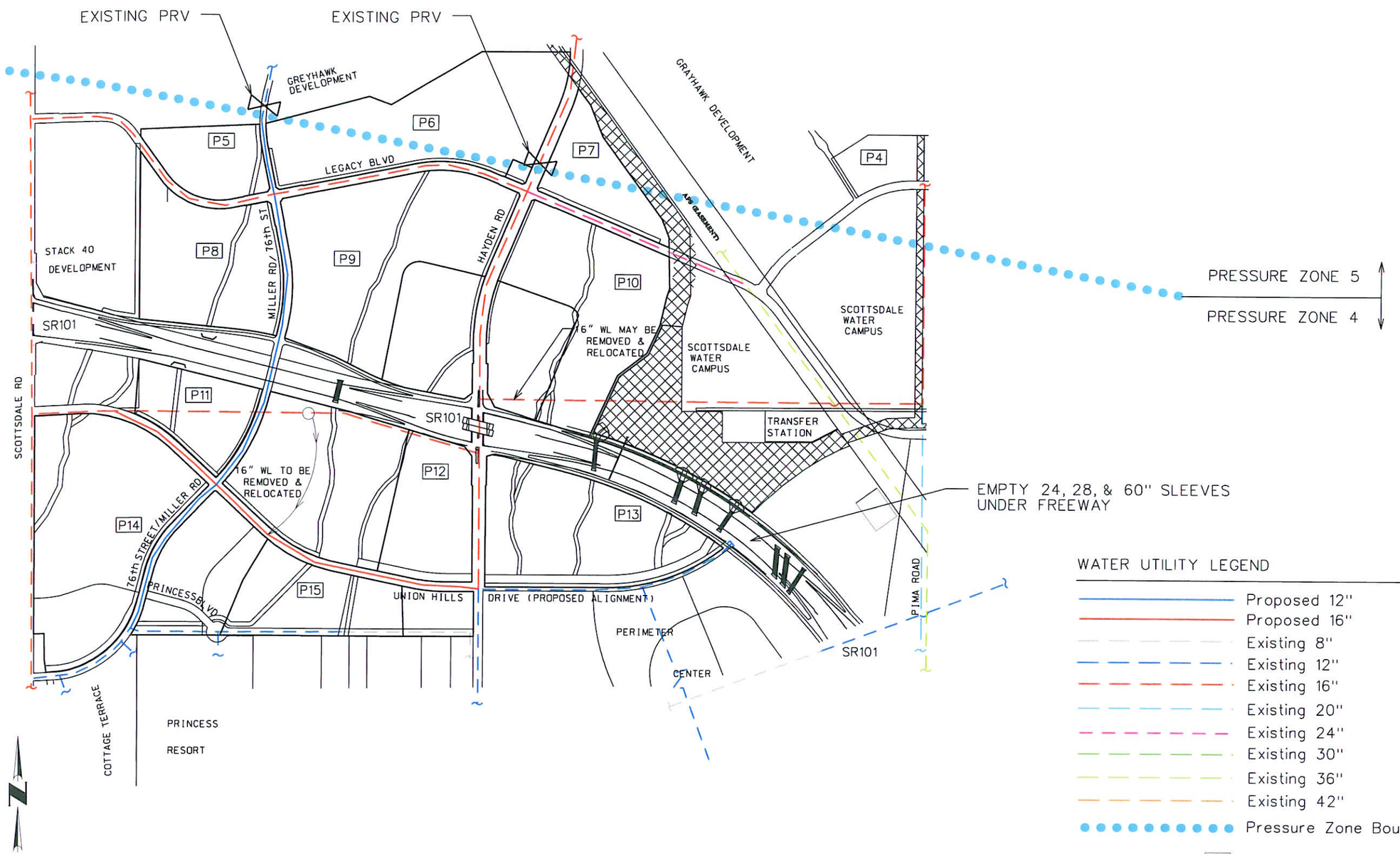
COE & VAN LOO
PLANNING ENGINEERING LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

LAND USE PLAN

JOB NO
07-0133901

FIGURE
2

FILE:N:\01\0220001\GRAPHICS\PL\EXHIBIT\01-0220001 - CROSSROADS EAST.INDD



CROSSROADS EAST

WATER SERVICE ANALYSIS

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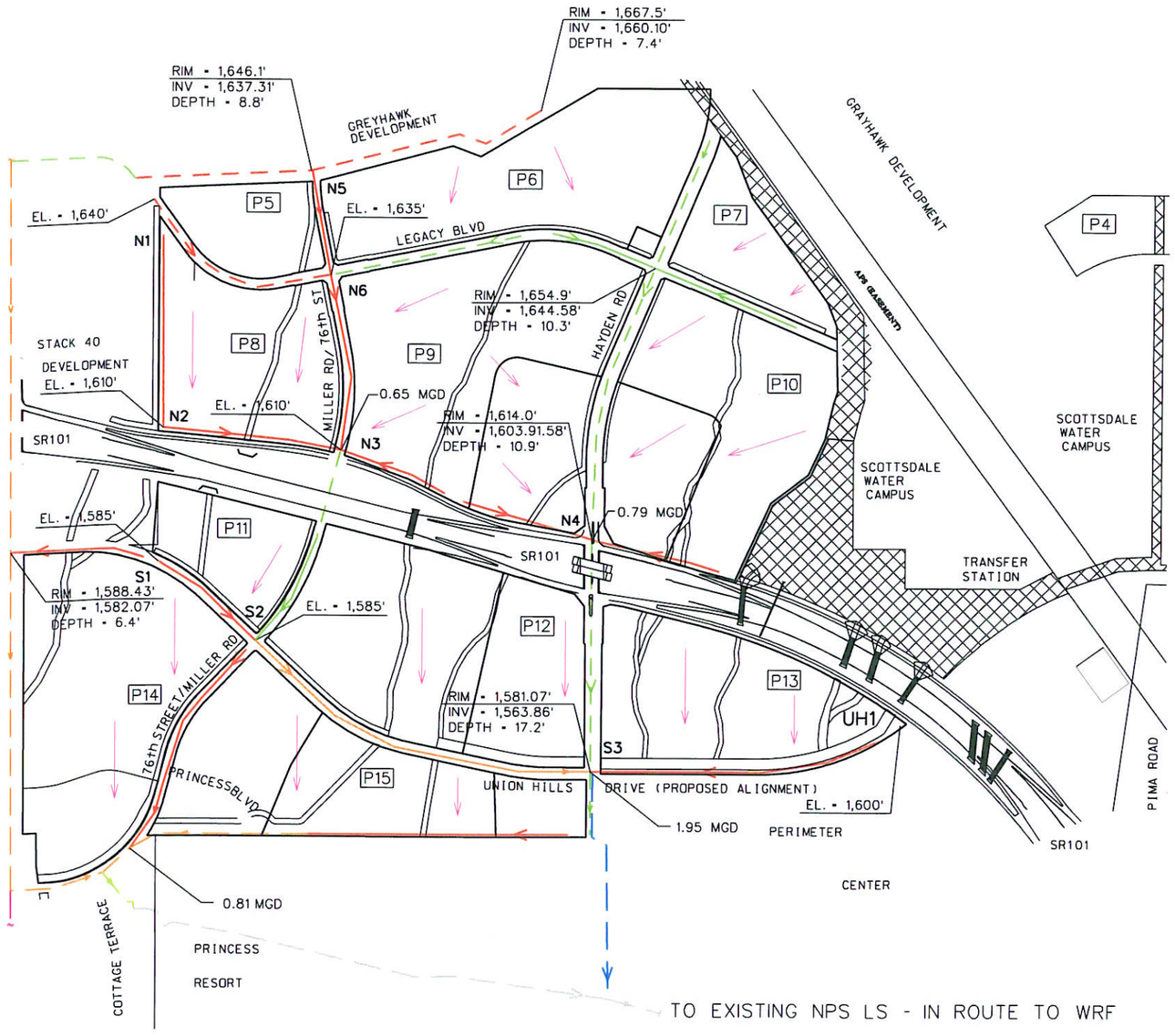
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO
1.07.0220002

FIGURE
3

OPTION 1: GRAVITY FLOW SYSTEM



WASTEWATER UTILITY LEGEND

- 8" PROP.
- 12" PROP.
- 12" EX.
- 15" PROP.
- 15" EX.
- 18" EX.
- 21" EX.
- 24" EX.
- P13 PARCEL NO.
- GENERAL FLOW DIRECTION

PEAK FLOW ESTIMATES BASED ON COS 2008 IWWMP CRITERIA
ALL PROPOSED INFRASTRUCTURE IS FOR PRELIMINARY PLANNING ANALYSIS ONLY

SCALE: NONE

CROSSROADS EAST

COE & VAN LOO
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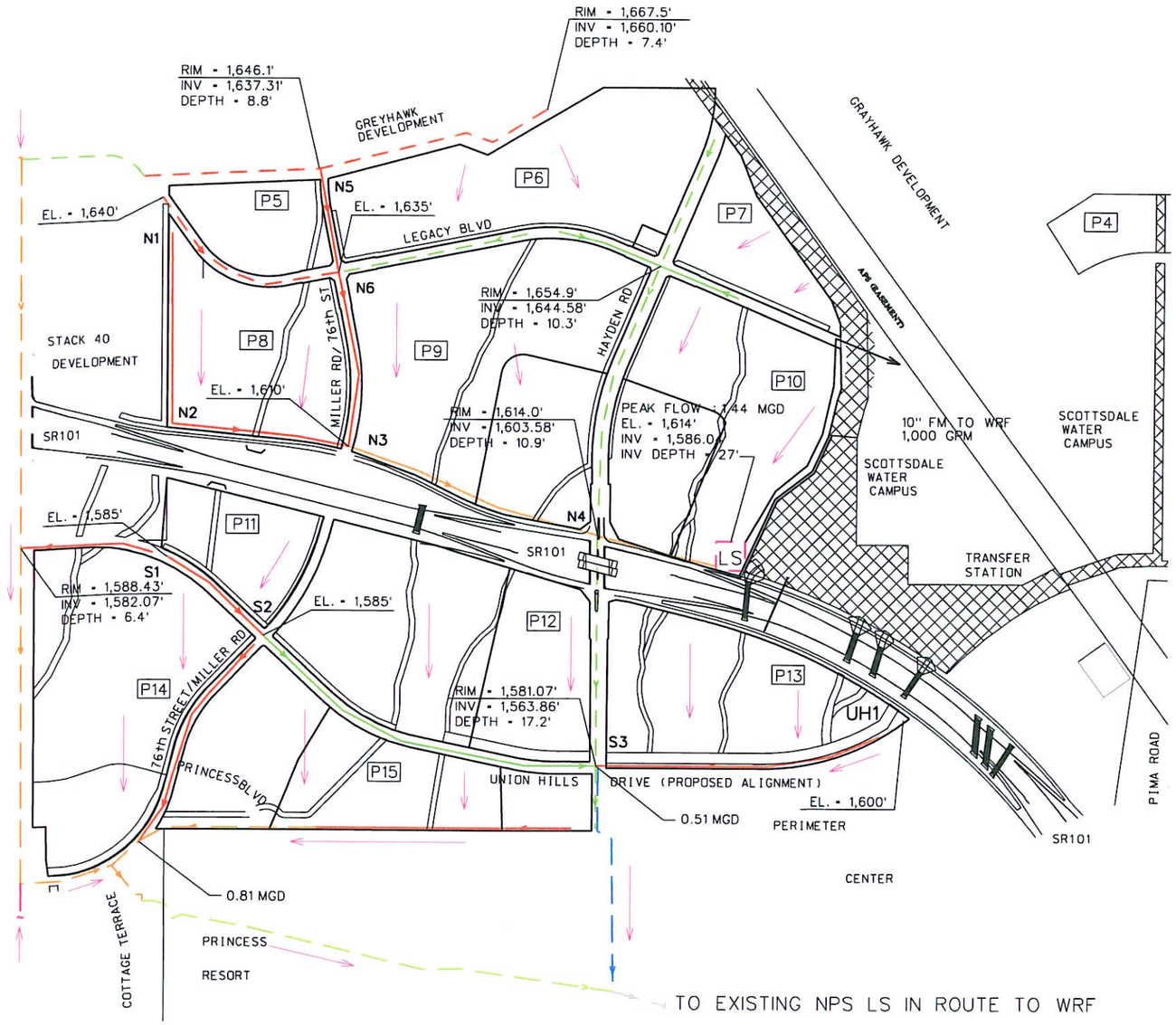
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

WASTEWATER SERVICE ANALYSIS

JOB NO
1.07.0220002

FIGURE
4

OPTION 2: NORTHERN LIFT STATION



WASTEWATER UTILITY LEGEND

- 8" PROP.
- 12" PROP.
- 15" PROP.
- 8" EX.
- 12" Ex.
- 15" EX.
- 18" EX.
- 21" EX.
- 24" EX.

P13 PARCEL NO.

PEAK FLOW ESTIMATES BASED ON COS 2008 IWWMP CRITERIA
ALL PROPOSED INFRASTRUCTURE IS FOR PRELIMINARY PLANNING ANALYSIS ONLY

SCALE: NONE

CROSSROADS EAST

WASTEWATER SERVICE ANALYSIS

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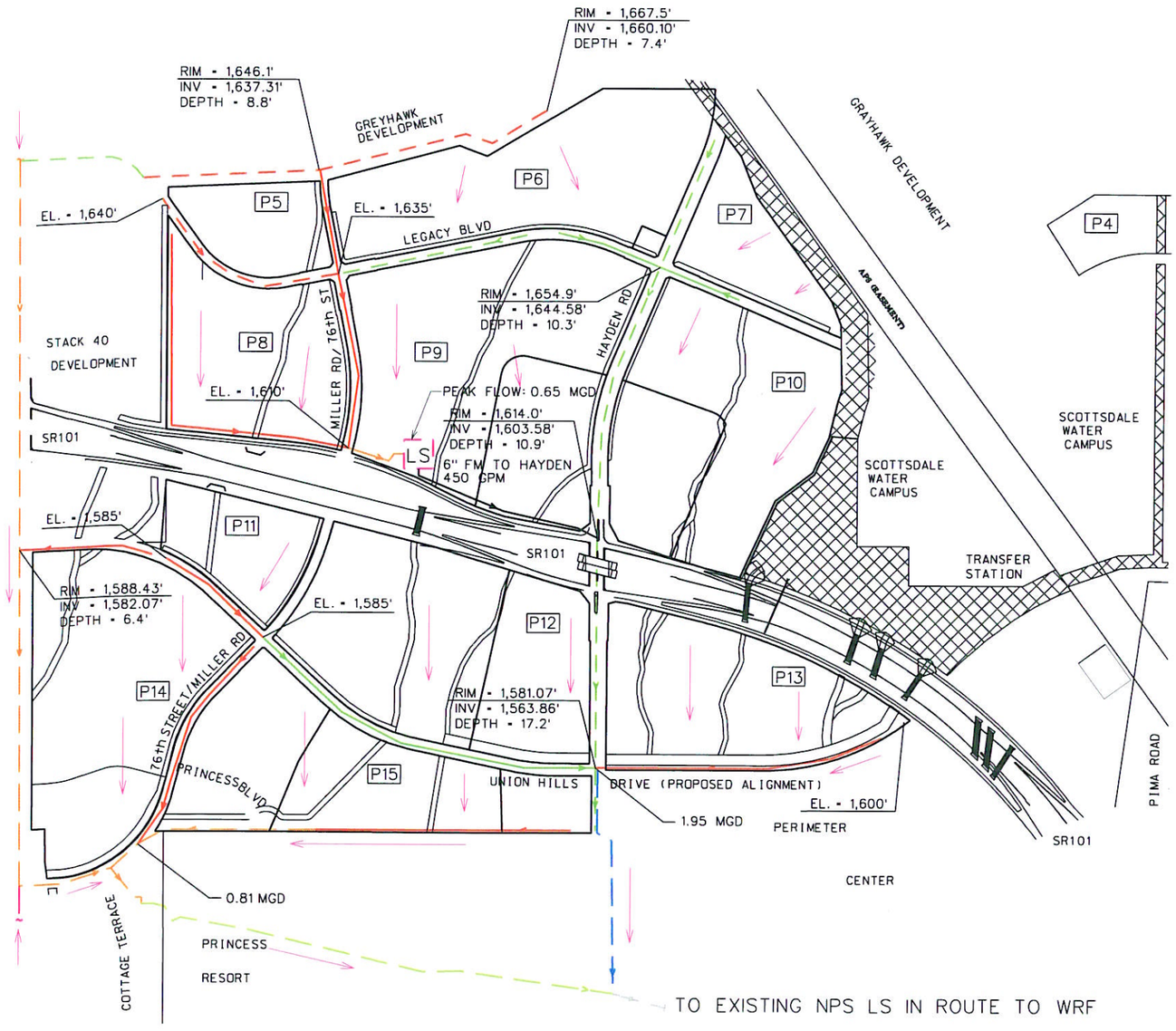
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO
1.07.0220002

FIGURE
5

OPTION 3: LIFT STATION SERVING WEST HALF OF CROSSROADS NORTH



WASTEWATER UTILITY LEGEND

- 8" PROP.
- 12" PROP.
- 15" PROP.
- 8" EX.
- 12" Ex.
- 15" EX.
- 18" EX.
- 21" EX.
- 24" EX.

P13 PARCEL NO.

SCALE: NONE

PEAK FLOW ESTIMATES BASED ON COS 2008 IWWMP CRITERIA
ALL PROPOSED INFRASTRUCTURE IS FOR PREliminary PLANNING ANALYSIS ONLY

CROSSROADS EAST

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

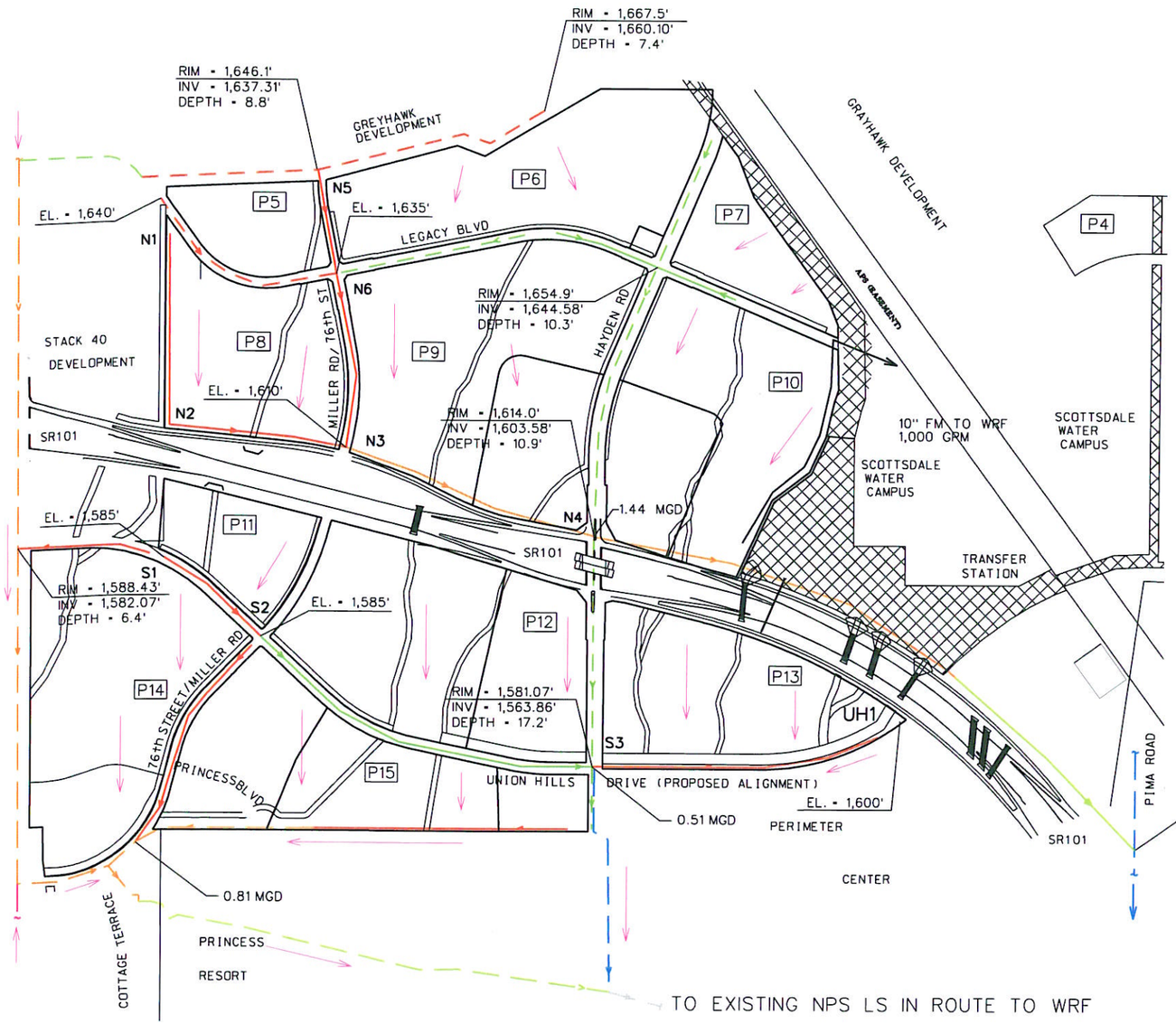
WASTEWATER SERVICE ANALYSIS

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO
1.07.0220002

FIGURE
6

OPTION 4: GRAVITY FLOW TO PIMA RD



WASTEWATER UTILITY LEGEND

- 8" PROP.
- 12" PROP.
- 15" PROP.
- 18" PROP.
- 8" EX.
- 12" Ex.
- 15" EX.
- 18" EX.
- 21" EX.
- 24" EX.
- P13 PARCEL NO.

PEAK FLOW ESTIMATES BASED ON COS 2008 IWWMP CRITERIA
ALL PROPOSED INFRASTRUCTURE IS FOR PRELIMINARY PLANNING ANALYSIS ONLY

SCALE: NONE

CROSSROADS EAST

COE & VAN LOO
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WASTEWATER SERVICE ANALYSIS

JOB NO
1.07.0220002

FIGURE
7

Appendix F – Crossroads East Planning Unit VII Master Water Report

MASTER WATER REPORT

CROSSROADS EAST PLANNING UNIT VII

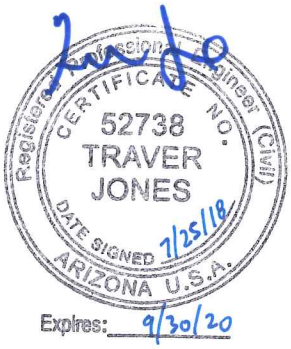
CASE 124-SA-2018

Prepared for:

Princess Hayden LLC
6623 North Scottsdale Road
Scottsdale, AZ 85250

Prepared by:

Kimley-Horn & Associates, Inc.
7740 North 16th Street, Suite 300
Phoenix, AZ 85020



Kimley»Horn

191769004
July 2018

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Crossroads East Planning Unit VII

MASTER WATER REPORT

JULY 2018

Prepared By:

Kimley»Horn

Kimley»Horn

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Appendices

Appendix A – Vicinity Map

Appendix B – Land Use Map, Planning Unit Layout, and ASLD Proposed Zoning Districts

Appendix C – Existing Conditions Water Infrastructure Exhibit and City of Scottsdale Quarter Section Maps

Appendix D – Proposed Conditions Water Infrastructure Exhibit

Appendix E – Crossroads East Preliminary Planning Analysis by Coe and Van Loo Consultants, June 2009

Appendix F – Fire Flow Test Results and WaterCAD Analysis Results

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

A new development will be located on a portion of Arizona State Land Department (ASLD) Crossroads East Planning Unit VII that was purchased at public auction on February 13, 2018. The project will include a multi-family development as well as supporting roadway, utility, drainage, and site infrastructure.

1.2 SITE LOCATION

Planning Unit VII encompasses approximately 111 acres in north Scottsdale, near the northwest corner of Hayden Road and the Princess Boulevard alignment. Approximately 47 acres of Planning Unit VII (hereinafter known as the Sale Parcel) was purchased from ASLD by Princess-Hayden LLC. The Sale Parcel is located in a portion of the Northeast Quarter of Section 35, Township 4 North, Range 4 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. See **Appendix A** for the Vicinity Map. The Sale Parcel is zoned PDC (R-5 and C-2). More specifically, the Sale Parcel is bounded by the future Mayo Boulevard alignment and vacant undeveloped desert to the north, Hayden Road to the east, Princess Boulevard and existing multi-family and hotel developments to the south, and vacant undeveloped desert to the west. The site slopes from the northeast to the southwest at approximately 1.8%. Refer to **Appendix B** for the Land Use Map.

1.3 PURPOSE

This Master Water Report for Crossroads East Planning Unit VII is intended to satisfy the City of Scottsdale water master planning requirement of the Development Agreement recorded against the property (19-ZN-2002#2) for Planning Unit VII, as well as more specific guidelines for the Sale Parcel development in accordance with the City of Scottsdale sewer guidelines and standards. It provides a description of the water system requirements (demands), infrastructure location and sizing, and phasing for Planning Unit VII.

1.4 OBJECTIVES

This Master Water Report provides an infrastructure plan for the development of Planning Unit VII that will meet the City of Scottsdale guidelines. The report will demonstrate the following:

1. Water demands for the Sale Parcel development and the remainder of Planning Unit VII
2. Location and size of proposed water infrastructure improvements necessary to serve the Sale Parcel development and future development of the surrounding Planning Unit VII

2.0 DESIGN DOCUMENTATION

2.1 DESIGN PROCEDURES, POLICIES, AND METHODOLOGIES.

The existing and proposed water network surrounding Planning Unit VII was analyzed using the computer program WaterCAD by Bentley. The water analysis utilizes the Hazen-Williams equation for pressurized pipes. The existing water system pressures and flows are based on two fire flow tests performed on May 2, 2018. After calibration of the water system to the flow tests, the average daily demand, maximum daily demand, peak hour demand, and maximum daily demand plus fire flow were analyzed to determine the size of the water infrastructure in accordance with the following standards as outlined in Chapter 6 of the 2018 City of Scottsdale Design Standards and Policy Manual (DS&PM).

Refer to **Appendix F** for the Fire Flow Test Results.

2.2 PREVIOUS STUDIES

Previous studies of the area include the Crossroads East Preliminary Planning Analysis prepared by Coe and Van Loo, dated June 2009 (CVL Study). This study examined the Crossroads East land area, which includes Planning Unit VII. The Crossroads East Planning Units cover approximately 900 acres; and the limits of this area is depicted on the Planning Unit Layout in **Appendix B**. This study calculated the demands of the parcels based upon maximum floor area ratios and rates determined in the City of Scottsdale Integrated Wastewater Report. See **Appendix E** for the Crossroads East Preliminary Planning Analysis by Coe and Van Loo Consultants, Inc.

3.0 DESCRIPTION OF EXISTING WATER INFRASTRUCTURE

3.1 EXISTING WATER INFRASTRUCTURE

Planning Unit VII currently consists of vacant desert and a gravel parking area that has previously been used for regional event parking. No water infrastructure currently exists on-site.

A 12-inch PVC water main exists in Princess Boulevard on the southwest portion of the Sale Parcel. This 12-inch water main provides water service to the residential developments on the south side of Princess Boulevard. The water main continues west along Princess Boulevard.

A 12-inch DIP water main is located in Hayden Road along the east side of Planning Unit VII. This 12-inch water main increases to a 16-inch DIP north of Mayo Boulevard.

A 66-inch SCP water transmission main is located in Haden Road adjacent to the Sale Parcel. This transmission main is not available for connection and will not be affected with this development.

The water main infrastructure surrounding Planning Unit VII is within Pressure Zone 4 of the City of Scottsdale water system. Refer to **Appendix C** for the Existing Conditions Water Infrastructure Exhibit and the City of Scottsdale Quarter Section Maps.

4.0 DEMANDS

4.1 GENERAL

The projected water demands for Planning Unit VII will be determined based on parcel size, the allowable zoning districts, and the ASLD land use budget. This report will review the demands for the Sale Parcel, as well as the remainder of Planning Unit VII, which encompasses approximately 64 acres and is hereinafter referred to as the Remainder Parcel. Refer to **Appendix B** for the ASLD Proposed Zoning Districts. These districts are anticipated to be approved by the City of Scottsdale in mid-2018. As shown on the ASLD Proposed Zoning Districts exhibit, the southern portion of Planning Unit VII is restricted to R-5 zoning, and the remainder is permitted for I-1, PRC, PCP, C-2, C-3, C-O, and R-5.

For the purposes of this report, all areas of Planning Unit VII that are permitted for uses other than R-5 will be assumed to be I-1 with office park use, and a floor area ratio (FAR) of 0.60; except for the parcel at the southwest corner of Hayden Road and Mayo Boulevard. This parcel is assumed to be C-2 with a retail use and a FAR of 0.60. Refer to **Appendix B** for the Land Use Map.

The Average Daily Demand (ADD), Maximum Daily Demand (MDD), and Peak Hour Demand (PHD) will be calculated for each parcel in accordance with Chapter 6 of the DS&PM and the assumptions noted above. Additionally, this report will assume a maximum fire flow demand of 3,900 gallons per minute (gpm) at 20 psi. It is anticipated that any buildings which are large enough to require a fire flow greater than 3,900 gpm will provide a building fire pump to supplement the flow.

4.2 SALE PARCEL WATER DEMANDS

As noted above, the southern portion of the Sale Parcel is restricted to R-5 zoning, and based on the Development Agreement between the City of Scottsdale and ASLD, the maximum allowable density for the R-5 zoning areas is 23 dwelling units per acre. The northern portion of the Sale Parcel is designated for C-2 zoning, and it is assumed that the use for this portion of the Sale Parcel will be used for supervised senior living, and will also maintain a maximum density of 23 dwelling units per acre. The area of the Sale Parcel allotted to R-5 zoning is 37 acres, and the area of the Sale Parcel with C-2 zoning is 10 acres. Table 1 below provides the design water demands for the Sale Parcel per Figure 6-1.2 of the DS&PM:

Table 1: Sale Parcel Water Demands

Zoning	Area	Land Use	Allowable Density	Maximum Dwelling Units	Average Daily Demand[1]		Maximum Daily Demand[2]		Peak Hour Demand[3]	
	(Acres)		(DU/Acre)		GPD	GPM	GPD	GPM	GPD	GPM
C-2	10	Senior Living	23	230	42,619	30	85,238	59	149,167	104
R-5	37	Multi-Family	23	851	157,690	110	315,381	219	551,916	383
	47			1,081	200,309	139	400,619	278	701,083	487

1. ADD is 185.3 GPD/Unit based on Figure 6.1-2 of the DS&PM and includes Inside Use and Outside Use.
2. MDD is 2.0 times the ADD.
3. PHD is 3.5 times the ADD.

4.3 REMAINDER OF PLANNING UNIT VII WATER DEMANDS

As previously noted, the majority of the Remainder Parcel will be designated as I-1 zoning, with a portion designated as C-2 zoning. The I-1 portion of the Remainder Parcel includes 48 acres and the C-2 portion includes 16 acres. Table 2 below provides the design flow rates for the Remainder Parcel per Figure 6.1-2 of the DS&PM:

Table 2: Remainder Parcel Water Demands

Zoning	Area	Land Use	Maximum Building Area	Average Daily Demand[1]		Maximum Daily Demand[2]		Peak Hour Demand[3]	
	(Acres)		(SF)	GPD	GPM	GPD	GPM	GPD	GPM
I-1	48	Office Park	1,254,528	752,717	523	1,505,434	1,045	2,634,509	1,830
C-2	16	Retail	418,176	334,541	232	669,082	465	1,170,893	813
	64			1,087,258	755	2,174,515	1,510	3,805,402	2,643

1. ADD is 0.7 GPD/SF (Retail) and 0.6 GPD/SF (Office) based on Figure 6.1-2 of the DS&PM and includes Inside Use and Outside Use.
2. MDD is 2.0 times the ADD.
3. PHD is 3.5 times the ADD.

5.0 DATA ANALYSIS METHODS

5.1 DESIGN CRITERIA

In addition to the domestic and landscape water demands outlined in Section 4, the proposed water system model will consider a demand that is the sum of the MDD and the fire flow demand for each parcel. To be conservative, the demands will be placed at the most hydraulically remote locations in the model.

The existing water system pressure and available flow will be based on the fire flow tests performed on May 4, 2018. A reservoir and pump system will be calibrated into the model to simulate the available water flow and pressure at the connection points. Refer to **Appendix F** for the Fire Flow Test Results.

The following design criteria will be used for the proposed water system:

- Minimum pressure of 50 psi for ADD, MDD, and PHD model scenarios
- Minimum pressure of 30 psi for MDD + Fire Flow model scenario
- Maximum pipe velocity of five feet per second for ADD, MDD, and PHD scenarios

Section 6-1.400 of the DS&PM provides general requirements for water main sizes based on mile and half-mile streets, and the CVL Study also provided recommendations for water main sizing throughout the Crossroads East development area.

6.0 RESULTS

6.1 PROPOSED WATER SYSTEM LAYOUT

As previously noted, existing water mains are present in the adjacent portions of Princess Boulevard and Hayden Road. The proposed water system for the Sale Parcel and the Remainder Parcel will connect to these existing water mains. The water main infrastructure noted below is anticipated to include fire hydrants with spacing per Section 6-1.502 of the DS&PM.

Sale Parcel Water Infrastructure

An existing 12-inch PVC water main is present within Princess Boulevard, along the south half of the Sale Parcel. This 12-inch water main will be extended to the west approximately 1,950 linear feet to connect with the existing 12-inch DIP water main in the east side of Hayden Road.

A new 16-inch water main will be constructed in the south side of the future Mayo Boulevard alignment and will connect to the existing 16-inch DIP water main in Hayden Road. This new 16-inch water main will extend west approximately 1,600 linear feet in the future Mayo Boulevard alignment to the northwestern corner of the Sale Parcel.

A new 16-inch water main will connect the Princess Boulevard 12-inch water main and the 16-inch Mayo Boulevard water main. This new 16-inch water main will be placed within the east half of the future 78th Street alignment, which bisects the western portion of the Sale Parcel.

Remainder Parcel Water Infrastructure

The City of Scottsdale Integrated Water Resources Master Plan recommends a well site within Planning Unit VII. The well site is anticipated to require an area of approximately 150 feet by 150 feet, and is anticipated to be sited on the C-2 portion of the Remainder Parcel. The exact location and area of the well site will be determined at the time of the C-2 portion development.

No additional water infrastructure is anticipated for the C-2 portion of the Remainder Parcel. For development of the western portion of the Remainder Parcel, the 16-inch water main in the future Mayo Boulevard alignment will need to be extended west to the future intersection of the Mayo Boulevard alignment and the future Miller Road alignment. Additionally, it is anticipated that a 12-inch or larger water main will be installed in the future Miller Road alignment with the development of the western portion of the Remainder Parcel. This new 12-inch water main will connect the Princess Boulevard 12-inch water main with the Mayo Boulevard 16-inch water main.

Refer to **Appendix D** for the Proposed Conditions Water Infrastructure Layout.

6.2 WATER SYSTEM ANALYSIS RESULTS

The aforementioned water system was modeled using the WaterCAD computer program. The existing system pressure and flow was based on the fire flow test results from May 4, 2018. The following demand scenarios were modeled: Average Daily Demand (ADD), Maximum Daily Demand (MDD), Peak Hour Demand (PHD), and Maximum Daily Demand plus Fire Flow. Flow demands were placed at the north end

of the C-2 portion of the Sale Parcel, the midpoint of the R-5 portion of the Sale Parcel, and at the northwest corner of the Remainder Parcel. These locations were selected due to their hydraulically remote positions, as well as being higher in elevation than the connection points. These locations and demands are conservative and it is anticipated that actual future demands and locations will provide greater flow and pressure than is shown by this model. Refer to Table 3 for the Water System Model Results.

Table 3: Water System Model Results

Demand Node	ADD		MDD		PHD		MDD + Fire Flow	
	Flow (GPM)	Pressure (PSI)	Flow (GPM)	Pressure (PSI)	Flow (GPM)	Pressure (PSI)	Flow (GPM)	Pressure (PSI)
Sale Parcel C-2	30	68.9	59	63.8	104	57.2	59	33.3
Sale Parcel R-5	110	76.2	219	71.1	383	64.7	219	41.5
Remainder Parcel	755	69.5	1,510	64.1	2,643	56.6	5,410	30.2

Refer to **Appendix F** for the WaterCAD Analysis Results.

6.3 CONFORMANCE TO PREVIOUS STUDIES

As previously noted, Planning Unit VII was part of the CVL Study in 2009. Since the CVL Study was completed, ASLD has revised the configuration, size, and location of the various planning units within Crossroads East. Additionally, the future roadway alignments of Mayo Boulevard, Miller Road, and others have changed since the CVL Study was completed.

The CVL Study recommended a 16-inch water main in the future Mayo Boulevard alignment, and a 12-inch water main in the future Miller Road alignment, which is consistent with the recommendations presented herein. Additionally, these water mains conform to City of Scottsdale requirements for 12-inch water mains in mile and half-mile alignment streets.

The CVL did not provide recommendations for water mains within Princess Boulevard or the future 78th Street alignment. Refer to **Appendix E** for the CVL Study.

Kimley-Horn prepared a Master Water Report for Crossroads East Planning Unit IV in July 2012. This report covered the area bounded by Scottsdale Road, Mayo Boulevard, the future Miller Road alignment, and Princess Boulevard, which is currently known as Planning Unit III. At the time of this report, the alignment of Miller Road was planned to be further east than the current configuration, thereby decreasing area covered by the study.

The previous Kimley-Horn study recommended that a 16-inch water main be installed in Miller Road between Princess Boulevard and the Loop 101 freeway. The 16-inch water main recommendation was based on prior conversations with previous City of Scottsdale staff. Based on the analysis presented in this report, a 12-inch water main appears to be adequate to service future development along Miller Road.

6.4 PROPOSED SPECIAL WATER FACILITIES

Portions of the water main may need to be constructed with extra protection due to drainage channel, culvert, or other crossings as specified by Maricopa Association of Governments (MAG) Standard Detail 404.

6.5 PROJECT PHASING

The Sale Parcel infrastructure noted in Section 6.1 will be constructed first, and the infrastructure for the remainder of Planning Unit VII will be constructed at a later date. The Sale Parcel infrastructure will be installed prior to, or concurrently with, the on-site development which is anticipated in 2018 or 2019. Individual developments within Planning Unit VII will need to provide site-specific water system modelling to justify site demands and infrastructure sizing.

The timing and phasing of the water main infrastructure for the remainder of Planning Unit VII will depend upon the configuration of future sale parcels.

8.0 CONCLUSION

8.1 OVERALL PROJECT

Based on the results of this Water Master Plan, the following can be concluded:

- Water main extensions can be installed to provide adequate pressure and flow to Planning Unit VII.
- The water demand calculations are based on conservative land use assumptions, and the actual water demands will likely be less than the demands presented in this report.
- Future developments within Planning Unit VII will present site-specific demands and models.
- This Water Master Plan is generally consistent with the CVL Study that was prepared in 2009 for Crossroads East.

This Water Basis of Design Report is intended to provide a level of assurance that water service can be provided to the Sale Parcel and the Remainder Parcel portions of Planning Unit VII. It is also intended to provide guidance for future developments within Planning Unit VII.

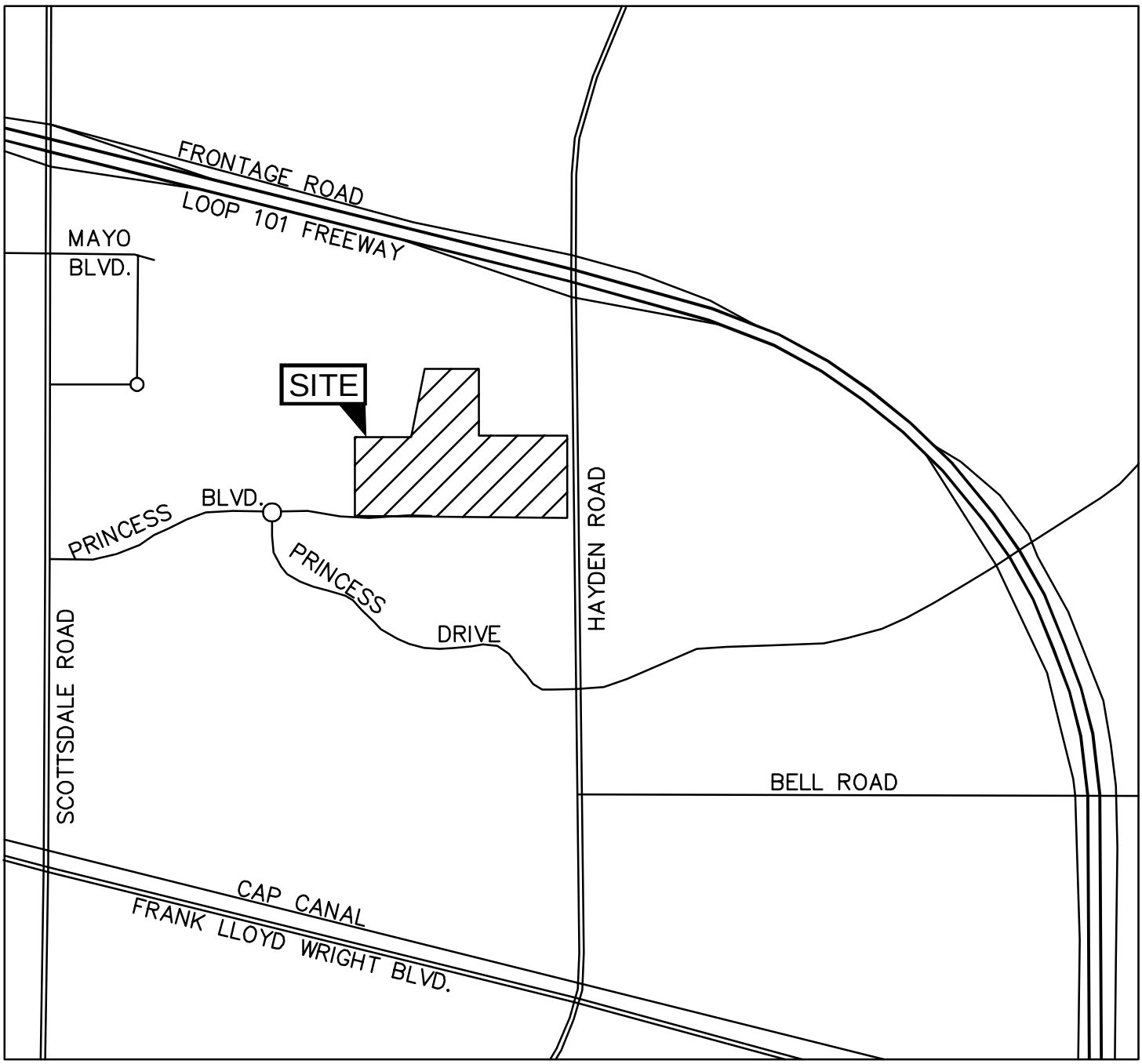
9.0 REFERENCES

City of Scottsdale, *Design Standards and Policies Manual, Chapter 6: Water,* January 2018.

Coe and Van Loo Consultants, Inc, *Crossroads East Preliminary Planning Analysis,* June 2009.

2017. WaterCAD v8i, Bentley Systems, Inc. and *WaterCAD User's Guide.*

Appendix A – Vicinity Map



VICINITY MAP
N.T.S.

Kimley»Horn

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Appendix B – Land Use Map, Planning Unit Layout, and ASLD Proposed Zoning Districts

LOOP 101 FREEWAY

FUTURE MILLER ROAD ALIGNMENT

FUTURE MAYO BOULEVARD ALIGNMENT

EXTENTS OF PLANNING UNIT VII

PLANNING UNIT VI
61 ACRES

PLANNING UNIT III
164 ACRES

REMAINDER PARCEL
ZONING: I-1
LAND USE: OFFICE PARK
48 ACRES

SALE PARCEL
ZONING: C-2
LAND USE: SENIOR LIVING
10 ACRES

FUTURE MAYO BOULEVARD ALIGNMENT

REMAINDER PARCEL
ZONING: C-2
LAND USE: RETAIL
16 ACRES

MAYO BOULEVARD

HAYDEN ROAD

SALE PARCEL
ZONING: R-5
LAND USE: MULTI-FAMILY
37 ACRES

FUTURE MILLER ROAD ALIGNMENT

PRINCESS BOULEVARD

PRINCESS BOULEVARD

PRINCESS DRIVE

NORTH

GRAPHIC SCALE IN FEET
0 60 120 240

LAND USE MAP

Kimley»Horn

K:\PHX_Civil\191769004 - Hayden 50\CADD\Exhibits\2018-04-24 Land Use Map.dwg Apr 30, 2018 traver.jones

Crossroads East

Planned Community District & Vicinity

Arizona State Land Department
1616 W Adams Street Phoenix, AZ 85007

1" = 500'

The Arizona State Land Department makes no warranties, expressed or implied, with respect to the information shown on this map.

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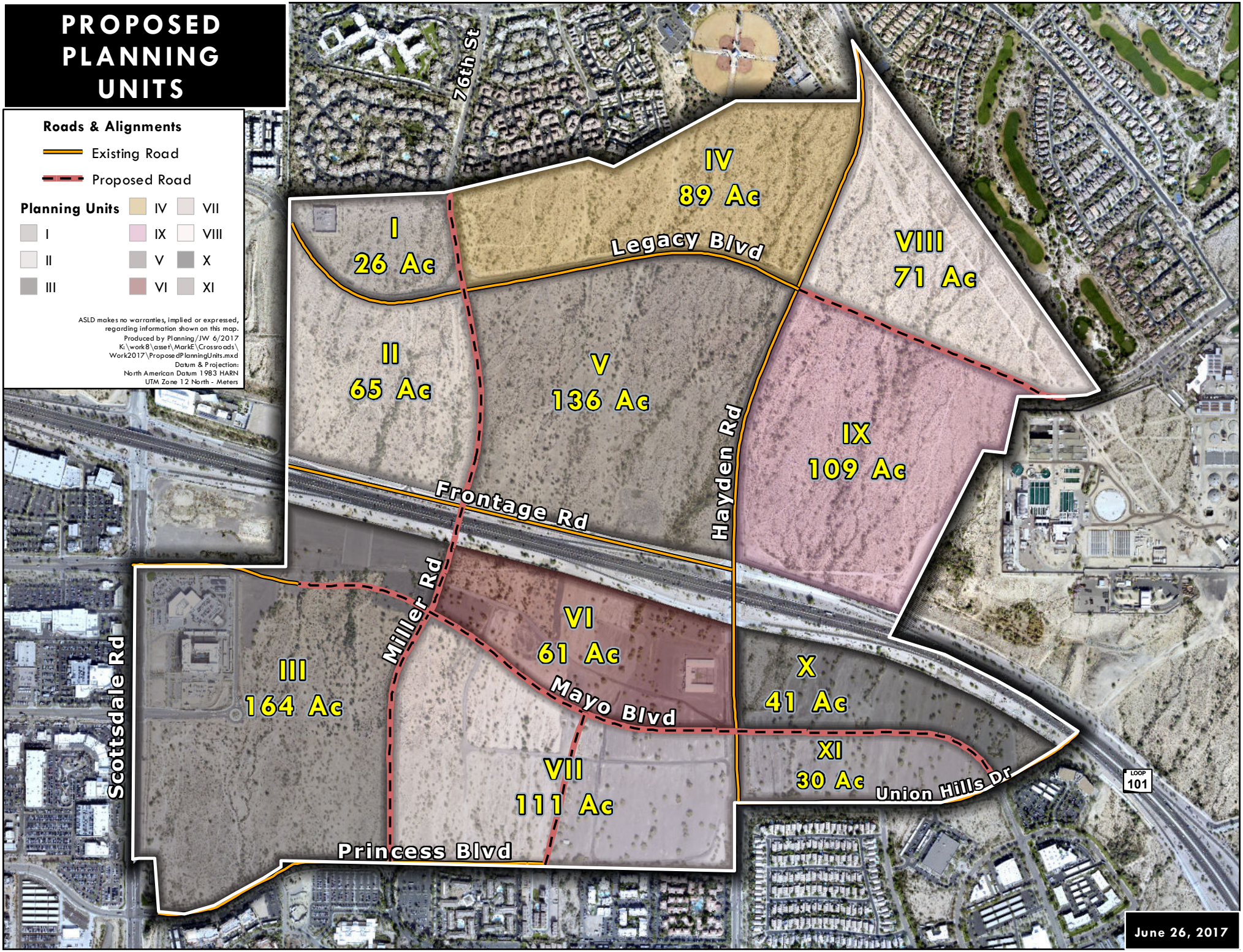
Proposed roadway alignments shown are approximate and have not been officially adopted into the City of Scottsdale's Transportation Master Plan


PROPOSED PLANNING UNITS
Roads & Alignments
Existing Road
Proposed Road
Planning Units
I
II
III
IV
IX
V
VI
VII
VIII
X
XI
ASLD makes no warranties, implied or expressed, regarding information shown on this map.
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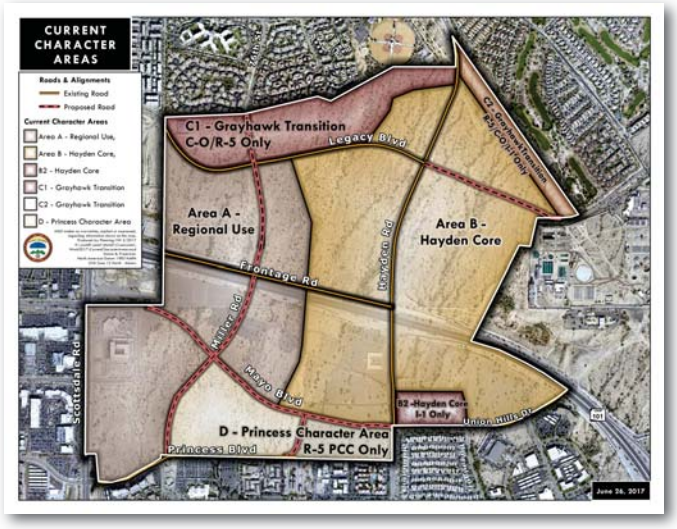
Datum & Projection:
North American Datum 1983 HARN
UTM Zone 12 North - Meters
76th St
I
26 Ac
IV
89 Ac
VIII
71 Ac
Legacy Blvd
II
65 Ac
V
136 Ac
IX
109 Ac
Hayden Rd
Frontage Rd
Miller Rd
VI
61 Ac
III
164 Ac
X
41 Ac
Mayo Blvd
Scottsdale Rd
XI
30 Ac
Union Hills Dr
VII
111 Ac
Princess Blvd
LOOP
101
June 26, 2017

WHERE ZONING CAN BE USED AT CROSSROADS EAST

JUNE 2017

2002

CURRENT/EXISTING CHARACTER AREAS



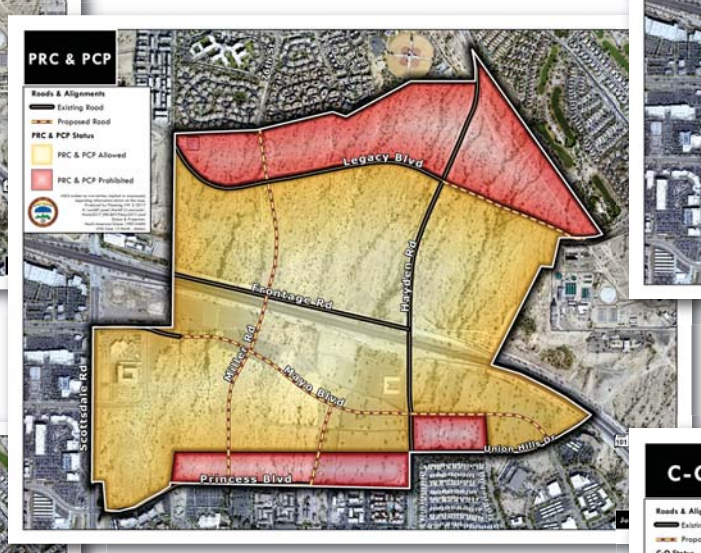
TODAY

PROPOSED ZONING DISTRICTS

LAND USE INDEX: PRC/PCP - REGIONAL CENTER C-2/C-3 COMMERCIAL
R-5 MULTIFAMILY RESIDENTIAL I-1 INDUSTRIAL PARK C-O COMMERCIAL OFFICE

LIMITED TO ALLOWED PROHIBITED



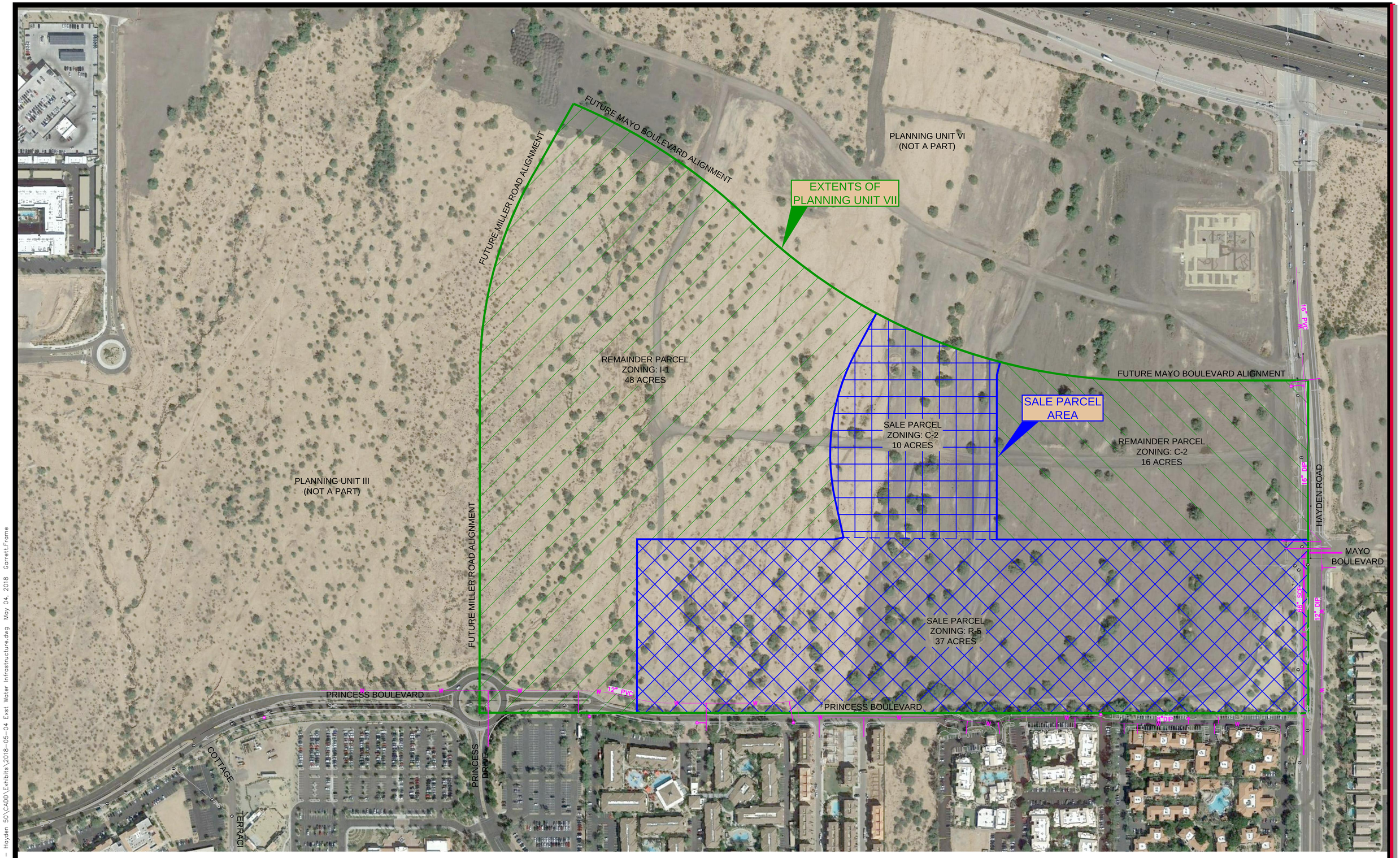








Appendix C – Existing Conditions Water Infrastructure Exhibit and City of Scottsdale Quarter Section Maps



NORTH

GRAPHIC SCALE IN FEET
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EXISTING CONDITIONS WATER INFRASTRUCTURE

Kimley»Horn

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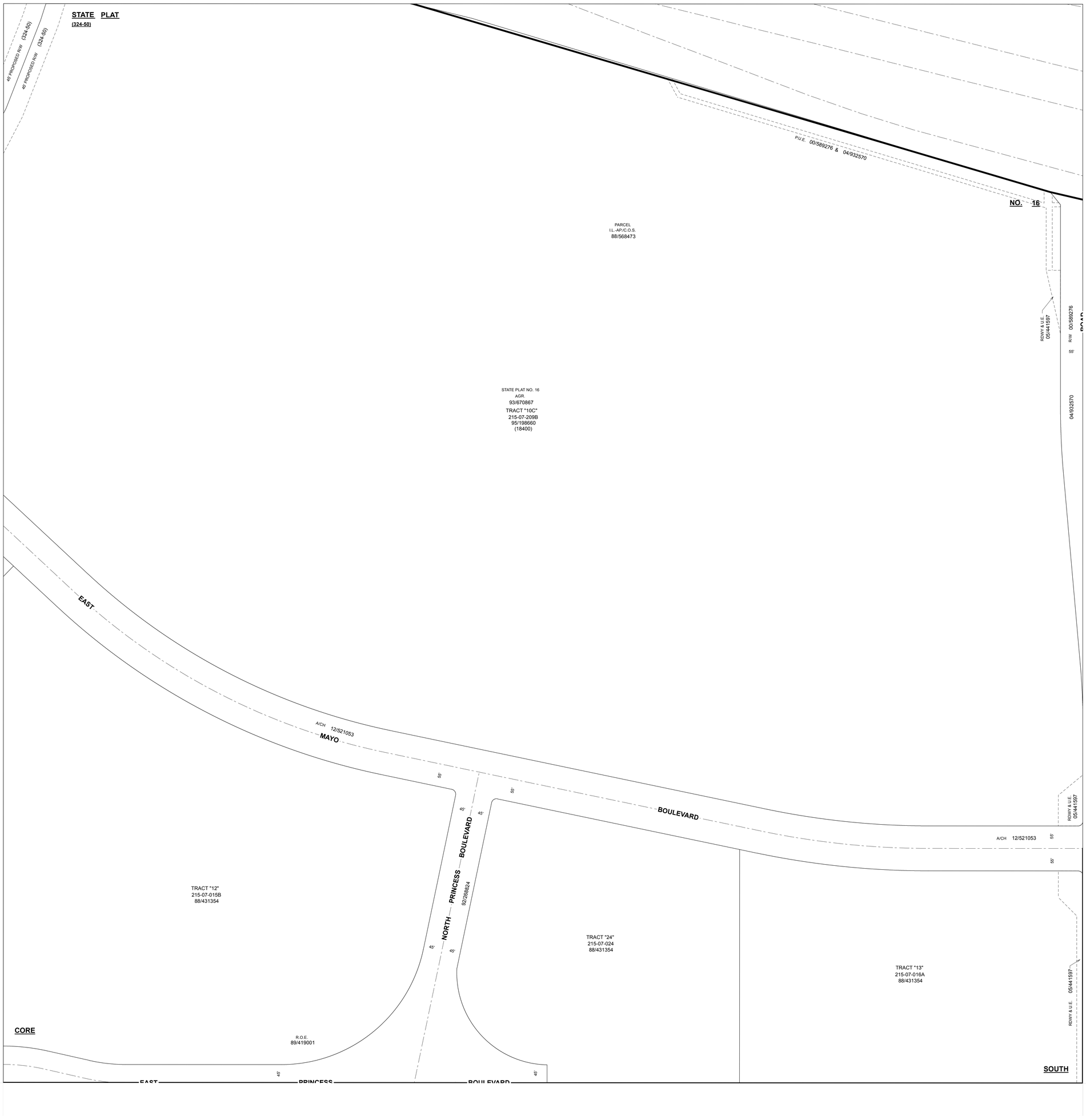

38-45

38-47

37-46

13-NOV-16

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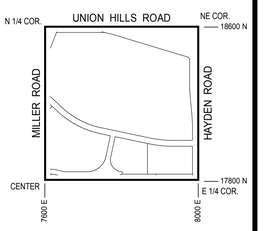
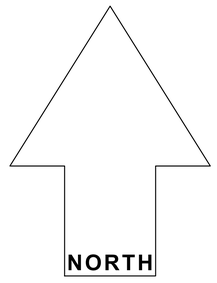
LEGEND:

VICINITY MAP





SCALE: 1" = 100'

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The map scale of 1" = 100' is based on a full size print of 30" x 36"

LAND

QUARTER SECTION MAP

38-46

NE 1/4 SEC. 35 T4N R4E

N O T I C E

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THE CITY OF SCOTTSDALE

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

39-45

38-44

38-46

37-45

19-MAR-17

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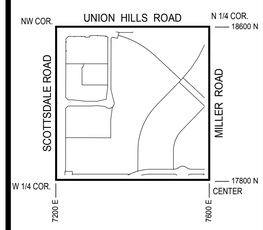
LEGEND:

- Water Valve
- Non-potable Water Valve
- Fire Hydrant
- Water Blowoff
- Water Main Reducer
- Water Sample Station
- Water Air Release Valve
- Non-potable Water Air Release Valve
- Water Pressure Reducing Valve
- Water Vault
- Water Manhole
- Non-Potable Water Manhole
- Water Pump
- Water Main
- Non-Potable Water Main
- Fire Line
- Water Service
- Non-Scottsdale Water Main
- Sewer Manhole
- Sewer Cleanout
- Sewer Lift Station
- Sewer Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force
- Non-Scottsdale Sewer Main
- Sewer Service

VICINITY MAP



NORTH

SCALE: 1" = 100'

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The map scale of 1" = 100' is based on a full size print of 30" x 36"

WATER & SEWER

QUARTER SECTION MAP

38-45

NW 1/4 SEC. 35 T4N R4E

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

N O T I C E

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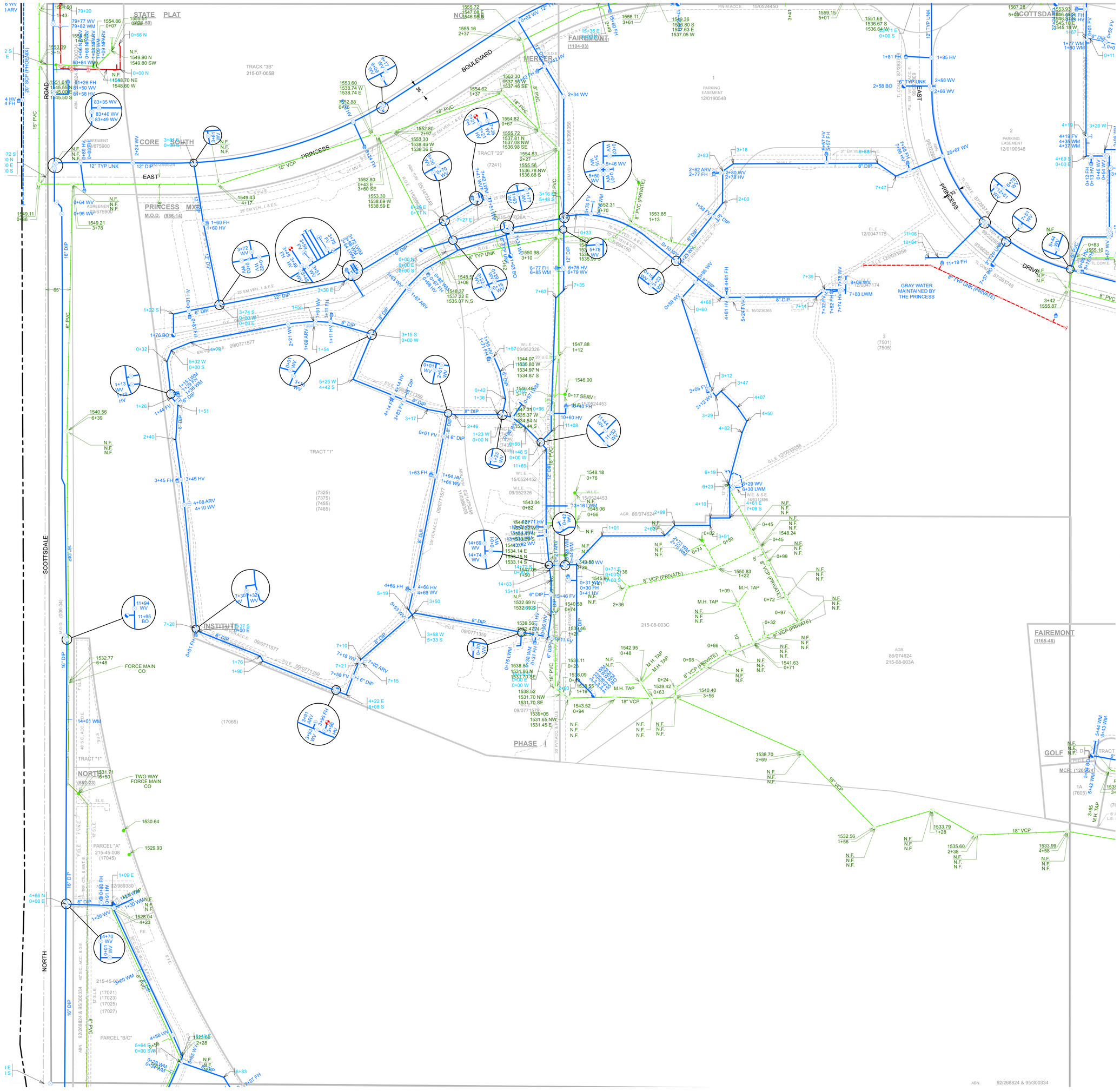
THE CITY OF SCOTTSDALE


STATE PLAT
NORTH
CORE SOUTH
PRINCESS MXD
M.O.D. (986-14)
INSTITUTE
FAIREMONT
(1104-03)
MERCER
COTTSDALE
BOULEVARD
PRINCESS
DRIVE
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ROAD
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PARCEL "A"
215-45-008
(17045)
PARCEL "B/C"
215-45-009
PHASE I
FAIREMONT
(1165-46)
GOLF
MCR (120-24)
GRAY WATER
MAINTAINED BY
THE PRINCESS
PARKING
EASEMENT
12/0190548
FORCE MAIN
CO
TWO WAY
FORCE MAIN
CO
20" SCIP (PHOENIX)
15" PVC
16" DIP
12" DIP
8" DIP
6" DIP
6" PVC
8" PVC
18" PVC
12" TYP UNK
8" TYP UNK
8" PVC (PRIVATE)
8" VCP (PRIVATE)
18" VCP
12" DIP/8" PVC
8" DIP/6" DIP
8" DIP/6" PVC
6" TYP UNK
12" TYP UNK
8" TYP UNK (PRIVATE)
8" DIP
8" PVC
8" VCP
8" VCP (PRIVATE)
18" VCP
8" DIP
8" DIP
8" DI

Appendix D – Proposed Conditions Water Infrastructure Exhibit

PLANNING UNIT III
(NOT A PART)

PLANNING UNIT VI
(NOT A PART)

PLANNING UNIT III
(NOT A PART)

73RD PLACE

REMAINDER PARCEL NODE

FUTURE MAYO BOULEVARD ALIGNMENT

FUTURE MILLER ROAD ALIGNMENT

EXTENTS OF
PLANNING UNIT VII

P-19

PROPOSED 16" DIP
WATER MAIN

SALE PARCEL C-2 NODE

P-20

PROPOSED 12" DIP
WATER MAIN

REMAINDER PARCEL
ZONING: I-1
48 ACRES
ADD: 523 GPM
MDD: 1,045 GPM
PHD: 1,830 GPM

SALE PARCEL
ZONING: C-2
10 ACRES
ADD: 30 GPM
MDD: 59 GPM
PHD: 104 GPM

SALE PARCEL
AREA

P-17

FUTURE 78TH
STREET ALIGNMENT

FUTURE MAYO BOULEVARD ALIGNMENT

P-16

REMAINDER PARCEL
ZONING: C-2
16 ACRES
ADD: 232 GPM
MDD: 465 GPM
PHD: 813 GPM

J-11
J-12
P-15
P-14
16" PVC
HAYDEN ROAD

150'X150' WELL SITE
SIZE AND LOCATION TO
BE DETERMINED WITH
FUTURE DEVELOPMENT

MAYO
BOULEVARD

J-10
P-12
J-9
P-2
P-13
MAYO
PRESSURE
FH
P-25
PMP-2
P-24
P-10
J-8

FUTURE MILLER ROAD ALIGNMENT

SALE PARCEL
ZONING: R-5
37 ACRES
ADD: 110 GPM
MDD: 219 GPM
PHD: 383 GPM

SALE PARCEL R-5 NODE

P-16

CONNECTION POINT TO
EXISTING WATER MAIN

P-21

J-13

PRINCESS BOULEVARD

12" PVC

J-2

PRINCESS
PRESSURE
FH

P-3

P-7

J-6

P-2

R-1

P-23

PMP-1

P-22

P-1

J-1

PRINCESS
FLOW FH

P5

J-5

P-6

P-4

J-4

PRINCESS BOULEVARD

PROPOSED 12" DIP
WATER MAIN

P-8

J-7

P-9

12" DIP

16" DIP

COTTAGE
TERRACE

PRINCESS
DRIVE

LEGEND

W — PROPOSED SEWER MAIN

W — EXISTING SEWER MAIN

P-17 — WATERCAD SYSTEM LABEL

NOTES

1. PROPOSED WATER MAIN LAYOUTS ARE SCHEMATIC ONLY.

ADD: AVERAGE DAILY DEMAND
MDD: MAXIMUM DAILY DEMAND
PHD: PEAK HOUR DEMAND

NORTH

GRAPHIC SCALE IN FEET
0 75 150 300

PROPOSED CONDITIONS WATER
INFRASTRUCTURE AND WATERCAD LAYOUT

Kimley»Horn

K:\PHX_Civil\191769004 - Hayden 50\CADD\Exhibits\2018-05-04 Prop Water Infrastructure.dwg Jul 25, 2018 trover.jones

Kimley»Horn

Appendix E – Crossroads East Preliminary Planning Analysis by Coe and Van Loo Consultants, June 2009

Appendix F – Fire Flow Test Results and WaterCAD Analysis Results

Flow Test Summary

Project Name:	EJFT 18092-1
Project Address:	7887 E Princess Blvd, Scottsdale, AZ 85255
Date of Flow Test:	2018-05-04
Time of Flow Test:	7:30 AM
Data Reliable Until:	2018-11-04
Conducted By:	Austin Gourley & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By:	Jim Demarbiex (City of Scottsdale) 602.541.0586
City Forces Contacted:	City of Scottsdale (602.228.2187)
Permit Number:	C55277

Note Scottsdale requires a max static pressure of 72 psi for safety factor

Raw Flow Test Data

Static Pressure:	88.0 PSI
Residual Pressure:	60.0 PSI
Flowing GPM:	2,227
GPM @ 20 PSI:	3,596

Data with a 16 PSI Safety Factor

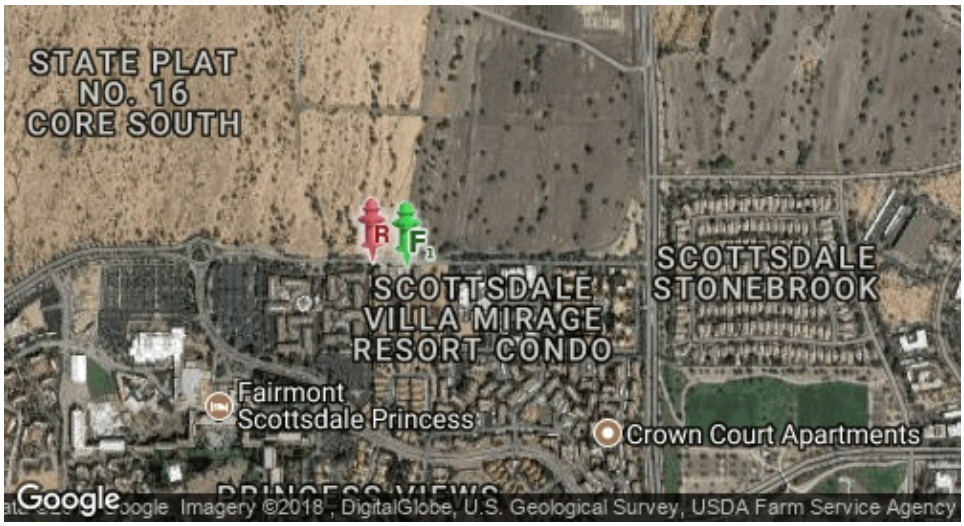
Static Pressure:	72.0 PSI
Residual Pressure:	44.0 PSI
Flowing GPM:	2,227
GPM @ 20 PSI:	3,111

Hydrant F_1

Pitot Pressure (1):	39	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	4	inches

Additional Coefficient 0.83 on orifice #1

Note: These Flow Test results are from the 2018 Crossroads East Planning Unit VII Master Water Report. Flow Test results for the current project are included with Appendix G.



Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
232 ft (measured linearly)

Static-Residual Elevation
1566 ft (above sea level)

Flow Hydrant (F_1) Elevation
1566 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC
21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

Flow Test Summary

Static-Residual Hydrant



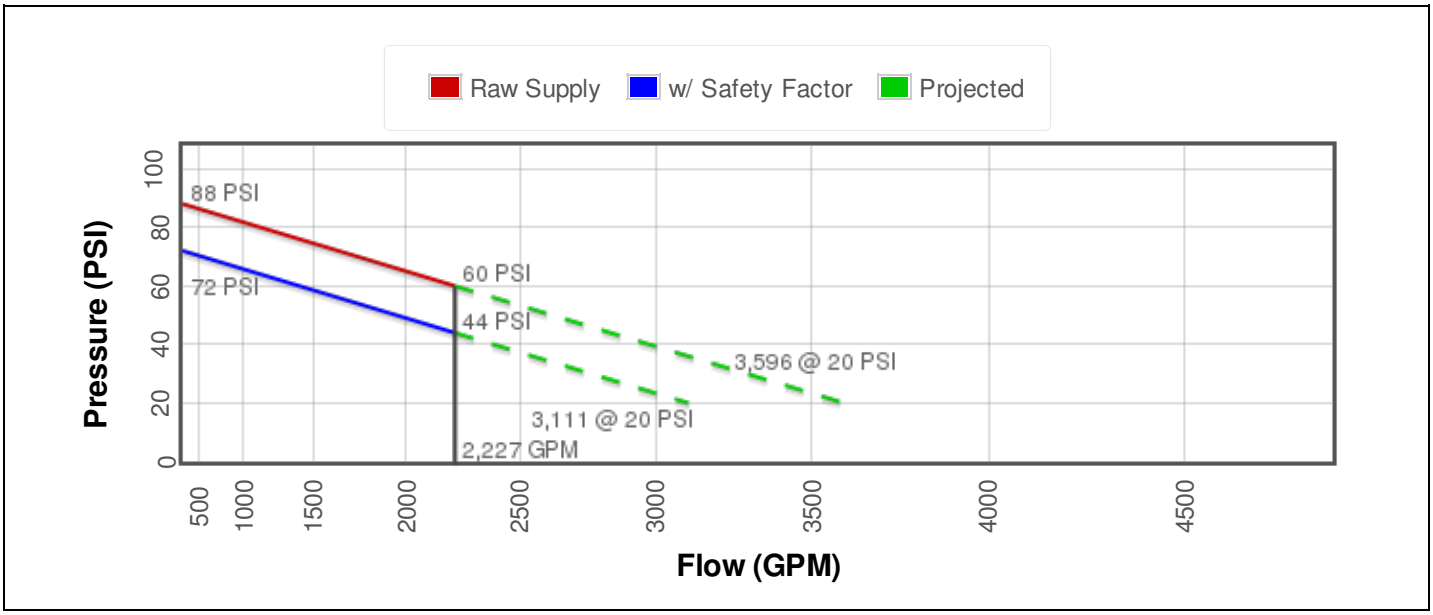
Flow Hydrant (only hydrant F1 shown for clarity)



Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



Flow Test Summary

Project Name:	EJFT 18092-2
Project Address:	7887 E Princess Blvd, Scottsdale, AZ 85255
Date of Flow Test:	2018-05-04
Time of Flow Test:	7:55 AM
Data Reliable Until:	2018-11-04
Conducted By:	Austin Gourley & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By:	Jim Demarbiex (City of Scottsdale) 602.541.0586
City Forces Contacted:	City of Scottsdale (602.228.2187)
Permit Number:	C55277

Note Scottsdale requires a max static pressure of 72 psi for safety factor

Raw Flow Test Data

Static Pressure:	80.0 PSI
Residual Pressure:	70.0 PSI
Flowing GPM:	1,839
GPM @ 20 PSI:	4,839

Data with a 8 PSI Safety Factor

Static Pressure:	72.0 PSI
Residual Pressure:	62.0 PSI
Flowing GPM:	1,839
GPM @ 20 PSI:	4,479

Hydrant F_1

Pitot Pressure (1):	30	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	30	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches



Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
1268 ft (measured linearly)

Static-Residual Elevation
1583 ft (above sea level)

Flow Hydrant (F_1) Elevation
1587 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC
21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

Flow Test Summary

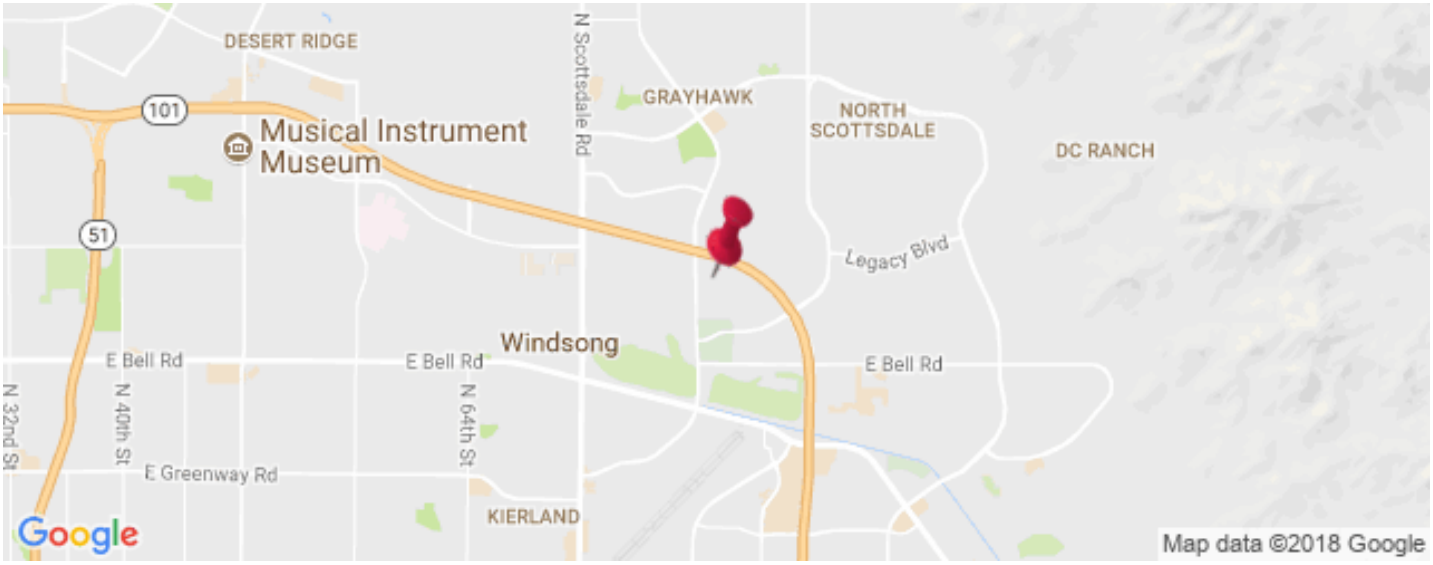
Static-Residual Hydrant



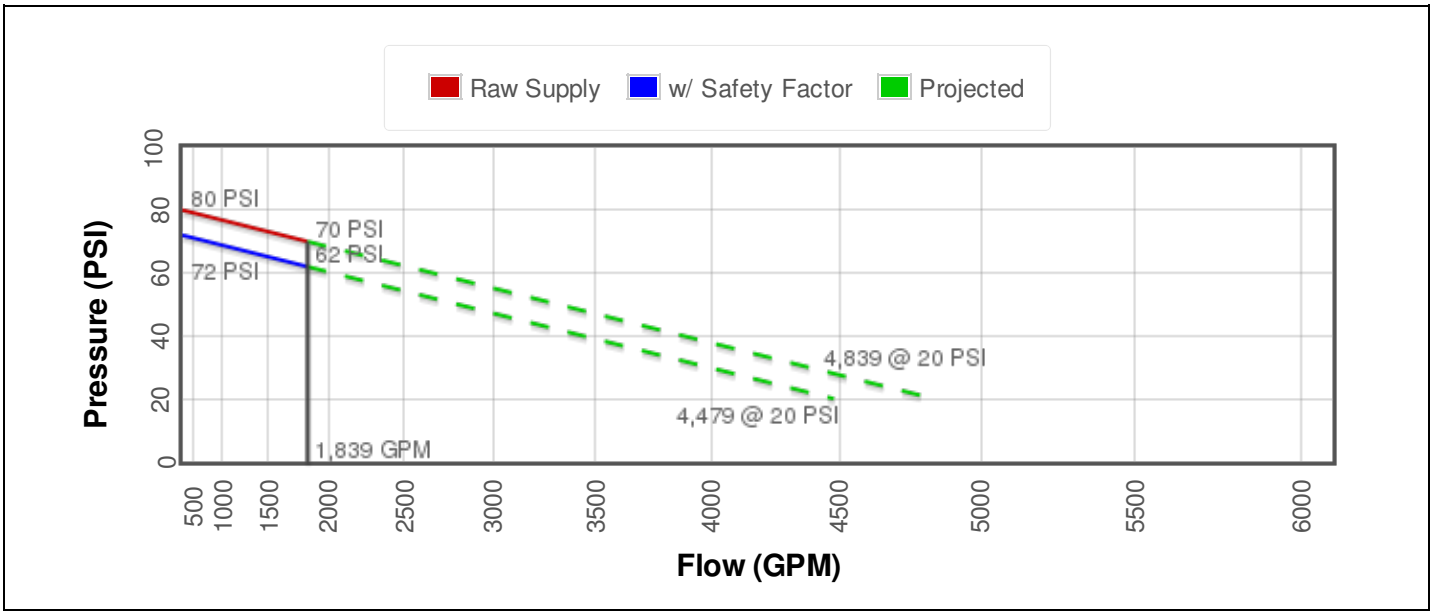
Flow Hydrant (only hydrant F1 shown for clarity)



Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



Active Scenario: Average Day

FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	59.00	0	241.03	78.8
J-2	60.00	0	241.03	78.3
J-3	60.60	0	241.06	78.1
J-4	59.80	0	241.06	78.4
J-5	60.50	0	241.07	78.1
J-6	60.30	0	241.07	78.2
J-7	68.00	0	241.51	75.1
J-8	76.40	0	241.63	71.5
J-9	76.80	0	241.63	71.3
J-10	76.80	0	241.63	71.3
J-11	96.90	0	241.45	62.5
J-12	86.60	0	241.44	67.0
J-13	59.00	0	240.93	78.7
Remainder Parcel	80.00	755	240.73	69.5
Sale Parcel C-2	81.80	30	241.06	68.9
Sale Parcel R-5	64.91	110	241.06	76.2

Active Scenario: Average Day

FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	PRINCESS PRESSURE FH	J-1	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-2	J-1	J-2	8.0	82	Ductile Iron	130.0	0	0.00	0.00
P-3	J-2	J-3	12.0	333	Ductile Iron	130.0	-164	0.46	0.03
P-4	J-3	J-4	8.0	28	Ductile Iron	130.0	0	0.00	0.00
P-5	J-4	PRINCESS FLOW FH	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-6	J-3	J-5	12.0	11	Ductile Iron	130.0	-164	0.46	0.00
P-7	J-6	J-5	16.0	26	Ductile Iron	130.0	164	0.26	0.00
P-8	J-7	J-6	12.0	1,691	Ductile Iron	130.0	293	0.83	0.44
P-9	J-8	J-7	12.0	481	Ductile Iron	130.0	293	0.83	0.13
P-10	J-8	MAYO PRESSURE FH	6.0	21	Ductile Iron	130.0	0	0.00	0.00
P-11	J-9	J-8	16.0	24	Ductile Iron	130.0	-602	0.96	0.01
P-12	J-9	J-10	12.0	171	Ductile Iron	130.0	0	0.00	0.00
P-13	J-10	MAYO FLOW FH	6.0	11	Ductile Iron	130.0	0	0.00	0.00
P-14	J-11	J-9	16.0	712	Ductile Iron	130.0	-602	0.96	0.17
P-15	J-12	J-11	16.0	47	Ductile Iron	130.0	-602	0.96	0.01
P-16	Sale Parcel C-2	J-12	16.0	1,567	Ductile Iron	130.0	-602	0.96	0.38
P-17	Sale Parcel R-5	Sale Parcel C-2	16.0	1,184	Ductile Iron	130.0	20	0.03	0.00
P-18	J-6	Sale Parcel R-5	16.0	323	Ductile Iron	130.0	130	0.21	0.00
P-19	Remainder Parcel	Sale Parcel C-2	16.0	1,382	Ductile Iron	130.0	-591	0.94	0.33
P-20	J-13	Remainder Parcel	12.0	2,240	Ductile Iron	130.0	164	0.46	0.20
P-21	J-2	J-13	12.0	1,146	Ductile Iron	130.0	164	0.46	0.10
P-22	J-1	PMP-1	100.0	1	Ductile Iron	130.0	0	0.00	0.00
P-23	PMP-1	R-1	100.0	100	Ductile Iron	130.0	0	0.00	0.00
P-24	J-8	PMP-2	100.0	1	Ductile Iron	130.0	-895	0.04	0.00
P-25	PMP-2	R-2	100.0	1	Ductile Iron	130.0	-895	0.04	0.00

Active Scenario: Max Day

FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	59.00	0	229.48	73.8
J-2	60.00	0	229.37	73.3
J-3	60.60	0	229.39	73.0
J-4	59.80	0	229.39	73.4
J-5	60.50	0	229.39	73.1
J-6	60.30	0	229.39	73.2
J-7	68.00	0	230.58	70.3
J-8	76.40	0	230.92	66.9
J-9	76.80	0	230.90	66.7
J-10	76.80	0	230.90	66.7
J-11	96.90	0	230.42	57.8
J-12	86.60	0	230.39	62.2
J-13	59.00	0	228.97	73.5
Remainder Parcel	80.00	1,510	228.18	64.1
Sale Parcel C-2	81.80	59	229.32	63.8
Sale Parcel R-5	64.91	219	229.35	71.1

Active Scenario: Max Day

FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	PRINCESS PRESSURE FH	J-1	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-2	J-1	J-2	8.0	82	Ductile Iron	130.0	239	1.53	0.11
P-3	J-2	J-3	12.0	333	Ductile Iron	130.0	-106	0.30	0.01
P-4	J-3	J-4	8.0	28	Ductile Iron	130.0	0	0.00	0.00
P-5	J-4	PRINCESS FLOW FH	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-6	J-3	J-5	12.0	11	Ductile Iron	130.0	-106	0.30	0.00
P-7	J-6	J-5	16.0	26	Ductile Iron	130.0	106	0.17	0.00
P-8	J-7	J-6	12.0	1,691	Ductile Iron	130.0	501	1.42	1.19
P-9	J-8	J-7	12.0	481	Ductile Iron	130.0	501	1.42	0.34
P-10	J-8	MAYO PRESSURE FH	6.0	21	Ductile Iron	130.0	0	0.00	0.00
P-11	J-9	J-8	16.0	24	Ductile Iron	130.0	-1,047	1.67	0.02
P-12	J-9	J-10	12.0	171	Ductile Iron	130.0	0	0.00	0.00
P-13	J-10	MAYO FLOW FH	6.0	11	Ductile Iron	130.0	0	0.00	0.00
P-14	J-11	J-9	16.0	712	Ductile Iron	130.0	-1,047	1.67	0.48
P-15	J-12	J-11	16.0	47	Ductile Iron	130.0	-1,047	1.67	0.03
P-16	Sale Parcel C-2	J-12	16.0	1,567	Ductile Iron	130.0	-1,047	1.67	1.07
P-17	Sale Parcel R-5	Sale Parcel C-2	16.0	1,184	Ductile Iron	130.0	177	0.28	0.03
P-18	J-6	Sale Parcel R-5	16.0	323	Ductile Iron	130.0	396	0.63	0.04
P-19	Remainder Parcel	Sale Parcel C-2	16.0	1,382	Ductile Iron	130.0	-1,165	1.86	1.14
P-20	J-13	Remainder Parcel	12.0	2,240	Ductile Iron	130.0	345	0.98	0.79
P-21	J-2	J-13	12.0	1,146	Ductile Iron	130.0	345	0.98	0.40
P-22	J-1	PMP-1	100.0	1	Ductile Iron	130.0	-239	0.01	0.00
P-23	PMP-1	R-1	100.0	100	Ductile Iron	130.0	-239	0.01	0.00
P-24	J-8	PMP-2	100.0	1	Ductile Iron	130.0	-1,549	0.06	0.00
P-25	PMP-2	R-2	100.0	1	Ductile Iron	130.0	-1,549	0.06	0.00

Active Scenario: Peak Hour

FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	59.00	0	216.15	68.0
J-2	60.00	0	214.69	66.9
J-3	60.60	0	214.57	66.6
J-4	59.80	0	214.57	67.0
J-5	60.50	0	214.56	66.7
J-6	60.30	0	214.56	66.7
J-7	68.00	0	216.53	64.3
J-8	76.40	0	217.09	60.9
J-9	76.80	0	217.06	60.7
J-10	76.80	0	217.06	60.7
J-11	96.90	0	216.14	51.6
J-12	86.60	0	216.08	56.0
J-13	59.00	0	213.41	66.8
Remainder Parcel	80.00	2,643	210.93	56.6
Sale Parcel C-2	81.80	104	214.05	57.2
Sale Parcel R-5	64.91	383	214.36	64.7

Active Scenario: Peak Hour

FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	PRINCESS PRESSURE FH	J-1	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-2	J-1	J-2	8.0	82	Ductile Iron	130.0	989	6.31	1.46
P-3	J-2	J-3	12.0	333	Ductile Iron	130.0	348	0.99	0.12
P-4	J-3	J-4	8.0	28	Ductile Iron	130.0	0	0.00	0.00
P-5	J-4	PRINCESS FLOW FH	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-6	J-3	J-5	12.0	11	Ductile Iron	130.0	348	0.99	0.00
P-7	J-6	J-5	16.0	26	Ductile Iron	130.0	-348	0.56	0.00
P-8	J-7	J-6	12.0	1,691	Ductile Iron	130.0	658	1.87	1.97
P-9	J-8	J-7	12.0	481	Ductile Iron	130.0	658	1.87	0.56
P-10	J-8	MAYO PRESSURE FH	6.0	21	Ductile Iron	130.0	0	0.00	0.00
P-11	J-9	J-8	16.0	24	Ductile Iron	130.0	-1,484	2.37	0.03
P-12	J-9	J-10	12.0	171	Ductile Iron	130.0	0	0.00	0.00
P-13	J-10	MAYO FLOW FH	6.0	11	Ductile Iron	130.0	0	0.00	0.00
P-14	J-11	J-9	16.0	712	Ductile Iron	130.0	-1,484	2.37	0.92
P-15	J-12	J-11	16.0	47	Ductile Iron	130.0	-1,484	2.37	0.06
P-16	Sale Parcel C-2	J-12	16.0	1,567	Ductile Iron	130.0	-1,484	2.37	2.03
P-17	Sale Parcel R-5	Sale Parcel C-2	16.0	1,184	Ductile Iron	130.0	623	0.99	0.31
P-18	J-6	Sale Parcel R-5	16.0	323	Ductile Iron	130.0	1,006	1.61	0.20
P-19	Remainder Parcel	Sale Parcel C-2	16.0	1,382	Ductile Iron	130.0	-2,003	3.20	3.12
P-20	J-13	Remainder Parcel	12.0	2,240	Ductile Iron	130.0	640	1.82	2.49
P-21	J-2	J-13	12.0	1,146	Ductile Iron	130.0	640	1.82	1.27
P-22	J-1	PMP-1	100.0	1	Ductile Iron	130.0	-989	0.04	0.00
P-23	PMP-1	R-1	100.0	100	Ductile Iron	130.0	-989	0.04	0.00
P-24	J-8	PMP-2	100.0	1	Ductile Iron	130.0	-2,141	0.09	0.00
P-25	PMP-2	R-2	100.0	1	Ductile Iron	130.0	-2,141	0.09	0.00

Active Scenario: Max Day + Fire Flow

FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	59.00	0	170.55	48.3
J-2	60.00	0	164.45	45.2
J-3	60.60	0	163.89	44.7
J-4	59.80	0	163.89	45.0
J-5	60.50	0	163.87	44.7
J-6	60.30	0	163.86	44.8
J-7	68.00	0	168.34	43.4
J-8	76.40	0	169.62	40.3
J-9	76.80	0	169.54	40.1
J-10	76.80	0	169.54	40.1
J-11	96.90	0	167.06	30.4
J-12	86.60	0	166.90	34.7
J-13	59.00	0	159.50	43.5
Remainder Parcel	80.00	5,410	149.82	30.2
Sale Parcel C-2	81.80	59	161.46	34.5
Sale Parcel R-5	64.91	219	163.24	42.5

Active Scenario: Max Day + Fire Flow

FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	PRINCESS PRESSURE FH	J-1	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-2	J-1	J-2	8.0	82	Ductile Iron	130.0	2,138	13.65	6.10
P-3	J-2	J-3	12.0	333	Ductile Iron	130.0	804	2.28	0.56
P-4	J-3	J-4	8.0	28	Ductile Iron	130.0	0	0.00	0.00
P-5	J-4	PRINCESS FLOW FH	6.0	13	Ductile Iron	130.0	0	0.00	0.00
P-6	J-3	J-5	12.0	11	Ductile Iron	130.0	804	2.28	0.02
P-7	J-6	J-5	16.0	26	Ductile Iron	130.0	-804	1.28	0.01
P-8	J-7	J-6	12.0	1,691	Ductile Iron	130.0	1,025	2.91	4.48
P-9	J-8	J-7	12.0	481	Ductile Iron	130.0	1,025	2.91	1.28
P-10	J-8	MAYO PRESSURE FH	6.0	21	Ductile Iron	130.0	0	0.00	0.00
P-11	J-9	J-8	16.0	24	Ductile Iron	130.0	-2,526	4.03	0.08
P-12	J-9	J-10	12.0	171	Ductile Iron	130.0	0	0.00	0.00
P-13	J-10	MAYO FLOW FH	6.0	11	Ductile Iron	130.0	0	0.00	0.00
P-14	J-11	J-9	16.0	712	Ductile Iron	130.0	-2,526	4.03	2.47
P-15	J-12	J-11	16.0	47	Ductile Iron	130.0	-2,526	4.03	0.16
P-16	Sale Parcel C-2	J-12	16.0	1,567	Ductile Iron	130.0	-2,526	4.03	5.44
P-17	Sale Parcel R-5	Sale Parcel C-2	16.0	1,184	Ductile Iron	130.0	1,610	2.57	1.78
P-18	J-6	Sale Parcel R-5	16.0	323	Ductile Iron	130.0	1,829	2.92	0.62
P-19	Remainder Parcel	Sale Parcel C-2	16.0	1,382	Ductile Iron	130.0	-4,076	6.50	11.64
P-20	J-13	Remainder Parcel	12.0	2,240	Ductile Iron	130.0	1,334	3.78	9.68
P-21	J-2	J-13	12.0	1,146	Ductile Iron	130.0	1,334	3.78	4.95
P-22	J-1	PMP-1	100.0	1	Ductile Iron	130.0	-2,138	0.09	0.00
P-23	PMP-1	R-1	100.0	100	Ductile Iron	130.0	-2,138	0.09	0.00
P-24	J-8	PMP-2	100.0	1	Ductile Iron	130.0	-3,550	0.15	0.00
P-25	PMP-2	R-2	100.0	1	Ductile Iron	130.0	-3,550	0.15	0.00

Appendix G – Fire Flow Test Results and WaterCAD Analysis Results

Flow Test Summary

Project Name:	EJFT 22516-1 - Hayden 101
Project Address:	E Mayo Blvd & Scottsdale Rd, Scottsdale, AZ 85255
Date of Flow Test:	2022-12-13
Time of Flow Test:	6:50 AM
Data Reliable Until:	2023-06-13
Conducted By:	Steven Saethre & Erick Preciado (EJ Flow Test) 602.999.7637
Witnessed By:	Sonny Schreiner (City of Scottsdale) 602.819.7718
City Forces Contacted:	City of Scottsdale (602.819.7718)
Permit Number:	C70909

Raw Flow Test Data

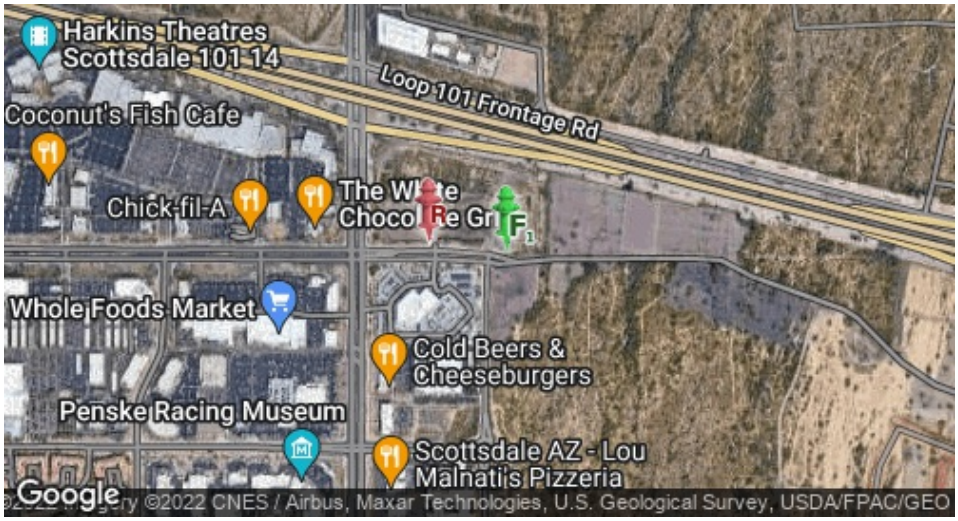
Static Pressure:	70.0 PSI
Residual Pressure:	64.0 PSI
Flowing GPM:	1,985
GPM @ 20 PSI:	6,238

Data with a 10 % Safety Factor

Static Pressure:	63.0 PSI
Residual Pressure:	57.0 PSI
Flowing GPM:	1,985
GPM @ 20 PSI:	5,750

Hydrant F_1

Pitot Pressure (1):	37	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	33	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches



Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
548 ft (measured linearly)

Static-Residual Elevation
1590 ft (above sea level)

Flow Hydrant (F_1) Elevation
1593 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC
21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 |
John L. Echeverri | NICET Level IV 78493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915
www.flowtestsummary.com

Flow Test Summary

Static-Residual Hydrant



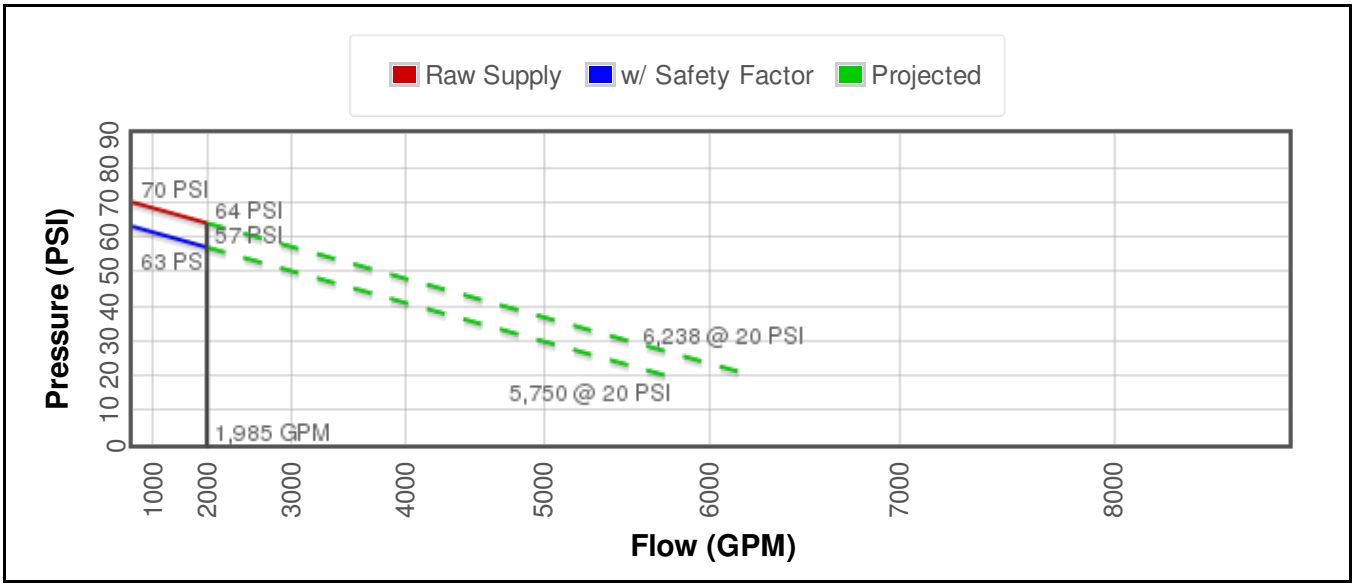
Flow Hydrant (only hydrant F1 shown for clarity)



Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



Flow Test Summary

Project Name:	EJFT 22516-2 - Hayden 101
Project Address:	N 78th St & E Mayo Blvd, Scottsdale, AZ 85255
Date of Flow Test:	2022-12-13
Time of Flow Test:	7:15AM
Data Reliable Until:	2023-06-13
Conducted By:	Steven Saethre & Erick Preciado (EJ Flow Test) 602.999.7637
Witnessed By:	Sonny Schreiner (City of Scottsdale) 602.819.7718
City Forces Contacted:	City of Scottsdale (602.819.7718)
Permit Number:	C70910

Raw Flow Test Data

Static Pressure:	71.0 PSI
Residual Pressure:	65.0 PSI
Flowing GPM:	2,175
GPM @ 20 PSI:	6,908

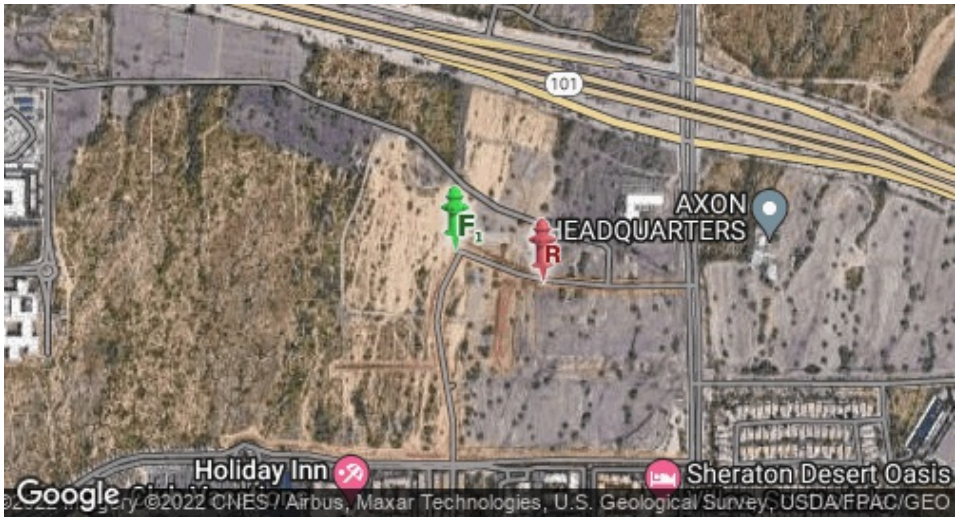
Data with a 10 % Safety Factor

Static Pressure:	63.9 PSI
Residual Pressure:	57.9 PSI
Flowing GPM:	2,175
GPM @ 20 PSI:	6,371

Hydrant F_1

Pitot Pressure (1):	44	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	40	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches

Submit new hydrant test and flow modeling with each BOD related to the master development. DSPM 6-1.202



Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
639 ft (measured linearly)

Static-Residual Elevation
1585 ft (above sea level)

Flow Hydrant (F_1) Elevation
1585 ft (above sea level)

Elevation & distance values are approximate

Flow Test Summary

Static-Residual Hydrant



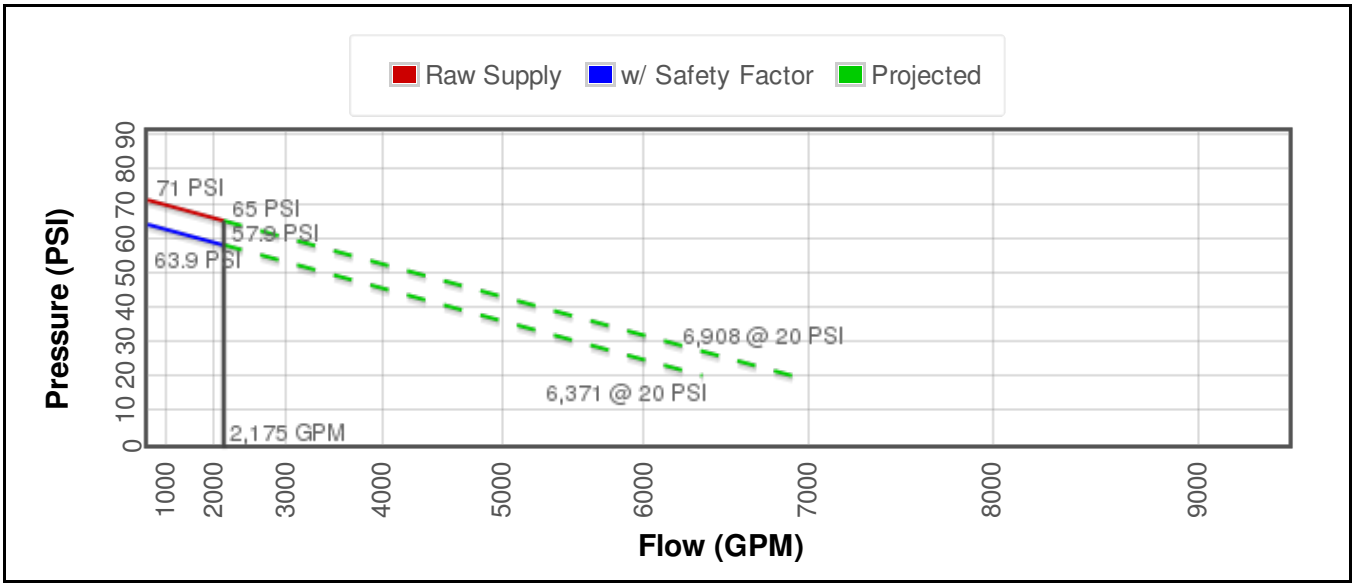
Flow Hydrant (only hydrant F1 shown for clarity)



Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



AZ LOOP 101

SALE PARCEL AREA

MAYO BLVD

OPTIMA

SCOTTSDALE PRESSURE FH

SCOTTSDALE FLOW FH

R&D LAB

R&D OFFICE

HOSPITAL

MEDICAL OFFICE

HEALTH CENTER

OFFICE

RESTAURANT

78TH FLOW FH

78TH PRESSURE FH

FUTURE MAYO BLVD ALIGNMENT

FUTURE MILLER ROAD ALIGNMENT

78TH STREET

HAYDEN ROAD

J-1 J-2 J-3 J-4 J-5 J-6 J-7 J-8 J-9 J-17 J-19 J-21 J-22 J-23 J-24 J-25 J-26 J-27 J-28 J-30 J-32 J-34 J-36 J-38 J-39 J-40 J-41 J-42 J-43 J-45 J-46 J-47 J-48 J-50 J-51 J-52 J-53 J-54 J-55 J-57

P-1 P-2 P-3(1) P-3(2)(1) P-3(2)(2) P-4(1)(1) P-4(1)(2) P-4(2) P-5(1) P-5(2)(1) P-5(2)(2) P-6 P-7 P-8 P-10 P-12 P-13 P-22 P-23 P-25 P-26 P-27 P-29 P-30(1) P-30(2)(1) P-30(2)(2) P-31 P-32(1) P-32(2) P-34(1) P-34(2) P-36 P-37 P-38 P-39 P-40 P-41 P-42 P-43 P-44(1) P-44(2) P-45 P-46 P-47(1) P-47(2) P-48 P-49 P-50 P-51 P-52 P-53 P-54 P-55 P-57

EX P-14

NORTH

GRAPHIC SCALE IN FEET
0 75 150 300

WaterCAD Layout

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2023-07-29 WaterCAD Layout.dwg Aug 28, 2024 Laurel.Wright

Average Daily Demand

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Demand (gpm)	Pressure (psi)
HEALTH CENTER	96.66	232.22	146	59
HOSPITAL	96.39	232.16	269	59
J-1	93.00	232.61	0	60
J-2	91.00	232.40	0	61
J-3	91.00	232.31	0	61
J-4	87.00	232.28	0	63
J-5	89.00	232.30	0	62
J-6	92.00	232.28	0	61
J-7	99.00	232.28	0	58
J-8	103.00	232.28	0	56
J-9	92.00	232.69	0	61
J-17	89.42	232.29	0	62
J-19	90.00	232.60	0	62
J-21	89.98	232.28	0	62
J-22	102.17	232.28	0	56
J-23	110.71	232.28	0	53
J-24	108.94	232.28	0	53
J-25	117.10	232.28	0	50
J-26	102.77	232.28	0	56
J-27	106.08	232.28	0	55
J-28	89.22	232.28	0	62
J-30	88.19	232.28	0	62
J-32	87.73	232.29	0	63
J-34	91.28	232.57	0	61
J-36	109.06	232.28	0	53
J-38	111.35	232.28	0	52
J-39	87.20	232.28	0	63
J-40	87.93	232.28	0	62
J-41	86.70	232.28	0	63
J-42	91.32	232.28	0	61
J-43	91.88	232.28	0	61

Average Daily Demand

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Demand (gpm)	Pressure (psi)
J-45	96.39	232.28	0	59
J-46	100.80	232.28	0	57
J-47	105.94	232.28	0	55
J-48	105.38	232.28	0	55
MEDICAL OFFICE	98.00	232.27	71	58
OFFICE	97.44	232.28	27	58
OPTIMA	96.00	232.53	479	59
R&D LAB	96.00	232.32	282	59
R&D OFFICE	96.57	232.27	198	59
RESTAURANT	96.61	232.28	54	59

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	535	J-1	J-2	16.0	Ductile Iron	130.0	766	1.22	0.20
P-2	545	J-2	J-3	16.0	Ductile Iron	130.0	484	0.77	0.09
P-6	486	J-6	J-7	16.0	Ductile Iron	130.0	-9	0.01	0.00
P-7	192	J-7	J-8	16.0	Ductile Iron	130.0	-9	0.01	0.00
P-8	337	J-2	R&D LAB	12.0	Ductile Iron	130.0	282	0.80	0.08
P-10	733	J-4	MEDICAL OFFICE	12.0	Ductile Iron	130.0	71	0.20	0.01
P-12	10	J-55	RESTAURANT	12.0	Ductile Iron	130.0	54	0.15	0.00
P-13	22	J-55	OFFICE	12.0	Ductile Iron	130.0	27	0.08	0.00
EX P-14	220	J-9	J-1	16.0	Ductile Iron	130.0	766	1.22	0.08
P-15	14	R-1	PMP-1	100.0	Ductile Iron	130.0	1,245	0.05	0.00
P-19	33	R-2	PMP-2	100.0	Ductile Iron	130.0	281	0.01	0.00
P-5(1)	232	J-5	J-17	16.0	Ductile Iron	130.0	110	0.17	0.01
P-22	17	J-17	78TH PRESSURE FH	6.0	Ductile Iron	130.0	0	0.00	0.00
P-23	24	SCOTTSDALE FLOW FH	J-9	6.0	Ductile Iron	130.0	0	0.00	0.00
P-24	32	PMP-1	J-9	100.0	Ductile Iron	130.0	1,245	0.05	0.00

Average Daily Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-25	23	SCOTTSDALE PRESSURE FH	J-19	6.0	Ductile Iron	130.0	0	0.00	0.00
P-26	133	J-19	J-9	16.0	Ductile Iron	130.0	-479	0.76	0.09
P-27	42	78TH FLOW FH	J-5	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	37	PMP-2	J-5	100.0	Ductile Iron	130.0	281	0.01	0.00
P-3(1)	499	J-3	J-21	16.0	Ductile Iron	130.0	286	0.46	0.03
P-29	653	J-21	J-22	24.0	Ductile Iron	130.0	51	0.04	0.00
P-30(1)	558	J-22	J-24	24.0	Ductile Iron	130.0	31	0.02	0.00
P-31	1,454	J-23	J-25	24.0	Ductile Iron	130.0	31	0.02	0.00
P-32(1)	734	J-25	J-27	16.0	Ductile Iron	130.0	31	0.05	0.00
P-32(2)	241	J-27	J-8	16.0	Ductile Iron	130.0	9	0.01	0.00
P-3(2)(1)	341	J-21	J-28	24.0	Ductile Iron	130.0	234	0.17	0.00
P-3(2)(2)(1)	327	J-28	J-30	24.0	Ductile Iron	130.0	234	0.17	0.00
P-3(2)(2)(2)	432	J-30	J-4	24.0	Ductile Iron	130.0	-35	0.02	0.00
P-36	515	J-30	HOSPITAL	12.0	Ductile Iron	130.0	269	0.76	0.11
P-4(2)	139	J-32	J-5	16.0	Ductile Iron	130.0	-172	0.27	0.00
P-37	761	J-41	HEALTH CENTER	12.0	Ductile Iron	130.0	146	0.41	0.05
P-38	186	J-19	J-34	16.0	Ductile Iron	130.0	479	0.76	0.03
P-39	66	J-34	OPTIMA	12.0	Ductile Iron	130.0	479	1.36	0.04
P-30(2)(1)	71	J-24	J-36	24.0	Ductile Iron	130.0	31	0.02	0.00
P-30(2)(2)	978	J-36	J-23	24.0	Ductile Iron	130.0	31	0.02	0.00
P-40	77	J-36	J-38	16.0	Ductile Iron	130.0	0	0.00	0.00
P-41	999	J-22	J-26	16.0	Ductile Iron	130.0	20	0.03	0.00
P-4(1)(1)	207	J-4	J-40	24.0	Ductile Iron	130.0	-106	0.08	0.00
P-4(1)(2)	546	J-39	J-32	16.0	Ductile Iron	130.0	-172	0.27	0.01
P-42	6	J-40	J-39	20.0	Ductile Iron	130.0	-172	0.18	0.00
P-43	545	J-40	J-41	20.0	Ductile Iron	130.0	66	0.07	0.00
P-5(2)(1)	740	J-17	J-43	16.0	Ductile Iron	130.0	110	0.17	0.01
P-5(2)(2)	37	J-43	J-6	16.0	Ductile Iron	130.0	-9	0.01	0.00
P-45	11	J-42	J-43	24.0	Ductile Iron	130.0	-118	0.08	0.00
P-46	479	J-42	J-45	24.0	Ductile Iron	130.0	20	0.01	0.00
P-34(1)	1,587	J-26	J-47	16.0	Ductile Iron	130.0	20	0.03	0.00

Average Daily Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-34(2)	68	J-47	J-27	16.0	Ductile Iron	130.0	-22	0.04	0.00
P-48	274	J-46	J-47	24.0	Ductile Iron	130.0	-43	0.03	0.00
P-49	27	J-47	J-48	30.0	Ductile Iron	130.0	0	0.00	0.00
P-50	343	J-3	R&D OFFICE	12.0	Ductile Iron	130.0	198	0.56	0.04

Maximum Daily Demand

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Demand (gpm)	Pressure (psi)
HEALTH CENTER	96.66	227.62	292	57
HOSPITAL	96.39	227.48	469	57
J-1	93.00	228.06	0	58
J-2	91.00	227.83	0	59
J-3	91.00	227.80	0	59
J-4	87.00	227.81	0	61
J-5	89.00	228.05	0	60
J-6	92.00	227.82	0	59
J-7	99.00	227.82	0	56
J-8	103.00	227.82	0	54
J-9	92.00	228.16	0	59
J-17	89.42	227.94	0	60
J-19	90.00	227.90	0	60
J-21	89.98	227.80	0	60
J-22	102.17	227.81	0	54
J-23	110.71	227.81	0	51
J-24	108.94	227.81	0	51
J-25	117.10	227.81	0	48
J-26	102.77	227.81	0	54
J-27	106.08	227.82	0	53
J-28	89.22	227.80	0	60
J-30	88.19	227.80	0	60
J-32	87.73	228.00	0	61
J-34	91.28	227.81	0	59
J-36	109.06	227.81	0	51
J-38	111.35	227.81	0	50
J-39	87.20	227.82	0	61
J-40	87.93	227.82	0	61
J-41	86.70	227.81	0	61
J-42	91.32	227.82	0	59
J-43	91.88	227.82	0	59

Maximum Daily Demand

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Demand (gpm)	Pressure (psi)
J-45	96.39	227.82	0	57
J-46	100.80	227.82	0	55
J-47	105.94	227.82	0	53
J-48	105.38	227.82	0	53
MEDICAL OFFICE	98.00	227.76	142	56
OFFICE	97.44	227.81	54	56
OPTIMA	96.00	227.68	865	57
R&D LAB	96.00	227.53	564	57
R&D OFFICE	96.57	227.64	397	57
RESTAURANT	96.61	227.81	108	57

Where is fire flow demand applied for Scenario 3 ? DSPM 6-1.406

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	535	J-1	J-2	16.0	Ductile Iron	130.0	832	1.33	0.24
P-2	545	J-2	J-3	16.0	Ductile Iron	130.0	268	0.43	0.03
P-6	486	J-6	J-7	16.0	Ductile Iron	130.0	67	0.11	0.00
P-7	192	J-7	J-8	16.0	Ductile Iron	130.0	67	0.11	0.00
P-8	337	J-2	R&D LAB	12.0	Ductile Iron	130.0	564	1.60	0.30
P-10	733	J-4	MEDICAL OFFICE	12.0	Ductile Iron	130.0	142	0.40	0.05
P-12	10	J-55	RESTAURANT	12.0	Ductile Iron	130.0	108	0.31	0.00
P-13	22	J-55	OFFICE	12.0	Ductile Iron	130.0	54	0.15	0.00
EX P-14	220	J-9	J-1	16.0	Ductile Iron	130.0	832	1.33	0.10
P-15	14	R-1	PMP-1	100.0	Ductile Iron	130.0	1,697	0.07	0.00
P-19	33	R-2	PMP-2	100.0	Ductile Iron	130.0	1,194	0.05	0.00
P-5(1)	232	J-5	J-17	16.0	Ductile Iron	130.0	482	0.77	0.10
P-22	17	J-17	78TH PRESSURE FH	6.0	Ductile Iron	130.0	0	0.00	0.00
P-23	24	SCOTTSDALE FLOW FH	J-9	6.0	Ductile Iron	130.0	0	0.00	0.00
P-24	32	PMP-1	J-9	100.0	Ductile Iron	130.0	1,697	0.07	0.00

Maximum Daily Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-25	23	SCOTTSDALE PRESSURE FH	J-19	6.0	Ductile Iron	130.0	0	0.00	0.00
P-26	133	J-19	J-9	16.0	Ductile Iron	130.0	-865	1.38	0.26
P-27	42	78TH FLOW FH	J-5	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	37	PMP-2	J-5	100.0	Ductile Iron	130.0	1,194	0.05	0.00
P-3(1)	499	J-3	J-21	16.0	Ductile Iron	130.0	-129	0.21	0.01
P-29	653	J-21	J-22	24.0	Ductile Iron	130.0	-182	0.13	0.00
P-30(1)	558	J-22	J-24	24.0	Ductile Iron	130.0	-110	0.08	0.00
P-31	1,454	J-23	J-25	24.0	Ductile Iron	130.0	-110	0.08	0.00
P-32(1)	734	J-25	J-27	16.0	Ductile Iron	130.0	-110	0.18	0.01
P-32(2)	241	J-27	J-8	16.0	Ductile Iron	130.0	-67	0.11	0.00
P-3(2)(1)	341	J-21	J-28	24.0	Ductile Iron	130.0	53	0.04	0.00
P-3(2)(2)(1)	327	J-28	J-30	24.0	Ductile Iron	130.0	53	0.04	0.00
P-3(2)(2)(2)	432	J-30	J-4	24.0	Ductile Iron	130.0	-416	0.30	0.01
P-36	515	J-30	HOSPITAL	12.0	Ductile Iron	130.0	469	1.33	0.32
P-4(2)	139	J-32	J-5	16.0	Ductile Iron	130.0	-712	1.14	0.05
P-37	761	J-41	HEALTH CENTER	12.0	Ductile Iron	130.0	292	0.83	0.20
P-38	186	J-19	J-34	16.0	Ductile Iron	130.0	865	1.38	0.09
P-39	66	J-34	OPTIMA	12.0	Ductile Iron	130.0	865	2.45	0.13
P-30(2)(1)	71	J-24	J-36	24.0	Ductile Iron	130.0	-110	0.08	0.00
P-30(2)(2)	978	J-36	J-23	24.0	Ductile Iron	130.0	-110	0.08	0.00
P-40	77	J-36	J-38	16.0	Ductile Iron	130.0	0	0.00	0.00
P-41	999	J-22	J-26	16.0	Ductile Iron	130.0	-72	0.11	0.00
P-4(1)(1)	207	J-4	J-40	24.0	Ductile Iron	130.0	-558	0.40	0.01
P-4(1)(2)	546	J-39	J-32	16.0	Ductile Iron	130.0	-712	1.14	0.18
P-42	6	J-40	J-39	20.0	Ductile Iron	130.0	-712	0.73	0.00
P-43	545	J-40	J-41	20.0	Ductile Iron	130.0	153	0.16	0.00
P-5(2)(1)	740	J-17	J-43	16.0	Ductile Iron	130.0	482	0.77	0.12
P-5(2)(2)	37	J-43	J-6	16.0	Ductile Iron	130.0	67	0.11	0.00
P-45	11	J-42	J-43	24.0	Ductile Iron	130.0	-416	0.29	0.00
P-46	479	J-42	J-45	24.0	Ductile Iron	130.0	230	0.16	0.00
P-34(1)	1,587	J-26	J-47	16.0	Ductile Iron	130.0	-72	0.11	0.01

Maximum Daily Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-34(2)	68	J-47	J-27	16.0	Ductile Iron	130.0	43	0.07	0.00
P-48	274	J-46	J-47	24.0	Ductile Iron	130.0	115	0.08	0.00
P-49	27	J-47	J-48	30.0	Ductile Iron	130.0	0	0.00	0.00
P-50	343	J-3	R&D OFFICE	12.0	Ductile Iron	130.0	397	1.13	0.16

Peak Hour Demand

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Demand (gpm)	Pressure (psi)
HEALTH CENTER	96.66	213.18	510	50
HOSPITAL	96.39	212.89	769	50
J-1	93.00	214.05	0	52
J-2	91.00	213.60	0	53
J-3	91.00	213.58	0	53
J-4	87.00	213.72	0	55
J-5	89.00	214.64	0	54
J-6	92.00	213.76	0	53
J-7	99.00	213.75	0	50
J-8	103.00	213.75	0	48
J-9	92.00	214.24	0	53
J-17	89.42	214.23	0	54
J-19	90.00	213.50	0	53
J-21	89.98	213.69	0	54
J-22	102.17	213.70	0	48
J-23	110.71	213.70	0	45
J-24	108.94	213.70	0	45
J-25	117.10	213.71	0	42
J-26	102.77	213.71	0	48
J-27	106.08	213.74	0	47
J-28	89.22	213.69	0	54
J-30	88.19	213.69	0	54
J-32	87.73	214.46	0	55
J-34	91.28	213.25	0	53
J-36	109.06	213.70	0	45
J-38	111.35	213.70	0	44
J-39	87.20	213.75	0	55
J-40	87.93	213.75	0	54
J-41	86.70	213.73	0	55
J-42	91.32	213.76	0	53
J-43	91.88	213.76	0	53

Peak Hour Demand

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Demand (gpm)	Pressure (psi)
J-45	96.39	213.75	0	51
J-46	100.80	213.75	0	49
J-47	105.94	213.74	0	47
J-48	105.38	213.74	0	47
MEDICAL OFFICE	98.00	213.58	248	50
OFFICE	97.44	213.69	95	50
OPTIMA	96.00	212.89	1,510	51
R&D LAB	96.00	212.76	988	51
R&D OFFICE	96.57	213.08	745	50
RESTAURANT	96.61	213.69	325	51

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	535	J-1	J-2	16.0	Ductile Iron	130.0	1,178	1.88	0.45
P-2	545	J-2	J-3	16.0	Ductile Iron	130.0	190	0.30	0.02
P-6	486	J-6	J-7	16.0	Ductile Iron	130.0	147	0.24	0.01
P-7	192	J-7	J-8	16.0	Ductile Iron	130.0	147	0.24	0.00
P-8	337	J-2	R&D LAB	12.0	Ductile Iron	130.0	988	2.80	0.83
P-10	733	J-4	MEDICAL OFFICE	12.0	Ductile Iron	130.0	248	0.70	0.14
P-12	10	J-55	RESTAURANT	12.0	Ductile Iron	130.0	325	0.92	0.00
P-13	22	J-55	OFFICE	12.0	Ductile Iron	130.0	95	0.27	0.00
EX P-14	220	J-9	J-1	16.0	Ductile Iron	130.0	1,178	1.88	0.19
P-15	14	R-1	PMP-1	100.0	Ductile Iron	130.0	2,688	0.11	0.00
P-19	33	R-2	PMP-2	100.0	Ductile Iron	130.0	2,502	0.10	0.00
P-5(1)	232	J-5	J-17	16.0	Ductile Iron	130.0	1,013	1.62	0.41
P-22	17	J-17	78TH PRESSURE FH	6.0	Ductile Iron	130.0	0	0.00	0.00
P-23	24	SCOTTSDALE FLOW FH	J-9	6.0	Ductile Iron	130.0	0	0.00	0.00
P-24	32	PMP-1	J-9	100.0	Ductile Iron	130.0	2,688	0.11	0.00

Peak Hour Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-25	23	SCOTTSDALE PRESSURE FH	J-19	6.0	Ductile Iron	130.0	0	0.00	0.00
P-26	133	J-19	J-9	16.0	Ductile Iron	130.0	-1,510	2.41	0.73
P-27	42	78TH FLOW FH	J-5	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	37	PMP-2	J-5	100.0	Ductile Iron	130.0	2,502	0.10	0.00
P-3(1)	499	J-3	J-21	16.0	Ductile Iron	130.0	-555	0.89	0.10
P-29	653	J-21	J-22	24.0	Ductile Iron	130.0	-381	0.27	0.01
P-30(1)	558	J-22	J-24	24.0	Ductile Iron	130.0	-231	0.16	0.00
P-31	1,454	J-23	J-25	24.0	Ductile Iron	130.0	-231	0.16	0.01
P-32(1)	734	J-25	J-27	16.0	Ductile Iron	130.0	-231	0.37	0.03
P-32(2)	241	J-27	J-8	16.0	Ductile Iron	130.0	-147	0.24	0.00
P-3(2)(1)	341	J-21	J-28	24.0	Ductile Iron	130.0	-174	0.12	0.00
P-3(2)(2)(1)	327	J-28	J-30	24.0	Ductile Iron	130.0	-174	0.12	0.00
P-3(2)(2)(2)	432	J-30	J-4	24.0	Ductile Iron	130.0	-943	0.67	0.03
P-36	515	J-30	HOSPITAL	12.0	Ductile Iron	130.0	769	2.18	0.80
P-4(2)	139	J-32	J-5	16.0	Ductile Iron	130.0	-1,489	2.38	0.18
P-37	761	J-41	HEALTH CENTER	12.0	Ductile Iron	130.0	510	1.45	0.55
P-38	186	J-19	J-34	16.0	Ductile Iron	130.0	1,510	2.41	0.25
P-39	66	J-34	OPTIMA	12.0	Ductile Iron	130.0	1,510	4.28	0.36
P-30(2)(1)	71	J-24	J-36	24.0	Ductile Iron	130.0	-231	0.16	0.00
P-30(2)(2)	978	J-36	J-23	24.0	Ductile Iron	130.0	-231	0.16	0.01
P-40	77	J-36	J-38	16.0	Ductile Iron	130.0	0	0.00	0.00
P-41	999	J-22	J-26	16.0	Ductile Iron	130.0	-150	0.24	0.02
P-4(1)(1)	207	J-4	J-40	24.0	Ductile Iron	130.0	-1,191	0.84	0.02
P-4(1)(2)	546	J-39	J-32	16.0	Ductile Iron	130.0	-1,489	2.38	0.71
P-42	6	J-40	J-39	20.0	Ductile Iron	130.0	-1,489	1.52	0.00
P-43	545	J-40	J-41	20.0	Ductile Iron	130.0	297	0.30	0.01
P-5(2)(1)	740	J-17	J-43	16.0	Ductile Iron	130.0	1,013	1.62	0.47
P-5(2)(2)	37	J-43	J-6	16.0	Ductile Iron	130.0	147	0.24	0.00
P-45	11	J-42	J-43	24.0	Ductile Iron	130.0	-866	0.61	0.00
P-46	479	J-42	J-45	24.0	Ductile Iron	130.0	519	0.37	0.01
P-34(1)	1,587	J-26	J-47	16.0	Ductile Iron	130.0	-150	0.24	0.03

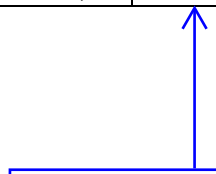
Peak Hour Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-34(2)	68	J-47	J-27	16.0	Ductile Iron	130.0	83	0.13	0.00
P-48	274	J-46	J-47	24.0	Ductile Iron	130.0	233	0.17	0.00
P-49	27	J-47	J-48	30.0	Ductile Iron	130.0	0	0.00	0.00
P-50	343	J-3	R&D OFFICE	12.0	Ductile Iron	130.0	745	2.11	0.50

Fire Flow Node FlexTable: Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Junction w/ Minimum Pressure (System)	Pressure (Calculated Zone Lower Limit) (psi)
HEALTH CENTER	True	4,000	4,079	4,292	4,371	30	J-25	34
HOSPITAL	True	4,000	4,508	4,469	4,977	30	J-25	32
MEDICAL OFFICE	True	4,000	4,166	4,142	4,308	30	J-25	34
OFFICE	True	4,000	4,941	4,054	4,995	35	J-25	30
R&D LAB	True	4,000	4,944	4,564	5,508	30	J-25	31
R&D OFFICE	True	4,000	4,960	4,397	5,357	30	J-25	31
RESTAURANT	True	4,000	4,941	4,108	5,049	36	J-25	30



The Total Flow reflects the Fire Flow (4,000 GPM) plus the MDD for each node.

WOOD PATEL

PHASE 2 WATER DEMAND DESIGN FLOWS

Project ASM Scottsdale
Location Scottsdale AZ
Project Number 235526
Project Engineer Andrew J. Sanchez, E.I.T.
References City of Scottsdale Design and Policies Manual (2018)

LAND USE AND DWELLING UNIT BREAKDOWN BY JUNCTION														FIRE FLOW		
BUILDING	WATER USE	HYDRAULIC MODEL NODE	AREA (SF)	LAND USE	AVERAGE DAILY DEMAND			MAX DAY DEMAND			PEAK HOUR DEMAND			BUILDING AREA	CONSTRUCTION TYPE	FIRE FLOW*
					(gpm)	(gpd)	Total (gpm)	(gpm)	(gpd)	Total (gpm)	(gpm)	(gpd)	Total (gpm)	(sf)		(gpm)
Office	Office	J-5	226,100	Office	157.0	113,050	157.0	314.0	226,100	314.0	549.5	395,675	549.5	236,800	II-B	2,000
	Cafeteria	J-5	10,700	Restaurant	17.8	12,840	174.8	35.7	25,680	349.7	107.0	77,040	656.5			
CUP	CUP	J-3	--	--	104.3	75,100	279.1	208.6	150,200	558.3	365.1	262,850	1,021.6	9,540	I-A	1,500
Lab	LAB	J-3	--	--	152.2	109,576	431.3	304.4	219,152	862.7	532.7	383,516	1,554.3	359,758	I-A	1,500
Irrigation	Irrigation	J-4	918,180	R&D (Outside)	5.6	4,032	436.9	11.2	8,064	873.9	19.6	14,112	1,573.9	N/A	N/A	N/A
Chemical	Chemical	J-3	--	--	--	--	436.9	--	--	873.9	--	--	1,573.9	1,275	I-A	1,500
Parking Structure	Parking	J-1	--	--	--	--	436.9	--	--	873.9	--	--	1,573.9	370,000	I-B	1,500
Total					**436.9**	**314,598**		**873.9**	**629,196**		**1,573.9**	**1,133,193**				

* Fire Flow represents 25% (75% reduction observed) of the Fire Flow required since buildings will be sprinklered as determined from the 2021 International Fire Code (IFC) Appendix B, Table B105.1(2).

Appendix H – City of Scottsdale IIP

System: Water **Estimated Start:** On-going

Project Number: W IIP-020

Project Name: Crossroads East - Water System Improvements

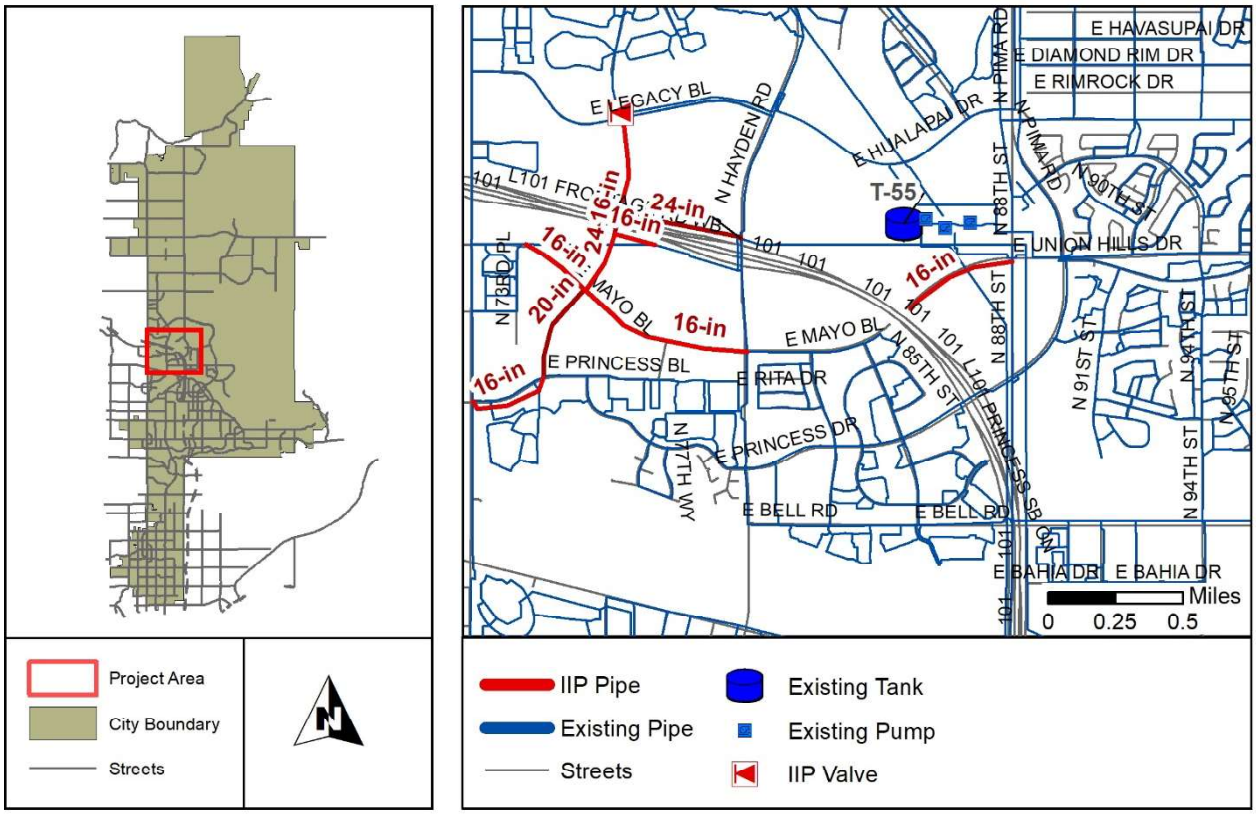
Location: Vicinity of Loop 101 and Hayden Road

Project Reference: 2013 IIP

Description: 3.5 miles of pipeline and pressure reducing valve stations west of Hayden Road and north of Princess Blvd: Add new water mains and pressure reducing valves to serve current and future connections in the Greater Airpark area. The 2020 IIP analysis identified several mains in this project that require upsizing from the diameters that were previously identified in the 2013 IIP.

Project Details:

Project Elements		Project Cost
Water mains, 12-inch diameter, 290 linear feet; 16-inch diameter, 11,720 linear feet; 20-inch diameter, 2,000 linear feet; 24-inch diameter, 2,840 linear feet; 1 PRV.		$8,937,000
Cost Allocation		
Existing Equivalent Demand Units (EDUs) – Rates	17%	$1,528,000
EDUs through year 2030 – Development Fees	33%	$2,969,000
EDUs beyond year 2030 – Development Fees	50%	$4,440,000



System: Water **Estimated Start:** On-going
Project Number: W IIP-020
Project Name: Crossroads East - Water System Improvements
Location: Vicinity of Loop 101 and Hayden Road
Project Reference: 2013 IIP
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Existing Equivalent Demand Units (EDUs) – Rates	17%	$1,528,000
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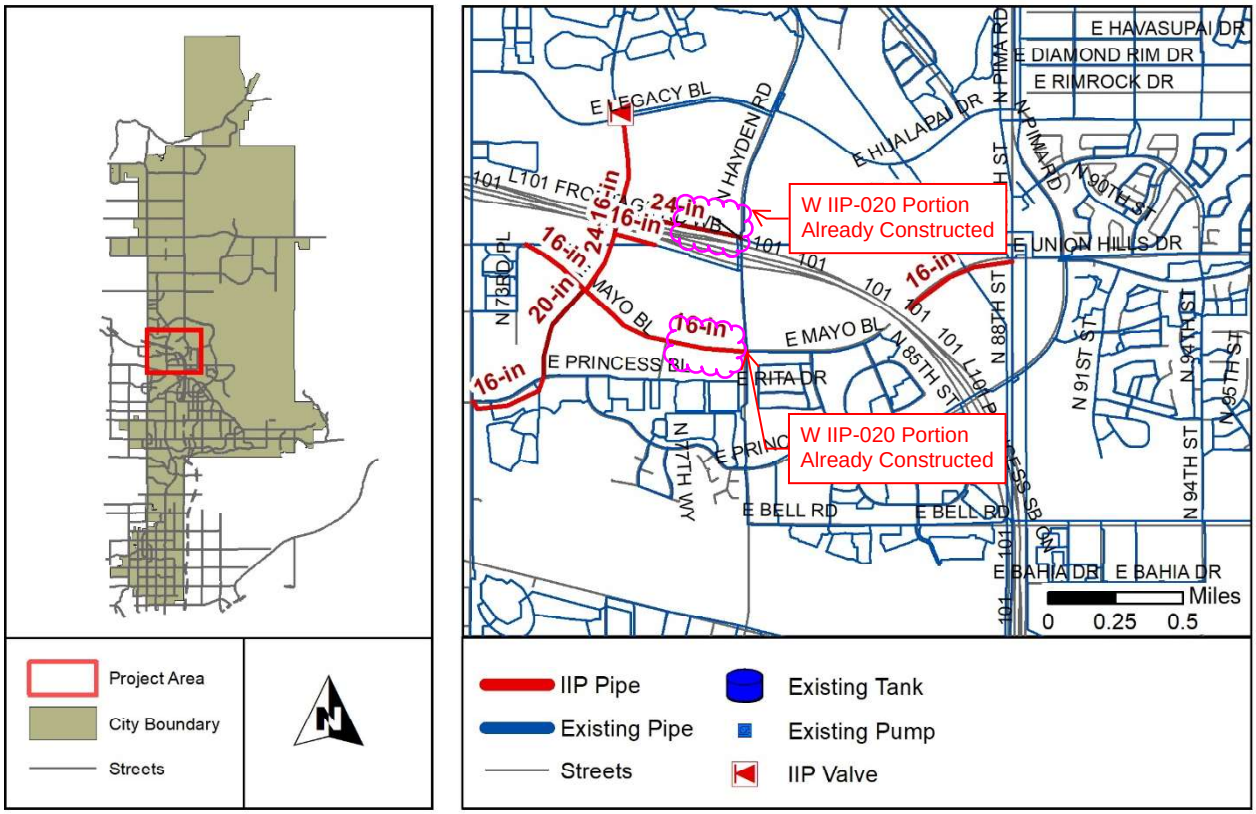
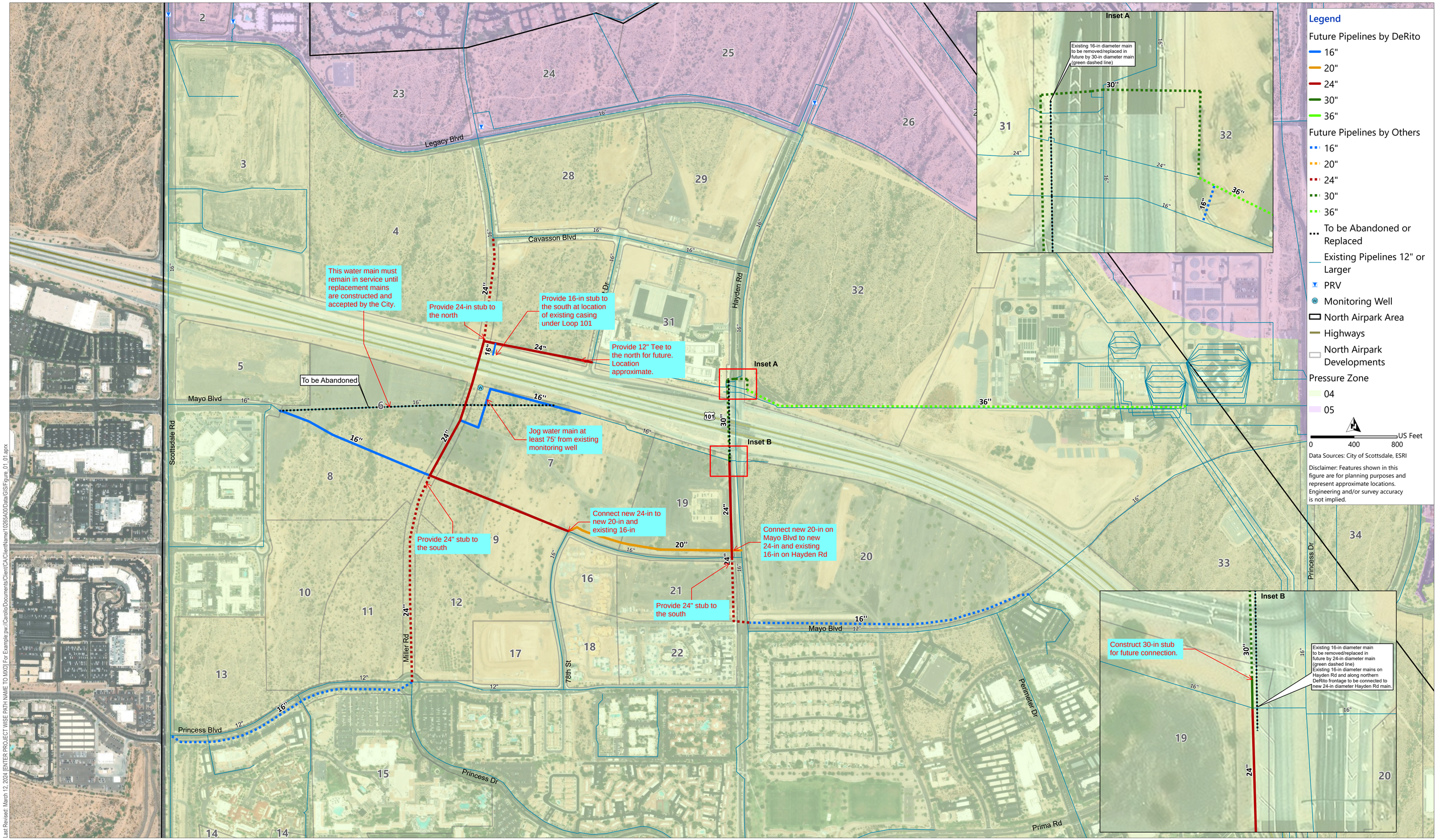
EDUs beyond year 2030 – Development Fees	50%	$4,440,000





Last Revised: March 12, 2024 [ENTER PROJECT WISE PATH NAME TO MXD] For Example:pw://Carollo/Documents/Client/CA/ClientName/102654000/data/GIS/Figure_01_01.aprx

Figure 4 North Airpark Future System
CITY OF SCOTTSDALE
NORTH AIRPARK WATER STUDY

Appendix I – Monitoring Well Layout

ADOT R/W LINE

DRAINAGE SWALE

PROP. AIR RELEASE VALVE

MOUNTABLE CURB

WELL ACCESS ROUTE

PROP. 24" DIP WATER MAIN

PROP. FIRE HYDRANT

MILLER ROAD

WELL HEAD

100'x55' WELL ACCESS

WELL ACCESS ROUTE

DRAINAGE SWALE

Move fire hydrant further south to permit clearance for service trucks to access the well site.

91.9± FG
92.0± FG
92.6± FG
92.5± FG
91.4± FG
92.3± FG
92.4± FG
90.9± FG
91.8± FG
92.5± FG
93.2± FG
93.6± FG
93.5± FG

6.20%
7.21%
5.08%
1.94%
1.56%
1.50%
1.27%
3.14%
1.78%
0.31%
2.87%
2.39%

4:1

108+00

GRAPHIC SCALE IN FEET
0 10 20 40

NORTH

BANNER HOSPITAL
PRELIMINARY
LAYOUT

WELL ACCESS EXHIBIT
8/29/24

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2024-08-19 Well Site No Wall.dwg Aug 29, 2024 Laurel.Wright
XREFS: X26801605_XB26801605_GD X26801605_UT X26801605VF A-ASP_MASTERPLAN_ALIGNED_LMW

Appendix J – Phasing Exhibit

CAVASSON BOULEVARD

AZ LOOP 101

NEW 24" DIP WATER MAIN

NEW 16" DIP WATER STUB

NEW 24" DIP WATER MAIN IN NEW 36" SLEEVE UNDER FREEWAY

EXST. 16" ACP WATER MAIN TO BE REMOVED FOLLOWING PHASE 1 COMPLETION

MAYO BOULEVARD

NEW 16" DIP WATER MAIN

NEW 16" DIP WATER MAIN

NEW 24" DIP WATER MAIN

NEW 30" DIP WATER STUB

73RD PLACE

MILLER ROAD ALIGNMENT

NEW 24" DIP WATER MAIN

MAYO BOULEVARD

NEW 24" DIP WATER MAIN

HAYDEN ROAD

NEW 12" DIP WATER MAIN

CHAUNCEY LANE

NEW 20" DIP WATER MAIN

This 12" DIP Water Main must be constructed and accepted by the City of Scottsdale and Maricopa County for the Banner Medical Office Building (6-DR-2024)

LEGEND

- PHASE I (FUNDED BY DEVELOPER)
- PHASE II (FUNDED BY DEVELOPER AND W-IIP-020)
- PHASE III (FUNDED BY DEVELOPER AND W-IIP-020)
- PHASE IV (FUNDED BY DEVELOPER)
- EXISTING WATER MAIN

NORTH

GRAPHIC SCALE IN FEET
0 75 150 300

WATER MAIN PHASING EXHIBIT

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2024-04-11 Water Phasing.dwg Aug 30, 2024 traver.jones

Appendix E Water Demand Calculation

Banner/NexCore Healthcare Plus
Dibble Project No. 1124010
Future Water Demand Calculations

DIBBLE

Factors	
Maximum Day	2
Peak Hour	3.5

From City of Scottsdale Design Standards and Policies Manual (2018)

Demands		
Land Use	*Demand/Unit	Unit
Hospital (GPD)	450	BED

*indoor and outdoor

Development Water Demand

Land Use	Units		Avg Day Demand		Max Day Demand		Peak Hour Demand	
	Number of Units	Unit	GAL/DAY	GAL/MIN	GAL/DAY	GAL/MIN	GAL/DAY	GAL/MIN
Hospital	300	BEDS	135,000	93.75	270,000	187.50	472,500	328.13

Development Fire Demand

Land Use	Avg Day Demand	Max Day Demand	Peak Hour Demand	Fire Flow Required	Max Day + Fire Flow
	GAL/MIN	GAL/MIN	GAL/MIN	GAL/MIN	GAL/MIN
Hospital	94	188	328	1,500	1,688

Optima McDowell Mountain Village Development Demands

Avg Day Demand	Max Day Demand	Peak Hour Demand
GAL/MIN	GAL/MIN	GAL/MIN
126	252	451

Demands provided by City of Scottsdale

This development is served by the water main in Mayo Boulevard

Appendix F IFC Codes

TABLE B105.1(2)REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW	FLOW DURATION
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]	(gallons per minute)[b]	(hours)
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	2
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	3
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	4
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
295,901–Greater	166,501–Greater	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
—	—	115,801–125,500	83,701–90,600	51,501–55,700	6,250	
—	—	125,501–135,500	90,601–97,900	55,701–60,200	6,500	
—	—	135,501–145,800	97,901–106,800	60,201–64,800	6,750	
—	—	145,801–156,700	106,801–113,200	64,801–69,600	7,000	
—	—	156,701–167,900	113,201–121,300	69,601–74,600	7,250	
—	—	167,901–179,400	121,301–129,600	74,601–79,800	7,500	
—	—	179,401–191,400	129,601–138,300	79,801–85,100	7,750	
—	—	191,401–Greater	138,301–Greater	85,101–Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

TABLE B105.2

REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *International Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *International Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire flow shall be not less than 1,000 gallons per minute.

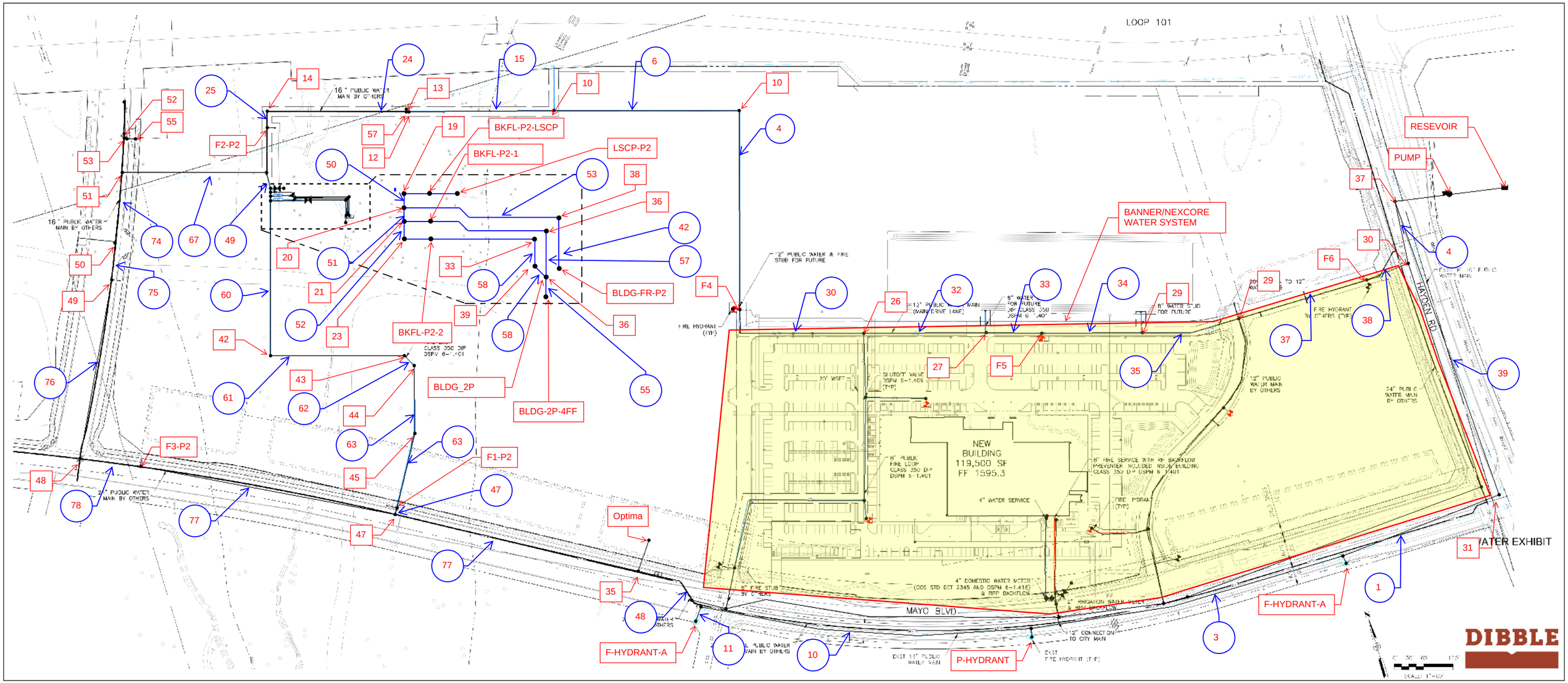
b. The reduced fire flow shall be not less than 1,500 gallons per minute.

Appendix G EPA.Net Results

XX NODES

XX LINKS

CALIBRATION
DEMANDS APPLIED AT
F-HYDRANT-A = 1986
F-HYDRAN-B = 2274



Fire Flow Calibration Condition

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 10	678	16	130	-1986.00	3.17	2.36	Open
Pipe 27	193	8	130	9.66	0.06	0.00	Open
Pipe 28	146	8	130	9.66	0.06	0.00	Open
Pipe 32	248	12	130	-29.65	0.08	0.00	Open
Pipe 31	55	12	130	0.00	0.00	0.00	Open
Pipe 33	115	12	130	-29.65	0.08	0.00	Open
Pipe 34	202	12	130	-29.65	0.08	0.00	Open
Pipe 38	75	12	130	1.53	0.00	0.00	Open
Pipe 39	502	16	130	-4260.00	6.80	9.14	Open
Pipe 1	357	16	130	4260.00	6.80	14.37	Open
Pipe 2	23	6	130	2274.00	25.80	1148.65	Open
Pipe 11	34	6	130	1986.00	22.54	681.72	Open
Pipe 9	23	6	130	0.00	0.00	0.00	Open
Pipe 19	27	4	130	0.00	0.00	0.00	Open
Pipe 35	203	12	130	-29.65	0.08	0.00	Open
Pipe 37	274	12	130	1.53	0.00	0.00	Open
Pipe 17	1	4	130	0.00	0.00	0.00	Open
Pipe 18	155	4	130	0.00	0.00	0.00	Open
Pipe 40	500	24	130	1.53	0.00	0.00	Open
Pipe 41	643	20	130	1.53	0.00	0.00	Open
Pipe 44	674	20	130	-29.64	0.03	0.00	Open
Pipe 46	42	24	130	-39.30	0.03	0.00	Open
Pipe 47	500	8	130	0.00	0.00	0.00	Open
Pipe 14	1	24	130	0.00	0.00	0.00	Closed
Pipe 42	52	20	130	1.53	0.00	0.00	Open
Pipe 48	7	16	130	0.00	0.00	0.00	Open
Pipe 36	192	12	130	-31.18	0.09	0.00	Open
Pipe 3	655	16	130	1986.00	3.17	2.84	Open
Pipe 43	215	20	130	29.64	0.03	0.00	Open
Pipe 26	48	8	130	0.00	0.00	0.00	Open
Pipe 45	60	20	130	-39.30	0.04	0.00	Open
Pipe 13	387	8	130	-9.66	0.06	0.00	Open
Pipe 12	77	8	130	-9.66	0.06	0.00	Open
Pipe 21	149	12	130	-31.18	0.09	0.00	Open
Pipe 20	118	8	130	0.00	0.00	0.00	Open
Pipe 7	218	8	130	0.00	0.00	0.00	Open
Pipe 30	302	12	130	39.30	0.11	0.01	Open
Pipe 22	306	12	130	-31.18	0.09	0.00	Open
Pipe 8	141	8	130	0.00	0.00	0.00	Open
Pipe 5	60	12	130	0.00	0.00	0.00	Open
Pipe 4	403	12	130	39.30	0.11	0.01	Open
Pipe 6	377	12	130	39.30	0.11	0.01	Open
Pipe 15	296	12	130	39.30	0.11	0.01	Open
Pipe 16	5	24	130	39.30	0.03	0.00	Open
Pipe 23	4	24	130	0.00	0.00	0.00	Open
Pipe 24	283	24	130	39.30	0.03	0.00	Open

Fire Flow Calibration Condition

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 25	33	24	130	39.30	0.03	0.00	Open
Pipe 29	94	24	130	39.30	0.03	0.00	Open
Pipe 49	31	8	130	538.37	3.44	2.86	Open
Pipe 50	6	8	130	538.37	3.44	1.93	Open
Pipe 51	7	8	130	538.37	3.44	1.92	Open
Pipe 52	8	8	130	-7989.86	51.00	249.31	Open
Pipe 53	160	8	130	0.00	0.00	0.00	Open
Pipe 54	37	8	130	0.00	0.00	0.00	Open
Pipe 57	34	8	130	8528.24	54.43	243.88	Open
Pipe 58	1	12	100	8528.24	24.19	55.05	Open
Pipe 59	26	8	130	-8528.24	54.43	447.55	Open
Pipe 60	317	8	130	538.37	3.44	1.92	Open
Pipe 61	273	8	130	538.37	3.44	1.92	Open
Pipe 62	28	8	130	538.37	3.44	2.96	Open
Pipe 63	138	8	130	538.37	3.44	2.13	Open
Pipe 64	155	8	130	538.37	3.44	2.11	Open
Pipe 65	14	8	130	538.37	3.44	1.92	Open
Pipe 66	488	12	100	-39.30	0.11	0.01	Open
Pipe 67	295	24	130	-499.07	0.35	0.01	Open
Pipe 68	70	24	130	0.00	0.00	0.00	Open
Pipe 69	10	24	130	0.00	0.00	0.00	Open
Pipe 70	66	24	130	0.00	0.00	0.00	Open
Pipe 71	16	8	130	0.00	0.00	0.00	Open
Pipe 72	6	8	130	0.00	0.00	0.00	Open
Pipe 73	16	8	130	0.00	0.00	0.00	Open
Pipe 74	141	24	130	-499.07	0.35	0.01	Open
Pipe 75	77	24	130	-499.07	0.35	0.01	Open
Pipe 76	370	24	130	-499.07	0.35	0.01	Open
Pipe 77	536	24	130	499.07	0.35	0.01	Open
Pipe 78	124	24	130	499.07	0.35	0.01	Open
Pump Pump	#N/A	#N/A	#N/A	4260.00	0.00	-148.67	Open
Valve BF2	#N/A	4	#N/A	0.00	0.00	25.50	Open
Valve BF1	#N/A	2	#N/A	0.00	0.00	25.40	Open
Valve BKFL_P2_1	#N/A	8	#N/A	8528.24	54.43	10.99	Open
Valve BKFL_P2_2	#N/A	8	#N/A	-8528.24	54.43	10.99	Open
Valve BKFL-P2_LSCP	#N/A	12	#N/A	0.00	0.00	25.40	Open

Fire Flow Calibration Condition

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc F6	1598.5	0	1724.99	54.81
Junc 28	1590	0	1724.99	58.49
Junc F5	1589.5	0	1724.99	58.71
Junc 27	1590	0	1724.99	58.49
Junc F4	1590	0	1724.98	58.49
Junc 11	1597	0	1724.99	55.46
Junc F2	1596	0	1724.99	55.89
Junc 17	1586	0	1724.99	60.22
Junc 18	1586	0	1750.49	71.27
Junc 7	1584	0	1726.59	61.78
Junc 26	1590	0	1724.99	58.49
Junc 25	1590	0	1724.98	58.49
Junc 31	1584	0	1733.58	64.81
Junc F_Hydrant_B	1591	2274	1702.03	48.11
Junc 1	1584.5	0	1728.45	62.37
Junc 8	1583	0	1724.99	61.52
Junc F_Hydrant_A	1590	1986	1701.81	48.45
Junc P_Hydrant	1589.5	0	1726.59	59.40
Junc LSCP	1586	0	1750.39	71.23
Junc F1	1595	0	1724.99	56.32
Junc D_BLDG_1FF	1595	0	1750.49	67.37
Junc D_BLDG_3FF	1622.3	0	1750.49	55.54
Junc 29	1591	0	1724.99	58.06
Junc 22	1596	0	1724.99	55.89
Junc 32	1587.3	0	1724.99	59.66
Junc F8	1585.7	0	1724.99	60.35
Junc 4	1585.6	0	1724.99	60.40
Junc F9	1583.6	0	1724.99	61.26
Junc 34	1584	0	1724.99	61.09
Junc 35	1583	0	1724.99	61.52
Junc Optima	1583	0	1724.99	61.52
Junc 37	1594	0	1738.17	62.47
Junc F7	1588.5	0	1724.99	59.14
Junc 2	1586	0	1724.99	60.22
Junc 30	1594	0	1724.99	56.76
Junc 24	1596	0	1724.99	55.89
Junc 6	1584	0	1724.99	61.09
Junc 9	1587	0	1724.99	59.79
Junc F3	1597	0	1724.99	55.46
Junc 3	1586	0	1724.99	60.22
Junc 5	1596.71	0	1724.98	55.58
Junc 10	1598.3	0	1724.98	54.89
Junc 12	1598.157	0	1724.98	54.95
Junc 13	1598.157	0	1724.98	54.95
Junc 14	1596.71	0	1724.98	55.58
Junc F2-P2	1598.12	0	1724.98	54.97

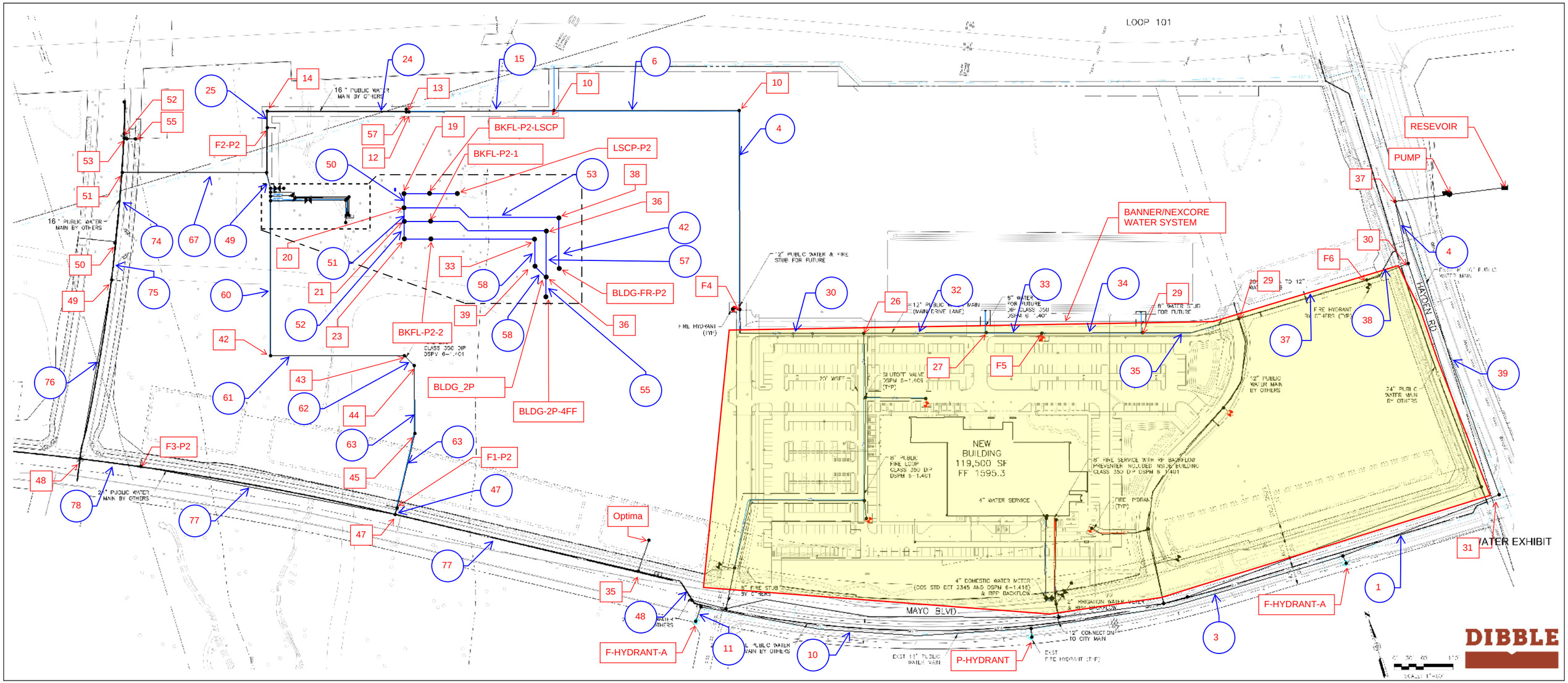
Fire Flow Calibration Condition

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 16	1597.77	0	1724.98	55.12
Junc 19	1597.88	0	1724.89	55.03
Junc 20	1597.88	0	1724.88	55.03
Junc 21	1597.88	0	1724.86	55.02
Junc 23	1597.88	0	1726.86	55.89
Junc 33	1600	0	1715.87	50.21
Junc 36	1600	0	1735.85	58.86
Junc 38	1600	0	1724.88	54.11
Junc 39	1600	0	1727.56	55.27
Junc BLDG_2P	1600	0	1727.50	55.25
Junc BLDG_FR_P2	1600	0	1724.88	54.11
Junc 42	1596.75	0	1726.25	56.11
Junc 43	1599.08	0	1725.72	54.88
Junc 44	1598.34	0	1725.64	55.16
Junc 45	1592.69	0	1725.35	57.48
Junc F1-P2	1586.29	0	1725.02	60.11
Junc 47	1580.86	0	1724.99	62.45
Junc 48	1586	0	1724.99	60.22
Junc 49	1590.27	0	1724.98	58.37
Junc 50	1591.236	0	1724.98	57.95
Junc 51	1587.56	0	1724.98	59.54
Junc 52	1588.391	0	1724.98	59.18
Junc 53	1588.391	0	1724.98	59.18
Junc 54	1588.391	0	1724.98	59.18
Junc 55	1588.391	0	1724.98	59.18
Junc 56	1588.391	0	1724.98	59.18
Junc 57	1598.157	0	1724.98	54.95
Junc F3-P2	1585.21	0	1724.99	60.57
Junc LSCP-P2	1597.88	0	1750.29	66.04
Resvr Reservoir	1589.5	#N/A	1589.50	0.00

STATIC CONDITIONS

XX NODES

XX LINKS



Static Condition

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc F6	1598.5	0	1747.50	64.56
Junc 28	1590	0	1747.50	68.24
Junc F5	1589.5	0	1747.50	68.46
Junc 27	1590	0	1747.50	68.24
Junc F4	1590	0	1747.49	68.24
Junc 11	1597	0	1747.49	65.21
Junc F2	1596	0	1747.50	65.64
Junc 17	1586	0	1747.50	69.98
Junc 18	1586	0	1773.00	81.03
Junc 7	1584	0	1747.50	70.84
Junc 26	1590	0	1747.49	68.24
Junc 25	1590	0	1747.49	68.24
Junc 31	1584	0	1747.50	70.84
Junc F_Hydrant_B	1591	0	1747.50	67.81
Junc 1	1584.5	0	1747.50	70.63
Junc 8	1583	0	1747.50	71.28
Junc F_Hydrant_A	1590	0	1747.50	68.24
Junc P_Hydrant	1589.5	0	1747.50	68.46
Junc LSCP	1586	0	1722.10	58.97
Junc F1	1595	0	1747.50	66.08
Junc D_BLDG_1FF	1595	0	1773.00	77.13
Junc D_BLDG_3FF	1622.3	0	1773.00	65.30
Junc 29	1591	0	1747.50	67.81
Junc 22	1596	0	1747.50	65.64
Junc 32	1587.3	0	1747.50	69.41
Junc F8	1585.7	0	1747.50	70.11
Junc 4	1585.6	0	1747.50	70.15
Junc F9	1583.6	0	1747.50	71.02
Junc 34	1584	0	1747.50	70.84
Junc 35	1583	0	1747.50	71.28
Junc Optima	1583	0	1747.50	71.28
Junc 37	1594	0	1747.50	66.51
Junc F7	1588.5	0	1747.50	68.89
Junc 2	1586	0	1747.50	69.98
Junc 30	1594	0	1747.50	66.51
Junc 24	1596	0	1747.50	65.64
Junc 6	1584	0	1747.50	70.84
Junc 9	1587	0	1747.50	69.54
Junc F3	1597	0	1747.49	65.21
Junc 3	1586	0	1747.50	69.98
Junc 5	1596.71	0	1747.49	65.33
Junc 10	1598.3	0	1747.49	64.64
Junc 12	1598.157	0	1747.49	64.71
Junc 13	1598.157	0	1747.49	64.71
Junc 14	1596.71	0	1747.49	65.33
Junc F2-P2	1598.12	0	1747.49	64.72

Static Condition

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 16	1597.77	0	1747.49	64.87
Junc 19	1597.88	0	1747.40	64.79
Junc 20	1597.88	0	1747.39	64.78
Junc 21	1597.88	0	1747.38	64.78
Junc 23	1597.88	0	1749.37	65.64
Junc 33	1600	0	1738.38	59.96
Junc 36	1600	0	1758.36	68.62
Junc 38	1600	0	1747.39	63.86
Junc 39	1600	0	1750.07	65.03
Junc BLDG_2P	1600	0	1750.02	65.00
Junc BLDG_FR_P2	1600	0	1747.39	63.86
Junc 42	1596.75	0	1748.76	65.87
Junc 43	1599.08	0	1748.23	64.63
Junc 44	1598.34	0	1748.15	64.91
Junc 45	1592.69	0	1747.86	67.23
Junc F1-P2	1586.29	0	1747.53	69.87
Junc 47	1580.86	0	1747.50	72.21
Junc 48	1586	0	1747.50	69.98
Junc 49	1590.27	0	1747.49	68.13
Junc 50	1591.236	0	1747.49	67.71
Junc 51	1587.56	0	1747.49	69.30
Junc 52	1588.391	0	1747.49	68.94
Junc 53	1588.391	0	1747.49	68.94
Junc 54	1588.391	0	1747.49	68.94
Junc 55	1588.391	0	1747.49	68.94
Junc 56	1588.391	0	1747.49	68.94
Junc 57	1598.157	0	1747.49	64.71
Junc F3-P2	1585.21	0	1747.50	70.32
Junc LSCP-P2	1597.88	0	1772.80	75.79
Resvr Reservoir	1589.5	#N/A	1589.50	0.00

Static Condition

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 10	678	16	130	0.00	0.00	0.00	Open
Pipe 27	193	8	130	8.21	0.05	0.01	Open
Pipe 28	146	8	130	8.21	0.05	0.01	Open
Pipe 32	248	12	130	-50.98	0.14	0.01	Open
Pipe 31	55	12	130	0.00	0.00	0.00	Open
Pipe 33	115	12	130	-50.98	0.14	0.01	Open
Pipe 34	202	12	130	-50.98	0.14	0.01	Open
Pipe 38	75	12	130	-33.21	0.09	0.00	Open
Pipe 39	502	16	130	0.00	0.00	0.00	Open
Pipe 1	357	16	130	0.00	0.00	0.00	Open
Pipe 2	23	6	130	0.00	0.00	0.00	Open
Pipe 11	34	6	130	0.00	0.00	0.00	Open
Pipe 9	23	6	130	0.00	0.00	0.00	Open
Pipe 19	27	4	130	0.00	0.00	0.00	Open
Pipe 35	203	12	130	-50.98	0.14	0.01	Open
Pipe 37	274	12	130	-33.21	0.09	0.00	Open
Pipe 17	1	4	130	0.00	0.00	0.00	Open
Pipe 18	155	4	130	0.00	0.00	0.00	Open
Pipe 40	500	24	130	-33.21	0.02	0.00	Open
Pipe 41	643	20	130	-33.21	0.03	0.00	Open
Pipe 44	674	20	130	-50.98	0.05	0.00	Open
Pipe 46	42	24	130	-59.19	0.04	0.00	Open
Pipe 47	500	8	130	0.00	0.00	0.00	Open
Pipe 14	1	24	130	0.00	0.00	0.00	Closed
Pipe 42	52	20	130	-33.21	0.03	0.00	Open
Pipe 48	7	16	130	0.00	0.00	0.00	Open
Pipe 36	192	12	130	-17.77	0.05	0.00	Open
Pipe 3	655	16	130	0.00	0.00	0.00	Open
Pipe 43	215	20	130	50.98	0.05	0.00	Open
Pipe 26	48	8	130	0.00	0.00	0.00	Open
Pipe 45	60	20	130	-59.19	0.06	0.00	Open
Pipe 13	387	8	130	-8.21	0.05	0.01	Open
Pipe 12	77	8	130	-8.21	0.05	0.01	Open
Pipe 21	149	12	130	-17.77	0.05	0.00	Open
Pipe 20	118	8	130	0.00	0.00	0.00	Open
Pipe 7	218	8	130	0.00	0.00	0.00	Open
Pipe 30	302	12	130	59.20	0.17	0.00	Open
Pipe 22	306	12	130	-17.77	0.05	0.00	Open
Pipe 8	141	8	130	0.00	0.00	0.00	Open
Pipe 5	60	12	130	0.00	0.00	0.00	Open
Pipe 4	403	12	130	59.20	0.17	0.00	Open
Pipe 6	377	12	130	59.20	0.17	0.00	Open
Pipe 15	296	12	130	59.20	0.17	0.00	Open
Pipe 16	5	24	130	59.20	0.04	0.00	Open
Pipe 23	4	24	130	0.00	0.00	0.00	Open
Pipe 24	283	24	130	59.19	0.04	0.00	Open

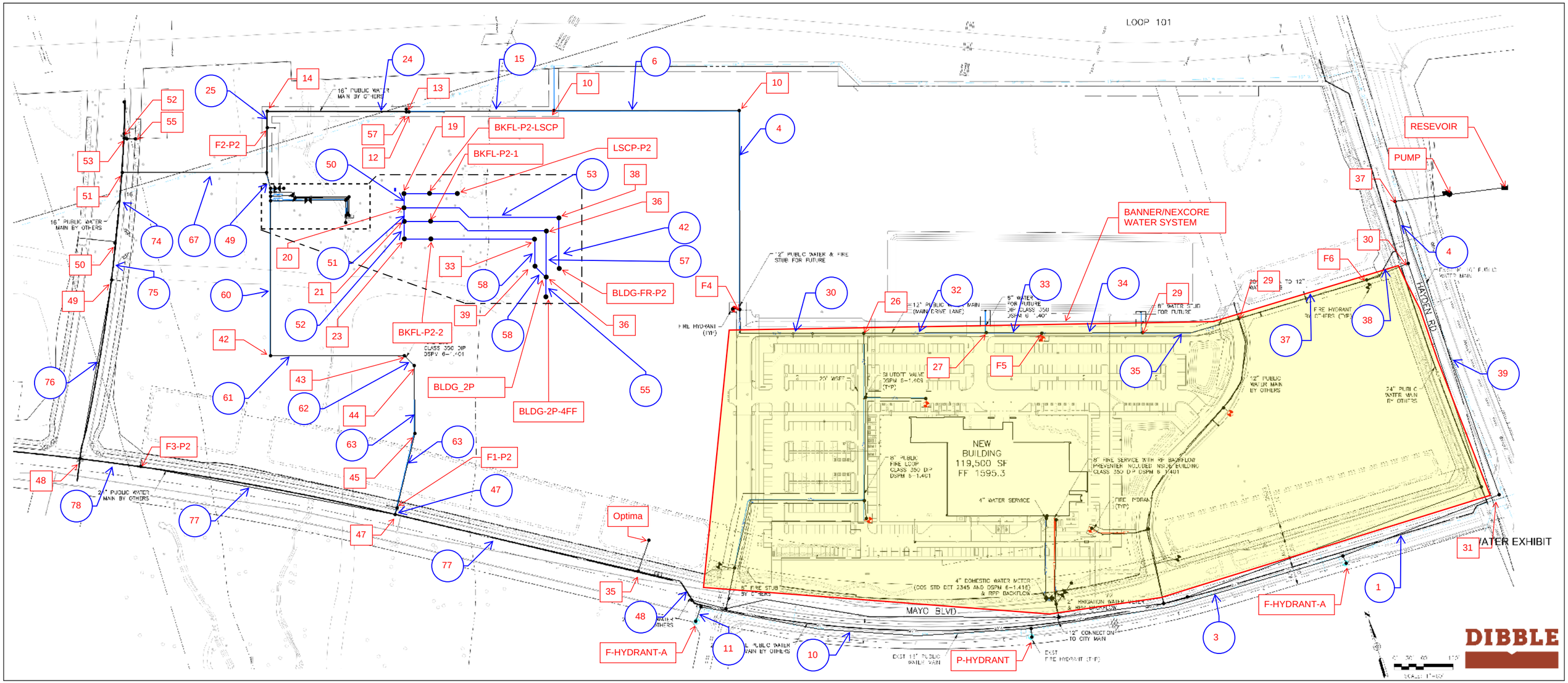
Static Condition

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 25	33	24	130	59.19	0.04	0.00	Open
Pipe 29	94	24	130	59.19	0.04	0.00	Open
Pipe 49	31	8	130	540.29	3.45	2.87	Open
Pipe 50	6	8	130	540.29	3.45	1.91	Open
Pipe 51	7	8	130	540.29	3.45	1.92	Open
Pipe 52	8	8	130	-7987.85	50.98	249.19	Open
Pipe 53	160	8	130	0.00	0.00	0.00	Open
Pipe 54	37	8	130	0.00	0.00	0.00	Open
Pipe 57	34	8	130	8528.15	54.43	243.89	Open
Pipe 58	1	12	100	8528.15	24.19	55.05	Open
Pipe 59	26	8	130	-8528.15	54.43	447.57	Open
Pipe 60	317	8	130	540.29	3.45	1.92	Open
Pipe 61	273	8	130	540.29	3.45	1.92	Open
Pipe 62	28	8	130	540.29	3.45	2.97	Open
Pipe 63	138	8	130	540.29	3.45	2.14	Open
Pipe 64	155	8	130	540.29	3.45	2.11	Open
Pipe 65	14	8	130	540.29	3.45	1.92	Open
Pipe 66	488	12	100	-59.19	0.17	0.01	Open
Pipe 67	295	24	130	-481.10	0.34	0.01	Open
Pipe 68	70	24	130	0.00	0.00	0.00	Open
Pipe 69	10	24	130	0.00	0.00	0.00	Open
Pipe 70	66	24	130	0.00	0.00	0.00	Open
Pipe 71	16	8	130	0.00	0.00	0.00	Open
Pipe 72	6	8	130	0.00	0.00	0.00	Open
Pipe 73	16	8	130	0.00	0.00	0.00	Open
Pipe 74	141	24	130	-481.10	0.34	0.01	Open
Pipe 75	77	24	130	-481.10	0.34	0.01	Open
Pipe 76	370	24	130	-481.10	0.34	0.01	Open
Pipe 77	536	24	130	481.10	0.34	0.01	Open
Pipe 78	124	24	130	481.10	0.34	0.01	Open
Pump Pump	#N/A	#N/A	#N/A	0.00	0.00	-158.00	Open
Valve BF2	#N/A	4	#N/A	0.00	0.00	25.50	Open
Valve BF1	#N/A	2	#N/A	0.00	0.00	25.40	Open
Valve BKFL_P2_1	#N/A	8	#N/A	8528.15	54.43	10.99	Open
Valve BKFL_P2_2	#N/A	8	#N/A	-8528.15	54.43	10.99	Open
Valve BKFL-P2_LSCP	#N/A	12	#N/A	0.00	0.00	25.40	Open

XX NODES

XX LINKS

Scenario 1: AVERAGE DAILY DEMAND
DEMANDS APPLIED AT
BLDG-2P-4FF =93.75GPM
LSCP-P2 =3.68GPM
OPTIMA=126GPM



Average Daily Demand Condition Scenario 1

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 10	678	16	130	-61.29	0.10	0.00	Open
Pipe 27	193	8	130	4.32	0.03	0.00	Open
Pipe 28	146	8	130	4.32	0.03	0.00	Open
Pipe 32	248	12	130	-37.65	0.11	0.01	Open
Pipe 31	55	12	130	0.00	0.00	0.00	Open
Pipe 33	115	12	130	-37.65	0.11	0.01	Open
Pipe 34	202	12	130	-37.65	0.11	0.01	Open
Pipe 38	75	12	130	-48.58	0.14	0.01	Open
Pipe 39	502	16	130	-61.29	0.10	0.00	Open
Pipe 1	357	16	130	61.29	0.10	0.00	Open
Pipe 2	23	6	130	0.00	0.00	0.00	Open
Pipe 11	34	6	130	0.00	0.00	0.00	Open
Pipe 9	23	6	130	0.00	0.00	0.00	Open
Pipe 19	27	4	130	0.00	0.00	0.00	Open
Pipe 35	203	12	130	-37.65	0.11	0.01	Open
Pipe 37	274	12	130	-48.58	0.14	0.01	Open
Pipe 17	1	4	130	0.00	0.00	0.00	Open
Pipe 18	155	4	130	0.00	0.00	0.00	Open
Pipe 40	500	24	130	113.57	0.08	0.00	Open
Pipe 41	643	20	130	113.57	0.12	0.00	Open
Pipe 44	674	20	130	124.49	0.13	0.00	Open
Pipe 46	42	24	130	181.46	0.13	0.03	Open
Pipe 47	500	8	130	126.00	0.80	0.45	Open
Pipe 14	1	24	130	162.14	0.11	0.00	Open
Pipe 42	52	20	130	113.57	0.12	0.01	Open
Pipe 48	7	16	130	61.29	0.10	0.02	Open
Pipe 36	192	12	130	10.93	0.03	0.00	Open
Pipe 3	655	16	130	61.29	0.10	0.00	Open
Pipe 43	215	20	130	-124.50	0.13	0.01	Open
Pipe 26	48	8	130	0.00	0.00	0.00	Open
Pipe 45	60	20	130	120.17	0.12	0.01	Open
Pipe 13	387	8	130	-4.32	0.03	0.00	Open
Pipe 12	77	8	130	-4.32	0.03	0.00	Open
Pipe 21	149	12	130	10.93	0.03	0.00	Open
Pipe 20	118	8	130	0.00	0.00	0.00	Open
Pipe 7	218	8	130	0.00	0.00	0.00	Open
Pipe 30	302	12	130	41.97	0.12	0.01	Open
Pipe 22	306	12	130	10.93	0.03	0.00	Open
Pipe 8	141	8	130	0.00	0.00	0.00	Open
Pipe 5	60	12	130	0.00	0.00	0.00	Open
Pipe 4	403	12	130	41.97	0.12	0.01	Open
Pipe 6	377	12	130	41.97	0.12	0.01	Open
Pipe 15	296	12	130	41.97	0.12	0.01	Open
Pipe 16	5	24	130	41.97	0.03	0.00	Open
Pipe 23	4	24	130	0.00	0.00	0.00	Open
Pipe 24	283	24	130	41.97	0.03	0.00	Open

Average Daily Demand Condition Scenario 1

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 25	33	24	130	41.97	0.03	0.00	Open
Pipe 29	94	24	130	41.97	0.03	0.00	Open
Pipe 49	31	8	130	79.54	0.51	0.25	Open
Pipe 50	6	8	130	75.86	0.48	0.14	Open
Pipe 51	7	8	130	75.86	0.48	0.16	Open
Pipe 52	8	8	130	28.98	0.18	0.03	Open
Pipe 53	160	8	130	0.00	0.00	0.00	Open
Pipe 54	37	8	130	0.00	0.00	0.00	Open
Pipe 57	34	8	130	46.88	0.30	0.06	Open
Pipe 58	1	12	100	46.88	0.13	0.00	Open
Pipe 59	26	8	130	46.87	0.30	0.09	Open
Pipe 60	317	8	130	-17.89	0.11	0.01	Open
Pipe 61	273	8	130	-17.89	0.11	0.01	Open
Pipe 62	28	8	130	-17.89	0.11	0.02	Open
Pipe 63	138	8	130	-17.89	0.11	0.01	Open
Pipe 64	155	8	130	-17.89	0.11	0.01	Open
Pipe 65	14	8	130	-17.89	0.11	0.01	Open
Pipe 66	488	12	100	55.46	0.16	0.02	Open
Pipe 67	295	24	130	-37.57	0.03	0.00	Open
Pipe 68	70	24	130	0.00	0.00	0.00	Open
Pipe 69	10	24	130	0.39	0.00	0.00	Open
Pipe 70	66	24	130	0.00	0.00	0.00	Open
Pipe 71	16	8	130	0.39	0.00	0.00	Open
Pipe 72	6	8	130	-0.39	0.00	0.00	Open
Pipe 73	16	8	130	0.00	0.00	0.00	Open
Pipe 74	141	24	130	-37.58	0.03	0.00	Open
Pipe 75	77	24	130	-37.58	0.03	0.00	Open
Pipe 76	370	24	130	-37.58	0.03	0.00	Open
Pipe 77	536	24	130	37.58	0.03	0.00	Open
Pipe 78	124	24	130	37.58	0.03	0.00	Open
Pipe 55	54	8	130	93.75	0.60	0.29	Open
Pump Pump	#N/A	#N/A	#N/A	223.43	0.00	-157.95	Open
Valve BF2	#N/A	4	#N/A	0.00	0.00	25.50	Open
Valve BF1	#N/A	2	#N/A	0.00	0.00	25.40	Open
Valve BKFL_P2_1	#N/A	8	#N/A	46.88	0.30	8.95	Open
Valve BKFL_P2_2	#N/A	8	#N/A	46.87	0.30	8.95	Open
Valve BKFL-P2_LSCP	#N/A	12	#N/A	3.68	0.01	26.25	Open

Average Daily Demand Condition Scenario 1

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc F6	1598.5	0	1747.45	64.54
Junc 28	1590	0	1747.44	68.22
Junc F5	1589.5	0	1747.44	68.44
Junc 27	1590	0	1747.44	68.22
Junc F4	1590	0	1747.44	68.22
Junc 11	1597	0	1747.44	65.19
Junc F2	1596	0	1747.44	65.62
Junc 17	1586	0	1747.44	69.95
Junc 18	1586	0	1721.94	58.90
Junc 7	1584	0	1747.44	70.82
Junc 26	1590	0	1747.44	68.22
Junc 25	1590	0	1747.44	68.22
Junc 31	1584	0	1747.45	70.82
Junc F_Hydrant_B	1591	0	1747.45	67.79
Junc 1	1584.5	0	1747.45	70.60
Junc 8	1583	0	1747.44	71.25
Junc F_Hydrant_A	1590	0	1747.44	68.22
Junc P_Hydrant	1589.5	0	1747.44	68.44
Junc LSCP	1586	0	1772.84	80.96
Junc F1	1595	0	1747.44	66.05
Junc D_BLDG_1FF	1595	0	1721.94	55.00
Junc D_BLDG_3FF	1622.3	0	1721.94	43.18
Junc 29	1591	0	1747.44	67.79
Junc 22	1596	0	1747.44	65.62
Junc 32	1587.3	0	1747.45	69.39
Junc F8	1585.7	0	1747.44	70.08
Junc 4	1585.6	0	1747.44	70.13
Junc F9	1583.6	0	1747.44	70.99
Junc 34	1584	0	1747.44	70.82
Junc 35	1583	0	1747.44	71.25
Junc Optima	1583	126	1747.22	71.15
Junc 37	1594	0	1747.45	66.49
Junc F7	1588.5	0	1747.44	68.87
Junc 2	1586	0	1747.44	69.95
Junc 30	1594	0	1747.45	66.49
Junc 24	1596	0	1747.44	65.62
Junc 6	1584	0	1747.44	70.82
Junc 9	1587	0	1747.44	69.52
Junc F3	1597	0	1747.44	65.19
Junc 3	1586	0	1747.44	69.95
Junc 5	1596.71	0	1747.43	65.31
Junc 10	1598.3	0	1747.43	64.62
Junc 12	1598.157	0	1747.43	64.68
Junc 13	1598.157	0	1747.43	64.68
Junc 14	1596.71	0	1747.43	65.31
Junc F2-P2	1598.12	0	1747.43	64.70

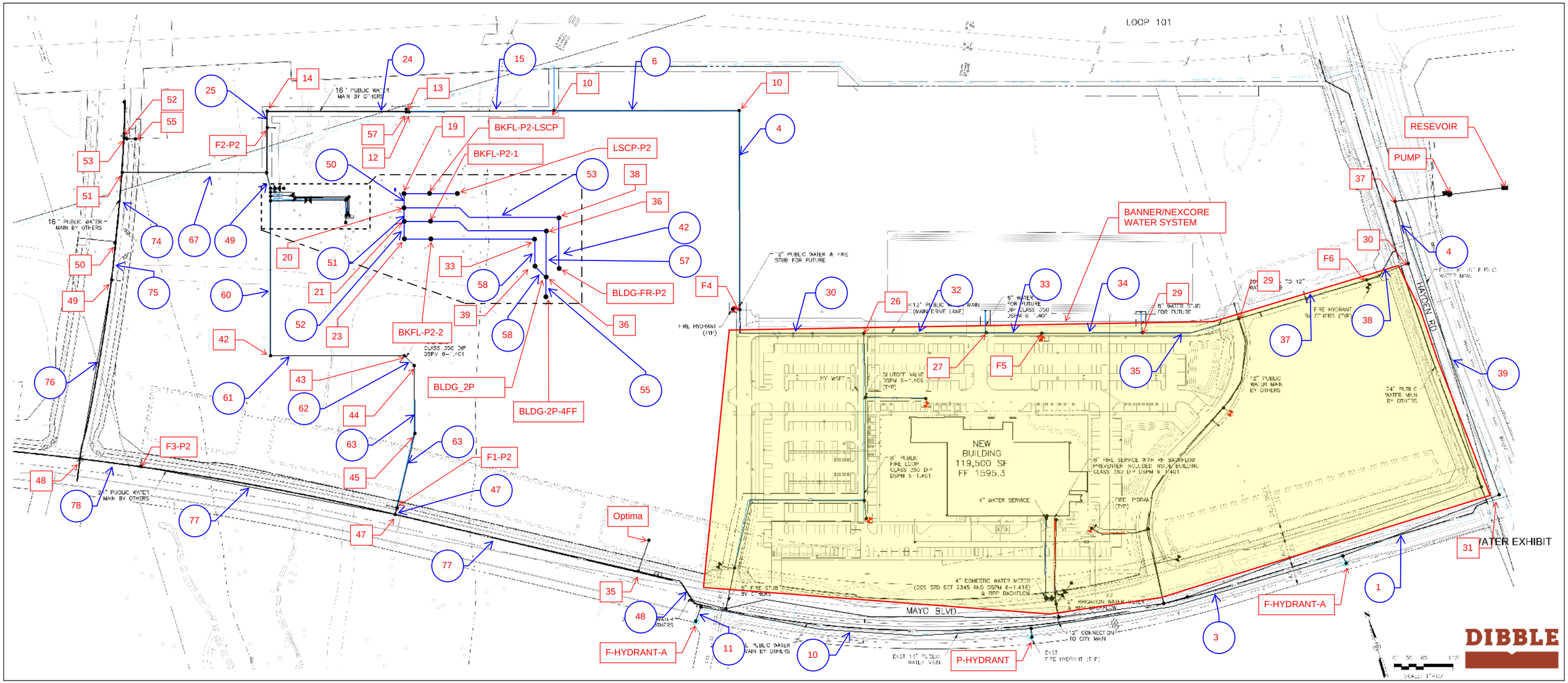
Average Daily Demand Condition Scenario 1

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 16	1597.77	0	1747.43	64.85
Junc 19	1597.88	0	1747.42	64.80
Junc 20	1597.88	0	1747.42	64.80
Junc 21	1597.88	0	1747.42	64.80
Junc 23	1597.88	0	1747.42	64.80
Junc 33	1600	0	1738.47	60.00
Junc 36	1600	0	1738.47	60.00
Junc 38	1600	0	1747.42	63.88
Junc 39	1600	0	1738.47	60.00
Junc BLDG_2P	1600	0	1738.47	60.00
Junc BLDG_FR_P2	1600	0	1747.42	63.88
Junc 42	1596.75	0	1747.42	65.29
Junc 43	1599.08	0	1747.42	64.28
Junc 44	1598.34	0	1747.43	64.60
Junc 45	1592.69	0	1747.43	67.05
Junc F1-P2	1586.29	0	1747.43	69.82
Junc 47	1580.86	0	1747.43	72.17
Junc 48	1586	0	1747.43	69.95
Junc 49	1590.27	0	1747.43	68.10
Junc 50	1591.236	0	1747.43	67.68
Junc 51	1587.56	0	1747.43	69.27
Junc 52	1588.391	0	1747.43	68.91
Junc 53	1588.391	0	1747.43	68.91
Junc 54	1588.391	0	1747.43	68.91
Junc 55	1588.391	0	1747.43	68.91
Junc 56	1588.391	0	1747.43	68.91
Junc 57	1598.157	0	1747.43	64.68
Junc F3-P2	1585.21	0	1747.43	70.29
Junc LSCP-P2	1597.88	3.68	1721.17	53.42
Junc BLDG_2P_4FF	1654.6	93.75	1738.45	36.33
Resvr Reservoir	1589.5	#N/A	1589.50	0.00

XX NODES

XX LINKS

Scenario 2: PEAK HOUR DEMAND
DEMANDS APPLIED AT
BLDG-2P-4FF =328.13GPM
LSCP-P2 =3.68GPM
OPTIMA=451GPM



Peak Hour Demand Condition Scenerio 2

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc F6	1598.5	0	1747.02	64.35
Junc 28	1590	0	1746.98	68.02
Junc F5	1589.5	0	1746.96	68.23
Junc 27	1590	0	1746.95	68.01
Junc F4	1590	0	1746.91	67.99
Junc 11	1597	0	1746.94	64.97
Junc F2	1596	0	1746.94	65.40
Junc 17	1586	0	1746.97	69.75
Junc 18	1586	0	1721.47	58.70
Junc 7	1584	0	1746.97	70.61
Junc 26	1590	0	1746.94	68.00
Junc 25	1590	0	1746.91	67.99
Junc 31	1584	0	1747.01	70.63
Junc F_Hydrant_B	1591	0	1746.99	67.59
Junc 1	1584.5	0	1746.99	70.41
Junc 8	1583	0	1746.94	71.03
Junc F_Hydrant_A	1590	0	1746.94	68.00
Junc P_Hydrant	1589.5	0	1746.97	68.23
Junc LSCP	1586	0	1721.57	58.74
Junc F1	1595	0	1746.99	65.86
Junc D_BLDG_1FF	1595	0	1721.47	54.80
Junc D_BLDG_3FF	1622.3	0	1721.47	42.97
Junc 29	1591	0	1746.99	67.59
Junc 22	1596	0	1746.97	65.42
Junc 32	1587.3	0	1747.02	69.21
Junc F8	1585.7	0	1746.99	69.89
Junc 4	1585.6	0	1746.97	69.92
Junc F9	1583.6	0	1746.94	70.78
Junc 34	1584	0	1746.94	70.60
Junc 35	1583	0	1746.92	71.03
Junc Optima	1583	451	1744.50	69.98
Junc 37	1594	0	1747.03	66.31
Junc F7	1588.5	0	1746.99	68.67
Junc 2	1586	0	1746.99	69.76
Junc 30	1594	0	1747.03	66.31
Junc 24	1596	0	1746.94	65.40
Junc 6	1584	0	1746.94	70.60
Junc 9	1587	0	1746.99	69.32
Junc F3	1597	0	1746.94	64.97
Junc 3	1586	0	1746.97	69.75
Junc 5	1596.71	0	1746.88	65.07
Junc 10	1598.3	0	1746.85	64.37
Junc 12	1598.157	0	1746.83	64.42
Junc 13	1598.157	0	1746.83	64.42
Junc 14	1596.71	0	1746.83	65.05
Junc F2-P2	1598.12	0	1746.83	64.43

Peak Hour Demand Condition Scenerio 2

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 16	1597.77	0	1746.83	64.59
Junc 19	1597.88	0	1746.75	64.50
Junc 20	1597.88	0	1746.74	64.50
Junc 21	1597.88	0	1746.73	64.50
Junc 23	1597.88	0	1746.73	64.50
Junc 33	1600	0	1735.83	58.85
Junc 36	1600	0	1735.83	58.85
Junc 38	1600	0	1746.74	63.58
Junc 39	1600	0	1735.80	58.84
Junc BLDG_2P	1600	0	1735.80	58.84
Junc BLDG_FR_P2	1600	0	1746.74	63.58
Junc 42	1596.75	0	1746.76	65.00
Junc 43	1599.08	0	1746.79	64.00
Junc 44	1598.34	0	1746.79	64.33
Junc 45	1592.69	0	1746.81	66.78
Junc F1-P2	1586.29	0	1746.83	69.56
Junc 47	1580.86	0	1746.83	71.91
Junc 48	1586	0	1746.83	69.69
Junc 49	1590.27	0	1746.83	67.84
Junc 50	1591.236	0	1746.83	67.42
Junc 51	1587.56	0	1746.83	69.01
Junc 52	1588.391	0	1746.83	68.65
Junc 53	1588.391	0	1746.83	68.65
Junc 54	1588.391	0	1746.83	68.65
Junc 55	1588.391	0	1746.83	68.65
Junc 56	1588.391	0	1746.83	68.65
Junc 57	1598.157	0	1746.83	64.42
Junc F3-P2	1585.21	0	1746.83	70.03
Junc LSCP-P2	1597.88	3.68	1720.50	53.13
Junc BLDG_2P_4FF	1654.6	328.13	1735.64	35.11
Resvr Reservoir	1589.5	#N/A	1589.50	0.00

Peak Hour Demand Condition Scenerio 2

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 10	678	16	130	-215.44	0.34	0.04	Open
Pipe 27	193	8	130	13.84	0.09	0.01	Open
Pipe 28	146	8	130	13.84	0.09	0.01	Open
Pipe 32	248	12	130	-130.17	0.37	0.07	Open
Pipe 31	55	12	130	0.00	0.00	0.00	Open
Pipe 33	115	12	130	-130.17	0.37	0.07	Open
Pipe 34	202	12	130	-130.17	0.37	0.06	Open
Pipe 38	75	12	130	-170.16	0.48	0.12	Open
Pipe 39	502	16	130	-215.44	0.34	0.04	Open
Pipe 1	357	16	130	215.44	0.34	0.05	Open
Pipe 2	23	6	130	0.00	0.00	0.00	Open
Pipe 11	34	6	130	0.00	0.00	0.00	Open
Pipe 9	23	6	130	0.00	0.00	0.00	Open
Pipe 19	27	4	130	0.00	0.00	0.00	Open
Pipe 35	203	12	130	-130.17	0.37	0.08	Open
Pipe 37	274	12	130	-170.16	0.48	0.10	Open
Pipe 17	1	4	130	0.00	0.00	0.00	Open
Pipe 18	155	4	130	0.00	0.00	0.00	Open
Pipe 40	500	24	130	397.21	0.28	0.02	Open
Pipe 41	643	20	130	397.21	0.41	0.05	Open
Pipe 44	674	20	130	437.21	0.45	0.05	Open
Pipe 46	42	24	130	638.81	0.45	0.36	Open
Pipe 47	500	8	130	451.00	2.88	4.85	Open
Pipe 14	1	24	130	567.38	0.40	0.00	Open
Pipe 42	52	20	130	397.21	0.41	0.07	Open
Pipe 48	7	16	130	215.44	0.34	0.19	Open
Pipe 36	192	12	130	40.00	0.11	0.01	Open
Pipe 3	655	16	130	215.44	0.34	0.04	Open
Pipe 43	215	20	130	-437.21	0.45	0.05	Open
Pipe 26	48	8	130	0.00	0.00	0.00	Open
Pipe 45	60	20	130	423.37	0.43	0.07	Open
Pipe 13	387	8	130	-13.84	0.09	0.01	Open
Pipe 12	77	8	130	-13.84	0.09	0.01	Open
Pipe 21	149	12	130	40.00	0.11	0.01	Open
Pipe 20	118	8	130	0.00	0.00	0.00	Open
Pipe 7	218	8	130	0.00	0.00	0.00	Open
Pipe 30	302	12	130	144.00	0.41	0.10	Open
Pipe 22	306	12	130	40.00	0.11	0.01	Open
Pipe 8	141	8	130	0.00	0.00	0.00	Open
Pipe 5	60	12	130	0.00	0.00	0.00	Open
Pipe 4	403	12	130	144.00	0.41	0.07	Open
Pipe 6	377	12	130	144.00	0.41	0.07	Open
Pipe 15	296	12	130	144.00	0.41	0.07	Open
Pipe 16	5	24	130	144.00	0.10	0.00	Open
Pipe 23	4	24	130	0.00	0.00	0.00	Open
Pipe 24	283	24	130	144.00	0.10	0.00	Open

Peak Hour Demand Condition Scenerio 2

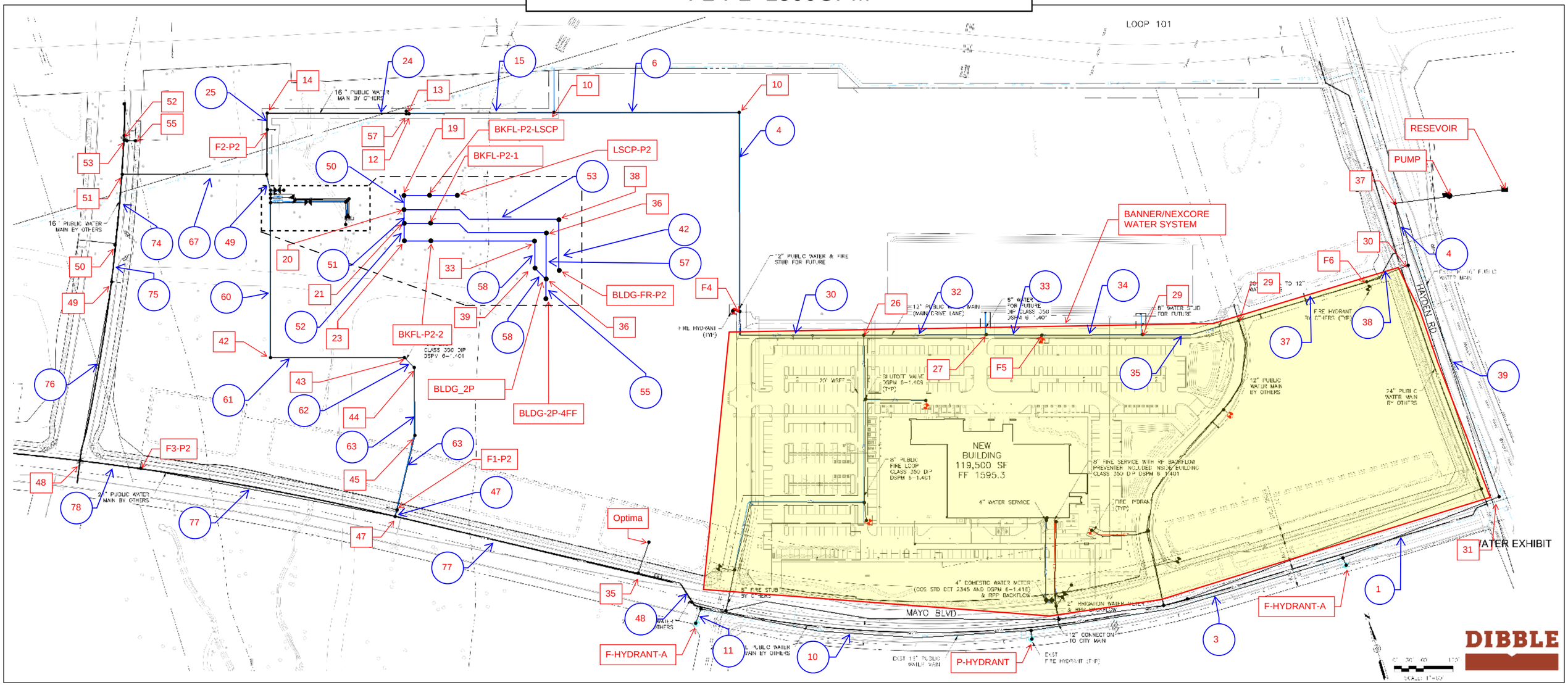
Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 25	33	24	130	144.00	0.10	0.00	Open
Pipe 29	94	24	130	144.00	0.10	0.00	Open
Pipe 49	31	8	130	269.61	1.72	2.50	Open
Pipe 50	6	8	130	265.93	1.70	1.57	Open
Pipe 51	7	8	130	265.93	1.70	1.57	Open
Pipe 52	8	8	130	90.02	0.57	0.21	Open
Pipe 53	160	8	130	0.00	0.00	0.00	Open
Pipe 54	37	8	130	0.00	0.00	0.00	Open
Pipe 57	34	8	130	175.92	1.12	0.73	Open
Pipe 58	1	12	100	175.92	0.50	0.12	Open
Pipe 59	26	8	130	152.21	0.97	0.90	Open
Pipe 60	317	8	130	-62.20	0.40	0.11	Open
Pipe 61	273	8	130	-62.20	0.40	0.11	Open
Pipe 62	28	8	130	-62.20	0.40	0.16	Open
Pipe 63	138	8	130	-62.20	0.40	0.12	Open
Pipe 64	155	8	130	-62.20	0.40	0.12	Open
Pipe 65	14	8	130	-62.20	0.40	0.10	Open
Pipe 66	488	12	100	187.81	0.53	0.19	Open
Pipe 67	295	24	130	-125.61	0.09	0.00	Open
Pipe 68	70	24	130	0.00	0.00	0.00	Open
Pipe 69	10	24	130	1.85	0.00	0.00	Open
Pipe 70	66	24	130	0.00	0.00	0.00	Open
Pipe 71	16	8	130	1.85	0.01	0.00	Open
Pipe 72	6	8	130	-1.85	0.01	0.00	Open
Pipe 73	16	8	130	0.00	0.00	0.00	Open
Pipe 74	141	24	130	-125.62	0.09	0.00	Open
Pipe 75	77	24	130	-125.62	0.09	0.00	Open
Pipe 76	370	24	130	-125.62	0.09	0.00	Open
Pipe 77	536	24	130	125.62	0.09	0.00	Open
Pipe 78	124	24	130	125.62	0.09	0.00	Open
Pipe 55	54	8	130	328.13	2.09	3.08	Open
Pump Pump	#N/A	#N/A	#N/A	782.82	0.00	-157.53	Open
Valve BF2	#N/A	4	#N/A	0.00	0.00	25.50	Open
Valve BF1	#N/A	2	#N/A	0.00	0.00	25.40	Open
Valve BKFL_P2_1	#N/A	8	#N/A	175.92	1.12	10.90	Open
Valve BKFL_P2_2	#N/A	8	#N/A	152.21	0.97	10.90	Open
Valve BKFL-P2_LSCP	#N/A	12	#N/A	3.68	0.01	26.25	Open

Scenario 3: MAX DAY + FIRE FLOW

DEMANDS APPLIED AT
BLDG-2P-4FF =187.5GPM
LSCP-P2 =3.68GPM
OPTIMA=252GPM
F2-P2=1500GPM

XX NODES

XX LINKS



Maximum Daily Demand + Fire Flow Condition Scenario 3

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc F6	1598.5	0	1745.10	63.52
Junc 28	1590	0	1744.70	67.03
Junc F5	1589.5	0	1744.54	67.18
Junc 27	1590	0	1744.44	66.92
Junc F4	1590	0	1743.65	66.58
Junc 11	1597	0	1744.30	63.82
Junc F2	1596	0	1744.42	64.31
Junc 17	1586	0	1744.87	68.84
Junc 18	1586	0	1719.37	57.79
Junc 7	1584	0	1744.85	69.70
Junc 26	1590	0	1744.20	66.82
Junc 25	1590	0	1743.65	66.58
Junc 31	1584	0	1745.08	69.79
Junc F_Hydrant_B	1591	0	1744.99	66.72
Junc 1	1584.5	0	1744.99	69.54
Junc 8	1583	0	1744.73	70.08
Junc F_Hydrant_A	1590	0	1744.73	67.05
Junc P_Hydrant	1589.5	0	1744.85	67.31
Junc LSCP	1586	0	1770.27	79.85
Junc F1	1595	0	1744.92	64.96
Junc D_BLDG_1FF	1595	0	1719.37	53.89
Junc D_BLDG_3FF	1622.3	0	1719.37	42.06
Junc 29	1591	0	1744.92	66.69
Junc 22	1596	0	1744.87	64.51
Junc 32	1587.3	0	1745.12	68.38
Junc F8	1585.7	0	1744.94	69.00
Junc 4	1585.6	0	1744.87	69.01
Junc F9	1583.6	0	1744.69	69.80
Junc 34	1584	0	1744.73	69.64
Junc 35	1583	0	1744.67	70.05
Junc Optima	1583	252	1743.85	69.70
Junc 37	1594	0	1745.16	65.50
Junc F7	1588.5	0	1744.92	67.78
Junc 2	1586	0	1744.92	68.86
Junc 30	1594	0	1745.16	65.50
Junc 24	1596	0	1744.42	64.31
Junc 6	1584	0	1744.74	69.65
Junc 9	1587	0	1744.92	68.43
Junc F3	1597	0	1744.30	63.82
Junc 3	1586	0	1744.87	68.84
Junc 5	1596.71	0	1743.14	63.45
Junc 10	1598.3	0	1742.67	62.55
Junc 12	1598.157	0	1742.32	62.47
Junc 13	1598.157	0	1742.32	62.47
Junc 14	1596.71	0	1742.31	63.09
Junc F2-P2	1598.12	1500	1742.30	62.47

Maximum Daily Demand + Fire Flow Condition Scenario 3

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 16	1597.77	0	1742.31	62.63
Junc 19	1597.88	0	1742.30	62.58
Junc 20	1597.88	0	1742.30	62.58
Junc 21	1597.88	0	1742.29	62.57
Junc 23	1597.88	0	1742.29	62.57
Junc 33	1600	0	1731.39	56.93
Junc 36	1600	0	1731.39	56.93
Junc 38	1600	0	1742.30	61.66
Junc 39	1600	0	1731.39	56.93
Junc BLDG_2P	1600	0	1731.39	56.93
Junc BLDG_FR_P2	1600	0	1742.30	61.66
Junc 42	1596.75	0	1742.35	63.09
Junc 43	1599.08	0	1742.39	62.10
Junc 44	1598.34	0	1742.40	62.42
Junc 45	1592.69	0	1742.43	64.88
Junc F1-P2	1586.29	0	1742.46	67.67
Junc 47	1580.86	0	1742.46	70.02
Junc 48	1586	0	1742.40	67.77
Junc 49	1590.27	0	1742.37	65.90
Junc 50	1591.236	0	1742.36	65.48
Junc 51	1587.56	0	1742.34	67.07
Junc 52	1588.391	0	1742.34	66.71
Junc 53	1588.391	0	1742.34	66.71
Junc 54	1588.391	0	1742.34	66.71
Junc 55	1588.391	0	1742.34	66.71
Junc 56	1588.391	0	1742.34	66.71
Junc 57	1598.157	0	1742.32	62.47
Junc F3-P2	1585.21	0	1742.41	68.12
Junc LSCP-P2	1597.88	3.68	1716.05	51.20
Junc BLDG_2P_4FF	1654.6	187.5	1731.33	33.25
Resvr Reservoir	1589.5	#N/A	1589.50	0.00

Maximum Daily Demand + Fire Flow Condition Scenario 3

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 10	678	16	130	-496.35	0.79	0.18	Open
Pipe 27	193	8	130	155.06	0.99	0.63	Open
Pipe 28	146	8	130	155.06	0.99	0.64	Open
Pipe 32	248	12	130	-505.41	1.43	0.95	Open
Pipe 31	55	12	130	0.00	0.00	0.00	Open
Pipe 33	115	12	130	-505.41	1.43	0.88	Open
Pipe 34	202	12	130	-505.41	1.43	0.81	Open
Pipe 38	75	12	130	-463.14	1.31	0.82	Open
Pipe 39	502	16	130	-496.35	0.79	0.17	Open
Pipe 1	357	16	130	496.35	0.79	0.24	Open
Pipe 2	23	6	130	0.00	0.00	0.00	Open
Pipe 11	34	6	130	0.00	0.00	0.00	Open
Pipe 9	23	6	130	0.00	0.00	0.00	Open
Pipe 19	27	4	130	0.00	0.00	0.00	Open
Pipe 35	203	12	130	-505.41	1.43	1.06	Open
Pipe 37	274	12	130	-463.14	1.31	0.67	Open
Pipe 17	1	4	130	0.00	0.00	0.00	Open
Pipe 18	155	4	130	0.00	0.00	0.00	Open
Pipe 40	500	24	130	983.69	0.70	0.09	Open
Pipe 41	643	20	130	983.69	1.00	0.27	Open
Pipe 44	674	20	130	941.42	0.96	0.20	Open
Pipe 46	42	24	130	1282.71	0.91	1.42	Open
Pipe 47	500	8	130	252.00	1.61	1.63	Open
Pipe 14	1	24	130	1446.83	1.03	0.24	Open
Pipe 42	52	20	130	983.69	1.00	0.38	Open
Pipe 48	7	16	130	496.35	0.79	1.01	Open
Pipe 36	192	12	130	-42.27	0.12	0.01	Open
Pipe 3	655	16	130	496.35	0.79	0.21	Open
Pipe 43	215	20	130	-941.42	0.96	0.23	Open
Pipe 26	48	8	130	0.00	0.00	0.00	Open
Pipe 45	60	20	130	786.36	0.80	0.24	Open
Pipe 13	387	8	130	-155.06	0.99	0.70	Open
Pipe 12	77	8	130	-155.06	0.99	0.70	Open
Pipe 21	149	12	130	-42.27	0.12	0.01	Open
Pipe 20	118	8	130	0.00	0.00	0.00	Open
Pipe 7	218	8	130	0.00	0.00	0.00	Open
Pipe 30	302	12	130	660.47	1.87	1.83	Open
Pipe 22	306	12	130	-42.27	0.12	0.01	Open
Pipe 8	141	8	130	0.00	0.00	0.00	Open
Pipe 5	60	12	130	0.00	0.00	0.00	Open
Pipe 4	403	12	130	660.47	1.87	1.26	Open
Pipe 6	377	12	130	660.47	1.87	1.26	Open
Pipe 15	296	12	130	660.47	1.87	1.18	Open
Pipe 16	5	24	130	660.47	0.47	0.05	Open
Pipe 23	4	24	130	0.00	0.00	0.00	Open
Pipe 24	283	24	130	660.47	0.47	0.05	Open

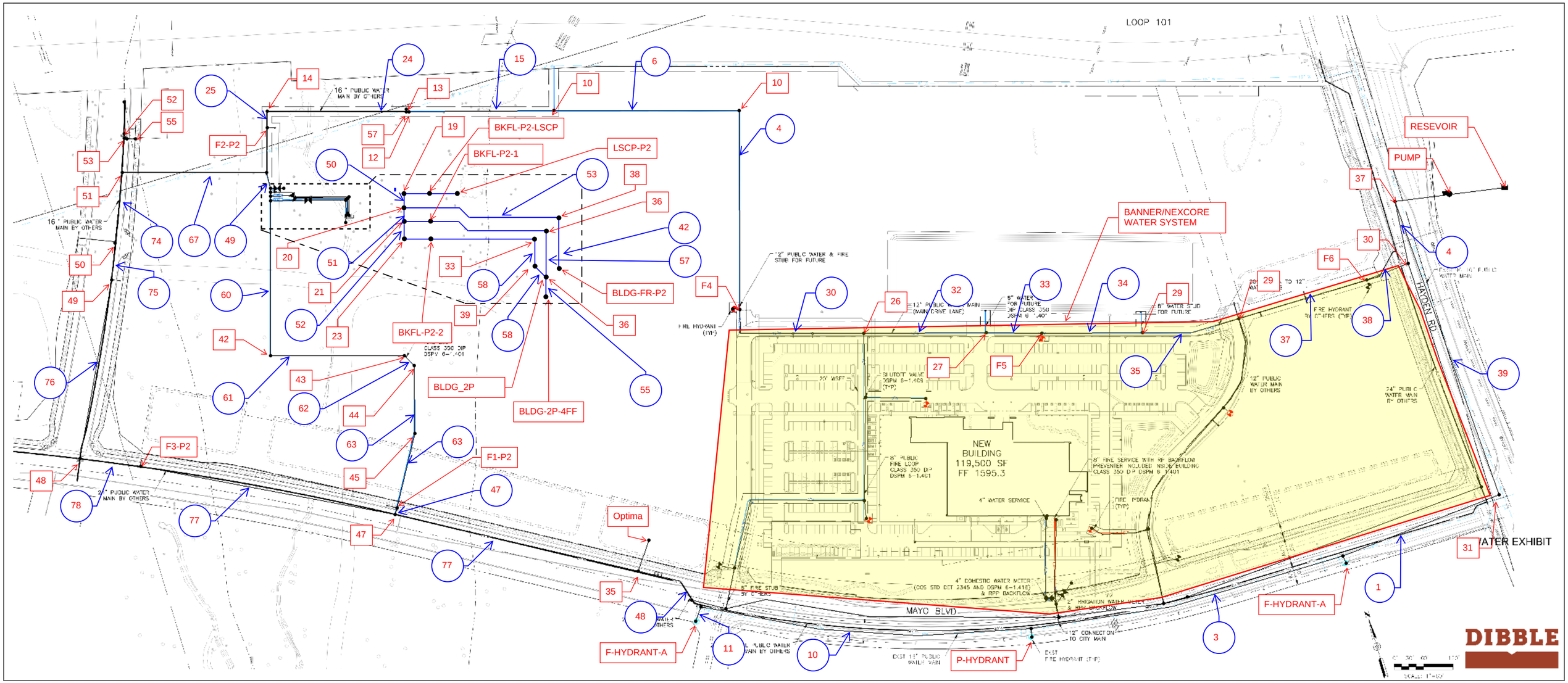
Maximum Daily Demand + Fire Flow Condition Scenario 3

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 25	33	24	130	660.47	0.47	0.10	Open
Pipe 29	94	24	130	-839.53	0.60	0.10	Open
Pipe 49	31	8	130	110.97	0.71	0.46	Open
Pipe 50	6	8	130	107.29	0.68	0.31	Open
Pipe 51	7	8	130	107.29	0.68	0.30	Open
Pipe 52	8	8	130	9.19	0.06	0.00	Open
Pipe 53	160	8	130	0.00	0.00	0.00	Open
Pipe 54	37	8	130	0.00	0.00	0.00	Open
Pipe 57	34	8	130	98.10	0.63	0.25	Open
Pipe 58	1	12	100	98.10	0.28	0.12	Open
Pipe 59	26	8	130	89.40	0.57	0.32	Open
Pipe 60	317	8	130	-80.21	0.51	0.17	Open
Pipe 61	273	8	130	-80.21	0.51	0.17	Open
Pipe 62	28	8	130	-80.21	0.51	0.26	Open
Pipe 63	138	8	130	-80.21	0.51	0.19	Open
Pipe 64	155	8	130	-80.21	0.51	0.19	Open
Pipe 65	14	8	130	-80.21	0.51	0.17	Open
Pipe 66	488	12	100	1030.71	2.92	4.52	Open
Pipe 67	295	24	130	-950.51	0.67	0.09	Open
Pipe 68	70	24	130	0.00	0.00	0.00	Open
Pipe 69	10	24	130	1.85	0.00	0.00	Open
Pipe 70	66	24	130	0.00	0.00	0.00	Open
Pipe 71	16	8	130	1.85	0.01	0.00	Open
Pipe 72	6	8	130	-1.85	0.01	0.00	Open
Pipe 73	16	8	130	0.00	0.00	0.00	Open
Pipe 74	141	24	130	-950.51	0.67	0.11	Open
Pipe 75	77	24	130	-950.51	0.67	0.13	Open
Pipe 76	370	24	130	-950.51	0.67	0.09	Open
Pipe 77	536	24	130	950.51	0.67	0.09	Open
Pipe 78	124	24	130	950.51	0.67	0.11	Open
Pipe 55	54	8	130	187.50	1.20	1.07	Open
Pump Pump	#N/A	#N/A	#N/A	1943.18	0.00	-155.66	Open
Valve BF2	#N/A	4	#N/A	0.00	0.00	25.50	Open
Valve BF1	#N/A	2	#N/A	0.00	0.00	25.40	Open
Valve BKFL_P2_1	#N/A	8	#N/A	98.10	0.63	10.90	Open
Valve BKFL_P2_2	#N/A	8	#N/A	89.40	0.57	10.90	Open
Valve BKFL-P2_LSCP	#N/A	12	#N/A	3.68	0.01	26.25	Open

XX NODES

XX LINKS

Scenario 4: INITIAL SERVICE DEMANDS APPLIED AT BLDG-2P-4FF =306GPM LSCP-P2 =3.68GPM OPTIMA=252GPM



Initial Service

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 10	678	16	130	-151.58	0.24	0.02	Open
Pipe 27	193	8	130	21.58	0.14	0.02	Open
Pipe 28	146	8	130	21.58	0.14	0.02	Open
Pipe 32	248	12	130	-105.60	0.30	0.05	Open
Pipe 31	55	12	130	0.00	0.00	0.00	Open
Pipe 33	115	12	130	-105.60	0.30	0.05	Open
Pipe 34	202	12	130	-105.60	0.30	0.04	Open
Pipe 38	75	12	130	-125.95	0.36	0.07	Open
Pipe 39	502	16	130	-151.58	0.24	0.02	Open
Pipe 1	357	16	130	151.58	0.24	0.03	Open
Pipe 2	23	6	130	0.00	0.00	0.00	Open
Pipe 11	34	6	130	0.00	0.00	0.00	Open
Pipe 9	23	6	130	0.00	0.00	0.00	Open
Pipe 19	27	4	130	0.00	0.00	0.00	Open
Pipe 35	203	12	130	-105.60	0.30	0.05	Open
Pipe 37	274	12	130	-125.95	0.36	0.06	Open
Pipe 17	1	4	130	0.00	0.00	0.00	Open
Pipe 18	155	4	130	0.00	0.00	0.00	Open
Pipe 40	500	24	130	284.15	0.20	0.01	Open
Pipe 41	643	20	130	284.15	0.29	0.03	Open
Pipe 44	674	20	130	304.50	0.31	0.02	Open
Pipe 46	42	24	130	434.50	0.31	0.17	Open
Pipe 47	500	8	130	252.00	1.61	1.63	Open
Pipe 14	1	24	130	410.10	0.29	0.00	Open
Pipe 42	52	20	130	284.15	0.29	0.04	Open
Pipe 48	7	16	130	151.58	0.24	0.10	Open
Pipe 36	192	12	130	20.35	0.06	0.00	Open
Pipe 3	655	16	130	151.58	0.24	0.02	Open
Pipe 43	215	20	130	-304.50	0.31	0.03	Open
Pipe 26	48	8	130	0.00	0.00	0.00	Open
Pipe 45	60	20	130	282.92	0.29	0.03	Open
Pipe 13	387	8	130	-21.58	0.14	0.02	Open
Pipe 12	77	8	130	-21.58	0.14	0.02	Open
Pipe 21	149	12	130	20.35	0.06	0.00	Open
Pipe 20	118	8	130	0.00	0.00	0.00	Open
Pipe 7	218	8	130	0.00	0.00	0.00	Open
Pipe 30	302	12	130	127.19	0.36	0.08	Open
Pipe 22	306	12	130	20.35	0.06	0.00	Open
Pipe 8	141	8	130	0.00	0.00	0.00	Open
Pipe 5	60	12	130	0.00	0.00	0.00	Open
Pipe 4	403	12	130	127.19	0.36	0.06	Open
Pipe 6	377	12	130	127.19	0.36	0.06	Open
Pipe 15	296	12	130	127.19	0.36	0.06	Open
Pipe 16	5	24	130	127.19	0.09	0.00	Open
Pipe 23	4	24	130	0.00	0.00	0.00	Open
Pipe 24	283	24	130	127.19	0.09	0.00	Open

Initial Service

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 25	33	24	130	127.19	0.09	0.00	Open
Pipe 29	94	24	130	127.19	0.09	0.00	Open
Pipe 49	31	8	130	251.61	1.61	2.19	Open
Pipe 50	6	8	130	247.93	1.58	1.36	Open
Pipe 51	7	8	130	247.92	1.58	1.40	Open
Pipe 52	8	8	130	84.02	0.54	0.18	Open
Pipe 53	160	8	130	0.00	0.00	0.00	Open
Pipe 54	37	8	130	0.00	0.00	0.00	Open
Pipe 57	34	8	130	163.91	1.05	0.64	Open
Pipe 58	1	12	100	163.91	0.46	0.12	Open
Pipe 59	26	8	130	142.09	0.91	0.78	Open
Pipe 60	317	8	130	-58.08	0.37	0.09	Open
Pipe 61	273	8	130	-58.08	0.37	0.09	Open
Pipe 62	28	8	130	-58.08	0.37	0.14	Open
Pipe 63	138	8	130	-58.08	0.37	0.10	Open
Pipe 64	155	8	130	-58.08	0.37	0.10	Open
Pipe 65	14	8	130	-58.08	0.37	0.10	Open
Pipe 66	488	12	100	182.50	0.52	0.18	Open
Pipe 67	295	24	130	-124.42	0.09	0.00	Open
Pipe 68	70	24	130	0.00	0.00	0.00	Open
Pipe 69	10	24	130	1.85	0.00	0.00	Open
Pipe 70	66	24	130	0.00	0.00	0.00	Open
Pipe 71	16	8	130	1.85	0.01	0.00	Open
Pipe 72	6	8	130	-1.85	0.01	0.00	Open
Pipe 73	16	8	130	0.00	0.00	0.00	Open
Pipe 74	141	24	130	-124.42	0.09	0.00	Open
Pipe 75	77	24	130	-124.42	0.09	0.00	Open
Pipe 76	370	24	130	-124.42	0.09	0.00	Open
Pipe 77	536	24	130	124.42	0.09	0.00	Open
Pipe 78	124	24	130	124.42	0.09	0.00	Open
Pipe 55	54	8	130	306.00	1.95	2.70	Open
Pump Pump	#N/A	#N/A	#N/A	561.68	0.00	-157.74	Open
Valve BF2	#N/A	4	#N/A	0.00	0.00	25.50	Open
Valve BF1	#N/A	2	#N/A	0.00	0.00	25.40	Open
Valve BKFL_P2_1	#N/A	8	#N/A	163.91	1.05	10.90	Open
Valve BKFL_P2_2	#N/A	8	#N/A	142.09	0.91	10.90	Open
Valve BKFL-P2_LSCP	#N/A	12	#N/A	3.68	0.01	26.25	Open

Initial Service

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc F6	1598.5	0	1747.23	64.45
Junc 28	1590	0	1747.21	68.12
Junc F5	1589.5	0	1747.20	68.33
Junc 27	1590	0	1747.19	68.11
Junc F4	1590	0	1747.16	68.10
Junc 11	1597	0	1747.18	65.07
Junc F2	1596	0	1747.18	65.51
Junc 17	1586	0	1747.21	69.85
Junc 18	1586	0	1721.71	58.80
Junc 7	1584	0	1747.20	70.72
Junc 26	1590	0	1747.18	68.11
Junc 25	1590	0	1747.16	68.10
Junc 31	1584	0	1747.23	70.73
Junc F_Hydrant_B	1591	0	1747.22	67.69
Junc 1	1584.5	0	1747.22	70.51
Junc 8	1583	0	1747.19	71.14
Junc F_Hydrant_A	1590	0	1747.19	68.11
Junc P_Hydrant	1589.5	0	1747.20	68.33
Junc LSCP	1586	0	1772.61	80.86
Junc F1	1595	0	1747.22	65.95
Junc D_BLDG_1FF	1595	0	1721.71	54.90
Junc D_BLDG_3FF	1622.3	0	1721.71	43.07
Junc 29	1591	0	1747.22	67.69
Junc 22	1596	0	1747.21	65.52
Junc 32	1587.3	0	1747.23	69.30
Junc F8	1585.7	0	1747.22	69.99
Junc 4	1585.6	0	1747.21	70.03
Junc F9	1583.6	0	1747.19	70.88
Junc 34	1584	0	1747.19	70.71
Junc 35	1583	0	1747.18	71.14
Junc Optima	1583	252	1746.37	70.79
Junc 37	1594	0	1747.24	66.40
Junc F7	1588.5	0	1747.22	68.77
Junc 2	1586	0	1747.22	69.85
Junc 30	1594	0	1747.24	66.40
Junc 24	1596	0	1747.18	65.51
Junc 6	1584	0	1747.19	70.71
Junc 9	1587	0	1747.22	69.42
Junc F3	1597	0	1747.18	65.07
Junc 3	1586	0	1747.21	69.85
Junc 5	1596.71	0	1747.13	65.18
Junc 10	1598.3	0	1747.11	64.48
Junc 12	1598.157	0	1747.09	64.53
Junc 13	1598.157	0	1747.09	64.53
Junc 14	1596.71	0	1747.09	65.16
Junc F2-P2	1598.12	0	1747.09	64.55

Initial Service

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 16	1597.77	0	1747.09	64.70
Junc 19	1597.88	0	1747.02	64.62
Junc 20	1597.88	0	1747.02	64.62
Junc 21	1597.88	0	1747.01	64.62
Junc 23	1597.88	0	1747.00	64.62
Junc 33	1600	0	1736.10	58.97
Junc 36	1600	0	1736.11	58.97
Junc 38	1600	0	1747.02	63.70
Junc 39	1600	0	1736.08	58.97
Junc BLDG_2P	1600	0	1736.08	58.97
Junc BLDG_FR_P2	1600	0	1747.02	63.70
Junc 42	1596.75	0	1747.03	65.12
Junc 43	1599.08	0	1747.06	64.12
Junc 44	1598.34	0	1747.06	64.44
Junc 45	1592.69	0	1747.08	66.90
Junc F1-P2	0	0	1747.09	757.02
Junc 47	1580.86	0	1747.09	72.03
Junc 48	1586	0	1747.09	69.80
Junc 49	1590.27	0	1747.09	67.95
Junc 50	1591.236	0	1747.09	67.53
Junc 51	1587.56	0	1747.09	69.13
Junc 52	1588.391	0	1747.09	68.77
Junc 53	1588.391	0	1747.09	68.77
Junc 54	1588.391	0	1747.09	68.77
Junc 55	1588.391	0	1747.09	68.77
Junc 56	1588.391	0	1747.09	68.77
Junc 57	1598.157	0	1747.09	64.53
Junc F3-P2	1585.21	0	1747.09	70.14
Junc LSCP-P2	1597.88	3.68	1720.78	53.25
Junc BLDG_2P_4FF	1654.6	306	1735.94	35.24
Resvr Reservoir	1589.5	#N/A	1589.50	0.00

BANNER SCOTTSDALE MEDICAL CENTER

Preliminary Sewer Report

Dibble Project No. 1124152

1st Submittal Date: July 14, 2025

DIBBLE

BANNER SCOTTSDALE MEDICAL CENTER

Preliminary Sewer Report

Scottsdale, AZ

City of Scottsdale Case No. X-XX-202X
Dibble Project No. 1124152

Prepared For: Banner Health
2901 N Central Avenue, Suite 160
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May 20, 2025

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1. INTRODUCTION

This report is prepared for Banner Health to support the entitlements of a 29-acre Banner Scottsdale Medical Center in Scottsdale, Maricopa County, AZ (a portion of Parcel 215-07-209H). The site is located on the northeast corner of Miller Rd. and Mayo Blvd. The new phased development will consist of a hospital and parking land uses. This development is divided into multiple phases:

- **Phase 1** includes a new 4-story 348,500-sf 106 bed hospital with adjoining 2-story diagnostic treatment building, loading dock, central utility plant, parking areas, ground mounted helipad and associated hardscape and utility improvements. Access drives into the medical center from Mayo Blvd, and Miller Rd will be constructed during Phase 1.
- **Future Phases** include hospital expansion of a new 5-story 145,000sf patient tower, expansion to the diagnostic and treatment centers encompassing an addition 72,000sf, a new 4-story 52,500sf NICU/Patient tower, and a new parking structure to support 300 licensed patient beds.

The purpose of this Preliminary Sewer Report is to provide analysis and results for the proposed wastewater distribution system at the site for the full buildout.

1.1 Project Location

The new Banner Scottsdale Medical Center site is approximately 29-acres in size and is located at the northeast corner of the intersection of Miller Rd. and Mayo Blvd in Scottsdale, AZ. The majority of the site is in the northwest quadrant of Township 4 North, Range 4 East, Section 35, with a small portion of the site in the southeast quadrant of Township 4 North, Range 4 East, Section 26. The site is bounded by Arizona State Route 101 to the north, Banner NexCore Health Center Plus to the east, Mayo Blvd and residential properties to the south, and Miller Rd to the west. See **Figure 1** below for a Vicinity Map.

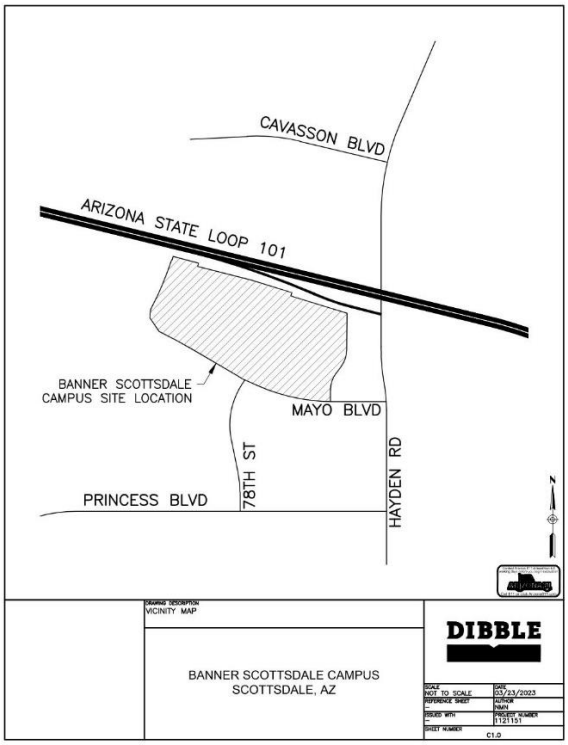


Figure 1 - Vicinity Map

2. EXISTING CONDITIONS

The new Banner Scottsdale Medical Center lies in Parcel 215-07-209H which is located on a portion of the Arizona State Land Department (ASLD) Crossroads East Planning Unit VI. The project requires a land use modification and a conditional use permit and is planned to be zoned C-O. The project site is undeveloped desert that drains from northwest to southeast.

A new 18-inch polyvinyl chloride (PVC) public gravity sewer main is located south of the site within Mayo Blvd. This gravity sewer conveys wastewater west along Mayo Blvd to the new 12" main on Miller Rd. It is then conveyed to North Pumpback Station at the intersection of Frank Lloyd Wright Boulevard and Pima Road through the Tournament Players Club golf course (TCP). From the lift station, wastewater is conveyed north through a 30-inch sewer force main to the existing City of Scottsdale wastewater reclamation facility, northeast of the project site. The existing 12-inch sewer main in Hayden Road previously served the Greyhawk and Cavasson developments north of Loop 101. However, the City of Scottsdale Crossroads East Lift Station has been constructed to redirect sewer flows within Hayden Road, north of Loop 101, to the east.

3. DESIGN CRITERIA

All new sewer mains will be submitted to the City of Scottsdale Maricopa County Environmental Service Division for review. New sewers at the site will be designed to meet City of Scottsdale *Design Standards and Policies Manual (2018)*, Maricopa Association of Governments (MAG) standards and details, *Arizona Administrative Code (AAC) Title 18*, and *Arizona Department of Environmental Quality (ADEQ) Bulletin 11*. Key design criteria include the following:

- All public sanitary sewer lines shall be extra strength vitrified clay pipe (VCP) or polyvinyl chloride (PVC) pipe material.
- No public sewer lines will be less than 8 inches in diameter.
- The Manning's n-value of all pipes shall be 0.013.
- Minimum full flow velocity is 2.5 feet per second.
- The maximum velocity shall be 10 feet per second at peak flow.
- The maximum d/D ratio is 0.65 for gravity sewer lines 12 inches in diameter and less in the ultimate peak flow condition. Gravity sewer lines greater than 12 inches in diameter shall not exceed a d/D ratio of 0.70.
- Sewer manholes shall be located at a maximum spacing of 500 feet for sewer pipes between 8 inches to 15 inches in diameter.
- Manholes shall be 4 feet in diameter for manholes less than 10-feet deep or connecting to pipes less than 15 inches in diameter. For manholes more than 10-feet deep or connecting to pipes greater than 15 inches, the manhole shall be 5-feet in diameter.
- The maximum sewer cleanout spacing shall be 150 feet for 6-inch pipes or smaller.
- Sewer service pipes shall have a minimum diameter of 6 inches for commercial developments.
- No sanitary sewer lines shall be installed with less than 4 feet of cover over the top of the pipe.
- All sewers must maintain a 1-foot vertical clearance to dry utilities. Sewer mains below water mains shall maintain 1 to 2 feet of vertical separation with extra protection, greater than 2 feet of separation with no protection. Sewer mains above water mains shall maintain a minimum of 2 feet of vertical separation and always require protection. Sewer service below water mains shall maintain 1-foot of vertical separation. Sewer services above water mains shall maintain a minimum of 1-foot of vertical separation and always require protection.
- All sewers must maintain 6 feet of horizontal clearance to dry utilities. Water mains and sewer mains shall run parallel to each other with 9 feet of separation to pipe centerlines to maintain 6 feet of clearance at manholes.

4. PROPOSED CONDITIONS

4.1 Horizontal Sewer Design

The new Banner Scottsdale hospital building will be served by a new private 12-inch gravity sewer service on site and connect into a public 18-inch gravity sewer main in Mayo Boulevard. The public 18-inch sewer main in Mayo Boulevard will be completed as a part of the Crossroads East Planning Unit VI master plan, that will occur concurrently with the Banner/Nexcore Health Center Plus construction. A *Master Sewer Report for Crossroads East Planning Unit VI* has been prepared by Kimley-Horn & Associates, Inc., and is included in **Appendix B** for reference. The new public 18-inch sewer main will convey wastewater flows to the west in Mayo Boulevard and travel to the Miller Road sewer main and ultimately through the Tournament Players Club golf course (TPC) to the existing North Pumpback Station at the intersection of Frank Lloyd Wright Boulevard and Pima Road. All new private sewer services on site will be PVC SDR35. Banner Health is responsible for maintenance of the private sewer on site, north of the new public 18-inch sewer main. See **Appendix A** for the sewer exhibit.

The new Banner Scottsdale hospital has 3 sewer plumbing connections that exit the building, one of which is a line for a 2,500 gallon grease interceptor located in the loading dock, which will serve a kitchen in the hospital. The plumbing connections for the Banner Scottsdale hospital are set at various elevations below the building finished floor, which has been set at 1603.70, as outlined below:

- East 8-inch sewer: 1595.75
- West 6-inch sewer: 1595.83
- South 8-inch sewer: 1597.00

A new sewer monitoring vault will be installed downstream of the new Banner Scottsdale hospital and will capture all flow from the hospital, as required by the City of Scottsdale.

5. HYDRAULIC ANALYSIS

5.1 Wastewater Flows

The City of Scottsdale *Design Standards and Policies Manual (2018)* specifies the design demand for office land use as 0.4 gallons per day (GPD) per square-foot. The design manual does not specify demand values for hospitals: therefore, the City of Scottsdale has assigned a design demand of 350 gallons per day (GPD) per bed for the hospital land use. This design demand is consistent with previous hospital developments within the City of Scottsdale. A peaking factor of 3.0 is used for the hospital land use.

The flows generated by the full build-out of the new Banner Scottsdale Medical Center are provided in **Table 1** below. These sewer demands are consistent with the demands specified in the *Master Sewer Report for Crossroads East Planning Unit VI*, prepared by Kimley-Horn & Associates, Inc. See **Appendix C** for full water demand calculation.

Table 1- Full Build-Out Wastewater Demands

FACILITY	NUMBER OF UNITS	UNIT	AVERAGE DAY DEMAND		PEAK DAY DEMAND		
			GPD	GPM	GPD	GPM	CFS
Hospital	**300**	**Beds**	**105,000**	**72.92**	**315,000**	**218.75**	**0.49**

5.2 Sewer Capacity

All proposed sewer services were analyzed using the Hydraflow Express Civil3D extension, which uses the Manning's equation for open channel flow. A roughness coefficient of 0.013 was used for the calculations. The results of the sewer model are provided in **Appendix D**.

6. CONCLUSION

The proposed sewer system will support the development of the new Banner Scottsdale Medical Center while adhering to the City of Scottsdale design standards. A new private 12-inch sewer gravity service is designed within the project site to serve the new Banner Scottsdale hospital. The concurrent 18-inch public sewer main in Mayo Boulevard has been designed to accommodate the anticipated demand from the Banner Scottsdale Medical Center.

7. REFERENCES

Arizona Administrative Code (AAC) Title 18, September 2016.

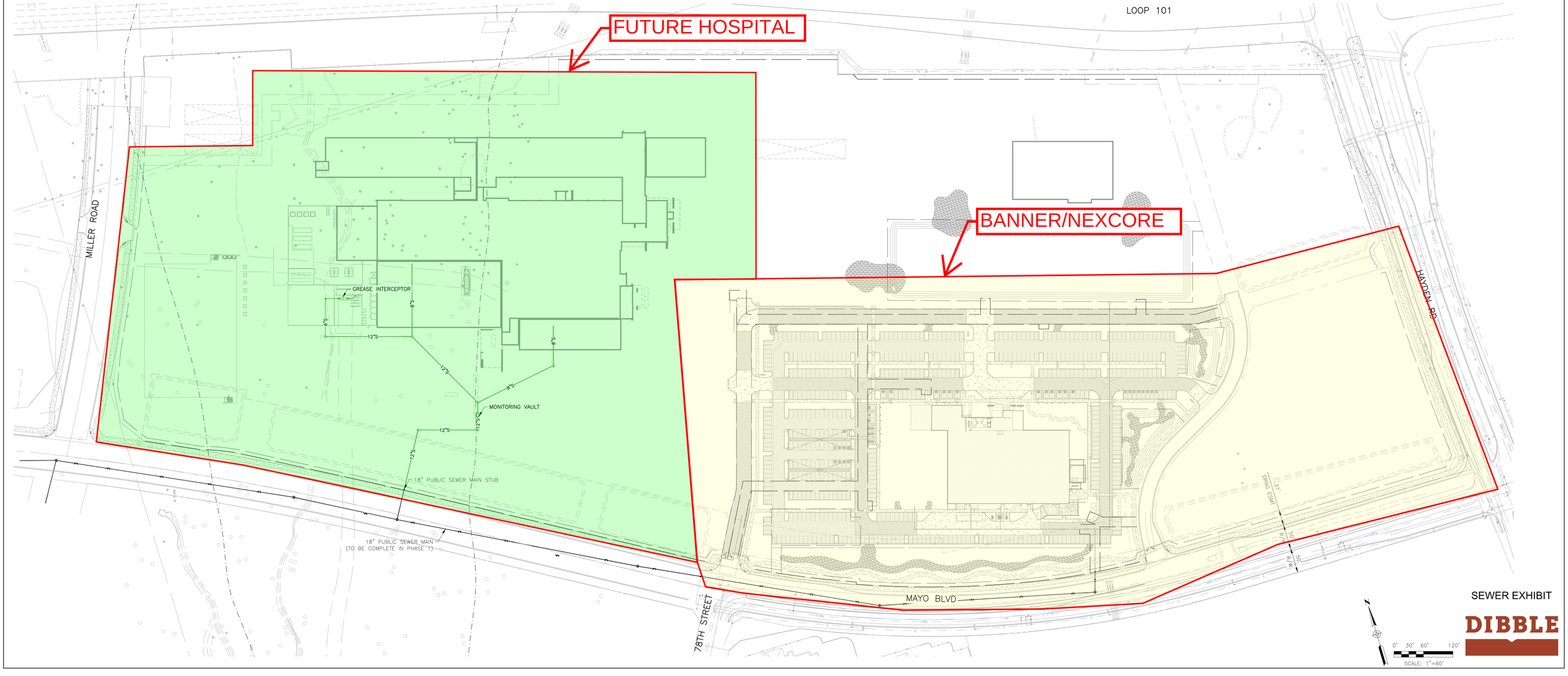
Arizona Department of Environmental Quality (ADEQ) Bulletin 11, July 1978.

City of Scottsdale. *Design Standards and Policies Manual*, 2018.

Kimley-Horn & Associates, Inc. *Master Sewer Report for Crossroads East Planning Unit VI*, 2023.

Maricopa Association of Governments. *Uniform Standard Details for Public Works Construction*, 2021.

Appendix A Sewer Exhibit


FUTURE HOSPITAL
BANNER/NEXCORE
LOOP 101
MILLER ROAD
HAYDEN RD
78TH STREET
MAYO BLVD
GREASE INTERCEPTOR
MONITORING VAULT
18" PUBLIC SEWER MAIN STUB
18" PUBLIC SEWER MAIN
(TO BE COMPLETE IN PHASE 1)
8"S
12"S
31'
DRNG ESMT
50'
R/W
0' 30' 60' 120'
SCALE: 1"=60'
SEWER EXHIBIT
DIBBLE

Appendix B Master Sewer Report for Crossroads East Planning Unit VI

FINAL Basis of Design Report

☐ APPROVED

☑ APPROVED AS NOTED

☐ REVISE AND RESUBMIT

CITY OF SCOTTSDALE

SCOTTSDALE WATER

9379 E San Salvador Dr.
Scottsdale, AZ 85258

Disclaimer: If approved; the approval is granted under the condition that the final construction documents submitted for city review will match the information herein. Any subsequent changes in the water or sewer design that materially impact design criteria or standards will require re-analysis, re-submittal, and approval of a revised basis of design report prior to the plan review submission.; this approval is not a guarantee of construction document acceptance.
For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY apritchard DATE 9/25/2024

MASTER SEWER REPORT

The City of Scottsdale (COS) engaged Carollo Engineers in 2022 to develop the North Airpark Sewer Study to analyze the impact of development in the area with respect to required sewer collection system infrastructure. This analysis has determined that there is insufficient capacity in the existing gravity sewer system to accommodate additional flows from this development. Construction for new sewer to accommodate sewer demands from this area is underway. No new flows will be permitted to be discharged to the existing sewer until construction and County acceptance of the new sewer from Scottsdale Rd/Mayo Blvd to the North Pumpback Station has been completed.

CROSSROADS EAST PLANNING UNIT VI AND PORTION OF PLANNING UNIT III

CASE 37-SA-2023

Developments within this master development will be responsible for repayment to the City of Scottsdale proportional design and construction costs for new sewer infrastructure required to convey flows from this development through a Repayment Agreement (DSPM 7-1.000, 7-1.400, SRC 49-212) :

•Along the Mayo Blvd frontage from Miller Rd west to the development's western boundary

•From the intersection of the Mayo Blvd and Miller Rd south along Miller road, across Princess Blvd, south/southeast along Princess Dr to approximately 79th St

•South and east through the TPC golf course to Pima Rd

•Along Mayo Blvd from Miller Rd to approximately 2150 LF east

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Prepared by:

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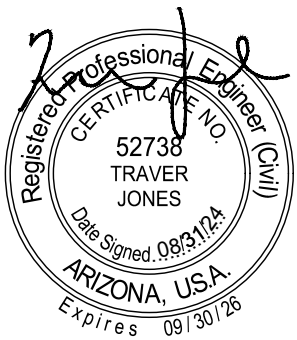

291268016
August 2024
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Crossroads East Planning Unit VI and Portion of Planning Unit III

MASTER SEWER REPORT

AUGUST 2024

Prepared By:

Kimley»Horn

37-SA-2023

Kimley»Horn

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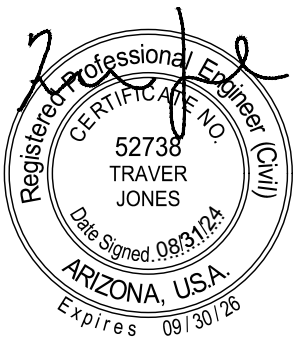

37-SA-2023

Appendices

Appendix A – Vicinity Map

Appendix B – Land Use Map, Planning Unit Layout, and ASLD Proposed Zoning Districts

Appendix C – Existing Conditions Sewer Infrastructure Exhibit and City of Scottsdale Quarter Section Maps

Appendix D – Proposed Conditions Sewer Infrastructure Exhibit

Appendix E – North Airpark Sewer Study by Carollo Engineers, April 2023 (Draft)

Appendix F – IIP-004 Wastewater Gravity Main Basis of Design Report by Kimley-Horn, November 2023

Appendix G – Sewer Flow Calculations

37-SA-2023

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

A new development will be located on a portion of Arizona State Land Department (ASLD) Crossroads East Planning Unit VI and a portion of Planning Unit III that was purchased at public auction on April 13, 2022. The project will include a mixed-use development as well as supporting roadway, utility, drainage, and site infrastructure.

1.2 SITE LOCATION

Planning Unit VI encompasses approximately 61 gross acres in north Scottsdale, near the northwest corner of Hayden Road and Mayo Boulevard. The project site also includes approximately 24 acres of Planning Unit III, located at the northwest corner of the Mayo Boulevard alignment and the Miller Road alignment. The combined parcels encompass approximately 85 gross acres (hereinafter known as the Sale Parcel) and were purchased from ASLD by Hayden Loop 101 Investors LLC.

The Sale Parcel is located in the North Half of Section 35 and the South Half of Section 26, Township 4 North, Range 4 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. See **Appendix A** for the Vicinity Map. The Sale Parcel is zoned PCD. More specifically, the Sale Parcel is bounded by the future Mayo Boulevard alignment and vacant undeveloped desert to the south, Hayden Road to the east, the Loop 101 freeway to the north, and vacant undeveloped desert to the west. The site slopes from the northeast to the southwest at approximately 1.5%. Refer to **Appendix B** for the Land Use Map.

1.3 PURPOSE

This Master Sewer Report for Crossroads East Planning Unit VI is intended to satisfy the City of Scottsdale wastewater master planning requirement of the Development Agreement recorded against the property (19-ZN-2002#2) for Planning Unit VI, as well as more specific guidelines for the Sale Parcel development in accordance with the City of Scottsdale sewer guidelines and standards. It provides a description of the sewer system requirements (demands), infrastructure location and sizing, and phasing for the Sale Parcel.

1.4 OBJECTIVES

This Master Sewer Report provides an infrastructure plan for the development of the Sale Parcel that will meet the City of Scottsdale guidelines. The report will demonstrate the following:

1. Wastewater demands for the Sale Parcel development.

2. Location and size of proposed wastewater infrastructure improvements necessary to serve the Sale Parcel development and future development of the surrounding parcels.

37-SA-2023

2.0 DESIGN DOCUMENTATION

2.1 DESIGN PROCEDURES, POLICIES, AND METHODOLOGIES.

The existing and proposed sewer network surrounding the Sale Parcel was analyzed using the computer program FlowMaster by Bentley. The sewer analysis utilizes the Manning's equation for gravity flow pipes. The sewer system was analyzed to determine the size of the wastewater infrastructure in accordance with the following standards as outlined in Chapter 7 of the 2018 City of Scottsdale Design Standards and Policy Manual (DS&PM).

- Full flow velocity in sewer lines shall be not less than 2.5 fps based upon Manning's formula with an "n" value of 0.013 (Section 7-1.404)
- Maximum velocity will be limited to 10 fps at estimated peak flow for unlined pipe. (Section 7-1.404)
- Maximum velocity of 15 fps for lined ductile pipe. (Section 7-1.404)
- Depth to diameter (d/D) for gravity sewer pipes 12 inches in diameter and less shall be no greater than 0.65 in the ultimate peak flow condition. (Section 7-1.404)
- Depth to diameter (d/D) for gravity sewer pipes greater than 12 inches in diameter shall be no greater than 0.70 in the ultimate peak flow condition. (Section 7-1.404)

2.2 PREVIOUS STUDIES

North Airpark Sewer Study

The governing document for regional sewer planning is the North Airpark Sewer Study (NASS) that was prepared for the City of Scottsdale by Carollo Engineers. The "Revised Draft" version of this report dated April 7 was provided by the City of Scottsdale for use with this report. This study encompasses approximately five square miles in north Scottsdale, of which the Sale Parcel is a portion.

Table 1 of the NASS identifies the Sale Parcel as areas 6, 7, and 19 and provides estimated sewer flows based on parcel areas and similar zoning districts. Table 1 below outlines the estimated Sale Parcel flows based on the NASS.

Table 1: Estimated Sewer Flows per NASS

Polygon ID	Area (ac)	AADF (gpm)	Peaking Factor	PHF (gpm)
6	29	67	3.00	200
7	42	143	3.00	428
19	21	69	5.97	412

AADF = Average Annual Daily Flow, PHF = Peak Hour Flow

The NASS also outlines a proposed collection system including sewer main sizing within the surrounding road network. This network is shown in Figure 4 of the NASS. Areas 6 and 7 are intended to flow towards Miller Road and be collected in a new 27-inch sewer main in Miller Road that flows south. Area 19 is shown to flow east to the sewer main in Hayden Road. This sewer also flows south to large-diameter sewer mains within the TPC golf course.

The NASS does not directly address any existing sewer capacity issues or any repayment allocations amongst contributing parcels. The study does not discuss the available capacity within any of the existing lines, nor does the study provide information on the source of the existing flows within the existing lines. No sewer system modelling data is available for review with the report.

Refer to **Appendix E** for the North Airpark Sewer Study.

Optima Sewer Study

The parcel to the west of the Sale Parcel consists of 22 acres owned by Optima and is planned to be developed as 8-story condominiums with rooftop amenities and ground floor retail. The site was rezoned from C-4 Commercial to PCP Planned Community Park. This rezoning was approved by City of Scottsdale in November 2022 and represented a substantial density increase for this site, as the previous land use was for an automotive dealership. The proposed Optima development will include 1,330 residential units with 29,450 square feet of restaurant/retail area. This increase in density triggered substantial sewer system concerns, and Optima was stipulated to make the following sewer system improvements with their development:

- New sewer main in Mayo Boulevard from Scottsdale Road to Miller Road,
- New sewer main in Miller Road from Mayo Boulevard to Princess Boulevard,
- New sewer main in Princess Boulevard from Miller Road to the northern edge of the TPC golf course,
- New sewer main in the TPC golf course to the City of Scottsdale north pumpback station at the intersection of Pima and the CAP canal.

The Optima development is eligible for repayments for a portion of this infrastructure based on funds allocated by the City's Infrastructure Improvement Program (IIP).

At the time of this memorandum, the Optima development team has completed design and is underway with sewer main construction from the project frontage to the north side of the TPC golf course. Upon completion, the Optima project will be allowed to discharge sewer from the first phase of their development to the existing sewer infrastructure (24-inch sewer main) along the north side of the TPC golf course. The City of Scottsdale will undertake the design and construction of the new parallel sewer main (36-inch sewer main) improvements within the TPC golf course to the north pumpback station.

Refer to **Appendix F** for the IIP-004 Wastewater Gravity Main Basis of Design Report.

2.3 COORDINATION WITH CITY STAFF

Several meetings with City Staff have taken place to understand the sewer capacity issues affecting this area. City Staff raised concerns about regional sewer capacity at a meeting in September 2022, however, the extents of the capacity deficiencies were not known at this time since the NASS had not been completed.

Additional meetings were held with City Staff in early 2023 to discuss the sewer capacity in this area. At a meeting with City Staff on 4/26/2023, Anita Pritchard (City of Scottsdale Senior Water Resources Engineer) and Scott Mars (City of Scottsdale Water Resources Director of Planning and Engineering) informed the development team that there is no sewer capacity for any developments until a new 36-inch sewer main is installed across the TPC golf course located approximately two miles downstream from the Sale Parcel. City Staff noted that this would take place January 2026 or later.

Following further discussions with City Staff and management in May and June 2023, portions of the sewer transmission main near the TPC golf course have shifted and City Staff expects that the sewer transmission main will be completed in the fall of 2025.

At a meeting held with City staff on March 28, 2024, construction of the City's portion of the regional sewer main improvements is anticipated to begin in late April 2024 and expected completion is October 2025.

3.0 DESCRIPTION OF EXISTING SEWER INFRASTRUCTURE

3.1 EXISTING SEWER INFRASTRUCTURE

The Sale Parcel currently consists of vacant desert and a gravel parking area that has previously been used for regional event parking. No wastewater infrastructure currently exists on-site.

A 12-inch PVC sewer main is located in Hayden Road along the east side of the Sale Parcel. This sewer main is approximately 16 feet deep and flows to the south at a slope of approximately 1.4%. Near the intersection of Hayden Road and Union Hills Drive, this sewer main increases to a 21-inch PVC sewer main. The depth of this 21-inch sewer main decreases to approximately eight feet deep as it flows south at a slope of approximately 0.17%.

A sewer lift station is located on the east side of Hayden Road, north of the Loop 101 freeway. Sewer flows from areas north of the Loop 101 freeway are directed to this lift station and no sewer flows from north of the Loop 101 will enter the 12-inch sewer main in Hayden Road. See **Appendix C** for the Existing Sewer Infrastructure Exhibit and City of Scottsdale Quarter Section Maps.

3.2 PROPOSED SEWER INFRASTRUCTURE BY OTHERS

As previously noted, the Optima development to the west of the Sale Parcel will be constructing regional sewer infrastructure that will be utilized by the proposed development. This infrastructure is anticipated to be installed and operational prior to the proposed development and will therefore be considered existing infrastructure for the purposes of this report. The sewer infrastructure to be installed with the Optima development is under construction at the time of this report and includes the following:

- New 27-inch Hobas sewer main in Mayo Boulevard from Scottsdale Road to Miller Road
- New 27-inch Hobas sewer main in the Miller Road alignment from Mayo Boulevard to Princess Boulevard
- New 36-inch Hobas sewer main in Princess Drive from Princess Boulevard to Hayden Road
- New 36-inch Hobas sewer main in TPC Champions course (design and construction by City of Scottsdale)
- New 48-inch Hobas sewer main in Pima Road to north pumpback (design and construction by City of Scottsdale)

Refer to **Appendix F** for the Optima Wastewater Master Plan.

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4.0 DEMANDS

4.1 GENERAL

The projected sewer demands for the Sale Parcel will be determined based on parcel size, the anticipated land uses, and the anticipated densities. This report will review the demands for the Sale Parcel, which encompasses approximately 85 gross acres. Per the ASLD Proposed Zoning Districts shown in **Appendix B**, permitted zoning categories for the Sale Parcel include I-1, PRC, PCP, C-2, C-3, C-0, and R-5.

For the purposes of this report, assumptions regarding the land uses and densities have been made and are depicted on the Land Use Map in **Appendix B**.

The average day and peak hour sewer demands will be calculated for each parcel in accordance with Chapter 7 of the DS&PM and the assumptions noted above, with the exception of the Research & Development parcel which has unique sewer demands discussed further below.

4.2 SALE PARCEL SEWER DEMANDS

As noted above, the assumptions for the Sale Parcel land uses are shown on the Land Use Map in **Appendix B.** Table 2 below provides the design sewer demands for the Sale Parcel per Figure 7-1.2 of the DS&PM:

60 gpm

207 gpm

Table 2: Sale Parcel Sewer Deman

Zoning	Net Area (Acres)	Land Use	Density	Unit	Units or Area		Average Day Sewer Demand		Design Peaking Factor[5]	Peak Flow	
							GPD	GPM		GPD	GPM
I-1 PCD	21.07	R&D Office	-	-	248,800	SF	99,520	69	3	298,560	415
I-1 PCD		R&D Cafeteria	-	-	11,800	SF	14,160	10	6	84,960	118
I-1 PCD		R&D Lab	-	-	406,300	SF	137,732	96	3	413,196	287
C-2 PCD	27.31	Hospital	0.63	FAR	320	Bed	112,000	78	3	336,000	233
C-2 PCD	9.87	Medical Office	0.21	FAR	85,000	SF	34,000	24	3	102,000	71
C-2 PCD	10.92	Health Center	0.39	FAR	175,000	SF	70,000	49	3	210,000	146
C-2	2.54	Office	0.30	FAR	32,670	SF	13,068	9	3	39,204	27
C-2	5.81	Restaurant	0.12	FAR	30,000	SF	36,000	25	6	216,000	150
	77.52						516,480	359		1,699,920	1,447

1181 gpm

1. Research and Development laboratory sewer demand is based on correspondence with City staff, see **Appendix G**. Demands shown in Table 1 have been increased by 10% compared to Appendix G.
2. Office sewer demand is 0.4 GPD/SF per DS&PM Table 7-1.2.
3. Restaurant sewer demand is 1.2 GPD/SF per DS&PM Table 7-1.2.
4. Design peaking factor is determined by land use per DS&PM Table 7-1.2.
5. Hospital sewer demand is assumed to be 350 GPD/Bed.
6. Health Center and Medical Office sewer demand is assumed to be 0.4 GPD/SF.

Refer to **Appendix G** for Sewer Calculations and City correspondence for the Research & Development parcel.

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The Research & Development parcel will include a unique use that includes non-typical wastewater flows. The user of this parcel has worked with City staff to determine the appropriate wastewater flows and peaking factors, and these numbers are included in the table above. Refer to **Appendix G** for correspondence regarding the Research & Development wastewater flows. For the purposes of this Master Sewer Report, the demands shown in Appendix G were increased by approximately 10% to account for potential future changes in the precise parcel demands.

4.4 ADJACENT PARCEL SEWER DEMANDS

Sewer demands for the adjacent parcels are set forth in the NASS. Table 3 outlines the average annual daily flow (AADF) and peak hour flow (PHF) for the adjacent parcels provided in Table 1 of the NASS.

Table 3: Adjacent Parcel Sewer Demands

NASS Polygon ID	Area (acres)	AADF (gpm)	PHF (gpm)
4	61	140	421
5	19	148	1,026
8	21	48	145
9	18	41	124

Per the NASS, the projected sewer demands outlined above are based on the parcel areas, zoning and land use assumptions, and peaking factors. Refer to **Appendix E** for the NASS.

As previously noted, the parcel to the west of the Sale Parcel is under development as the Optima condominium and mixed-use development. Based on the IIP-004 Wastewater Gravity Main Basis of Design Report, the AADF and PHF anticipated from the Optima project are 149 gpm and 1,026 gpm, respectively. Refer to **Appendix F** for the Optima Wastewater Master Plan.

5.0 DATA ANALYSIS METHODS

5.1 DESIGN CRITERIA

The proposed sewer system will be analyzed using Manning's equation and the FlowMaster computer program. The following design criteria will be used:

- Minimum pipe diameter of eight inches
- Minimum mean full flow velocity of 2.5 feet per second (fps)
- Manning's "n" value of 0.013
- Maximum peak flow velocity of 10 fps
- Maximum depth to Diameter (d/D) ratio of 0.65 for pipes 12 inches and less
- Maximum d/D ratio of 0.70 for pipes larger than 12 inches

In general, the Sale Parcel slopes from the northeast to the southwest at approximately 1.5%. Sewer mains running in the east-west direction will be designed with minimal slopes, and sewer mains running in a north-south direction will have greater slopes that can be adjusted to achieve a desirable sewer depth.

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6.0 RESULTS

6.1 PROPOSED SEWER SYSTEM LAYOUT

As previously noted, existing sewer mains are present within Princess Boulevard, Scottsdale Road, and Hayden Road. New 27-inch sewer mains will be constructed in Mayo Boulevard and Miller Road as part of the Optima development prior to the Sale Parcel development. The proposed sewer system for the Sale Parcel will connect to these existing sewer mains to provide service to the Sale Parcel.

The Research & Development parcel will include a sewer service to the 27-inch sewer main in Mayo Boulevard. This sewer service will connect to one of the proposed manholes along the parcel frontage. The design of this sewer service will be outlined as part of that developments Basis of Design Report.

two

A new 18-inch Hobas sewer main will be installed in Mayo Boulevard from Miller Road to the east to provide sewer service to the portion of the Sale Parcel at the northeast corner of Mayo Boulevard and Miller Road. This new sewer main will connect to the 27-inch Hobas sewer main at a manhole at the intersection of Miller Road and Mayo Boulevard. This sewer main will also provide capacity for the NASS Parcel 9 area at the southeast corner of Mayo Boulevard and Miller Road.

Partial reimbursements for sewer main construction in Mayo Boulevard will be available under City of Scottsdale Wastewater Infrastructure Improvement Project 004. NASS Polygons 7 and 9 will each have a reimbursement associated with their respective polygons per SRC Chapter 49 Article V. ~~The total cost allocated to this portion of WW-IIP-004 is~~ $960,000.

The maximum funds available for reimbursement for this segment of sewer is

The portion of the Sale Parcel adjacent to Hayden Road will connect to the existing 12-inch PVC sewer main in Hayden Road through services for each future parcel. The services will be sized with the design of the on-site improvements.

Table 4 below summarizes the proposed sewer main extensions required for the Sale Parcel.

Table 4: Sewer Main Extension Summary

Segment	Diameter (Inches)	Slope	Capacity[1] (GPM)	Demand (GPM)
Mayo Blvd, East from Miller Road	18	0.33%	2,267	574
Hayden Road (Existing 12" Main)	12	1.40%	1,431	412

1. Capacity is based on d/D=0.70 for sewer main larger than 12-inch diameter.

Refer to **Appendix D** for the Proposed Sewer Infrastructure Exhibit showing the sewer tributary areas and proposed sewer infrastructure. Refer to **Appendix G** for Sewer Capacity Calculations. The sewer main extensions described above will need to be designed to comply with Chapter 7 of the DS&PM and other applicable regulations.

The pipe slopes noted in Table 4 and in **Appendix D** are the minimum pipe slopes to meet the required capacities; the final design may incorporate greater slopes for added sewer main capacity.

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554 gpm

6.2 CONFORMANCE TO PREVIOUS AND ADJACENT STUDIES

Table 5 outlines the proposed Sale Parcel sewer demands compared to the estimated sewer demands for the corresponding parcels shown in the NASS.

Table 5: Proposed Sewer Demand vs. NASS Estimate

NASS Polygon ID	NASS Average Day Demand (gpm)	Sale Parcel Average Day Demand (gpm)	NASS Peak Hour Flow Demand (gpm)	Sale Parcel Peak Hour Flow Demand (gpm)
6	67	175	200	~~820~~
7	143	150	428	450
19	69	34	412	177
Total	279	559	1,040	~~1,447~~ 1181 gpm

As noted above, the total Sale Parcel sewer demands calculated in Table 1 are similar to the estimated flow projections shown in the NASS.

The IIP-004 Wastewater Gravity Main Basis of Design Report provides design information for the sewer main in Mayo Boulevard between Scottsdale Road and Miller Road, the sewer main in Miller Road between Mayo Boulevard and Princess Boulevard, and sewer mains in Princess Boulevard and areas to the south. Coordination will be maintained with the Optima development team to provide the anticipated flows that will contribute to these sewer mains that serve both parcels.

The proposed improvements are in general conformance with the NASS and the IIP-004 Wastewater Gravity Main Basis of Design Report, with minor site-specific changes.

6.3 RESEARCH AND DEVELOPMENT PARCEL SEWER DEMANDS

As previously noted, the Research & Development parcel will include a unique user with sewer demands that are different from any of the typical demands quantified in the DS&PM tables. The sewer demands for the Research & Development parcel are based on coordination with the development team and City staff. The anticipated sewer flows from the Research & Development parcel are included in **Appendix G**. For the purposes of this Master Sewer Report, the flows have been increased to provide a buffer to allow for minor future changes to the site.

6.4 PROPOSED SPECIAL WASTEWATER FACILITIES

Portions of the sewer main may need to be constructed with ductile iron pipe (DIP) or FRP Hobas pipe due to drainage channel, culvert, or other crossings as specified by Maricopa Association of Governments (MAG) Standard Detail 404. Any segments of DIP sewer shall be CIPP-lined following installation, and pipe material shall not change between manholes per DSPM 7-1.401. The preliminary sewer design indicates that there will not be crossing issues due to the depth of the sewer. All proposed sewer main will be under paved roadways, so there will not be any washes crossing the proposed sewer main.

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The 18-inch sewer main in Mayo Boulevard will be constructed with Hobas FRP sewer main and Armorock polymer concrete manholes.

The design plans will include construction details for connections to the proposed Armorock polymer concrete manholes that are to be used with the 27-inch sewer main extensions in Mayo Boulevard and Miller Road. Hobas pipe shall be used for connections to the Research & Development site to withstand any corrosive discharge. This will need to connect to the existing manholes on the 27-inch sewer main in Mayo Boulevard.

There are several >50 cfs washes in this area of undeveloped land. As this parcel develops, the washes will be placed into culverts or storm drain pipes for roadway crossings. Any storm water that crosses a proposed sewer main will be contained within a culvert or storm drain pipe. Since the proposed sewer main is located within the streets, there will not be any instances of a natural wash crossing the sewer main.

6.5 PROJECT PHASING

The Sale Parcel infrastructure noted in Section 6.1 will be constructed in a single phase, prior to any on-site developments. On-site developments will prepare Basis of Design reports that will demonstrate compliance with this Master Sewer Report.

37-SA-2023

7.0 CONCLUSION

7.1 OVERALL PROJECT

Based on the results of this Sewer Master Report, the following can be concluded:

- The proposed development will be responsible for new 18-inch Hobas sewer main in Mayo Boulevard from Miller Road extending to the east to serve the “Polygon 7” and “Polygon 9” areas outlined in the NASS.
- Sewer flows from the portion of the Sale Parcel immediately east of Miller Road can be conveyed in a new 18-inch Hobas sewer main in Mayo Boulevard to the 27-inch Hobas sewer main in Mayo Boulevard that is installed with the Optima development.
- Sewer flows from the portion of the Sale Parcel adjacent to Hayden Road can be directed to the existing 12-inch sewer main in Hayden Road.
- This Sewer Master Report is generally consistent with the North Airpark Sewer Study prepared by Carollo Engineers (draft version, April 2023).
- This Sewer Master Report incorporates the anticipated sewer flows from the Optima multi-family project at the northeast corner of Scottsdale Road and Mayo Boulevard.

This Sewer Master Report is intended to provide a level of assurance that sewer service can be provided to the Sale Parcel and the downstream portions of Planning Units III and VII. It is also intended to provide guidance for future developments within the Sale Parcel.

8.0 REFERENCES

City of Scottsdale, *Design Standards and Policies Manual, Chapter 7: Wastewater,* January 2018.

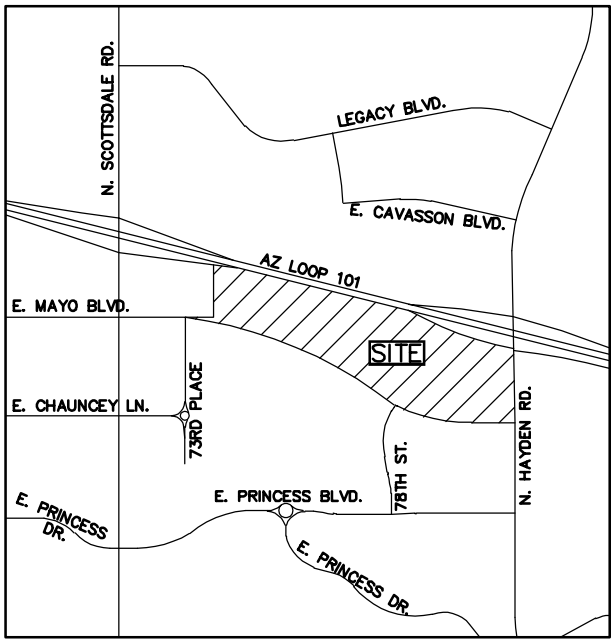
Carollo Engineers, *North Airpark Sewer Study (Draft),* April 2023.

Kimley-Horn & Associates, Inc. *Optima McDowell Mountain Village Wastewater Master Plan*, December 2022.

2017. FlowMaster v8i, Bentley Systems, Inc. and *FlowMaster User's Guide*

37-SA-2023

Appendix A – Vicinity Map



VICINITY MAP

CITY OF SCOTTSDALE

N.T.S.

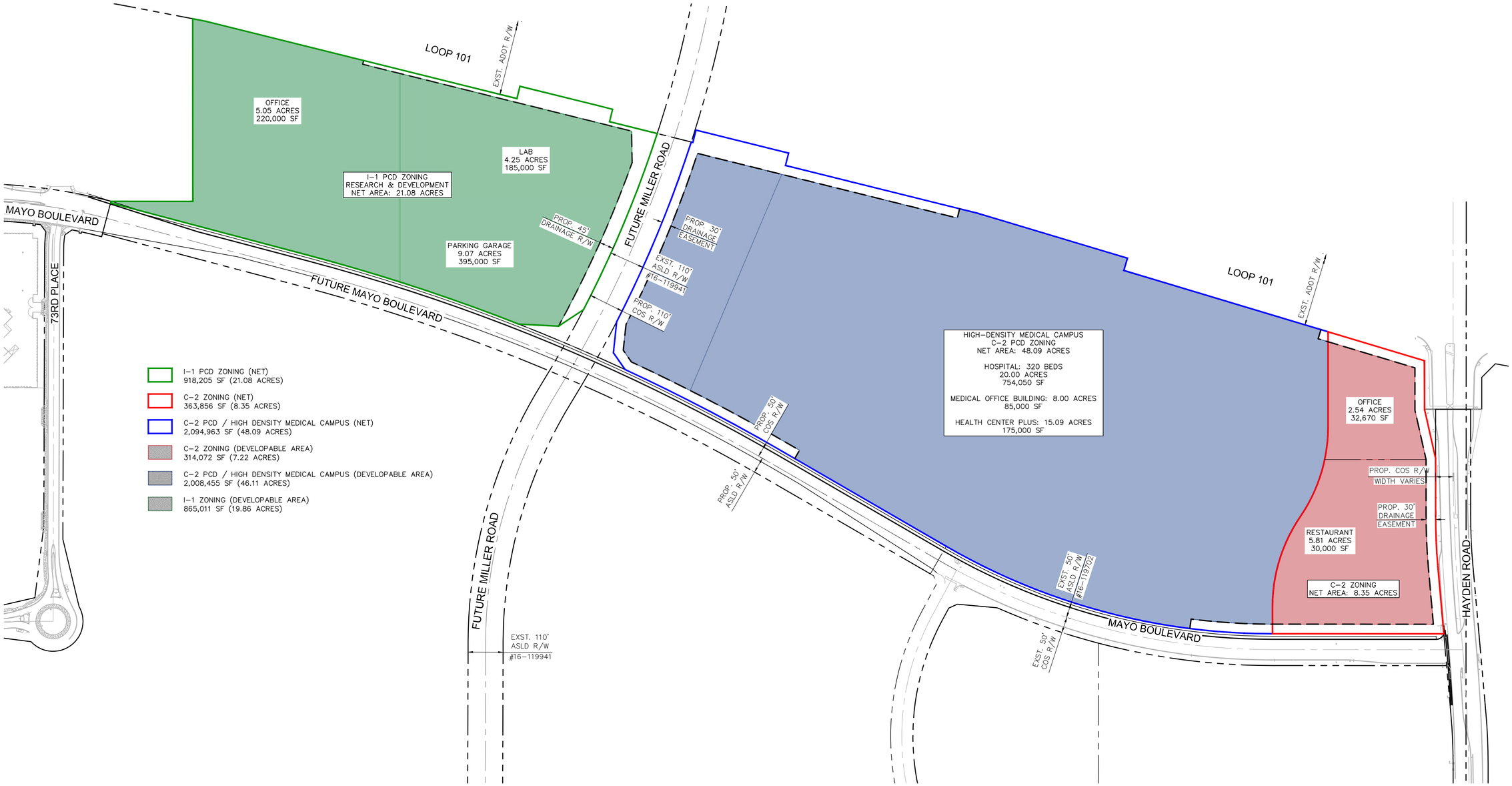
NORTH

Kimley»Horn

37-SA-2023

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\Vicinity Map.dwg Feb 28, 2024 Laurel.Wright

Appendix B – Land Use Map, Planning Unit Layout, and ASLD Proposed Zoning Districts



LAND USE MAP
SWC - HAYDEN ROAD & LOOP 101 FREEWAY

Kimley»Horn

4/11/2024

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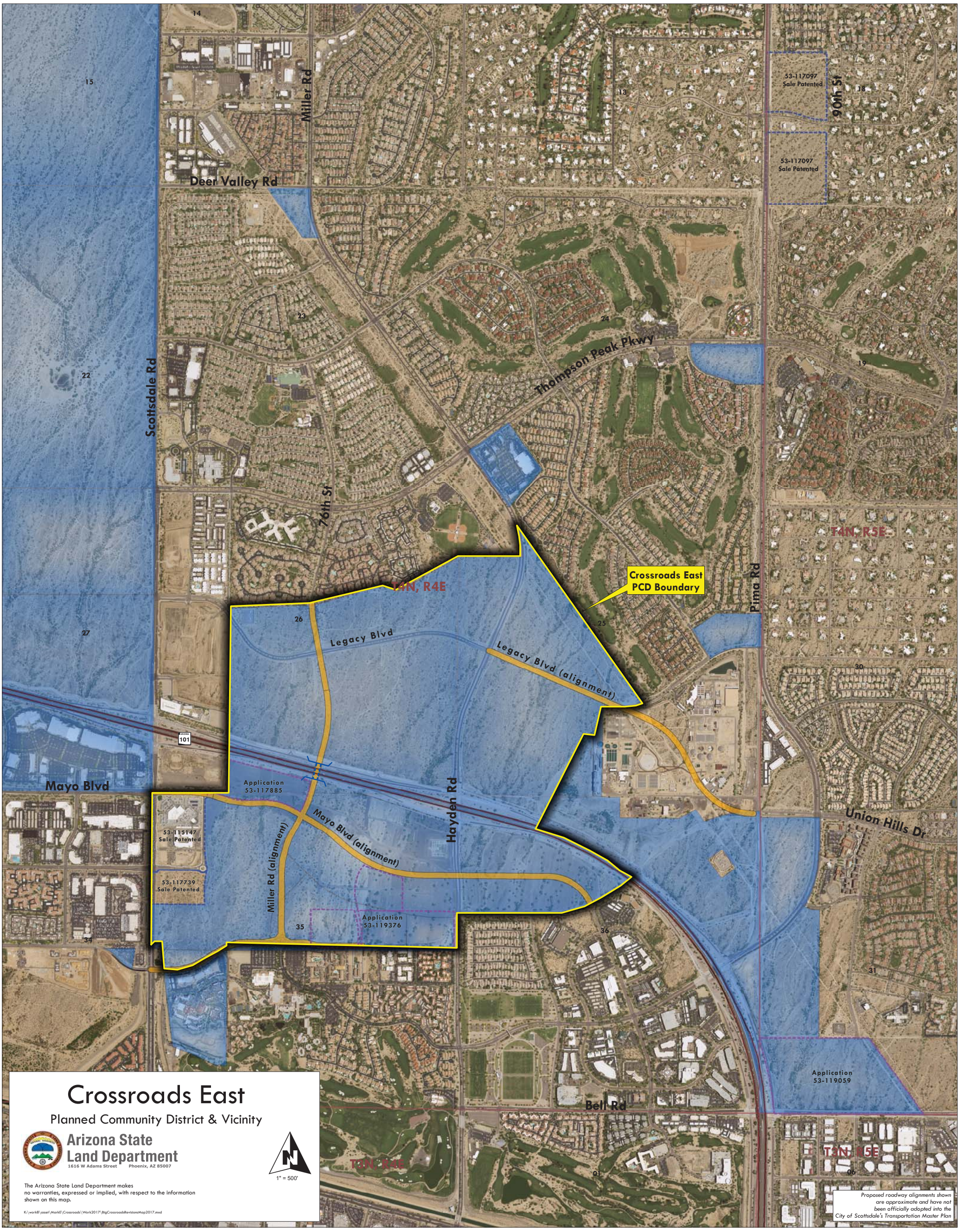
14
15
13
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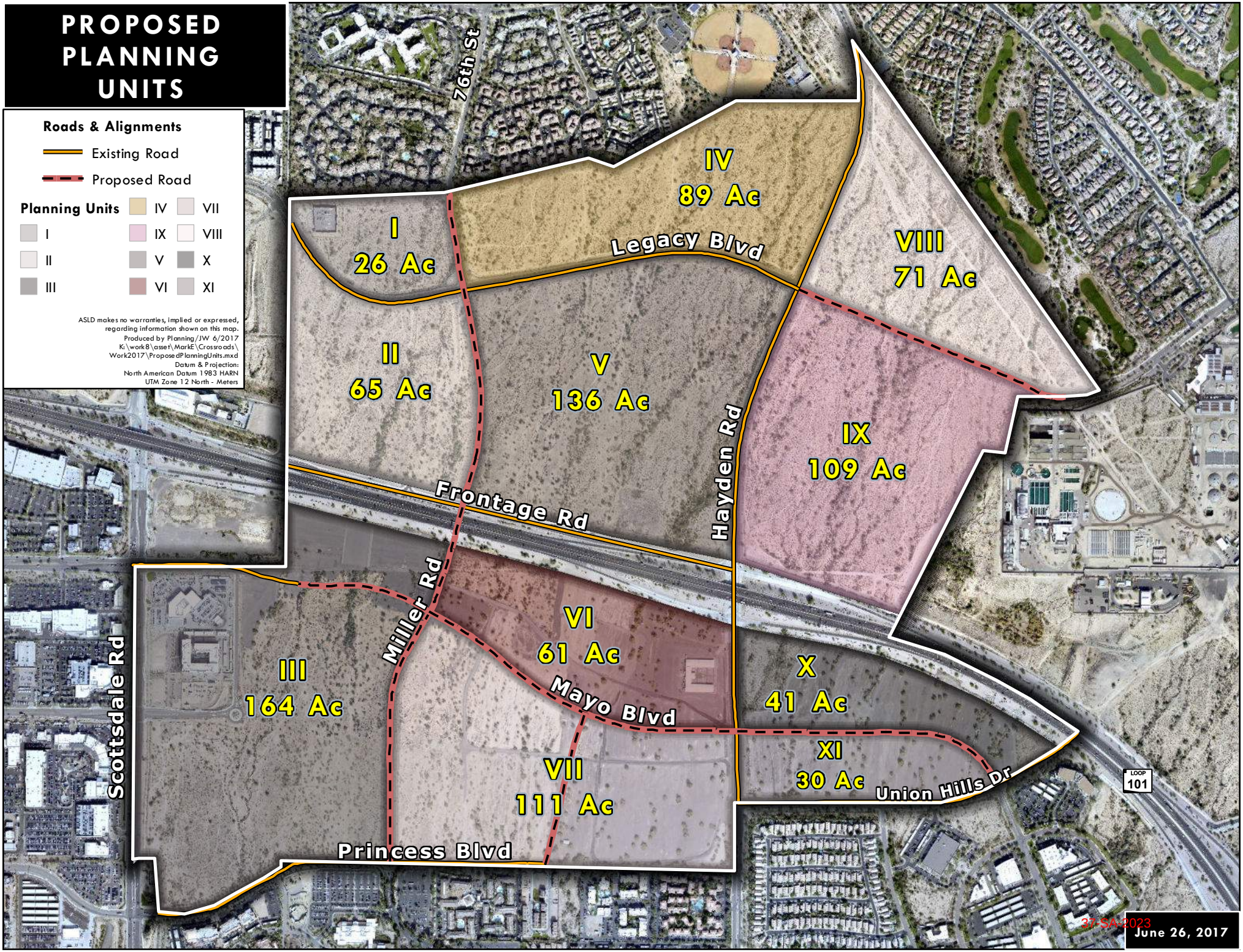
22
23
24
25
26
27
30
31
34
35
36
01
06
Miller Rd
Deer Valley Rd
90th St
53-117097
Sale Patented
53-117097
Sale Patented
Scottsdale Rd
76th St
Thompson Peak Pkwy
T4N, R4E
T4N, R5E
Crossroads East
PCD Boundary
Pima Rd
Legacy Blvd
Legacy Blvd (alignment)
101
Mayo Blvd
Application
53-117885
Hayden Rd
Union Hills Dr
53-115147
Sale Patented
Mayo Blvd (alignment)
Miller Rd (alignment)
53-117739
Sale Patented
Application
53-119376
Application
53-119059
Bell Rd
T3N, R4E
T3N, R5E
Crossroads East
Planned Community District & Vicinity
Arizona State
Land Department
1616 W Adams Street Phoenix, AZ 85007
1" = 500'
The Arizona State Land Department makes
no warranties, expressed or implied, with respect to the information
shown on this map.
K:\work8\asset\MarkE\Crossroads\Work2017\BigCrossroadsRevisionsMap2017.mxd
Proposed roadway alignments shown
are approximate and have not
been officially adopted into the
City of Scottsdale's Transportation Master Plan

37-SA-2023


PROPOSED PLANNING UNITS
Roads & Alignments
Existing Road
Proposed Road
Planning Units
I
II
III
IV
IX
V
VI
VII
VIII
X
XI
ASLD makes no warranties, implied or expressed, regarding information shown on this map.
Produced by Planning/JW 6/2017
K:\work8\asset\MarkE\Crossroads\Work2017\ProposedPlanningUnits.mxd
Datum & Projection:
North American Datum 1983 HARN
UTM Zone 12 North - Meters
76th St
IV
89 Ac
I
26 Ac
Legacy Blvd
VIII
71 Ac
II
65 Ac
V
136 Ac
IX
109 Ac
Hayden Rd
Frontage Rd
Miller Rd
VI
61 Ac
Scottsdale Rd
III
164 Ac
Mayo Blvd
X
41 Ac
XI
30 Ac
Union Hills Dr
LOOP
101
VII
111 Ac
Princess Blvd
37-SA-2023
June 26, 2017

WHERE ZONING CAN BE USED AT CROSSROADS EAST

JUNE 2017

2002

CURRENT/EXISTING CHARACTER AREAS



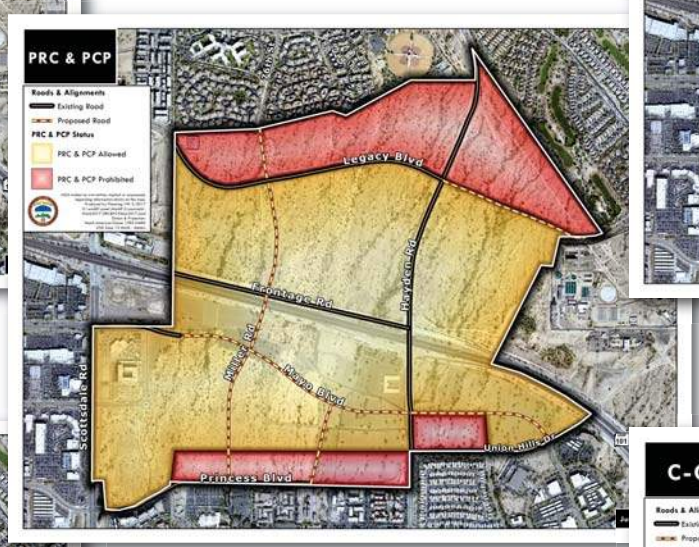
TODAY

PROPOSED ZONING DISTRICTS

LAND USE INDEX: PRC/PCP - REGIONAL CENTER C-2/C-3 COMMERCIAL
R-5 MULTIFAMILY RESIDENTIAL I-1 INDUSTRIAL PARK C-O COMMERCIAL OFFICE

LIMITED TO ALLOWED PROHIBITED











37-SA-2023

Appendix C – Existing Conditions Sewer Infrastructure Exhibit and City of Scottsdale Quarter Section Maps



NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

EXISTING SEWER INFRASTRUCTURE

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2022-12-06 Exst Sewer Exhibit.dwg Jan 26, 2023 Laurel.Wright



GENERAL NOTES:

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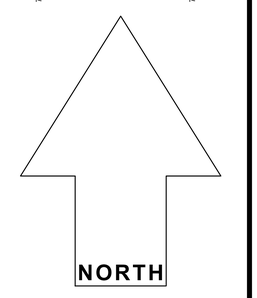
- THE SECTION LINE BEARING AND DISTANCES ARE BASED ON THE CITY OF SCOTTSDALE GPS SURVEY OF SEPTEMBER, 1991. BEARINGS ARE NAD 83 GRID AND DISTANCES ARE FLATTENED TO GROUND. WHERE NO CORNER WAS FOUND THE DIMENSIONS ARE GIVEN TO CALCULATED SECTION CORNERS AND ARE NOTED AS 'CALCULATED' ON THE MAP.

LEGEND:

- Cleanout
- Lift Station (SLS)
- Manhole (S)
- Non-GPS Point
- Plug
- Sewer Service Point
- Sewer Tap Point
- Sewer Valve
- Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force (Force)
- Sewer Main - Private

VICINITY MAP



The map scale of 1" = 100' is based on a full size print of 30" x 36"

SEWER

QUARTER SECTION MAP

37-45

SW 1/4 SEC. 35 T4N R4E

N O T I C E

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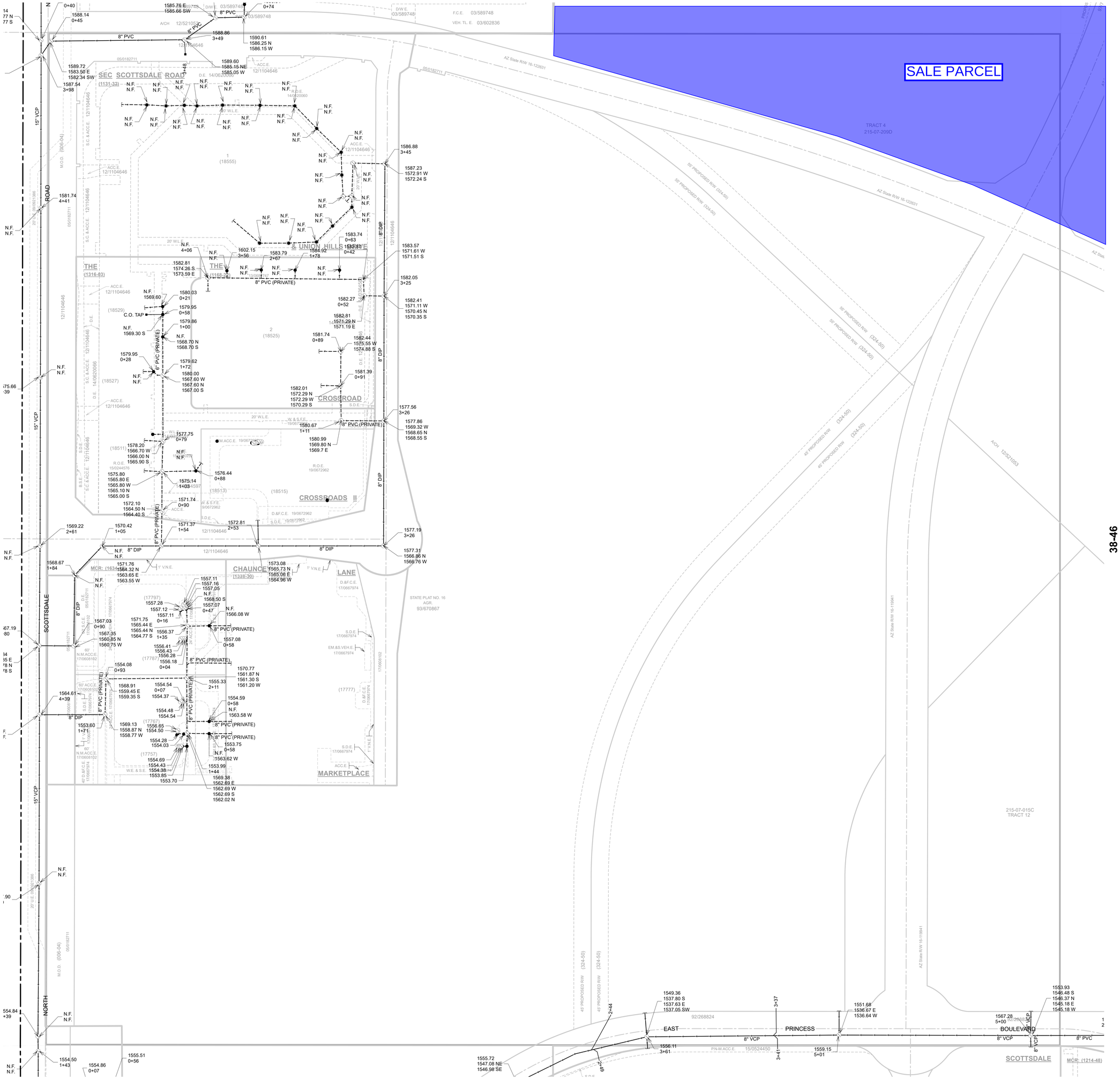
THE CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS
3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

04-DEC-22

37-SA-2023



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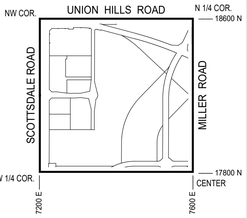
LEGEND:

- Cleanout
- Lift Station (SLS)
- Manhole
- Non-GPS Point
- Plug
- Sewer Service Point
- Sewer Tap Point
- Sewer Valve
- Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force (Force)
- Sewer Main - Private

VICINITY MAP



NORTH

SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

SEWER

QUARTER SECTION MAP

38-45

NW 1/4 SEC. 35 T4N R4E

N O T I C E

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THE CITY OF SCOTTSDALE

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

37-SA-2023

39-46

38-45

38-47

37-46

SALE PARCEL

PARCEL
I.L.-AP./C.O.S.
88/568473

STATE PLAT NO. 16
AGR.
93/670867

HAYDEN 50
(1447-40)

SOUTH

NO 16

(17800)

(17900)

1
(17800)
AV.E.
21/0339746

TRACT 10A
215-07-209D

P.U.E. 00/589276 & 04/932570

A.S.R.W. 97/652885

AZ State RW 16-10941

AZ State RW 16-122631

W.L.E. 22/0522066

A/CH 12/521053

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16' W.S.F.E. 21/0339746

16' W.E. & S.E. 19/1023980

19/0196527

19/0196507

92/268824

R.O.E. 21/0011543

R.O.E. 89/419001

50' D.&F.C.E.

28' D.&F.C.E.

12' D.&F.C.E.

33' X 33' S.D.E.
19/1023980

S.D.E. - See Plat for location

10' N.A.A.C.E.

R/W & U.E. 05/441597

R/W & U.E. 05/441586

R/W 00/589276

22/0630808

04/932570

97/652885

1583.03
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1563.81 S

1605.76
0+40

1605.21
1+45

1581.08
1564.00 N
1563.90 S

1602.09
1584.70 N
1584.60 SE

1603.01
0+68

1602.03
1583.73 N
1583.63 S

1602.43
2+88

1597.03
1+64

1597.04
1579.59 N
1579.49 S

1594.68
3+21

1594.07
1577.28 N
1577.18 S

1590.73
2+31

1590.07
1572.69 NW
1572.59 SE

1587.08
1569.41 N
1569.31 S

1587.94
3+31

1583.59
0+87

1581.84
0+21

1566.23
1+59

1581.78
3+89

1581.07
1563.86 NW
1563.68 N
1563.58 S

1579.4
4+99

1574.03
1+44

1575.05
1562.94 N
1562.84 S

1572.38
2+02

1571.79
2+45

1572.43
1565.87 N
1565.77 E

1572.95
1564.50 W
1562.80 N
1562.80 S

1573.23
5+01

1553.93
1546.48 S
1546.37 N
1545.18 E
1545.18 W

1562.76
2+81

1563.35
1556.30 E
1556.30 N
1556.21 W

1563.85
4+30

1565.45
1560.07 E
1559.97 W

1564.84
2+55

1564.42
1558.64 E

1563.59
1+29

1564.00
1557.35 S

1564.97
1557.23 S

1564.41
1+24

1556.33
1+17

1567.37
3+73

1568.02
1562.11 N
1562.01 W

1559.97

1561.58

1559.27

1558.46

1559.70

1560.92
0+91

N.F.

8" PVC

8" DIP

8" VCP

21" PVC

12" PVC

ROAD

HAYDEN

NORTH

EAST

PRINCESS

BOULEVARD

EVARD

OTTSDALE

MCR: (1214-48)

87/046859

87/228061

86/629084

SCOTTSDALE VILLA

MIRAGE

SCOTTSDALE
(518-48)

PIMA

M.O.D. (481-29)

12' W.L.E.

24' EM ACC., SVS.VEH. & P.U.E.

ACC. E.

TR. A

TR. C

3-207
3-107
3-308

GENERAL NOTES:

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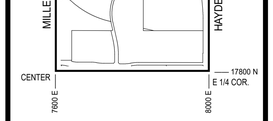
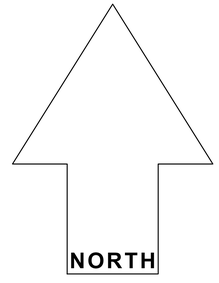
LEGEND:

- Cleanout
- Lift Station (LS)
- Manhole
- Non-GPS Point
- Plug
- Sewer Service Point
- Sewer Tap Point
- Sewer Valve
- Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force (Force)
- Sewer Main - Private

VICINITY MAP





SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

SEWER

QUARTER SECTION MAP

38-46

NE 1/4 SEC. 35 T4N R4E

N O T I C E

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THE CITY OF SCOTTSDALE

04-DEC-22

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

37-SA-2022

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- Lift Station (SLS)
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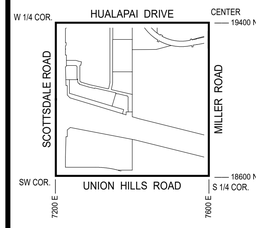
- Plug
- Sewer Service Point
- Sewer Tap Point
- Sewer Valve
- Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force (Force)
- Sewer Main - Private

VICINITY MAP



NORTH

SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

SEWER

QUARTER SECTION MAP

39-45

SW 1/4 SEC. 26 T4N R4E

N O T I C E

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THE CITY OF SCOTTSDALE

CITY OF SCOTTSDALE

SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS

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Scottsdale, Arizona 85251

37-SA-2021

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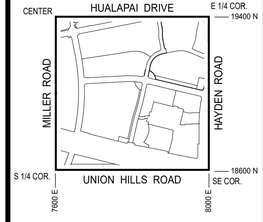
VICINITY MAP



NORTH

SCALE: 1" = 100'

0 50 100 200

The map scale of 1" = 100' is based on a full size print of 30" x 36"

SEWER

QUARTER SECTION MAP

39-46

SE 1/4 SEC. 26 T4N R4E

CITY OF SCOTTSDALE
SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS
3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251

N O T I C E

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THE CITY OF SCOTTSDALE

Appendix D – Proposed Conditions Sewer Infrastructure Exhibit

NASS POLYGON 4
PROJECTED FLOW: 421 GPM

EXISTING 15" VCP SEWER
SLOPE: 1.30%

PROPOSED OPTIMA
MULTI-FAMILY
DEVELOPMENT
1,026 GPM

EXST. 12" PVC SEWER
MAIN UNDER FREEWAY
SLOPE: 0.5%

RIM: 99.7±
INV(W): 84.8±

RESEARCH AND
DEVELOPMENT
820 GPM

DIVERTED FLOWS FROM
SCOTTSDALE ROAD

27" HOBAS

RIM: 88.8±
INV: 82.2±

27" HOBAS SEWER MAIN BY
OPTIMA DEVELOPMENT
SLOPE: 0.18%

NASS POLYGON 6
PROJECTED FLOW: 200 GPM

CITY OF SCOTTSDALE
LIFT STATION LOCATION

ELEV: 100.9±

MAYO BOULEVARD

27" HOBAS

RIM: 93.2±
INV(SE): 71.9±
INV(W): 70.9±

SALE PARCEL
AREA

RIM: 88.2±
INV(E): 70.3±
INV(NW): 68.1±
INV(S): 68.0±

PROP. 18" HOBAS
SEWER MAIN
SLOPE: 0.33%

HOSPITAL/MEDICAL
CAMPUS
450 GPM

NASS POLYGON 7
PROJECTED FLOW: 428 GPM

OFFICE
27 GPM

RIM: 91.4±
INV(SE): 73.6±
INV(NW): 73.5±

MANHOLE SPACING AT
500' MAXIMUM INTERVAL

18" HOBAS

ELEV: 97.2±

NASS POLYGON 19
PROJECTED FLOW: 412 GPM

NOTE: PARCELS ADJACENT
TO HAYDEN ROAD WILL
SEWER TO THE EXISTING
MAIN IN HAYDEN ROAD.

RIM: 89.4±
INV(SE): 75.3±
INV(NW): 75.2±

RESTAURANT
150 GPM

73RD PLACE

RIM: 87.1±
INV(E): 77.0±
INV(W): 76.9±

NASS POLYGON 9
PROJECTED FLOW: 124 GPM

EXISTING 12" PVC SEWER
SLOPE: 1.40%
DEMAND: 177 GPM
CAPACITY: 1,431 GPM

RIM: 90.5±
INV(W): 79.3±

MAYO BOULEVARD

RIM: 89.5±
INV(E): 78.8±
INV(W): 78.7±

27" HOBAS SEWER MAIN BY
OPTIMA DEVELOPMENT
SLOPE: 0.18%

GENERAL COMMERCIAL
16 ACRES
436 GPM

EXISTING 12" PVC SEWER
SLOPE: 1.40%
DEMAND: 684 GPM
CAPACITY: 1,431 GPM

HAYDEN ROAD

EXISTING 15" PVC SEWER
SLOPE: 0.50%
CAPACITY: 1,716 GPM

AXON DRIVE

RIM: 81.1±
INV: 63.6±

FUTURE MILLER ROAD ALIGNMENT

EXISTING 21" PVC SEWER
SLOPE: 0.17%
CAPACITY: 2,455 GPM

PRINCESS BOULEVARD

EXISTING 8" PVC SEWER
SLOPE: UNKNOWN
CAPACITY: XXX GPM

PRINCESS BOULEVARD

PRINCESS
DRIVE

COTTAGE
TERRACE

NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

LEGEND

- PROPOSED 18" HOBAS SEWER MAIN
- EXISTING SEWER MAIN
- SEWER MAIN TO BE CONSTRUCTED BY OTHERS
- FLOW DIRECTION OF TRIBUTARY AREA
- RIM: 20.0±
  INV: 10.0± — CONCEPTUAL SEWER MANHOLE RIM AND INVERT ELEVATIONS

NOTES

1. PROPOSED SEWER MAIN LAYOUTS ARE SCHEMATIC ONLY.
2. SEWER CAPACITY FOR 12" AND SMALLER SEWER MAIN IS BASED ON d/D=0.65 AND d/D=0.70 FOR 18" PIPE.
3. THE PIPE DIAMETERS AND SLOPES NOTED HEREIN ARE PRELIMINARY AND MAY BE ADJUSTED AND/OR REDUCED BASED ON MORE ACCURATE DATA PROVIDED WITH ACTUAL END-USER INFORMATION.

PROPOSED CONDITIONS SEWER INFRASTRUCTURE

Kimley»Horn

K:\PHX_Civil\291268016 Hayden 101\CADD\Exhibits\2024-08-23 Prop Sewer Infrastructure.dwg Aug 29, 2024 Laurel.Wright

Appendix E – North Airpark Sewer Study by Carollo Engineers, April 2023 (Draft)



City of Scottsdale
North Airpark Sewer Study

Technical Memorandum
SEWER COLLECTION SYSTEM ANALYSIS

REVISED DRAFT | April 7, 2023

37-SA-2023

City of Scottsdale
North Airpark Sewer Study

Technical Memorandum
SEWER COLLECTION SYSTEM ANALYSIS

REVISED DRAFT | April 7, 2023

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Eric J. McLeskey,
April 7, 2023,
State of Arizona,
PE License No. 51579.

37-SA-2023

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4.2 Collection System Capacity Analysis 9

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Abbreviations

AADF	average annual daily flow
ac	acre(s)
BOD	basis of design
C-2/C-3	Central Business District
Carollo	Carollo Engineers, Inc.
City	City of Scottsdale
C-O	Commercial Office District
d/D	flow depth to pipe diameter
DS&PM	Design Standards and Policy Manual
ft	feet
fps	feet per second
gpad	gallons per acre per day
gpm	gallons per minute
GIS	Geographic Information System
I-1	Industrial Park District
IIP	Infrastructure Improvements Plan
IWRMP	Integrated Water Resources Master Plan
lf	linear feet
LTC	Long-term Care
PCD	Planned Community District
PCP	Planned Airpark Core Development
PHF	peak hour flow
PRC	Planned Regional Center
R-5	Multi-Family Residential District
Study	sewer alignment analysis
TPC	Tournament Players Club

Technical Memorandum

SEWER COLLECTION SYSTEM ANALYSIS

The City of Scottsdale (City) contracted Carollo Engineers, Inc. (Carollo) to conduct a sewer capacity evaluation and new sewer alignment analysis (Study) for a portion of the Greater Airpark Character Area shown in Figure 1 as the North Airpark Sewer Study Area. This Study builds upon the work conducted to evaluate existing and planned sewers defined in the City's 2021 Infrastructure Improvements Plan (IIP) and 2022 Integrated Water Resources Master Plan (IWRMP). This Study addresses differences between current development plans and the land use assumptions used for the IIP and IWRMP.

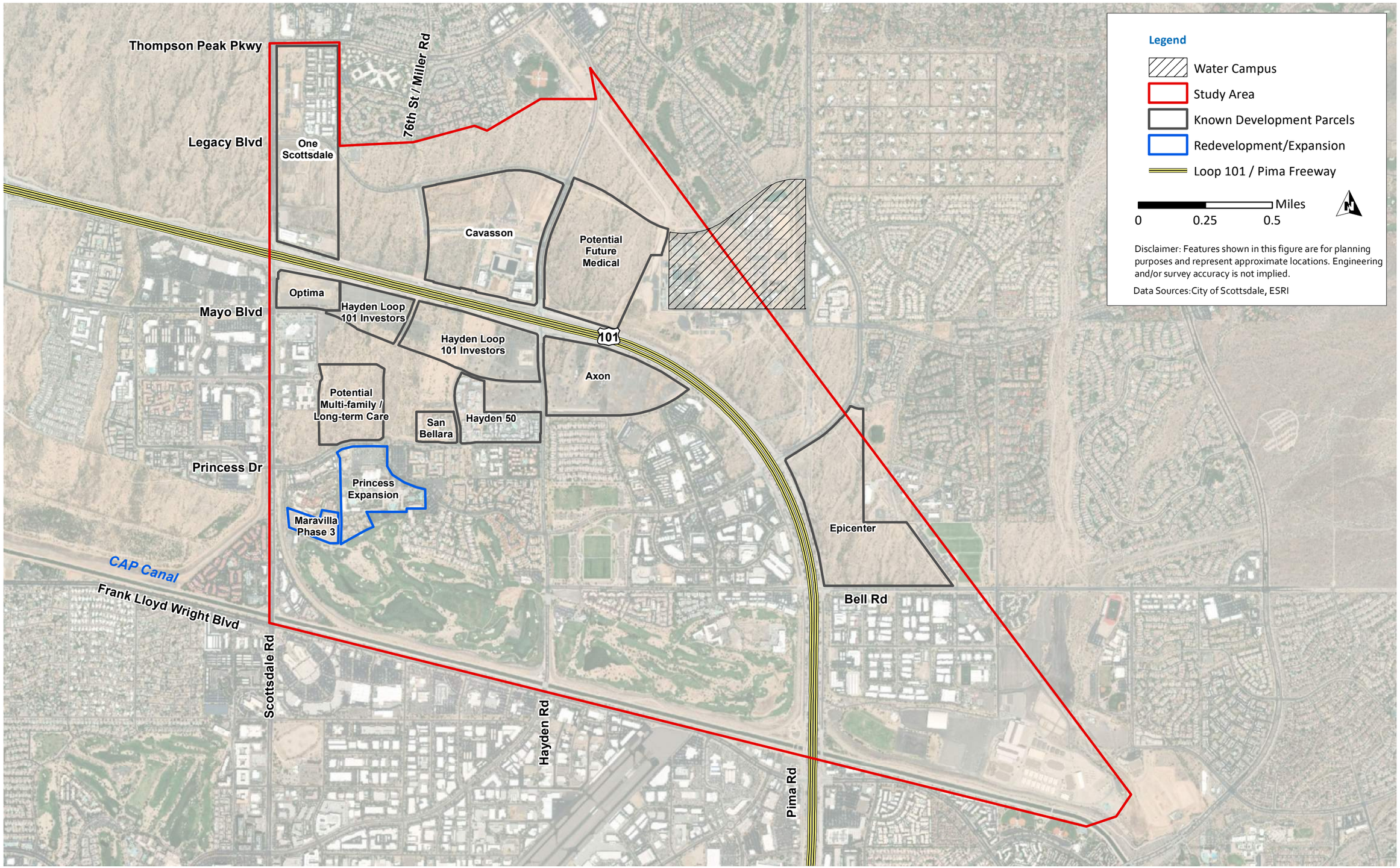
There are approximately 1,120 acres (ac) (1.8 square miles) of undeveloped State Lands within the Study Area. Nearly 700 ac are associated with nine known developments shown in Figure 1, which are at various stages of development ranging from preliminary concepts and the development review stage to partially constructed. Five of these developments have either completed master plans or basis of design (BOD) reports that quantify their anticipated wastewater flows, including:

- Axon
- Cavasson
- Hayden 50 / San Bellara Apartment Community
- One Scottsdale
- Optima

The remaining four developments are "known" in that they have approached the City to engage in preliminary discussions regarding options or have just begun to go through the development review process. These include:

- Epicenter
- Hayden Loop 101 Investors
- Potential Multi-Family / Long-Term Care
- Potential Future Medical
- Princess Resort

37-SA-2023



carollo

Last Revised: April 03, 2023
M:\Client\Scottsdale\201337\GIS\mxd\Figure 1.1 Study Area.mxd

Figure 1 North Airpark Sewer Study Area
37-SA-2023
REVISED DRAFT | APRIL 7, 2023

The planning basis used in this Study for the known developments included BOD reports or master plans (where available), approved zoning, or the City's current understanding regarding potential development scenarios. The remaining 420 ac of undeveloped land within the Study Area was evaluated based primarily on land use and approved/potential zoning.

This Study provides:

- Updated wastewater generation rates for undeveloped areas within the Study Area for the buildout (year 2055) condition.
- A re-evaluation of the capacity available in the existing wastewater collection system and the sizing recommendations for planned infrastructure including the following projects from the IIP and IWRMP:
  - WW IIP-004: Mayo Boulevard Sewer Improvements
  - WW IIP-005: Greenway Hayden Loop Sewer Improvements (Tournament Players Club [TPC] Golf Courses)
  - IWRMP WW-001: Pima Road Improvements

1.0 Study Area

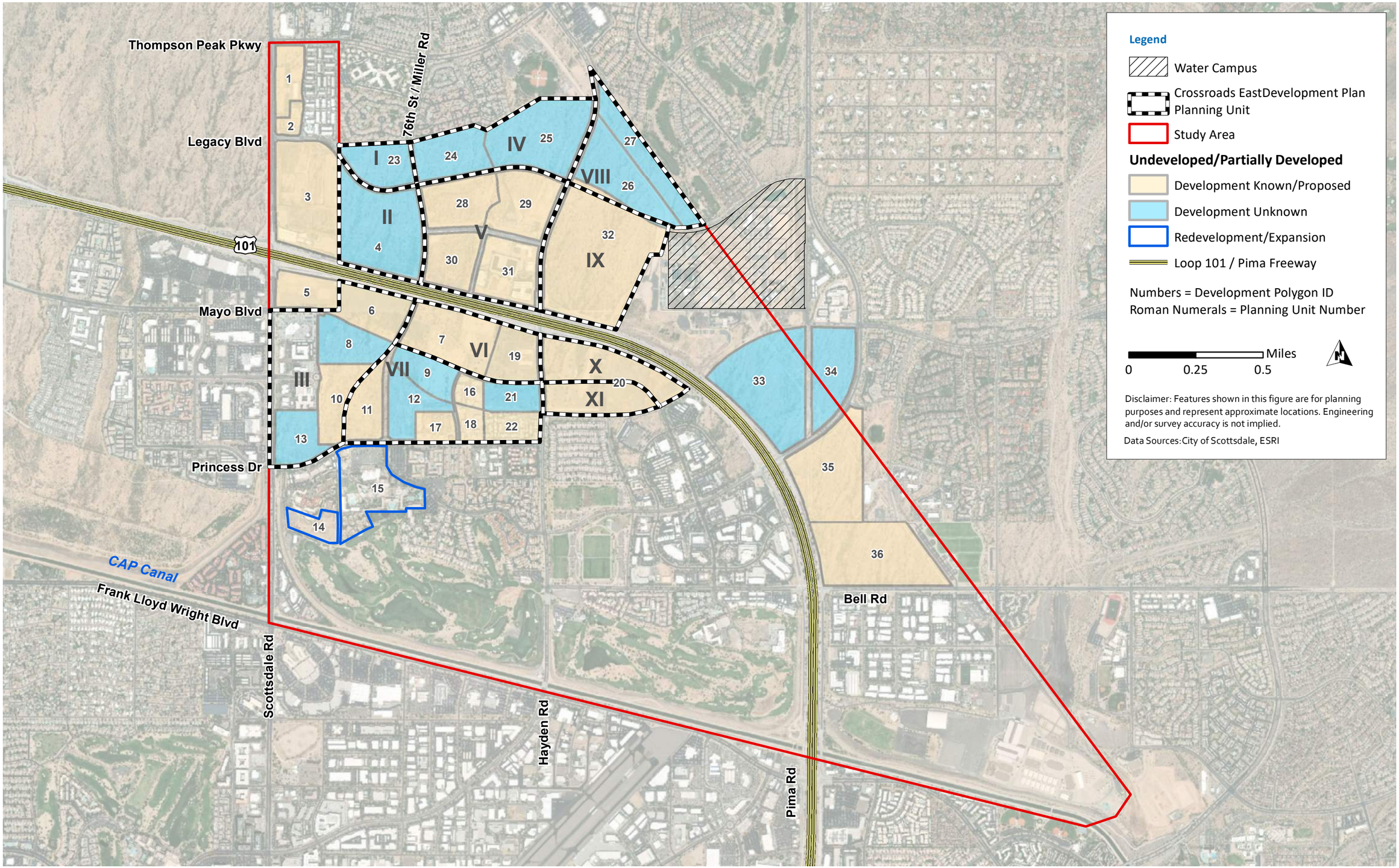
The Study Area encompasses approximately 5 square miles in the northern portion of the Greater Airpark Character Area. A portion of the Study Area includes the Crossroads East Planned Community District (PCD), which is sub-divided into 11 Planning Units as shown in Figure 2. The boundaries of the Planning Units shown in Figure 2 are approximate representations of those described in the Crossroad East PCD Development Plan Amendment (Revised April 26, 2018). The Planning Units have defined limits on the types of zoning allowed within them and were used in this Study to refine the land use assumptions associated with the undeveloped areas within them.

2.0 System Evaluation Criteria

The capacity of the planned wastewater collection system was based on the hydraulic design criteria in the City's Design Standards and Policy Manual (DS&PM) section 7-1.404. This requires the following flow depth to pipe diameter (d/D) values for ultimate (fully developed), peak flow conditions:

- Pipes less than 12 inches in diameter or less: d/D less than 0.65
- Pipes greater than 12 inches in diameter: d/D less than 0.7

Sewer mains are required to provide mean, full flow velocities equal to or greater than 2.5 feet per section (fps). Maximum sewer main flow velocities at peak flow are required to be less than 10 fps.



carollo

Last Revised: April 03, 2023
M:\Client\Scottsdale\201337\GIS\mxd\Figure 1.2 North Airpark Planning Units and Undeveloped Area.mxd

Figure 2 North Airpark Planning Units and Undeveloped Parcels
37-SA-2023
REVISED DRAFT | APRIL 7, 2023

3.0 Study Area Flow Projections

Wastewater generation rates for the buildout condition were prepared for the undeveloped areas within the Study Area following a multi-tiered approach. For areas with an approved master plan or BOD report (approved or in-review), the wastewater flow estimates from these documents were used. For all other undeveloped areas, wastewater flow estimates were prepared by applying the unit wastewater generation rates from areas with approved master plans or BOD reports.

Three developments were used to model wastewater generation rates for undeveloped areas within the Study Area that did not have a master plan or BOD report:

- Cavasson – Master Wastewater Report (5/21/2021)
- Hayden 50 – Mark-Taylor San Artes Apartments Preliminary Drainage Report (2/15/2019)
- Optima – Optima McDowell Mountain Village Wastewater Master Plan (3/2023)

These were selected to provide a reasonable basis for mixed use (Cavasson), high-density mixed use (Optima), and high-density residential (Hayden 50) that could be applied to areas that are currently anticipated to develop in a similar manner.

This approach included a review of allowable zoning within the Crossroads East PCD's Planning Units with the associated Grayhawk, Princess and Hayden Core Transition areas. Appendix A contains exhibits from the Crossroads East PCD Development Plan that illustrate the Planning Units, allowable zoning, and locations of transition areas.

Table 1 summarizes the flow projections at buildout for the undeveloped areas within the Study Area. For those within the Crossroads East PCD, the zoning assumptions that were used to prepare the wastewater flow estimates are identified. Appendix A (Table A.1) summarizes the allowable zoning for the undeveloped areas within the Crossroads East PCD. Table 1 includes the Polygon ID's associated with the areas in Figure 2, the estimated acreage, and the average annual and peak hourly flow estimates for each polygon. The basis for the wastewater generation rates is also identified along with notes that cite the sources of the flow values.

The peak hour flow to average annual daily flow (PHF/AADF) peaking factors for the undeveloped areas are based on master planned or BOD values (2.91 to 6.93) or the City's DS&PM requirements (3.0 or greater). The peaking factors from the IWMRP were based on flow monitoring data for existing flows and assumed that future wastewater generation rates and peak flows would follow patterns of "existing" development.

Table 1 Buildout Wastewater Flow Projections for Undeveloped and Partially Developed Areas

Polygon ID	Estimated Parcel Acreage (ac)	Within Crossroads East PCD (Y/N)	Crossroads East Zoning Assumption [1]	Development Name	Flow Basis	AADF (gpm)	PHF (gpm)	Peaking Factor (PHF/AADF)	Unit Wastewater Flow (gpad)	Comments - Flow Basis Source
Tributary to the TPC Sewer										
OS-1 [2]			NA	NA	IWRMP	505	743	1.47	NA	Offsite flows from Scottsdale Road 15-inch diameter sewer north of North Airpark Sewer Study Area
1	16	N	NA	One Scottsdale	BOD	96	297	3.10	8,640	Proposed Wastewater Demand Calculations (61-DR-2015#3)
2	6	N	NA	One Scottsdale	BOD	74	223	3.00	17,760	Proposed Wastewater Demand Calculations (61-DR-2015#3)
3	60	N	NA	One Scottsdale	BOD	378	1,700	4.50	9,067	Appendix C, Table 3.1 - Wastewater Design Flows (30-DR-2021#3)
4	61	Y	PRC/PCP	Unknown/State Lands	Estimated	140	421	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
5	19	N	NA	Optima	BOD	148	1,026	6.93	11,217	Table 1 - Optima McDowell Mountain Village Wastewater Master Plan (3/2023)
6	29	Y	PRC/PCP	Hayden Loop 101 Investors	Estimated	67	200	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
7	42	Y	PRC/PCP	Hayden Loop 101 Investors	Estimated	143	428	3.00	4,903	Hayden Loop 101 Investors Polygons 7 and 19 from 1113-PA-2022 Site Plan
8	21	Y	PRC/PCP	Unknown/State Lands	Estimated	48	145	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
9	18	Y	PRC/PCP	Unknown/State Lands	Estimated	41	124	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
10	23	Y	PRC/PCP	Potential Multi-Family/LTC	Estimated	53	159	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
11	21	Y	R-5	Potential Multi-Family/LTC	Estimated	66	259	3.89	4,555	Assumes same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess Transition Area
12	22	Y	R-5	Unknown/State Lands	Estimated	70	271	3.89	4,555	Assumes same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess Transition Area
13	21	Y	PRC/PCP	Unknown/State Lands	Estimated	48	145	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
14	NA	N	NA	Maravilla Phase 3	Master Plan	24	113	4.67	NA	Wastewater Collection System BOD Report for Maravilla Senior Living Community Phase 3 (August 17, 2021)
15	NA	N	NA	Princess Resort Expansion	BOD	92	414	4.50	NA	Master Plan: Phase 2 Sunset Beach Villas & Bungalows (38-DR-2022) and four BODs submitted under 5-ZN-2015#2
16	7	Y	NA	Hayden 50	BOD	30	119	4.00	6,143	Table 3 - Wastewater Design Flows (57-DR-2018)
17	11	Y	NA	San Bellara	BOD	31	125	4.00	4,091	Table 1 - On-site Sewer Demand (29-DR-2020)
18	7	Y	NA	Hayden 50	BOD	24	94	4.00	4,857	Table 3 - Wastewater Design Flows (57-DR-2018)
19	21	Y	PRC/PCP	Hayden Loop 101 Investors	Estimated	69	412	5.97	4,731	Hayden Loop 101 Investors Polygons 7 and 19 from 1113-PA-2022 Site Plan
20	71	Y	NA	Axon	BOD	163	479	2.94	3,306	Table 2 - Wastewater Collection System BOD Report (March 4, 2022)
21	14	Y	PRC/PCP	Unknown/State Lands	Estimated	86	391	4.6	8,828	Assumed 75% of residential density and the same non-residential density as the Optima Master Plan
22	15	Y	NA	Hayden 50	BOD	47	185	3.89	4,555	Table 3 - Wastewater Design Flows (57-DR-2018)
Tributary to the Crossroads Lift Station										
23	23	Y	R-5	Unknown/State Lands	Estimated	73	283	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
24	28	Y	R-5	Unknown/State Lands	Estimated	89	345	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
25	53	Y	R-5	Unknown/State Lands	Estimated	168	653	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
26	40	Y	R-5	Unknown/State Lands	Estimated	127	493	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
27	27	Y	R-5	Unknown/State Lands	Estimated	85	332	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
28	29	Y	NA	Cavasson	BOD	67	195	2.91	3,314	Master Wastewater Report (May 21, 2021)
29	33	Y	NA	Cavasson	BOD	67	195	2.91	2,913	Master Wastewater Report (May 21, 2021)
30	24	Y	NA	Cavasson	BOD	67	195	2.91	4,005	Master Wastewater Report (May 21, 2021)
31	31	Y	NA	Cavasson	BOD	67	195	2.91	3,101	Master Wastewater Report (May 21, 2021)
32	106	Y	NA	Potential Future Medical	BOD	138	414	3.00	1,875	Table 1 - Wastewater Demands (5-ZN-2022_1-30)
Tributary to the Pima Road Sewer										
OS-2 [3]			NA	NA	IWRMP	1,246	2,117	1.70	NA	Offsite flows from four locations along Pima Road
33	68	N	PRC/PCP	Unknown/State Lands	Estimated	156	469	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
34	33	N	PRC/PCP	Unknown/State Lands	Estimated	76	228	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
35	55	N	PRC/PCP	Epicenter	Estimated	126	379	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
36	63	N	PRC/PCP	Epicenter	Estimated	145	435	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0

Note:

(1) From Crossroad East Development Plan Amendment (Revised April 26, 2018). See Appendix A for zoning maps. The "NA" values indicate that a parcel was either not a part of the Crossroad East Development Plan Study Area or a BOD or Master Plan value was used as the basis for flow estimates.

(2) Offsite flows to the existing 15-inch diameter sewer are required to be routed from their current path (through Princess Drive/Cottage Terrace and the western portion of the TPC sewer) to the sewers to be constructed east at Mayo Blvd to provide capacity for Polygon IDs Nos. 10, 13, 14, and 15.

(3) Location 1: 18-inch diameter sewer (Princess Dr. south of Legacy Blvd), Location 2: 18-inch diameter sewer (north of Bell Road, east of Pima Rd), Location 3: 18-inch diameter sewer (Bell Rd east of Pima Rd), Location 4: 30-inch diameter sewer (Westworld Rd east of Pima Rd)

Abbreviations:

AADF = average annual daily flow; PHF = peak hour flow; R-5 = Multi-Family Residential District; PRC = Planned Regional Center; PCP = Planned Airpark Core Development; ac = acre(s); gpm = gallons per minute; gpad = gallons per acre per day; BOD = basis of design report; LTC = Long-term Care.

4.0 Collection System Evaluation

4.1 Hydraulic Model Updates

The wastewater collection system that currently serves the Study Area is shown in Figure 3. The hydraulic model developed in the IWRMP was updated to analyze the hydraulic capacity of the collection system. The model updates included:

- Incorporating gravity sewers north of the Loop 101 that are within the Crossroads Lift Station service area.
- Re-alignment of the Mayo Boulevard and Miller Road future sewers to match revised and approved roadway alignments.
- Updates to wastewater flow loading polygons to make certain flows were directed to the intended interceptor.
- Pipe and manhole invert verification/adjustments were made based on two sets of survey data (provided by others: Kimley Horn Survey [1/19/2023] and Dibble Survey [1/24/2023]) for the 18-inch and 24-inch diameter sewers that cross the TPC Golf Courses.
- Incorporating the average daily flows summarized in Table 1 into the flow loading polygons and developing diurnal patterns to achieve the peak flows summarized in Table 1.

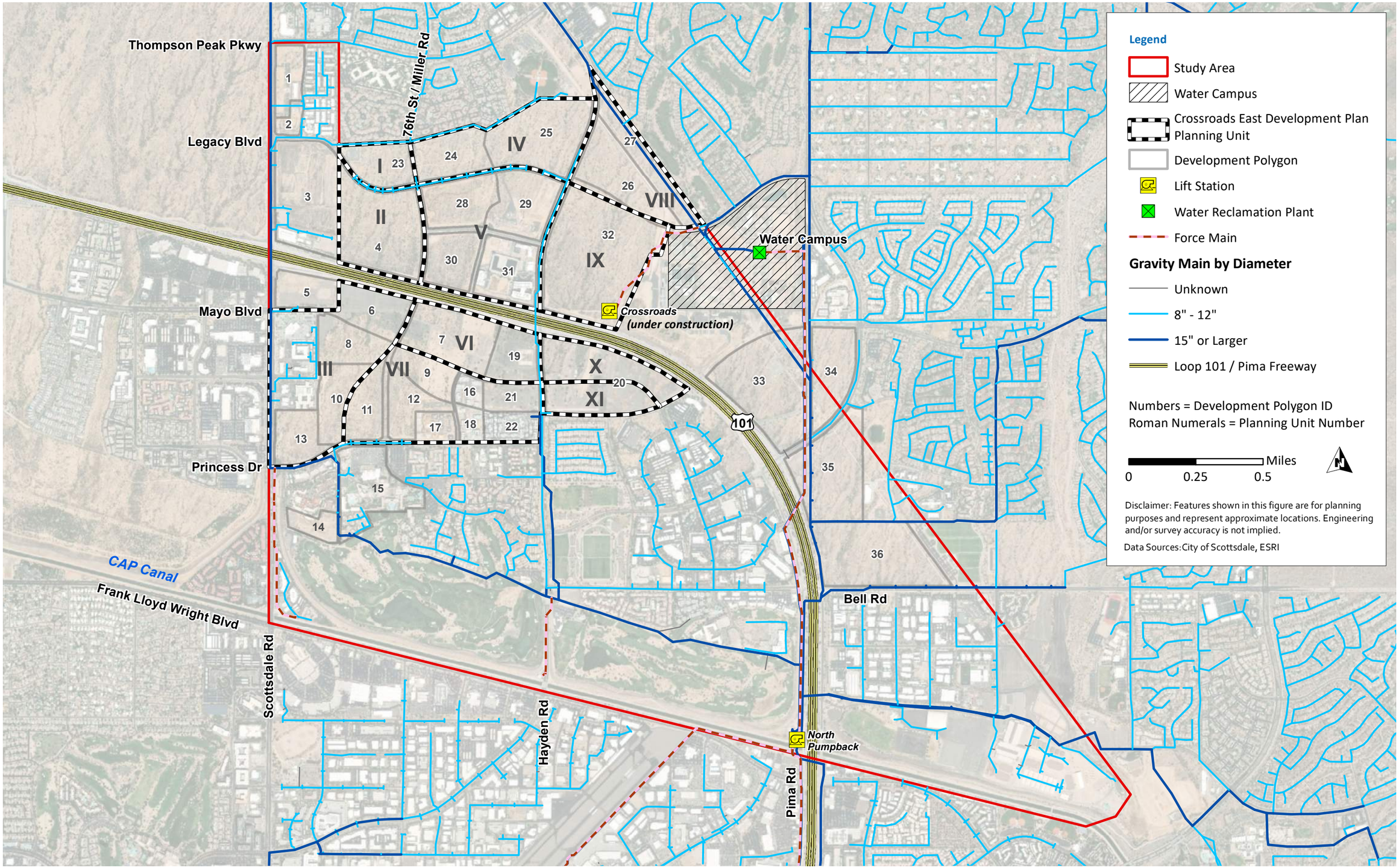


Figure 3 North Airpark Existing Sewer Collection System
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4.2 Collection System Capacity Analysis

The wastewater collection system was evaluated for year 2055 (assumed buildout) conditions to represent the ultimate system flows. The existing sewers and planned IIP projects WW IIP-004 and WW IIP-005 (Appendix B) as well as sewers in Scottsdale Road, Princess Drive, and Pima Road were re-evaluated in this analysis.

For the year 2055 analysis, it was assumed that Polygon ID Nos. 23 through 32 would be conveyed to the Crossroads Lift Station. The existing 12-inch diameter sewer in Hayden Road was assumed to be plugged (as planned) south of the Crossroads Lift Station, resulting in all flow contributions to the Hayden Road sewer that are then conveyed to the TPC sewer being from polygons south of the Loop 101.

Figure 4 illustrates the locations of new sewers, existing sewers that require upsizing and the sewage collection areas associated with each major interceptor. The flow routing assumed:

- One hundred percent of the flow from Polygon ID Nos. 1 through 3 (One Scottsdale) are diverted from the 15-inch diameter sewer in Scottsdale Road south of the Loop 101 to the east into a new 27-inch diameter sewer to be constructed in Mayo Boulevard, which continues to a new 27-inch diameter sewer in Miller Road to Princess Drive. This flow routing was done to avoid surcharging the 15-inch diameter sewer in Scottsdale Road and the existing 18-inch diameter sewer in the TPC Golf Courses that is predicted without this adjustment. A diversion structure should be installed at Scottsdale Road and Mayo Boulevard to allow the City flexibility in routing and balancing flows between the two interceptors.
- The diversion of the offsite flows (Polygon ID No. OS-1) from the 15-inch diameter sewer in Scottsdale Road through the Scottsdale Road/Mayo Road diversion structure, continuing east to the Miller Road and Princess Drive sewers. These are considered substitution flows for Polygon IDs Nos. 10 and 13 through 15 and must be re-routed to avoid surcharging the existing 18-inch diameter sewer in Cottage Terrace and the western portion of the 18-inch diameter TPC sewer.
- The flows from Polygon ID No. 4 are routed south to the new 18-inch and 27-inch diameter sewers to be constructed in Miller Road to Princess Drive.
- The flows from Polygon ID No. 5 (Optima) are routed to Miller Road into a new 27-inch diameter sewer in Mayo Blvd.

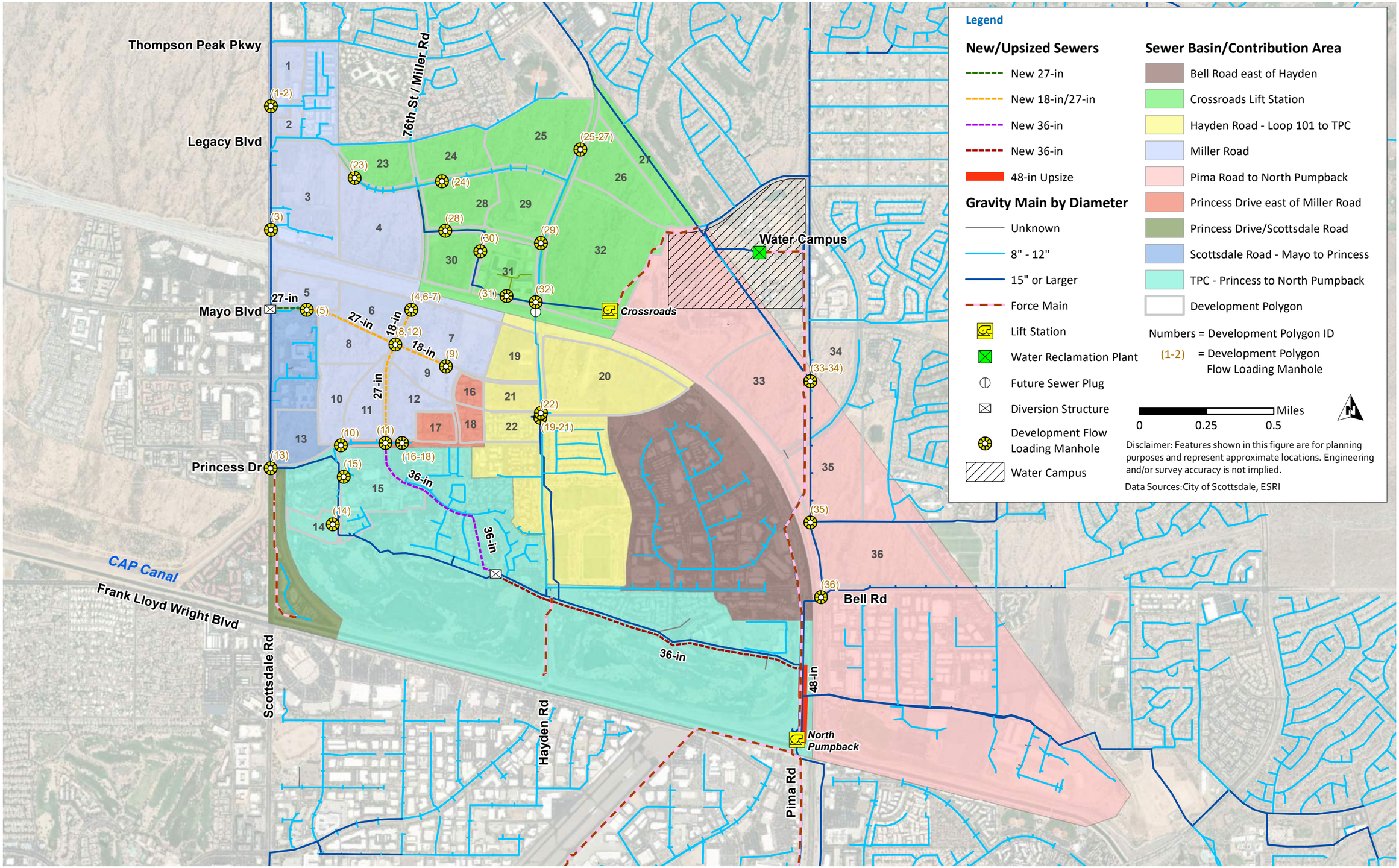

Figure 4 North Airpark Sewer Improvements
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The hydraulic model identified the need to size new sewers in the Study Area as follows to meet the System Evaluation Criteria (Section 2). Increased wastewater flow projections require larger diameter sewers than identified in the 2021 IIP:

- **Scottsdale Connection** – Mayo Boulevard from Scottsdale Road to the eastern Optima development property line: 27-inch diameter, approximately 1,330 linear feet (lf).
- **Mayo Boulevard Sewer Improvements** – Miller Road from the Loop 101 to Mayo Boulevard (approximately 800 lf) and Mayo Boulevard from Miller Road to west of 78th Street (approximately 1,100 lf): 18-inch diameter. This is an upsizing portion of Project WW IIP-004.
- **Mayo/Miller Segment** – Mayo Boulevard from the eastern Optima development property line to Miller Road, Miller Road from Mayo Boulevard to Princess Drive: 27-inch diameter, approximately 3,300 lf. This is an upsizing portion of Project WW IIP-004.
- **Princess Drive Segment** – The TPC sewer bypass from Princess Drive and Miller Road to the TPC Golf Course: 36-inch diameter. The sewer will extend south from the 27-inch diameter sewer on Miller Road and continue southeast on Princess Drive to east of 77th Way where it will turn south to cross the TPC Stadium Golf Course, connecting to a new diversion manhole intersecting the existing 18-inch diameter sewer within the golf course. This segment is a re-definition of Project WW IIP-005 that includes approximately 3,800 lf of 36-inch diameter sewer.
- **TPC Segment** – The 36-inch diameter sewer will continue east and parallel to the existing 18-inch and 24-inch diameter sewers within the TPC Stadium and Champions Golf Courses from the new sewer diversion structure that will be located approximately 1,100 ft west of Hayden Road (near holes 1 and 2 at the TPC Stadium Course) and continue to Pima Road. This project is portion of modified Project WW IIP-005 that includes approximately 6,400 lf of a new sewer.
- **Pima Road Segment** – The Pima Road sewer from the TPC parallel sewers to the North Pumpback Station: 48-inch diameter. This project definition includes a portion of Project WW IWRMP-001 but extends an additional 700 lf (approximately 1,700 lf total) north to the TPC sewer. Increased wastewater flow projections require larger diameter sewers than identified in the 2022 IWRMP.

The way in which the flows are balanced through the proposed parallel sewers across the TPC Golf Courses will impact the sizing of the recommended parallel pipes. As currently modeled, the crowns of the proposed parallel pipes are matched with the crowns of the existing sewers. This is done to prevent surcharging the existing 18-inch and 24-inch diameter sewers. The intent is that the TPC Segment will ultimately convey the majority of the upstream flow from the existing 18-inch diameter sewer and the Princess Drive Segment Adjustments to pipe sizing may occur as the Princess Drive Segment and TPC Segment pipe design progresses.

5.0 Summary and Recommendations

Recent development proposals for the North Airpark Area include higher density uses that result in more wastewater flows than were anticipated in the 2021 IIP and 2022 IWRMP. This Study provides updated average annual and peak hour wastewater flow projections for the undeveloped areas within the Study Area using wastewater generation rates associated with these uses.

The City's wastewater hydraulic model that was calibrated for the 2022 IWRMP was applied in this Study. Infrastructure and flow loading was updated in the model to reflect the most recent geographic information system (GIS) data and the flows from this Study.

Table 2 summarizes the project definitions, sizes, and approximate lengths of the recommended sewer main improvements.

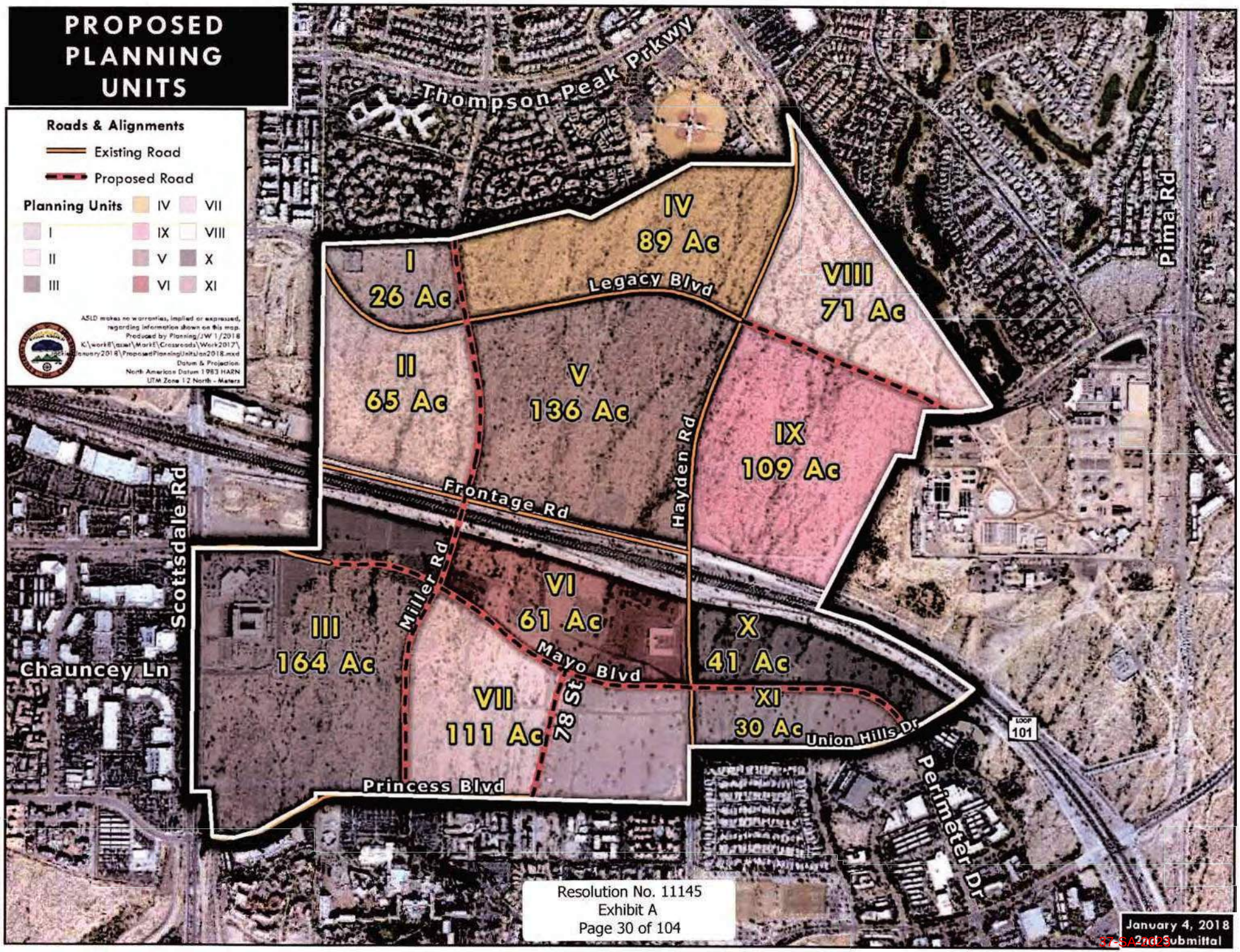
Table 2 Infrastructure Project Recommendation Summary

Originating IIP or IWRMP Project ID	Name – Location	Diameter (in) (1)	Length (ft) (1)
NA	Scottsdale Connection	27	1,330
WW IIP-004 (2)	Mayo Blvd Sewer Improvements: Miller Rd from Loop 101 to Mayo Blvd	18	800
	Mayo Blvd Sewer Improvements: Mayo Blvd from Miller Rd to 78th Street	18	1,100
	Mayo/Miller Segment	27	3,300
WW IIP-005 (3)	Princess Drive Segment	36	3,800
	TPC Segment	36	6,400
IWRMP WW-001	Pima Road Segment	48	1,700

Notes:
(1) Independent verification of sewer inverts, pipe diameters and required lengths will need to be completed during design.
(2) Project name "Mayo Boulevard Sewer Improvements" in the City's 2021 Infrastructure Improvements Plan.
(3) Project name "Greenway Hayden Loop Sewer Improvements" in the City's 2021 Infrastructure Improvements Plan.
Abbreviations:
IIP = Infrastructure Improvements Plan; IWRMP = Integrated Water Resources Master Plan; NA = Not Applicable.

Appendix A

CROSSROADS EAST PLANNING UNITS AND ZONING


PROPOSED PLANNING UNITS
Roads & Alignments
Existing Road
Proposed Road
Planning Units
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
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North American Datum 1983 HARN
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Thompson Peak Prkwy
Pima Rd
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89 Ac
I
26 Ac
Legacy Blvd
VIII
71 Ac
II
65 Ac
V
136 Ac
IX
109 Ac
Hayden Rd
Frontage Rd
Scottsdale Rd
Miller Rd
VI
61 Ac
III
164 Ac
X
41 Ac
Mayo Blvd
Chauncey Ln
VII
111 Ac
78 St
XI
30 Ac
Union Hills Dr
LOOP 101
Perimeter Dr
Princess Blvd
Resolution No. 11145
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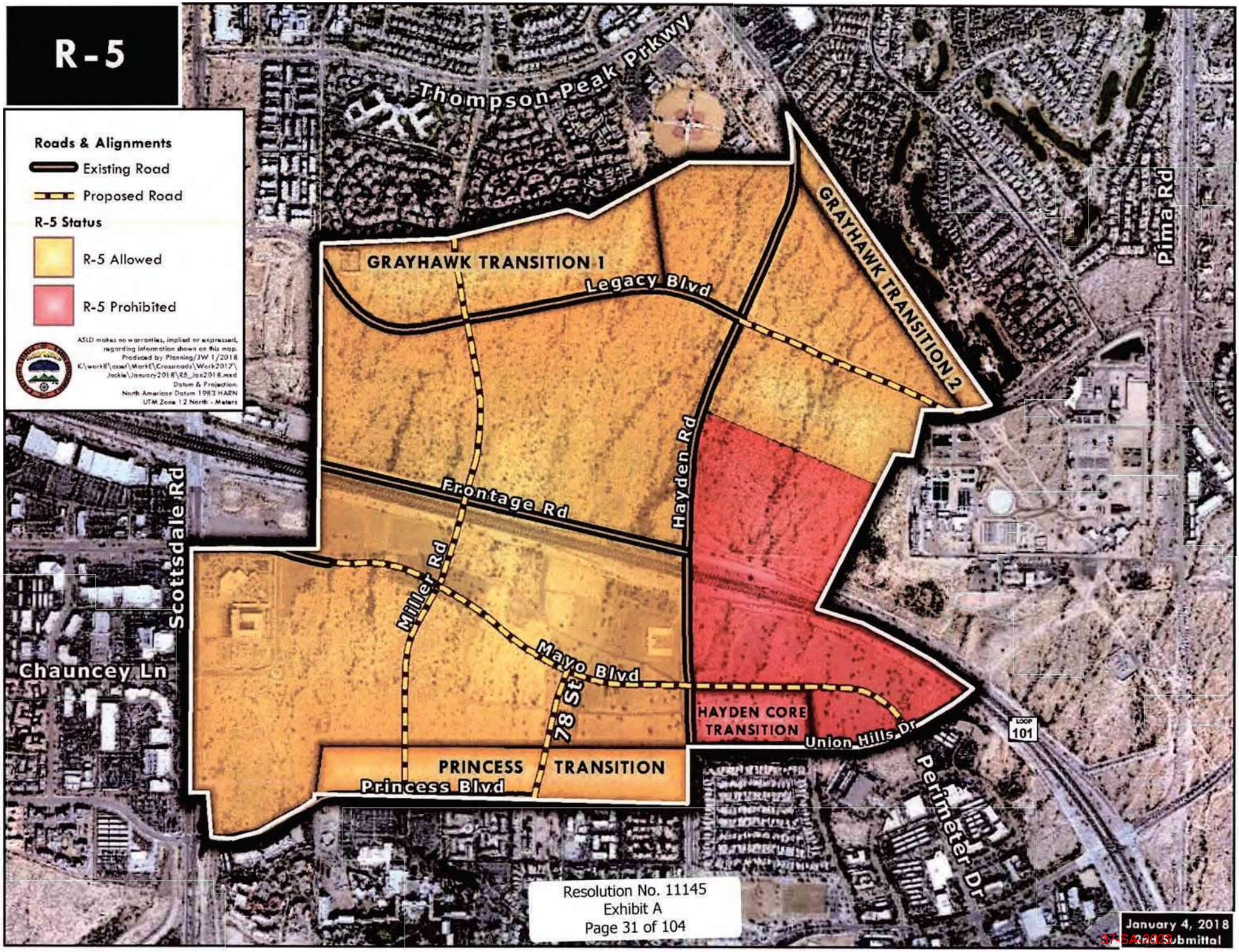
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R-5 Prohibited
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Scottsdale Rd
Miller Rd
Chauncey Ln
Mayo Blvd
78 St
HAYDEN CORE TRANSITION
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PRINCESS TRANSITION
Princess Blvd
Perimeter Dr
Resolution No. 11145
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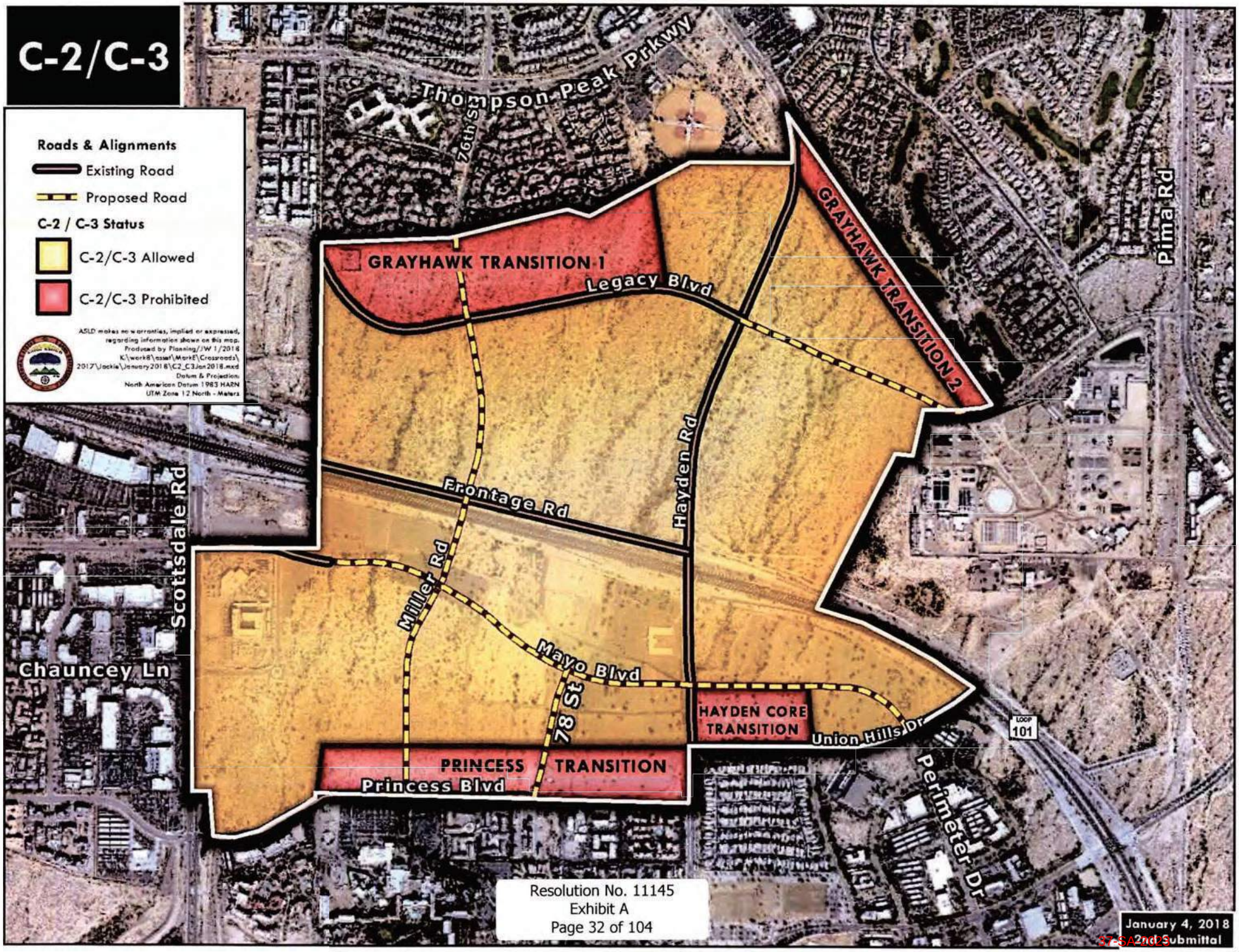
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Roads & Alignments
Existing Road
Proposed Road
C-2 / C-3 Status
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C-2/C-3 Prohibited
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UTM Zone 12 North - Meters
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Pima Rd
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Legacy Blvd
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Hayden Rd
Frontage Rd
Scottsdale Rd
Miller Rd
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HAYDEN CORE TRANSITION
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Resolution No. 11145
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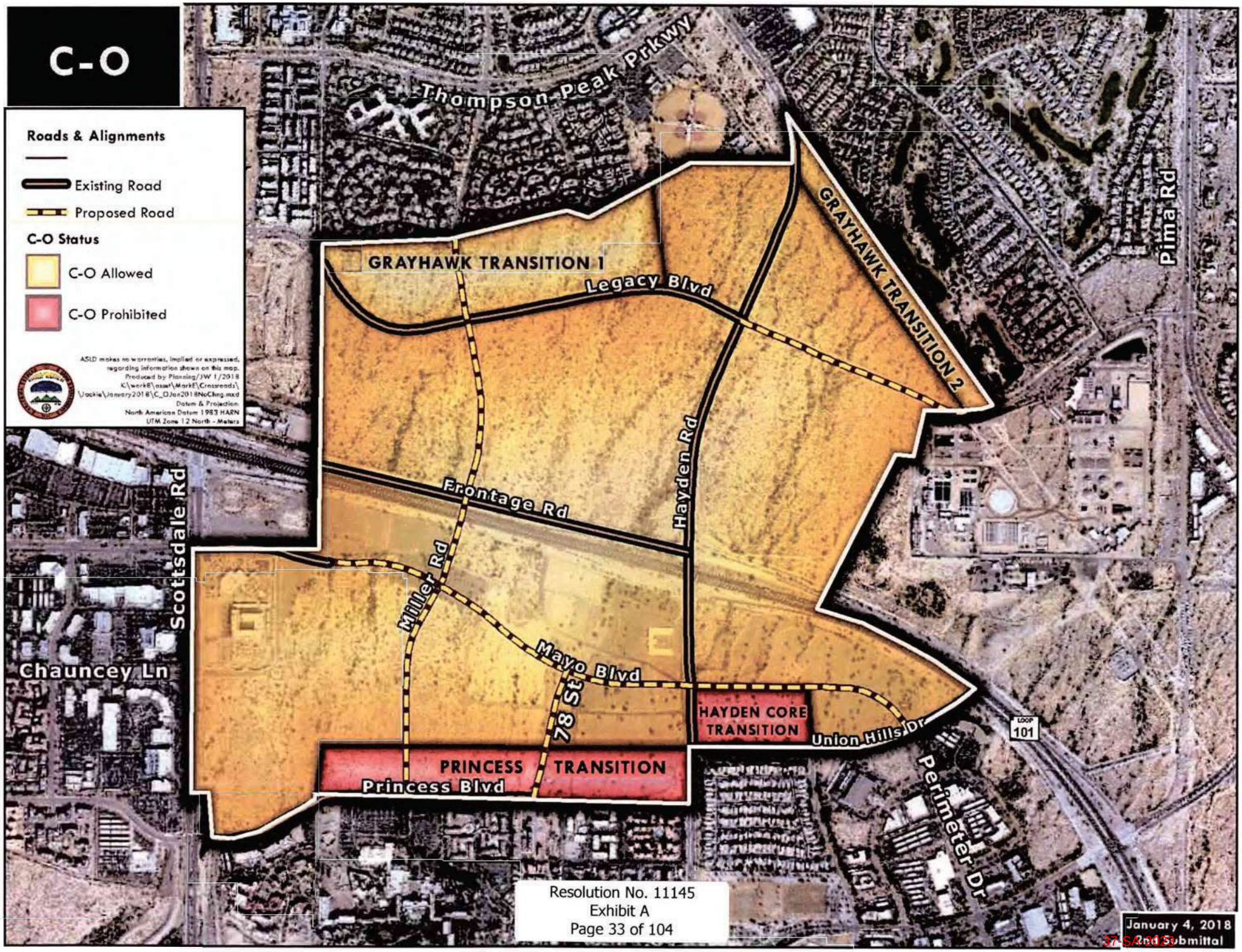
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Roads & Alignments
Existing Road
Proposed Road
C-O Status
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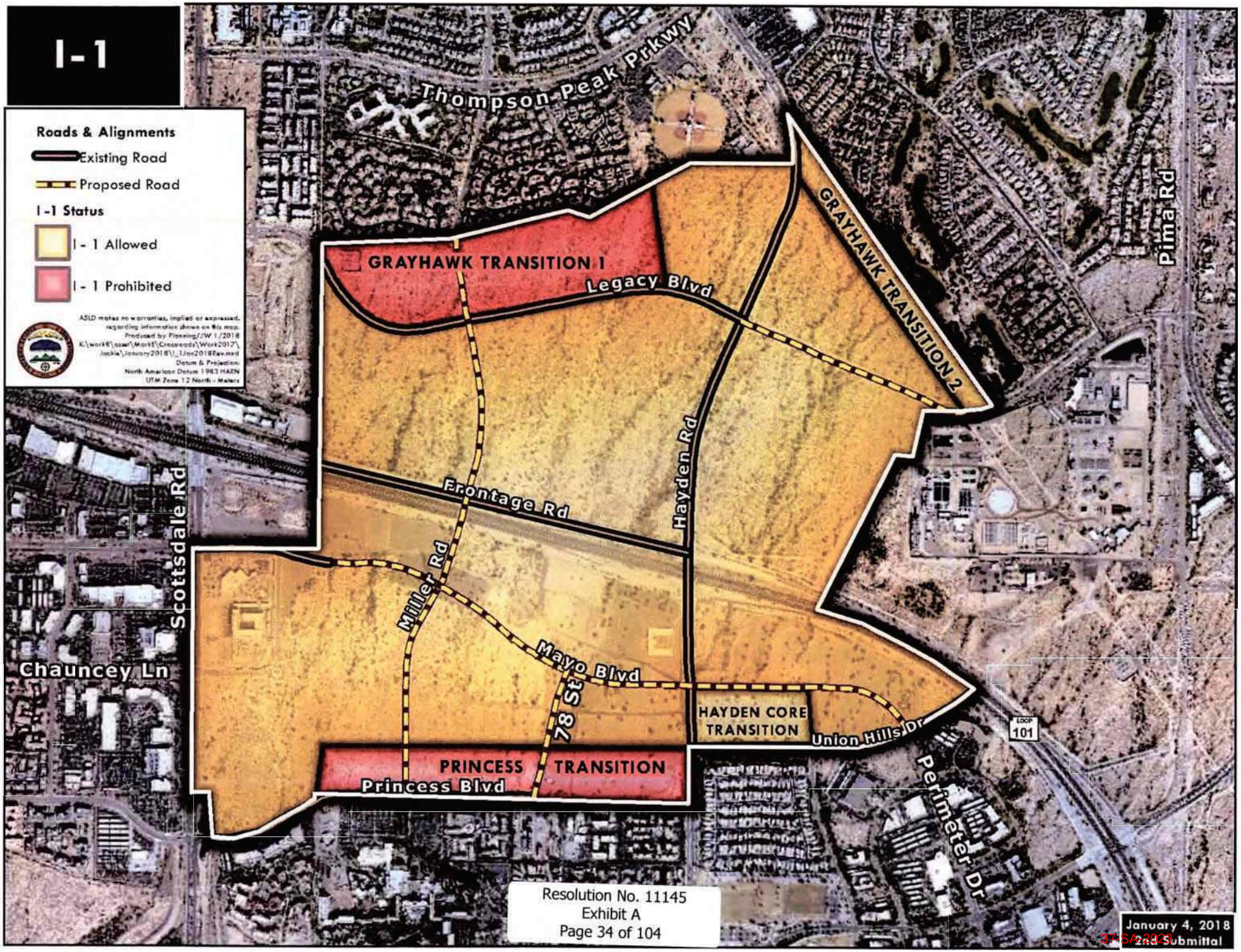
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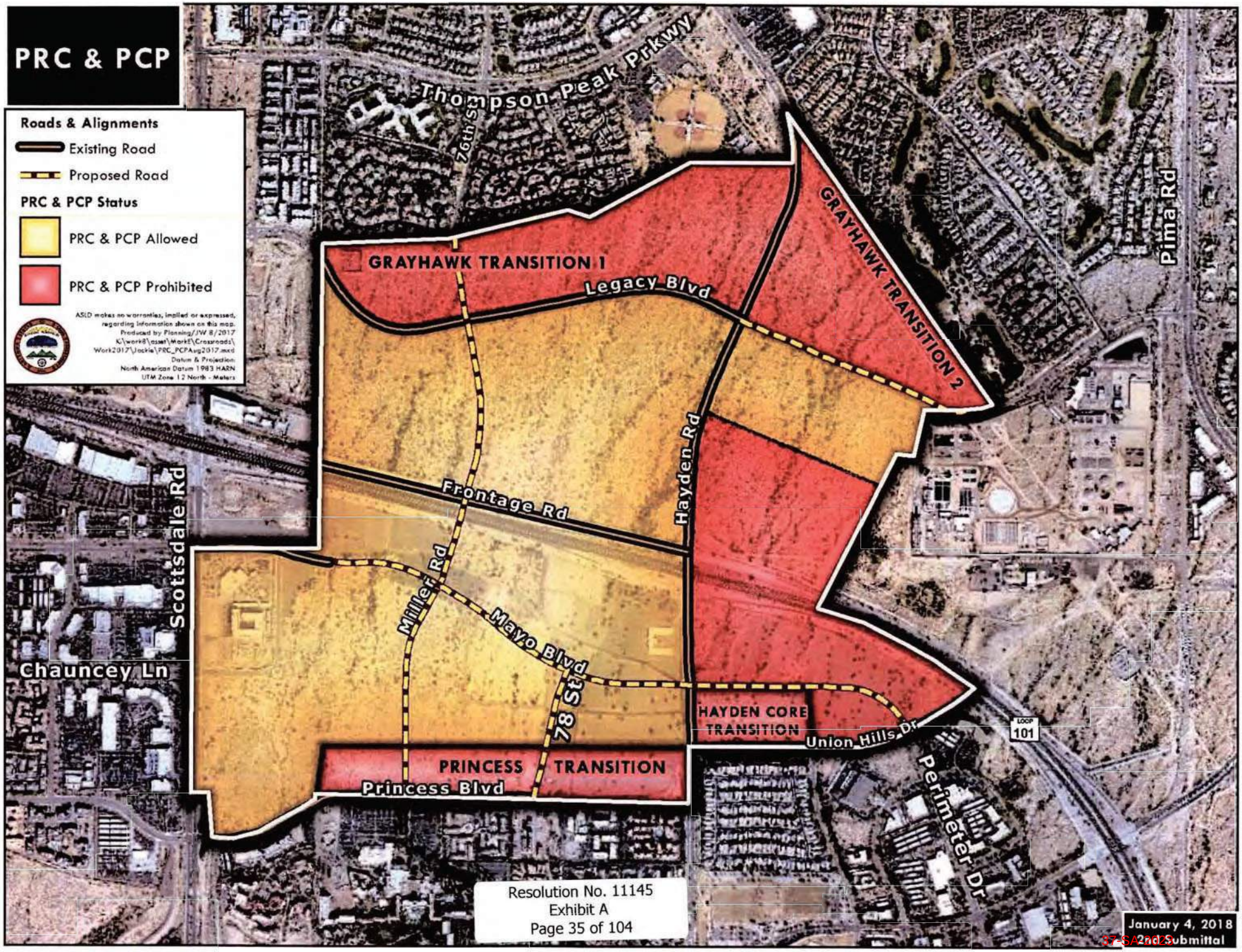
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Union Hills Dr
LOOP 101
PRINCESS TRANSITION
Princess Blvd
Perimeter Dr
Resolution No. 11145
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Table A.1 Allowable Zoning for Undeveloped Areas within the Crossroads East PCD

Polygon ID	Estimated Parcel Acreage (ac)	R-5 Zoning Allowed [1]	C-2/C-3 Zoning Allowed [1]	C-O Zoning Allowed [1]	I-1 Zoning Allowed [1]	PRC & PCP Zoning Allowed [1]	Development Name
Tributary to the TPC Sewer							
1	16	NA	NA	NA	NA	NA	One Scottsdale
2	6	NA	NA	NA	NA	NA	One Scottsdale
3	60	NA	NA	NA	NA	NA	One Scottsdale
4	61	Y	Y	Y	Y	Y	Unknown/State Lands
5	19	NA	NA	NA	NA	NA	Optima
6	29	Y	Y	Y	Y	Y	Hayden Loop 101 Investors
7	42	Y	Y	Y	Y	Y	Hayden Loop 101 Investors
8	21	Y	Y	Y	Y	Y	Unknown/State Lands
9	18	Y	Y	Y	Y	Y	Unknown/State Lands
10	23	Y	Y	Y	Y	Y	Potential Multi-Family/LTC
11	21	Y	50%	50%	50%	50%	Potential Multi-Family/LTC
12	22	Y	65%	65%	65%	65%	Unknown/State Lands
13	21	Y	Y	Y	Y	Y	Unknown/State Lands
14	NA	NA	NA	NA	NA	NA	Maravilla Phase 3
15	NA	NA	NA	NA	NA	NA	Princess Resort Expansion
16	7	Y	Y	Y	Y	Y	Hayden 50
17	11	Y	N	N	N	N	San Bellara
18	7	Y	N	N	N	N	Hayden 50
19	21	Y	Y	Y	Y	Y	Hayden Loop 101 Investors
20	71	N	75%	75%	Y	N	Axon
21	14	Y	Y	Y	Y	Y	Unknown/State Lands
22	15	Y	N	N	N	N	Hayden 50

Polygon ID	Estimated Parcel Acreage (ac)	R-5 Zoning Allowed [1]	C-2/C-3 Zoning Allowed [1]	C-O Zoning Allowed [1]	I-1 Zoning Allowed [1]	PRC & PCP Zoning Allowed [1]	Development Name
Tributary to the Crossroads Lift Station							
23	23	Y	N	Y	N	N	Unknown/State Lands
24	28	Y	N	Y	N	N	Unknown/State Lands
25	53	Y	Y	Y	Y	N	Unknown/State Lands
26	40	Y	Y	Y	Y	N	Unknown/State Lands
27	27	Y	N	Y	Y	N	Unknown/State Lands
28	29	Y	Y	Y	Y	Y	Cavasson
29	33	Y	Y	Y	Y	Y	Cavasson
30	24	Y	Y	Y	Y	Y	Cavasson
31	31	Y	Y	Y	Y	Y	Cavasson
32	106	40%	Y	Y	Y	40%	Potential Future Medical
Tributary to the Pima Road Sewer							
33	68	NA	NA	NA	NA	NA	Unknown/State Lands
34	33	NA	NA	NA	NA	NA	Unknown/State Lands
35	55	NA	NA	NA	NA	NA	Epicenter
36	63	NA	NA	NA	NA	NA	Epicenter

Notes:

(1) From Crossroads East Development Plan Amendment (Revised April 26, 2018). Percentages of allowed zoning are based on the estimated parcel acreage and the zoning maps in Appendix A, including considerations for zoning transition areas. The "NA" values indicate a parcel was not part of the Crossroads East Development Plan study area.

Abbreviations:

ADF = average daily flow; PHF = peak hour flow; R-5 = Multi-Family Residential District; C-2/C-3 = Central Business District; C-O = Commercial Office District; I-1 = Industrial Park District; PRC = Planned Regional Center; PCP = Planned Airpark Core Development; ac = acre(s); gpm = gallons per minute; gpad = gallons per acre per day; BOD = basis of design report

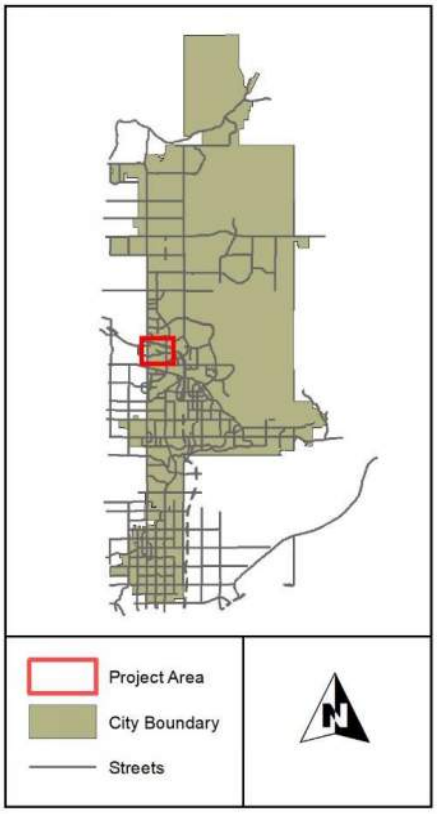
Appendix B

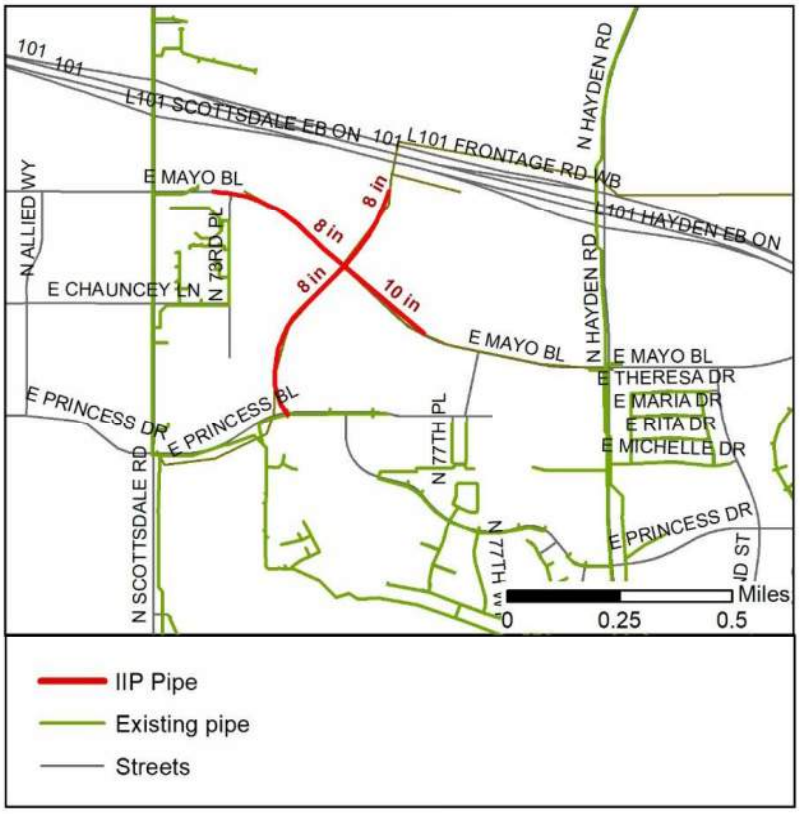
2021 IIP PROJECTS IN STUDY AREA

System:	Wastewater	**Estimated Start:**	2025
Project Number:	WW IIP-004		
Project Name:	Mayo Boulevard Sewer Improvements		
Location:	Mayo Boulevard from Scottsdale Road to Princess Boulevard		
Project Reference:	2021 IIP		
Description:	Construct new 8-inch diameter and 10-inch diameter sewer mains to provide capacity for current and future connections.		

Project Details:

Project Elements		**Project Cost**
Sewer Lines, 8-inch diameter, 4,930 linear feet; 10-inch diameter, 1,220 linear feet.		$4,466,000
Cost Allocation		
Existing Equivalent Demand Units (EDUs) – Rates	0%	$0
EDUs through year 2030 – Development Fees	33%	$1,464,000
EDUs beyond year 2030 – Development Fees	67%	$3,002,000





System: Wastewater **Estimated Start:** 2025

Project Number: WW IIP-005

Project Name: Greenway Hayden Loop Sewer Improvements

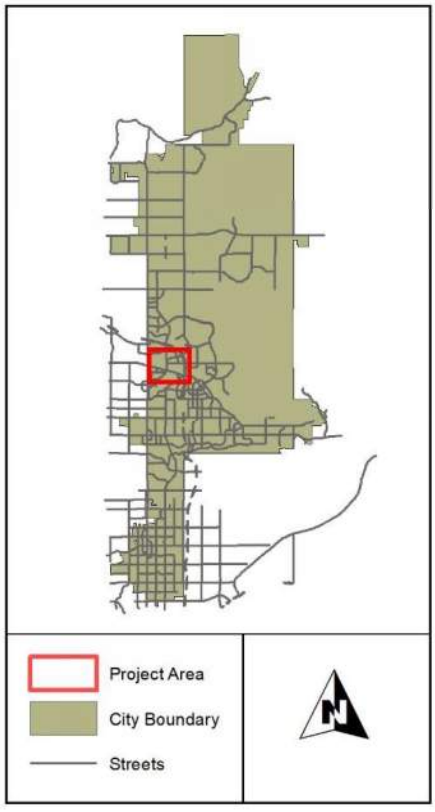
Location: North of Frank Lloyd Wright Boulevard between Pima Road and Princess Drive

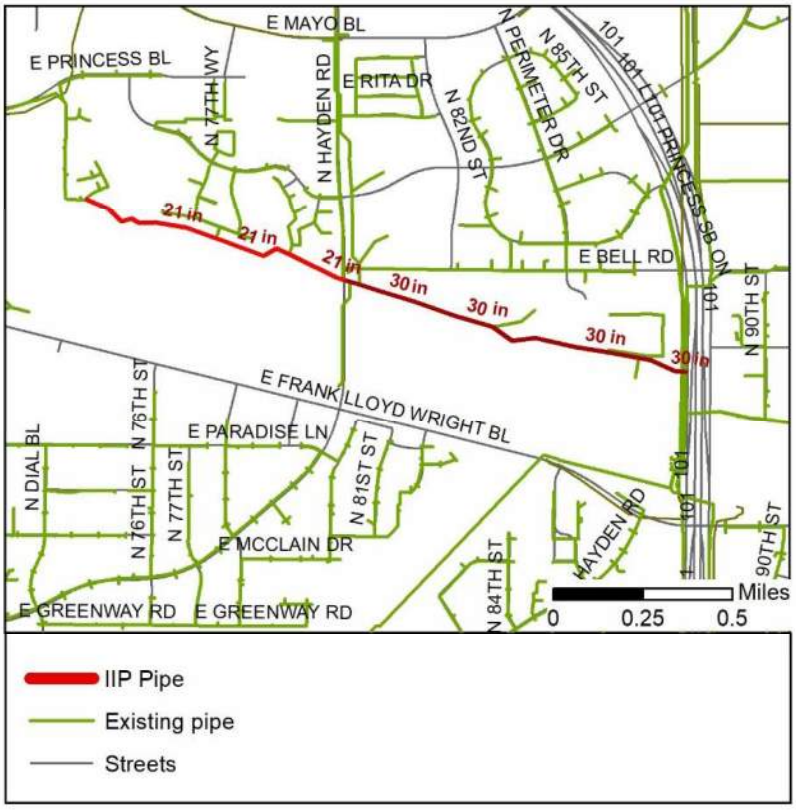
Project Reference: 2021 IIP

Description: Upsize existing 18-inch diameter sewer by replacing with a 21-inch diameter and 30-inch diameter sewer to provide capacity for current and future connections. The model predicted depth to diameter (d/D) is greater than 0.75 by year 2025.

Project Details:

Project Elements		Project Cost
Sewer Lines, 21-inch diameter, 4,125 linear feet; 30-inch diameter, 5,300 linear feet.		$11,932,000
Cost Allocation		
Existing Equivalent Demand Units (EDUs) – Rates	50%	$5,983,000
EDUs through year 2030 – Development Fees	10%	$1,208,000
EDUs beyond year 2030 – Development Fees	40%	$4,741,000





Appendix F – IIP-004 Wastewater Gravity Main Basis of Design Report by Kimley-Horn, November 2023

IIP-004 Wastewater Gravity Main

Basis of Design Report

NOVEMBER 2023



PREPARED BY:

Kimley-Horn and Associates, Inc.

3300 E Sunrise Rd, Suite #130

Tucson, AZ 85718

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Appendix B: Geotechnical Investigation Report

Appendix C: Hydraulic Model Results

Appendix D: Pipe Deflection Calculation

Appendix E: Manhole Structural Calculations

ABBREVIATIONS

ADEQ	Arizona Department of Environmental Quality
ADF	Average Daily Flow
ft/s	Feet Per Second
GIS	Geographic Information System
gpad	Gallons Per Acre Per Day
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
LF	Linear Feet
O&M	Operation and Maintenance
sf	Square Feet
TPC	Tournament Players Club

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

This Basis of Design Report is in support of the City of Scottsdale Wastewater Infrastructure Improvement Plan Project Number 004, commonly referred to as IIP-004. IIP-004 is approximately 723-LF of new 18" and 4,314-LF of new 27" gravity main along Scottsdale Rd, Mayo Blvd, and Miller Rd. See **Figure 1** below for location map.

IIP-004 is one of several gravity main improvement projects within the City of Scottsdale North Airpark Wastewater Service Area that are currently in design/construction. Each of these projects, as shown in the location map below, convey wastewater flows from one project/segment to the other. For comprehensive view of the wastewater service area please refer to the City of Scottsdale North Airpark Sewer Study in **Appendix A**. It is important to note that project alignments shown in the North Airpark Sewer Study are for planning purposes, provided design plans and this corresponding Basis of Design Report details the proposed/detailed pipe alignments and pipe diameters.

1.2 REGULATORY DOCUMENTS AND PREVIOUS STUDIES

To adhere to City of Scottsdale design parameters the following documents were utilized:

- *Arizona Department of Environmental Quality (ADEQ), Engineering Bulletin 11: Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works*
- *City of Scottsdale, Design Standards & Policies Manual.*
- *City of Scottsdale, Infrastructure Improvements Plan Water and Wastewater, March 2021.*
- *Carollo Engineers, North Airpark Sewer Study, April 2023.*

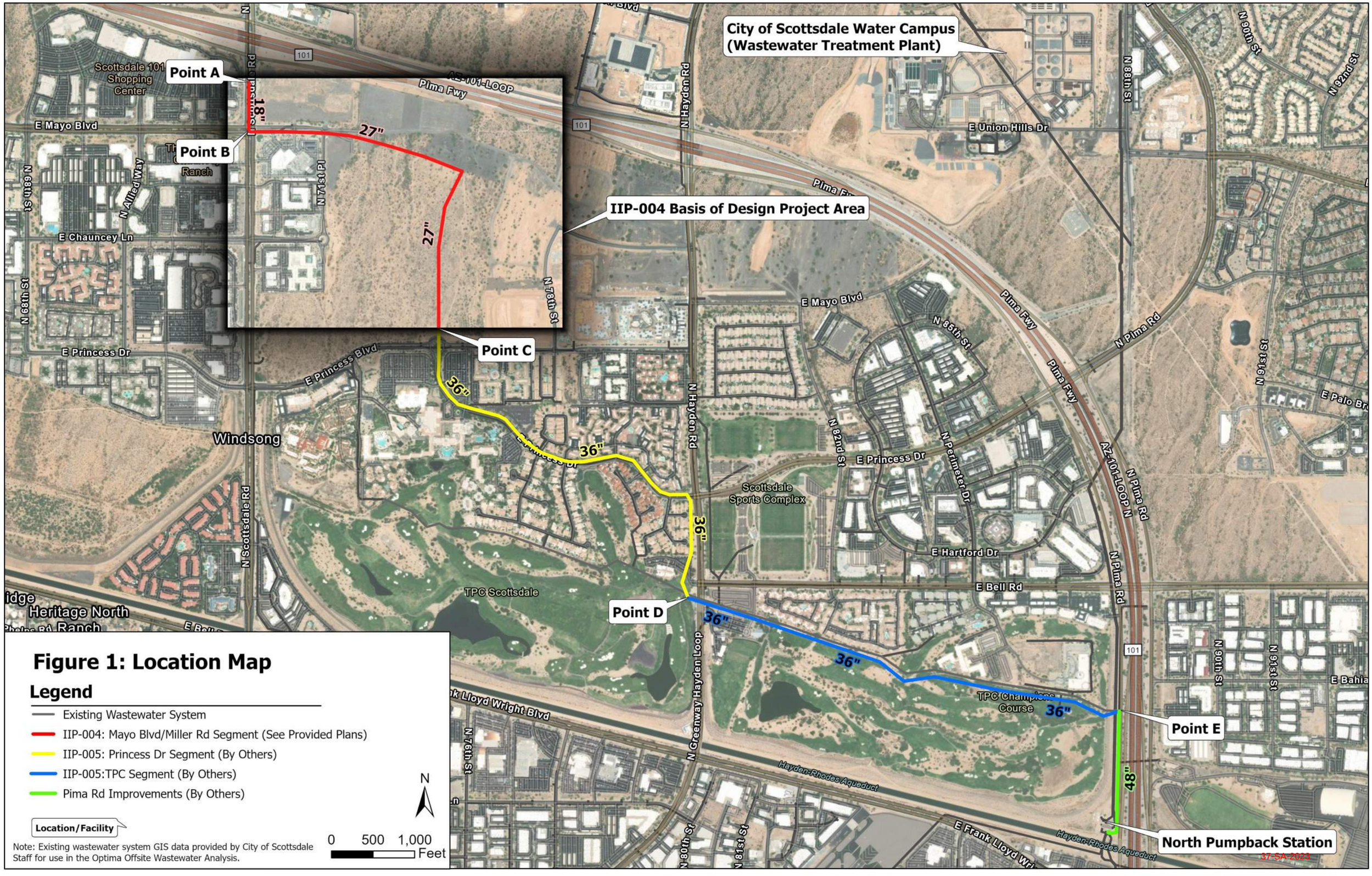

Figure 1: Location Map

Legend

- Existing Wastewater System
- IIP-004: Mayo Blvd/Miller Rd Segment (See Provided Plans)
- IIP-005: Princess Dr Segment (By Others)
- IIP-005:TPC Segment (By Others)
- Pima Rd Improvements (By Others)

Location/Facility

N

0 500 1,000 Feet

Note: Existing wastewater system GIS data provided by City of Scottsdale Staff for use in the Optima Offsite Wastewater Analysis.

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2 ANALYSIS AND PIPE DIAMETER SIZING

The proposed wastewater improvements outlined with this report were modeled using the SewerGEMS hydraulic modeling software. Model network pipe diameters, invert elevations, and rim elevations are updated to reflect current design plans for IIP-004. As part of the North Airpark Sewer Study, the City of Scottsdale generated and maintains a full system hydraulic model. The City provided direction to Kimley-Horn such that the hydraulic model used for the analysis of IIP-004 complies with the City's full system hydraulic model.

2.1 WASTEWATER FLOW GENERATION

The North Airpark Sewer Study provides wastewater flows for the entire tributary wastewater basin. Wastewater flows were allocated in the IIP-004 hydraulic model based on loading assumptions/locations provided in the North Airpark Sewer Study. Wastewater flows allocated to upstream manholes/gravity mains (included in the full system City Model and not included in the IIP-004 hydraulic model) were attributed to corresponding manholes within the IIP-004 hydraulic model. For wastewater flows and loading locations **Table 1** and **Figure 2**.

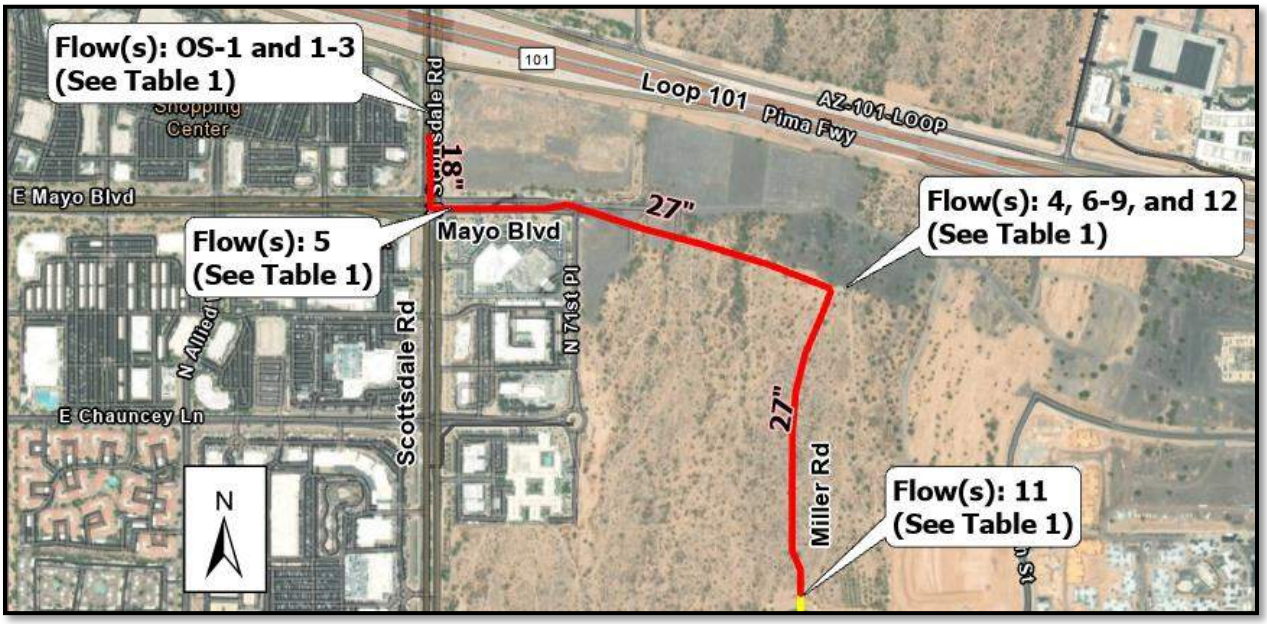
Table 1: Wastewater Flow Projections

Flow Loading Location[1]	Average Daily Wastewater Flow[2] (gpm)	Peaking Factor[2]	Peak Wastewater Flow[2] (gpm)
OS-1	505	1.47	743
1	96	3.1	297
2	74	3	223
3	378	4.5	1,700
4	140	3	421
5	148	6.93	1,026
6	67	3	200
7	143	3	428
8	48	3	145
9	41	3	124
11	66	3.89	259
12	70	3.89	271
Total	**1,776**	**-**	**5,837**

1.) See Table 1 and Appendix A for loading locations.

2.) See Appendix A for additional information on flow projections.

Figure 2: Wastewater Loading Locations



2.2 PIPE DEPTHS AND DESIGN SLOPES

IIP-004 pipe depths and corresponding slopes were established by three key points, see IIP-004 plan set for reference. The upstream pipe depth is established by the tie-in to the existing 15" gravity main located with Scottsdale Rd (see IIP-004 plan set), the depth of IIP-004 along Mayo Blvd and Miller Rd is established by a storm drain crossing (see IIP-004 plan set), the downstream pipe depth is determined by the proposed inverts of IIP-005 which IIP-004 terminates at. Refer to IIP-004 plan set for specifics on pipe inverts, depths, and slopes. Refer to **Appendix B** for Geotechnical Investigation Report.

Slopes for IIP-004 were established by existing grades, existing utilities, and required existing and proposed tie-in points. Additionally, pipe slopes were set to avoid hydraulic jumps and avoid lower velocities, when possible, in an effort to reduce odor concerns. Due to the above-described pipe invert constraints, there are pipe segments with steep and/or shallow pipe slopes. Note that segments with steep and/or shallow pipe slopes are still within the acceptable minimum slope design constraint and maximum velocity design constraint discussed below in Section 2.3. Once IIP-004 is in operation it is recommended that the City of Scottsdale monitor the new gravity main to address any potential future odor concerns.

2.3 HYDRAULIC DESIGN CRITERIA

The IIP-004 hydraulic model was evaluated based on criteria outlined in the City of Scottsdale Design Standards & Policies Manuel. **Table 2** below provides a summary of design criteria used for the analysis.

Table 2: Summary of Design Criteria

Gravity Mains:

- Minimum pipe slope is required to provide a full flow velocity of 2.5 ft/s.
- Maximum velocity at peak flow limited to 10.0 ft/s.
- Manning's Formula "n" value to equal 0.013.
- Depth of flow to diameter ratio (d/D) for pipes greater than 12" in diameter not to exceed 0.70.

Manholes:

- Manhole spacing not to exceed 800 ft.
- Minimum drop across manhole to be 0.1 ft.

Sewer Diameter (inch)	Minimum Slope (ft/ft)	Minimum Slope (%)
18	.00180	0.180
27	0.00100	0.100

2.4 RECOMMENDED GRAVITY MAIN DIAMETERS

Based on the proposed wastewater flows detailed in **Section 2.1**, designed slopes discussed in **Section 2.2**, and design criteria summarized in **Section 2.3** the proposed IIP-004 gravity main will be 18" from Point A to Point B and 27" from Point B to Point C. For hydraulic model results tables and corresponding model element map see **Appendix C**.

3 MATERIAL RECOMMNEDATIONS

3.1 GRAVITY MAIN

The City of Scottsdale requested that the proposed 18" and 27" gravity mains be fiberglass reinforced polymer mortar (FRP) pipe in accordance with ASTM D3262 with piping fittings and joints conforming with ASTM D4161. Material outlined in the IIP-004 is to be of Hobas Pipe, USA (or approved equal) Stiffness Class (SN) 46.

Hobas Pipe, USA (manufacturer) has a maximum long-term deflection not to exceed 4%. Kimley-Horn performed a pipe deflection calculation using Stiffness Class 46 as shown in **Appendix D.** The Contractor is to have pipe manufacturer provide supplemental pipe stiffness recommendations based on provided design drawings to be reviewed by the Engineer for acceptance.

3.2 MANHOLES

The City of Scottsdale requested that the proposed manholes be polymer concrete in accordance with MAG Standard Specification Section 744 "Precast Polymer Concrete Manhole". Manholes will have watertight 30-inch frames and covers in accordance with MAG Standard detail 424 and City of Scottsdale standard detail 2421.

The Contractor is to have precast polymer concrete manhole manufacturer provide shop drawings for all manholes to be reviewed by the Engineer for acceptance.

Structural calculations have been provided by the manufacturer, which are included within **Appendix E** below**.**

4 ADDITIONAL RECOMMENDATIONS

As discussed in **Section 2.2** there are segments of proposed pipe that are of steep slope (still within the maximum velocity design constraint) that are of increased risk of a hydraulic jump and corresponding odor concern. The proposed system is sized for the buildout condition, in early development stages the gravity main will experience lower flows and corresponding lower velocity, this may increase the risk of odor concern. Kimley-Horn recommends that once the IIP-004 gravity main is in operation the City of Scottsdale monitor the new gravity main to address any potential future odor concerns.

Appendix A: City of Scottsdale North Airpark Sewer Study



City of Scottsdale
North Airpark Sewer Study

Technical Memorandum
SEWER COLLECTION SYSTEM ANALYSIS

REVISED DRAFT | April 7, 2023

37-SA-2023

City of Scottsdale
North Airpark Sewer Study

Technical Memorandum
SEWER COLLECTION SYSTEM ANALYSIS

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State of Arizona,
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Abbreviations

AADF	average annual daily flow
ac	acre(s)
BOD	basis of design
C-2/C-3	Central Business District
Carollo	Carollo Engineers, Inc.
City	City of Scottsdale
C-O	Commercial Office District
d/D	flow depth to pipe diameter
DS&PM	Design Standards and Policy Manual
ft	feet
fps	feet per second
gpad	gallons per acre per day
gpm	gallons per minute
GIS	Geographic Information System
I-1	Industrial Park District
IIP	Infrastructure Improvements Plan
IWRMP	Integrated Water Resources Master Plan
lf	linear feet
LTC	Long-term Care
PCD	Planned Community District
PCP	Planned Airpark Core Development
PHF	peak hour flow
PRC	Planned Regional Center
R-5	Multi-Family Residential District
Study	sewer alignment analysis
TPC	Tournament Players Club

Technical Memorandum

SEWER COLLECTION SYSTEM ANALYSIS

The City of Scottsdale (City) contracted Carollo Engineers, Inc. (Carollo) to conduct a sewer capacity evaluation and new sewer alignment analysis (Study) for a portion of the Greater Airpark Character Area shown in Figure 1 as the North Airpark Sewer Study Area. This Study builds upon the work conducted to evaluate existing and planned sewers defined in the City's 2021 Infrastructure Improvements Plan (IIP) and 2022 Integrated Water Resources Master Plan (IWRMP). This Study addresses differences between current development plans and the land use assumptions used for the IIP and IWRMP.

There are approximately 1,120 acres (ac) (1.8 square miles) of undeveloped State Lands within the Study Area. Nearly 700 ac are associated with nine known developments shown in Figure 1, which are at various stages of development ranging from preliminary concepts and the development review stage to partially constructed. Five of these developments have either completed master plans or basis of design (BOD) reports that quantify their anticipated wastewater flows, including:

- Axon
- Cavasson
- Hayden 50 / San Bellara Apartment Community
- One Scottsdale
- Optima

The remaining four developments are "known" in that they have approached the City to engage in preliminary discussions regarding options or have just begun to go through the development review process. These include:

- Epicenter
- Hayden Loop 101 Investors
- Potential Multi-Family / Long-Term Care
- Potential Future Medical
- Princess Resort

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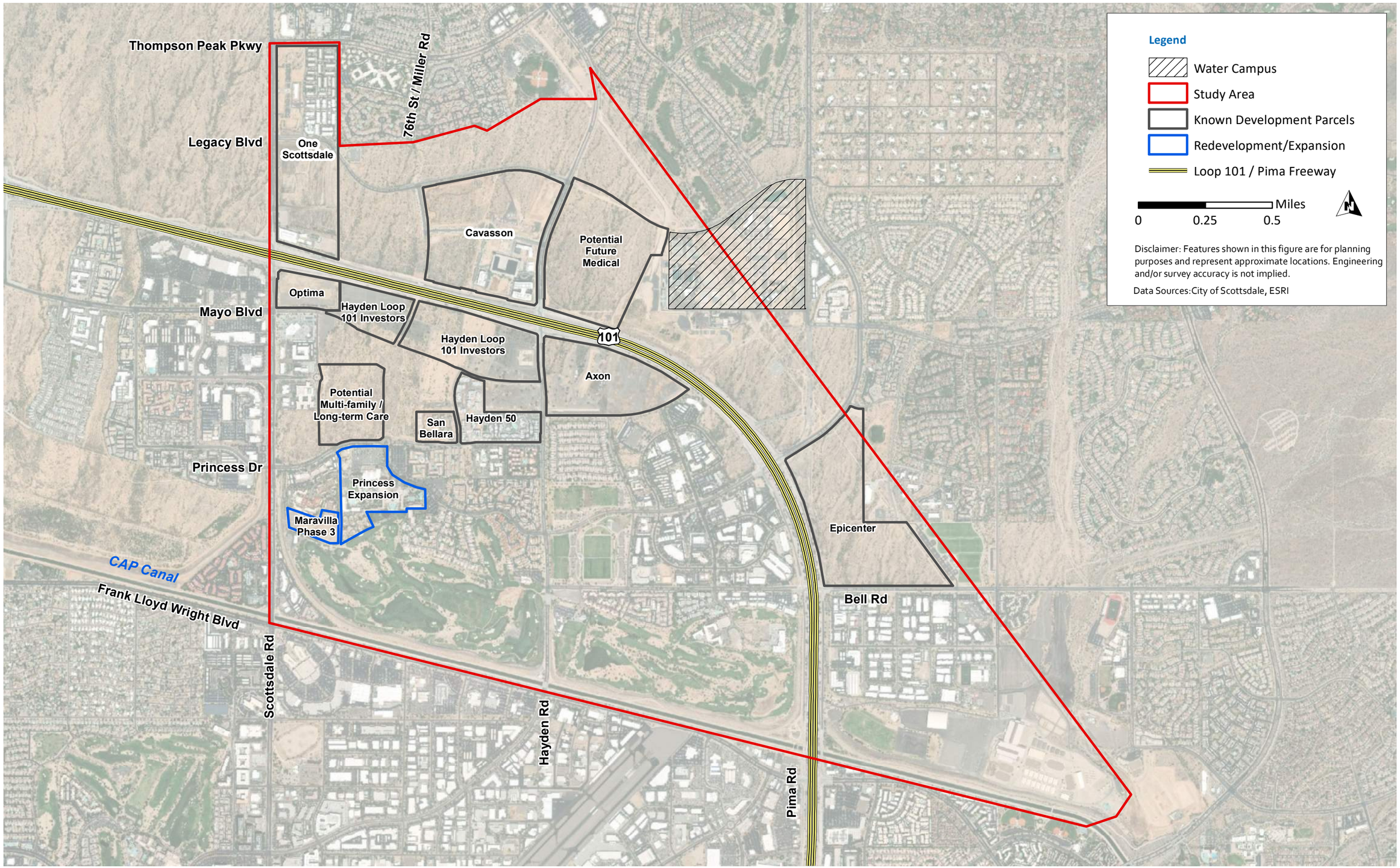

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M:\Client\Scottsdale\201337\GIS\mxd\Figure 1.1 Study Area.mxd

Figure 1 North Airpark Sewer Study Area
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The planning basis used in this Study for the known developments included BOD reports or master plans (where available), approved zoning, or the City's current understanding regarding potential development scenarios. The remaining 420 ac of undeveloped land within the Study Area was evaluated based primarily on land use and approved/potential zoning.

This Study provides:

- Updated wastewater generation rates for undeveloped areas within the Study Area for the buildout (year 2055) condition.
- A re-evaluation of the capacity available in the existing wastewater collection system and the sizing recommendations for planned infrastructure including the following projects from the IIP and IWRMP:
  - WW IIP-004: Mayo Boulevard Sewer Improvements
  - WW IIP-005: Greenway Hayden Loop Sewer Improvements (Tournament Players Club [TPC] Golf Courses)
  - IWRMP WW-001: Pima Road Improvements

1.0 Study Area

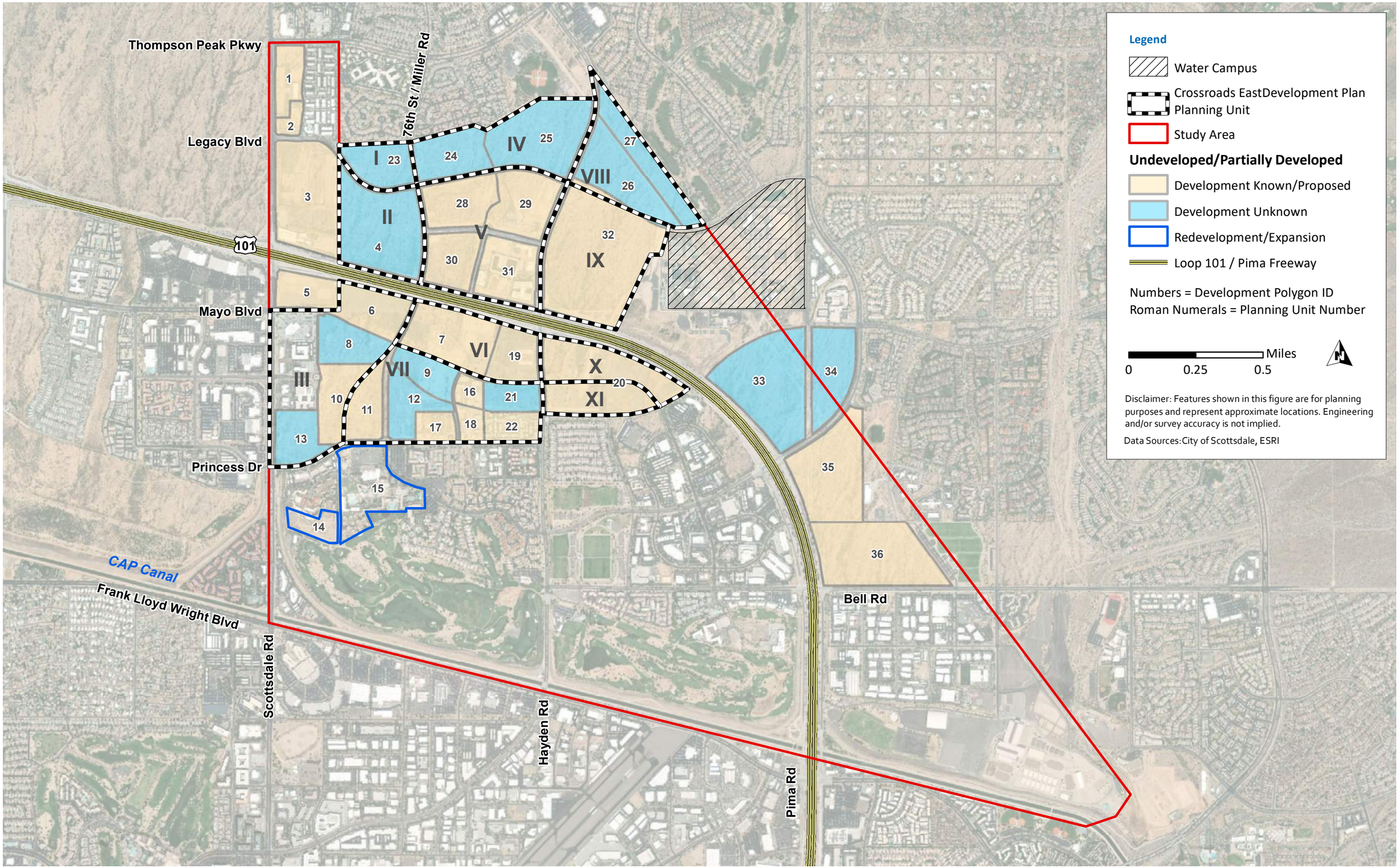
The Study Area encompasses approximately 5 square miles in the northern portion of the Greater Airpark Character Area. A portion of the Study Area includes the Crossroads East Planned Community District (PCD), which is sub-divided into 11 Planning Units as shown in Figure 2. The boundaries of the Planning Units shown in Figure 2 are approximate representations of those described in the Crossroad East PCD Development Plan Amendment (Revised April 26, 2018). The Planning Units have defined limits on the types of zoning allowed within them and were used in this Study to refine the land use assumptions associated with the undeveloped areas within them.

2.0 System Evaluation Criteria

The capacity of the planned wastewater collection system was based on the hydraulic design criteria in the City's Design Standards and Policy Manual (DS&PM) section 7-1.404. This requires the following flow depth to pipe diameter (d/D) values for ultimate (fully developed), peak flow conditions:

- Pipes less than 12 inches in diameter or less: d/D less than 0.65
- Pipes greater than 12 inches in diameter: d/D less than 0.7

Sewer mains are required to provide mean, full flow velocities equal to or greater than 2.5 feet per section (fps). Maximum sewer main flow velocities at peak flow are required to be less than 10 fps.



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M:\Client\Scottsdale\201337\GIS\mxd\Figure 1.2 North Airpark Planning Units and Undeveloped Area.mxd

Figure 2 North Airpark Planning Units and Undeveloped Parcels
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3.0 Study Area Flow Projections

Wastewater generation rates for the buildout condition were prepared for the undeveloped areas within the Study Area following a multi-tiered approach. For areas with an approved master plan or BOD report (approved or in-review), the wastewater flow estimates from these documents were used. For all other undeveloped areas, wastewater flow estimates were prepared by applying the unit wastewater generation rates from areas with approved master plans or BOD reports.

Three developments were used to model wastewater generation rates for undeveloped areas within the Study Area that did not have a master plan or BOD report:

- Cavasson – Master Wastewater Report (5/21/2021)
- Hayden 50 – Mark-Taylor San Artes Apartments Preliminary Drainage Report (2/15/2019)
- Optima – Optima McDowell Mountain Village Wastewater Master Plan (3/2023)

These were selected to provide a reasonable basis for mixed use (Cavasson), high-density mixed use (Optima), and high-density residential (Hayden 50) that could be applied to areas that are currently anticipated to develop in a similar manner.

This approach included a review of allowable zoning within the Crossroads East PCD's Planning Units with the associated Grayhawk, Princess and Hayden Core Transition areas. Appendix A contains exhibits from the Crossroads East PCD Development Plan that illustrate the Planning Units, allowable zoning, and locations of transition areas.

Table 1 summarizes the flow projections at buildout for the undeveloped areas within the Study Area. For those within the Crossroads East PCD, the zoning assumptions that were used to prepare the wastewater flow estimates are identified. Appendix A (Table A.1) summarizes the allowable zoning for the undeveloped areas within the Crossroads East PCD. Table 1 includes the Polygon ID's associated with the areas in Figure 2, the estimated acreage, and the average annual and peak hourly flow estimates for each polygon. The basis for the wastewater generation rates is also identified along with notes that cite the sources of the flow values.

The peak hour flow to average annual daily flow (PHF/AADF) peaking factors for the undeveloped areas are based on master planned or BOD values (2.91 to 6.93) or the City's DS&PM requirements (3.0 or greater). The peaking factors from the IWMRP were based on flow monitoring data for existing flows and assumed that future wastewater generation rates and peak flows would follow patterns of "existing" development.

Table 1 Buildout Wastewater Flow Projections for Undeveloped and Partially Developed Areas

Polygon ID	Estimated Parcel Acreage (ac)	Within Crossroads East PCD (Y/N)	Crossroads East Zoning Assumption [1]	Development Name	Flow Basis	AADF (gpm)	PHF (gpm)	Peaking Factor (PHF/AADF)	Unit Wastewater Flow (gpad)	Comments - Flow Basis Source
Tributary to the TPC Sewer										
OS-1 [2]			NA	NA	IWRMP	505	743	1.47	NA	Offsite flows from Scottsdale Road 15-inch diameter sewer north of North Airpark Sewer Study Area
1	16	N	NA	One Scottsdale	BOD	96	297	3.10	8,640	Proposed Wastewater Demand Calculations (61-DR-2015#3)
2	6	N	NA	One Scottsdale	BOD	74	223	3.00	17,760	Proposed Wastewater Demand Calculations (61-DR-2015#3)
3	60	N	NA	One Scottsdale	BOD	378	1,700	4.50	9,067	Appendix C, Table 3.1 - Wastewater Design Flows (30-DR-2021#3)
4	61	Y	PRC/PCP	Unknown/State Lands	Estimated	140	421	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
5	19	N	NA	Optima	BOD	148	1,026	6.93	11,217	Table 1 - Optima McDowell Mountain Village Wastewater Master Plan (3/2023)
6	29	Y	PRC/PCP	Hayden Loop 101 Investors	Estimated	67	200	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
7	42	Y	PRC/PCP	Hayden Loop 101 Investors	Estimated	143	428	3.00	4,903	Hayden Loop 101 Investors Polygons 7 and 19 from 1113-PA-2022 Site Plan
8	21	Y	PRC/PCP	Unknown/State Lands	Estimated	48	145	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
9	18	Y	PRC/PCP	Unknown/State Lands	Estimated	41	124	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
10	23	Y	PRC/PCP	Potential Multi-Family/LTC	Estimated	53	159	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
11	21	Y	R-5	Potential Multi-Family/LTC	Estimated	66	259	3.89	4,555	Assumes same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess Transition Area
12	22	Y	R-5	Unknown/State Lands	Estimated	70	271	3.89	4,555	Assumes same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess Transition Area
13	21	Y	PRC/PCP	Unknown/State Lands	Estimated	48	145	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
14	NA	N	NA	Maravilla Phase 3	Master Plan	24	113	4.67	NA	Wastewater Collection System BOD Report for Maravilla Senior Living Community Phase 3 (August 17, 2021)
15	NA	N	NA	Princess Resort Expansion	BOD	92	414	4.50	NA	Master Plan: Phase 2 Sunset Beach Villas & Bungalows (38-DR-2022) and four BODs submitted under 5-ZN-2015#2
16	7	Y	NA	Hayden 50	BOD	30	119	4.00	6,143	Table 3 - Wastewater Design Flows (57-DR-2018)
17	11	Y	NA	San Bellara	BOD	31	125	4.00	4,091	Table 1 - On-site Sewer Demand (29-DR-2020)
18	7	Y	NA	Hayden 50	BOD	24	94	4.00	4,857	Table 3 - Wastewater Design Flows (57-DR-2018)
19	21	Y	PRC/PCP	Hayden Loop 101 Investors	Estimated	69	412	5.97	4,731	Hayden Loop 101 Investors Polygons 7 and 19 from 1113-PA-2022 Site Plan
20	71	Y	NA	Axon	BOD	163	479	2.94	3,306	Table 2 - Wastewater Collection System BOD Report (March 4, 2022)
21	14	Y	PRC/PCP	Unknown/State Lands	Estimated	86	391	4.6	8,828	Assumed 75% of residential density and the same non-residential density as the Optima Master Plan
22	15	Y	NA	Hayden 50	BOD	47	185	3.89	4,555	Table 3 - Wastewater Design Flows (57-DR-2018)
Tributary to the Crossroads Lift Station										
23	23	Y	R-5	Unknown/State Lands	Estimated	73	283	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
24	28	Y	R-5	Unknown/State Lands	Estimated	89	345	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
25	53	Y	R-5	Unknown/State Lands	Estimated	168	653	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
26	40	Y	R-5	Unknown/State Lands	Estimated	127	493	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
27	27	Y	R-5	Unknown/State Lands	Estimated	85	332	3.89	4,555	Assumed same peaking factor as Hayden 50 (Polygon ID No. 22) due to similarities in Princess/Grayhawk Transition Area
28	29	Y	NA	Cavasson	BOD	67	195	2.91	3,314	Master Wastewater Report (May 21, 2021)
29	33	Y	NA	Cavasson	BOD	67	195	2.91	2,913	Master Wastewater Report (May 21, 2021)
30	24	Y	NA	Cavasson	BOD	67	195	2.91	4,005	Master Wastewater Report (May 21, 2021)
31	31	Y	NA	Cavasson	BOD	67	195	2.91	3,101	Master Wastewater Report (May 21, 2021)
32	106	Y	NA	Potential Future Medical	BOD	138	414	3.00	1,875	Table 1 - Wastewater Demands (5-ZN-2022_1-30)
Tributary to the Pima Road Sewer										
OS-2 [3]			NA	NA	IWRMP	1,246	2,117	1.70	NA	Offsite flows from four locations along Pima Road
33	68	N	PRC/PCP	Unknown/State Lands	Estimated	156	469	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
34	33	N	PRC/PCP	Unknown/State Lands	Estimated	76	228	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
35	55	N	PRC/PCP	Epicenter	Estimated	126	379	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0
36	63	N	PRC/PCP	Epicenter	Estimated	145	435	3.00	3,311	Assumed same unit wastewater flow as Cavasson Master Plan and PHF/AADF peaking factor of 3.0

Note:

(1) From Crossroad East Development Plan Amendment (Revised April 26, 2018). See Appendix A for zoning maps. The "NA" values indicate that a parcel was either not a part of the Crossroad East Development Plan Study Area or a BOD or Master Plan value was used as the basis for flow estimates.

(2) Offsite flows to the existing 15-inch diameter sewer are required to be routed from their current path (through Princess Drive/Cottage Terrace and the western portion of the TPC sewer) to the sewers to be constructed east at Mayo Blvd to provide capacity for Polygon IDs Nos. 10, 13, 14, and 15.

(3) Location 1: 18-inch diameter sewer (Princess Dr. south of Legacy Blvd), Location 2: 18-inch diameter sewer (north of Bell Road, east of Pima Rd), Location 3: 18-inch diameter sewer (Bell Rd east of Pima Rd), Location 4: 30-inch diameter sewer (Westworld Rd east of Pima Rd)

Abbreviations:

AADF = average annual daily flow; PHF = peak hour flow; R-5 = Multi-Family Residential District; PRC = Planned Regional Center; PCP = Planned Airpark Core Development; ac = acre(s); gpm = gallons per minute; gpad = gallons per acre per day; BOD = basis of design report; LTC = Long-term Care.

4.0 Collection System Evaluation

4.1 Hydraulic Model Updates

The wastewater collection system that currently serves the Study Area is shown in Figure 3. The hydraulic model developed in the IWRMP was updated to analyze the hydraulic capacity of the collection system. The model updates included:

- Incorporating gravity sewers north of the Loop 101 that are within the Crossroads Lift Station service area.
- Re-alignment of the Mayo Boulevard and Miller Road future sewers to match revised and approved roadway alignments.
- Updates to wastewater flow loading polygons to make certain flows were directed to the intended interceptor.
- Pipe and manhole invert verification/adjustments were made based on two sets of survey data (provided by others: Kimley Horn Survey [1/19/2023] and Dibble Survey [1/24/2023]) for the 18-inch and 24-inch diameter sewers that cross the TPC Golf Courses.
- Incorporating the average daily flows summarized in Table 1 into the flow loading polygons and developing diurnal patterns to achieve the peak flows summarized in Table 1.

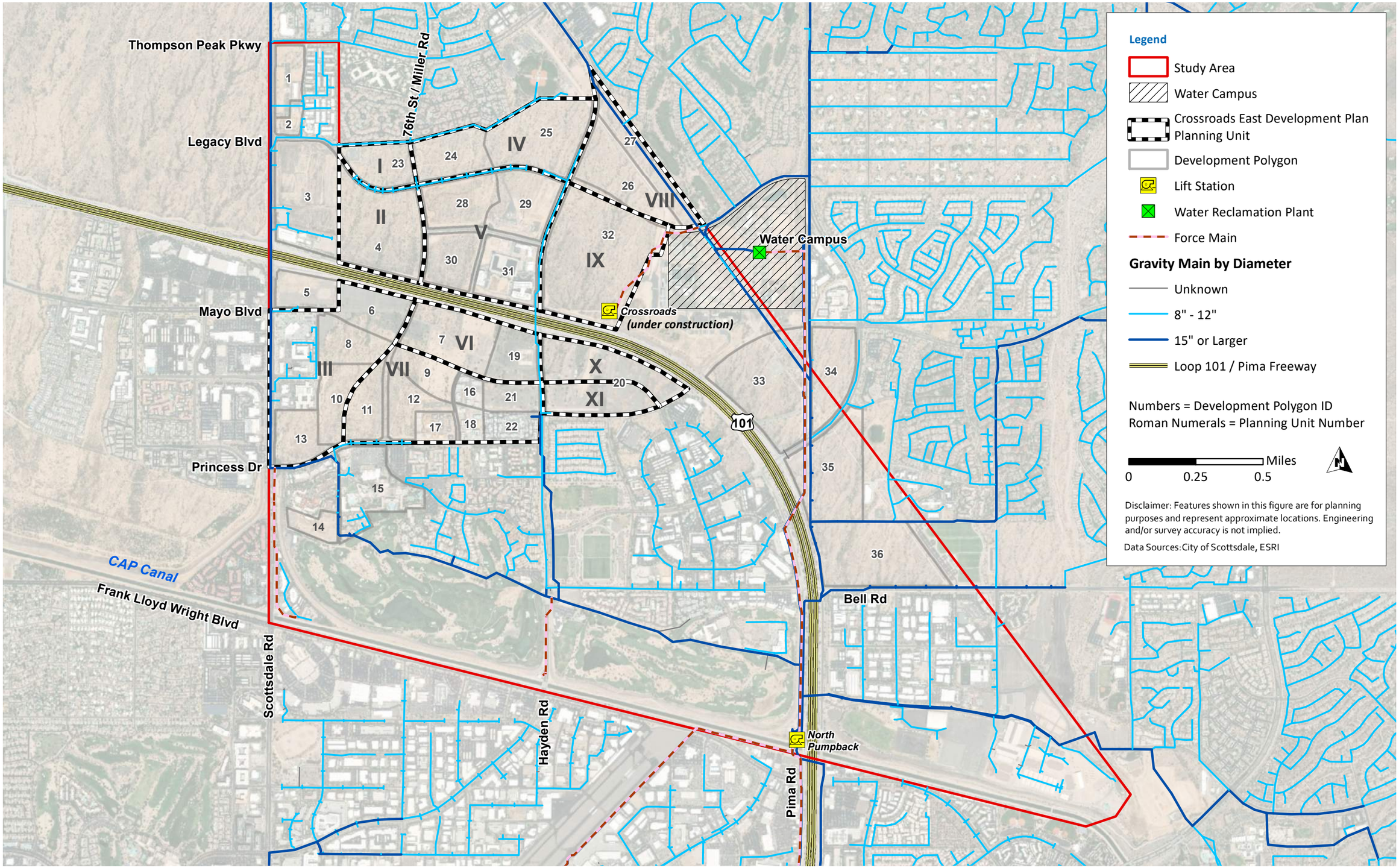

Figure 3 North Airpark Existing Sewer Collection System
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4.2 Collection System Capacity Analysis

The wastewater collection system was evaluated for year 2055 (assumed buildout) conditions to represent the ultimate system flows. The existing sewers and planned IIP projects WW IIP-004 and WW IIP-005 (Appendix B) as well as sewers in Scottsdale Road, Princess Drive, and Pima Road were re-evaluated in this analysis.

For the year 2055 analysis, it was assumed that Polygon ID Nos. 23 through 32 would be conveyed to the Crossroads Lift Station. The existing 12-inch diameter sewer in Hayden Road was assumed to be plugged (as planned) south of the Crossroads Lift Station, resulting in all flow contributions to the Hayden Road sewer that are then conveyed to the TPC sewer being from polygons south of the Loop 101.

Figure 4 illustrates the locations of new sewers, existing sewers that require upsizing and the sewage collection areas associated with each major interceptor. The flow routing assumed:

- One hundred percent of the flow from Polygon ID Nos. 1 through 3 (One Scottsdale) are diverted from the 15-inch diameter sewer in Scottsdale Road south of the Loop 101 to the east into a new 27-inch diameter sewer to be constructed in Mayo Boulevard, which continues to a new 27-inch diameter sewer in Miller Road to Princess Drive. This flow routing was done to avoid surcharging the 15-inch diameter sewer in Scottsdale Road and the existing 18-inch diameter sewer in the TPC Golf Courses that is predicted without this adjustment. A diversion structure should be installed at Scottsdale Road and Mayo Boulevard to allow the City flexibility in routing and balancing flows between the two interceptors.
- The diversion of the offsite flows (Polygon ID No. OS-1) from the 15-inch diameter sewer in Scottsdale Road through the Scottsdale Road/Mayo Road diversion structure, continuing east to the Miller Road and Princess Drive sewers. These are considered substitution flows for Polygon IDs Nos. 10 and 13 through 15 and must be re-routed to avoid surcharging the existing 18-inch diameter sewer in Cottage Terrace and the western portion of the 18-inch diameter TPC sewer.
- The flows from Polygon ID No. 4 are routed south to the new 18-inch and 27-inch diameter sewers to be constructed in Miller Road to Princess Drive.
- The flows from Polygon ID No. 5 (Optima) are routed to Miller Road into a new 27-inch diameter sewer in Mayo Blvd.

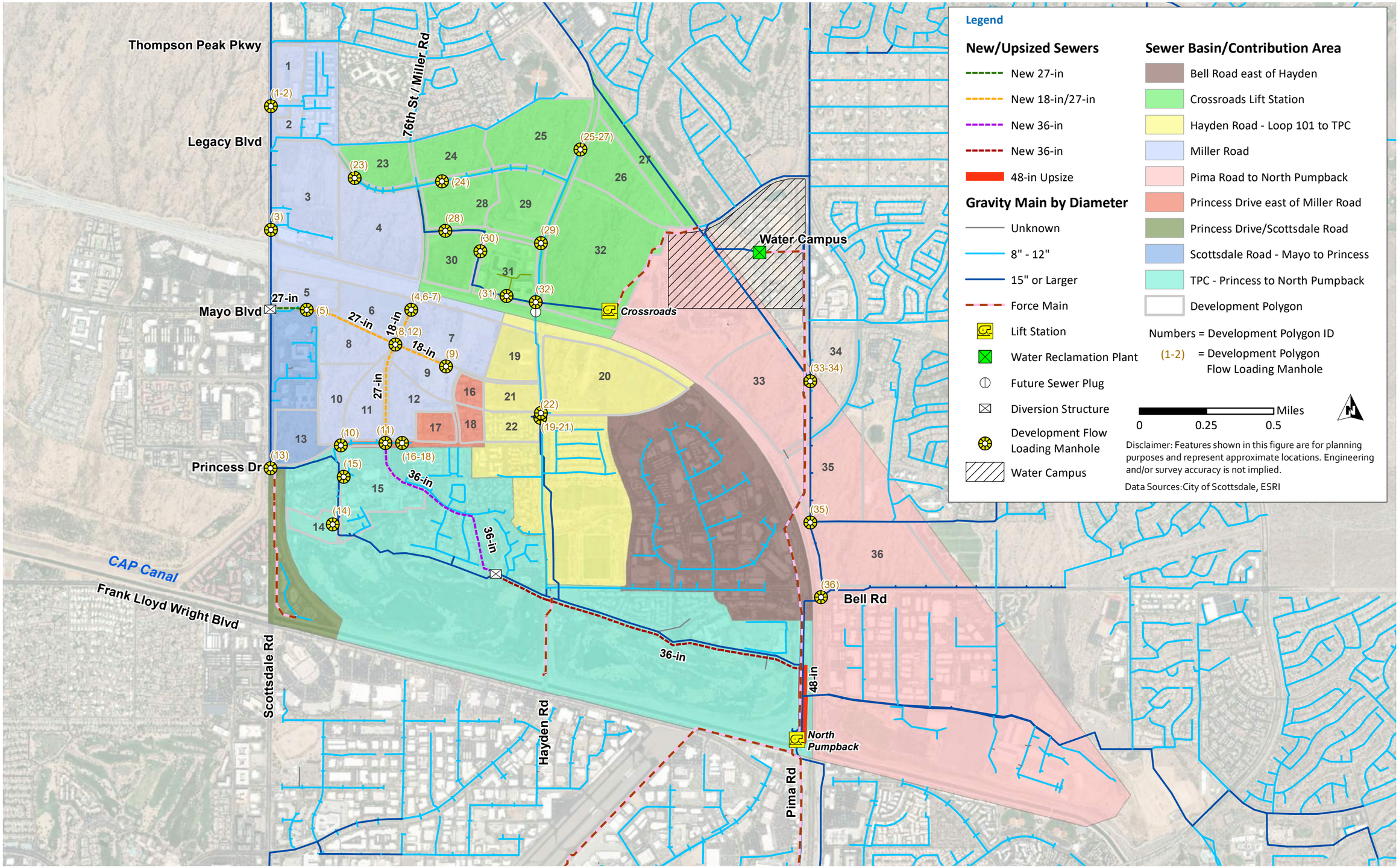


Figure 4 North Airpark Sewer Improvements
37-SA-2023
REVISED DRAFT | APRIL 7, 2023

The hydraulic model identified the need to size new sewers in the Study Area as follows to meet the System Evaluation Criteria (Section 2). Increased wastewater flow projections require larger diameter sewers than identified in the 2021 IIP:

- **Scottsdale Connection** – Mayo Boulevard from Scottsdale Road to the eastern Optima development property line: 27-inch diameter, approximately 1,330 linear feet (lf).
- **Mayo Boulevard Sewer Improvements** – Miller Road from the Loop 101 to Mayo Boulevard (approximately 800 lf) and Mayo Boulevard from Miller Road to west of 78th Street (approximately 1,100 lf): 18-inch diameter. This is an upsizing portion of Project WW IIP-004.
- **Mayo/Miller Segment** – Mayo Boulevard from the eastern Optima development property line to Miller Road, Miller Road from Mayo Boulevard to Princess Drive: 27-inch diameter, approximately 3,300 lf. This is an upsizing portion of Project WW IIP-004.
- **Princess Drive Segment** – The TPC sewer bypass from Princess Drive and Miller Road to the TPC Golf Course: 36-inch diameter. The sewer will extend south from the 27-inch diameter sewer on Miller Road and continue southeast on Princess Drive to east of 77th Way where it will turn south to cross the TPC Stadium Golf Course, connecting to a new diversion manhole intersecting the existing 18-inch diameter sewer within the golf course. This segment is a re-definition of Project WW IIP-005 that includes approximately 3,800 lf of 36-inch diameter sewer.
- **TPC Segment** – The 36-inch diameter sewer will continue east and parallel to the existing 18-inch and 24-inch diameter sewers within the TPC Stadium and Champions Golf Courses from the new sewer diversion structure that will be located approximately 1,100 ft west of Hayden Road (near holes 1 and 2 at the TPC Stadium Course) and continue to Pima Road. This project is portion of modified Project WW IIP-005 that includes approximately 6,400 lf of a new sewer.
- **Pima Road Segment** – The Pima Road sewer from the TPC parallel sewers to the North Pumpback Station: 48-inch diameter. This project definition includes a portion of Project WW IWRMP-001 but extends an additional 700 lf (approximately 1,700 lf total) north to the TPC sewer. Increased wastewater flow projections require larger diameter sewers than identified in the 2022 IWRMP.

The way in which the flows are balanced through the proposed parallel sewers across the TPC Golf Courses will impact the sizing of the recommended parallel pipes. As currently modeled, the crowns of the proposed parallel pipes are matched with the crowns of the existing sewers. This is done to prevent surcharging the existing 18-inch and 24-inch diameter sewers. The intent is that the TPC Segment will ultimately convey the majority of the upstream flow from the existing 18-inch diameter sewer and the Princess Drive Segment Adjustments to pipe sizing may occur as the Princess Drive Segment and TPC Segment pipe design progresses.

5.0 Summary and Recommendations

Recent development proposals for the North Airpark Area include higher density uses that result in more wastewater flows than were anticipated in the 2021 IIP and 2022 IWRMP. This Study provides updated average annual and peak hour wastewater flow projections for the undeveloped areas within the Study Area using wastewater generation rates associated with these uses.

The City's wastewater hydraulic model that was calibrated for the 2022 IWRMP was applied in this Study. Infrastructure and flow loading was updated in the model to reflect the most recent geographic information system (GIS) data and the flows from this Study.

Table 2 summarizes the project definitions, sizes, and approximate lengths of the recommended sewer main improvements.

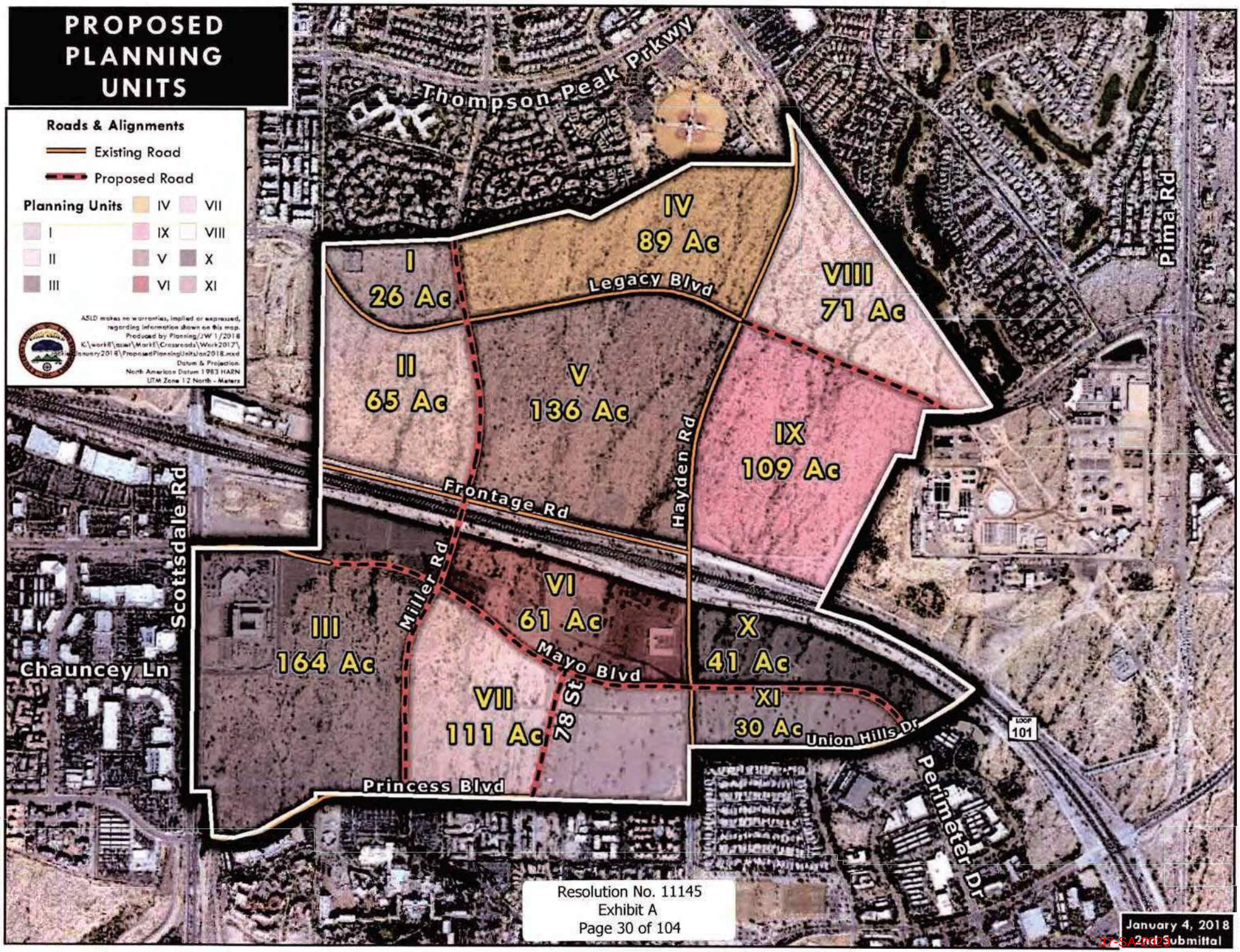
Table 2 Infrastructure Project Recommendation Summary

Originating IIP or IWRMP Project ID	Name – Location	Diameter (in) (1)	Length (ft) (1)
NA	Scottsdale Connection	27	1,330
WW IIP-004 (2)	Mayo Blvd Sewer Improvements: Miller Rd from Loop 101 to Mayo Blvd	18	800
	Mayo Blvd Sewer Improvements: Mayo Blvd from Miller Rd to 78th Street	18	1,100
	Mayo/Miller Segment	27	3,300
WW IIP-005 (3)	Princess Drive Segment	36	3,800
	TPC Segment	36	6,400
IWRMP WW-001	Pima Road Segment	48	1,700

Notes:
(1) Independent verification of sewer inverts, pipe diameters and required lengths will need to be completed during design.
(2) Project name "Mayo Boulevard Sewer Improvements" in the City's 2021 Infrastructure Improvements Plan.
(3) Project name "Greenway Hayden Loop Sewer Improvements" in the City's 2021 Infrastructure Improvements Plan.
Abbreviations:
IIP = Infrastructure Improvements Plan; IWRMP = Integrated Water Resources Master Plan; NA = Not Applicable.

Appendix A

CROSSROADS EAST PLANNING UNITS AND ZONING


PROPOSED PLANNING UNITS
Roads & Alignments
Existing Road
Proposed Road
Planning Units
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
ASLD makes no warranties, implied or expressed, regarding information shown on this map.
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North American Datum 1983 HARN
UTM Zone 12 North - Meters
Thompson Peak Prkwy
Pima Rd
IV
89 Ac
I
26 Ac
Legacy Blvd
VIII
71 Ac
II
65 Ac
V
136 Ac
IX
109 Ac
Hayden Rd
Frontage Rd
Scottsdale Rd
Miller Rd
VI
61 Ac
III
164 Ac
X
41 Ac
Mayo Blvd
Chauncey Ln
VII
111 Ac
78 St
XI
30 Ac
Union Hills Dr
LOOP 101
Perimeter Dr
Princess Blvd
Resolution No. 11145
Exhibit A
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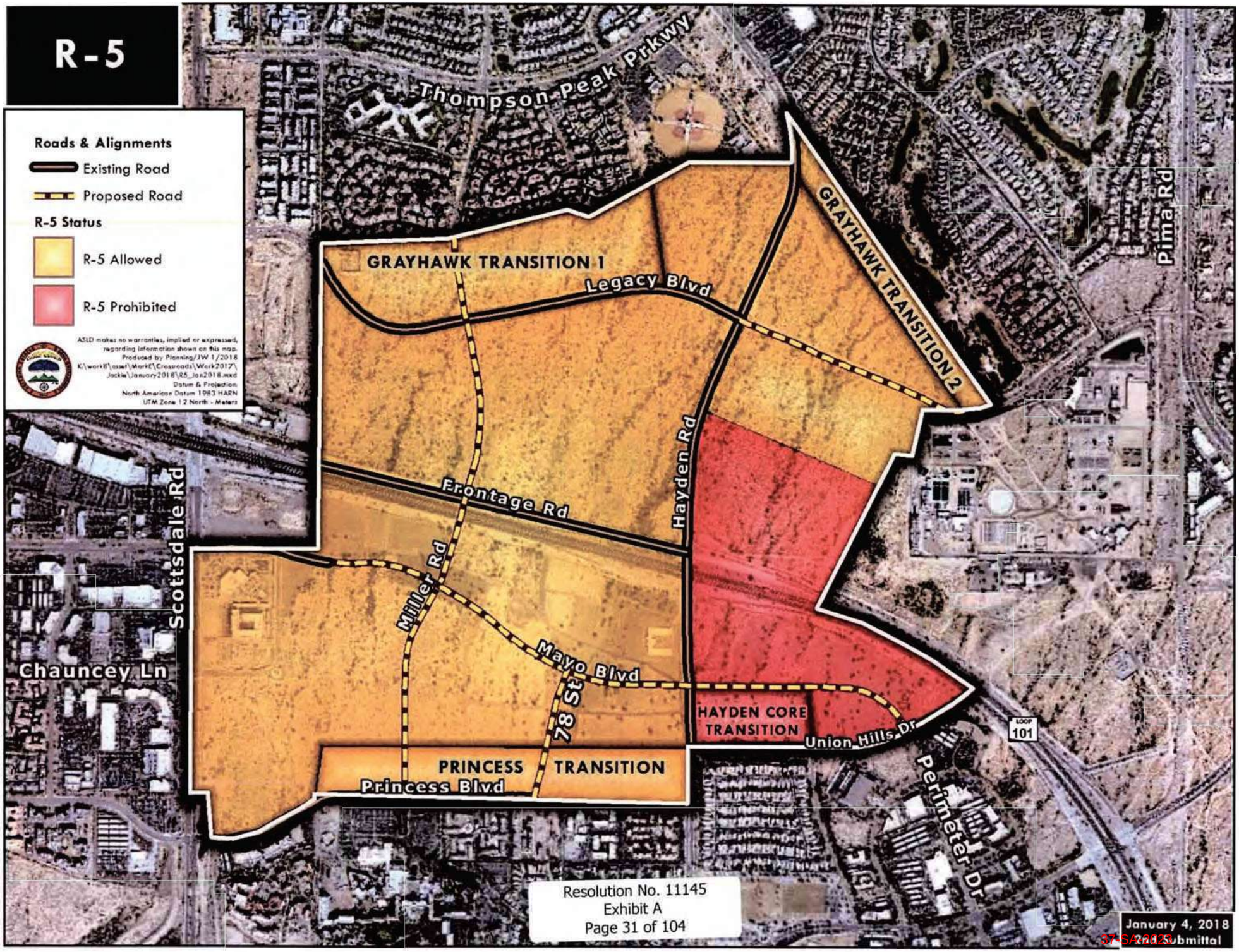
R-5
Roads & Alignments
Existing Road
Proposed Road
R-5 Status
R-5 Allowed
R-5 Prohibited
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Thompson Peak Prkwy
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Legacy Blvd
GRAYHAWK TRANSITION 2
Pima Rd
Hayden Rd
Frontage Rd
Scottsdale Rd
Miller Rd
Chauncey Ln
Mayo Blvd
78 St
HAYDEN CORE TRANSITION
Union Hills Dr
LOOP 101
PRINCESS TRANSITION
Princess Blvd
Perimeter Dr
Resolution No. 11145
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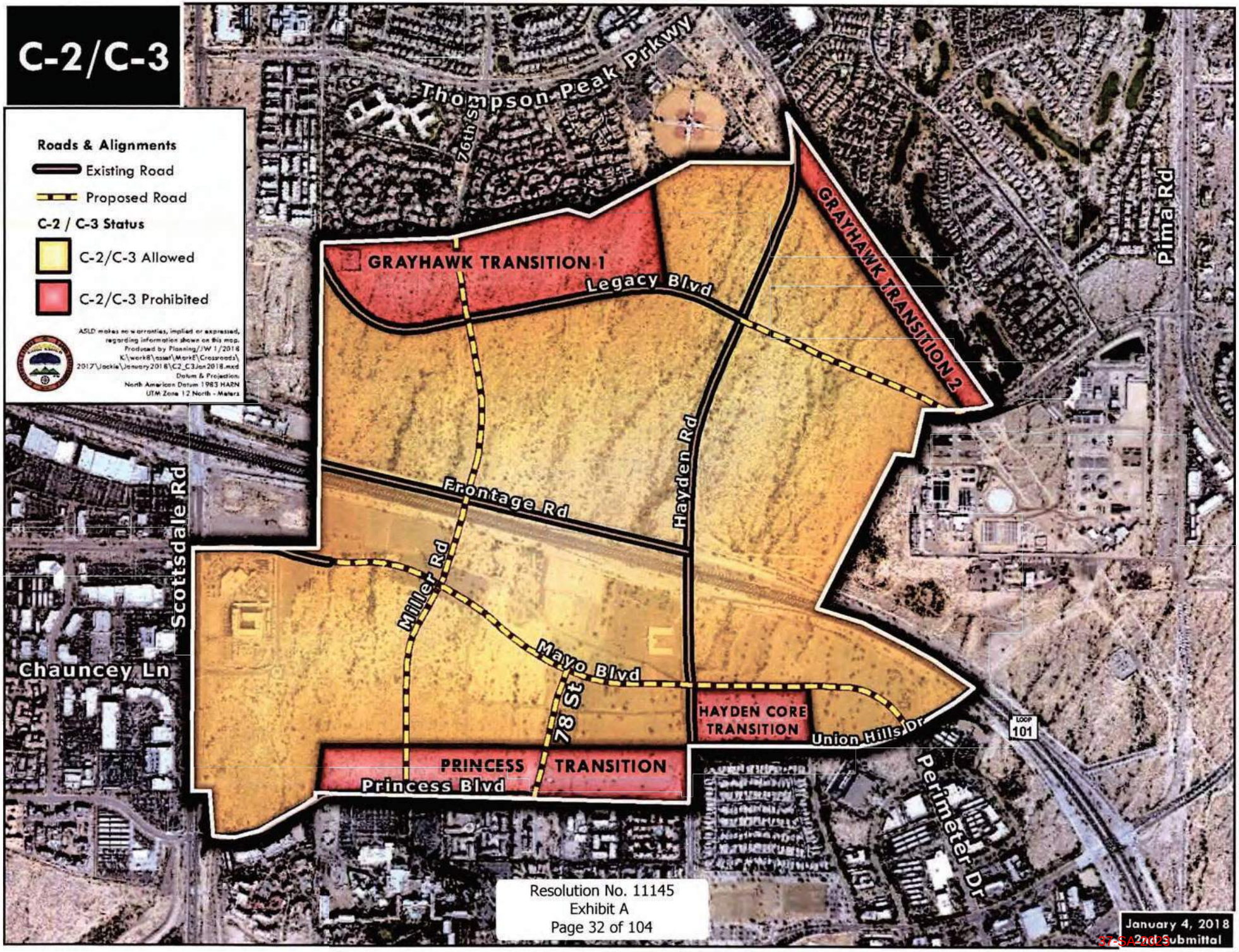
Page 31 of 104
January 4, 2018
Submittal


C-2/C-3
Roads & Alignments
Existing Road
Proposed Road
C-2 / C-3 Status
C-2/C-3 Allowed
C-2/C-3 Prohibited
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North American Datum 1983 HARN
UTM Zone 12 North - Meters
Thompson Peak Prkwy
76th St
Pima Rd
GRAYHAWK TRANSITION 1
Legacy Blvd
GRAYHAWK TRANSITION 2
Hayden Rd
Frontage Rd
Scottsdale Rd
Miller Rd
Mayo Blvd
78 St
Chauncey Ln
HAYDEN CORE TRANSITION
Union Hills Dr
LOOP 101
PRINCESS TRANSITION
Princess Blvd
Perimeter Dr
Resolution No. 11145
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January 4, 2018
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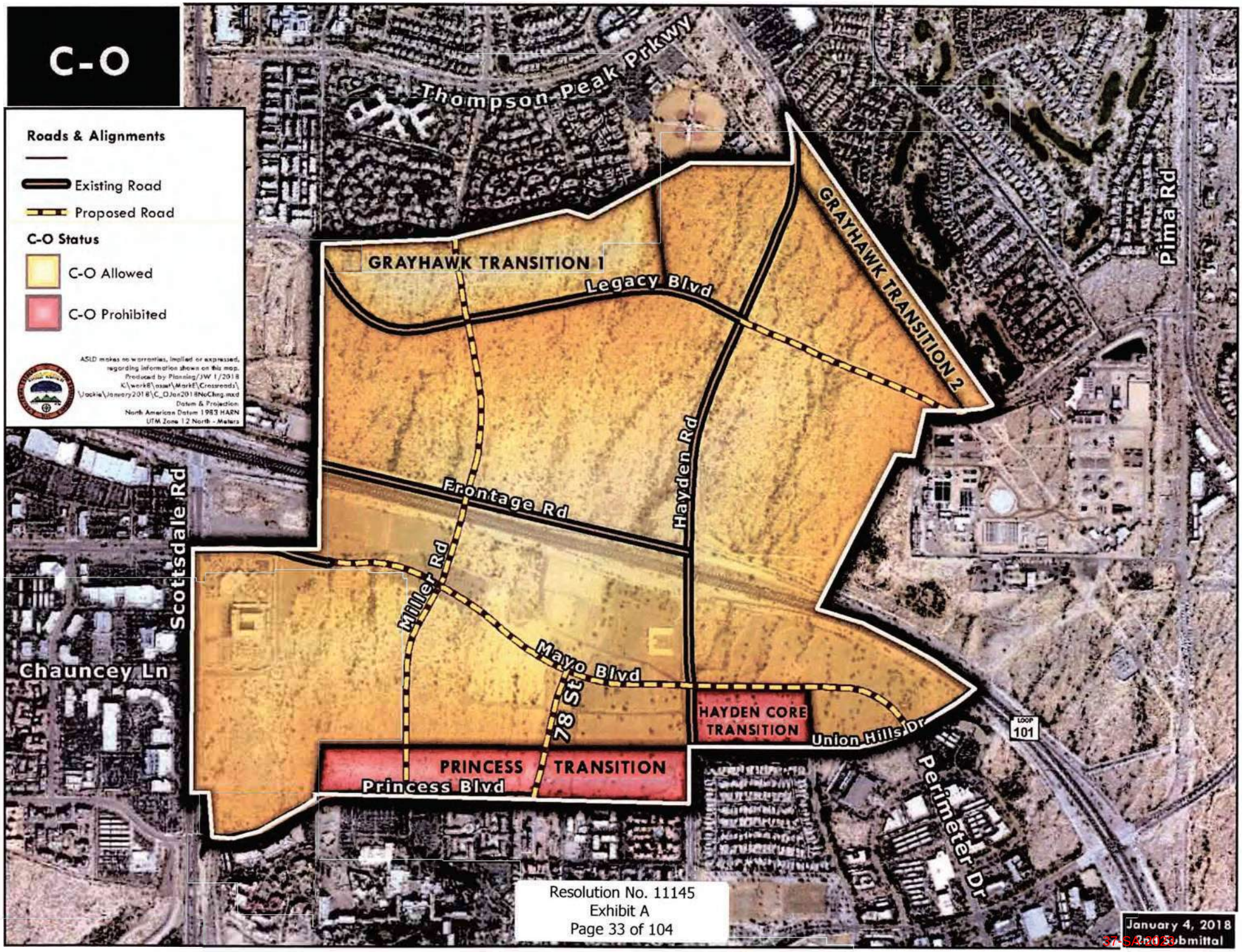
C-O
Roads & Alignments
Existing Road
Proposed Road
C-O Status
C-O Allowed
C-O Prohibited
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HAYDEN CORE TRANSITION
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Resolution No. 11145
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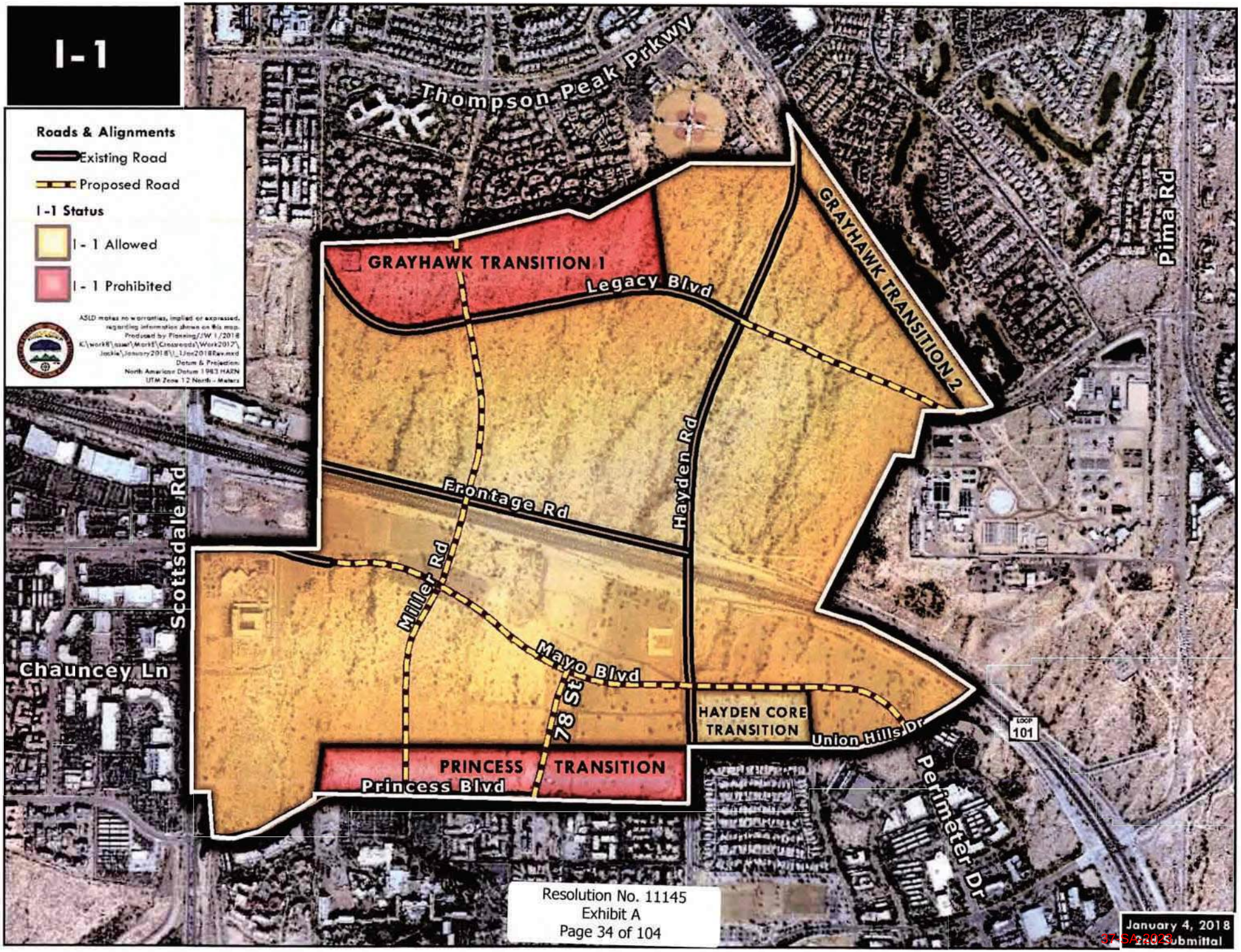
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Roads & Alignments
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Proposed Road
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I - 1 Prohibited
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78 St
HAYDEN CORE TRANSITION
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Princess Blvd
Perimeter Dr
Resolution No. 11145
Exhibit A
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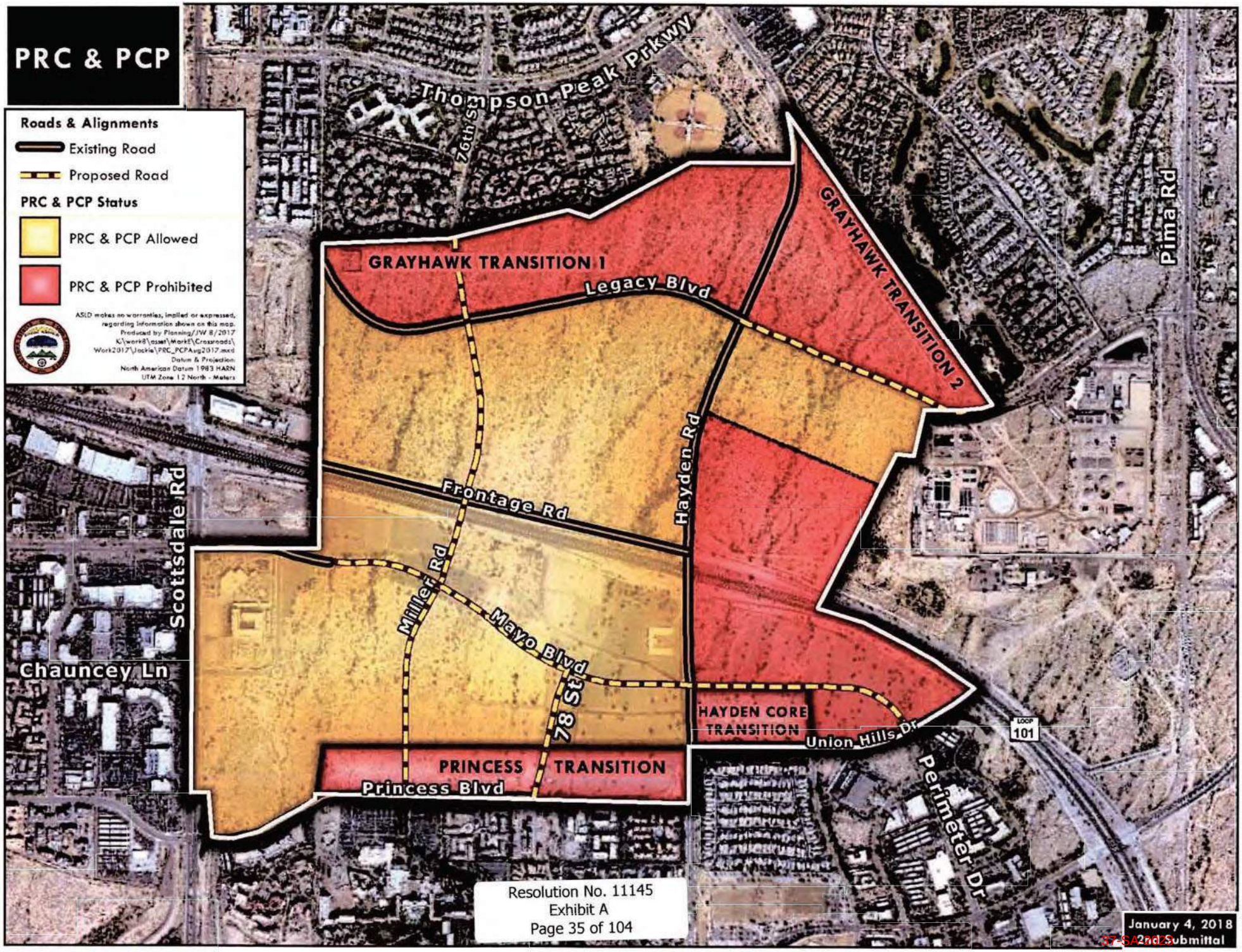
January 4, 2018
1st Submittal


PRC & PCP
Roads & Alignments
Existing Road
Proposed Road
PRC & PCP Status
PRC & PCP Allowed
PRC & PCP Prohibited
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Chauncey Ln
HAYDEN CORE TRANSITION
Union Hills Dr
LOOP 101
PRINCESS TRANSITION
Princess Blvd
Perimeter Dr
Resolution No. 11145
Exhibit A
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January 4, 2018
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Table A.1 Allowable Zoning for Undeveloped Areas within the Crossroads East PCD

Polygon ID	Estimated Parcel Acreage (ac)	R-5 Zoning Allowed [1]	C-2/C-3 Zoning Allowed [1]	C-O Zoning Allowed [1]	I-1 Zoning Allowed [1]	PRC & PCP Zoning Allowed [1]	Development Name
Tributary to the TPC Sewer							
1	16	NA	NA	NA	NA	NA	One Scottsdale
2	6	NA	NA	NA	NA	NA	One Scottsdale
3	60	NA	NA	NA	NA	NA	One Scottsdale
4	61	Y	Y	Y	Y	Y	Unknown/State Lands
5	19	NA	NA	NA	NA	NA	Optima
6	29	Y	Y	Y	Y	Y	Hayden Loop 101 Investors
7	42	Y	Y	Y	Y	Y	Hayden Loop 101 Investors
8	21	Y	Y	Y	Y	Y	Unknown/State Lands
9	18	Y	Y	Y	Y	Y	Unknown/State Lands
10	23	Y	Y	Y	Y	Y	Potential Multi-Family/LTC
11	21	Y	50%	50%	50%	50%	Potential Multi-Family/LTC
12	22	Y	65%	65%	65%	65%	Unknown/State Lands
13	21	Y	Y	Y	Y	Y	Unknown/State Lands
14	NA	NA	NA	NA	NA	NA	Maravilla Phase 3
15	NA	NA	NA	NA	NA	NA	Princess Resort Expansion
16	7	Y	Y	Y	Y	Y	Hayden 50
17	11	Y	N	N	N	N	San Bellara
18	7	Y	N	N	N	N	Hayden 50
19	21	Y	Y	Y	Y	Y	Hayden Loop 101 Investors
20	71	N	75%	75%	Y	N	Axon
21	14	Y	Y	Y	Y	Y	Unknown/State Lands
22	15	Y	N	N	N	N	Hayden 50

Polygon ID	Estimated Parcel Acreage (ac)	R-5 Zoning Allowed [1]	C-2/C-3 Zoning Allowed [1]	C-O Zoning Allowed [1]	I-1 Zoning Allowed [1]	PRC & PCP Zoning Allowed [1]	Development Name
Tributary to the Crossroads Lift Station							
23	23	Y	N	Y	N	N	Unknown/State Lands
24	28	Y	N	Y	N	N	Unknown/State Lands
25	53	Y	Y	Y	Y	N	Unknown/State Lands
26	40	Y	Y	Y	Y	N	Unknown/State Lands
27	27	Y	N	Y	Y	N	Unknown/State Lands
28	29	Y	Y	Y	Y	Y	Cavasson
29	33	Y	Y	Y	Y	Y	Cavasson
30	24	Y	Y	Y	Y	Y	Cavasson
31	31	Y	Y	Y	Y	Y	Cavasson
32	106	40%	Y	Y	Y	40%	Potential Future Medical
Tributary to the Pima Road Sewer							
33	68	NA	NA	NA	NA	NA	Unknown/State Lands
34	33	NA	NA	NA	NA	NA	Unknown/State Lands
35	55	NA	NA	NA	NA	NA	Epicenter
36	63	NA	NA	NA	NA	NA	Epicenter

Notes:

(1) From Crossroads East Development Plan Amendment (Revised April 26, 2018). Percentages of allowed zoning are based on the estimated parcel acreage and the zoning maps in Appendix A, including considerations for zoning transition areas. The "NA" values indicate a parcel was not part of the Crossroads East Development Plan study area.

Abbreviations:

ADF = average daily flow; PHF = peak hour flow; R-5 = Multi-Family Residential District; C-2/C-3 = Central Business District; C-O = Commercial Office District; I-1 = Industrial Park District; PRC = Planned Regional Center; PCP = Planned Airpark Core Development; ac = acre(s); gpm = gallons per minute; gpad = gallons per acre per day; BOD = basis of design report

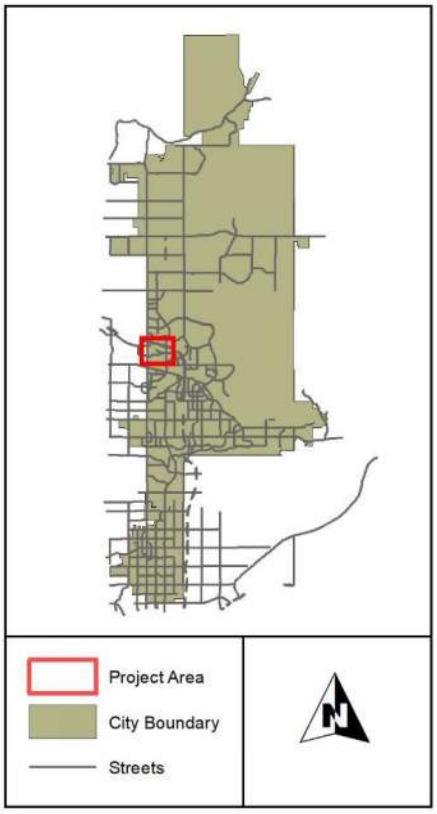
Appendix B

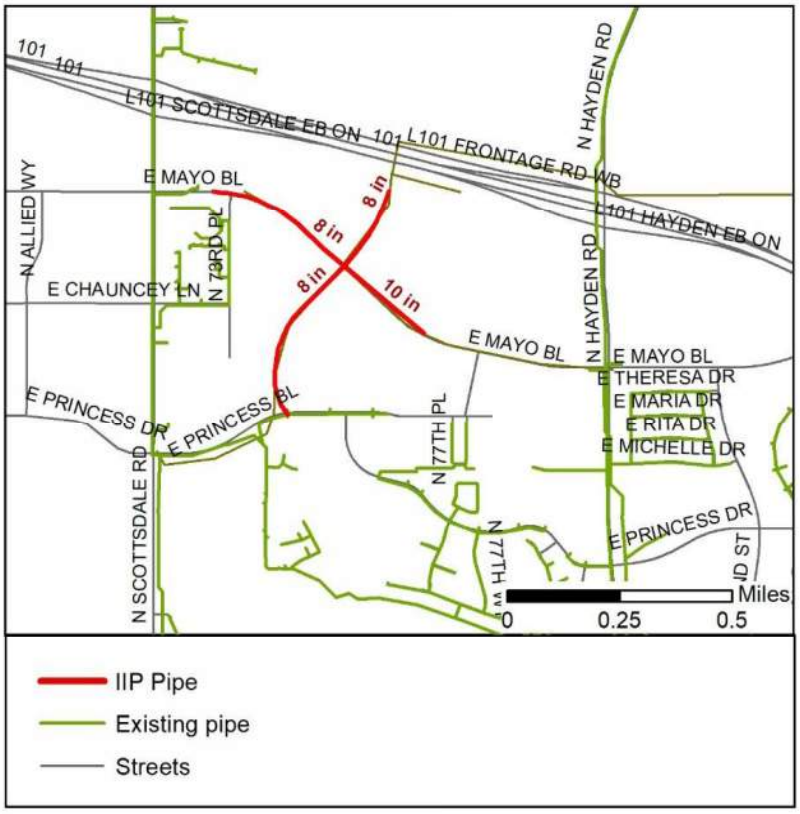
2021 IIP PROJECTS IN STUDY AREA

System:	Wastewater	**Estimated Start:**	2025
Project Number:	WW IIP-004		
Project Name:	Mayo Boulevard Sewer Improvements		
Location:	Mayo Boulevard from Scottsdale Road to Princess Boulevard		
Project Reference:	2021 IIP		
Description:	Construct new 8-inch diameter and 10-inch diameter sewer mains to provide capacity for current and future connections.		

Project Details:

Project Elements		**Project Cost**
Sewer Lines, 8-inch diameter, 4,930 linear feet; 10-inch diameter, 1,220 linear feet.		$4,466,000
Cost Allocation		
Existing Equivalent Demand Units (EDUs) – Rates	0%	$0
EDUs through year 2030 – Development Fees	33%	$1,464,000
EDUs beyond year 2030 – Development Fees	67%	$3,002,000





System: Wastewater **Estimated Start:** 2025

Project Number: WW IIP-005

Project Name: Greenway Hayden Loop Sewer Improvements

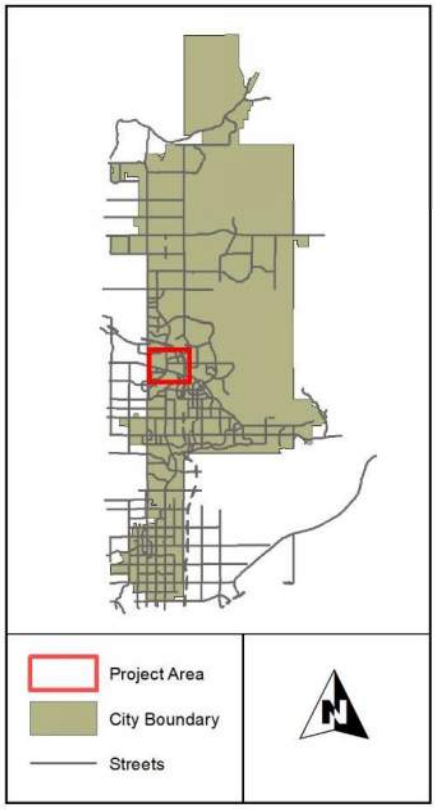
Location: North of Frank Lloyd Wright Boulevard between Pima Road and Princess Drive

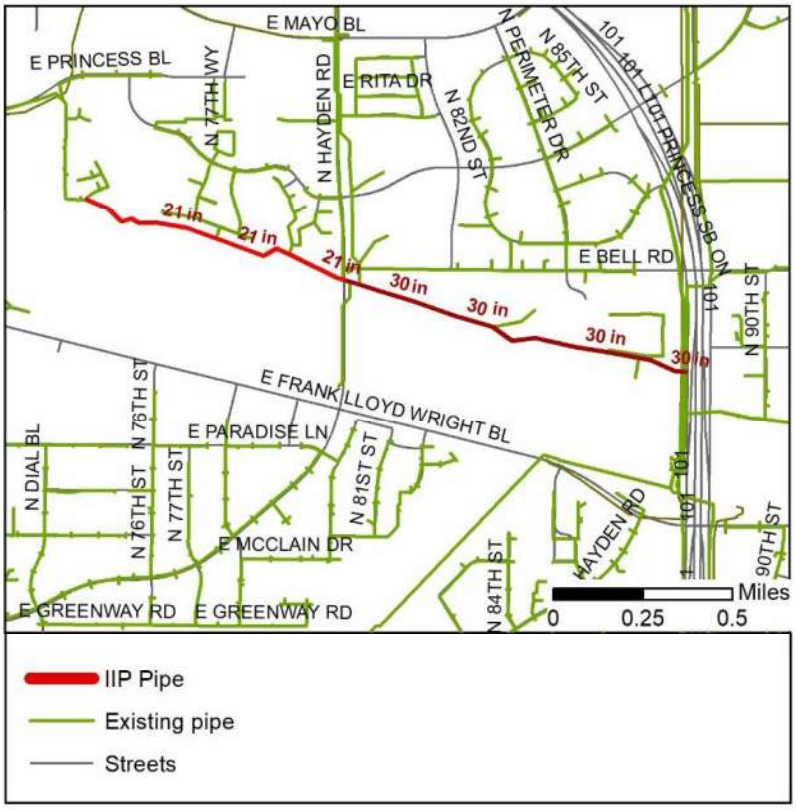
Project Reference: 2021 IIP

Description: Upsize existing 18-inch diameter sewer by replacing with a 21-inch diameter and 30-inch diameter sewer to provide capacity for current and future connections. The model predicted depth to diameter (d/D) is greater than 0.75 by year 2025.

Project Details:

Project Elements		Project Cost
Sewer Lines, 21-inch diameter, 4,125 linear feet; 30-inch diameter, 5,300 linear feet.		$11,932,000
Cost Allocation		
Existing Equivalent Demand Units (EDUs) – Rates	50%	$5,983,000
EDUs through year 2030 – Development Fees	10%	$1,208,000
EDUs beyond year 2030 – Development Fees	40%	$4,741,000





Appendix B: Geotechnical Investigation Report

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers
A UES Company



REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: Mayo/Miller Gravity Main

LOCATION: Scottsdale Road to Princess Drive
Scottsdale, Arizona

CLIENT: Kimley-Horn and Associates, Inc.

PROJECT NO: 230363SA

DATE: April 14, 2023

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers
A UES Company

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2.2 .... Geologic Conditions 2
2.3 .... Seismic Design Parameters 2
2.4 .... General Subsurface Conditions 3

3.0 ANALYSIS AND RECOMMENDATIONS 3

3.1 .... Analysis 3
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4.0 GENERAL 7

APPENDIX - Field and Laboratory Data



1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed sewer gravity main pipeline from Scottsdale Road to Princess Drive in Scottsdale, Arizona.

We understand that construction will consist of 4,600 linear feet of new gravity sewer main pipeline along the Mayo Boulevard and Miller Road Alignments. The diameter of the pipeline will range from 18 to 27 inches with a maximum depth of approximately 20 feet below existing grade. Construction will consist of installing the pipeline using traditional open trench method.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The pipeline will follow the alignments of Mayo Boulevard and Miller Road. Mayo Boulevard is only partially developed on the west end and Miller Road is undeveloped at this time. The alignment passes through mostly native desert land with future mixed use to be developed. There is an auto dealership on the southeast corner of Scottsdale Road. Areas along the north side of the alignment have been partially graded with asphalt millings for event parking. Refer to the following historical aerials:

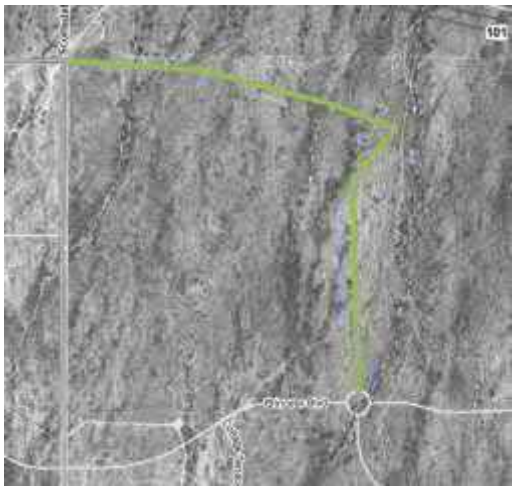


Figure 2.1.1 Dated 1969



Figure 2.1.2 Dated 2002



Figure 2.1.3 Dated 2013



Figure 2.1.4 Dated 2022

"Historical Aerial Photography," *ArcGIS Web Application*. [Online]. Available: https://gis.maricopa.gov.

2.2 Geologic Conditions

The site is **not** located near areas that have undergone considerable subsidence due to groundwater removal. Areas of subsidence are known to produce earth fissuring, which has affected areas several miles west of the site. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known earth fissures are located near the intersection of North 40th Street and East Lupine Avenue, several miles southwest from this site and east of the intersection of East Cactus Road and Frank Lloyd Wright Boulevard, several miles southeast of this site. Based on local experience, subsidence and earth fissures historically have **not** been a problem in this area.

2.3 Seismic Design Parameters

The project area is in a seismic zone that is considered to have low historical seismicity. Earthquakes in eastern Arizona are quite rare. The seismicity of the Scottsdale area has had only two magnitude 3.0 events in over 100 years. Liquefaction is not considered a concern as groundwater generally exceeds 50 feet below ground surface.

Although borings were not advanced to 100 feet, based on the nature of the subsoils encountered in the test locations and the geology in the area, Site Class Definition, Class D should be used for design of the structures supported at ground surface. In addition, the following seismic parameters may be used for design (based on ASCE 7-16 (IBCE 2018), utilizing the ATC Hazards Tool):

Table 2.3.1 Seismic Parameters

MCE[1] spectral response acceleration for 0.2 second period, S_S:	0.222g
MCE[1] spectral response acceleration for 1.0 second period, S_1:	0.073g
Site coefficient, Fa:	1.6
Site coefficient, Fv:	2.4
MCE[1] spectral response acceleration adjusted for site class, S_{MS}:	0.355g
MCE[1] spectral response acceleration adjusted for site class, S_{M1}:	0.176g
5% Damped spectral response acceleration, S_{DS}:	0.237g
5% Damped spectral response acceleration, S_{D1}:	0.117g
NOTE 1: MCE = maximum considered earthquake	

2.4 General Subsurface Conditions

Subsoils along the alignment consist primarily of layers of silty sand, clayey sand, silty clayey sand, and sandy lean clay to the termination depths of 31.5 feet below existing grades. In addition, subordinate amounts of gravel were noted in the soil profile and weak degrees of calcareous cementation were noted deeper in the soil profile. The standard penetration resistance test (SPT) values generally range from 5 to 50± blows per foot (bpf) generally increasing with depth. **However, note the loose sandy zone found at boring B-1 at a depth of 5 to ~10 feet deep.** No groundwater was encountered during this investigation. Based on visual and tactile observation, the shallow surface soils were in a 'dry' to 'dry to moist' state at the time of investigation.

Laboratory testing indicates in-situ dry density of the soils in the range of 102.5 to 105.5 pcf with water contents of 4.7 to 11.8 percent at the time of investigation. Liquid limits are in the range of 23 to 42 percent with plasticity indexes in the range of 6 to 24 percent. Percent passing the #200 sieve ranges from 26.2 to 66.1 percent. The upper clayey soils exhibit volume increase (**swell**) due to wetting of **2.1 percent** when compacted to moisture and density levels normally expected during construction.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates data subsoils at the site are generally favorable for the support of the proposed pipeline on typical bedding required for the piping and trench loading conditions. However, relatively loose soil conditions were noted to depth of at least 5 feet or deeper (**10 feet**

at B-1). If the pipeline profile lies within a potential loose/soft soil segment, some additional pipe bedding or increased manhole bases may be warranted. See discussion below. Variable soil conditions were encountered in the soil borings, including sandy soils. Any structures required can be supported on shallow spread foundations**.**

Bedding, haunching and initial backfill should be selected per the requirements of the pipe materials used and the trench loading conditions; see Section 3.8. Groundwater is not expected to be a factor in pipeline design or construction.

3.2 Site Preparation

Given the anticipated depth of the sewer line, the excavations will penetrate soft/loose soils layers but should terminate in medium to very dense layers. **Note the presence of loose soils extending down to 10 feet at boring B-1. These loose soils will present some challenges to maintain open vertical cuts and install shoring if that method is chosen by the contractor.** See Section 3.5 regarding preparation of the pipe trench before placing bedding.

Care should be taken during excavation not to endanger nearby elements such as roadways, utilities, etc. **Depending on proximity**, existing elements may require shoring, bracing or underpinning to provide structural stability and protect personnel working in the excavation. The need for shoring or bracing is a means and methods decision by the contractor.

Excavations to the levels expected will likely terminate within similar soil types. All excavations must comply with current governmental regulations including the current OSHA Excavation and Trench Safety Standards. Based on this limited soil data, the soils would be classified as Type C. This will require side slopes for open-cut excavation to cut back at 1½:1 (horizontal to vertical). It is recommended that a representative of the Geotechnical Engineer or the Contractor Qualified party examine the cut slope during excavation to reduce the risks posed by unstable conditions. The slopes should be protected from erosion due to run-off or long-term surcharge at the slope crest. Construction equipment, building materials, excavated soil and vehicular traffic should not be allowed within 10 feet or one-third the slope height, whichever is greater, from the top of slope. Adjustments to the recommended slopes may be necessary due to wet zones, loose strata and other conditions not observed in the borings. Shotcrete or soil stabilizer on the slope face may be useful in preventing erosion due to run-off and/or drying of the slope.

A representative of the geotechnical engineer shall examine the exposed subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials. Fill placement and quality should be as defined in the "Fill and Backfill" section of this report.

3.3 Foundation Design

If is recommended that any vault/manhole structures be founded on a spread footing or mat type foundation bearing on medium dense or denser native soils at an invert depth on the order of 9 feet below grade. A recommended allowable bearing capacity of **4,000 psf** can be utilized for design. This bearing capacity refers to the total of all loads, dead and live, and is a net pressure. It may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. Positive drainage away from any proposed structure must always be maintained.

Estimated settlements under design loads are on the order of less than 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content.

3.4 Lateral Pressures

The following **static** equivalent fluid lateral pressure values may be utilized for the proposed construction. As usual these are modeled as a right triangle pressure distribution (assumes level backfill, no surcharge loading, and above the water table):

Active Pressures	
Unrestrained Walls	35 pcf
Restrained Walls	50 pcf
Passive Pressures	
Continuous Footings	300 pcf
Spread Footings	350 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. **If/where softer stiff/loose soil conditions are encountered in the upper 5 to 10 feet, over-sized thrust blocks are recommended where needed or use mechanically restrained joints as specified by the pipeline engineer. For thrust block design by the pipeline engineer, it is recommended to use a lateral bearing capacity of 1,500 psf for thrust block calculations in the upper 5 feet, not the 3000 psf noted in MAG Detail 380. The higher value is suitable in deeper dense soils zones.**

3.5 Bedding, Backfill, and Fill

The native soils are suitable for trench backfill (above any required bedding and initial granular backfill) and roadway fill. The trench backfill should be moisture conditioned, placed in suitable lifts and mechanically compacted as specified. **Water settling is not recommended.** Pipe bedding should meet the project specifications as specified by the governing municipality. Special granular pipe bedding or cementitious slurry meeting MAG Standard Specifications Section 728 for Controlled Low Strength Material (CLSM) may be required depending on the pipe materials and trench loading conditions.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 40 percent passing the #200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent. Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Manhole and Minor Structures - Below footing level	100
B.	Pavement/Sidewalk Subgrade or Fill	95
C.	Utility Trench Backfill – native soils	95 (full depth)

Under any roadways, the backfill above the top of any pipe shall meet the requirements of MAG Standard Specification Section 601, Type I backfill using a MAG specified aggregate base or concrete slurry. **To reduce trench settlement potential, all fill under roadways should be compacted to 95 percent full depth increasing to 100 percent for top two feet when using granular fill.**

Accurate prediction of the amount of construction water necessary for compaction is not possible due to the varying factors. These include variable natural soil moisture, seasonal changes in moisture content, air temperature and wind speed that impact evaporation. The optimum moisture contents reported on the moisture-density relations data is based on the minus #4 materials. It will be corrected downward depending on the percentage of rock (plus #4 fraction) in the matrix. For ADOT highway projects, a range of 80 to 100 gallons per cubic yard, for winter to summer months respectively, is typically recommended.

The value for the Modulus of Soil Reaction Value (E') is dependent on the pipe backfill material utilized, the laying conditions and pipe backfill compaction. Based on the soil test data and field observations, the following Modulus of Soil Reaction Value (E') values may be used.

Table 3.5.1 Modulus of Soil Reaction (E')

Pipe Backfill Material	Compaction (%)	E' (psi)	Comments
Native Fill	95	2,000	1,2
Granular Fill	95	3,000	1,3
Undisturbed Loose Native Soils	N/A	500	4

Note:

1. Standard Proctor maximum dry density (ASTM D-698).
2. Must meet Fill and Backfill specifications. Assumes well mixed 3-inch minus native soils obtained from pipe trench/excavation. Must meet the following Unified Soil classification: (1) fine-grained soils with Liquid limit<50% and medium to no plasticity (CL, ML, ML-CL) and more than 40% retained on #200 sieve; or (2) coarse-grained soils with fines (GM, GC, SM, SC) containing more than 12% fines.
3. Must meet fill and backfill specifications. Assumes 3-inch minus coarse-grained soils with little or no fines (GW, GP, SW, SP) containing less than 12% fines or soils meeting the requirements of M.A.G. section 702 Table 702-1Type A or Type B select.
4. Assumes firm/loose to very stiff/medium dense native soils.

3.6 Corrosion

Laboratory values for soil pH were on the order of 8.6, with soil resistivities on the order of 2,300 Ohm-Centimeters. Chloride concentrations were 48 ppm. Based on the soil classification, test results and local experience, the soils will be mildly corrosive to direct buried metal. Accordingly, suitable pipe wall thickness and corrosion protection should be selected per the lifetime requirements of the project.

Sulfate concentrations were 20 ppm. This indicates a negligible potential for sulfate attack. Subsurface concrete should use Type I or II cement, which is readily available and used in the area.

4.0 GENERAL

The scope of this investigation and report includes only regional published considerations for seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, not any site-specific studies. The scope does not include any considerations of hazardous releases or toxic contamination of any type.

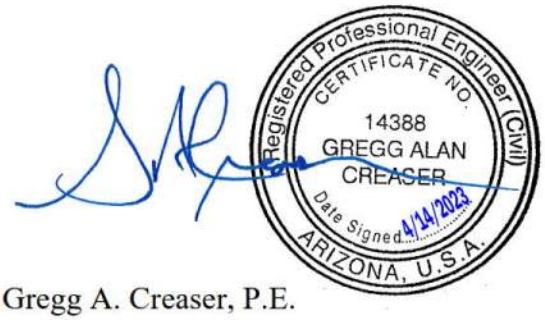
Our analysis of data and the recommendations presented herein assume that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, LLC



Keith R. Gravel, P.E.



Gregg A. Creaser, P.E.

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers
A UES Company

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF SOIL BORINGS

TABULATION OF TEST DATA

MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

CORROSIVE TEST DATA

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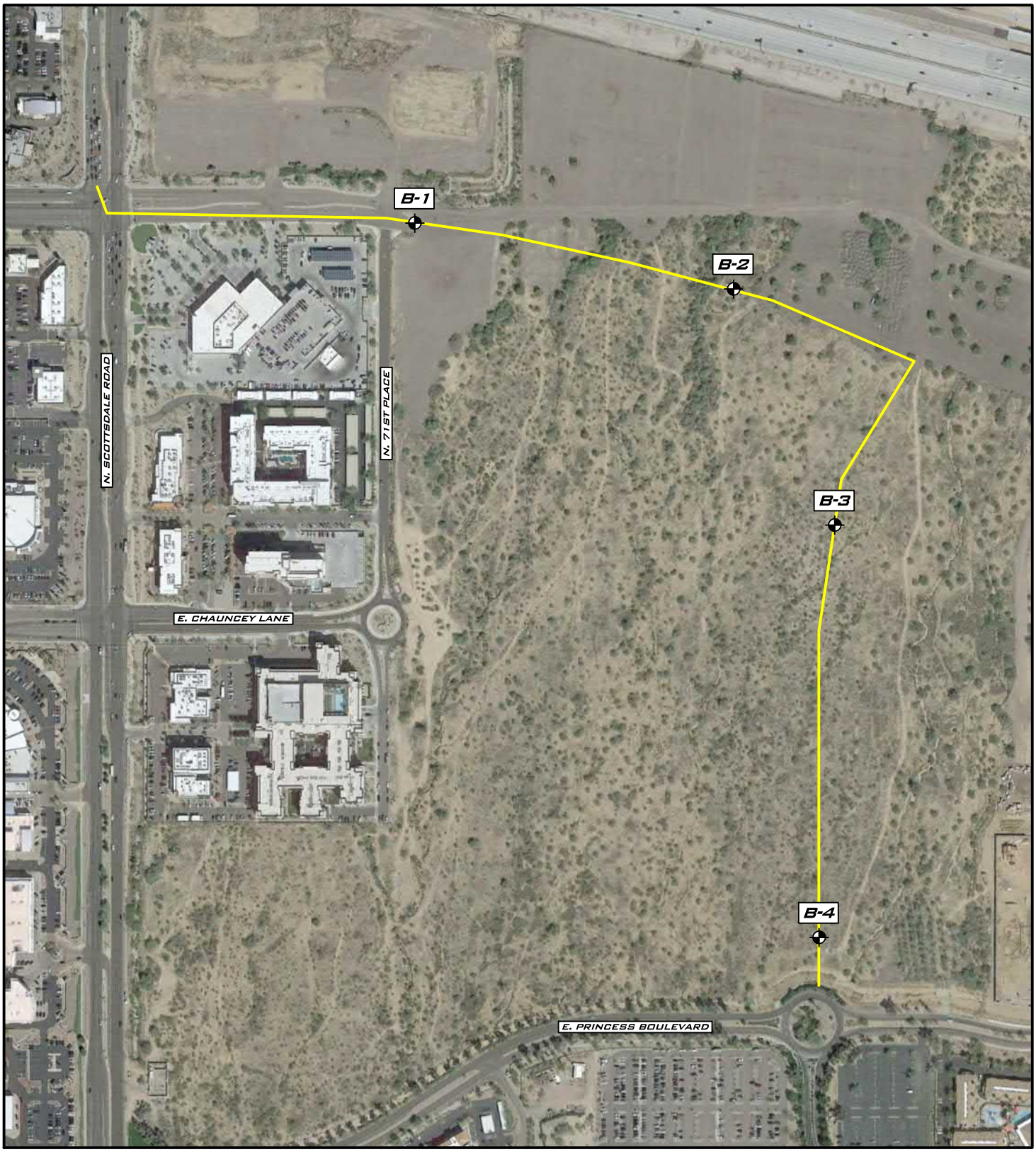
FIELD AND LABORATORY INVESTIGATION

On March 17, 2023 soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our staff engineer, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME-75 drill rig utilizing 7-inch diameter hollow stem flight augers. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests for classification and pavement design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Compression tests were performed on a selected ring sample in order to estimate settlements and determine effects of inundation. All field and laboratory data are presented in this appendix.



- APPROXIMATE SOIL BORING LOCATIONS

N

DR: JS	CHK: XXX	DATE: 03/09/23	PROJECT NO.: 230363SA	SHEET: 1 OF 1

SOIL BORING LOCATION PLAN

MAYO/MILLER GRAVITY MAIN
SCOTTSDALE ROAD TO PRINCESS DRIVE
SCOTTSDALE, ARIZONA

SPEEDIE AND ASSOCIATES
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37-SA-2023

SOIL LEGEND

SAMPLE DESIGNATION		DESCRIPTION	
	AS	**Auger Sample**	A grab sample taken directly from auger flights.
	BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
	S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
	RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
	LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
	ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
	--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

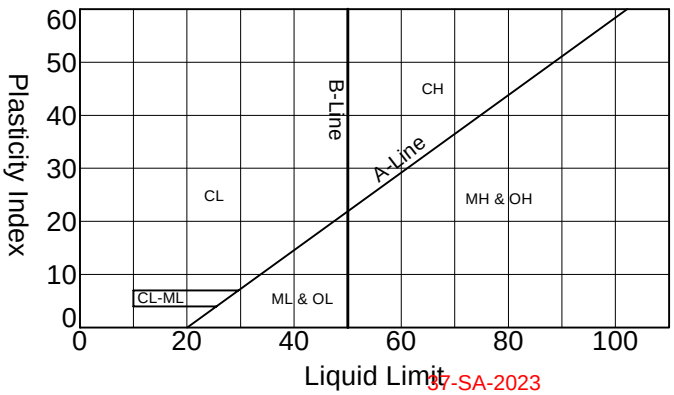
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ◆	mm	Sieve Size ◆
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×

◆U.S. Standard ×Clear Square Openings



Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Medium Dense Brown SILTY SAND (SM-Dry to Moist) with Little Gravel	S-1	2.5	NT	NT	
5	Loose Brown SILTY, CLAYEY SAND (SC/SM-Moist) with Little Gravel	S-2	6.0	NT	NT	
10	Medium Dense CLAYEY SAND (SC-Dry to Moist) with Trace Gravel	S-3	11.5	NT	NT	
		BS-4	15.0	NT	NT	
15	Trace Weak Calcareous Cementation	RS-5	16.0	11.8	104.6	
20	Dense, Little Gravel, Weak Calcareous Cementation	S-6	21.5	NT	NT	
25	Hard Brown SANDY LEAN CLAY (CL-Dry) with Trace Gravel	S-7	26.5	NT	NT	
30	Dense Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel Interbedded Layers of Silty Sand	S-8	31.5	NT	NT	

Penetration Resistance Blows per Foot: 0, 25, 50

End of Boring

Boring Date: **3-17-23**
Field Engineer/Technician: **R. Bainum**
Driller: **J. Garcia**
Contractor: **Southlands Engr.**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-1**

Mayo/Miller Gravity Main

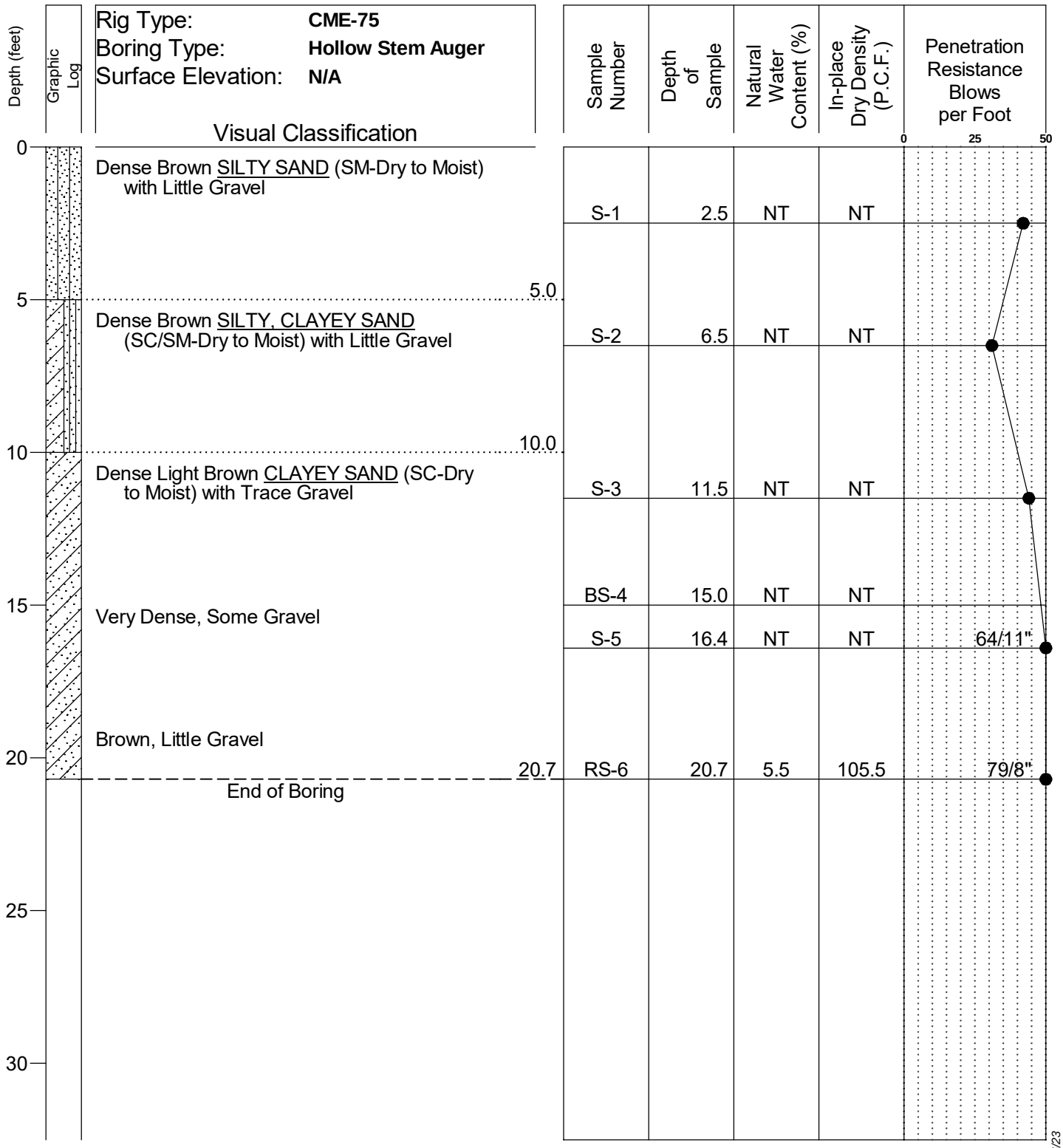
Scottsdale Road to Princess Drive

Scottsdale, Arizona

Project No.: **230363SA**

37-SA-2023

_SPEEDIE 230363SA.GPJ GENGEO.GDT 4/5/23



Boring Date: **3-17-23**
Field Engineer/Technician: **R. Bainum**
Driller: **J. Garcia**
Contractor: **Southlands Engr.**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-2**

Mayo/Miller Gravity Main

Scottsdale Road to Princess Drive

Scottsdale, Arizona

Project No.: **230363SA**

37-SA-2023

_SPEEDIE 230363SA.GPJ GENGEO.GDT 4/6/23

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Medium Dense Light Brown SILTY SAND (SM-Dry to Moist) with Little Gravel	S-1	2.5	NT	NT	
5	Medium Dense Light Brown SILTY, CLAYEY SAND (SC/SM-Dry to Moist) with Little Gravel	RS-2	6.0	4.7	102.5	
10	Hard Light Brown SANDY LEAN CLAY (CL-Dry to Moist) with Trace Gravel	BS-3	10.0	NT	NT	
		S-4	11.3	NT	NT	80/10"
15		S-5	16.5	NT	NT	58/12"
20	Very Dense Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel	S-6	20.8	NT	NT	50/4"
25	End of Boring					
30						

Penetration Resistance Blows per Foot: 0, 25, 50

5.0
10.0
18.5
20.8

Boring Date: **3-17-23**
Field Engineer/Technician: **R. Bainum**
Driller: **J. Garcia**
Contractor: **Southlands Engr.**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-3**

Mayo/Miller Gravity Main

Scottsdale Road to Princess Drive

Scottsdale, Arizona

Project No.: **230363SA**

37-SA-2023

_SPEEDIE 230363SA.GPJ GENGEO.GDT 4/5/23

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Loose Light Brown SILTY, CLAYEY SAND (SC/SM-Dry to Moist) with Little Gravel	S-1	2.5	NT	NT	
5	Very Dense, Weak Calcareous Cementation	S-2	6.3	NT	NT	78/9"
10	10.0	S-3	11.5	NT	NT	60/12"
	Hard Brown SANDY LEAN CLAY (CL-Dry to Moist) with Trace Gravel, Weak Calcareous Cementation					
	12.5					
15	Very Dense Light Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel, Weak Calcareous Cementation	BS-4	15.0	NT	NT	
		S-5	16.3	NT	NT	77/10"
20	Moderate Calcareous Cementation 20.8	S-6	20.8	NT	NT	50/3"
	End of Boring					
25						
30						

Penetration Resistance Blows per Foot: 0, 25, 50

Boring Date: **3-17-23**
Field Engineer/Technician: **R. Bainum**
Driller: **J. Garcia**
Contractor: **Southlands Engr.**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-4**

Mayo/Miller Gravity Main

Scottsdale Road to Princess Drive

Scottsdale, Arizona

Project No.: **230363SA**

37-SA-2023

_SPEEDIE 230363SA.GPJ GENGEO.GDT 4/5/23

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B-1	BS-4	BULK	10.1 - 15.0	NT	NT	42.5	55	77	92	100	34	18	16	SC	CLAYEY SAND
B-1	RS-5	RING	15.0 - 16.0	11.8	104.6	NT	NT	NT	NT	NT	NT	NT	NT		
B-2	RS-6	RING	20.0 - 20.7	5.5	105.5	32.8	43	75	89	100	42	18	24	SC	CLAYEY SAND
B-3	RS-2	RING	5.0 - 6.0	4.7	102.5	NT	NT	NT	NT	NT	NT	NT	NT		
B-3	BS-3	BULK	5.1 - 10.0	NT	NT	26.2	37	58	82	100	23	17	6	SC-SM	SILTY, CLAYEY SAND with GRAVEL
B-4	BS-4	BULK	10.1 - 15.0	NT	NT	66.1	79	91	97	100	30	21	9	CL	SANDY LEAN CLAY

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Mayo/Miller Gravity Main
Scottsdale Road to Princess Drive
Scottsdale, Arizona
Project No. 230363SA

SPEEDIE AND ASSOCIATES

5/9/2023

MOISTURE-DENSITY RELATIONS

PROJECT: Mayo/Miller Gravity Main **PROJECT NO.: 230363SA**

LOCATION: Scottsdale Road to Princess Drive **DATE: 3/17/23**

BORING NO.: B-1 **SAMPLE NO.: BS-4** **SAMPLE DEPTH: 10.1 to 15** **LABORATORY NO.:**

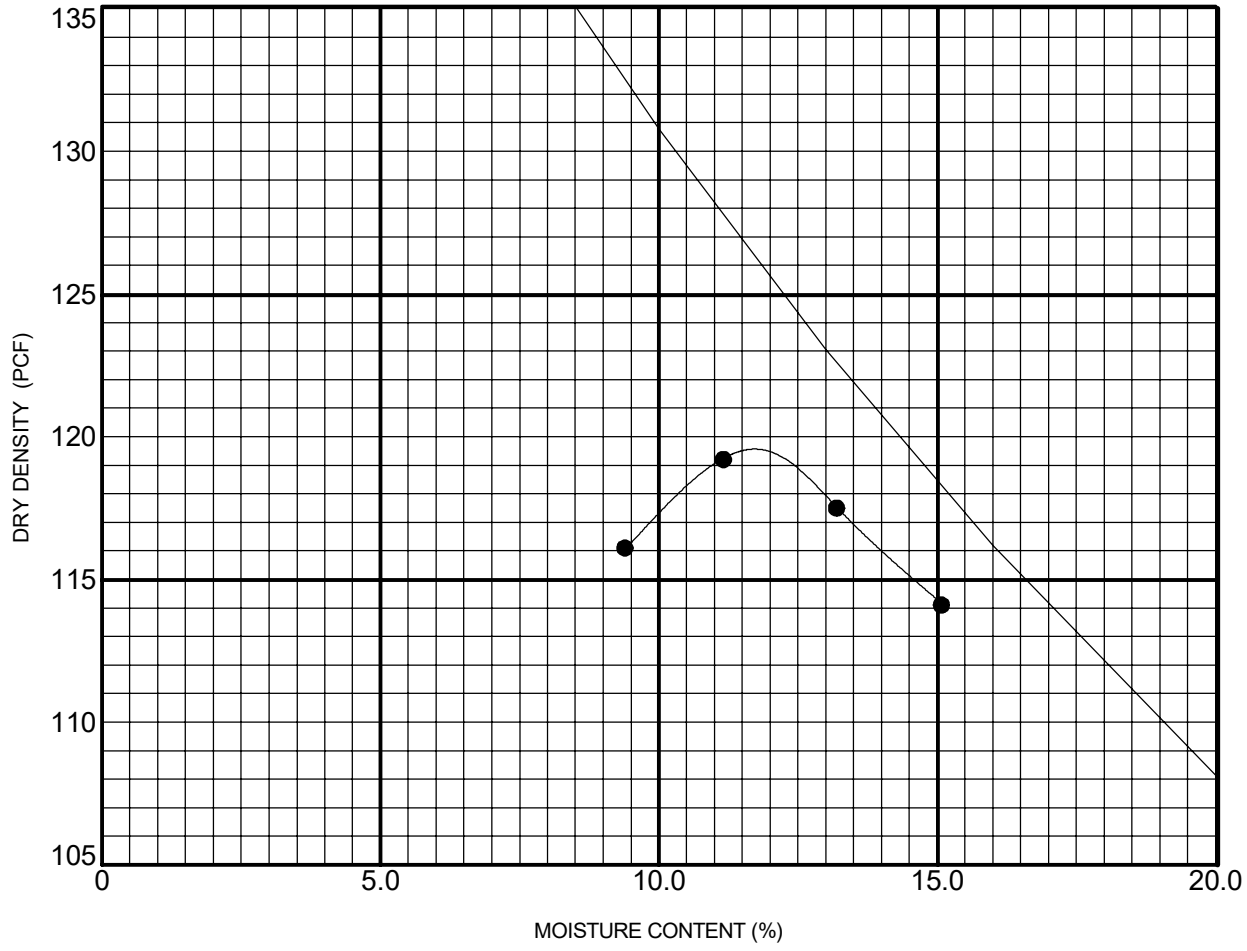
METHOD OF COMPACTION: **D698A**

LIQUID LIMIT: **34** **PLASTIC LIMIT:** **18** **PLASTICITY INDEX:** **15**

CLASSIFICATION: **SC** **ASTM SOIL DESCRIPTION:** **CLAYEY SAND**

MAXIMUM DRY DENSITY: **119.6 PCF**

OPTIMUM MOISTURE CONTENT: **11.7%**



SPEEDIE AND ASSOCIATES

SA-2023

GEOTECH PROCTOR 230363SA.GPJ 4/5/23

MOISTURE-DENSITY RELATIONS

PROJECT: Mayo/Miller Gravity Main **PROJECT NO.: 230363SA**

LOCATION: Scottsdale Road to Princess Drive **DATE: 3/17/23**

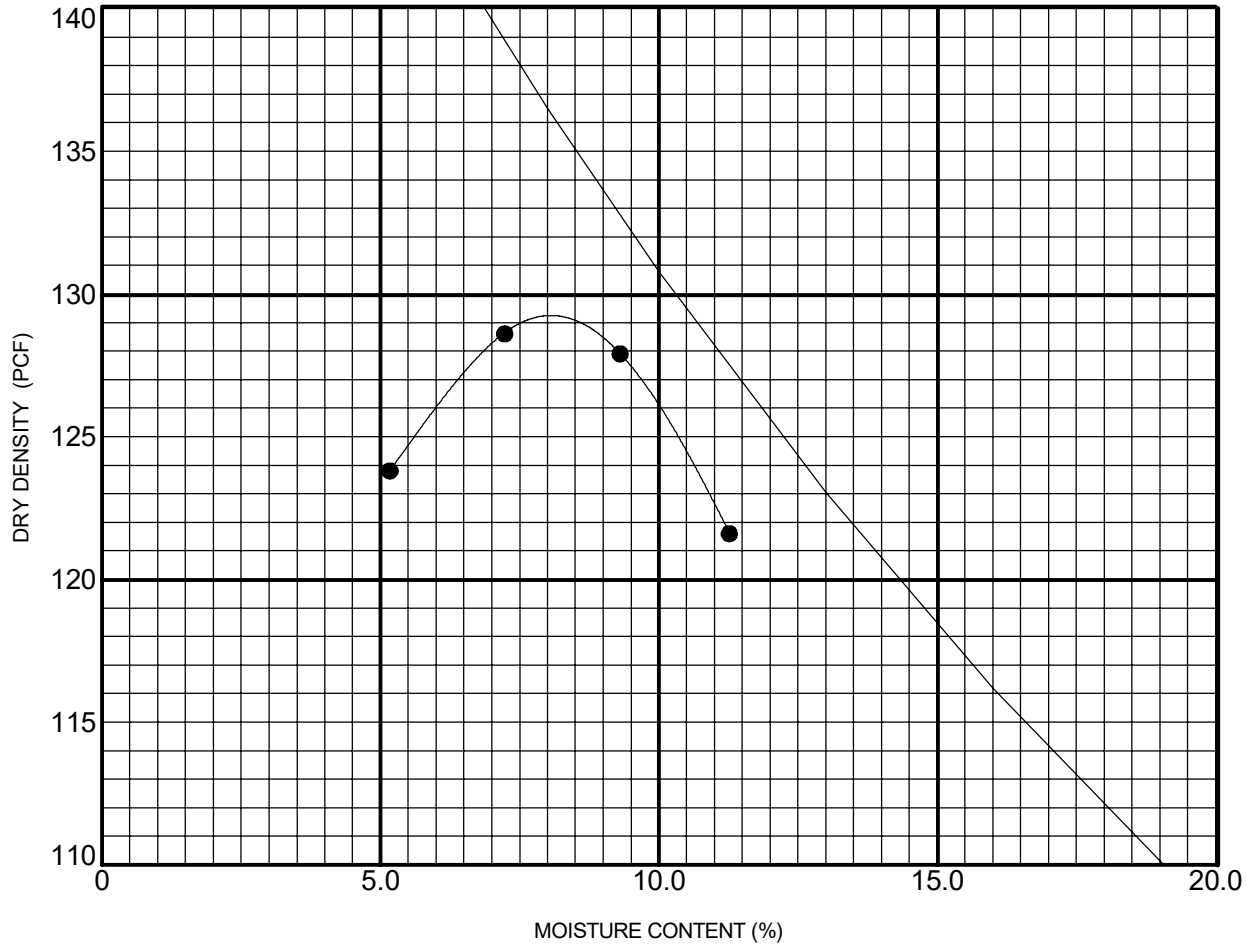
BORING NO.: B-3 **SAMPLE NO.: BS-3** **SAMPLE DEPTH: 5.1 to 10** **LABORATORY NO.:**

METHOD OF COMPACTION: **D698A**

LIQUID LIMIT: **23** **PLASTIC LIMIT:** **17** **PLASTICITY INDEX:** **6**

CLASSIFICATION: **SC-SM** **ASTM SOIL DESCRIPTION:** **SILTY, CLAYEY SAND with GRAVEL**

MAXIMUM DRY DENSITY: **129.3 PCF** OPTIMUM MOISTURE CONTENT: **8.2%**



SPEEDIE AND ASSOCIATES

SA-SA 2023

GEOTECH PROCTOR 230363SA.GPJ 4/5/23

SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
B-1, BS-4	15.0	119.6	11.7	113.8	9.7	95.2	16.3	100	2.2

Mayo/Miller Gravity Main
Scottsdale Road to Princess Drive
Scottsdale, Arizona
Project No. 230363SA

SPEEDIE AND ASSOCIATES

SWELL TEST 230363SA.GPJ GENGEO.GDT 4/5/23

CORROSIVE TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	PERCENT FINER #200 SIEVE	pH	RESISTIVITY (Ohm-Centimeters)	SULFATE (SO4) (ppm)	CHLORIDE (CL) (ppm)	SULFIDE (+ or -)	REDOX (millivolts)	UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
B-1	BS-4	BULK	10.1 - 15.0	42.5	8.6	2300	20.3	48	NT	NT	SC	CLAYEY SAND

Sheet 1 of 1

Mayo/Miller Gravity Main
Scottsdale Road to Princess Drive
Scottsdale, Arizona
Project No. 230363SA

SPEEDIE AND ASSOCIATES

TABOFLAB REDOX-SULFIDE 230363SA.GPJ GENGEO.GDT 4/5/23

Appendix C: Hydraulic Model Results

Model Results – Gravity Mains

ID	Label	Start Node	Invert - Start (ft)	Stop Node	Invert - Stop (ft)	Length (ft)	Slope Calculated (%)	Diameter (in)	Manning's n	Velocity (ft/s)	Flow (gpm)	Capacity Full Flow (gpm)	$d_{Flow}/D_{Diameter}$
486	P-8	MH-15	1,576.24	MH-54	1,574.64	90.9	1.7596	15	0.013	7.44	2,963	3,846	0.66
560	P-10	MH-14	1,576.72	MH-15	1,576.34	23.6	1.6103	15	0.013	7.12	2,963	3,679	0.68
562	P-6	MH-75	1,588.69	MH-14	1,576.82	576.1	2.0606	15	0.013	8.17	2,963	4,162	0.63
443	P-50	MH-16	1,573.39	MH-17	1,572.97	229.7	0.1829	27	0.013	3.79	3,989	5,944	0.54
444	P-58	MH-17	1,572.87	MH-18	1,572.38	293.7	0.1668	27	0.013	3.64	3,989	5,677	0.56
445	P-46	MH-18	1,572.28	MH-19	1,571.81	184.5	0.2547	27	0.013	4.14	3,989	7,015	0.51
446	P-49	MH-19	1,571.81	MH-20	1,571.50	175.3	0.1769	27	0.013	3.87	3,989	5,846	0.52
450	P-55	MH-23	1,570.70	MH-24	1,570.05	365.7	0.1778	27	0.013	3.63	3,989	5,860	0.57
451	P-54	MH-24	1,569.95	MH-25	1,569.18	423.4	0.1818	27	0.013	3.62	3,989	5,927	0.57
452	P-56	MH-25	1,569.08	MH-26	1,568.37	405.3	0.1752	27	0.013	3.6	3,989	5,818	0.57
454	P-42	MH-27	1,567.73	MH-28	1,567.27	255.5	0.18	27	0.013	4.17	5,578	5,897	0.66
455	P-38	MH-28	1,567.17	MH-29	1,566.73	243.3	0.1808	27	0.013	4.2	5,578	5,911	0.65
456	P-37	MH-29	1,566.62	MH-30	1,566.18	241.7	0.182	27	0.013	4.21	5,578	5,930	0.64
457	P-4	MH-30	1,566.08	MH-31	1,560.71	365.1	1.4708	27	0.013	8.3	5,578	16,857	0.4
458	P-3	MH-31	1,560.61	MH-32	1,555.16	364	1.4973	27	0.013	8.36	5,578	17,008	0.39
459	P-2	MH-32	1,555.06	MH-33	1,551.14	263.5	1.4876	27	0.013	8.34	5,578	16,953	0.39
487	P-66	MH-54	1,573.54	MH-16	1,573.49	33.1	0.1512	27	0.013	3.19	2,963	5,405	0.52
555	P-53	MH-20	1,571.39	MH-23	1,570.81	327.3	0.1772	27	0.013	3.66	3,989	5,851	0.55
557	P-17	MH-26	1,568.27	MH-74	1,568.21	19.5	0.3082	27	0.013	4.73	5,578	7,717	0.63
558	P-32	MH-74	1,568.11	MH-27	1,567.84	160.3	0.1685	27	0.013	4.34	5,578	5,705	0.63

Model Results – Manholes

ID	Label	Elevation - Rim (ft)	Elevation - Invert (ft)	Depth (ft)	Hydraulic Grade Line (ft)	Sanitary Loads	Is Ever Overflowing?
401	MH-14	1,589.65	1,576.72	0.88	1,577.61	<Collection: 0 items>	FALSE
402	MH-15	1,589.65	1,576.24	0.85	1,577.19	<Collection: 0 items>	FALSE
403	MH-16	1,590.24	1,573.39	1.28	1,574.68	<Collection: 1 item>	FALSE
404	MH-17	1,590.41	1,572.87	1.33	1,574.21	<Collection: 0 items>	FALSE
405	MH-18	1,591.29	1,572.28	1.2	1,573.48	<Collection: 0 items>	FALSE
406	MH-19	1,592.58	1,571.81	1.26	1,573.08	<Collection: 0 items>	FALSE
407	MH-20	1,592.98	1,571.39	1.32	1,572.72	<Collection: 0 items>	FALSE
410	MH-23	1,591.09	1,570.70	1.33	1,572.04	<Collection: 0 items>	FALSE
411	MH-24	1,592.08	1,569.95	1.33	1,571.29	<Collection: 0 items>	FALSE
412	MH-25	1,592.34	1,569.08	1.34	1,570.43	<Collection: 0 items>	FALSE
413	MH-26	1,592.03	1,568.27	1.41	1,569.69	<Collection: 1 item>	FALSE
414	MH-27	1,589.88	1,567.73	1.58	1,569.32	<Collection: 0 items>	FALSE
415	MH-28	1,586.15	1,567.17	1.57	1,568.75	<Collection: 0 items>	FALSE
416	MH-29	1,582.43	1,566.62	1.56	1,568.20	<Collection: 0 items>	FALSE
417	MH-30	1,579.29	1,566.08	0.91	1,567.40	<Collection: 0 items>	FALSE
418	MH-31	1,573.57	1,560.61	0.9	1,561.60	<Collection: 0 items>	FALSE
419	MH-32	1,568.46	1,551.04	4.92	1,556.04	<Collection: 0 items>	FALSE
420	MH-33	1,565.79	1,550.50	1.95	1,552.46	<Collection: 1 item>	FALSE
485	MH-54	1,590.08	1,573.54	1.16	1,575.46	<Collection: 0 items>	FALSE
556	MH-74	1,591.85	1,568.11	1.52	1,569.64	<Collection: 0 items>	FALSE
561	MH-75	1,594.00	1,588.69	0.78	1,589.47	<Collection: 1 item>	FALSE

Model Element ID Map



Appendix D: Pipe Deflection Calculation

Pipe Deflection Calculation

Variable	Value	Description (units)	Notes
D	27	Pipe Diameter (in)	See IIP-004 plans.
H	28	Pipe Cover (ft)	See IIP-004 plans.
γ_s	130	Unit weight of soul overburden lb/ft^3	Conservative value of 130 lb/ft^3 used for evaluation.
D_L	1	Deflection lag factor (unitless)	Per AWWA M45 Section 5.7.3.3.
W_C	25.3	Vertical soil load on pipe (psi)	Per AWWA M45 Section 5.7.3.5, Eq. 5-9.
W_L	0.2	Live load on pipe (psi)	Per AWWA M45 Section 5.7.3.5, Table 5-2. Assumes HS-20 Loading.
K_x	0.1	Bedding coefficient (unitless)	Per AWWA M45 Section 5.7.3.4.
PS	46	Pipe stiffness (psi)	HOBAS stiffness class.
M_s	2,000	Composite soil constrained modulus (psi)	Native Fill from Geotechnical Investigation Report.
Δy/D	**0.0198**	Calculated predicted vertical pipe deflection, fraction of mean diameter (unitless)	AWWA M45 Section 5.7.3, Eq. 5-8
Δy/D (%)	**1.98**	Calculate value as percent (percent)	**Passed**. Manufacturer maximum allowable equal to 4.00%

Excerpts from AWWA M-45 Fiberglass Pipe Design:

$$\frac{\Delta y}{D} = \frac{(D_L W_c + W_L) K_x}{0.149\,PS + 0.061\,M_s} \qquad \frac{\Delta y}{D} = \frac{(D_L W_c + W_L) K_x}{149\,PS + 61{,}000\,M_s} \qquad \text{(Eq. 5-8)}$$

Where:
- D_L = deflection lag factor, dimensionless
- W_c = vertical soil load on pipe, psi
- W_L = live load on pipe, psi
- K_x = bedding coefficient, dimensionless
- PS = pipe stiffness, psi
- M_s = composite soil constrained modulus, psi

Where:
- D_L = deflection lag factor, dimensionless
- W_c = vertical soil load on pipe, N/m^2
- W_L = live load on pipe, N/m^2
- K_x = bedding coefficient, dimensionless
- PS = pipe stiffness, kPa
- M_s = composite soil constrained modulus, MPa

5.7.3.5 Vertical soil load on the pipe W_c. The long-term vertical soil load on the pipe may be considered as the weight of the rectangular prism of soil directly above the pipe. The soil prism would have a height equal to the depth of earth cover and a width equal to the pipe outside diameter.

$$W_c = \frac{\gamma_s H}{144} \qquad W_c = \gamma_s H \qquad \text{(Eq. 5-9)}$$

Where:
- W_c = vertical soil load, psi
- γ_s = unit weight of soil overburden, lb/ft^3
- H = burial depth to top of pipe, ft

Where:
- W_c = vertical soil load, N/m^2
- γ_s = unit weight of soil overburden, N/m^3
- H = burial depth to top of pipe, m

Table 5-2 AASHTO HS-20, HS-25, and Cooper E80 live loads

AASHTO Live Loads		HS-20		HS-25		Coopers E80 Live Loads			
Depth		W_L		W_L		Depth		W_L	
ft	*m*	*psi*	*kPa*	*psi*	*kPa*	*ft*	*m*	*psi*	*kPa*
2	0.6	13.4	92	16.8	116	3	0.9	16	110
2.5	0.8	9.7	67	12.2	84	4	1.2	14.1	97
3	0.9	7.4	51	9.2	63	5	1.5	12.2	84
4	1.2	4.7	32	5.9	41	6	1.8	10.5	72
5	1.5	3.4	23	4.2	29	7	2.1	9	62
6	1.8	2.6	18	3.2	22	8	2.4	7.7	53
8	2.4	1.6	11	2	14	10	3.0	5.7	39
10	3.0	1.1	7.6	1.4	10	12	3.7	4.6	32
12	3.7	0.8	5.5	1.1	7.6	15	4.6	3.4	23
15	4.6	0.6	4.1	0.7	4.8	20	6.1	2.2	15
20	6.1	0.4	2.8	0.5	3.4	25	7.6	1.5	10
28	8.5	0.2	1.4	0.25	1.8	30	9.1	1.1	7.6
40	12.2	0.1	0.7	0.1	0.7	40	12.2	0.6	4.1

NOTE: Cooper E80 as defined by American Railway Engineers and Maintenance-of-Way Association (AREMA) in its *Manual of Railway Engineering*.

Appendix E: Manhole Structural Calculations

Dan Brauch, PE
National Sales Engineer

CELL: 480.665.6098
EMAIL : dan@armorock.com

January 10, 2023

RE: Circular Polymer Manhole Stress Design

To whom it may concern:

Utilizing the American Concrete Pipe Association (ACPA) Design Data 20 (DD20): Circular Precast Manholes methods of determining manhole maximum bury depth and allowable stresses, it is found that the Armorock manholes meet or exceed the pressure capacity of traditional precast concrete manholes with substantial factors of safety seen in round structures.

For more information, please refer to the attached analysis and the ACPA DD20 (Appendix A) also attached to this document.

Please feel free to contact me if you have any questions.

Sincerely,

Dan Brauch, PE
National Sales Engineer

Circular Polymer Concrete Manhole Design:

Design was completed per the American Concrete Pipe Association (ACPA) Design Data 20 (DD20): Circular Precast Manholes. Utilizing the design criteria set in ACPA DD20, the wall thickness of 48", 60", and 72" manholes was completed and confirms that Armorock polymer manholes can withstand the similar maximum depths and allowable bearing stresses utilizing these methods.

The minimum compressive strength for Armorock's polymer concrete is 11,000 psi.
Armorock manufacturers 48" and 60" manholes with a wall thickness of two (2) inches and 72" manholes with three (3) inches wall thickness.

Per ACPA DD20:
**Assuming angle of internal friction is 30 degrees and soil is saturated with water table at grade.*

Radial Pressure Equation

$p = 81.6\ H$

where:
p = total earth and hydrostatic pressure (psf)
H = depth of manhole (feet)

Compressive Stress Equation

$s' = \frac{pD}{2t}$

where:
s' = compressive stress in concrete cross section (psf)
p = total earth and hydrostatic pressure (psf)
D = inside diameter (feet)
t = wall thickness (feet)

$s' = 144s$

where:
s' = compressive stress in concrete cross section (psf)
s = compressive stress in concrete cross section (psi)

Traditional Precast Manholes:

Per ACPA DD20 the allowable stress is equal to 45% of the minimum compressive strength (s) of the concrete mix. D/12 is the minimum thickness for precast manholes sized 48" diameter and larger per ASTM C76.

For precast concrete manholes the maximum height equation can be re-written as:

$$0.45s = \left(\frac{(81.6HD)}{144 * 2 * \frac{D}{12}}\right) \quad ==> \quad 0.45s = 3.4H \quad ==> \quad H = 0.132s$$

where:
s = minimum compressive strength (psi) = *4,000psi minimum for traditional concrete*
H = depth of manhole (feet)
D = Diameter of manhole (feet)
minimum compressive strength for precast = 4,000 psi

The maximum depth for a manhole four (4) feet in diameter or larger with traditional concrete construction is 529 feet.

Polymer Manholes:

Polymer concrete utilizes a thinner wall and a high-performance mix design. Armorock manufactures 48" and 60" manholes with a 2" wall thickness and 72" manholes with a 3" wall thickness.

Substituting for actual wall thickness, the maximum height equation can be rewritten as:

$$0.45s = \left(\frac{(81.6HD)}{144 * 2 * \frac{t}{12}}\right) \quad ==> \quad 0.45s = \frac{3.4HD}{t} \quad ==> \quad H = \frac{0.132ts}{D}$$

where:
s = minimum compressive strength (psi) = 8,2*000 psi minimum for Armorock*
H = depth of manhole (feet)
D = Diameter of manhole (feet)
t = thickness of manhole wall (inches)

The maximum depth for Armorock Polymer manholes with standard wall thickness in 48", 60", and 72" diameters is 195 feet or deeper.

- *48" = 244 feet*
- *60" = 195 feet*
- *72" = 244 feet*

Factors of Safety:

Most manholes will have a depth of less than 50'. For manholes that are 50' deep the radial pressure calculated from equation (4) and is equal to *4,080 psf*

The compressive stress capacity in the polymer manhole is found in Compressive Stress Equation (psf):

$$s' = \frac{pD}{2t} \quad ==> \quad p = \frac{2(0.45s * 144)(\frac{t}{12})}{D}$$

Where:

p = pressure capacity of polymer manhole (psf)

s = minimum stress of polymer concrete (psi)

Allowable compressive stress is 45% of minimum stress of the polymer concrete (s'=.45s)

t = thickness (inches)

D = diameter (feet)

Using this equation, the ultimate pressure capacity of Armorock manholes is:

- *48" = 44,280 psf*
- *60" = 35,424 psf*
- *72" = 44,280 psf*

The ratio between the ultimate pressure capacity and a radical pressure seen can is our effective factor of safety. In this instance a manhole 50' deep or shallower will have a minimum factor of safety of 8 for 48", 60", and 72" diameter manholes.

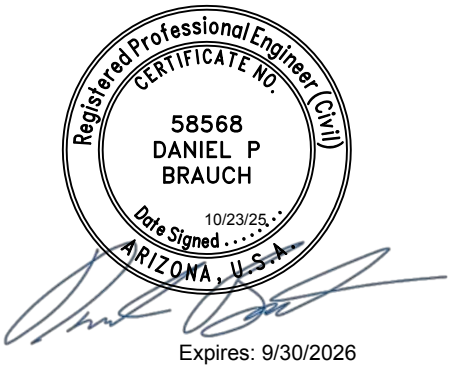
@ 50' Deep

- *48" = 10.8 FS*
- *60" = 8.7 FS*
- *72" = 10.8 FS*

Vertical Dead Loads:

Per ACPA DD20 – two other factors can control the maximum depth of a stack of manhole risers; end bearing at the joints and foundation capacity. Foundation capacity is site specific and ACPA dictates that the end bearing on the joints has been shown to not be a limiting factor. These factors are not considered in this design.

Utilizing the ACPA DD20 it is found that the Armorock manholes meet or exceed the pressure capacity of traditional precast concrete manholes with substantial factors of safety seen in round structures. For more information, please refer to the ACPA DD20 also attached to this document.



Expires: 9/30/2026

Appendix G – Sewer Flow Calculations

18" SEWER MAIN IN MAYO BLVD

Worksheet for Mayo Boulevard East

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.330	%
Normal Depth	12.6	in
Diameter	18.0	in

Results		
Discharge	2,267.43	gal/min
Flow Area	1.3	ft²
Wetted Perimeter	3.0	ft
Hydraulic Radius	5.3	in
Top Width	1.37	ft
Critical Depth	10.4	in
Percent Full	70.0	%
Critical Slope	0.580	%
Velocity	3.82	ft/s
Velocity Head	0.23	ft
Specific Energy	1.28	ft
Froude Number	0.688	
Maximum Discharge	2,913.26	gal/min
Discharge Full	2,708.23	gal/min
Slope Full	0.231	%
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	65.0	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	12.6	in
Critical Depth	10.4	in
Channel Slope	0.330	%
Critical Slope	0.580	%

EXISTING SEWER MAIN

Hayden Road 12" Sewer

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.013	
Channel Slope	1.400	%
Normal Depth	7.8	in
Diameter	12.0	in

Results		
Discharge	1,431.11	gal/min
Flow Area	0.5	ft²
Wetted Perimeter	1.9	ft
Hydraulic Radius	3.5	in
Top Width	0.95	ft
Critical Depth	9.2	in
Percent Full	65.0	%
Critical Slope	0.921	%
Velocity	5.90	ft/s
Velocity Head	0.54	ft
Specific Energy	1.19	ft
Froude Number	1.382	
Maximum Discharge	2,035.21	gal/min
Discharge Full	1,891.97	gal/min
Slope Full	0.801	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	65.0	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.8	in
Critical Depth	9.2	in
Channel Slope	1.400	%
Critical Slope	0.921	%

EXISTING SEWER MAIN

Worksheet for Hayden Road 21" Sewer

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.170	%
Normal Depth	14.7	in
Diameter	21.0	in

Results		
Discharge	2,454.86	gal/min
Flow Area	1.8	ft²
Wetted Perimeter	3.5	ft
Hydraulic Radius	6.2	in
Top Width	1.60	ft
Critical Depth	10.3	in
Percent Full	70.0	%
Critical Slope	0.506	%
Velocity	3.04	ft/s
Velocity Head	0.14	ft
Specific Energy	1.37	ft
Froude Number	0.506	
Maximum Discharge	3,154.07	gal/min
Discharge Full	2,932.09	gal/min
Slope Full	0.119	%
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	65.0	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	14.7	in
Critical Depth	10.3	in
Channel Slope	0.170	%
Critical Slope	0.506	%

37-SA-2023

60 gpm

207 gpm

SALE PARCEL SEWER DEMANDS													
Zoning	Net Area (Acres)	Land Use	Density	Unit	Demand	Demand Unit	Units or Area		Average Day Sewer Demand		Design Peaking Factor	Peak Flow	
									GPD	GPM		GPD	GPM
I-1 PCD	21.07	R&D Office	-	-	0.4	gpd/sf	248,800	SF	99,520	69	3	298,560	~~415~~
I-1 PCD		R&D Cafeteria	-	-	1.2	gpd/sf	11,800	SF	14,160	10	6	84,960	~~118~~
I-1 PCD		R&D Lab + CUP	-	-	-	-	406,300	SF	137,732	96	3	413,196	287
C-2 PCD	27.31	Hospital	0.63	FAR	350	gpd/bed	320	Bed	112,000	78	3	336,000	233
C-2 PCD	9.87	Medical Office	0.21	FAR	0.4	gpd/sf	85,000	SF	34,000	24	3	102,000	71
C-2 PCD	10.92	Health Center	0.39	FAR	0.4	gpd/sf	175,000	SF	70,000	49	3	210,000	146
C-2	2.54	Office	0.3	FAR	0.4	gpd/sf	32,670	SF	13,068	9	3	39,204	27
C-2	5.81	Restaurant	0.12	FAR	1.2	gpd/sf	30,000	SF	36,000	25	6	216,000	150
	77.52								516,480	359		1,699,920	~~1,447~~

1181 gpm

1. Research and Development laboratory sewer demand is based on correspondence with City staff, see Appendix G.
2. Office sewer demand is 0.4 GPD/SF per DS&PM Table 7-1.2.
3. Restaurant sewer demand is 1.2 GPD/SF per DS&PM Table 7-1.2.
4. Design peaking factor is determined by land use per DS&PM Table 7-1.2.
5. Hospital sewer demand is assumed to be 350 GPD/Bed.
6. Health Center and Medical Office sewer demand is assumed to be 0.4 GPD/SF.

WOOD PATEL

TABLE 2
FULL BUILD OUT CONDITION
WASTEWATER MODEL

Project	ASM - Arizona
Location	Scottsdale AZ
Project Number	235526
Project Engineer	Andrew Sanchez, EIT
References	City of Scottsdale Design Standards and Policies Manual (2018)
	Arizona Administrative Code, Title 18, Chapter 9

FROM NODE	TO NODE	AREA (SF)	LAND USE	SEWER AVERAGE DAY FLOW (GPD)	TOTAL AVERAGE DAY FLOW (GPM)	TOTAL AVERAGE DAY FLOW (GPM)	SEWER PEAK FLOW (GPD)	TOTAL PEAK FLOW (GPM)	TOTAL PEAK FLOW (GPM)
Outfall 1 Office									
Office	SSMH#1	226,100	Office	90,440	62.8	62.8	271,320	377	376.8
Cafeteria	SSMH#1	10,700	Cafeteria	12,840	8.9	71.7	77,040	107	483.8
SSMH#1	Outfall 1			--	--	71.7	--	--	483.8
Total Outfall 1				**103,280**	**71.7**		**348,360**	**483.8**	
Outfall 2 Lab									
Lab	MV	359,758	N/A	87,661*	60.9	60.9	262,982	183	182.6
CUP	MV	9,540	N/A	37,550**	26.1	87.0	112,650	78	260.9
MV	SSMH#2			--	--	87.0	--	--	260.9
SSMH#2	Outfall 2			--	--	87.0	--	--	260.9
Total Outfall 2				**125,211**	**87.0**		**375,632**	**260.9**	
Total Flow into 27" Sanitary Sewer Main from Site				**228,491**	**158.7**		**723,992**	**744.7**	

Notes:
MV = Monitouring Vault
* = 80% of "*Lab*" value from Phase 2 Water Demand Design Flows spreadsheet for the Water Basis of Design Report.
** = 50% of "*CUP*" value from Phase 2 Water Demand Design Flows spreadsheet for the Water Basis of Design Report.

Appendix C Water Demand Calculations

Banner Scottsdale Hospital

Dibble Project No. 1 1124152

Sewer Demand Calculations

Factors	
Peak Hour	3

From City of Scottsdale Engineering Design Standards & Policies Manual

Demands		
Land Use	GPD/Unit	Unit
Hospital	350	BED

From City of Scottsdale Engineering Design Standards & Policies Manual

Facility Demand	Land Use	Units		Demand	Avg Day Flow	Avg Day Flow	Peak Day Flow	Peak Day Flow	Peak Day
		NUMBER OF UNITS	UNIT	[GPD/UNIT]	[GPD]	[GPM]	[GPD]	[GPM]	[CFS]
Banner Health Scottsdale									
West Hospital Connection	Hospital	30	BED	350.0	10,500	7	31,500	22	0.05
South Hospital Connection	Hospital	135	BED	350.0	47,250	33	141,750	98	0.22
East Hostpital Connection	Hospital	135	BED	350.0	47,250	33	141,750	98	0.22
Total Banner Scottsdale Hostpital					**105,000**	**73**	**315,000**	**219**	**0.49**

Banner Scottsdale Hospital

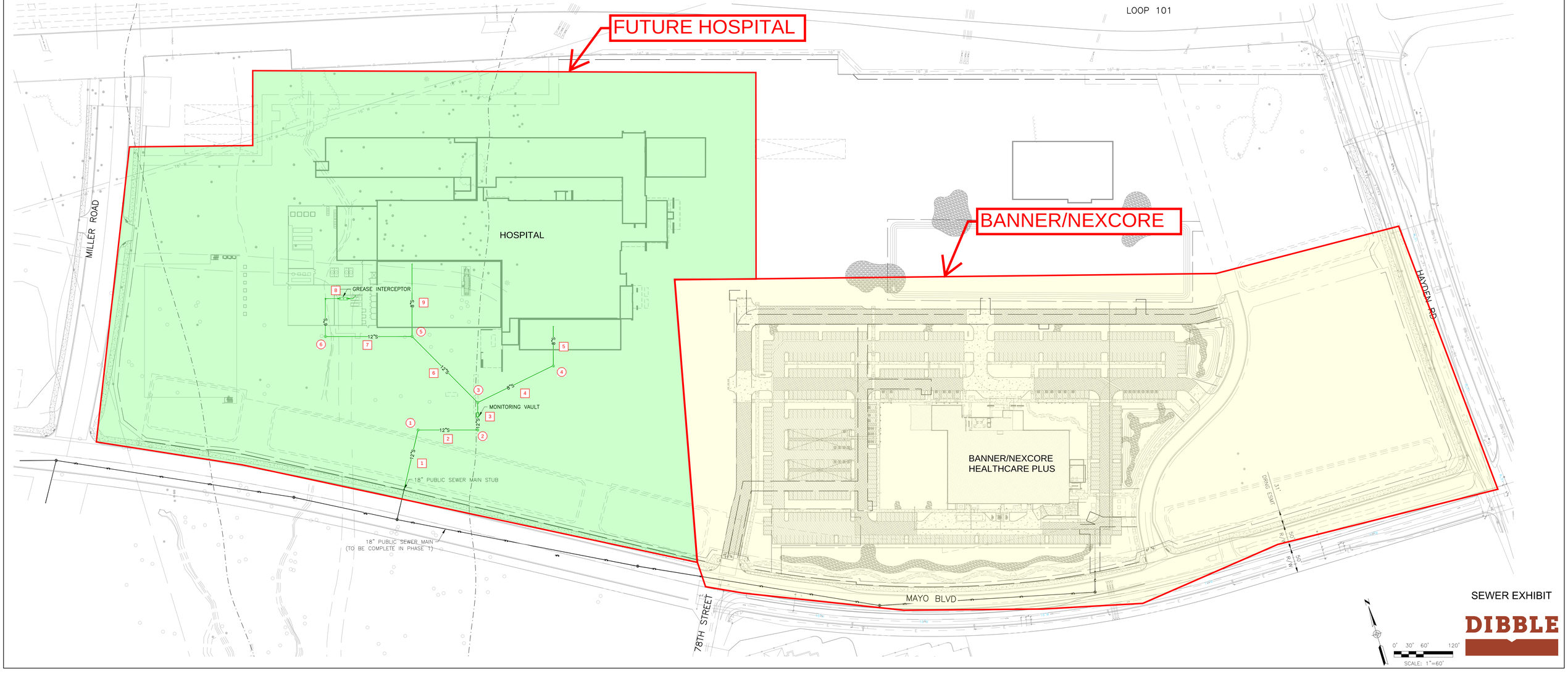
Dibble Project No. 1124152

Sewer Pipe Segment Summary Table

Segment No.	Pipe Diameter (in)	Manning's n	Design Slope [%]	Length [FT]	Downstream Inv Elev [FT]	Upstream Inv Elev [FT]	Downstream Manhole No.	Upstream Manhole No.	d/D = 0.65 Full Pipe Flow [GPM]	Peak Flow [GPM]	Peak Flow Depth [FT]	Peak Flow d/D	Peak Flow Velocity [FPS]
1	12	0.013	4.00	121	1579.30	1584.57	Connection	1	2,430	219	0.18	0.18	5.04
2	12	0.013	1.50	121	1584.57	1586.39	1	2	1,488	219	0.23	0.23	3.55
3	12	0.013	2.00	46	1586.39	1587.41	2	3	1,715	219	0.21	0.21	4.05
4	8	0.013	2.00	171	1587.41	1590.83	3	4	575	98	0.17	0.26	3.09
5	8	0.013	2.00	81	1590.83	1592.00	4	Building	575	98	0.17	0.26	3.09
6	12	0.013	1.50	189	1587.41	1590.25	3	5	1,488	120	0.17	0.17	3.05
7	12	0.013	2.00	176	1590.25	1592.01	5	6	1,718	22	0.07	0.07	2.02
8	6	0.013	1.76	118	1592.01	1594.09	6	Building	254	22	0.09	0.18	2.06
9	8	0.013	2.72	147	1590.25	1594.09	5	Building	681	98	0.15	0.23	3.75

*Note that a monitoring/sampling vault is to be constructed on pipe segment 3.

Appendix D Hydroflow Analysis


FUTURE HOSPITAL
BANNER/NEXCORE
LOOP 101
MILLER ROAD
HOSPITAL
GREASE INTERCEPTOR
MONITORING VAULT
18" PUBLIC SEWER MAIN STUB
18" PUBLIC SEWER MAIN
(TO BE COMPLETE IN PHASE 1)
BANNER/NEXCORE
HEALTHCARE PLUS
MAYO BLVD
78TH STREET
HAYDEN RD
31' DRNG ESMT
50' R/W
50' R/W
SEWER EXHIBIT
DIBBLE
0' 30' 60' 120'
SCALE: 1"=60'

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 23 2025

Segment 1

Circular

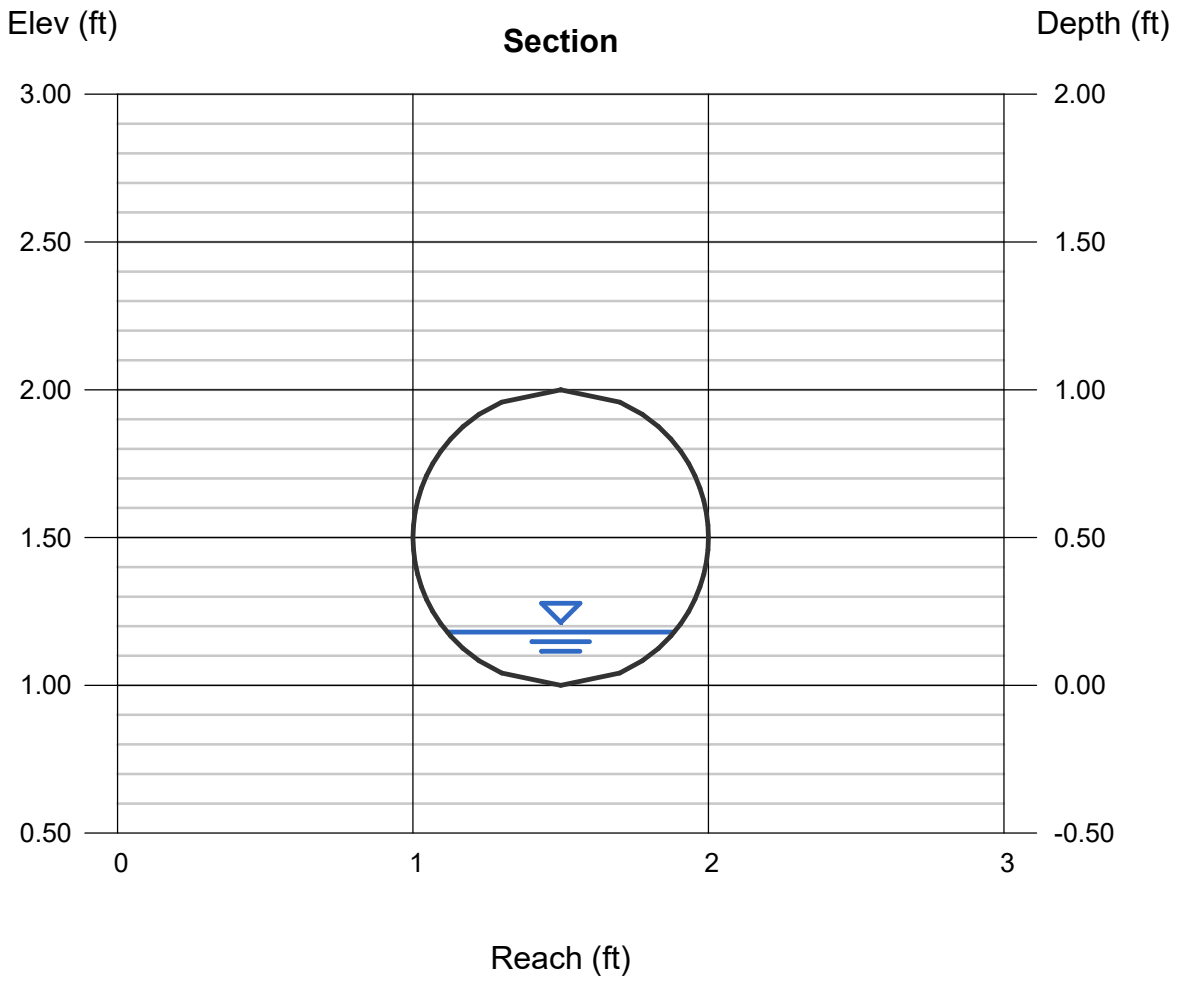
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 4.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.49

Highlighted

Depth (ft)	= 0.18
Q (cfs)	= 0.490
Area (sqft)	= 0.10
Velocity (ft/s)	= 5.04
Wetted Perim (ft)	= 0.88
Crit Depth, Yc (ft)	= 0.29
Top Width (ft)	= 0.77
EGL (ft)	= 0.57



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 23 2025

Segment 2

Circular

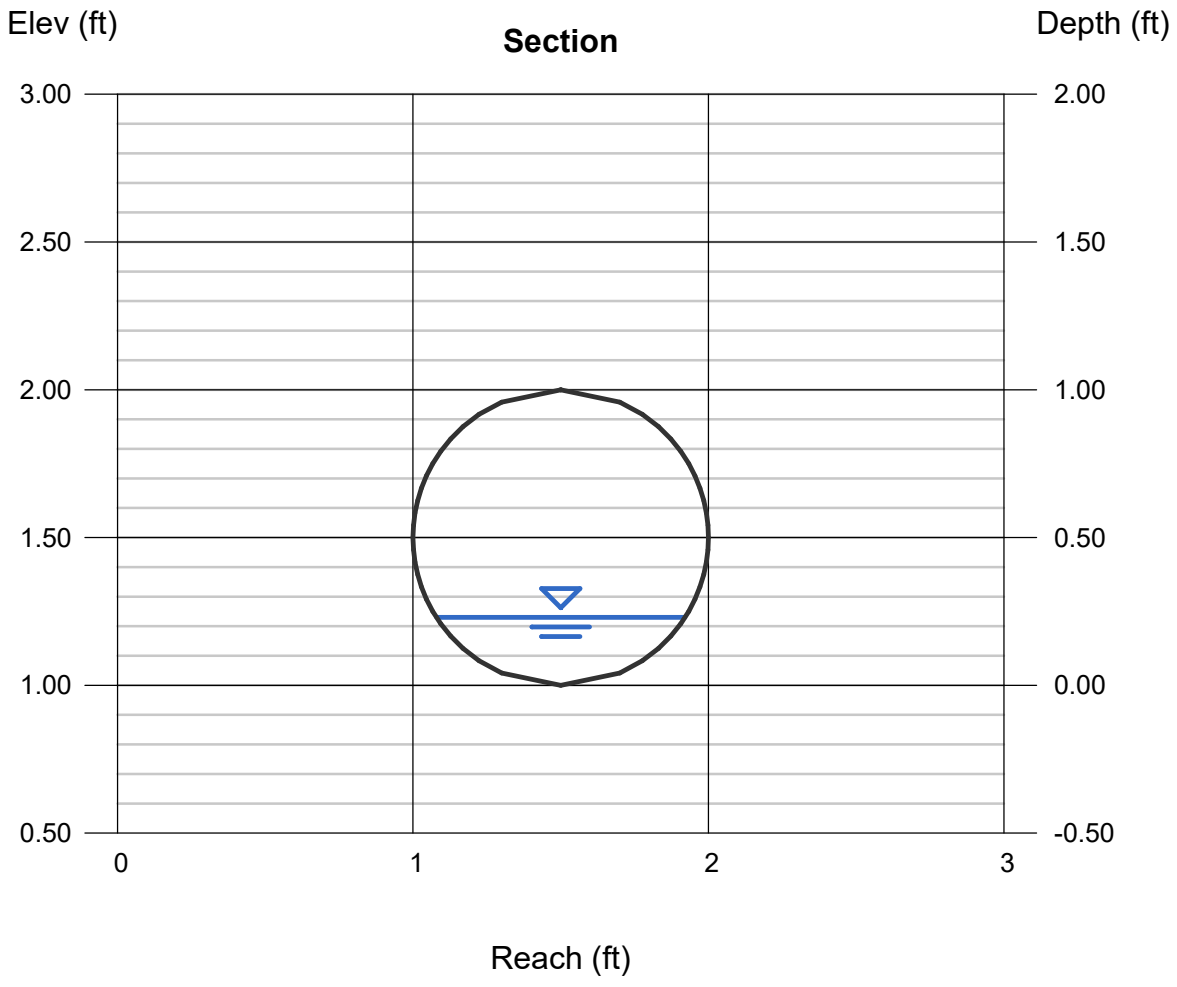
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.49

Highlighted

Depth (ft)	= 0.23
Q (cfs)	= 0.490
Area (sqft)	= 0.14
Velocity (ft/s)	= 3.55
Wetted Perim (ft)	= 1.00
Crit Depth, Yc (ft)	= 0.29
Top Width (ft)	= 0.84
EGL (ft)	= 0.43



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 23 2025

Segment 3

Circular

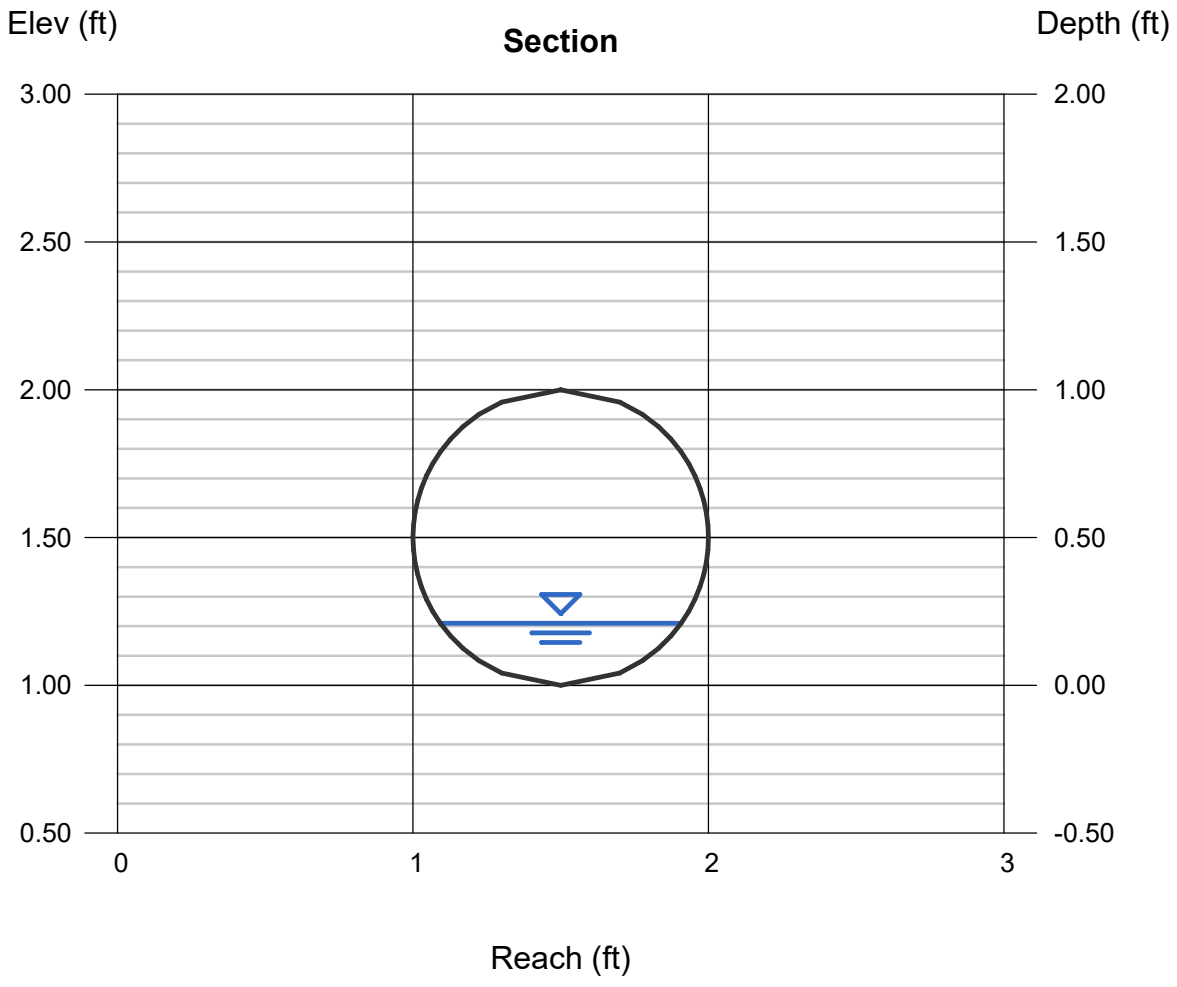
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.49

Highlighted

Depth (ft)	= 0.21
Q (cfs)	= 0.490
Area (sqft)	= 0.12
Velocity (ft/s)	= 4.05
Wetted Perim (ft)	= 0.95
Crit Depth, Yc (ft)	= 0.29
Top Width (ft)	= 0.82
EGL (ft)	= 0.47



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 23 2025

Segment 4

Circular

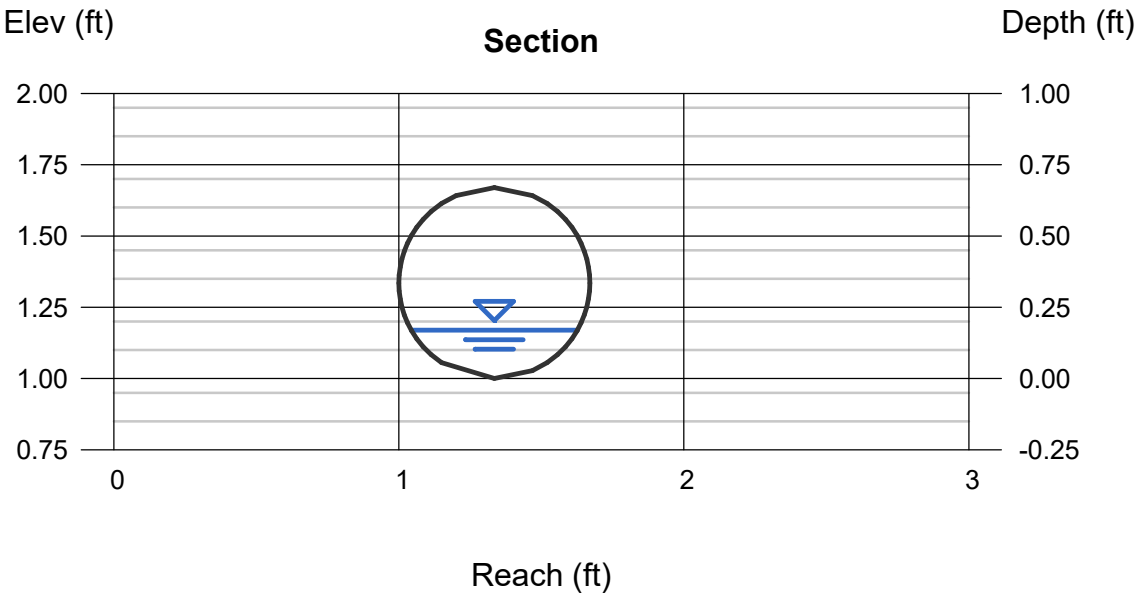
Diameter (ft)	= 0.67
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.22

Highlighted

Depth (ft)	= 0.17
Q (cfs)	= 0.220
Area (sqft)	= 0.07
Velocity (ft/s)	= 3.09
Wetted Perim (ft)	= 0.71
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 0.58
EGL (ft)	= 0.32



Channel Report

Segment 5

Circular

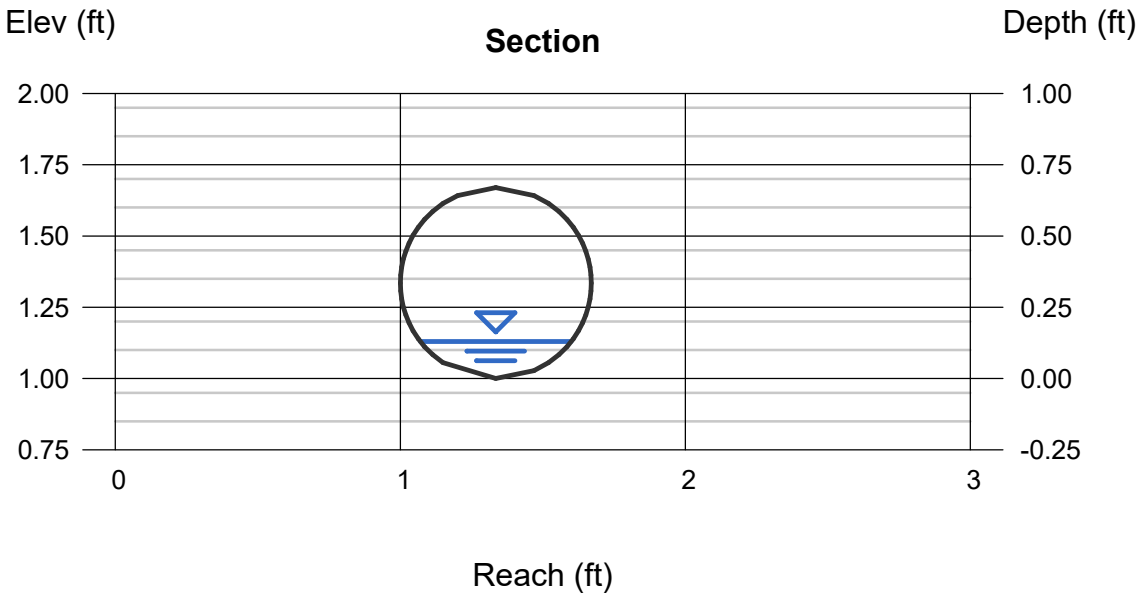
Diameter (ft)	= 0.67
Invert Elev (ft)	= 1.00
Slope (%)	= 6.01
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.22

Highlighted

Depth (ft)	= 0.13
Q (cfs)	= 0.220
Area (sqft)	= 0.05
Velocity (ft/s)	= 4.54
Wetted Perim (ft)	= 0.61
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 0.53
EGL (ft)	= 0.45



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 23 2025

Segment 6

Circular

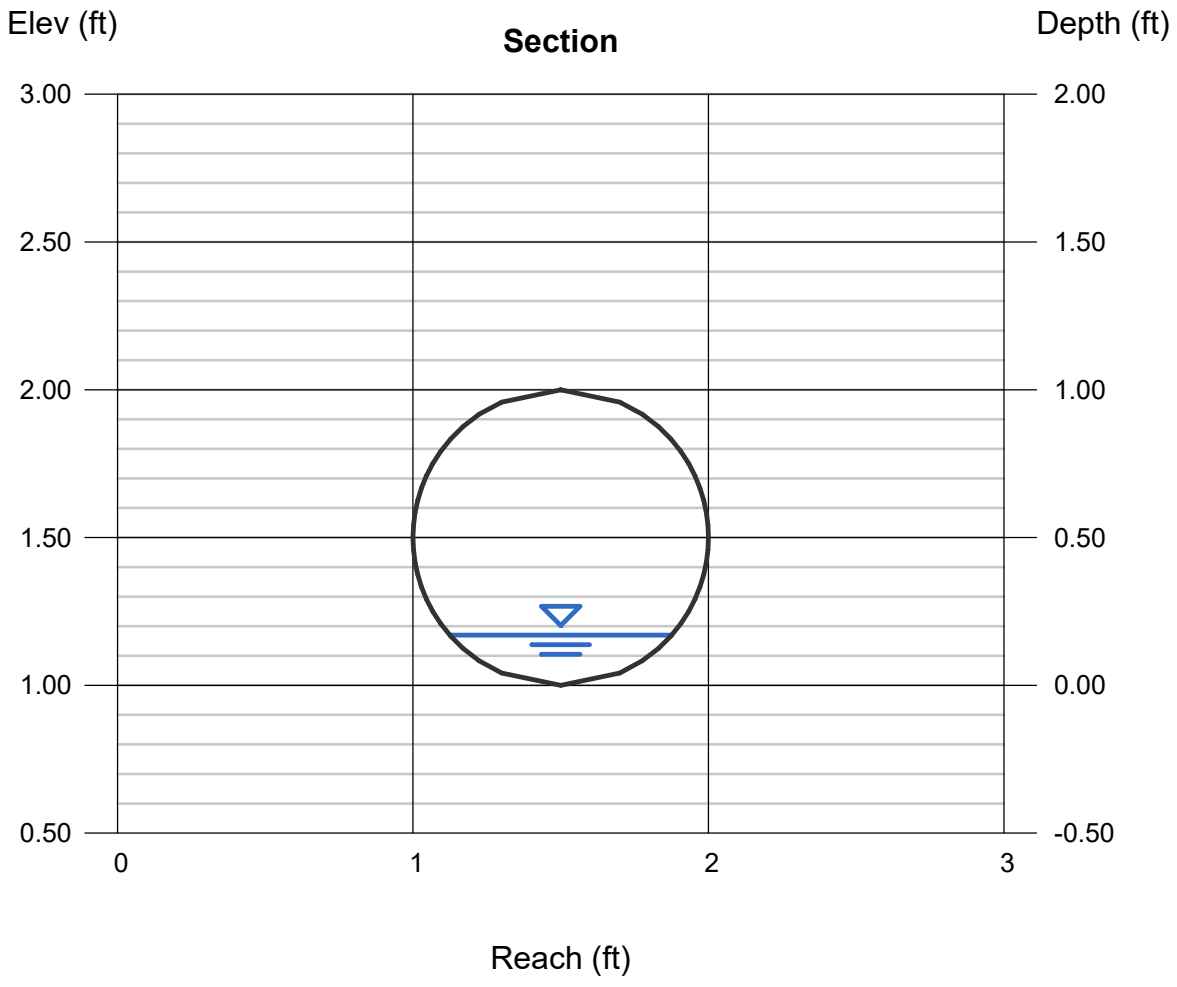
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.27

Highlighted

Depth (ft)	= 0.17
Q (cfs)	= 0.270
Area (sqft)	= 0.09
Velocity (ft/s)	= 3.05
Wetted Perim (ft)	= 0.85
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 0.75
EGL (ft)	= 0.31



Channel Report

Segment 7

Circular

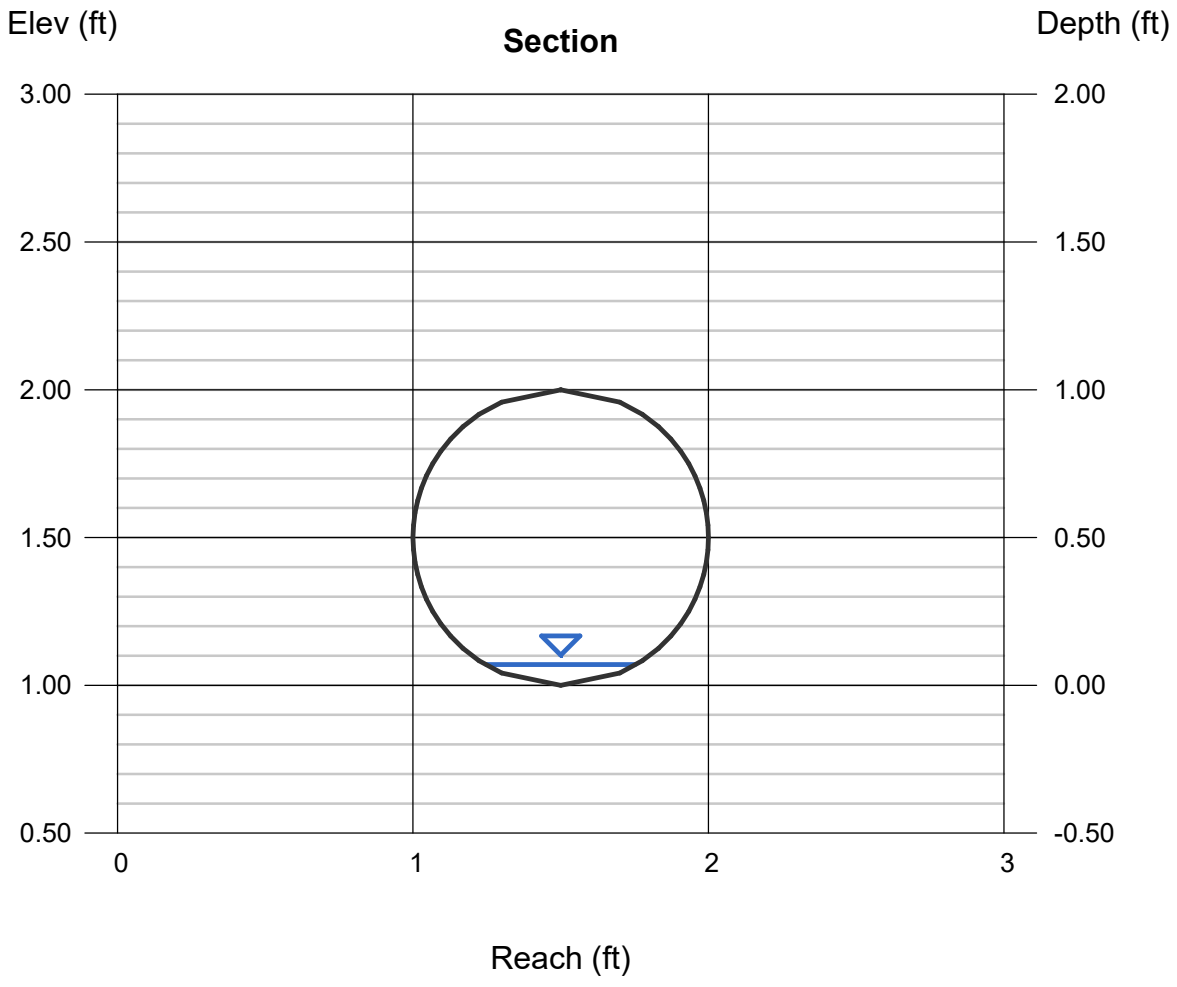
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.05

Highlighted

Depth (ft)	= 0.07
Q (cfs)	= 0.050
Area (sqft)	= 0.02
Velocity (ft/s)	= 2.02
Wetted Perim (ft)	= 0.54
Crit Depth, Yc (ft)	= 0.10
Top Width (ft)	= 0.51
EGL (ft)	= 0.13



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Apr 25 2025

Segment 8

Circular

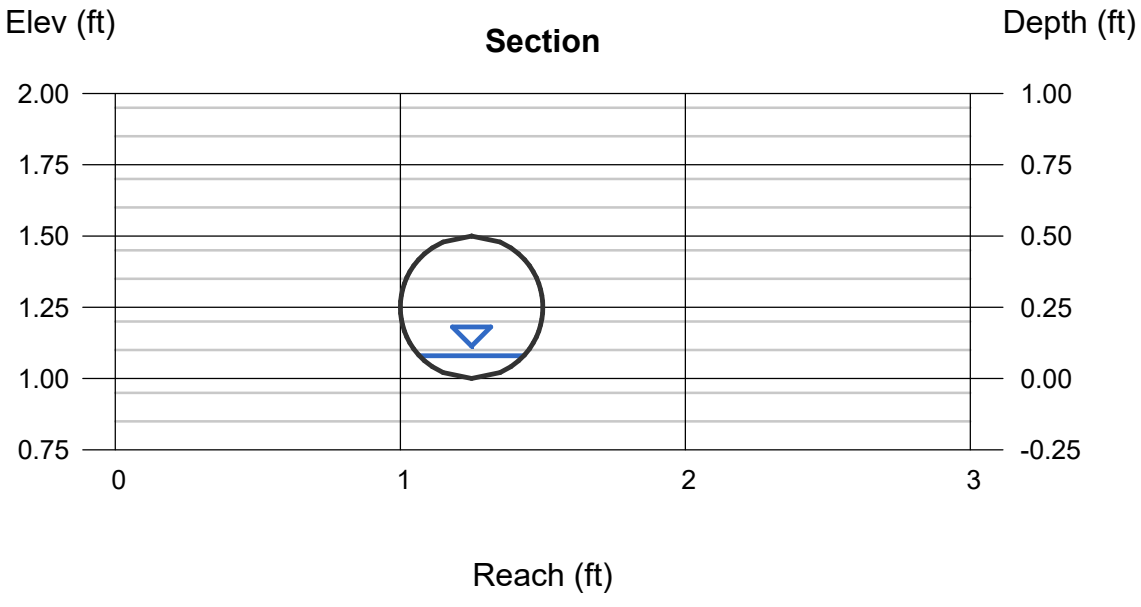
Diameter (ft)	= 0.50
Invert Elev (ft)	= 1.00
Slope (%)	= 3.23
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.05

Highlighted

Depth (ft)	= 0.08
Q (cfs)	= 0.050
Area (sqft)	= 0.02
Velocity (ft/s)	= 2.45
Wetted Perim (ft)	= 0.41
Crit Depth, Yc (ft)	= 0.11
Top Width (ft)	= 0.37
EGL (ft)	= 0.17



Channel Report

Segment 9

Circular

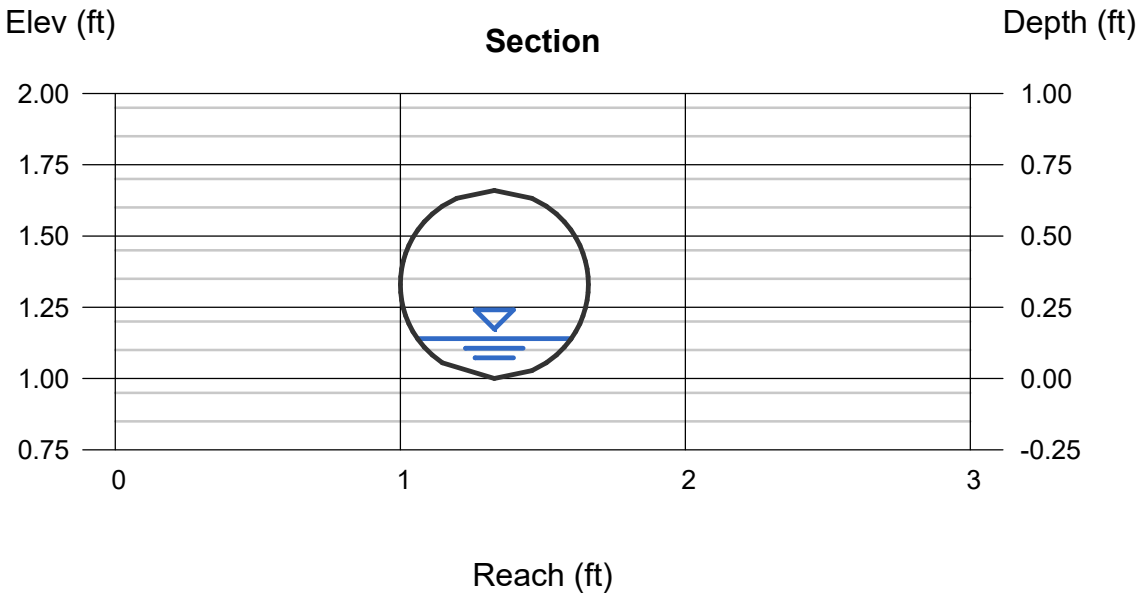
Diameter (ft)	= 0.66
Invert Elev (ft)	= 1.00
Slope (%)	= 4.59
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.22

Highlighted

Depth (ft)	= 0.14
Q (cfs)	= 0.220
Area (sqft)	= 0.05
Velocity (ft/s)	= 4.12
Wetted Perim (ft)	= 0.63
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 0.54
EGL (ft)	= 0.40



BANNER SCOTTSDALE MEDICAL CENTER

Preliminary Drainage Report

Dibble Project No. 1124152

1st Submittal Date: July 14, 2025



DIBBLE

BANNER SCOTTSDALE MEDICAL CENTER

Preliminary Drainage Report

Scottsdale, AZ

City of Scottsdale Case No. X-XX-202X
Dibble Project No. 1124152

Prepared For: Banner Health
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June 10, 2025

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1. INTRODUCTION

This report is prepared for Banner Health to support the entitlements of the 29-acre Banner Scottsdale Medical Center in Scottsdale, Maricopa County, AZ (a portion of Parcel 215-07-209H). The site is located on the northeast corner of Miller Road and Mayo Boulevard. A portion of the site is currently being developed for the Banner/NexCore Health Center Plus project, located at the northeast corner of the Mayo Boulevard and 78th Street intersection. The new phased development for the Banner Health Scottsdale project will consist of a hospital and parking. This development is divided into multiple phases with the total bed count being 300:

- **Phase 1** includes a new 4-story, 348,500-square-foot (sf) hospital with adjoining 2-story diagnostic treatment building, loading dock, central utility plant, parking areas, ground mounted helipad, and associated hardscape and utility improvements. Access drives into the medical center from Mayo Boulevard and Miller Road will be constructed during Phase 1.
- **Future Phases** include the hospital expansion of a new 5-story 145,000-sf patient tower, expansion to the diagnostic and treatment centers (a 72,000-sf addition), a new 4-story 52,500-sf NICU/Patient tower, and a new parking structure to support the hospital.

The purpose of this Preliminary Drainage Report is to provide analysis and results for the existing and proposed drainage system at the site.

1.1 Project Location

The new Banner Scottsdale Medical Center project site is approximately 29 acres in size and is located at the northeast corner of the intersection of Miller Rd. and Mayo Blvd in Scottsdale, AZ. The majority of the site is in the northwest quadrant of Township 4 North, Range 4 East, Section 35, with a small portion of the site in the southeast quadrant of Township 4 North, Range 4 East, Section 26. The site is bounded by Arizona State Route 101 to the north, the Banner/NexCore Health Center Plus site to the east, Mayo Boulevard to the south, and Miller Road to the west. See **Figure 1** below for a Vicinity Map.

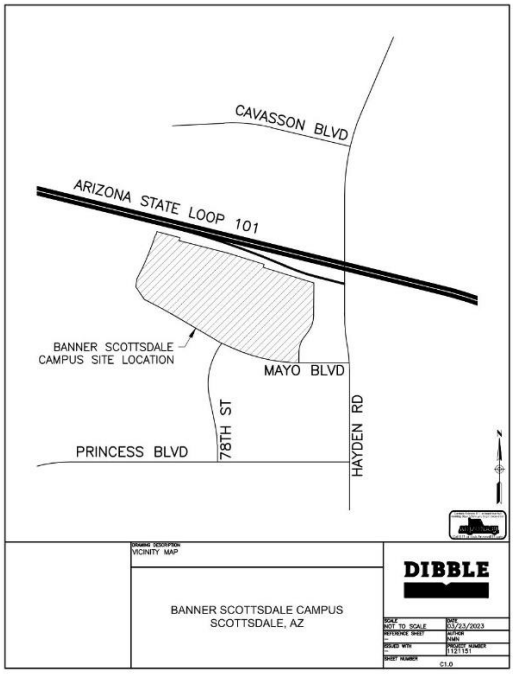


Figure 1 - Vicinity Map

2. EXISTING CONDITIONS

The project site lies in a portion of Parcel 215-07-209H and will be located on a portion of the Crossroads East Planning Unit VI, zoned as Planned Community District (PCD). The site is composed of a temporary overflow parking lot and partially undeveloped desert that generally slopes to the southeast with an elevation difference of approximately 14 feet across the project site.

Kimley-Horn & Associates, Inc. has prepared the *Master Drainage Report for Crossroads East Planning Unit VI*, which provides off-site discharges into the project site. An excerpt from this report showing the upstream culverts and their contributing off-site discharge is provided in **Appendix C**. The flow through these culverts was determined by the *Cavasson Master Drainage Report – Phase 3 Update,* prepared by Hubbard Engineering.

The project site is bounded by Arizona State Route 101 to the north. There is one five-barrel 10-foot by 6-foot box culvert (C3) and one three-barrel 36-inch reinforced concrete pipe (RCP) culvert (C4) that convey regional stormwater from the north side of Arizona State Route 101, beneath the freeway, to Parcel 215-07-209H, onto the Banner Scottsdale Medical Center project site. Runoff then travels overland across the vacant parcel to an existing four-barrel high 36-inch density polyethylene (HDPE) culvert conveying off-site flows to the south side of Mayo Boulevard. Stormwater runoff generated by the project site itself is stored in temporary storage basins along the north side of Mayo Boulevard. Runoff entering these temporary storage basins either overtop Mayo Boulevard or enter the existing culvert beneath Mayo Boulevard and allow stormwater runoff to continue south.

A portion of Parcel 215-07-209H has been developed as a part of the Banner/NexCore Health Center Plus project. The drainage design for this project includes the construction of a new regional detention basin that collects stormwater runoff from the existing three-barrel 36-inch RCP culvert (C5) and stormwater runoff generated by the undeveloped watershed directly north of the Banner/NexCore Health Center Plus site. This retention basin then conveys flows at a maximum 40 cfs controlled discharge, as stipulated in the *Master Drainage Report for Crossroads East Planning Unit VI*, prepared by Kimley-Horn & Associates, Inc, to an existing 48-inch HDPE storm drain that starts directly north of the intersection of Mayo Boulevard and 78th Street and travels south within 78th Street.

Directly east of the Banner/NexCore Health Center Plus project site, one existing 30-inch RCP culvert (C6), an existing 24-inch culvert (C7), and another existing 24-inch culvert (C8) discharges additional regional stormwater runoff to the south side of Arizona State Route 101. The peak flow from these culverts is routed through natural surface conveyance to an existing three-barrel 24-inch HDPE culvert across Mayo Boulevard. At the time of writing this report, Kimley-Horn & Associates, Inc. is designing a storm drain system to collect off-site flows from culverts C6, C7, and C8 at the location of their existing outlet and route them around the adjacent Banner/NexCore Health Center Plus site.

Dibble completed one-dimensional (1D) hydrologic modeling of the contributing watershed as verification of previous hydrology. The results of the 1D hydrologic modeling differ from those completed as a part of the Master Drainage Report and have been used as the basis of design for drainage improvements for the Banner Scottsdale Medical Center. Additional discussion is provided in **Section 4.1** and **Section 5.1** of this report.

2.1 FEMA Floodplains

The majority of the Banner Scottsdale Medical Center project site is located in Federal Emergency Management Agency (FEMA) Zone 'AO' (Alluvial Fan), defined as "Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet." At the site, the FEMA defined average depth is 1-foot and the velocity is 3 feet-per-second (fps) in this zone. Mandatory flood insurance requirements for federally backed loans apply. A small portion of the site lies within FEMA Zone 'X', defined as "Areas of 0.2% annual chance flood; areas of

1% annual chance flood with average depth less than 1 foot or areas less than 1 square mile; and areas protected by levees from 1% annual chance flood." This hazard designation is considered minimal, and flood insurance is not federally mandated. The Banner Health Scottsdale hospital lies within FEMA Zone 'AO'. The FEMA Flood Insurance Rate (FIRM) panel for this area is provided in **Appendix A**.

3. DESIGN CRITERIA

The Banner Scottsdale Medical Center project is designed consistent with standards set forth in the Flood Control District of Maricopa County (FCDMC) *Drainage Design Manual for Maricopa County Volume I Hydrology (2018)* and *Volume II Hydraulics (2018)*. Additionally, the drainage infrastructure has been designed to meet the City of Scottsdale *Design Standards and Policies Manual (2018)* requirements with additional stipulations provided by the Crossroads East planning area, as defined in the *Master Drainage Report for Crossroads East Planning Unit VI* (Case #37-SA-2023), prepared by Kimley-Horn & Associates, Inc.

3.1 Rainfall

National Oceanic and Atmospheric Administration (NOAA) Atlas 14 was used for this project. Rainfall depths and intensities have been obtained directly from the NOAA Atlas 14 Precipitation Data Frequency Data Server and may be found in **Appendix B**.

3.2 Finished Floors

The site drainage design will provide protection of new buildings from inundation of the lowest floor from the 100-year and 500-year storm events. The Banner Scottsdale Medical Center hospital will be constructed within the FEMA zone 'AO' floodplain with a specified depth of 1 foot; therefore, the Base Flood Elevation (BFE) is defined as 1 foot above the highest natural (pre-construction) adjacent ground surface (HAG) at the building permitter. In addition, buildings classified as "essential", by the American Society of Civil Engineers (ASCE) *ASCE 24-14 Flood Resistant Design and Construction (2015)* document, must be elevated an additional 2 feet or be above the 500-year water surface elevation – whichever is greater. This is defined as the Regulatory Flood Elevation (RFE), i.e. the elevation that the building finished floor is to be regulated to. The Banner Scottsdale Medical Center hospital is defined as a "essential" facility; therefore, the required finished floor elevation is the higher of the HAG plus 3 feet or the 500-year water surface elevation.

3.3 Storm Runoff Conveyance

Stormwater runoff will be conveyed through the site via a combination of surface flow, underground roof drains, and storm drain pipes. All storm drains will be designed to convey the 100-year storm. Runoff in excess of the 100-year storm will travel overland. The Banner Scottsdale Medical Center site is also required to route off-site drainage flows through the site to their historic discharge points.

3.4 Detention Basin

The Banner Scottsdale Medical Center project shall provide detention storage for the greater of the first flush runoff volume or the pre-development versus post-development volume as stipulated in the *Master Drainage Report for Crossroads East Planning Unit VI*, prepared by Kimley-Horn & Associates, Inc. The following City of Scottsdale criteria apply to detention facilities:

- Basin side slopes shall not exceed a 4:1 ratio and 100-year basin depths shall not exceed 3 feet.
- All retention/detention facilities must be disposed of or evacuated within 36 hours for the 100-year, 2-hour storm event.
- Stormwater facilities shall be designed with a positive gravity draining outfall and emergency overflows from outlet clogging or extreme flooding events.

4. METHODOLOGY

The drainage design for the Banner Scottsdale Medical Center project utilized a combination of Autodesk *Storm and Sanitary Analysis* (SSA) unsteady hydraulic routing software, HEC-1, the FCDMC *Drainage Design Management System for Windows* (DDMSW), and spreadsheets.

4.1 Major Drainage Area Rainfall Runoff Calculations

One-dimensional (1D) hydrologic modeling was used to provide basin inflow hydrographs to use in the SSA unsteady hydraulic routing software. Modeling was performed using the *HEC-1 Hydrograph Package*. DDMSW version 5.6.0 was used to pre-process the HEC-1 modeling parameters. Post-development runoff models were developed for both the 100-year, 6-hour and 100-year, 24-hour design storms. The worse case was used as the basis for sizing major stormwater infrastructure for the project site. Existing condition HEC-1 models for both the 100-year, 6-hour and 100-year, 24-hour design storms were also developed to determine the pre-development peak discharge for the pre-development versus post-development analysis of the project site. Specific modeling parameters are described in the following sections. The model domain, subbasins, and flow routing for both the pre-development and post-development conditions are included in **Exhibit D-1** and **D-4** in **Appendix D**. These exhibits include the subbasins previously delineated by the *Cavasson Master Drainage Report – Phase 3 Update* (Plan #1838-21), prepared by Hubbard Engineering in August 2021 for the Cavasson Development north of Arizona State Route 101. The models were modified based on field observations and as-built plans.

4.1.1 Inflow Hydrographs

The model makes use of inflow hydrographs produced as part of the *Crossroads East Drainage Infrastructure Phase I* project. These hydrographs were developed through two-dimensional (2D) flow modeling of the watershed contributing to the Crossroads East system. Inflow hydrographs for the 100-year, 24-hour and 100-year, 6-hour storms were retained from the original modeling without modification.

4.1.2 Rainfall Losses

The Green & Ampt Method was selected for this project. The rainfall loss parameters were developed using guidance provided in the *Hydrology Manual*. The Green & Ampt infiltration equation parameters were based on logarithmic area-averaging of the map unit hydraulic conductivities (XKSAT) for mapped soils in each basin. The selection of capillary suction (PSIF) and soil moisture deficit (DTHETA) were based on the calculated sub-basin value of XKSAT. The bare ground XKSAT values for each sub-basin were then adjusted for vegetation cover. The calculation of these parameters was accomplished within DDMSW.

4.1.3 Land Use

Land use data for the Green & Ampt Method computations were selected based on future condition land use expectations. A hydrologic modeling land use exhibit is provided as **Exhibit D-2** and **D-5** in **Appendix D**.

4.1.4 Soil Parameters

Soils information for the Green & Ampt method was obtained from soil surveys performed by the Natural Resource Conservation Service (NRCS). A soils map is provided as **Exhibit D-3** and **D-6** in **Appendix D**.

4.1.5 Unit Hydrographs

The Clark Unit Hydrograph Method was used for this project. The longest flow paths for each subbasin were selected using topographic mapping. DDMSW uses the Papadakis and Kazan equation to calculate times of concentration. Watershed roughness coefficients (K_b) were calculated by DDMSW using equation parameters taken from Table 3.1 of the Hydrology Manual.

4.1.6 Depth-Area Reduction Factors

Depth area reduction factors were not used in this model.

4.1.7 Flow Routing

Normal depth routing was used for surface flow in this model, and kinematic wave routing was used for storm drain flow.

4.2 First Flush

The 'first flush' volume is considered the minimum level of control for new development at which stormwater pollution prevention practices must be in place. First flush is intended to retain and/or treat runoff to remove pollution elements such as hydrocarbons and fine sediment. Each on-site detention basin has been sized at minimum for the first flush volume. Minimum storage volumes for detention basins were determined using **Equation 1** below.

Equation 1 – First Flush Storage Volume

$$V_R = C * \frac{P}{12} * A$$

Where:
$V_R = retention\ volume\ required\ (cubic\ feet)$
$C = 1.0$
$P = rainfall\ depth = 0.5\ (inches)\ per\ City\ of\ Scottsdale$
$A = drainage\ area\ (square - feet)$

Calculations for the first flush storage volume are provided in **Appendix E**. Drainage areas for these calculations are provided in **Appendix G**.

4.3 Hydraulic Routing

The proposed drainage plan for the Banner Scottsdale Medical Center project includes detention routing through a number of storage basins combined with underground storm drain. An unsteady hydraulic routing software was used for the design and analysis of critical components of the system. SSA was used to model these components. Inflow hydrographs from the one-dimensional HEC-1 model were input into storage elements in the model with a weir and bleed-off pipe at the outlet of the most downstream on-site detention basin. The height of the weir crests will be set at or above the first flush storage elevation for each basin, such that any runoff greater than the first flush volume will overtop the weir and continue downstream. For the preliminary hydraulic analysis, the height of the weir crest was set at 1 foot above the bottom of the basin. Dynamic storage routing within the storage areas and in connecting storm drain was provided by the software.

Two models were created for the project. The first is referred to as the On-Site model and provides a hydraulic analysis for the majority of new drainage infrastructure on the Banner Scottsdale Medical Center project site. The second is referred to as the Banner/NexCore model and provides an update to the SSA model that was created for the Banner/NexCore Health Center Plus project. This update includes an additional detention basin at the southeast corner of the Banner Scottsdale Medical Center project site that drains to the existing 48-inch storm drain in 78th Street.

The outfall of the On-Site model occurs downstream of the existing four-barrel 36-inch HDPE culvert crossing beneath Mayo Boulevard. The tailwater condition at the outfall is derived from the *Off-Site Improvement Plans for Hayden 101* prepared by Kimley-Horn. The hydraulic grade line (HGL) elevation was assigned as 1585.23 to match the high-water elevation in the detention basin downstream from the existing culvert provided in the plans. The outfall of the Banner/NexCore model occurs at the connection into the existing 48-inch storm drain in 78th Street. The tailwater condition at the outfall is derived from the *Hayden 50 – Final Offsite Improvements Drainage Report* (Plan #4817-18-2) prepared by Kimley-Horn. The HGL elevation was assigned as 1576.00 to match the hydraulic calculations provided in that report.

Detention and storm drain hydraulic routing results from the SSA models are provided in **Appendix H**.

5. PROPOSED DRAINAGE CONDITIONS

5.1 Grading and Drainage Plan

The Preliminary Grading and Drainage Plan for the Banner Scottsdale Medical Center is provided in **Appendix F**. This grading and drainage plan illustrates the relevant peak discharges and proposed drainage improvements for both on-site and off-site improvements. The drainage plan includes first flush storage and treatment for the site.

Results from the 1D hydrologic modeling of the contributing watershed, provided in **Appendix D**, support that 145 cfs enters the project site from the triple-barrel 36-inch culvert outlet along the northern edge of the site. Kimley-Horn and Associates, Inc. previously determined that 183 cfs of stormwater runoff is conveyed through this culvert, as documented in the *Master Drainage Report*. Due to greater confidence in the hydrology developed as a part of the current project, it has been used for the design of drainage infrastructure at the Banner Scottsdale Medical Center project site.

A new off-site detention basin at the outlet of the existing triple-barrel 36-inch culvert will be used to collect off-site flows and direct them to a new double-barrel 48-inch storm drain system. This storm drain system will direct stormwater runoff through the project site, to the existing four-barrel 36-inch culvert beneath Mayo Boulevard.

On-site grading is divided into seven major drainage areas, as shown in **Appendix G**. Stormwater runoff generated by Drainage Areas A, B, C, D, and E will be directed through surface runoff and storm drain pipes to detention basins on the project site. These detention basins will drain to the new double-barrel 48-inch storm drain. Each basin will store the first flush volume from its drainage area and provide flow attenuation of the 100-year peak discharge. Overtopping weir crest heights will be set at or above the first flush storage elevation for each basin. Any runoff greater than the first flush volume will overtop the weir and continue downstream. The 100-year hydraulic grade line of the system will be designed to be at least one foot below the surface elevation. The design 100-year peak discharge at the Banner Scottsdale Medical Center project outfall (the four-barrel 36-inch culvert beneath Mayo Boulevard) is 151 cfs.

The 100-year peak discharge of 151 cfs at the Banner Scottsdale Medical Center project outfall was compared to pre-condition hydrologic modeling to confirm that the downstream 100-year peak discharge does not increase as a result of project improvements. In the pre-condition hydrologic model, the pre-development 100-year peak discharge is reported from the combine point CP-ALL. The pre-development 100-year peak discharge is 197 cfs. For comparison, the *Master Drainage Report* reports the 100-year peak discharge conveyed through the culvert at the project outfall as 218 cfs. Therefore, the Banner Scottsdale Medical Center project improvements reduce the peak discharge of runoff at the project outfall when compared to either the pre-condition hydrologic modeling completed for this project or the *Master Drainage Report*.

Stormwater runoff generated by Drainage Area F will be directed through surface runoff to the existing regional detention basin north of the Banner/NexCore Health Center Plus project site and drain to the existing 24-inch storm drain on that project site. Lastly, stormwater runoff generated by Drainage Area X will be directed through surface runoff to a detention basin located at the southeast corner of the project site. This detention basin will store the first flush volume from its drainage area and provide flow attenuation for the 100-year peak discharge. The overtopping weir crest height for this detention basin will be set at or above the first flush storage elevation for the basin, and runoff greater than the first flush volume will overtop the weir and continue downstream. The detention basin in Drainage Area X will drain to the existing 48-inch storm drain in 78th Street through a new manhole connection on the Banner/NexCore

Health Center Plus project site. The design 100-year peak discharge at the Banner/NexCore Health Center Plus project outfall (the connection into the 48-inch storm drain in 78th Street) is 37.4 cfs, remaining below the maximum 40 cfs discharge stipulated in the *Master Drainage Report*.

All detention basins are designed with either a 6-inch or 8-inch bleed off pipe to drain within 36 hours of the end of the storm duration. Drain time will be assessed within the SSA dynamic routing software by plotting the dynamic basin depth against time. Basins will be considered 'drained' when the basin depth falls below 0.08 feet (1 inch).

5.2 Finished Floor

A 500-year analysis was completed for the project site to ensure that the finished floor elevation is set above the greater of the 500-year water surface elevation or 3 feet above the HAG at the building perimeter. For this project, the elevation as determined by HAG plus 3 feet criteria governed the placement of the finished floor. A HAG exhibit is provided as a part of the Preliminary Grading and Drainage Plan in **Appendix F.** The finished floor elevation for the Banner Scottsdale Medical Center hospital has been set at 1603.70. Additional background information and discussion is provided in the *500-Year Water Surface Elevation Analysis Technical Memorandum* in **Appendix I**.

6. CONCLUSION

The preliminary grading and drainage design provided within this report will support the development of the Banner Scottsdale Medical Center project, while maintaining City of Scottsdale design standards. Drainage infrastructure for the site is consistent with previous planning efforts for this area, and will provide the new building reasonable protection from flooding. The proposed project design supports that there will be no adverse impact to adjacent properties for up to and including the 100-year design storm event.

7. REFERENCES

City of Scottsdale. *Design Standards and Policies Manual*, 2018.

Flood Control District of Maricopa County. *Drainage Design Manual for Maricopa County, Volume I Hydrology*, 2018.

Flood Control District of Maricopa County. *Drainage Design Manual for Maricopa County, Volume II Hydraulics*, 2018.

Hubbard Engineering. *Cavasson Master Drainage Report – Phase 3 Update,* 2021.

Kimley-Horn & Associates, Inc. *Master Drainage Report for Crossroads East Planning Unit VI*, 2023.

Maricopa Association of Governments. *Uniform Standard Details for Public Works Construction*, 2021.

Appendix A FEMA FIRM Panel

NOTES TO USERS

This map is for use in administering the Nation 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 contained within the Flood Insurance Study (FIS) report that accompanies 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 FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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 Flood Insurance Study report for this jurisdiction.

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 **projection** used in the preparation of this map was Arizona State Plane Central zone (FIPSZONE 0202). The **horizontal datum** was NAD 83 HARN, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane 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 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. Map users wishing to obtain flood elevations referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29) may use the following Maricopa County website application: http://www.fcd.maricopa.gov/Maps/gismaps/apps/gdacs/application/index.cfm

This web tool allows users to obtain point-specific datum conversion values by zooming in and hovering over a VERTCON checkbox on the layers menu on the left side of the screen. The VERTCON grid referenced in this web application was also used to convert existing flood elevations from NGVD 29 to NAVD 88.

To obtain current elevation, description, and/or location information for National Geodetic Survey 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. To obtain information about Geodetic Densification and Cadastral Survey bench marks produced by the Maricopa County Department of Transportation, please visit the Flood Control District of Maricopa County website at:
http://www.fcd.maricopa.gov/Maps/gismaps/apps/gdacs/application/index.cfm.

Base map information shown on this FIRM was derived from multiple sources. Aerial imagery was provided in digital format by the Maricopa County Department of Public Works, Flood Control District. The imagery is dated October 2009 to November 2009. Additional National Agricultural Imagery Program (NAIP) imagery was provided by the Arizona State Land Department (ALRIS) and is dated 2007. The coordinate system used for the production of the digital FIRM is State Plane Arizona Central NAD83 HARN, International Feet.

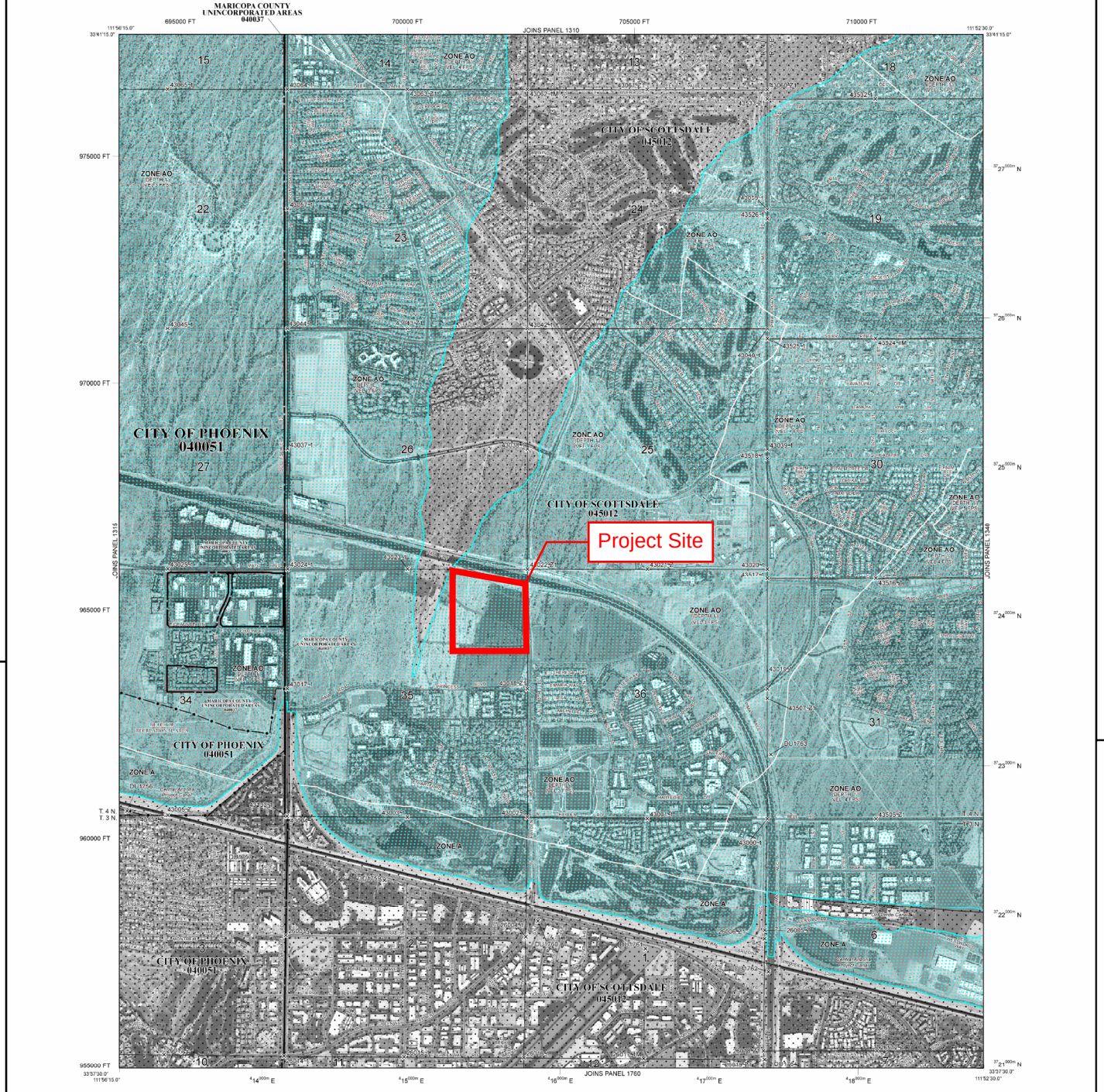
The **profile base line** depicted on this map represents the hydraulic modeling baselines that match flood profiles in the FIS report. As a result of improved topographic data, the profile base line, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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 **FEMA 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, 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/.



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 Area 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 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 (NAVD 88)

A — A — Cross section line
23 — 23 — Transect line
97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000m N — 1000-meter Universal Transverse Mercator grid ticks, zone 12
6000000 M — 5000-foot grid ticks: Arizona State Plane coordinate system, central zone (FIPSZONE 0202), Transverse Mercator
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
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
December 3, 1993 - September 30, 1998 - July 16, 2001 - September 30, 2005 - October 16, 2013 - to add base flood elevation, to add special flood hazard areas, to incorporate previously issued letters of map revision, to add roads and road names, to update corporate limits, to change floodway, to advance suffix, to change base flood elevations, and to add floodway.

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" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1320L

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1320 OF 4425
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1320	L
PHOENIX, CITY OF	040051	1320	L
SCOTTSDALE, CITY OF	045012	1320	L

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
04013C1320L
MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

Appendix B NOAA Atlas 14 Precipitation Values

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.6531°, Longitude: -111.9121°
Elevation: 1594 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

DEPTH

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.196** (0.163-0.241)	**0.257** (0.215-0.315)	**0.346** (0.287-0.422)	**0.415** (0.342-0.505)	**0.507** (0.412-0.615)	**0.578** (0.463-0.696)	**0.651** (0.512-0.782)	**0.723** (0.560-0.867)	**0.821** (0.620-0.987)	**0.896** (0.663-1.08)
10-min	**0.299** (0.248-0.366)	**0.391** (0.326-0.479)	**0.526** (0.436-0.643)	**0.631** (0.520-0.768)	**0.772** (0.626-0.936)	**0.880** (0.705-1.06)	**0.990** (0.780-1.19)	**1.10** (0.852-1.32)	**1.25** (0.943-1.50)	**1.36** (1.01-1.64)
15-min	**0.371** (0.308-0.454)	**0.484** (0.405-0.593)	**0.652** (0.540-0.797)	**0.782** (0.645-0.953)	**0.957** (0.777-1.16)	**1.09** (0.874-1.31)	**1.23** (0.966-1.48)	**1.36** (1.06-1.64)	**1.55** (1.17-1.86)	**1.69** (1.25-2.03)
30-min	**0.499** (0.414-0.611)	**0.651** (0.545-0.799)	**0.879** (0.728-1.07)	**1.05** (0.868-1.28)	**1.29** (1.04-1.56)	**1.47** (1.18-1.77)	**1.65** (1.30-1.99)	**1.84** (1.42-2.20)	**2.09** (1.57-2.51)	**2.28** (1.68-2.74)
60-min	**0.617** (0.513-0.756)	**0.806** (0.674-0.989)	**1.09** (0.901-1.33)	**1.30** (1.08-1.59)	**1.60** (1.29-1.93)	**1.82** (1.46-2.19)	**2.05** (1.61-2.46)	**2.27** (1.76-2.73)	**2.58** (1.95-3.10)	**2.82** (2.08-3.39)
2-hr	**0.720** (0.606-0.862)	**0.931** (0.786-1.12)	**1.24** (1.04-1.48)	**1.48** (1.22-1.76)	**1.80** (1.48-2.13)	**2.04** (1.65-2.41)	**2.29** (1.83-2.70)	**2.55** (1.99-3.00)	**2.89** (2.21-3.40)	**3.15** (2.36-3.73)
3-hr	**0.795** (0.670-0.973)	**1.02** (0.861-1.25)	**1.33** (1.12-1.63)	**1.58** (1.31-1.92)	**1.92** (1.58-2.32)	**2.20** (1.78-2.64)	**2.48** (1.97-2.98)	**2.78** (2.17-3.33)	**3.19** (2.42-3.82)	**3.52** (2.61-4.22)
6-hr	**0.958** (0.823-1.14)	**1.21** (1.04-1.44)	**1.54** (1.32-1.82)	**1.81** (1.53-2.13)	**2.17** (1.81-2.54)	**2.45** (2.02-2.86)	**2.75** (2.23-3.20)	**3.05** (2.43-3.56)	**3.45** (2.68-4.02)	**3.77** (2.86-4.40)
12-hr	**1.08** (0.933-1.27)	**1.36** (1.17-1.60)	**1.72** (1.48-2.01)	**2.00** (1.70-2.33)	**2.38** (2.00-2.77)	**2.66** (2.22-3.10)	**2.96** (2.44-3.44)	**3.27** (2.65-3.79)	**3.67** (2.90-4.28)	**3.98** (3.09-4.67)
24-hr	**1.26** (1.10-1.47)	**1.60** (1.41-1.86)	**2.07** (1.81-2.40)	**2.45** (2.12-2.83)	**2.97** (2.56-3.43)	**3.38** (2.89-3.89)	**3.81** (3.22-4.40)	**4.26** (3.56-4.92)	**4.89** (4.01-5.65)	**5.39** (4.36-6.26)
2-day	**1.37** (1.19-1.58)	**1.75** (1.52-2.02)	**2.29** (1.98-2.64)	**2.72** (2.35-3.13)	**3.32** (2.84-3.82)	**3.80** (3.22-4.37)	**4.30** (3.62-4.96)	**4.83** (4.02-5.59)	**5.56** (4.55-6.46)	**6.15** (4.95-7.17)
3-day	**1.47** (1.29-1.69)	**1.88** (1.65-2.16)	**2.48** (2.17-2.84)	**2.96** (2.58-3.39)	**3.64** (3.15-4.17)	**4.19** (3.60-4.79)	**4.78** (4.06-5.48)	**5.40** (4.54-6.20)	**6.27** (5.19-7.23)	**6.97** (5.70-8.08)
4-day	**1.58** (1.39-1.80)	**2.02** (1.78-2.30)	**2.67** (2.35-3.04)	**3.21** (2.81-3.65)	**3.97** (3.46-4.51)	**4.59** (3.97-5.22)	**5.26** (4.51-5.99)	**5.96** (5.06-6.82)	**6.97** (5.83-8.00)	**7.80** (6.44-8.99)
7-day	**1.78** (1.56-2.05)	**2.28** (2.00-2.61)	**3.03** (2.65-3.46)	**3.64** (3.17-4.15)	**4.51** (3.91-5.14)	**5.22** (4.49-5.95)	**5.97** (5.10-6.83)	**6.79** (5.73-7.80)	**7.94** (6.61-9.15)	**8.89** (7.30-10.3)
10-day	**1.94** (1.70-2.22)	**2.48** (2.18-2.84)	**3.29** (2.89-3.75)	**3.94** (3.44-4.49)	**4.87** (4.23-5.53)	**5.62** (4.85-6.38)	**6.42** (5.49-7.32)	**7.27** (6.16-8.31)	**8.48** (7.08-9.73)	**9.46** (7.79-10.9)
20-day	**2.40** (2.12-2.74)	**3.10** (2.73-3.52)	**4.10** (3.60-4.65)	**4.86** (4.26-5.51)	**5.90** (5.15-6.69)	**6.71** (5.83-7.61)	**7.54** (6.51-8.58)	**8.39** (7.19-9.58)	**9.55** (8.10-11.0)	**10.5** (8.78-12.1)
30-day	**2.82** (2.48-3.21)	**3.64** (3.21-4.13)	**4.81** (4.23-5.45)	**5.70** (5.00-6.45)	**6.91** (6.03-7.82)	**7.85** (6.82-8.88)	**8.82** (7.62-9.98)	**9.80** (8.41-11.1)	**11.1** (9.47-12.7)	**12.2** (10.3-14.0)
45-day	**3.30** (2.92-3.74)	**4.26** (3.77-4.82)	**5.63** (4.97-6.36)	**6.65** (5.86-7.52)	**8.02** (7.03-9.06)	**9.06** (7.90-10.2)	**10.1** (8.78-11.5)	**11.2** (9.65-12.7)	**12.6** (10.8-14.5)	**13.8** (11.6-15.8)
60-day	**3.67** (3.26-4.14)	**4.75** (4.21-5.35)	**6.26** (5.54-7.05)	**7.36** (6.50-8.30)	**8.82** (7.76-9.94)	**9.92** (8.68-11.2)	**11.0** (9.59-12.5)	**12.1** (10.5-13.7)	**13.6** (11.7-15.5)	**14.7** (12.5-16.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.6531°, Longitude: -111.9121°
Elevation: 1594 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

INTENSITY

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

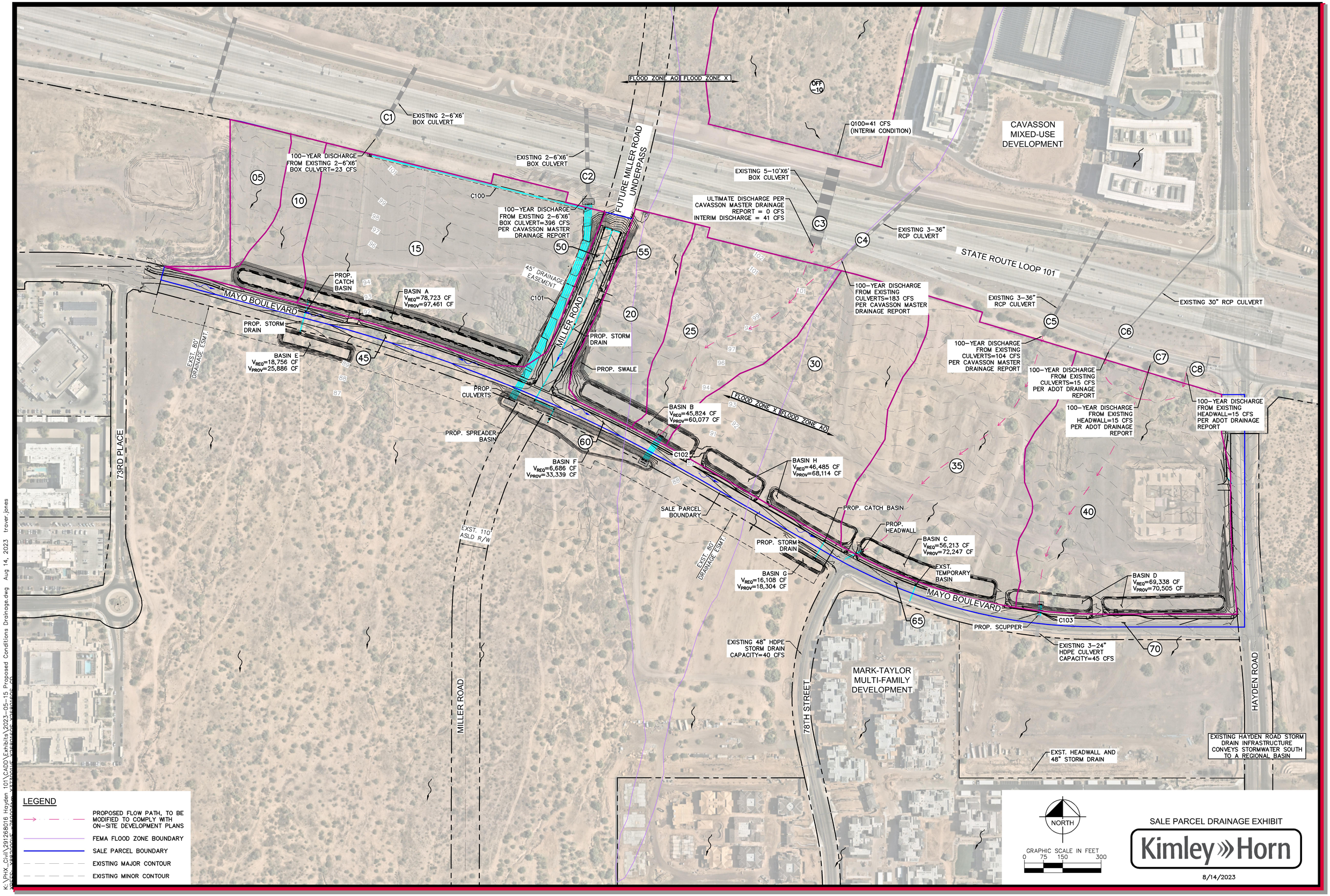
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.35** (1.96-2.89)	**3.08** (2.58-3.78)	**4.15** (3.44-5.06)	**4.98** (4.10-6.06)	**6.08** (4.94-7.38)	**6.94** (5.56-8.35)	**7.81** (6.14-9.38)	**8.68** (6.72-10.4)	**9.85** (7.44-11.8)	**10.8** (7.96-12.9)
10-min	**1.79** (1.49-2.20)	**2.35** (1.96-2.87)	**3.16** (2.62-3.86)	**3.79** (3.12-4.61)	**4.63** (3.76-5.62)	**5.28** (4.23-6.35)	**5.94** (4.68-7.14)	**6.60** (5.11-7.92)	**7.49** (5.66-9.01)	**8.18** (6.05-9.85)
15-min	**1.48** (1.23-1.82)	**1.94** (1.62-2.37)	**2.61** (2.16-3.19)	**3.13** (2.58-3.81)	**3.83** (3.11-4.64)	**4.36** (3.50-5.25)	**4.91** (3.86-5.90)	**5.46** (4.23-6.54)	**6.20** (4.68-7.44)	**6.76** (5.00-8.14)
30-min	**0.998** (0.828-1.22)	**1.30** (1.09-1.60)	**1.76** (1.46-2.15)	**2.11** (1.74-2.57)	**2.58** (2.09-3.12)	**2.94** (2.35-3.53)	**3.31** (2.60-3.97)	**3.67** (2.85-4.41)	**4.17** (3.15-5.01)	**4.55** (3.37-5.48)
60-min	**0.617** (0.513-0.756)	**0.806** (0.674-0.989)	**1.09** (0.901-1.33)	**1.30** (1.08-1.59)	**1.60** (1.29-1.93)	**1.82** (1.46-2.19)	**2.05** (1.61-2.46)	**2.27** (1.76-2.73)	**2.58** (1.95-3.10)	**2.82** (2.08-3.39)
2-hr	**0.360** (0.303-0.431)	**0.465** (0.393-0.559)	**0.619** (0.520-0.740)	**0.737** (0.612-0.879)	**0.899** (0.738-1.07)	**1.02** (0.827-1.21)	**1.15** (0.913-1.35)	**1.27** (0.997-1.50)	**1.44** (1.10-1.70)	**1.58** (1.18-1.86)
3-hr	**0.264** (0.223-0.324)	**0.339** (0.286-0.416)	**0.442** (0.372-0.541)	**0.525** (0.436-0.638)	**0.640** (0.524-0.772)	**0.731** (0.592-0.878)	**0.826** (0.656-0.992)	**0.927** (0.723-1.11)	**1.06** (0.805-1.27)	**1.17** (0.867-1.40)
6-hr	**0.159** (0.137-0.189)	**0.201** (0.173-0.239)	**0.257** (0.220-0.304)	**0.301** (0.255-0.355)	**0.362** (0.302-0.424)	**0.409** (0.337-0.477)	**0.458** (0.371-0.533)	**0.508** (0.405-0.593)	**0.576** (0.447-0.672)	**0.629** (0.477-0.735)
12-hr	**0.089** (0.077-0.105)	**0.113** (0.097-0.132)	**0.142** (0.122-0.166)	**0.165** (0.141-0.193)	**0.197** (0.166-0.229)	**0.221** (0.184-0.256)	**0.246** (0.202-0.285)	**0.271** (0.220-0.314)	**0.304** (0.241-0.355)	**0.330** (0.256-0.387)
24-hr	**0.052** (0.046-0.061)	**0.066** (0.058-0.077)	**0.086** (0.075-0.100)	**0.101** (0.088-0.118)	**0.123** (0.106-0.142)	**0.140** (0.120-0.162)	**0.158** (0.134-0.183)	**0.177** (0.148-0.204)	**0.203** (0.167-0.235)	**0.224** (0.181-0.260)
2-day	**0.028** (0.024-0.033)	**0.036** (0.031-0.042)	**0.047** (0.041-0.055)	**0.056** (0.048-0.065)	**0.069** (0.059-0.079)	**0.079** (0.067-0.091)	**0.089** (0.075-0.103)	**0.100** (0.083-0.116)	**0.115** (0.094-0.134)	**0.128** (0.103-0.149)
3-day	**0.020** (0.017-0.023)	**0.026** (0.022-0.030)	**0.034** (0.030-0.039)	**0.041** (0.035-0.047)	**0.050** (0.043-0.057)	**0.058** (0.049-0.066)	**0.066** (0.056-0.076)	**0.074** (0.063-0.086)	**0.087** (0.072-0.100)	**0.096** (0.079-0.112)
4-day	**0.016** (0.014-0.018)	**0.021** (0.018-0.023)	**0.027** (0.024-0.031)	**0.033** (0.029-0.037)	**0.041** (0.036-0.046)	**0.047** (0.041-0.054)	**0.054** (0.046-0.062)	**0.062** (0.052-0.071)	**0.072** (0.060-0.083)	**0.081** (0.067-0.093)
7-day	**0.010** (0.009-0.012)	**0.013** (0.011-0.015)	**0.018** (0.015-0.020)	**0.021** (0.018-0.024)	**0.026** (0.023-0.030)	**0.031** (0.026-0.035)	**0.035** (0.030-0.040)	**0.040** (0.034-0.046)	**0.047** (0.039-0.054)	**0.052** (0.043-0.061)
10-day	**0.008** (0.007-0.009)	**0.010** (0.009-0.011)	**0.013** (0.012-0.015)	**0.016** (0.014-0.018)	**0.020** (0.017-0.023)	**0.023** (0.020-0.026)	**0.026** (0.022-0.030)	**0.030** (0.025-0.034)	**0.035** (0.029-0.040)	**0.039** (0.032-0.045)
20-day	**0.005** (0.004-0.005)	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.010** (0.008-0.011)	**0.012** (0.010-0.013)	**0.013** (0.012-0.015)	**0.015** (0.013-0.017)	**0.017** (0.014-0.019)	**0.019** (0.016-0.022)	**0.021** (0.018-0.025)
30-day	**0.003** (0.003-0.004)	**0.005** (0.004-0.005)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.010** (0.009-0.012)	**0.012** (0.010-0.013)	**0.013** (0.011-0.015)	**0.015** (0.013-0.017)	**0.016** (0.014-0.019)
45-day	**0.003** (0.002-0.003)	**0.003** (0.003-0.004)	**0.005** (0.004-0.005)	**0.006** (0.005-0.006)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.008-0.011)	**0.011** (0.009-0.013)	**0.012** (0.010-0.014)
60-day	**0.002** (0.002-0.002)	**0.003** (0.002-0.003)	**0.004** (0.003-0.004)	**0.005** (0.004-0.005)	**0.006** (0.005-0.006)	**0.006** (0.006-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.008-0.011)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Appendix C Excerpt from the Master Drainage Report for Crossroads East Planning Unit VI



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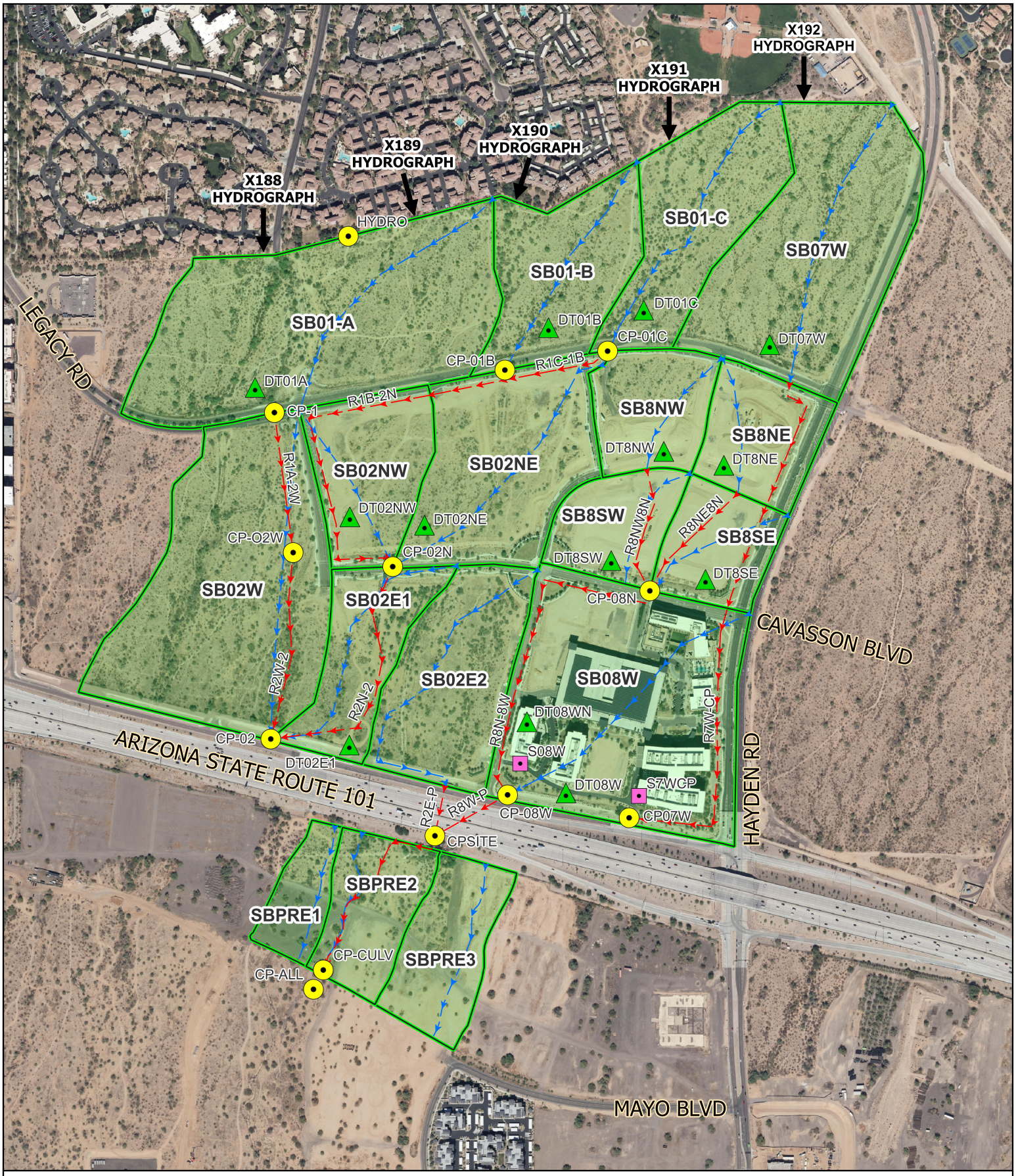
Appendix D One-Dimensional Hydrology Modeling

Appendix D1 Pre-Development Condition



BANNER HEALTH SCOTTSDALE

Exhibit D-1: HEC-1 Schematic - Pre Development Condition

DIBBLE

LEGEND

- HEC-1 Storage
- HEC-1 Combine Point
- TC Flow Path
- HEC-1 Diversion
- HEC-1 Route
- Subbasin

0 350 700 1,050 1,400 ft

N

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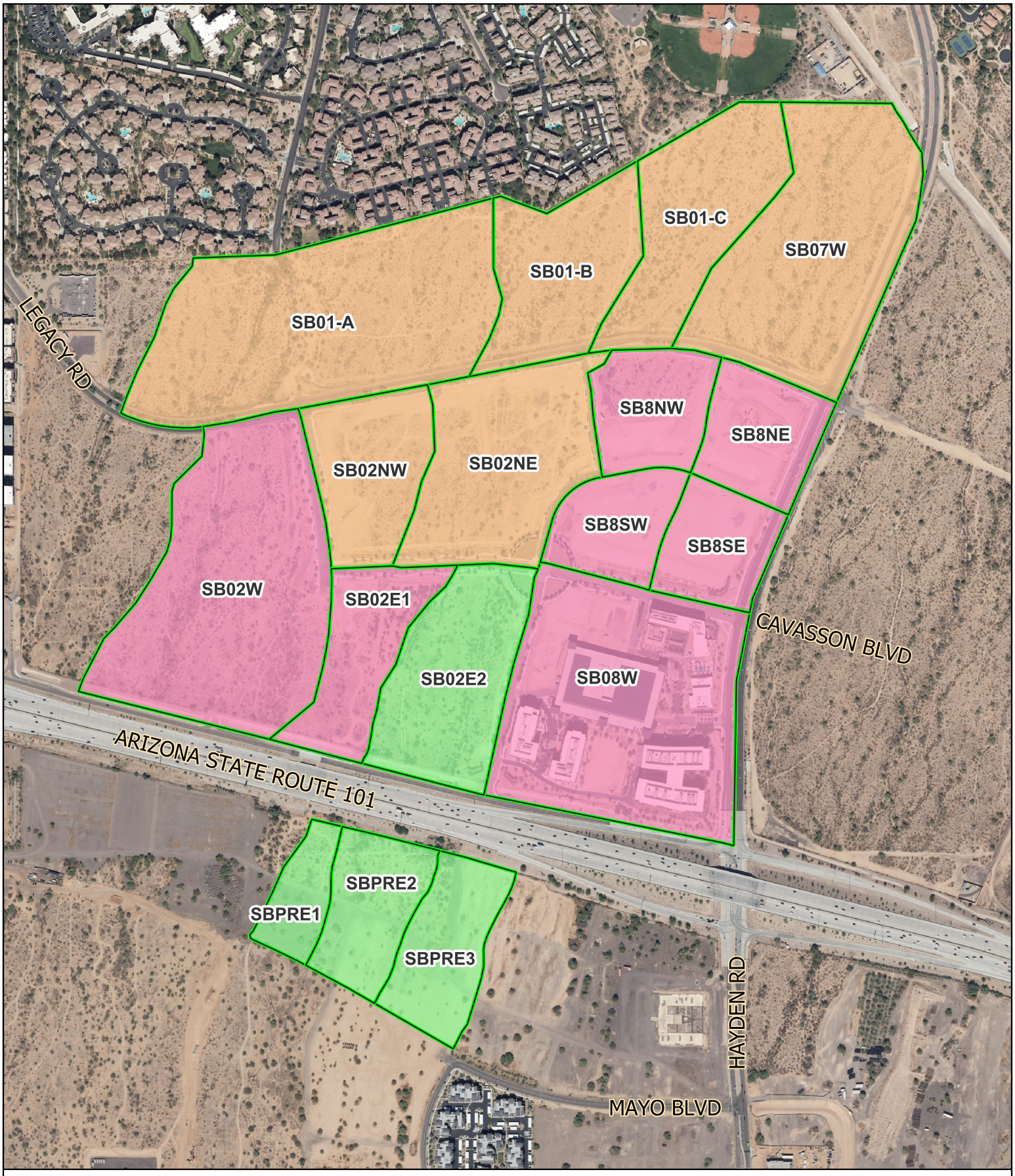

BANNER HEALTH SCOTTSDALE

Exhibit D-2: Land Use Map - Pre-Development Condition

DIBBLE

LEGEND

- Subbasin
- Commercial
- Multi-Family
- Undeveloped Desert

0 350 700 1,050 1,400 ft

N

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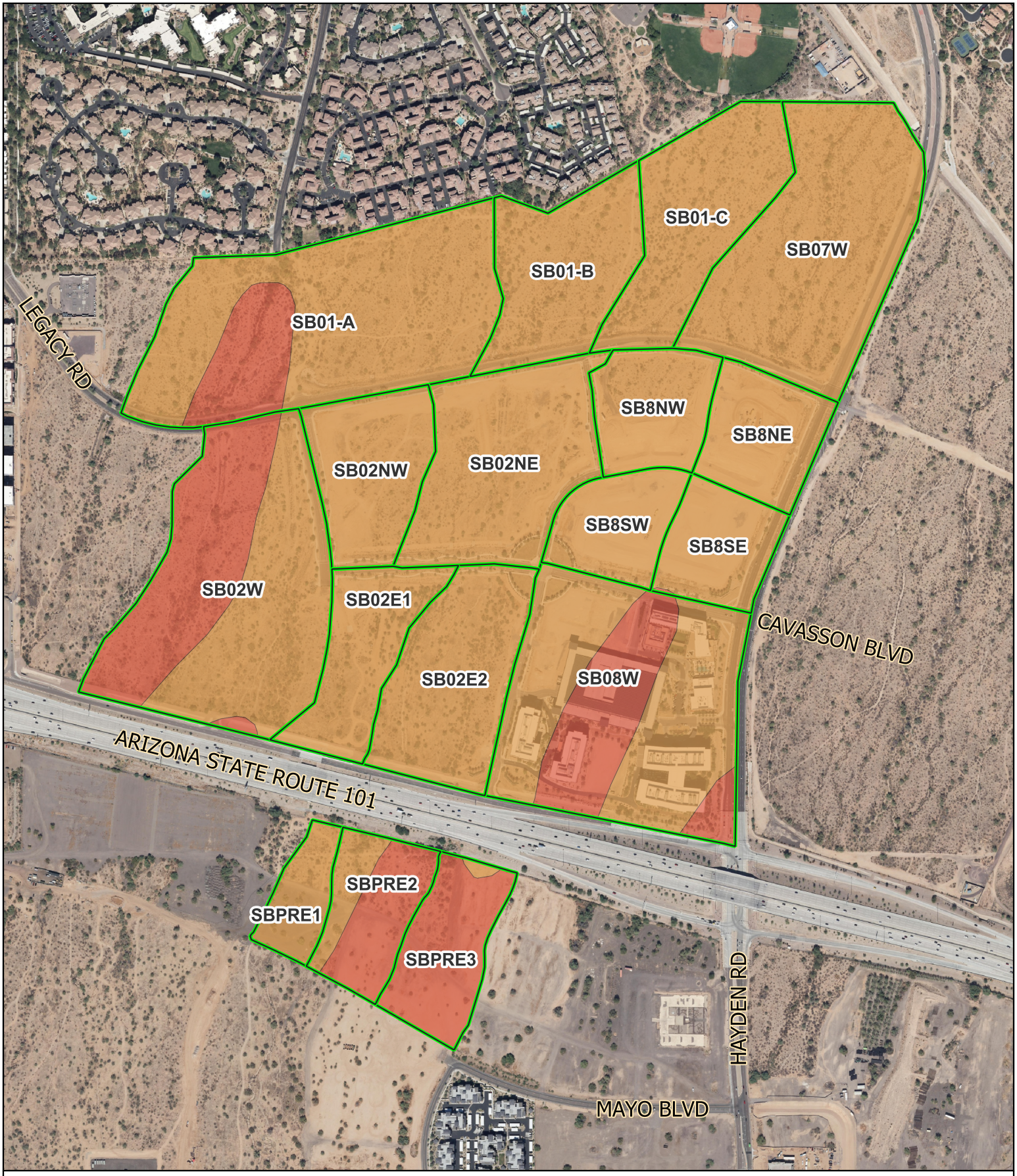

BANNER HEALTH SCOTTSDALE
Exhibit D-3: Soils Map - Pre-Development Condition

DIBBLE

LEGEND

- Subbasin
- Gilman loams
- Momoli gravelly sandy loam, 1 to 5 percent slopes

0 350 700 1,050 1,400 ft

N

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Appendix D1-1 100-YR 6-HR Results

RAINFALL DATA

Project Reference: BANNER PRE 6HR

Rain ID: DEFAULT **Method: NOAA14**

Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 MIN	0.258	0.349	0.418	0.511	0.583	0.656
10 MIN	0.393	0.530	0.636	0.778	0.887	0.998
15 MIN	0.487	0.658	0.789	0.965	1.099	1.237
30 MIN	0.656	0.886	1.063	1.299	1.480	1.666
1 HOUR	0.812	1.096	1.315	1.608	1.832	2.062
2 HOUR	0.939	1.251	1.490	1.814	2.060	2.315
3 HOUR	1.024	1.339	1.588	1.936	2.212	2.498
6 HOUR	1.215	1.549	1.817	2.182	2.465	2.760
12 HOUR	1.374	1.734	2.016	2.399	2.690	2.993
24 HOUR	1.622	2.097	2.476	3.005	3.425	3.865

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
SB01-C	0.028	0.33	95.8	95.8	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.336	0.289	0.265	0.242	0.227	0.215
												Vel (f/s)	1.44	1.67	1.83	2.00	2.13	2.25
												R (Hrs)	0.348	0.295	0.267	0.242	0.226	0.213
SB01-B	0.024	0.26	120.2	120.2	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.282	0.243	0.222	0.203	0.191	0.181
												Vel (f/s)	1.35	1.57	1.72	1.88	2.00	2.11
												R (Hrs)	0.259	0.220	0.199	0.180	0.168	0.158
SB01-A	0.062	0.31	106.4	106.4	URBAN	0.030	0.25	0.25	4.12	0.526	45	**Tc (Hrs)**	0.303	0.261	0.239	0.219	0.205	0.195
												Vel (f/s)	1.50	1.74	1.90	2.08	2.22	2.33
												R (Hrs)	0.188	0.159	0.145	0.131	0.122	0.115
SB02NE	0.034	0.32	88.1	88.1	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.339	0.292	0.267	0.244	0.230	0.217
												Vel (f/s)	1.38	1.61	1.76	1.92	2.04	2.16
												R (Hrs)	0.308	0.261	0.236	0.214	0.200	0.188
SB02NW	0.020	0.19	85.1	85.1	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.268	0.231	0.212	0.193	0.182	0.172
												Vel (f/s)	1.04	1.21	1.31	1.44	1.53	1.62
												R (Hrs)	0.212	0.179	0.163	0.147	0.137	0.129
SB02E1	0.018	0.31	77.9	77.9	Urban	0.033	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.293	0.265	0.247	0.230	0.218	0.208
												Vel (f/s)	1.55	1.72	1.84	1.98	2.09	2.19
												R (Hrs)	0.367	0.327	0.304	0.280	0.264	0.251
SB02W	0.058	0.35	87.6	87.6	URBAN	0.114	0.10	0.25	4.33	0.513	80	**Tc (Hrs)**	0.571*	0.515*	0.482*	0.447*	0.425*	0.406
												Vel (f/s)	0.90	1.00	1.07	1.15	1.21	1.26
												R (Hrs)	0.434	0.388	0.360	0.331	0.313	0.297
SB8NW	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.204	0.184	0.172	0.160	0.152	0.145
												Vel (f/s)	1.08	1.20	1.28	1.38	1.45	1.52
												R (Hrs)	0.152	0.136	0.126	0.116	0.109	0.104
SB8NE	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.204	0.184	0.172	0.160	0.152	0.145
												Vel (f/s)	1.08	1.20	1.28	1.38	1.45	1.52
												R (Hrs)	0.152	0.136	0.126	0.116	0.109	0.104
SB8SW	0.013	0.15	108.8	108.8	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.187	0.168	0.158	0.146	0.139	0.133
												Vel (f/s)	1.18	1.31	1.39	1.51	1.58	1.65

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
												R (Hrs)	0.150	0.134	0.124	0.114	0.108	0.102
SB02E2	0.027	0.37	79.8	79.8	NATURAL	0.063	0.35	0.35	4.03	0.499		**Tc (Hrs)**	1.324*	0.713*	0.569*	0.479*	0.437*	0.404
												Vel (f/s)	0.41	0.76	0.95	1.13	1.24	1.34
												R (Hrs)	1.787	0.899	0.699	0.578	0.522	0.478
SB8SE	0.013	0.17	97.6	97.6	URBAN	0.034	0.10	0.25	4.03	0.607	80	**Tc (Hrs)**	0.206	0.186	0.173	0.161	0.153	0.146
												Vel (f/s)	1.21	1.34	1.44	1.55	1.63	1.71
												R (Hrs)	0.184	0.164	0.152	0.140	0.133	0.126
SB08W	0.060	0.33	67.7	67.7	URBAN	0.030	0.10	0.25	4.22	0.540	80	**Tc (Hrs)**	0.300	0.271	0.253	0.235	0.223	0.213
												Vel (f/s)	1.61	1.79	1.91	2.06	2.17	2.27
												R (Hrs)	0.199	0.178	0.165	0.152	0.143	0.136
SB07W	0.048	0.32	97.8	97.8	URBAN	0.031	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.323	0.278	0.255	0.233	0.219	0.207
												Vel (f/s)	1.45	1.69	1.84	2.01	2.14	2.27
												R (Hrs)	0.240	0.203	0.184	0.166	0.155	0.146
SBPRE1	0.008	0.15	80.5	80.5	NATURAL	0.070	0.35	0.35	4.03	0.499		**Tc (Hrs)**	0.887*	0.478*	0.381	0.321	0.293	0.271
												Vel (f/s)	0.25	0.46	0.58	0.69	0.75	0.81
												R (Hrs)	1.113	0.561	0.436	0.361	0.325	0.298
SBPRE2	0.015	0.17	61.1	61.1	NATURAL	0.066	0.35	0.35	4.51	0.388		**Tc (Hrs)**	0.797*	0.493*	0.407	0.350	0.320	0.297
												Vel (f/s)	0.31	0.51	0.61	0.71	0.78	0.84
												R (Hrs)	0.764	0.448	0.362	0.306	0.277	0.255
SBPRE3	0.016	0.19	78.9	78.9	NATURAL	0.066	0.35	0.35	4.72	0.351		**Tc (Hrs)**	0.730*	0.468*	0.391	0.338	0.309	0.287
												Vel (f/s)	0.38	0.60	0.71	0.82	0.90	0.97
												R (Hrs)	0.730	0.446	0.365	0.311	0.281	0.259

LAND USE

Project Reference: BANNER PRE 6HR

Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
Major Basin ID: 01								
180	0.0622	100.0	0.25	45	50.0	NORMAL	0.030	High Density Residential - Multi Family (10-15 du per acre)
180	0.0245	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0275	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0343	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0197	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0477	100.0	0.25	45	50.0	NORMAL	0.031	High Density Residential - Multi Family (10-15 du per acre)
200	0.0175	100.0	0.10	80	60.0	NORMAL	0.033	General Commercial (Commercial where no detail available)
200	0.0583	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0601	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0153	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0150	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0134	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0131	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
NDR	0.0274	100.0	0.35	0	35.0	DRY	0.063	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0077	100.0	0.35	0	35.0	DRY	0.070	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0149	100.0	0.35	0	35.0	DRY	0.066	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0162	100.0	0.35	0	35.0	DRY	0.066	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%

* Non default value

SOILS

Project Reference: BANNER PRE 6HR

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Outcrop %)	Effective Rock (%)	Comments
Major Basin ID: 01									
SB01-A	645	55	64555	0.011	18.20	0.270	-	100	
	645	90	64590	0.051	81.80	0.390	-	100	
SB01-B	645	90	64590	0.025	100.00	0.390	-	100	
SB01-C	645	90	64590	0.028	100.00	0.390	-	100	
SB02E1	645	90	64590	0.018	100.00	0.390	-	100	
SB02E2	645	90	64590	0.027	100.00	0.390	-	100	
SB02NE	645	90	64590	0.034	100.00	0.390	-	100	
SB02NW	645	90	64590	0.020	100.00	0.390	-	100	
SB02W	645	55	64555	0.027	46.40	0.270	-	100	
	645	90	64590	0.031	53.60	0.390	-	100	
SB07W	645	90	64590	0.048	100.00	0.390	-	100	
SB08W	645	55	64555	0.020	33.30	0.270	-	100	
	645	90	64590	0.040	66.70	0.390	-	100	
SB8NE	645	90	64590	0.015	100.00	0.390	-	100	
SB8NW	645	90	64590	0.015	100.00	0.390	-	100	
SB8SE	645	55	64555	0.000	0.70	0.270	-	100	
	645	90	64590	0.013	99.30	0.390	-	100	
SB8SW	645	90	64590	0.013	100.00	0.390	-	100	
SBPRE1	645	90	64590	0.008	100.00	0.390	-	100	
SBPRE2	645	55	64555	0.010	69.10	0.270	-	100	
	645	90	64590	0.005	30.90	0.390	-	100	
SBPRE3	645	55	64555	0.016	96.90	0.270	-	100	
	645	90	64590	0.001	3.10	0.390	-	100	

HEC-1 FLOW SUMMARY

Project Reference: BANNER PRE 6HR

ID	Type	Area (sq mi)	Flow cfs 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin 01								
76THST	Hydrograph	0.24						50
SB01-A	Hydrograph	0.06						148
DT01A	Diversion	0.06						41
SB01A	Hydrograph	0.06						148
CP-1	Combined	0.30						165
R1A-2W	Routed	0.30						162
SB02NW	Hydrograph	0.02						47
DT02NW	Diversion	0.02						13
SB02NW	Hydrograph	0.02						47
CP-02W	Combined	0.32						207
R2W-2	Routed	0.32						206
SB01-C	Hydrograph	0.03						53
DT01C	Diversion	0.03						23
SB01C	Hydrograph	0.03						53
R1C-1B	Routed	0.03						53
SB01-B	Hydrograph	0.02						52
DT01B	Diversion	0.02						20
SB01B	Hydrograph	0.02						52
CP-01B	Combined	0.05						104
R1B-2N	Routed	0.05						102
SB02NE	Hydrograph	0.03						68
DT02NE	Diversion	0.03						30
SB02NE	Hydrograph	0.03						68
CP-02N	Combined	0.09						170
R2N-2	Routed	0.09						168
SB02E1	Hydrograph	0.02						37
DT02E1	Diversion	0.02						33
SB02E1	Hydrograph	0.02						37
SB02W	Hydrograph	0.06						102
CP-02	Combined	0.51						503
SB8NW	Hydrograph	0.01						41
DT8NW	Diversion	0.01						6
SB8NW	Hydrograph	0.01						41
R8NW8N	Routed	0.01						41
SB8NE	Hydrograph	0.01						41
DT8NE	Diversion	0.01						6
SB8NE	Hydrograph	0.01						41
R8NE8N	Routed	0.01						41
SB8SW	Hydrograph	0.01						36
DT8SW	Diversion	0.01						5
SB8SW	Hydrograph	0.01						36
SB8SE	Hydrograph	0.01						34
DT8SE	Diversion	0.01						6
SB8SE	Hydrograph	0.01						34
CP-08N	Combined	0.06						152
R8N-8W	Routed	0.06						151
SB08W	Hydrograph	0.06						151
CP-08W	Combined	0.12						302
DT08WN	Diversion	0.12						16
SB08WN	Hydrograph	0.12						302
S08W	Routed	0.12						264
DT08-W	Diversion	0.12						132
SB08-W	Hydrograph	0.12						132
R8W-P	Routed	0.12						131
SB02E2	Hydrograph	0.03						23
R2E-P	Routed	0.03						23
CPSITE	Combined	0.14						145
RP-CUL	Routed	0.14						145
SBPRE2	Hydrograph	0.01						21
CPCULV	Combined	0.16						165
SBPRE1	Hydrograph	0.01						10
SBPRE3	Hydrograph	0.02						23
CP-ALL	Combined	0.18						197
SB07W	Hydrograph	0.05						105

HEC-1 FLOW SUMMARY

Project Reference: BANNER PRE 6HR

ID	Type	Area	Flow cfs					
		(sq mi)	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DT07W	Diversion	0.05						37
SB07W	Hydrograph	0.05						105
R7W-CP	Routed	0.05						58
SB08-W	Hydrograph	0.12						132
CP-07W	Combined	0.05						132

Appendix D1-2 100-YR 24-HR Results

RAINFALL DATA

Project Reference: BANNER PRE 24HR

Rain ID: DEFAULT **Method: NOAA14**

Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 MIN	0.258	0.349	0.418	0.511	0.583	0.656
10 MIN	0.393	0.530	0.636	0.778	0.887	0.998
15 MIN	0.487	0.658	0.789	0.965	1.099	1.237
30 MIN	0.656	0.886	1.063	1.299	1.480	1.666
1 HOUR	0.812	1.096	1.315	1.608	1.832	2.062
2 HOUR	0.939	1.251	1.490	1.814	2.060	2.315
3 HOUR	1.024	1.339	1.588	1.936	2.212	2.498
6 HOUR	1.215	1.549	1.817	2.182	2.465	2.760
12 HOUR	1.374	1.734	2.016	2.399	2.690	2.993
24 HOUR	1.622	2.097	2.476	3.005	3.425	3.865

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
SB01-C	0.028	0.33	95.8	95.8	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.370	0.313	0.285	0.259	0.241	0.227
												Vel (f/s)	1.31	1.55	1.70	1.87	2.01	2.13
												R (Hrs)	0.388	0.322	0.291	0.261	0.242	0.225
SB01-B	0.024	0.26	120.2	120.2	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.311	0.263	0.240	0.218	0.203	0.191
												Vel (f/s)	1.23	1.45	1.59	1.75	1.88	2.00
												R (Hrs)	0.289	0.240	0.216	0.194	0.180	0.168
SB01-A	0.062	0.31	106.4	106.4	URBAN	0.030	0.25	0.25	4.12	0.526	45	**Tc (Hrs)**	0.333	0.282	0.258	0.234	0.218	0.205
												Vel (f/s)	1.37	1.61	1.76	1.94	2.09	2.22
												R (Hrs)	0.209	0.174	0.157	0.141	0.130	0.122
SB02NE	0.034	0.32	88.1	88.1	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.374	0.316	0.288	0.262	0.244	0.229
												Vel (f/s)	1.25	1.49	1.63	1.79	1.92	2.05
												R (Hrs)	0.343	0.285	0.257	0.231	0.214	0.199
SB02NW	0.020	0.19	85.1	85.1	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.296	0.250	0.228	0.207	0.193	0.181
												Vel (f/s)	0.94	1.11	1.22	1.35	1.44	1.54
												R (Hrs)	0.236	0.196	0.177	0.159	0.147	0.137
SB02E1	0.018	0.31	77.9	77.9	Urban	0.033	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.321	0.287	0.267	0.247	0.233	0.222
												Vel (f/s)	1.42	1.58	1.70	1.84	1.95	2.05
												R (Hrs)	0.406	0.357	0.331	0.303	0.285	0.269
SB02W	0.058	0.35	87.6	87.6	URBAN	0.114	0.10	0.25	4.33	0.513	80	**Tc (Hrs)**	0.624*	0.557*	0.520*	0.480*	0.454*	0.432 *
												Vel (f/s)	0.82	0.92	0.99	1.07	1.13	1.19
												R (Hrs)	0.479	0.423	0.392	0.358	0.337	0.319
SB8NW	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.223	0.199	0.186	0.171	0.162	0.154
												Vel (f/s)	0.99	1.11	1.18	1.29	1.36	1.43
												R (Hrs)	0.168	0.148	0.137	0.125	0.118	0.111
SB8NE	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.223	0.199	0.186	0.171	0.162	0.154
												Vel (f/s)	0.99	1.11	1.18	1.29	1.36	1.43
												R (Hrs)	0.168	0.148	0.137	0.125	0.118	0.111
SB8SW	0.013	0.15	108.8	108.8	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.204	0.183	0.170	0.157	0.149	0.141
												Vel (f/s)	1.08	1.20	1.29	1.40	1.48	1.56

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
												R (Hrs)	0.166	0.146	0.135	0.124	0.116	0.110
SB02E2	0.027	0.37	79.8	79.8	NATURAL	0.063	0.35	0.35	4.03	0.499		**Tc (Hrs)**	1.450*	0.752*	0.600*	0.506*	0.458*	0.415
												Vel (f/s)	0.37	0.72	0.90	1.07	1.18	1.31
												R (Hrs)	1.960	0.953	0.743	0.614	0.551	0.494
SB8SE	0.013	0.17	97.6	97.6	URBAN	0.034	0.10	0.25	4.03	0.607	80	**Tc (Hrs)**	0.225	0.201	0.187	0.173	0.164	0.156
												Vel (f/s)	1.11	1.24	1.33	1.44	1.52	1.60
												R (Hrs)	0.204	0.179	0.166	0.152	0.143	0.135
SB08W	0.060	0.33	67.7	67.7	URBAN	0.030	0.10	0.25	4.22	0.540	80	**Tc (Hrs)**	0.328	0.293	0.273	0.252	0.239	0.227
												Vel (f/s)	1.48	1.65	1.77	1.92	2.03	2.13
												R (Hrs)	0.220	0.194	0.180	0.164	0.154	0.146
SB07W	0.048	0.32	97.8	97.8	URBAN	0.031	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.356	0.301	0.275	0.249	0.232	0.218
												Vel (f/s)	1.32	1.56	1.71	1.88	2.02	2.15
												R (Hrs)	0.267	0.222	0.200	0.180	0.166	0.155
SBPRE1	0.008	0.15	80.5	80.5	NATURAL	0.070	0.35	0.35	4.03	0.499		**Tc (Hrs)**	1.279*	0.504*	0.403	0.339	0.307	0.279
												Vel (f/s)	0.17	0.44	0.55	0.65	0.72	0.79
												R (Hrs)	1.670	0.594	0.463	0.383	0.343	0.308
SBPRE2	0.015	0.17	61.1	61.1	NATURAL	0.066	0.35	0.35	4.51	0.388		**Tc (Hrs)**	0.955*	0.515*	0.429*	0.368	0.331	0.302
												Vel (f/s)	0.26	0.48	0.58	0.68	0.75	0.83
												R (Hrs)	0.933	0.470	0.384	0.324	0.288	0.260
SBPRE3	0.016	0.19	78.9	78.9	NATURAL	0.066	0.35	0.35	4.72	0.351		**Tc (Hrs)**	0.844*	0.488*	0.412	0.354	0.318	0.292
												Vel (f/s)	0.33	0.57	0.68	0.79	0.88	0.95
												R (Hrs)	0.857	0.467	0.387	0.327	0.290	0.264

Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
Major Basin ID: 01								
180	0.0622	100.0	0.25	45	50.0	NORMAL	0.030	High Density Residential - Multi Family (10-15 du per acre)
180	0.0245	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0275	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0343	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0197	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0477	100.0	0.25	45	50.0	NORMAL	0.031	High Density Residential - Multi Family (10-15 du per acre)
200	0.0175	100.0	0.10	80	60.0	NORMAL	0.033	General Commercial (Commercial where no detail available)
200	0.0583	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0601	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0153	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0150	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0134	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0131	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
NDR	0.0274	100.0	0.35	0	35.0	DRY	0.063	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0077	100.0	0.35	0	35.0	DRY	0.070	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0149	100.0	0.35	0	35.0	DRY	0.066	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0162	100.0	0.35	0	35.0	DRY	0.066	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%

SOILS

Project Reference: BANNER PRE 24HR

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Outcrop %)	Effective Rock (%)	Comments
Major Basin ID: 01									
SB01-A	645	55	64555	0.011	18.20	0.270	-	100	
	645	90	64590	0.051	81.80	0.390	-	100	
SB01-B	645	90	64590	0.025	100.00	0.390	-	100	
SB01-C	645	90	64590	0.028	100.00	0.390	-	100	
SB02E1	645	90	64590	0.018	100.00	0.390	-	100	
SB02E2	645	90	64590	0.027	100.00	0.390	-	100	
SB02NE	645	90	64590	0.034	100.00	0.390	-	100	
SB02NW	645	90	64590	0.020	100.00	0.390	-	100	
SB02W	645	55	64555	0.027	46.40	0.270	-	100	
	645	90	64590	0.031	53.60	0.390	-	100	
SB07W	645	90	64590	0.048	100.00	0.390	-	100	
SB08W	645	55	64555	0.020	33.30	0.270	-	100	
	645	90	64590	0.040	66.70	0.390	-	100	
SB8NE	645	90	64590	0.015	100.00	0.390	-	100	
SB8NW	645	90	64590	0.015	100.00	0.390	-	100	
SB8SE	645	55	64555	0.000	0.70	0.270	-	100	
	645	90	64590	0.013	99.30	0.390	-	100	
SB8SW	645	90	64590	0.013	100.00	0.390	-	100	
SBPRE1	645	90	64590	0.008	100.00	0.390	-	100	
SBPRE2	645	55	64555	0.010	69.10	0.270	-	100	
	645	90	64590	0.005	30.90	0.390	-	100	
SBPRE3	645	55	64555	0.016	96.90	0.270	-	100	
	645	90	64590	0.001	3.10	0.390	-	100	

HEC-1 FLOW SUMMARY

Project Reference: BANNER PRE 24HR

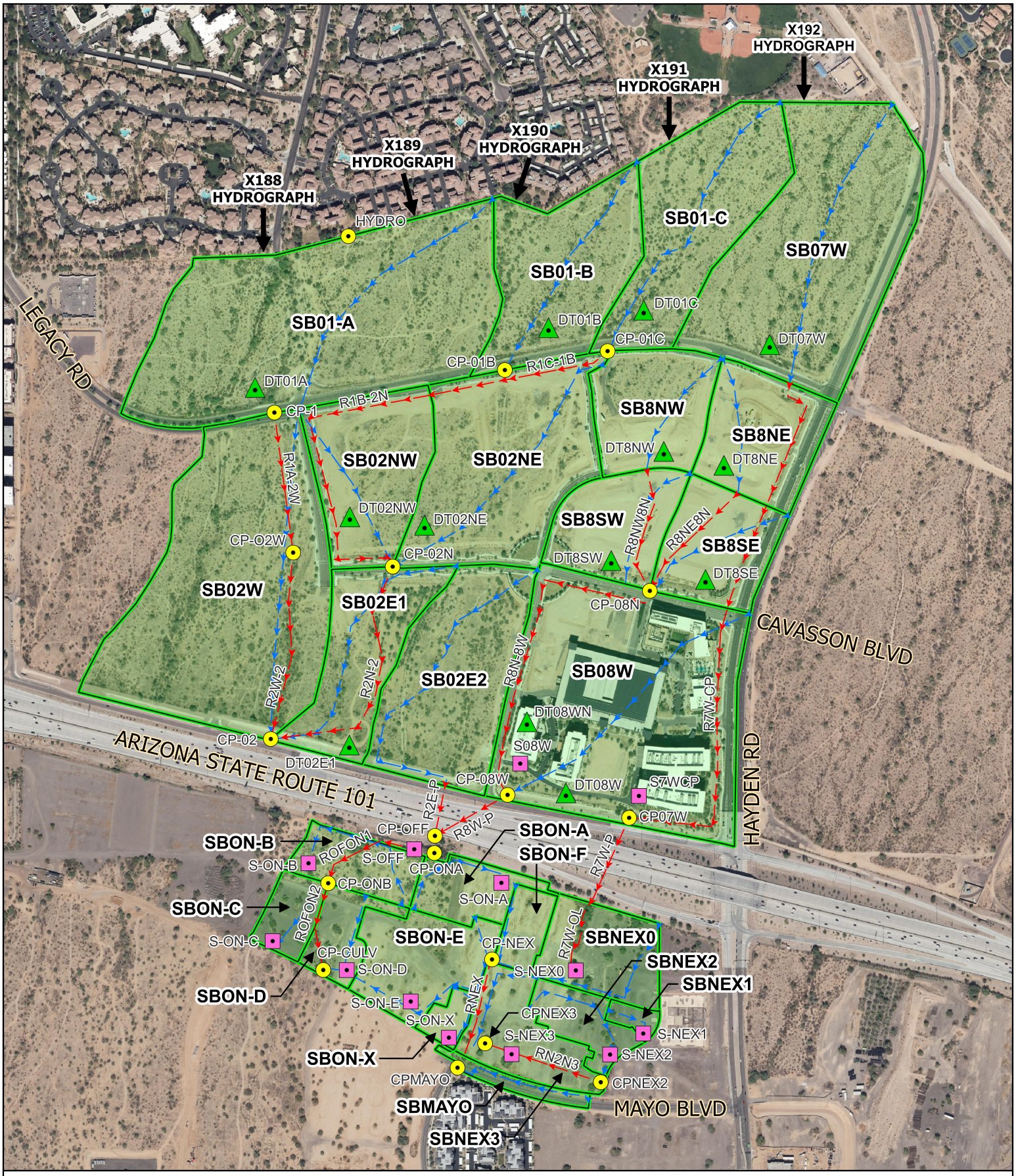
ID	Type	Area (sq mi)	Flow cfs 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin 01								
76THST	Hydrograph	0.24						50
SB01-A	Hydrograph	0.06						120
DT01A	Diversion	0.06						5
SB01A	Hydrograph	0.06						120
CP-1	Combined	0.30						120
R1A-2W	Routed	0.30						118
SB02NW	Hydrograph	0.02						38
DT02NW	Diversion	0.02						2
SB02NW	Hydrograph	0.02						38
CP-02W	Combined	0.32						154
R2W-2	Routed	0.32						154
SB01-C	Hydrograph	0.03						43
DT01C	Diversion	0.03						2
SB01C	Hydrograph	0.03						43
R1C-1B	Routed	0.03						43
SB01-B	Hydrograph	0.02						42
DT01B	Diversion	0.02						2
SB01B	Hydrograph	0.02						42
CP-01B	Combined	0.05						84
R1B-2N	Routed	0.05						83
SB02NE	Hydrograph	0.03						55
DT02NE	Diversion	0.03						3
SB02NE	Hydrograph	0.03						55
CP-02N	Combined	0.09						138
R2N-2	Routed	0.09						137
SB02E1	Hydrograph	0.02						29
DT02E1	Diversion	0.02						15
SB02E1	Hydrograph	0.02						29
SB02W	Hydrograph	0.06						81
CP-02	Combined	0.51						388
SB8NW	Hydrograph	0.01						34
DT8NW	Diversion	0.01						1
SB8NW	Hydrograph	0.01						34
R8NW8N	Routed	0.01						34
SB8NE	Hydrograph	0.01						34
DT8NE	Diversion	0.01						1
SB8NE	Hydrograph	0.01						34
R8NE8N	Routed	0.01						34
SB8SW	Hydrograph	0.01						29
DT8SW	Diversion	0.01						1
SB8SW	Hydrograph	0.01						29
SB8SE	Hydrograph	0.01						28
DT8SE	Diversion	0.01						1
SB8SE	Hydrograph	0.01						28
CP-08N	Combined	0.06						124
R8N-8W	Routed	0.06						123
SB08W	Hydrograph	0.06						122
CP-08W	Combined	0.12						243
DT08WN	Diversion	0.12						2
SB08WN	Hydrograph	0.12						243
S08W	Routed	0.12						209
DT08-W	Diversion	0.12						91
SB08-W	Hydrograph	0.12						118
R8W-P	Routed	0.12						118
SB02E2	Hydrograph	0.03						19
R2E-P	Routed	0.03						19
CPSITE	Combined	0.14						130
RP-CUL	Routed	0.14						130
SBPRE2	Hydrograph	0.01						18
CPCULV	Combined	0.16						147
SBPRE1	Hydrograph	0.01						8
SBPRE3	Hydrograph	0.02						20
CP-ALL	Combined	0.18						174
SB07W	Hydrograph	0.05						85

HEC-1 FLOW SUMMARY

Project Reference: BANNER PRE 24HR

ID	Type	Area	Flow cfs					
		(sq mi)	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DT07W	Diversion	0.05						4
SB07W	Hydrograph	0.05						85
R7W-CP	Routed	0.05						56
SB08-W	Hydrograph	0.12						91
CP-07W	Combined	0.05						99

Appendix D2 Post-Development Condition



BANNER HEALTH SCOTTSDALE

Exhibit D-4: HEC-1 Schematic - Post-Development Condition

DIBBLE

LEGEND

- HEC-1 Storage
- HEC-1 Combine Point
- TC Flow Path
- HEC-1 Diversion
- HEC-1 Route
- Subbasin

0 350 700 1,050 1,400 ft

N

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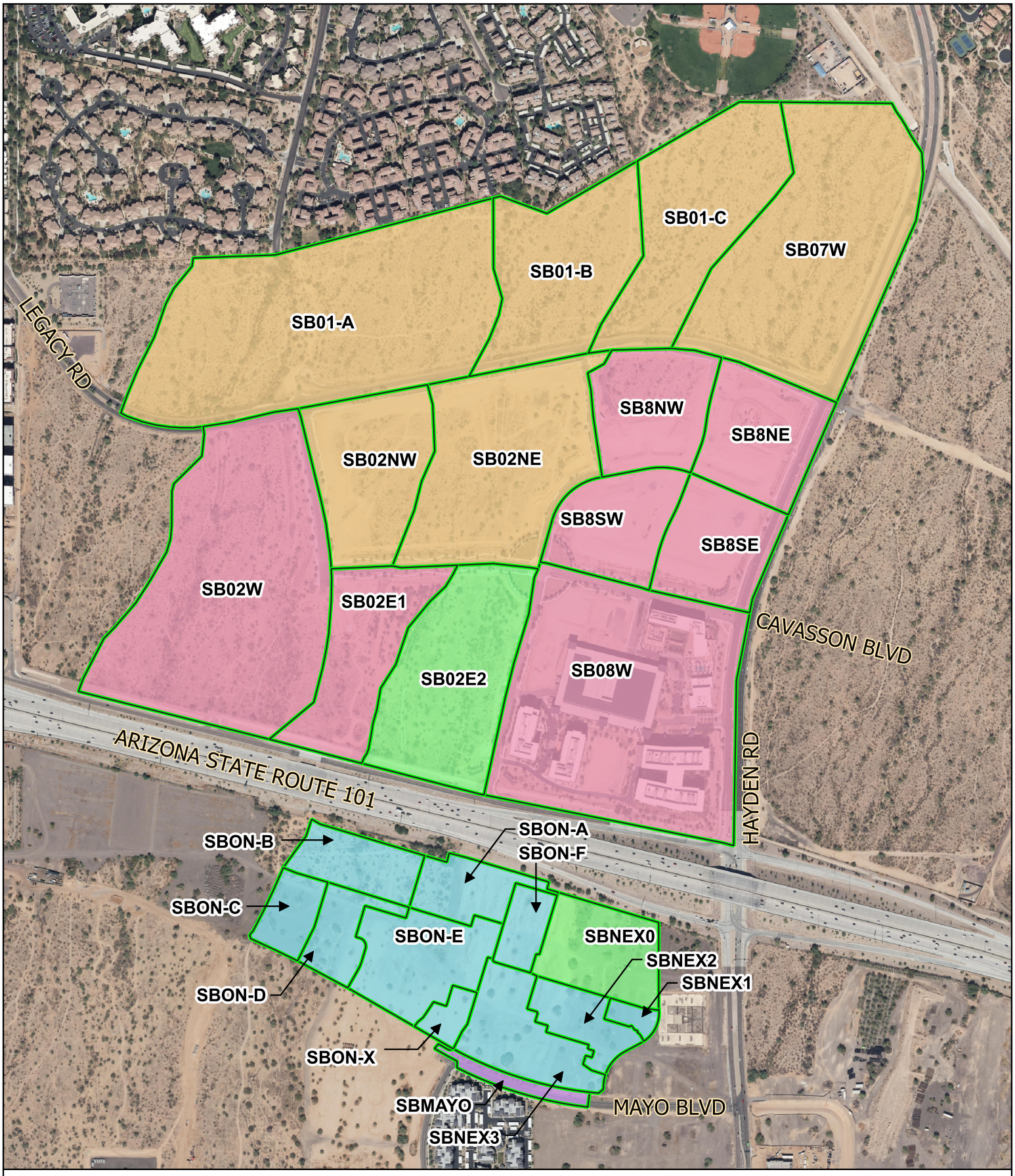

BANNER HEALTH SCOTTSDALE

Exhibit D-5: Land Use Map - Post-Development Condition

DIBBLE

LEGEND

- Subbasin
- Commercial
- Hospital
- Multi-Family
- Transportation
- Undeveloped Desert

0 350 700 1,050 1,400 ft

N

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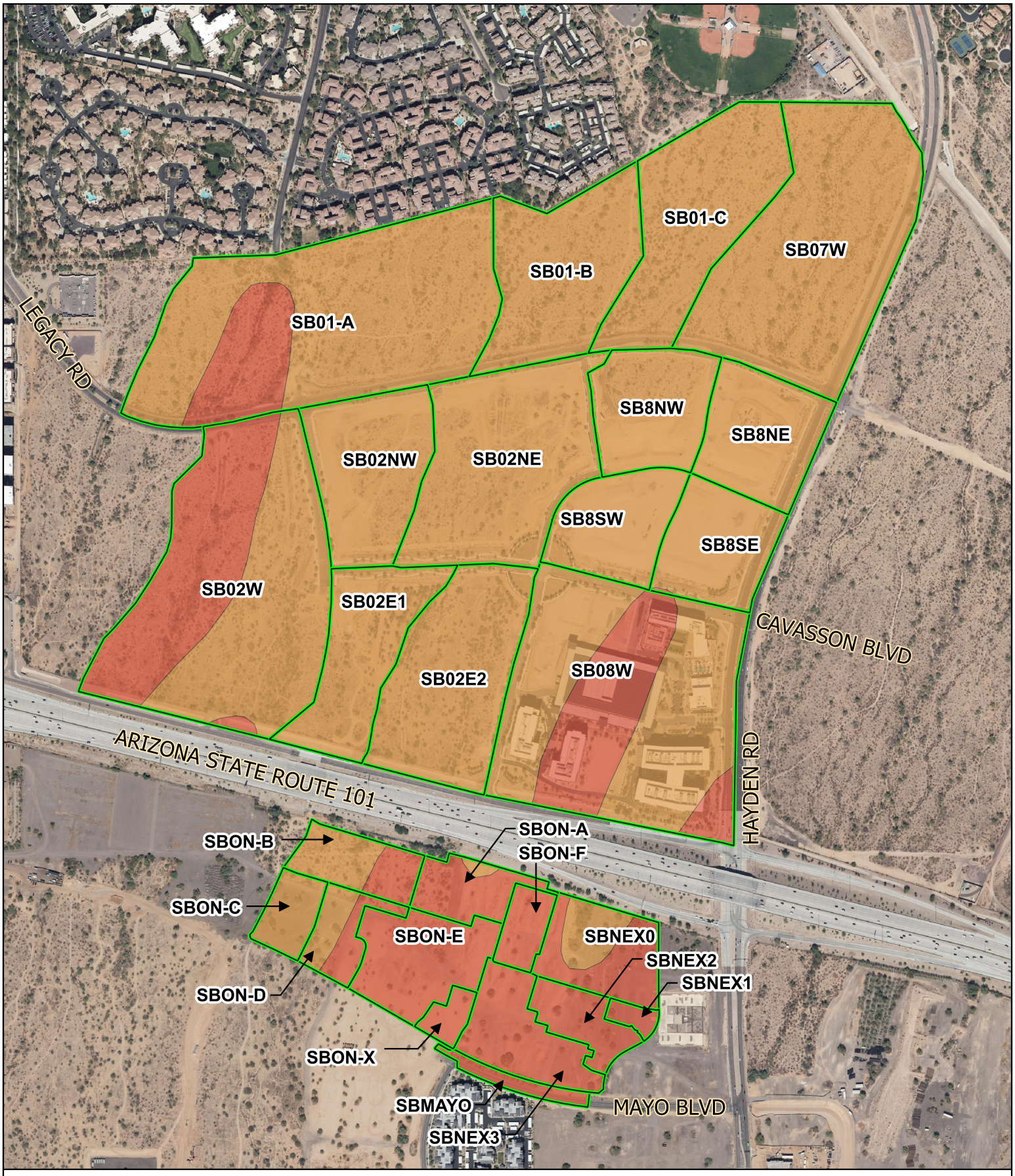

BANNER HEALTH SCOTTSDALE

Exhibit D-6: Soils Map - Post-Development Condition

DIBBLE

LEGEND

- Subbasin
- Gilman loams
- Momoli gravelly sandy loam, 1 to 5 percent slopes

0 350 700 1,050 1,400 ft

N

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Appendix D2-1 100-YR 6-HR Results

RAINFALL DATA

Project Reference: BANNER HEALTH 6HR

Rain ID: DEFAULT **Method: NOAA14**

Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 MIN	0.258	0.349	0.418	0.511	0.583	0.656
10 MIN	0.393	0.530	0.636	0.778	0.887	0.998
15 MIN	0.487	0.658	0.789	0.965	1.099	1.237
30 MIN	0.656	0.886	1.063	1.299	1.480	1.666
1 HOUR	0.812	1.096	1.315	1.608	1.832	2.062
2 HOUR	0.939	1.251	1.490	1.814	2.060	2.315
3 HOUR	1.024	1.339	1.588	1.936	2.212	2.498
6 HOUR	1.215	1.549	1.817	2.182	2.465	2.760
12 HOUR	1.374	1.734	2.016	2.399	2.690	2.993
24 HOUR	1.622	2.097	2.476	3.005	3.425	3.865

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
SB01-C	0.028	0.33	95.8	95.8	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.336	0.289	0.265	0.242	0.227	0.215
												Vel (f/s)	1.44	1.67	1.83	2.00	2.13	2.25
												R (Hrs)	0.348	0.295	0.267	0.242	0.226	0.213
SB01-B	0.024	0.26	120.2	120.2	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.282	0.243	0.222	0.203	0.191	0.181
												Vel (f/s)	1.35	1.57	1.72	1.88	2.00	2.11
												R (Hrs)	0.259	0.220	0.199	0.180	0.168	0.158
SB01-A	0.062	0.31	106.4	106.4	URBAN	0.030	0.25	0.25	4.12	0.526	45	**Tc (Hrs)**	0.303	0.261	0.239	0.219	0.205	0.195
												Vel (f/s)	1.50	1.74	1.90	2.08	2.22	2.33
												R (Hrs)	0.188	0.159	0.145	0.131	0.122	0.115
SB02NE	0.034	0.32	88.1	88.1	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.339	0.292	0.267	0.244	0.230	0.217
												Vel (f/s)	1.38	1.61	1.76	1.92	2.04	2.16
												R (Hrs)	0.308	0.261	0.236	0.214	0.200	0.188
SB02NW	0.020	0.19	85.1	85.1	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.268	0.231	0.212	0.193	0.182	0.172
												Vel (f/s)	1.04	1.21	1.31	1.44	1.53	1.62
												R (Hrs)	0.212	0.179	0.163	0.147	0.137	0.129
SBMAYO	0.002	0.15	26.1	26.1	Urban	0.039	0.05	0.35	4.72	0.270	95	**Tc (Hrs)**	0.295	0.269	0.253	0.235	0.224	0.215
												Vel (f/s)	0.75	0.82	0.87	0.94	0.98	1.02
												R (Hrs)	0.723	0.652	0.608	0.563	0.533	0.508
SBON-E	0.013	0.23	75.6	75.6	Urban	0.034	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.258	0.233	0.218	0.202	0.192	0.183
												Vel (f/s)	1.31	1.45	1.55	1.67	1.76	1.84
												R (Hrs)	0.301	0.269	0.250	0.230	0.217	0.206
SBON-X	0.002	0.07	112.7	112.7	Urban	0.039	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.135	0.122	0.114	0.106	0.100	0.096 *
												Vel (f/s)	0.76	0.84	0.90	0.97	1.03	1.07
												R (Hrs)	0.165	0.147	0.137	0.126	0.119	0.113
SB02E1	0.018	0.31	77.9	77.9	Urban	0.033	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.293	0.265	0.247	0.230	0.218	0.208
												Vel (f/s)	1.55	1.72	1.84	1.98	2.09	2.19
												R (Hrs)	0.367	0.327	0.304	0.280	0.264	0.251
SB02W	0.058	0.35	87.6	87.6	URBAN	0.114	0.10	0.25	4.33	0.513	80	**Tc (Hrs)**	0.571*	0.515*	0.482*	0.447*	0.425*	0.406
												Vel (f/s)	0.90	1.00	1.07	1.15	1.21	1.26

* Non default value or value out of range

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
												R (Hrs)	0.434	0.388	0.360	0.331	0.313	0.297
SB8NW	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.204	0.184	0.172	0.160	0.152	0.145
												Vel (f/s)	1.08	1.20	1.28	1.38	1.45	1.52
												R (Hrs)	0.152	0.136	0.126	0.116	0.109	0.104
SB8NE	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.204	0.184	0.172	0.160	0.152	0.145
												Vel (f/s)	1.08	1.20	1.28	1.38	1.45	1.52
												R (Hrs)	0.152	0.136	0.126	0.116	0.109	0.104
SB8SW	0.013	0.15	108.8	108.8	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.187	0.168	0.158	0.146	0.139	0.133
												Vel (f/s)	1.18	1.31	1.39	1.51	1.58	1.65
												R (Hrs)	0.150	0.134	0.124	0.114	0.108	0.102
SBNEX0	0.011	0.18	73.1	73.1	NATURAL	0.068	0.35	0.35	4.45	0.392		**Tc (Hrs)**	0.788*	0.488*	0.403	0.346	0.317	0.293
												Vel (f/s)	0.34	0.54	0.66	0.76	0.83	0.90
												R (Hrs)	0.942	0.553	0.447	0.378	0.342	0.314
SBON-F	0.004	0.12	53.3	53.3	Urban	0.037	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.217	0.196	0.183	0.170	0.161	0.154
												Vel (f/s)	0.81	0.90	0.96	1.04	1.09	1.14
												R (Hrs)	0.289	0.258	0.240	0.221	0.209	0.198
SB02E2	0.027	0.36	80.4	80.4	NATURAL	0.063	0.35	0.35	4.03	0.499		**Tc (Hrs)**	1.303*	0.702*	0.560*	0.472*	0.430*	0.397
												Vel (f/s)	0.41	0.75	0.94	1.12	1.23	1.33
												R (Hrs)	1.718	0.864	0.672	0.556	0.502	0.460
SB8SE	0.013	0.17	97.6	97.6	URBAN	0.034	0.10	0.25	4.03	0.607	80	**Tc (Hrs)**	0.206	0.186	0.173	0.161	0.153	0.146
												Vel (f/s)	1.21	1.34	1.44	1.55	1.63	1.71
												R (Hrs)	0.184	0.164	0.152	0.140	0.133	0.126
SB08W	0.060	0.33	67.7	67.7	URBAN	0.030	0.10	0.25	4.22	0.540	80	**Tc (Hrs)**	0.300	0.271	0.253	0.235	0.223	0.213
												Vel (f/s)	1.61	1.79	1.91	2.06	2.17	2.27
												R (Hrs)	0.199	0.178	0.165	0.152	0.143	0.136
SB07W	0.048	0.32	97.8	97.8	URBAN	0.031	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.323	0.278	0.255	0.233	0.219	0.207
												Vel (f/s)	1.45	1.69	1.84	2.01	2.14	2.27
												R (Hrs)	0.240	0.203	0.184	0.166	0.155	0.146
SBNEX1	0.001	0.06	73.7	73.7	Urban	0.041	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.146	0.132	0.123	0.115	0.109	0.104

* Non default value or value out of range

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
												Vel (f/s)	0.60	0.67	0.72	0.77	0.81	0.85
												R (Hrs)	0.236	0.211	0.196	0.181	0.171	0.162
SBNEX2	0.006	0.16	42.2	42.2	Urban	0.036	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.265	0.239	0.224	0.208	0.198	0.189
												Vel (f/s)	0.89	0.98	1.05	1.13	1.19	1.24
												R (Hrs)	0.362	0.323	0.300	0.276	0.261	0.248
SBNEX3	0.011	0.12	54.5	54.5	Urban	0.035	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.209	0.189	0.177	0.164	0.156	0.149
												Vel (f/s)	0.84	0.93	0.99	1.07	1.13	1.18
												R (Hrs)	0.156	0.139	0.129	0.119	0.113	0.107
SBON-A	0.007	0.13	43.8	43.8	Urban	0.036	0.10	0.25	4.65	0.478	80	**Tc (Hrs)**	0.236	0.213	0.200	0.185	0.176	0.168
												Vel (f/s)	0.81	0.90	0.95	1.03	1.08	1.13
												R (Hrs)	0.247	0.220	0.205	0.188	0.178	0.169
SBON-B	0.007	0.19	39.9	39.9	Urban	0.036	0.10	0.25	4.28	0.587	80	**Tc (Hrs)**	0.296	0.267	0.249	0.231	0.220	0.210
												Vel (f/s)	0.94	1.04	1.12	1.21	1.27	1.33
												R (Hrs)	0.429	0.382	0.355	0.327	0.308	0.293
SBON-C	0.005	0.08	175.9	175.9	Urban	0.037	0.10	0.25	4.03	0.671	80	**Tc (Hrs)**	0.123	0.111	0.104	0.096*	0.092*	0.087 *
												Vel (f/s)	0.95	1.06	1.13	1.22	1.28	1.35
												R (Hrs)	0.098	0.088	0.081	0.075	0.071	0.067
SBON-D	0.005	0.11	156.6	156.6	Urban	0.037	0.10	0.25	4.39	0.557	80	**Tc (Hrs)**	0.149	0.135	0.126	0.117	0.111	0.106
												Vel (f/s)	1.08	1.20	1.28	1.38	1.45	1.52
												R (Hrs)	0.157	0.140	0.130	0.120	0.113	0.107

LAND USE

Project Reference: BANNER HEALTH 6HR

Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
Major Basin ID: 01								
180	0.0622	100.0	0.25	45	50.0	NORMAL	0.030	High Density Residential - Multi Family (10-15 du per acre)
180	0.0245	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0275	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0343	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0197	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0477	100.0	0.25	45	50.0	NORMAL	0.031	High Density Residential - Multi Family (10-15 du per acre)
200	0.0175	100.0	0.10	80	60.0	NORMAL	0.033	General Commercial (Commercial where no detail available)
200	0.0583	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0601	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0153	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0150	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0134	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0131	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
2002	0.0025	100.0	0.05	95	0.0	DRY	0.039	Pavement and Rooftops
530	0.0014	100.0	0.10	80	75.0	NORMAL	0.041	Institutional (Includes hospitals and churches)
530	0.0058	100.0	0.10	80	75.0	NORMAL	0.036	Institutional (Includes hospitals and churches)
530	0.0108	100.0	0.10	80	75.0	NORMAL	0.035	Institutional (Includes hospitals and churches)
530	0.0065	100.0	0.10	80	75.0	NORMAL	0.036	Institutional (Includes hospitals and churches)
530	0.0074	100.0	0.10	80	75.0	NORMAL	0.036	Institutional (Includes hospitals and churches)
530	0.0046	100.0	0.10	80	75.0	NORMAL	0.037	Institutional (Includes hospitals and churches)
530	0.0055	100.0	0.10	80	75.0	NORMAL	0.037	Institutional (Includes hospitals and churches)

* Non default value

Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
530	0.0129	100.0	0.10	80	75.0	NORMAL	0.034	Institutional (Includes hospitals and churches)
530	0.0038	100.0	0.10	80	75.0	NORMAL	0.037	Institutional (Includes hospitals and churches)
530	0.0022	100.0	0.10	80	75.0	NORMAL	0.039	Institutional (Includes hospitals and churches)
NDR	0.0274	100.0	0.35	0	35.0	DRY	0.063	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0113	100.0	0.35	0	35.0	DRY	0.068	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%

* Non default value

SOILS

Project Reference: BANNER HEALTH 6HR

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Outcrop %)	Effective Rock (%)	Comments
Major Basin ID: 01									
SB01-A	645	55	64555	0.011	18.20	0.270	-	100	
	645	90	64590	0.051	81.80	0.390	-	100	
SB01-B	645	90	64590	0.025	100.00	0.390	-	100	
SB01-C	645	90	64590	0.028	100.00	0.390	-	100	
SB02E1	645	90	64590	0.018	100.00	0.390	-	100	
SB02E2	645	90	64590	0.027	100.00	0.390	-	100	
SB02NE	645	90	64590	0.034	100.00	0.390	-	100	
SB02NW	645	90	64590	0.020	100.00	0.390	-	100	
SB02W	645	55	64555	0.027	46.40	0.270	-	100	
	645	90	64590	0.031	53.60	0.390	-	100	
SB07W	645	90	64590	0.048	100.00	0.390	-	100	
SB08W	645	55	64555	0.020	33.30	0.270	-	100	
	645	90	64590	0.040	66.70	0.390	-	100	
SB8NE	645	90	64590	0.015	100.00	0.390	-	100	
SB8NW	645	90	64590	0.015	100.00	0.390	-	100	
SB8SE	645	55	64555	0.000	0.70	0.270	-	100	
	645	90	64590	0.013	99.30	0.390	-	100	
SB8SW	645	90	64590	0.013	100.00	0.390	-	100	
SBMAYO	645	55	64555	0.003	100.00	0.270	-	100	
SBNEX0	645	55	64555	0.008	66.40	0.270	-	100	
	645	90	64590	0.004	33.60	0.390	-	100	
SBNEX1	645	55	64555	0.001	100.00	0.270	-	100	
SBNEX2	645	55	64555	0.006	100.00	0.270	-	100	
SBNEX3	645	55	64555	0.011	100.00	0.270	-	100	
SBON-A	645	55	64555	0.006	92.40	0.270	-	100	
	645	90	64590	0.001	7.60	0.390	-	100	
SBON-B	645	55	64555	0.003	37.00	0.270	-	100	
	645	90	64590	0.005	63.00	0.390	-	100	
SBON-C	645	90	64590	0.005	100.00	0.390	-	100	
SBON-D	645	55	64555	0.003	50.90	0.270	-	100	
	645	90	64590	0.003	49.10	0.390	-	100	
SBON-E	645	55	64555	0.013	100.00	0.270	-	100	
SBON-F	645	55	64555	0.004	100.00	0.270	-	100	
SBON-X	645	55	64555	0.002	100.00	0.270	-	100	

HEC-1 FLOW SUMMARY

Project Reference: BANNER HEALTH 6HR

ID	Type	Area (sq mi)	Flow cfs 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin 01								
76THST	Hydrograph	0.24						50
SB01-A	Hydrograph	0.06						148
DT01A	Diversion	0.06						41
SB01A	Hydrograph	0.06						148
CP-1	Combined	0.30						165
R1A-2W	Routed	0.30						162
SB02NW	Hydrograph	0.02						47
DT02NW	Diversion	0.02						13
SB02NW	Hydrograph	0.02						47
CP-02W	Combined	0.32						207
R2W-2	Routed	0.32						206
SB01-C	Hydrograph	0.03						53
DT01C	Diversion	0.03						23
SB01C	Hydrograph	0.03						53
R1C-1B	Routed	0.03						53
SB01-B	Hydrograph	0.02						52
DT01B	Diversion	0.02						20
SB01B	Hydrograph	0.02						52
CP-01B	Combined	0.05						104
R1B-2N	Routed	0.05						102
SB02NE	Hydrograph	0.03						68
DT02NE	Diversion	0.03						30
SB02NE	Hydrograph	0.03						68
CP-02N	Combined	0.09						170
R2N-2	Routed	0.09						168
SB02E1	Hydrograph	0.02						37
DT02E1	Diversion	0.02						33
SB02E1	Hydrograph	0.02						37
SB02W	Hydrograph	0.06						102
CP-02	Combined	0.51						501
SB8NW	Hydrograph	0.01						41
DT8NW	Diversion	0.01						6
SB8NW	Hydrograph	0.01						41
R8NW8N	Routed	0.01						41
SB8NE	Hydrograph	0.01						41
DT8NE	Diversion	0.01						6
SB8NE	Hydrograph	0.01						41
R8NE8N	Routed	0.01						41
SB8SW	Hydrograph	0.01						36
DT8SW	Diversion	0.01						5
SB8SW	Hydrograph	0.01						36
SB8SE	Hydrograph	0.01						34
DT8SE	Diversion	0.01						6
SB8SE	Hydrograph	0.01						34
CP-08N	Combined	0.06						152
R8N-8W	Routed	0.06						151
SB08W	Hydrograph	0.06						151
CP-08W	Combined	0.12						302
DT08WN	Diversion	0.12						16
SB08WN	Hydrograph	0.12						302
S08W	Routed	0.12						264
DT08-W	Diversion	0.12						132
SB08-W	Hydrograph	0.12						132
R8W-P	Routed	0.12						131
SB02E2	Hydrograph	0.03						24
R2E-P	Routed	0.03						23
CP-OFF	Combined	0.14						145
SBON-A	Hydrograph	0.01						17
S-ON-A	Routed	0.01						7
CPON-A	Combined	0.15						151
S-OFF	Routed	0.15						131
ROFON1	Routed	0.15						128
SBON-B	Hydrograph	0.01						13
S-ON-B	Routed	0.01						7

HEC-1 FLOW SUMMARY

Project Reference: BANNER HEALTH 6HR

ID	Type	Area	Flow cfs					
		(sq mi)	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
CPON-B	Combined	0.16						136
ROFON2	Routed	0.16						135
SBON-C	Hydrograph							15
S-ON-C	Routed							7
SBON-D	Hydrograph							14
S-ON-D	Routed							11
SBON-E	Hydrograph	0.01						29
S-ON-E	Routed	0.01						4
CPCULV	Combined	0.18						148
SB07W	Hydrograph	0.05						105
DT07W	Diversion	0.05						37
SB07W	Hydrograph	0.05						105
R7W-CP	Routed	0.05						58
SB08-W	Hydrograph	0.12						132
CP-07W	Combined	0.05						132
S7WCP	Routed	0.05						129
R7W-P	Routed	0.05						128
R7W-OL	Routed	0.05						127
SBNEX0	Hydrograph	0.01						14
SBON-F	Hydrograph							9
CP-NEX	Combined	0.06						147
S-NEX0	Routed	0.06						21
RNEX	Routed	0.06						21
SBNEX1	Hydrograph							3
S-NEX1	Routed							2
SBNEX2	Hydrograph	0.01						12
CPNEX2	Combined	0.01						14
S-NEX2	Routed	0.01						6
RN2N3	Routed	0.01						6
SBNEX3	Hydrograph	0.01						30
CPNEX3	Combined	0.02						33
S-NEX3	Routed	0.02						22
SBON-X	Hydrograph							6
S-ON-X	Routed							2
SBMAYO	Hydrograph							3
CPMAYO	Combined	0.09						36

Appendix D2-2 100-YR 24-HR Results

RAINFALL DATA

Project Reference: BANNER HEALTH 24HR

Rain ID: DEFAULT **Method: NOAA14**

Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 MIN	0.258	0.349	0.418	0.511	0.583	0.656
10 MIN	0.393	0.530	0.636	0.778	0.887	0.998
15 MIN	0.487	0.658	0.789	0.965	1.099	1.237
30 MIN	0.656	0.886	1.063	1.299	1.480	1.666
1 HOUR	0.812	1.096	1.315	1.608	1.832	2.062
2 HOUR	0.939	1.251	1.490	1.814	2.060	2.315
3 HOUR	1.024	1.339	1.588	1.936	2.212	2.498
6 HOUR	1.215	1.549	1.817	2.182	2.465	2.760
12 HOUR	1.374	1.734	2.016	2.399	2.690	2.993
24 HOUR	1.622	2.097	2.476	3.005	3.425	3.865

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
SB01-C	0.028	0.33	95.8	95.8	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.370	0.313	0.285	0.259	0.241	0.227
												Vel (f/s)	1.31	1.55	1.70	1.87	2.01	2.13
												R (Hrs)	0.388	0.322	0.291	0.261	0.242	0.225
SB01-B	0.024	0.26	120.2	120.2	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.311	0.263	0.240	0.218	0.203	0.191
												Vel (f/s)	1.23	1.45	1.59	1.75	1.88	2.00
												R (Hrs)	0.289	0.240	0.216	0.194	0.180	0.168
SB01-A	0.062	0.31	106.4	106.4	URBAN	0.030	0.25	0.25	4.12	0.526	45	**Tc (Hrs)**	0.333	0.282	0.258	0.234	0.218	0.205
												Vel (f/s)	1.37	1.61	1.76	1.94	2.09	2.22
												R (Hrs)	0.209	0.174	0.157	0.141	0.130	0.122
SB02NE	0.034	0.32	88.1	88.1	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.374	0.316	0.288	0.262	0.244	0.229
												Vel (f/s)	1.25	1.49	1.63	1.79	1.92	2.05
												R (Hrs)	0.343	0.285	0.257	0.231	0.214	0.199
SB02NW	0.020	0.19	85.1	85.1	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.296	0.250	0.228	0.207	0.193	0.181
												Vel (f/s)	0.94	1.11	1.22	1.35	1.44	1.54
												R (Hrs)	0.236	0.196	0.177	0.159	0.147	0.137
SBMAYO	0.002	0.15	26.1	26.1	Urban	0.039	0.05	0.35	4.72	0.270	95	**Tc (Hrs)**	0.322	0.291	0.272	0.253	0.240	0.229
												Vel (f/s)	0.68	0.76	0.81	0.87	0.92	0.96
												R (Hrs)	0.795	0.711	0.662	0.609	0.575	0.546
SBON-E	0.013	0.23	75.6	75.6	Urban	0.034	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.282	0.252	0.235	0.217	0.205	0.195
												Vel (f/s)	1.20	1.34	1.44	1.55	1.65	1.73
												R (Hrs)	0.332	0.294	0.272	0.248	0.234	0.221
SBON-X	0.002	0.07	112.7	112.7	Urban	0.039	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.147	0.132	0.123	0.113	0.107	0.102
												Vel (f/s)	0.70	0.78	0.83	0.91	0.96	1.01
												R (Hrs)	0.182	0.161	0.149	0.136	0.128	0.121
SB02E1	0.018	0.31	77.9	77.9	Urban	0.033	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.321	0.287	0.267	0.247	0.233	0.222
												Vel (f/s)	1.42	1.58	1.70	1.84	1.95	2.05
												R (Hrs)	0.406	0.357	0.331	0.303	0.285	0.269
SB02W	0.058	0.35	87.6	87.6	URBAN	0.114	0.10	0.25	4.33	0.513	80	**Tc (Hrs)**	0.624*	0.557*	0.520*	0.480*	0.454*	0.432 *
												Vel (f/s)	0.82	0.92	0.99	1.07	1.13	1.19

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
												R (Hrs)	0.479	0.423	0.392	0.358	0.337	0.319
SB8NW	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.223	0.199	0.186	0.171	0.162	0.154
												Vel (f/s)	0.99	1.11	1.18	1.29	1.36	1.43
												R (Hrs)	0.168	0.148	0.137	0.125	0.118	0.111
SB8NE	0.015	0.15	82.2	82.2	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.223	0.199	0.186	0.171	0.162	0.154
												Vel (f/s)	0.99	1.11	1.18	1.29	1.36	1.43
												R (Hrs)	0.168	0.148	0.137	0.125	0.118	0.111
SB8SW	0.013	0.15	108.8	108.8	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.204	0.183	0.170	0.157	0.149	0.141
												Vel (f/s)	1.08	1.20	1.29	1.40	1.48	1.56
												R (Hrs)	0.166	0.146	0.135	0.124	0.116	0.110
SBNEX0	0.011	0.18	73.1	73.1	NATURAL	0.068	0.35	0.35	4.45	0.392		**Tc (Hrs)**	0.945*	0.509*	0.424*	0.364	0.327	0.299
												Vel (f/s)	0.28	0.52	0.62	0.73	0.81	0.88
												R (Hrs)	1.152	0.580	0.474	0.400	0.355	0.321
SBON-F	0.004	0.12	53.3	53.3	Urban	0.037	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.237	0.212	0.198	0.182	0.172	0.164
												Vel (f/s)	0.74	0.83	0.89	0.97	1.02	1.07
												R (Hrs)	0.319	0.282	0.261	0.239	0.224	0.212
SB02E2	0.027	0.36	80.4	80.4	NATURAL	0.063	0.35	0.35	4.03	0.499		**Tc (Hrs)**	1.450*	0.740*	0.591*	0.498*	0.451*	0.409
												Vel (f/s)	0.36	0.71	0.89	1.06	1.17	1.29
												R (Hrs)	1.947	0.916	0.714	0.590	0.529	0.475
SB8SE	0.013	0.17	97.6	97.6	URBAN	0.034	0.10	0.25	4.03	0.607	80	**Tc (Hrs)**	0.225	0.201	0.187	0.173	0.164	0.156
												Vel (f/s)	1.11	1.24	1.33	1.44	1.52	1.60
												R (Hrs)	0.204	0.179	0.166	0.152	0.143	0.135
SB08W	0.060	0.33	67.7	67.7	URBAN	0.030	0.10	0.25	4.22	0.540	80	**Tc (Hrs)**	0.328	0.293	0.273	0.252	0.239	0.227
												Vel (f/s)	1.48	1.65	1.77	1.92	2.03	2.13
												R (Hrs)	0.220	0.194	0.180	0.164	0.154	0.146
SB07W	0.048	0.32	97.8	97.8	URBAN	0.031	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.356	0.301	0.275	0.249	0.232	0.218
												Vel (f/s)	1.32	1.56	1.71	1.88	2.02	2.15
												R (Hrs)	0.267	0.222	0.200	0.180	0.166	0.155
SBNEX1	0.001	0.06	73.7	73.7	Urban	0.041	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.160	0.143	0.133	0.123	0.116	0.111

* Non default value or value out of range

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	AdjTime-Area Slope		Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
												Vel (f/s)	0.55	0.62	0.66	0.72	0.76	0.79
												R (Hrs)	0.261	0.230	0.213	0.195	0.183	0.174
SBNEX2	0.006	0.16	42.2	42.2	Urban	0.036	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.290	0.259	0.242	0.223	0.211	0.201
												Vel (f/s)	0.81	0.91	0.97	1.05	1.11	1.17
												R (Hrs)	0.399	0.352	0.326	0.298	0.281	0.265
SBNEX3	0.011	0.12	54.5	54.5	Urban	0.035	0.10	0.25	4.72	0.464	80	**Tc (Hrs)**	0.228	0.204	0.191	0.176	0.166	0.158
												Vel (f/s)	0.77	0.86	0.92	1.00	1.06	1.11
												R (Hrs)	0.172	0.152	0.141	0.129	0.121	0.115
SBON-A	0.007	0.13	43.8	43.8	Urban	0.036	0.10	0.25	4.65	0.478	80	**Tc (Hrs)**	0.258	0.231	0.216	0.199	0.188	0.179
												Vel (f/s)	0.74	0.83	0.88	0.96	1.01	1.07
												R (Hrs)	0.272	0.241	0.223	0.204	0.192	0.181
SBON-B	0.007	0.19	39.9	39.9	Urban	0.036	0.10	0.25	4.28	0.587	80	**Tc (Hrs)**	0.324	0.289	0.269	0.249	0.235	0.224
												Vel (f/s)	0.86	0.96	1.04	1.12	1.19	1.24
												R (Hrs)	0.474	0.418	0.386	0.354	0.332	0.314
SBON-C	0.005	0.08	175.9	175.9	Urban	0.037	0.10	0.25	4.03	0.671	80	**Tc (Hrs)**	0.135	0.120	0.112	0.104	0.098*	0.093 *
												Vel (f/s)	0.87	0.98	1.05	1.13	1.20	1.26
												R (Hrs)	0.109	0.096	0.089	0.081	0.076	0.072
SBON-D	0.005	0.11	156.6	156.6	Urban	0.037	0.10	0.25	4.39	0.557	80	**Tc (Hrs)**	0.163	0.146	0.136	0.125	0.119	0.113
												Vel (f/s)	0.99	1.11	1.19	1.29	1.36	1.43
												R (Hrs)	0.173	0.153	0.141	0.129	0.122	0.115

LAND USE

Project Reference: BANNER HEALTH 24HR

Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
Major Basin ID: 01								
180	0.0622	100.0	0.25	45	50.0	NORMAL	0.030	High Density Residential - Multi Family (10-15 du per acre)
180	0.0245	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0275	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0343	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
180	0.0197	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
180	0.0477	100.0	0.25	45	50.0	NORMAL	0.031	High Density Residential - Multi Family (10-15 du per acre)
200	0.0175	100.0	0.10	80	60.0	NORMAL	0.033	General Commercial (Commercial where no detail available)
200	0.0583	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0601	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
200	0.0153	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0150	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0134	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
200	0.0131	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
2002	0.0025	100.0	0.05	95	0.0	DRY	0.039	Pavement and Rooftops
530	0.0014	100.0	0.10	80	75.0	NORMAL	0.041	Institutional (Includes hospitals and churches)
530	0.0058	100.0	0.10	80	75.0	NORMAL	0.036	Institutional (Includes hospitals and churches)
530	0.0108	100.0	0.10	80	75.0	NORMAL	0.035	Institutional (Includes hospitals and churches)
530	0.0065	100.0	0.10	80	75.0	NORMAL	0.036	Institutional (Includes hospitals and churches)
530	0.0074	100.0	0.10	80	75.0	NORMAL	0.036	Institutional (Includes hospitals and churches)
530	0.0046	100.0	0.10	80	75.0	NORMAL	0.037	Institutional (Includes hospitals and churches)
530	0.0055	100.0	0.10	80	75.0	NORMAL	0.037	Institutional (Includes hospitals and churches)

* Non default value

Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
530	0.0129	100.0	0.10	80	75.0	NORMAL	0.034	Institutional (Includes hospitals and churches)
530	0.0038	100.0	0.10	80	75.0	NORMAL	0.037	Institutional (Includes hospitals and churches)
530	0.0022	100.0	0.10	80	75.0	NORMAL	0.039	Institutional (Includes hospitals and churches)
NDR	0.0274	100.0	0.35	0	35.0	DRY	0.063	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%
NDR	0.0113	100.0	0.35	0	35.0	DRY	0.068	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%

* Non default value

SOILS

Project Reference: BANNER HEALTH 24HR

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Outcrop %)	Effective Rock (%)	Comments
Major Basin ID: 01									
SB01-A	645	55	64555	0.011	18.20	0.270	-	100	
	645	90	64590	0.051	81.80	0.390	-	100	
SB01-B	645	90	64590	0.025	100.00	0.390	-	100	
SB01-C	645	90	64590	0.028	100.00	0.390	-	100	
SB02E1	645	90	64590	0.018	100.00	0.390	-	100	
SB02E2	645	90	64590	0.027	100.00	0.390	-	100	
SB02NE	645	90	64590	0.034	100.00	0.390	-	100	
SB02NW	645	90	64590	0.020	100.00	0.390	-	100	
SB02W	645	55	64555	0.027	46.40	0.270	-	100	
	645	90	64590	0.031	53.60	0.390	-	100	
SB07W	645	90	64590	0.048	100.00	0.390	-	100	
SB08W	645	55	64555	0.020	33.30	0.270	-	100	
	645	90	64590	0.040	66.70	0.390	-	100	
SB8NE	645	90	64590	0.015	100.00	0.390	-	100	
SB8NW	645	90	64590	0.015	100.00	0.390	-	100	
SB8SE	645	55	64555	0.000	0.70	0.270	-	100	
	645	90	64590	0.013	99.30	0.390	-	100	
SB8SW	645	90	64590	0.013	100.00	0.390	-	100	
SBMAYO	645	55	64555	0.003	100.00	0.270	-	100	
SBNEX0	645	55	64555	0.008	66.40	0.270	-	100	
	645	90	64590	0.004	33.60	0.390	-	100	
SBNEX1	645	55	64555	0.001	100.00	0.270	-	100	
SBNEX2	645	55	64555	0.006	100.00	0.270	-	100	
SBNEX3	645	55	64555	0.011	100.00	0.270	-	100	
SBON-A	645	55	64555	0.006	92.40	0.270	-	100	
	645	90	64590	0.001	7.60	0.390	-	100	
SBON-B	645	55	64555	0.003	37.00	0.270	-	100	
	645	90	64590	0.005	63.00	0.390	-	100	
SBON-C	645	90	64590	0.005	100.00	0.390	-	100	
SBON-D	645	55	64555	0.003	50.90	0.270	-	100	
	645	90	64590	0.003	49.10	0.390	-	100	
SBON-E	645	55	64555	0.013	100.00	0.270	-	100	
SBON-F	645	55	64555	0.004	100.00	0.270	-	100	
SBON-X	645	55	64555	0.002	100.00	0.270	-	100	

HEC-1 FLOW SUMMARY

Project Reference: BANNER HEALTH 24HR

ID	Type	Area (sq mi)	Flow cfs 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin 01								
76THST	Hydrograph	0.24						50
SB01-A	Hydrograph	0.06						120
DT01A	Diversion	0.06						5
SB01A	Hydrograph	0.06						120
CP-1	Combined	0.30						120
R1A-2W	Routed	0.30						118
SB02NW	Hydrograph	0.02						38
DT02NW	Diversion	0.02						2
SB02NW	Hydrograph	0.02						38
CP-02W	Combined	0.32						154
R2W-2	Routed	0.32						154
SB01-C	Hydrograph	0.03						43
DT01C	Diversion	0.03						2
SB01C	Hydrograph	0.03						43
R1C-1B	Routed	0.03						43
SB01-B	Hydrograph	0.02						42
DT01B	Diversion	0.02						2
SB01B	Hydrograph	0.02						42
CP-01B	Combined	0.05						84
R1B-2N	Routed	0.05						83
SB02NE	Hydrograph	0.03						55
DT02NE	Diversion	0.03						3
SB02NE	Hydrograph	0.03						55
CP-02N	Combined	0.09						138
R2N-2	Routed	0.09						137
SB02E1	Hydrograph	0.02						29
DT02E1	Diversion	0.02						15
SB02E1	Hydrograph	0.02						29
SB02W	Hydrograph	0.06						81
CP-02	Combined	0.51						388
SB8NW	Hydrograph	0.01						34
DT8NW	Diversion	0.01						1
SB8NW	Hydrograph	0.01						34
R8NW8N	Routed	0.01						34
SB8NE	Hydrograph	0.01						34
DT8NE	Diversion	0.01						1
SB8NE	Hydrograph	0.01						34
R8NE8N	Routed	0.01						34
SB8SW	Hydrograph	0.01						29
DT8SW	Diversion	0.01						1
SB8SW	Hydrograph	0.01						29
SB8SE	Hydrograph	0.01						28
DT8SE	Diversion	0.01						1
SB8SE	Hydrograph	0.01						28
CP-08N	Combined	0.06						124
R8N-8W	Routed	0.06						123
SB08W	Hydrograph	0.06						122
CP-08W	Combined	0.12						243
DT08WN	Diversion	0.12						2
SB08WN	Hydrograph	0.12						243
S08W	Routed	0.12						209
DT08-W	Diversion	0.12						91
SB08-W	Hydrograph	0.12						118
R8W-P	Routed	0.12						118
SB02E2	Hydrograph	0.03						20
R2E-P	Routed	0.03						20
CP-OFF	Combined	0.14						130
SBON-A	Hydrograph	0.01						14
S-ON-A	Routed	0.01						6
CPON-A	Combined	0.15						136
S-OFF	Routed	0.15						118
ROFON1	Routed	0.15						116
SBON-B	Hydrograph	0.01						11
S-ON-B	Routed	0.01						6

HEC-1 FLOW SUMMARY

Project Reference: BANNER HEALTH 24HR

ID	Type	Area	Flow cfs					
		(sq mi)	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
CPON-B	Combined	0.16						122
ROFON2	Routed	0.16						120
SBON-C	Hydrograph							12
S-ON-C	Routed							6
SBON-D	Hydrograph							11
S-ON-D	Routed							11
SBON-E	Hydrograph	0.01						24
S-ON-E	Routed	0.01						4
CPCULV	Combined	0.18						132
SB07W	Hydrograph	0.05						85
DT07W	Diversion	0.05						4
SB07W	Hydrograph	0.05						85
R7W-CP	Routed	0.05						56
SB08-W	Hydrograph	0.12						91
CP-07W	Combined	0.05						99
S7WCP	Routed	0.05						98
R7W-P	Routed	0.05						98
R7W-OL	Routed	0.05						98
SBNEX0	Hydrograph	0.01						12
SBON-F	Hydrograph							8
CP-NEX	Combined	0.06						114
S-NEX0	Routed	0.06						19
RNEX	Routed	0.06						19
SBNEX1	Hydrograph							2
S-NEX1	Routed							2
SBNEX2	Hydrograph	0.01						10
CPNEX2	Combined	0.01						12
S-NEX2	Routed	0.01						6
RN2N3	Routed	0.01						6
SBNEX3	Hydrograph	0.01						25
CPNEX3	Combined	0.02						27
S-NEX3	Routed	0.02						19
SBON-X	Hydrograph							5
S-ON-X	Routed							2
SBMAYO	Hydrograph							2
CPMAYO	Combined	0.09						31

Appendix E First Flush Storage Volume Calculations

DIBBLE

Banner Health Scottsdale

DIBBLE PROJECT NO. 1124010

ON-SITE DRAINAGE CALCULATIONS

DES: NMG

DATE: 2025-0507

FIRST FLUSH HYDROLOGY CALCULATIONS

DRAINAGE AREA	TOTAL AREA [SF]	RUNOFF COEFFICIENT	RAINFALL DEPTH [IN]	VOLUME REQUIRED [CF]
A	182,077	1.00	0.50	**7,587**
B	205,034	1.00	0.50	**8,543**
C	127,242	1.00	0.50	**5,302**
D	152,998	1.00	0.50	**6,375**
E	360,803	1.00	0.50	**15,033**
F	107,054	1.00	0.50	**4,461**
X	61,680	1.00	0.50	**2,570**
TOTAL				**49,870**

DIBBLE

Banner Health Scottsdale

DIBBLE PROJECT NO. 1124010

ON-SITE DRAINAGE CALCULATIONS

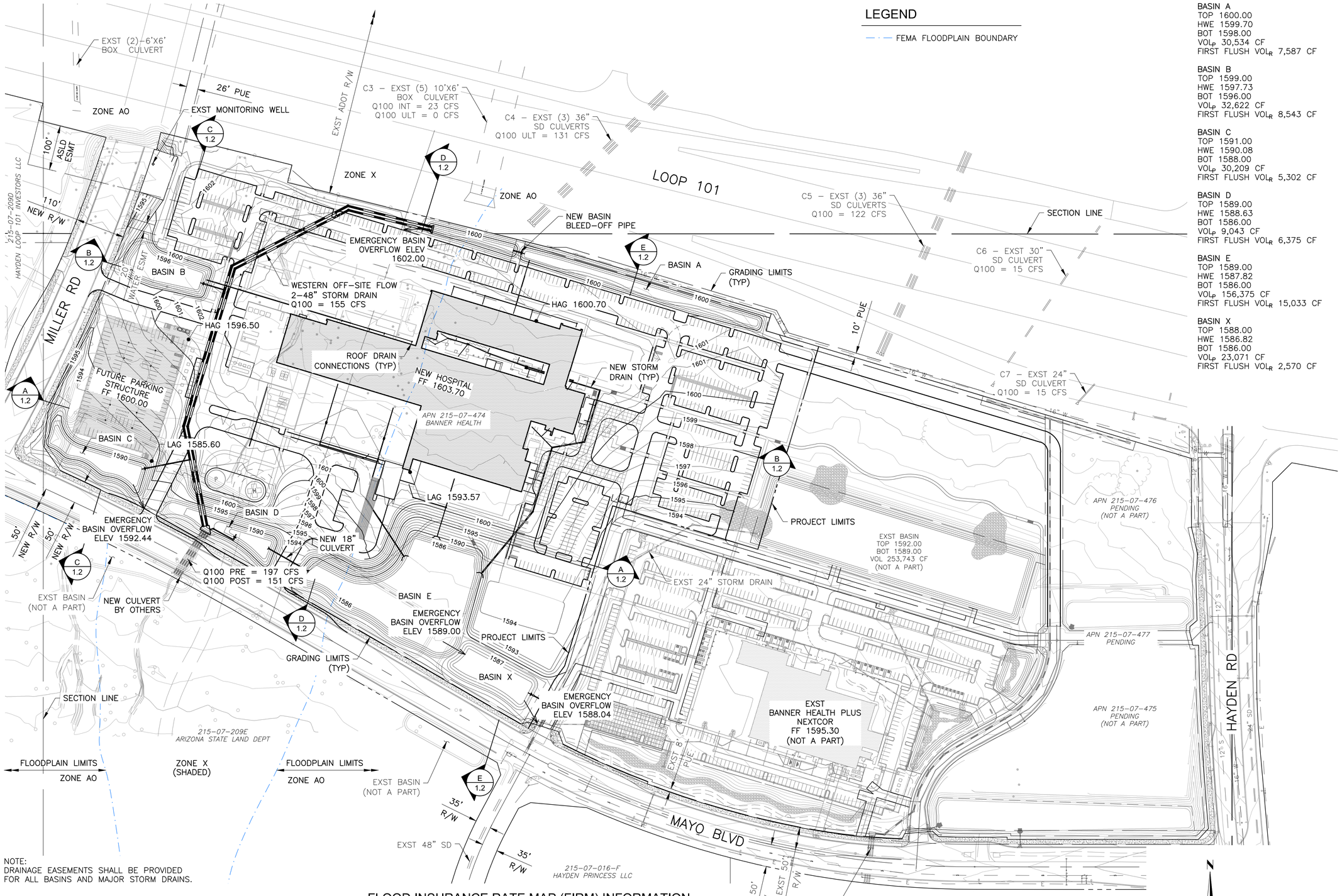
DES: NMG

DATE: 2025-0507

ON-SITE RETENTION BASIN VOLUME CALCULATIONS

BASIN ELEV [FT]	AREA [SF]	DEPTH [FT]	INCREMENTAL VOLUME [CF]	CUMULATIVE VOLUME [CF]		VOLUME REQUIRED [CF]
Basin A						
1,600.0	19,843	2.0	9,345	**30,534**		**5,302**
1,599.5	17,538	1.5	8,199	21,189		
1,599.0	15,257	1.0	7,058	12,990	*HIGH WATER ELEVATION*	
1,598.5	12,975	0.5	5,932	5,932		
1,598.0	10,754	N/A	N/A	N/A		
Basin B						
1,599.0	14,132	3.0	6,746	**32,622**		**8,543**
1,598.5	12,850	2.5	6,172	25,877		
1,598.0	11,837	2.0	5,650	19,705		
1,597.5	10,762	1.5	5,150	14,055		
1,597.0	9,837	1.0	4,679	8,906	*HIGH WATER ELEVATION*	
1,596.5	8,879	0.5	4,227	4,227		
1,596.0	8,027	N/A	N/A	N/A		
Basin C						
1,591.0	13,891	3.0	6,615	**30,209**		**5,302**
1,590.5	12,568	2.5	5,971	23,595		
1,590.0	11,316	2.0	5,333	17,624		
1,589.5	10,014	1.5	4,714	12,291		
1,589.0	8,842	1.0	1,705	7,577		
1,588.8	8,205	0.8	2,364	5,872	*HIGH WATER ELEVATION*	
1,588.5	7,552	0.5	3,509	3,509		
1,588.0	6,483	N/A	N/A	N/A		
Basin D						
1,589.0	5,186	3.0	2,345	**9,043**		**6,375**
1,588.5	4,195	2.5	1,946	6,697	*HIGH WATER ELEVATION*	
1,588.0	3,587	2.0	1,604	4,752		
1,587.5	2,828	1.5	1,289	3,148		
1,587.0	2,328	1.0	1,045	1,859		
1,586.5	1,853	0.5	814	814		
1,586.0	1,402	N/A	N/A	N/A		
Basin E						
1,589.0	58,721	3.0	28,802	**156,375**		**15,033**
1,588.5	56,485	2.5	27,690	127,573		
1,588.0	54,274	2.0	26,591	99,884		
1,587.5	52,089	1.5	25,504	73,293		
1,587.0	49,928	1.0	24,426	47,789		
1,586.5	47,777	0.5	23,362	23,362	*HIGH WATER ELEVATION*	
1,586.0	45,672	N/A	N/A	N/A		
Basin X						
1,588.0	14,497	2.0	6,866	**23,071**		**2,570**
1,587.5	12,966	1.5	6,115	16,205		
1,587.0	11,493	1.0	5,392	10,090		
1,586.5	10,076	0.5	4,698	4,698	*HIGH WATER ELEVATION*	
1,586.0	8,715	N/A	N/A	N/A		
TOTAL				**281,853**		**43,124**

Appendix F Preliminary Grading and Drainage Plan



NOTE:
DRAINAGE EASEMENTS SHALL BE PROVIDED FOR ALL BASINS AND MAJOR STORM DRAINS.

SUMMARY TABLE				
BUILDING ID	NATURAL HIGH ADJACENT GRADE	LOW ADJACENT GRADE	REGULATORY FLOOD DATUM	FINISHED FLOOR ELEVATION
HOSPITAL	1600.70	1593.57	1603.70	1603.70
FUTURE PARKING GARAGE	1596.50	1585.60	1597.50	1600.00

NOTE: ALL ELECTROMECHANICAL EQUIPMENT PAD ELEVATIONS SHALL BE SET AT OR ABOVE REGULATORY FLOOD DATUM ELEVATION.

FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

COMMUNITY NUMBER	PANEL # PANEL DATE	SUFFIX	DATE OF FIRM (INDEX DATE)	FIRM ZONE	BASE FLOOD ELEVATION (IN AO ZONE USE DEPTH)
045012	1320 4/30/2024	L	2/8/2024	AO	DEPTH 1
045012	1320 4/30/2024	L	2/8/2024	X (SHADED)	N/A

ENGINEER'S FEMA CERTIFICATION

THE LOWEST FLOOR ELEVATION(S) AND/OR FLOOD PROOFING ELEVATION(S) ON THIS PLAN ARE SUFFICIENTLY HIGH TO PROVIDE PROTECTION FROM FLOODING CAUSED BY A 100-YEAR STORM, AND ARE IN ACCORDANCE WITH SCOTTSDALE REVISED CODE, CHAPTER 37 - FLOODPLAIN AND STORM WATER REGULATION.

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811 Call 811 or click Arizona811.com

Plot Date: 6/10/2025 4:31:17 PM G:\2024\1124152_Banner_Health_Scottsdale\CAD\1124152-H4-PRELIM G&D.dwg

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smithgroup.com

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GOODYEAR, AZ 85395
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SEALS AND SIGNATURES

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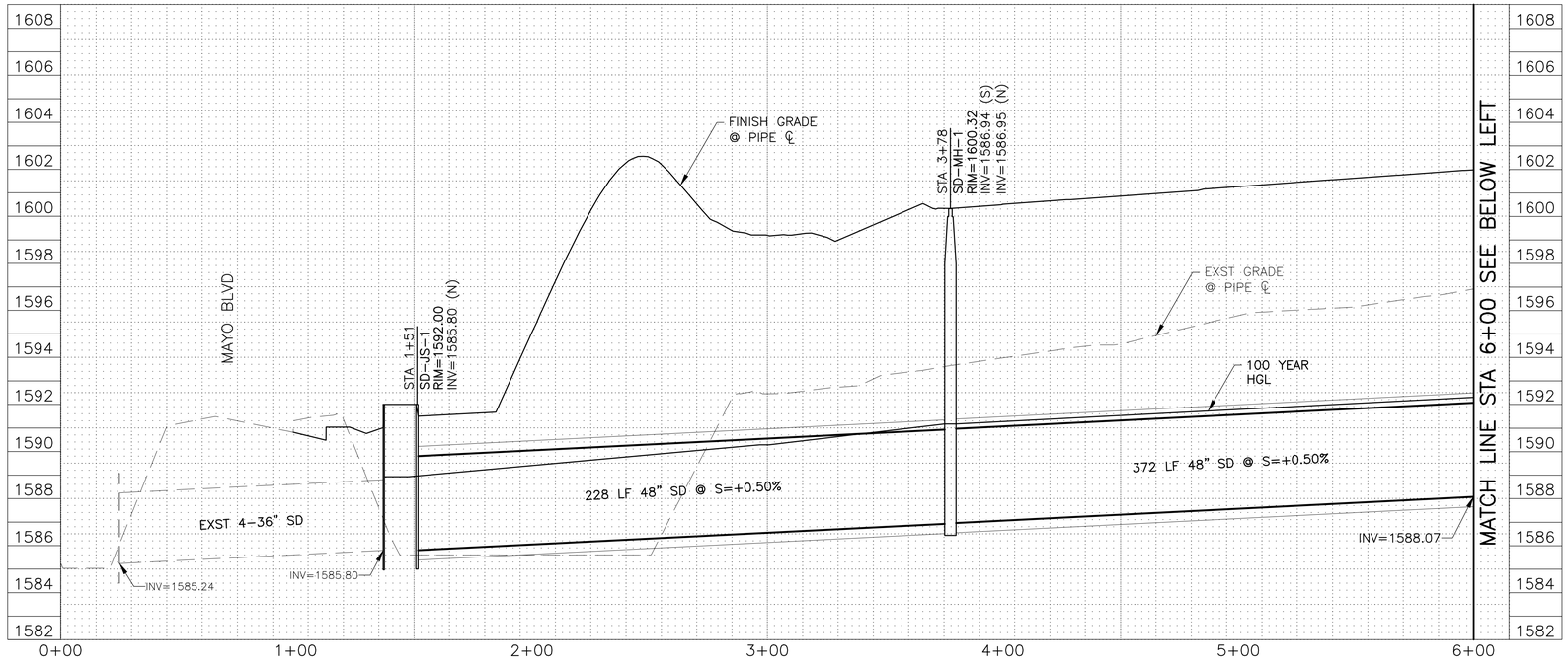
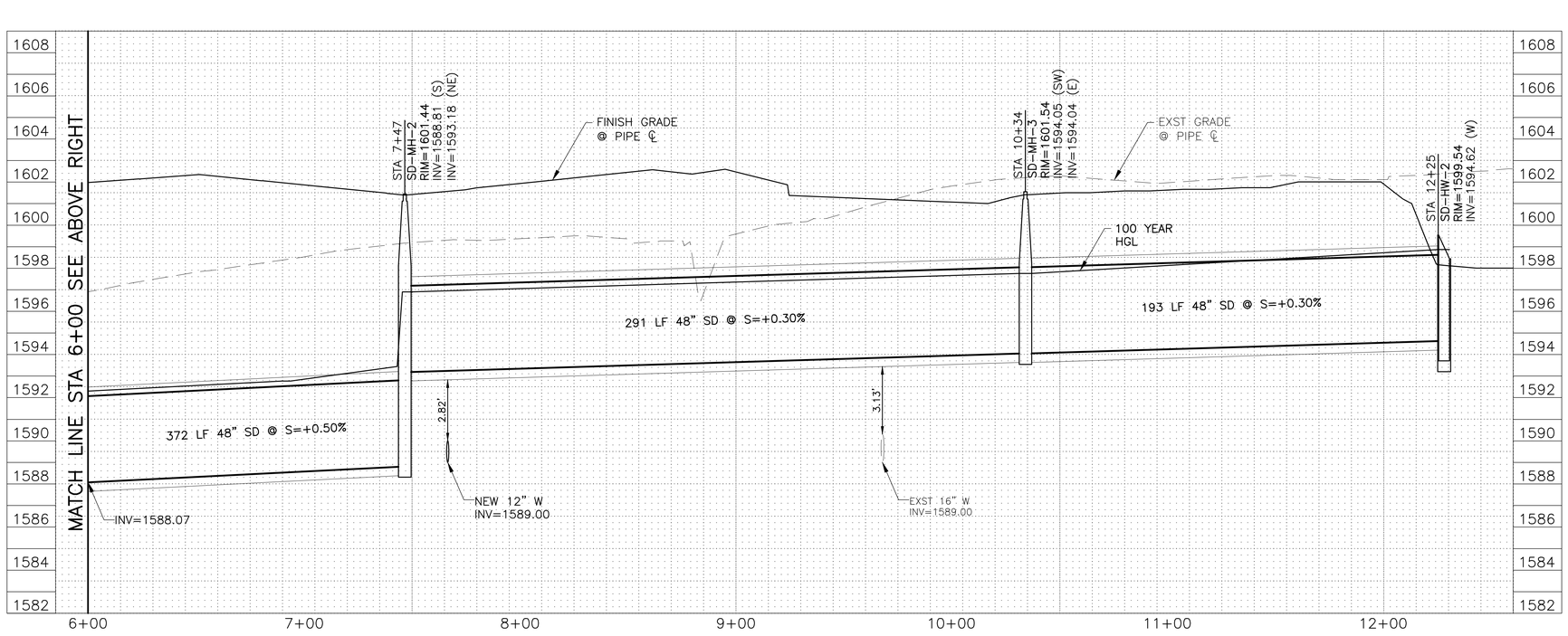
SHEET TITLE
PRELIMINARY GRADING & DRAINAGE

PROJECT NUMBER
PC1.0
SHEET NUMBER



WESTERN OFF-SITE FLOW STORM DRAIN



WESTERN OFF-SITE FLOW STORM DRAIN

0' 15' 30' 60'

SCALE: 1"=30' H
1"=3' V

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ENTITLEMENT REVIEW		05JUN25

SEALS AND SIGNATURES

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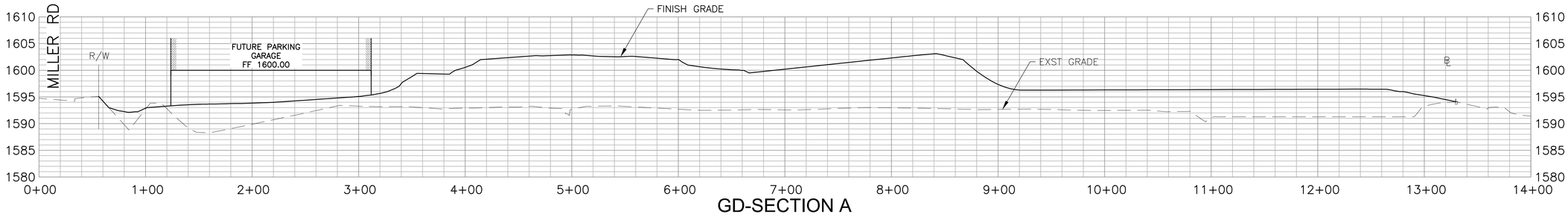
SHEET TITLE

STORM DRAIN PROFILES

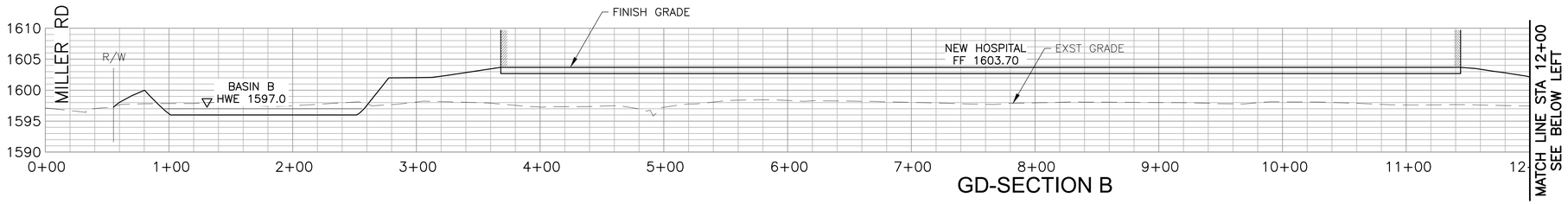
PROJECT NUMBER

PC1.1

SHEET NUMBER



GD-SECTION A



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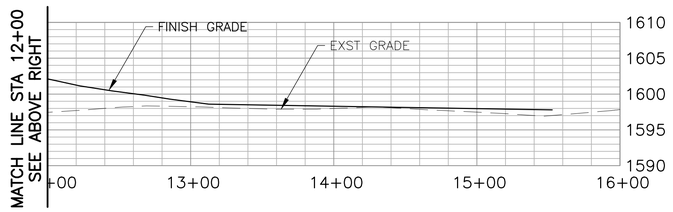

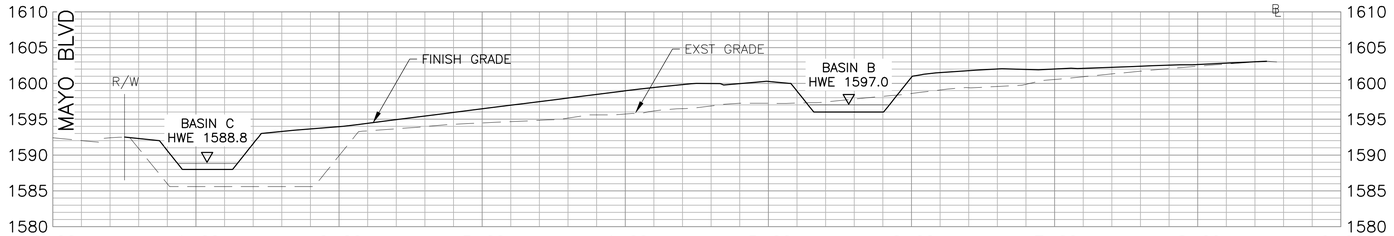

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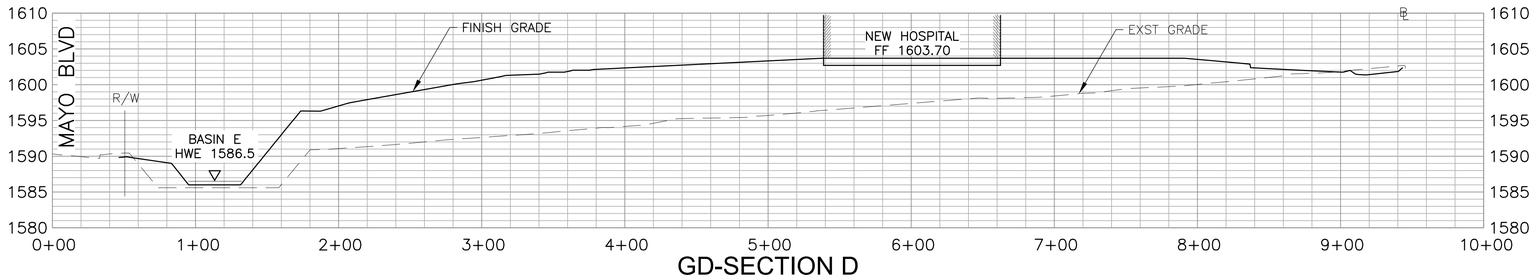
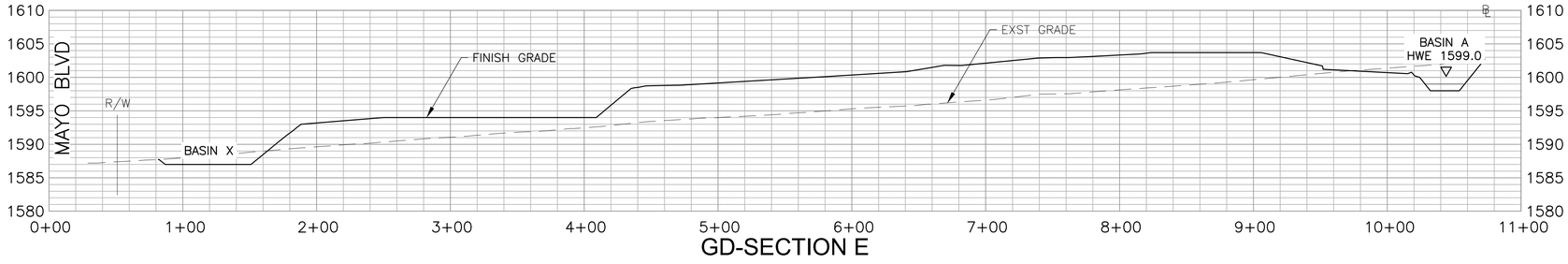


GD-SECTION D



GD-SECTION E

0' 25' 50' 100'

SCALE: 1"=50' H
1"=10' V

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SEALS AND SIGNATURES

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SHEET TITLE

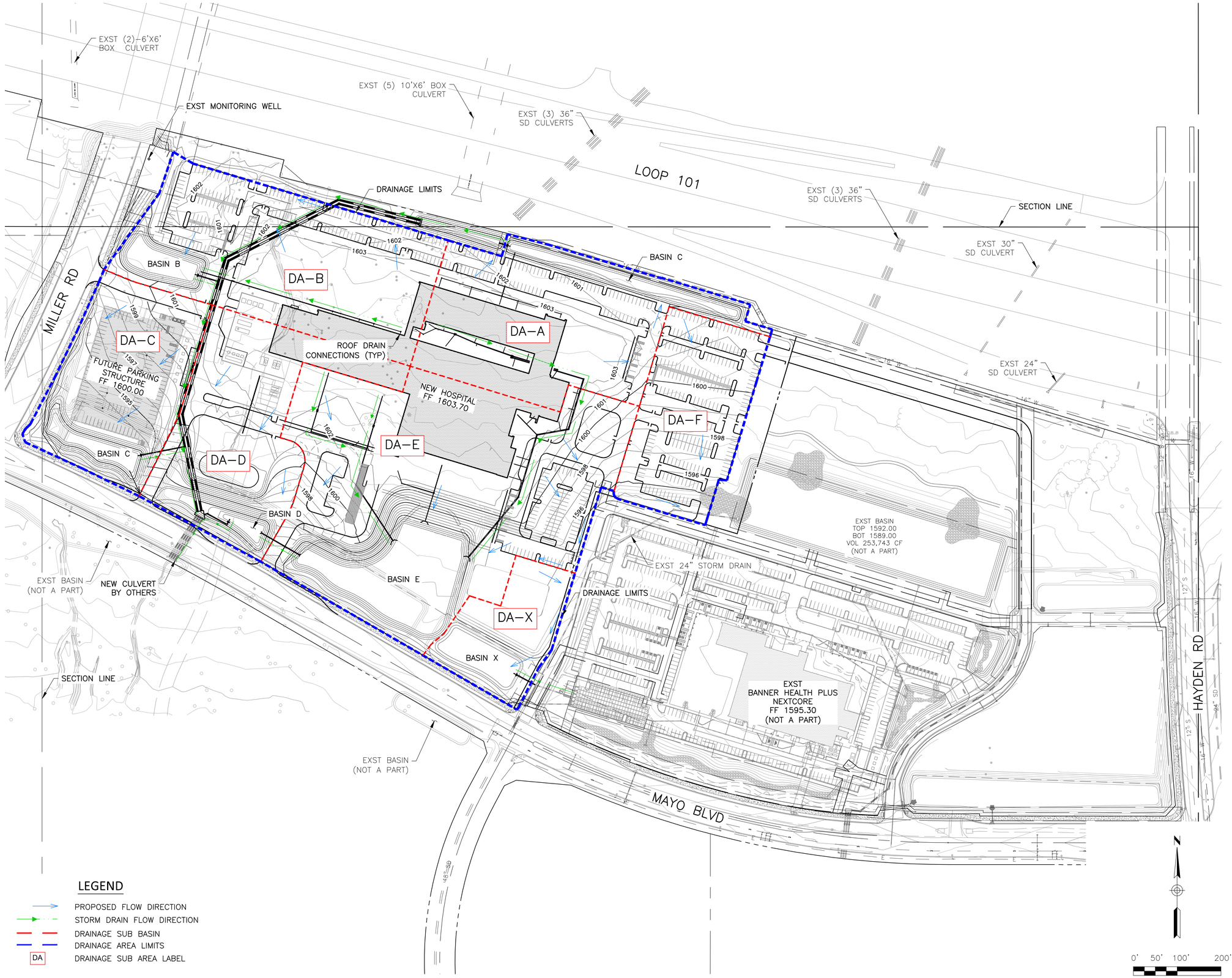
CROSS SECTIONS

PROJECT NUMBER

PC1.2

SHEET NUMBER

Appendix G Drainage Area Exhibit



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ENTITLEMENT REVIEW		05JUN25

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SHEET TITLE

DRAINAGE AREA EXHIBIT

PROJECT NUMBER

XX

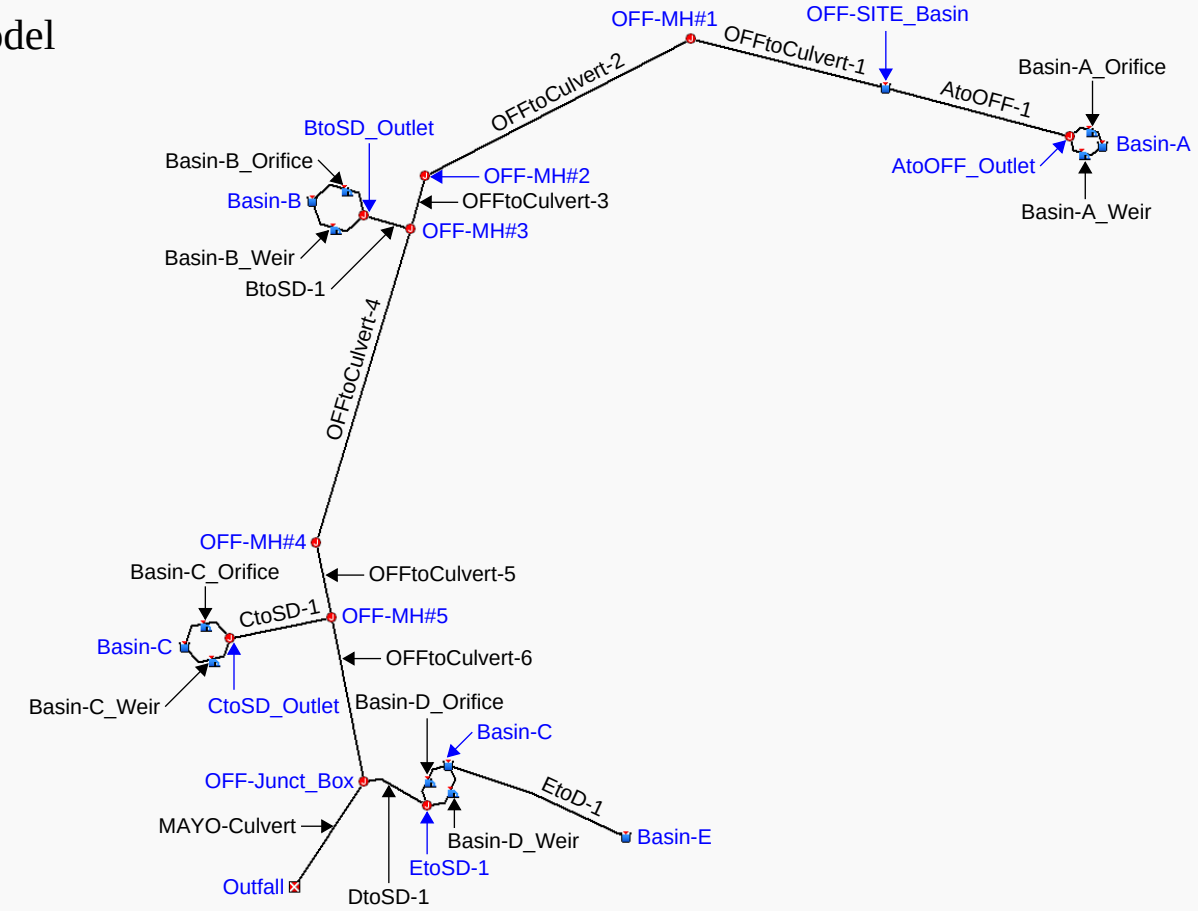
SHEET NUMBER

Appendix H Storage Routing Calculations

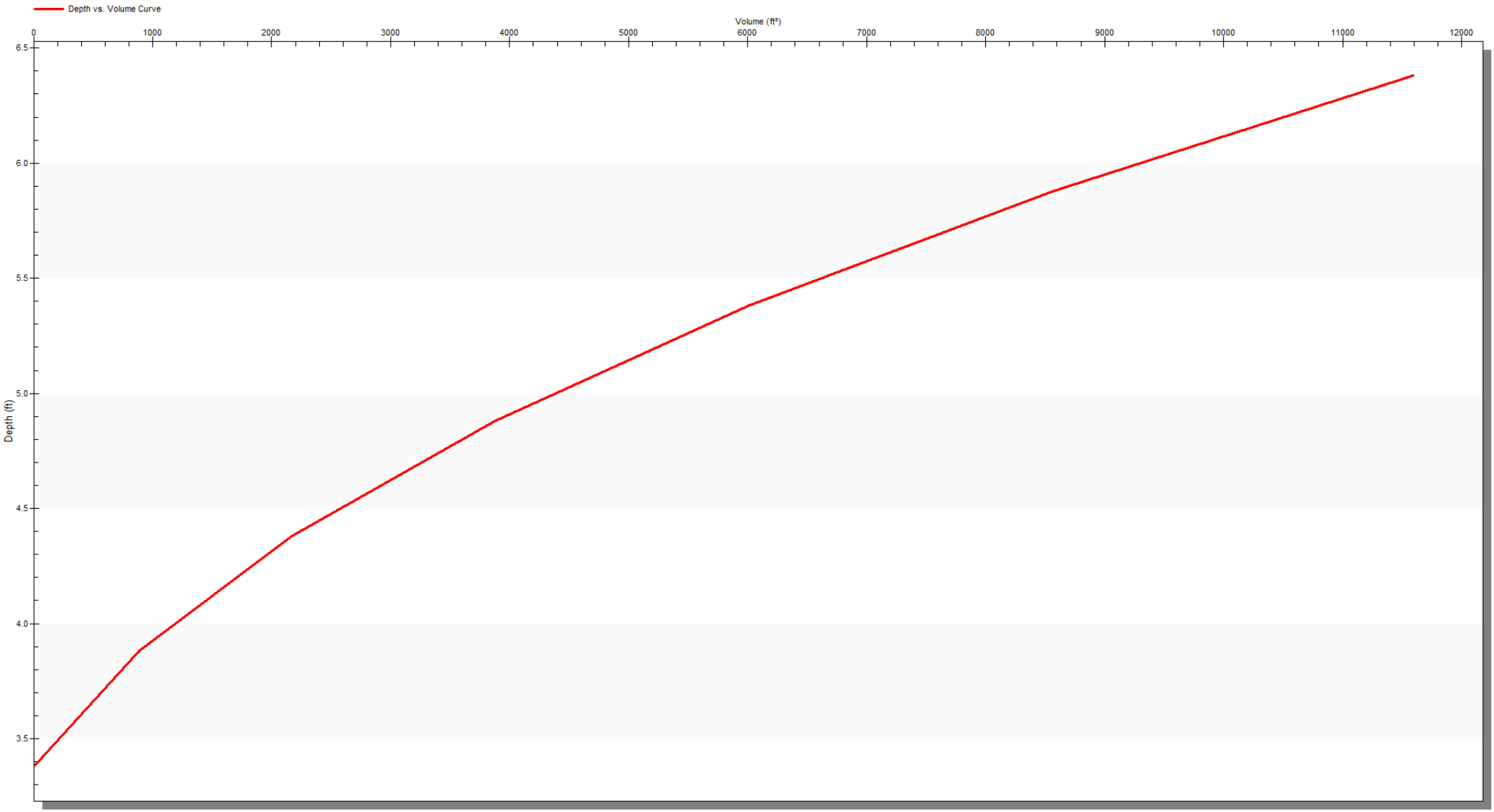
Appendix H1 On-Site Model

STORM AND SANITARY ANALYSIS
PLAN VIEW

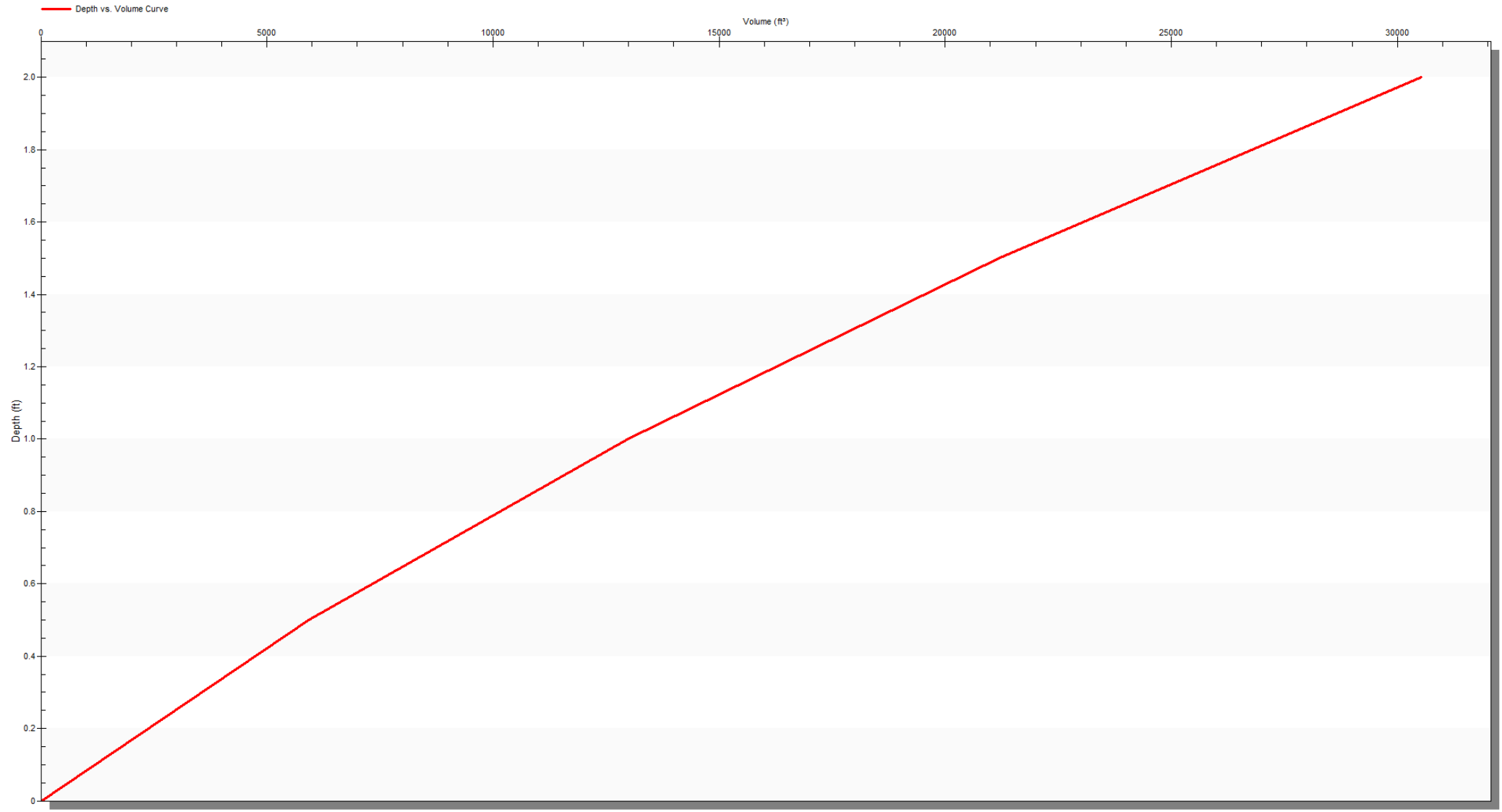
On-Site Model



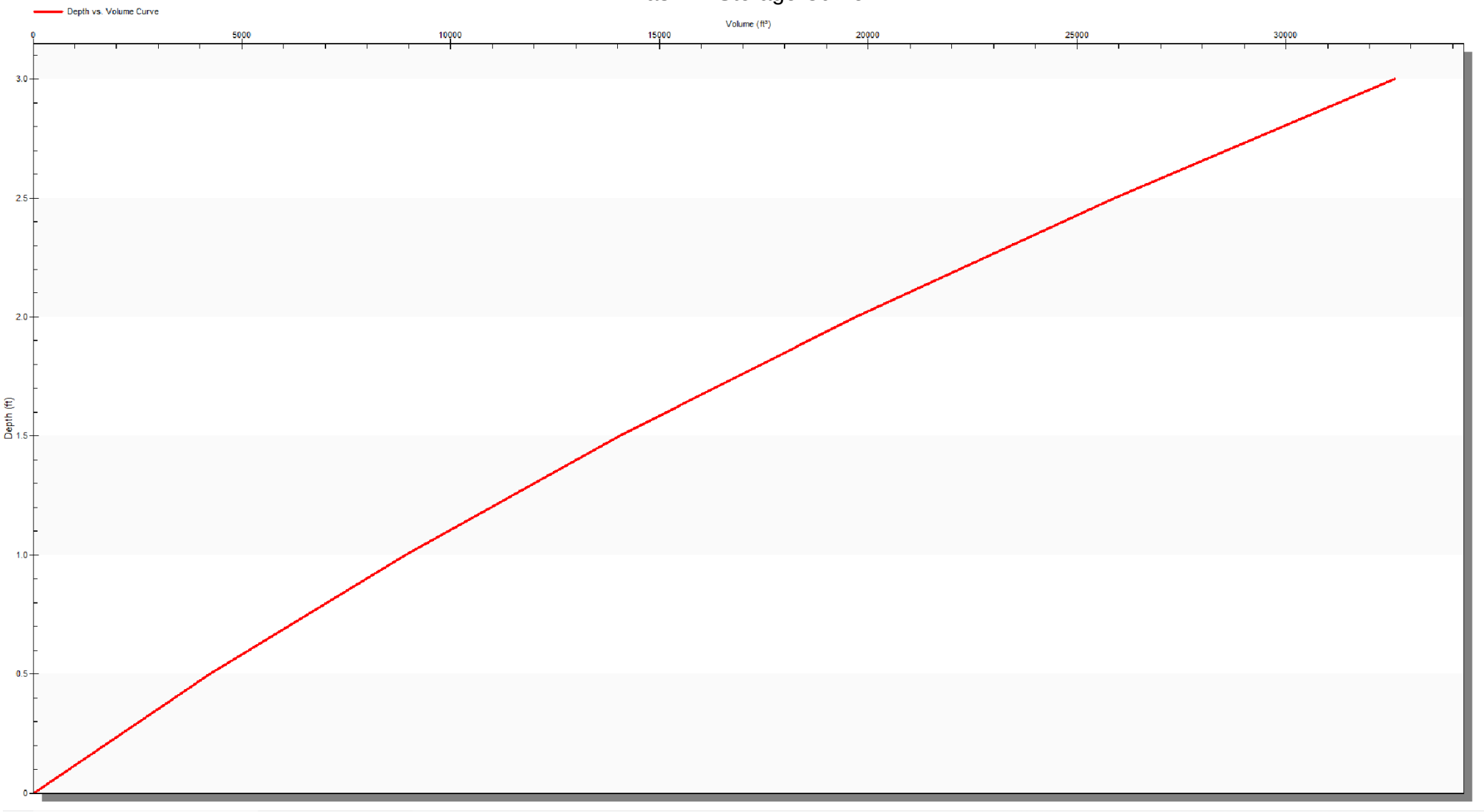
(Off-Site Detention Basin)
Basin-OFF Storage Curve



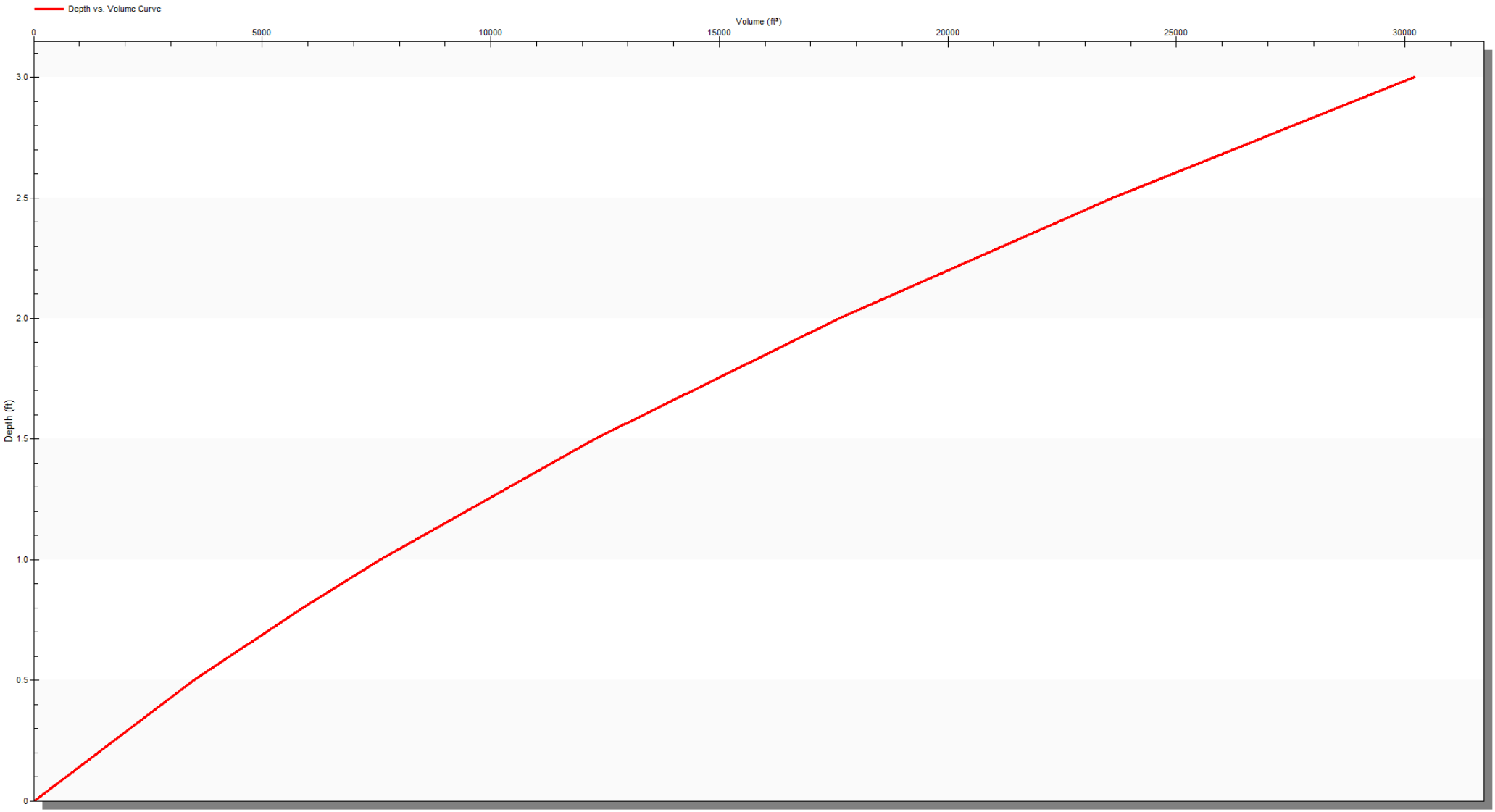
(Detention Basin A)
Basin-A Storage Curve



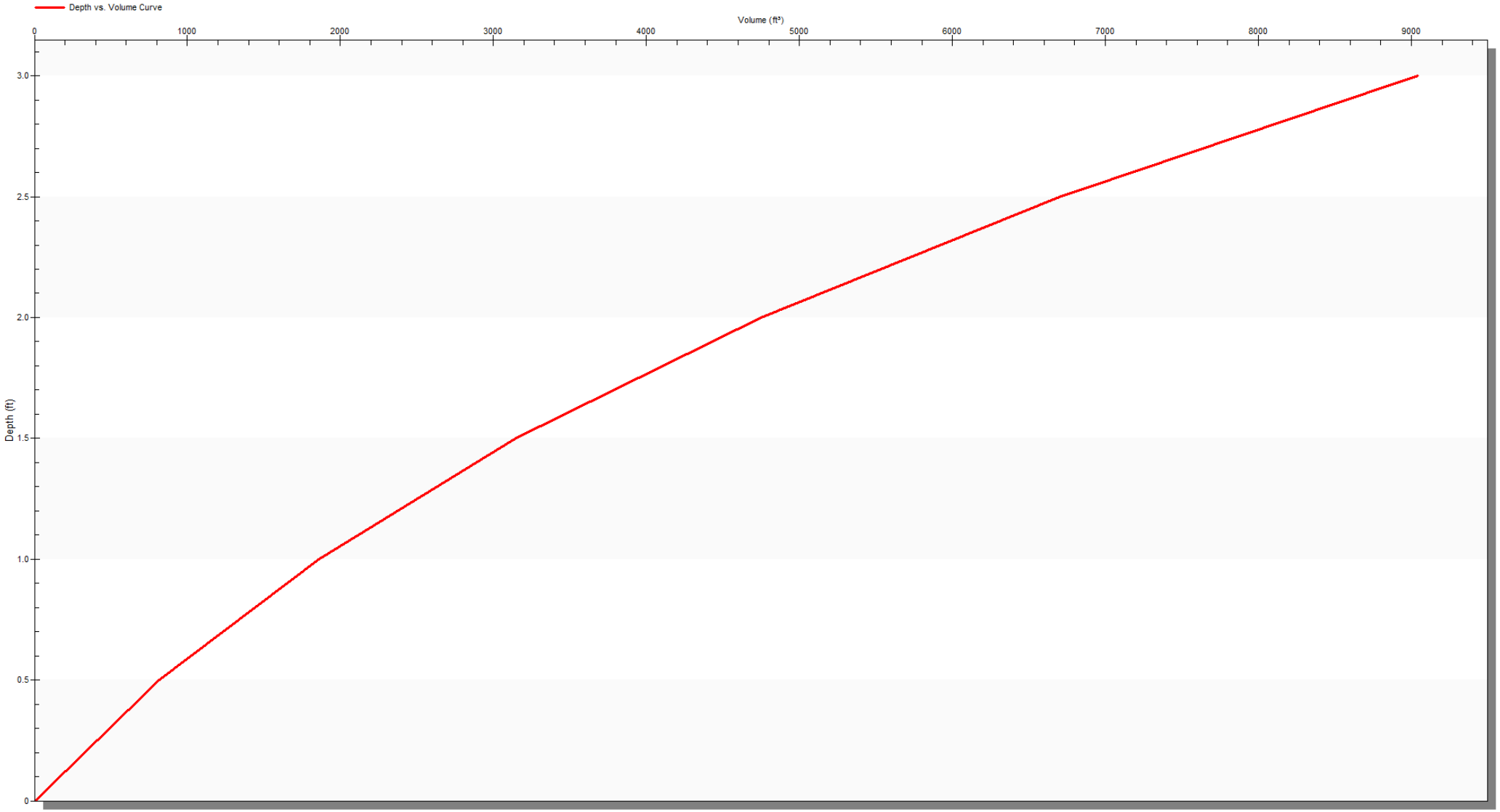
(Detention Basin B)
Basin-B Storage Curve



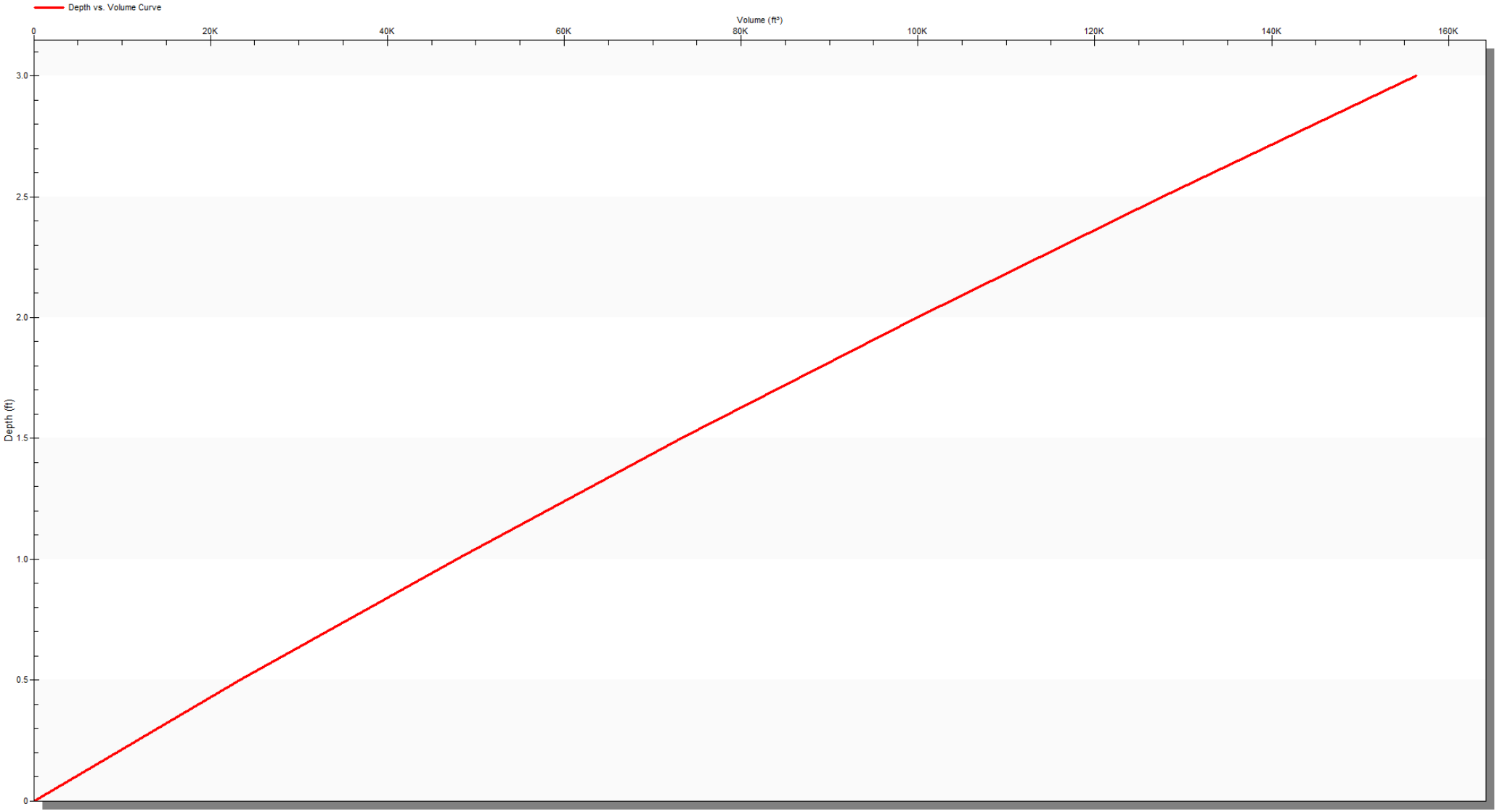
(Detention Basin C)
Basin-C Storage Curve



(Detention Basin D)
Basin-D Storage Curve



(Detention Basin E)
Basin-E Storage Curve



Appendix H1-1 100-YR 6-HR Results

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... Banner_Health_6HR.SPF
Description ..... Banner Health Scottsdale Drainage
Analysis
Storm Event: 6-hour

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date JAN-01-2025 00:00:00
Ending Date JAN-03-2025 12:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 0
Number of nodes 17
Number of links 20

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
AtoOFF_Outlet	JUNCTION	1598.00	1601.00	0.00	
BtoSD_Outlet	JUNCTION	1596.00	1599.00	0.00	
CtoSD_Outlet	JUNCTION	1588.00	1591.00	0.00	
EtoSD-1	JUNCTION	1586.00	1589.00	0.00	
OFF-Junct_Box	JUNCTION	1585.80	1592.00	0.00	
OFF-MH#1	JUNCTION	1594.04	1601.54	0.00	
OFF-MH#2	JUNCTION	1588.81	1601.44	0.00	
OFF-MH#3	JUNCTION	1588.54	1601.94	0.00	
OFF-MH#4	JUNCTION	1586.94	1600.32	0.00	
OFF-MH#5	JUNCTION	1586.57	1599.12	0.00	
Outfall	OUTFALL	1585.23	1588.23	0.00	
Basin-A	STORAGE	1598.00	1600.00	0.00	Yes
Basin-B	STORAGE	1596.00	1599.00	0.00	Yes
Basin-C	STORAGE	1588.00	1591.00	0.00	Yes
Basin-D	STORAGE	1586.00	1589.00	0.00	Yes
Basin-E	STORAGE	1586.00	1589.00	0.00	Yes
OFF-SITE_Basin	STORAGE	1594.62	1601.00	0.00	Yes

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
AtoOFF-1	AtoOFF_Outlet	OFF-SITE_Basin	CONDUIT	10.0	0.0100	0.0130
BtoSD-1	BtoSD_Outlet	OFF-MH#3	CONDUIT	40.0	18.6500	0.0130
CtoSD-1	CtoSD_Outlet	OFF-MH#5	CONDUIT	94.0	1.5266	0.0130
DtoSD-1	EtoSD-1	OFF-Junct_Box	CONDUIT	59.0	0.3390	0.0130
EtoD-1	Basin-E	Basin-D	CONDUIT	101.0	0.0010	0.0130
MAYO-Culvert	OFF-Junct_Box	Outfall	CONDUIT	112.0	0.5089	0.0130
OFFtoCulvert-1	OFF-SITE_Basin	OFF-MH#1	CONDUIT	193.0	0.3005	0.0130
OFFtoCulvert-2	OFF-MH#1	OFF-MH#2	CONDUIT	291.0	0.2990	0.0130
OFFtoCulvert-3	OFF-MH#2	OFF-MH#3	CONDUIT	54.0	0.5000	0.0130
OFFtoCulvert-4	OFF-MH#3	OFF-MH#4	CONDUIT	318.0	0.5000	0.0130
OFFtoCulvert-5	OFF-MH#4	OFF-MH#5	CONDUIT	75.0	0.5000	0.0130
OFFtoCulvert-6	OFF-MH#5	OFF-Junct_Box	CONDUIT	153.0	0.5000	0.0130

Basin-A_Orifice	Basin-A	AtoOFF_Outlet	ORIFICE
Basin-B_Orifice	Basin-B	BtoSD_Outlet	ORIFICE
Basin-C_Orifice	Basin-C	CtoSD_Outlet	ORIFICE
Basin-D_Orifice	Basin-D	EtoSD-1	ORIFICE
Basin-A_Weir	Basin-A	AtoOFF_Outlet	WEIR
Basin-B_Weir	Basin-B	BtoSD_Outlet	WEIR
Basin-C_Weir	Basin-C	CtoSD_Outlet	WEIR
Basin-D_Weir	Basin-D	EtoSD-1	WEIR

****
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
AtoOFF-1	CIRCULAR	1.50	1.50	1	1.77	0.38	1.05
BtoSD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	45.36
CtoSD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	12.98
DtoSD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	6.12
EtoD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	0.33
MAYO-Culvert	CIRCULAR	3.00	3.00	4	7.07	0.75	47.58
OFFtoCulvert-1	CIRCULAR	4.00	4.00	2	12.57	1.00	78.74
OFFtoCulvert-2	CIRCULAR	4.00	4.00	2	12.57	1.00	78.54
OFFtoCulvert-3	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57
OFFtoCulvert-4	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57
OFFtoCulvert-5	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57
OFFtoCulvert-6	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	14.692	4.787
External Outflow	14.492	4.722
Initial Stored Volume	0.006	0.002
Final Stored Volume	0.203	0.066
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 Time Flooded minutes	Retention Time hh:mm:ss
AtoOFF_Outlet	0.15	1.39	1599.39	0	04:19	0	0	0:00:00
BtoSD_Outlet	0.03	0.54	1596.54	0	04:15	0	0	0:00:00
CtoSD_Outlet	0.09	2.32	1590.32	0	04:15	0	0	0:00:00
EtoSD-1	0.31	2.74	1588.74	0	04:09	0	0	0:00:00
OFF-Junct_Box	0.33	3.14	1588.94	0	04:13	0	0	0:00:00
OFF-MH#1	0.16	3.73	1597.77	0	04:11	0	0	0:00:00
OFF-MH#2	0.14	4.66	1593.47	0	04:11	0	0	0:00:00
OFF-MH#3	0.14	4.24	1592.78	0	04:12	0	0	0:00:00
OFF-MH#4	0.15	4.22	1591.16	0	04:12	0	0	0:00:00
OFF-MH#5	0.15	3.74	1590.30	0	04:12	0	0	0:00:00
Outfall	0.82	1.99	1587.22	0	04:13	0	0	0:00:00
Basin-A	0.22	1.70	1599.70	0	04:19	0	0	0:00:00
Basin-B	0.13	1.73	1597.73	0	04:17	0	0	0:00:00
Basin-C	0.14	2.31	1590.31	0	04:18	0	0	0:00:00
Basin-D	0.51	2.70	1588.70	0	04:09	0	0	0:00:00
Basin-E	0.51	1.87	1587.87	0	04:47	0	0	0:00:00
OFF-SITE_Basin	0.15	4.26	1598.88	0	04:10	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
AtoOFF_Outlet	JUNCTION	0.00	6.24	0	04:19	0.00		
BtoSD_Outlet	JUNCTION	0.00	8.52	0	04:18	0.00		
CtoSD_Outlet	JUNCTION	0.00	7.15	0	04:35	0.00		
EtoSD-1	JUNCTION	0.00	5.56	0	04:04	0.00		
OFF-Junct_Box	JUNCTION	0.00	154.94	0	04:12	0.00		
OFF-MH#1	JUNCTION	0.00	149.79	0	04:10	0.00		
OFF-MH#2	JUNCTION	0.00	149.66	0	04:11	0.00		
OFF-MH#3	JUNCTION	0.00	157.35	0	04:11	0.00		
OFF-MH#4	JUNCTION	0.00	157.34	0	04:12	0.00		
OFF-MH#5	JUNCTION	0.00	157.34	0	04:12	0.00		
Outfall	OUTFALL	0.00	150.51	0	04:13	0.00		
Basin-A	STORAGE	17.00	17.00	0	04:02	0.00		
Basin-B	STORAGE	13.30	13.30	0	04:04	0.00		
Basin-C	STORAGE	15.00	15.00	0	03:59	0.00		
Basin-D	STORAGE	13.80	18.56	0	04:02	0.00		
Basin-E	STORAGE	29.00	38.86	0	04:03	0.00		
OFF-SITE_Basin	STORAGE	145.40	150.72	0	04:09	0.00		

Storage Node Summary

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	Time of Max Ponded Volume hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. Exfiltration hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Basin-A	24.747	81	0	04:19	2.750	9	6.24	0.00	0:00:00	0.000
Basin-B	16.564	51	0	04:17	1.121	3	8.52	0.00	0:00:00	0.000
Basin-C	20.985	70	0	04:18	1.078	4	7.15	0.00	0:00:00	0.000
Basin-D	7.317	85	0	04:09	0.930	11	13.89	0.00	0:00:00	0.000
Basin-E	92.954	59	0	04:47	24.154	15	4.26	0.00	0:00:00	0.000
OFF-SITE_Basin	4.154	30	0	04:10	0.064	0	149.79	0.00	0:00:00	0.000

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall	99.99	4.14	150.51
System	99.99	4.14	150.51

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 minutes	Reported Condition
AtoOFF-1	CONDUIT	0	04:19	4.19	1.51	6.24	1.05	5.94	0.79	0	> CAPACITY
BtoSD-1	CONDUIT	0	04:18	6.71	1.63	8.53	45.36	0.19	0.68	0	Calculated
CtoSD-1	CONDUIT	0	04:39	4.10	1.00	7.14	12.98	0.55	1.00	40	SURCHARGED
DtoSD-1	CONDUIT	0	04:55	3.80	1.00	5.02	6.12	0.82	1.00	61	SURCHARGED
EtoD-1	CONDUIT	0	04:08	6.25	1.00	10.18	0.33	30.79	1.00	77	SURCHARGED
MAYO-Culvert	CONDUIT	0	04:13	5.98	1.00	150.51	190.33	0.79	0.83	0	Calculated
OFFtoCulvert-1	CONDUIT	0	04:10	6.03	1.00	149.79	157.49	0.95	0.97	0	Calculated
OFFtoCulvert-2	CONDUIT	0	04:11	7.01	1.00	149.66	157.08	0.95	0.79	0	Calculated
OFFtoCulvert-3	CONDUIT	0	04:11	5.95	1.00	149.64	203.14	0.74	1.00	8	SURCHARGED
OFFtoCulvert-4	CONDUIT	0	04:12	6.26	1.00	157.34	203.14	0.77	1.00	8	SURCHARGED
OFFtoCulvert-5	CONDUIT	0	04:12	6.33	1.00	157.34	203.14	0.77	0.97	0	Calculated
OFFtoCulvert-6	CONDUIT	0	04:12	6.74	1.00	154.94	203.14	0.76	0.86	0	Calculated
Basin-A_Orifice	ORIFICE	0	03:56			0.74					
Basin-B_Orifice	ORIFICE	0	04:27			1.07					
Basin-C_Orifice	ORIFICE	0	04:48			0.90					
Basin-D_Orifice	ORIFICE	0	10:22			0.77					
Basin-A_Weir	WEIR	0	04:19			5.70			0.35		
Basin-B_Weir	WEIR	0	04:17			7.46			0.37		
Basin-C_Weir	WEIR	0	04:34			6.84			0.66		
Basin-D_Weir	WEIR	0	04:18			9.41			0.87		

****
Highest Flow Instability Indexes
****
Link Basin-D_Orifice (4)
Link DtoSD-1 (3)
Link Basin-D_Weir (3)
Link MAYO-Culvert (1)
Link Basin-C_Weir (1)

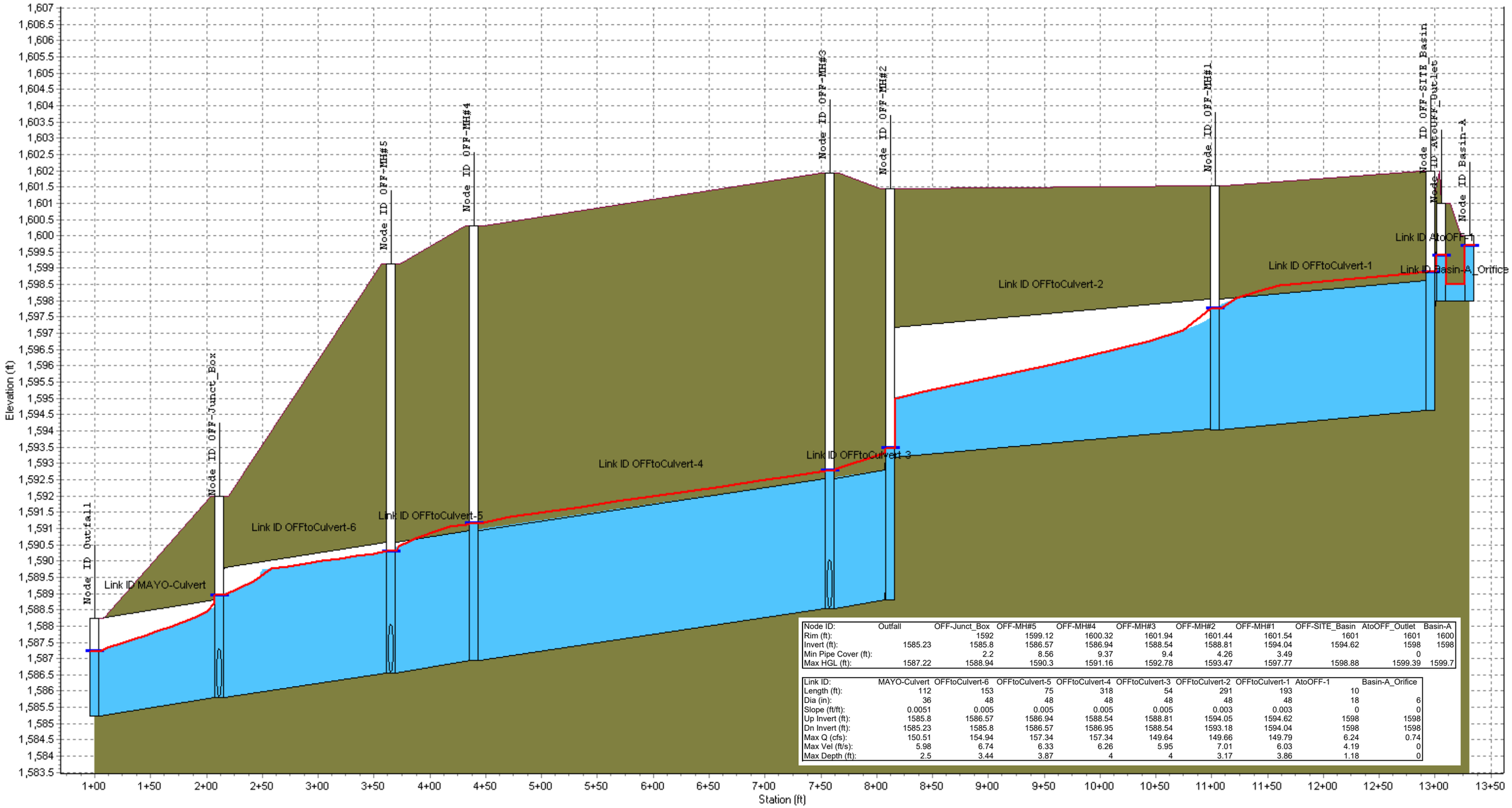
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-A is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-B is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-C is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-D is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-E is below storage node invert

```
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node OFF-SITE_Basin is below storage node
invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit AtoOFF-1.
  WARNING 004 : Minimum elevation drop used for Conduit EtoD-1.

  Analysis began on:  Mon Jun  9 16:42:13 2025
  Analysis ended on:  Mon Jun  9 16:42:18 2025
  Total elapsed time: 00:00:05
```

Profile Plot

Primary Storm Sewer



Node ID:	Outfall	OFF-Junct_Box	OFF-MH#5	OFF-MH#4	OFF-MH#3	OFF-MH#2	OFF-MH#1	OFF-SITE_Basin	AtoOFF_Outlet	Basin-A
Rim (ft):		1592	1599.12	1600.32	1601.94	1601.44	1601.54	1601	1601	1600
Invert (ft):	1585.23	1585.8	1586.57	1586.94	1588.54	1588.81	1594.04	1594.62	1598	1598
Min Pipe Cover (ft):		2.2	8.56	9.37	9.4	4.26	3.49		0	
Max HGL (ft):	1587.22	1588.94	1590.3	1591.16	1592.78	1593.47	1597.77	1598.88	1599.39	1599.7

Link ID:	MAYO-Culvert	OFFtoCulvert-6	OFFtoCulvert-5	OFFtoCulvert-4	OFFtoCulvert-3	OFFtoCulvert-2	OFFtoCulvert-1	AtoOFF-1	Basin-A_Orifice
Length (ft):	112	153	75	318	54	291	193	10	
Dia (in):	36	48	48	48	48	48	48	18	6
Slope (ft/ft):	0.0051	0.005	0.005	0.005	0.005	0.003	0.003	0	0
Up Invert (ft):	1585.8	1586.57	1586.94	1588.54	1588.81	1594.05	1594.62	1598	1598
Dn Invert (ft):	1585.23	1585.8	1586.57	1586.95	1588.54	1593.18	1594.04	1598	1598
Max Q (cfs):	150.51	154.94	157.34	157.34	149.64	149.66	149.79	6.24	0.74
Max Vel (ft/s):	5.98	6.74	6.33	6.26	5.95	7.01	6.03	4.19	0
Max Depth (ft):	2.5	3.44	3.87	4	4	3.17	3.86	1.18	0

Appendix H1-2 100-YR 24-HR Results

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... Banner_Health_24HR.SPF
Description ..... Banner Health Scottsdale Drainage
Analysis
Storm Event: 24-hour

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date JAN-01-2025 00:00:00
Ending Date JAN-03-2025 12:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 0
Number of nodes 17
Number of links 20

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
AtoOFF_Outlet	JUNCTION	1598.00	1601.00	0.00	
BtoSD_Outlet	JUNCTION	1596.00	1599.00	0.00	
CtoSD_Outlet	JUNCTION	1588.00	1591.00	0.00	
EtoSD-1	JUNCTION	1586.00	1589.00	0.00	
OFF-Junct_Box	JUNCTION	1585.80	1592.00	0.00	
OFF-MH#1	JUNCTION	1594.04	1601.54	0.00	
OFF-MH#2	JUNCTION	1588.81	1601.44	0.00	
OFF-MH#3	JUNCTION	1588.54	1601.94	0.00	
OFF-MH#4	JUNCTION	1586.94	1600.32	0.00	
OFF-MH#5	JUNCTION	1586.57	1599.12	0.00	
Outfall	OUTFALL	1585.23	1588.23	0.00	
Basin-A	STORAGE	1598.00	1600.00	0.00	Yes
Basin-B	STORAGE	1596.00	1599.00	0.00	Yes
Basin-C	STORAGE	1588.00	1591.00	0.00	Yes
Basin-D	STORAGE	1586.00	1589.00	0.00	Yes
Basin-E	STORAGE	1586.00	1589.00	0.00	Yes
OFF-SITE_Basin	STORAGE	1594.62	1601.00	0.00	Yes

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
AtoOFF-1	AtoOFF_Outlet	OFF-SITE_Basin	CONDUIT	10.0	0.0100	0.0130
BtoSD-1	BtoSD_Outlet	OFF-MH#3	CONDUIT	40.0	18.6500	0.0130
CtoSD-1	CtoSD_Outlet	OFF-MH#5	CONDUIT	94.0	1.5266	0.0130
DtoSD-1	EtoSD-1	OFF-Junct_Box	CONDUIT	59.0	0.3390	0.0130
EtoD-1	Basin-E	Basin-D	CONDUIT	101.0	0.0010	0.0130
MAYO-Culvert	OFF-Junct_Box	Outfall	CONDUIT	112.0	0.5089	0.0130
OFFtoCulvert-1	OFF-SITE_Basin	OFF-MH#1	CONDUIT	193.0	0.3005	0.0130
OFFtoCulvert-2	OFF-MH#1	OFF-MH#2	CONDUIT	291.0	0.2990	0.0130
OFFtoCulvert-3	OFF-MH#2	OFF-MH#3	CONDUIT	54.0	0.5000	0.0130
OFFtoCulvert-4	OFF-MH#3	OFF-MH#4	CONDUIT	318.0	0.5000	0.0130
OFFtoCulvert-5	OFF-MH#4	OFF-MH#5	CONDUIT	75.0	0.5000	0.0130
OFFtoCulvert-6	OFF-MH#5	OFF-Junct_Box	CONDUIT	153.0	0.5000	0.0130

Basin-A_Orifice	Basin-A	AtoOFF_Outlet	ORIFICE
Basin-B_Orifice	Basin-B	BtoSD_Outlet	ORIFICE
Basin-C_Orifice	Basin-C	CtoSD_Outlet	ORIFICE
Basin-D_Orifice	Basin-D	EtoSD-1	ORIFICE
Basin-A_Weir	Basin-A	AtoOFF_Outlet	WEIR
Basin-B_Weir	Basin-B	BtoSD_Outlet	WEIR
Basin-C_Weir	Basin-C	CtoSD_Outlet	WEIR
Basin-D_Weir	Basin-D	EtoSD-1	WEIR

****
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
AtoOFF-1	CIRCULAR	1.50	1.50	1	1.77	0.38	1.05
BtoSD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	45.36
CtoSD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	12.98
DtoSD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	6.12
EtoD-1	CIRCULAR	1.50	1.50	1	1.77	0.38	0.33
MAYO-Culvert	CIRCULAR	3.00	3.00	4	7.07	0.75	47.58
OFFtoCulvert-1	CIRCULAR	4.00	4.00	2	12.57	1.00	78.74
OFFtoCulvert-2	CIRCULAR	4.00	4.00	2	12.57	1.00	78.54
OFFtoCulvert-3	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57
OFFtoCulvert-4	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57
OFFtoCulvert-5	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57
OFFtoCulvert-6	CIRCULAR	4.00	4.00	2	12.57	1.00	101.57

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	22.056	7.187
External Outflow	21.788	7.100
Initial Stored Volume	0.006	0.002
Final Stored Volume	0.260	0.085
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 Time Flooded minutes	Retention Time hh:mm:ss
AtoOFF_Outlet	0.19	1.26	1599.26	0	12:19	0	0	0:00:00
BtoSD_Outlet	0.05	0.41	1596.41	0	12:18	0	0	0:00:00
CtoSD_Outlet	0.10	1.98	1589.98	0	12:14	0	0	0:00:00
EtoSD-1	0.37	2.52	1588.52	0	12:10	0	0	0:00:00
OFF-Junct_Box	0.40	2.88	1588.68	0	12:14	0	0	0:00:00
OFF-MH#1	0.26	3.40	1597.44	0	12:11	0	0	0:00:00
OFF-MH#2	0.24	3.78	1592.59	0	12:12	0	0	0:00:00
OFF-MH#3	0.23	3.36	1591.90	0	12:12	0	0	0:00:00
OFF-MH#4	0.25	3.79	1590.73	0	12:13	0	0	0:00:00
OFF-MH#5	0.24	3.38	1589.94	0	12:14	0	0	0:00:00
Outfall	0.82	1.87	1587.10	0	12:14	0	0	0:00:00
Basin-A	0.31	1.60	1599.60	0	12:19	0	0	0:00:00
Basin-B	0.19	1.61	1597.61	0	12:20	0	0	0:00:00
Basin-C	0.19	1.97	1589.97	0	12:17	0	0	0:00:00
Basin-D	0.60	2.47	1588.47	0	12:09	0	0	0:00:00
Basin-E	0.60	1.96	1587.96	0	12:50	0	0	0:00:00
OFF-SITE_Basin	0.25	3.82	1598.44	0	12:10	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	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
AtoOFF_Outlet	JUNCTION	0.00	5.37	0	12:19	0.00		
BtoSD_Outlet	JUNCTION	0.00	6.53	0	12:20	0.00		
CtoSD_Outlet	JUNCTION	0.00	5.75	0	12:34	0.00		
EtoSD-1	JUNCTION	0.00	5.39	0	13:00	0.00		
OFF-Junct_Box	JUNCTION	0.00	138.77	0	12:14	0.00		
OFF-MH#1	JUNCTION	0.00	134.61	0	12:10	0.00		
OFF-MH#2	JUNCTION	0.00	134.48	0	12:11	0.00		
OFF-MH#3	JUNCTION	0.00	139.92	0	12:12	0.00		
OFF-MH#4	JUNCTION	0.00	139.78	0	12:12	0.00		
OFF-MH#5	JUNCTION	0.00	139.72	0	12:12	0.00		
Outfall	OUTFALL	0.00	134.84	0	12:14	0.00		
Basin-A	STORAGE	13.80	13.80	0	12:02	0.00		
Basin-B	STORAGE	10.70	10.70	0	12:04	0.00		
Basin-C	STORAGE	12.30	12.30	0	11:59	0.00		
Basin-D	STORAGE	11.30	15.50	0	12:03	0.00		
Basin-E	STORAGE	23.60	32.34	0	12:04	0.00		
OFF-SITE_Basin	STORAGE	130.40	135.11	0	12:10	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Basin-A	23.007	75	0	12:19	3.823	13	5.37	0.00	0:00:00	0.000
Basin-B	15.177	47	0	12:20	1.670	5	6.53	0.00	0:00:00	0.000
Basin-C	17.180	58	0	12:17	1.422	5	5.75	0.00	0:00:00	0.000
Basin-D	6.396	74	0	12:09	1.100	13	10.76	0.00	0:00:00	0.000
Basin-E	97.581	62	0	12:50	28.672	18	4.43	0.00	0:00:00	0.000
OFF-SITE_Basin	3.079	22	0	12:10	0.066	0	134.61	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall	99.99	5.34	134.84
System	99.99	5.34	134.84

****
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 minutes	Reported Condition
AtoOFF-1	CONDUIT	0 12:19	3.95	1.51	5.37	1.05	5.11	0.72	0	> CAPACITY
BtoSD-1	CONDUIT	0 12:20	5.53	1.63	6.54	45.36	0.14	0.64	0	Calculated
CtoSD-1	CONDUIT	0 12:34	3.36	1.00	5.80	12.98	0.45	1.00	31	SURCHARGED
DtoSD-1	CONDUIT	0 13:04	3.84	1.00	5.37	6.12	0.88	1.00	64	SURCHARGED
EtoD-1	CONDUIT	0 12:06	5.24	1.00	9.02	0.33	27.30	1.00	123	SURCHARGED
MAYO-Culvert	CONDUIT	0 12:14	5.63	1.00	134.84	190.33	0.71	0.79	0	Calculated
OFFtoCulvert-1	CONDUIT	0 12:10	5.64	1.00	134.61	157.49	0.85	0.90	0	Calculated
OFFtoCulvert-2	CONDUIT	0 12:11	6.81	1.00	134.48	157.08	0.86	0.73	0	Calculated
OFFtoCulvert-3	CONDUIT	0 12:11	5.79	1.00	134.45	203.14	0.66	0.89	0	Calculated
OFFtoCulvert-4	CONDUIT	0 12:12	5.91	1.00	139.78	203.14	0.69	0.89	0	Calculated
OFFtoCulvert-5	CONDUIT	0 12:12	5.89	1.00	139.72	203.14	0.69	0.90	0	Calculated
OFFtoCulvert-6	CONDUIT	0 12:14	6.59	1.00	138.77	203.14	0.68	0.78	0	Calculated
Basin-A_Orifice	ORIFICE	0 11:56			0.74					
Basin-B_Orifice	ORIFICE	0 12:26			1.06					
Basin-C_Orifice	ORIFICE	0 12:46			0.89					
Basin-D_Orifice	ORIFICE	0 21:47			0.75					
Basin-A_Weir	WEIR	0 12:19			4.81			0.30		
Basin-B_Weir	WEIR	0 12:20			5.47			0.30		
Basin-C_Weir	WEIR	0 12:31			5.36			0.49		
Basin-D_Weir	WEIR	0 12:16			7.96			0.76		

****
Highest Flow Instability Indexes
****
Link DtoSD-1 (6)
Link MAYO-Culvert (5)
Link Basin-D_Orifice (4)
Link OFFtoCulvert-6 (4)
Link Basin-D_Weir (3)

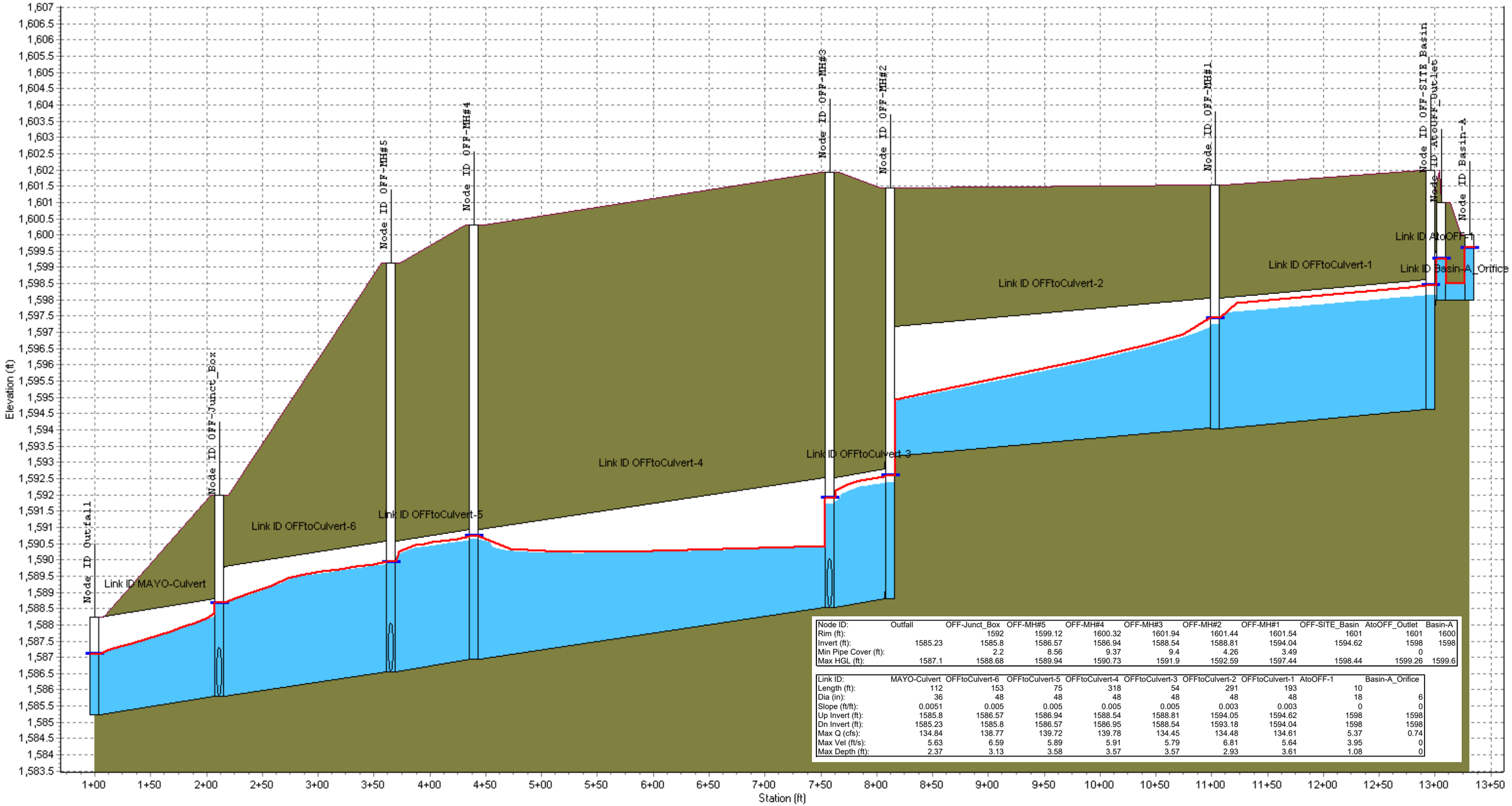
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-A is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-B is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-C is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-D is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-E is below storage node invert

```
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node OFF-SITE_Basin is below storage node
invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit AtoOFF-1.
  WARNING 004 : Minimum elevation drop used for Conduit EtoD-1.

  Analysis began on:  Mon Jun  9 16:49:34 2025
  Analysis ended on:  Mon Jun  9 16:49:39 2025
  Total elapsed time: 00:00:05
```

Profile Plot

Primary Storm Sewer

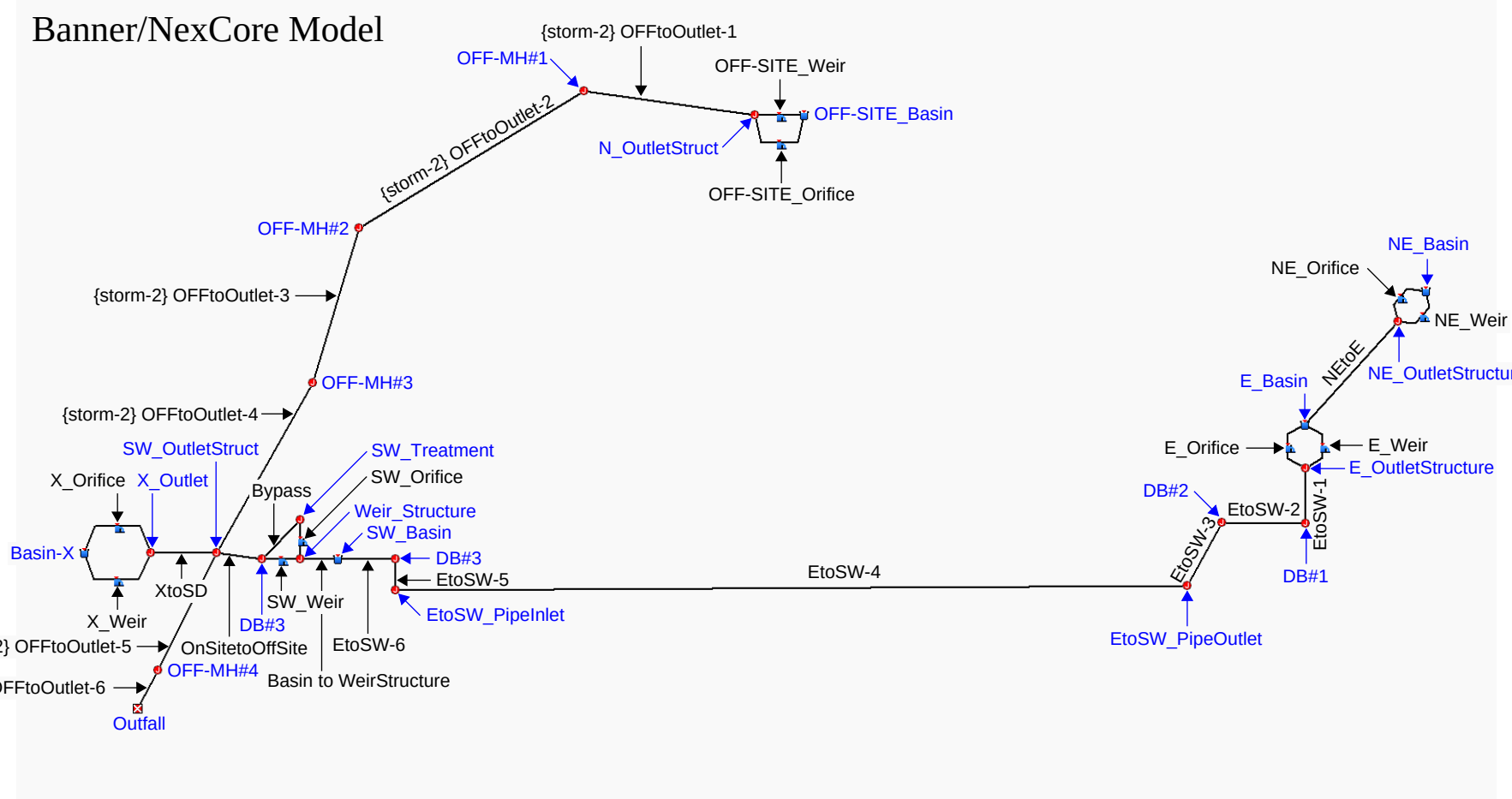


Node ID:	Outfall	OFF-Junct_Box	OFF-MH#5	OFF-MH#4	OFF-MH#3	OFF-MH#2	OFF-MH#1	OFF-SITE_Basin	AtoOFF_Outlet	Basin-A
Rim (ft):		1592	1599.12	1600.32	1601.94	1601.44	1601.54	1601	1601	1600
Invert (ft):	1585.23	1585.8	1586.57	1586.94	1588.54	1588.81	1594.04	1594.62	1598	1598
Min Pipe Cover (ft):		2.2	8.56	9.37	9.4	4.26	3.49		0	
Max HGL (ft):	1587.1	1588.68	1589.94	1590.73	1591.9	1592.59	1597.44	1598.44	1599.26	1599.6

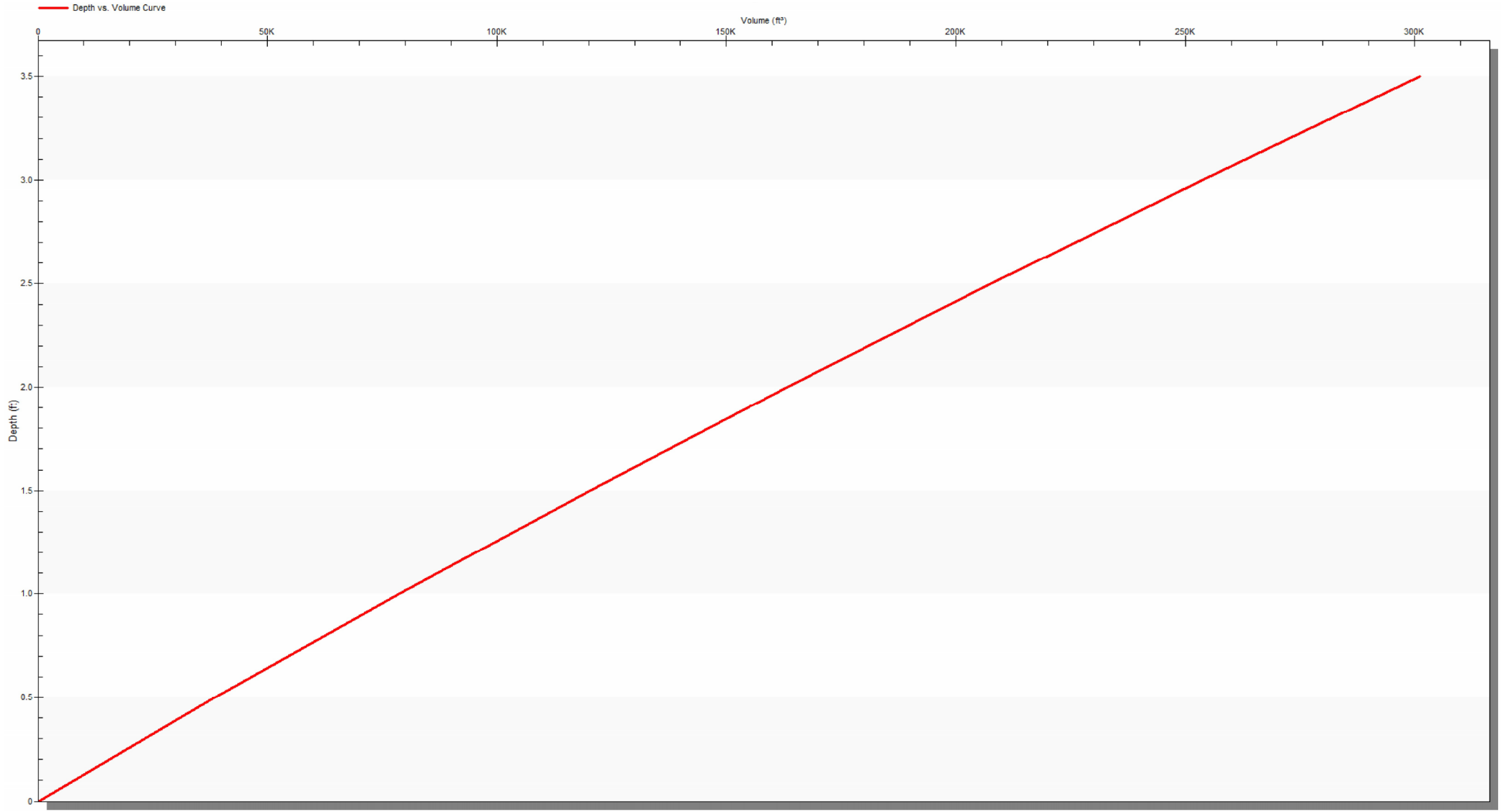
Link ID:	MAYO-Culvert	OFFtoCulvert-6	OFFtoCulvert-5	OFFtoCulvert-4	OFFtoCulvert-3	OFFtoCulvert-2	OFFtoCulvert-1	AtoOFF-1	Basin-A_Orifice
Length (ft):	112	153	75	318	54	291	193	10	
Dia (in):	36	48	48	48	48	48	48	18	6
Slope (ft/ft):	0.0051	0.005	0.005	0.005	0.005	0.003	0.003	0	0
Up Invert (ft):	1585.8	1586.57	1586.94	1588.54	1588.81	1594.05	1594.62	1598	1598
Dn Invert (ft):	1585.23	1585.8	1586.57	1586.95	1588.54	1593.18	1594.04	1598	1598
Max Q (cfs):	134.84	138.77	139.72	139.78	134.45	134.48	134.61	5.37	0.74
Max Vel (ft/s):	5.63	6.59	5.89	5.91	5.79	6.81	5.64	3.95	0
Max Depth (ft):	2.37	3.13	3.58	3.57	3.57	2.93	3.61	1.08	0

Appendix H2 Banner/NexCore Model

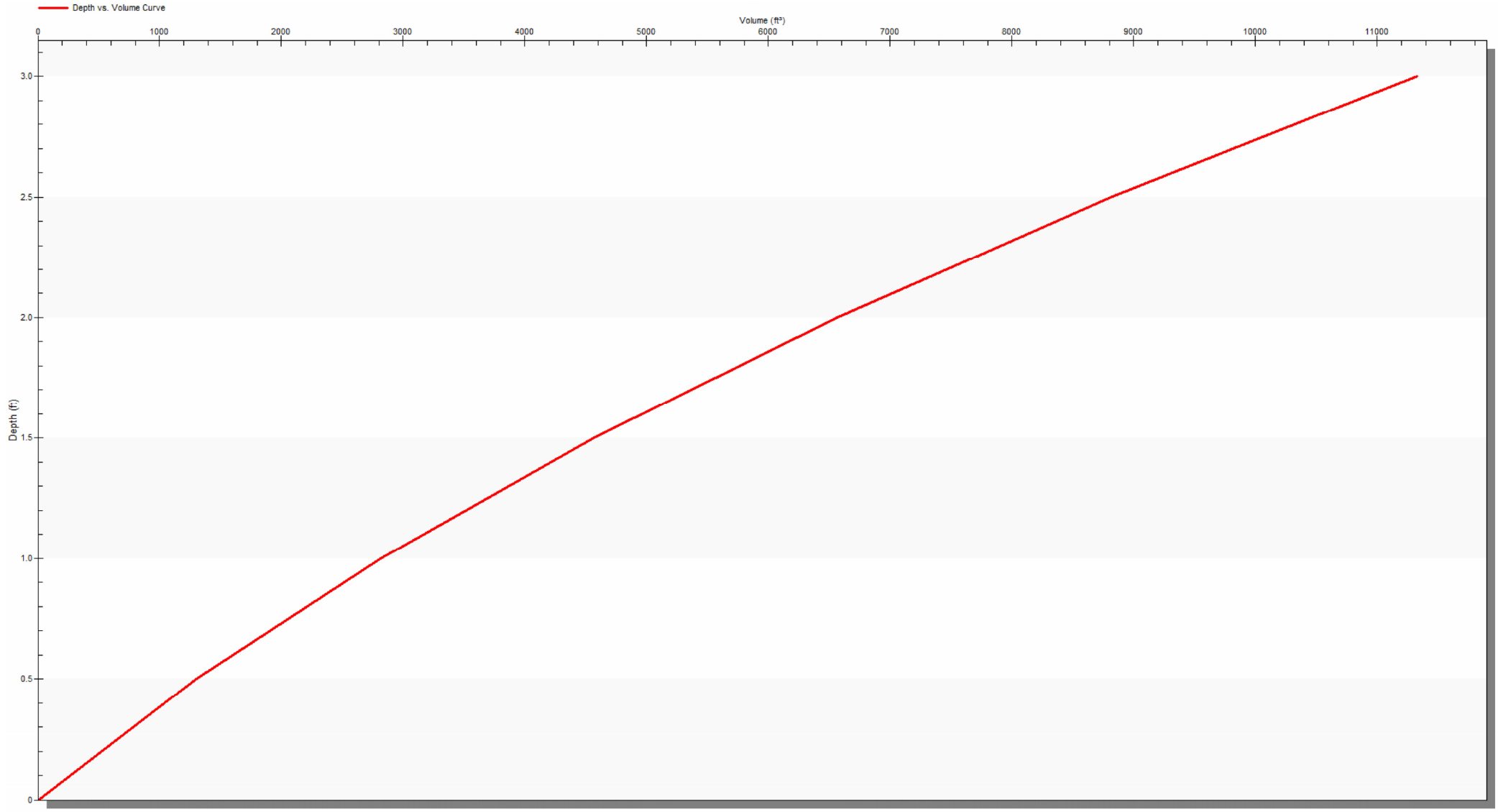
STORM AND SANITARY ANALYSIS
PLAN VIEW



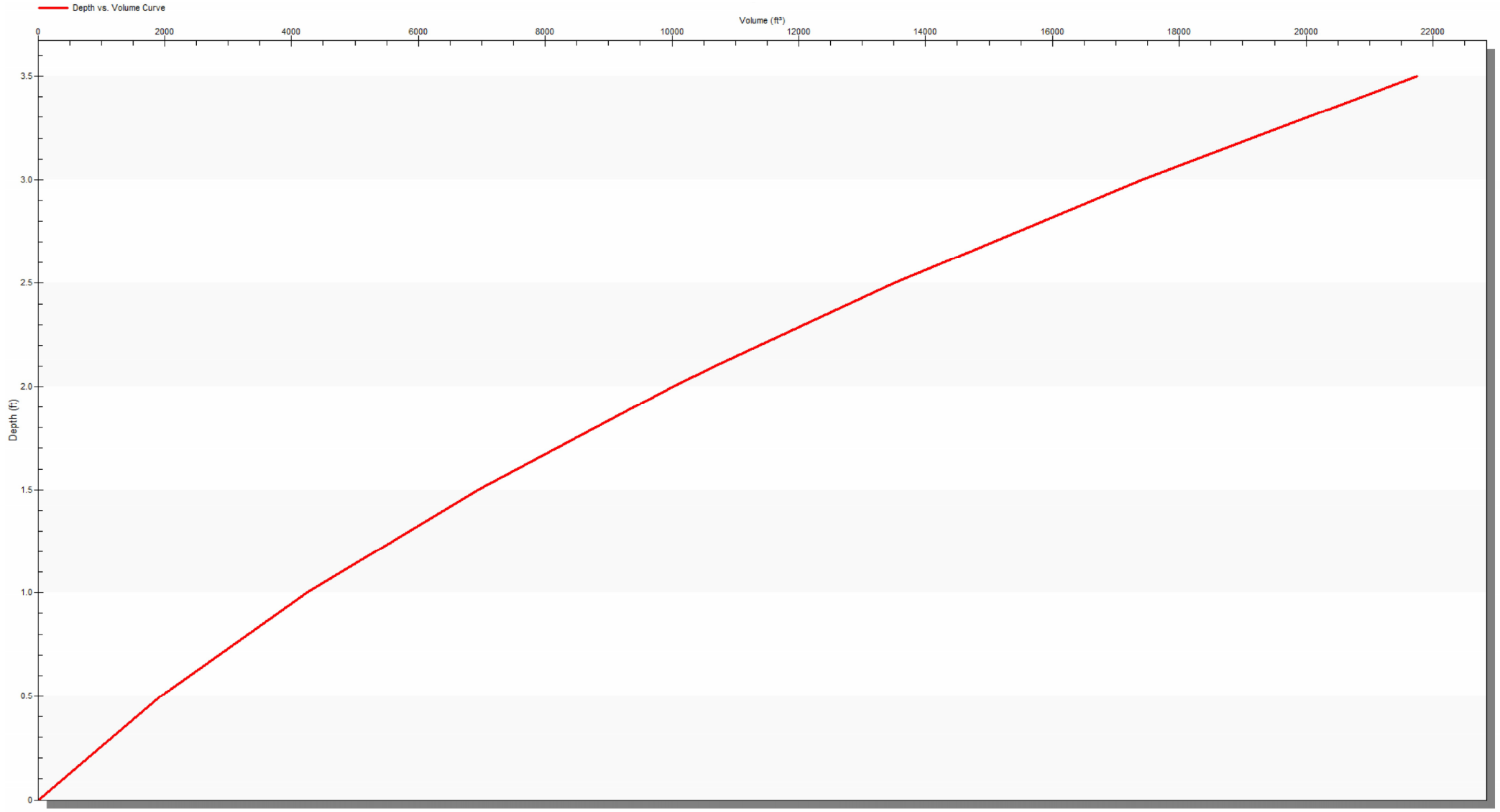
(Detention Basin A)
Off-Site Basin Storage Curve



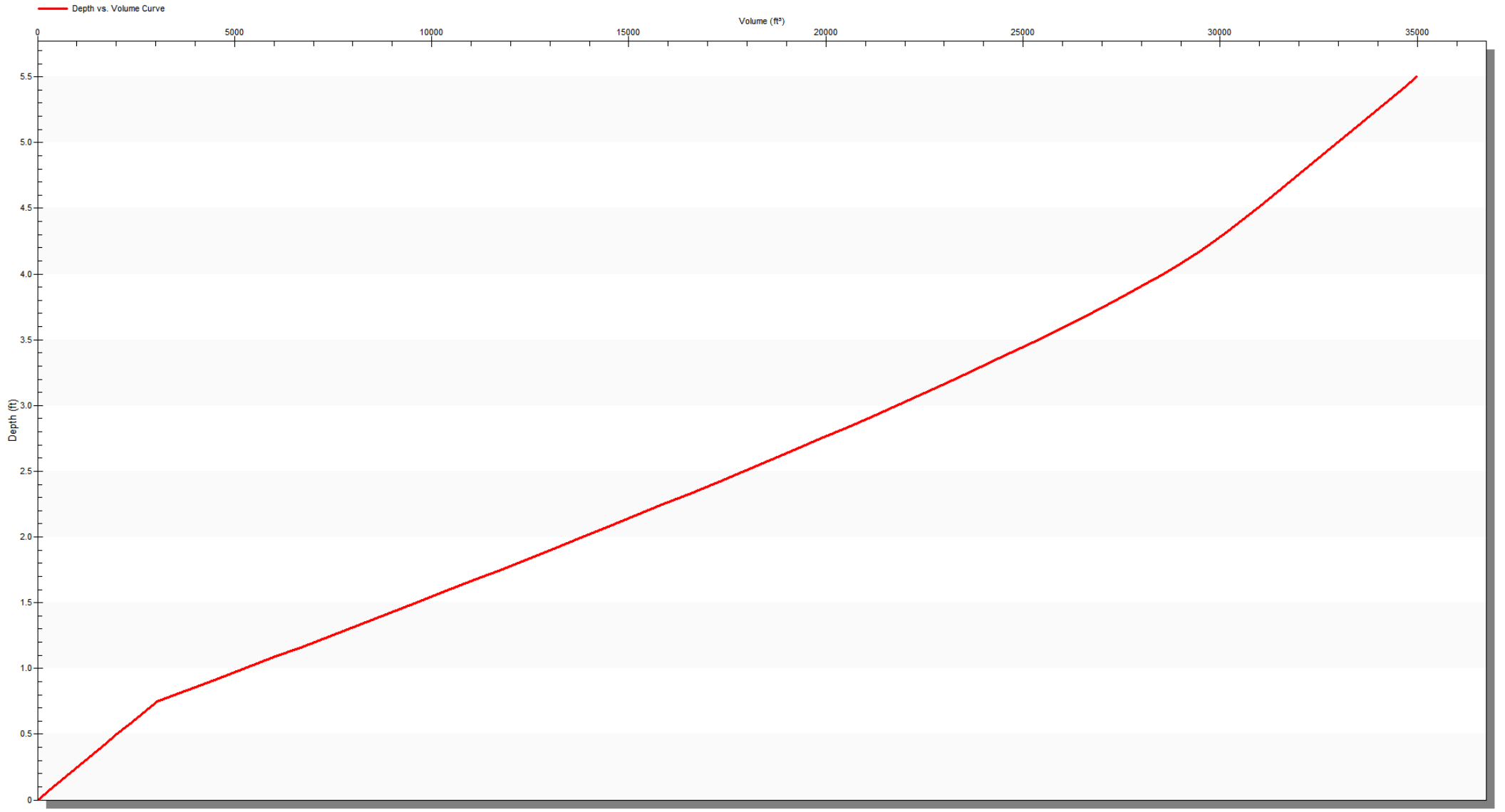
(Detention Basin B)
Northeast Basin Storage Curve



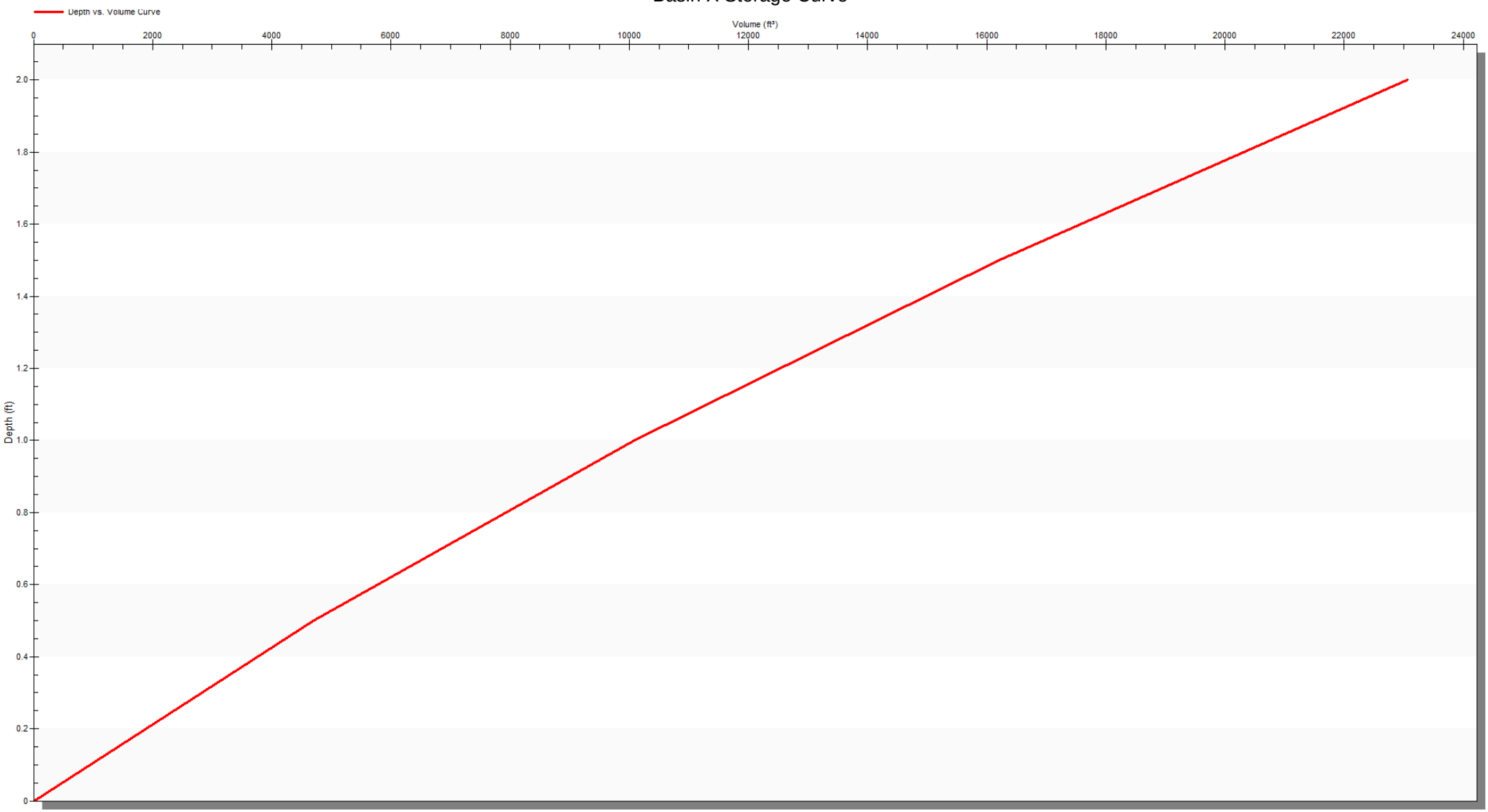
(Detention Basin C)
East Basin Storage Curve



(Detention Basin D)
Underground Retention Storage Curve



(Detention Basin X)
Basin X Storage Curve



Appendix H2-1 100-YR 6-HR Results

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... Banner_NexCore_6HR_Update.SPF
Description ..... Banner NexCore Off-Site Drainage Design
Storm Event: 6-hour

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date JAN-01-2025 00:00:00
Ending Date JAN-03-2025 12:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 0
Number of nodes 23
Number of links 27

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DB#1	JUNCTION	1588.27	1592.40	0.00	
DB#2	JUNCTION	1588.08	1592.92	0.00	
DB#3	JUNCTION	1581.68	1592.04	0.00	
DB#4	JUNCTION	1581.60	1587.88	0.00	
E_OutletStructure	JUNCTION	1588.50	1592.50	0.00	
EtoSW_PipeInlet	JUNCTION	1582.25	1586.74	0.00	
EtoSW_PipeOutlet	JUNCTION	1587.95	1590.00	0.00	
N_OutletStruct	JUNCTION	1586.44	1592.00	0.00	
NE_OutletStructure	JUNCTION	1589.00	1592.20	0.00	
OFF-MH#1	JUNCTION	1584.96	1593.28	0.00	
OFF-MH#2	JUNCTION	1582.69	1592.92	0.00	
OFF-MH#3	JUNCTION	1581.31	1590.83	0.00	
OFF-MH#4	JUNCTION	1574.50	1588.02	0.00	Yes
SW_OutletStruct	JUNCTION	1579.60	1588.52	0.00	
SW_Treatment	JUNCTION	1581.60	1587.93	0.00	
Weir_Structure	JUNCTION	1581.60	1587.84	0.00	
X_Outlet	JUNCTION	1586.00	1588.00	0.00	
Outfall	OUTFALL	1573.84	1577.84	0.00	
Basin-X	STORAGE	1586.00	1588.00	0.00	Yes
E_Basin	STORAGE	1588.50	1592.00	0.00	Yes
NE_Basin	STORAGE	1589.00	1592.00	0.00	Yes
OFF-SITE_Basin	STORAGE	1589.00	1593.00	0.00	Yes
SW_Basin	STORAGE	1581.60	1587.23	0.00	Yes

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
{storm}.OFFtoOutlet-5SW_OutletStruct	OFF-MH#4		CONDUIT	110.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-1N_OutletStruct	OFF-MH#1		CONDUIT	148.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-2OFF-MH#1	OFF-MH#2		CONDUIT	227.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-3OFF-MH#2	OFF-MH#3		CONDUIT	138.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-4OFF-MH#3	SW_OutletStruct		CONDUIT	171.0	1.0000	0.0130
BasintoWeirStuctureSW_Basin	Weir_Structure		CONDUIT	31.1	0.0032	0.0130
Bypass	SW_Treatment	DB#4	CONDUIT	10.0	0.0100	0.0130

EtoSW-1	E_OutletStructure	DB#1	CONDUIT	103.0	0.2233	0.0130
EtoSW-2	DB#1	DB#2	CONDUIT	77.0	0.2468	0.0130
EtoSW-3	DB#2	EtoSW_PipeOutlet	CONDUIT	50.0	0.2600	0.0130
EtoSW-4	EtoSW_PipeOutlet	EtoSW_PipeInlet	CHANNEL	431.6	0.4935	0.0300
EtoSW-5	EtoSW_PipeInlet	DB#3	CONDUIT	57.0	1.0000	0.0130
EtoSW-6	DB#3	SW_Basin	CONDUIT	16.0	0.5000	0.0130
NEtoE	NE_OutletStructure	E_Basin	CONDUIT	103.0	0.4854	0.0130
OFFtoOutlet-6	OFF-MH#4	Outfall	CONDUIT	55.0	1.2000	0.0130
OnSitetoOffSite	DB#4	SW_OutletStruct	CONDUIT	56.0	3.5714	0.0130
XtoSD	X_Outlet	SW_OutletStruct	CONDUIT	56.0	11.4286	0.0130
E_Orifice	E_Basin	E_OutletStructure	ORIFICE			
NE_Orifice	NE_Basin	NE_OutletStructure	ORIFICE			
OFF-SITE_Orifice	OFF-SITE_Basin	N_OutletStruct	ORIFICE			
SW_Orifice	Weir_Structure	SW_Treatment	ORIFICE			
X_Orifice	Basin-X	X_Outlet	ORIFICE			
E_Weir	E_Basin	E_OutletStructure	WEIR			
NE_Weir	NE_Basin	NE_OutletStructure	WEIR			
OFF-SITE_Weir	OFF-SITE_Basin	N_OutletStruct	WEIR			
SW_Weir	Weir_Structure	DB#4	WEIR			
X_Weir	Basin-X	X_Outlet	WEIR			

****
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
{storm}.OFFtoOutlet-5	CIRCULAR	4.00	4.00	1	12.57	1.00	143.64
{storm-2}.OFFtoOutlet-1	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
{storm-2}.OFFtoOutlet-2	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
{storm-2}.OFFtoOutlet-3	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
{storm-2}.OFFtoOutlet-4	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
BasintoWeirStucture	CIRCULAR	2.00	2.00	1	3.14	0.50	1.28
Bypass	CIRCULAR	0.50	0.50	1	0.20	0.13	0.06
EtoSW-1	CIRCULAR	1.00	1.00	1	0.79	0.25	1.68
EtoSW-2	CIRCULAR	1.00	1.00	1	0.79	0.25	1.77
EtoSW-3	CIRCULAR	1.00	1.00	1	0.79	0.25	1.82
EtoSW-4	IRREGULAR	0.92	30.75	1	11.63	0.38	21.07
EtoSW-5	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
EtoSW-6	CIRCULAR	2.00	2.00	1	3.14	0.50	16.00
NEtoE	CIRCULAR	1.00	1.00	1	0.79	0.25	2.48
OFFtoOutlet-6	CIRCULAR	4.00	4.00	1	12.57	1.00	157.35
OnSitetoOffSite	CIRCULAR	2.00	2.00	1	3.14	0.50	42.75
XtoSD	CIRCULAR	1.50	1.50	1	1.77	0.38	35.51

****
Transect Summary
****

Transect EtoSWChannel
Area:

0.0004	0.0014	0.0032	0.0057	0.0089
0.0128	0.0174	0.0228	0.0288	0.0356
0.0431	0.0513	0.0602	0.0698	0.0801
0.0911	0.1029	0.1154	0.1285	0.1424
0.1570	0.1723	0.1883	0.2051	0.2225
0.2407	0.2595	0.2791	0.2994	0.3204
0.3422	0.3646	0.3877	0.4119	0.4375
0.4646	0.4931	0.5232	0.5548	0.5878
0.6223	0.6584	0.6959	0.7349	0.7753
0.8173	0.8607	0.9057	0.9521	1.0000

Hrad:

0.0243	0.0486	0.0729	0.0972	0.1215
0.1458	0.1701	0.1944	0.2187	0.2430
0.2673	0.2916	0.3159	0.3402	0.3645
0.3888	0.4131	0.4373	0.4616	0.4859
0.5102	0.5345	0.5588	0.5831	0.6074

0.6317	0.6560	0.6803	0.7046	0.7289
0.7532	0.7775	0.8018	0.8049	0.8069
0.8112	0.8175	0.8256	0.8352	0.8460
0.8580	0.8710	0.8849	0.8996	0.9150
0.9309	0.9475	0.9645	0.9821	1.0000

Width:

0.0146	0.0293	0.0439	0.0585	0.0732
0.0878	0.1025	0.1171	0.1317	0.1464
0.1610	0.1756	0.1903	0.2049	0.2195
0.2342	0.2488	0.2635	0.2781	0.2927
0.3074	0.3220	0.3366	0.3513	0.3659
0.3805	0.3952	0.4098	0.4245	0.4391
0.4537	0.4684	0.4830	0.5111	0.5417
0.5722	0.6028	0.6333	0.6639	0.6945
0.7250	0.7556	0.7861	0.8167	0.8472
0.8778	0.9083	0.9389	0.9694	1.0000

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	11.012	3.588
External Outflow	10.972	3.576
Initial Stored Volume	0.003	0.001
Final Stored Volume	0.043	0.014
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 Time Flooded minutes	Retention Time hh:mm:ss
DB#1	0.22	1.98	1590.25	0	04:34	0	0	0:00:00
DB#2	0.18	1.30	1589.38	0	04:47	0	0	0:00:00
DB#3	0.63	3.90	1585.58	0	04:08	0	0	0:00:00
DB#4	0.11	1.72	1583.32	0	04:07	0	0	0:00:00
E_OutletStructure	0.26	2.87	1591.37	0	04:28	0	0	0:00:00
EtoSW_PipeInlet	0.38	3.33	1585.58	0	04:07	0	0	0:00:00
EtoSW_PipeOutlet	0.13	0.55	1588.50	0	04:36	0	0	0:00:00
N_OutletStruct	0.53	5.39	1591.83	0	05:00	0	0	0:00:00
NE_OutletStructure	0.21	2.42	1591.42	0	04:31	0	0	0:00:00
OFF-MH#1	0.48	4.50	1589.46	0	05:00	0	0	0:00:00
OFF-MH#2	0.45	3.57	1586.26	0	05:00	0	0	0:00:00
OFF-MH#3	0.40	2.69	1584.00	0	05:01	0	0	0:00:00
OFF-MH#4	1.52	2.20	1576.70	0	00:00	0	0	0:00:00
SW_OutletStruct	0.32	1.69	1581.29	0	04:26	0	0	0:00:00
SW_Treatment	0.48	2.29	1583.89	0	04:07	0	0	0:00:00
Weir_Structure	0.69	2.91	1584.51	0	04:07	0	0	0:00:00
X_Outlet	0.03	0.15	1586.15	0	04:22	0	0	0:00:00
Outfall	2.16	2.16	1576.00	0	00:00	0	0	0:00:00
Basin-X	0.09	0.82	1586.82	0	04:22	0	0	0:00:00
E_Basin	0.36	2.87	1591.37	0	04:28	0	0	0:00:00
NE_Basin	0.22	2.37	1591.37	0	04:37	0	0	0:00:00
OFF-SITE_Basin	0.58	3.01	1592.01	0	05:00	0	0	0:00:00
SW_Basin	0.70	3.95	1585.55	0	04:07	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
DB#1	JUNCTION	0.00	3.15	0	04:28	0.00		
DB#2	JUNCTION	0.00	3.15	0	04:34	0.00		
DB#3	JUNCTION	0.00	3.17	0	04:38	0.00		

DB#4	JUNCTION	0.00	21.85	0	04:07	0.00
E_OutletStructure	JUNCTION	0.00	7.47	0	04:34	0.00
EtoSW_PipeInlet	JUNCTION	0.00	3.12	0	04:36	0.00
EtoSW_PipeOutlet	JUNCTION	0.00	3.15	0	04:34	0.00
N_OutletStruct	JUNCTION	0.00	23.28	0	05:00	0.00
NE_OutletStructure	JUNCTION	0.00	7.15	0	04:39	0.00
OFF-MH#1	JUNCTION	0.00	23.06	0	05:00	0.00
OFF-MH#2	JUNCTION	0.00	23.06	0	05:01	0.00
OFF-MH#3	JUNCTION	0.00	23.06	0	05:01	0.00
OFF-MH#4	JUNCTION	3.00	37.37	0	04:26	0.00
SW_OutletStruct	JUNCTION	0.00	35.39	0	04:25	0.00
SW_Treatment	JUNCTION	0.00	0.93	0	04:40	0.00
Weir_Structure	JUNCTION	0.00	21.85	0	04:07	0.00
X_Outlet	JUNCTION	0.00	0.79	0	04:22	0.00
Outfall	OUTFALL	0.00	37.38	0	04:26	0.00
Basin-X	STORAGE	5.50	5.50	0	04:00	0.00
E_Basin	STORAGE	12.50	12.50	0	04:04	0.00
NE_Basin	STORAGE	2.50	7.02	0	04:32	0.00
OFF-SITE_Basin	STORAGE	146.80	146.80	0	04:10	0.00
SW_Basin	STORAGE	30.40	31.79	0	04:01	0.00

Storage Node Summary

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded days	Time of Max Ponded hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. hh:mm:ss	Total Exfiltration 1000 ft³
Basin-X	8.102	35	0	04:22	0.867	4	0.79	0.00	0:00:00	0.000
E_Basin	16.184	75	0	04:28	1.659	8	7.95	0.00	0:00:00	0.000
NE_Basin	8.112	73	0	04:37	0.660	6	7.15	0.00	0:00:00	0.000
OFF-SITE_Basin	254.964	73	0	05:00	46.679	13	23.28	0.00	0:00:00	0.000
SW_Basin	28.282	80	0	04:07	4.339	12	21.85	0.00	0:00:00	0.000

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall	100.00	3.48	37.38
System	100.00	3.48	37.38

Link Flow Summary

Link ID	Element Type	Time of Peak Flow	Maximum Velocity	Length Factor	Peak Flow during	Design Flow	Ratio of Maximum	Ratio of Maximum Reported	Total

Time	Condition		Occurrence	Attained		Analysis	Capacity	/Design	Flow	Surcharged
			days hh:mm	ft/sec		cfs	cfs	Flow	Depth	minutes
{storm}.OFFtoOutlet-5	CONDUIT	0	04:26	8.05	1.00	35.38	143.64	0.25	0.38	0 Calculated
{storm-2}.OFFtoOutlet-1	CONDUIT	0	05:00	7.34	1.00	23.06	22.62	1.02	1.00	118 SURCHARGED
{storm-2}.OFFtoOutlet-2	CONDUIT	0	05:01	7.34	1.00	23.06	22.62	1.02	1.00	118 SURCHARGED
{storm-2}.OFFtoOutlet-3	CONDUIT	0	05:01	7.34	1.00	23.06	22.62	1.02	1.00	114 SURCHARGED
{storm-2}.OFFtoOutlet-4	CONDUIT	0	05:00	7.96	1.00	23.06	22.62	1.02	0.92	0 > CAPACITY
BasintoWeirStucture	CONDUIT	0	04:07	6.95	1.00	21.85	1.28	17.04	1.00	169 SURCHARGED
Bypass	CONDUIT	0	04:40	5.12	1.00	0.92	0.06	16.48	1.00	59 SURCHARGED
EtoSW-1	CONDUIT	0	04:28	4.01	1.00	3.15	1.68	1.87	1.00	137 SURCHARGED
EtoSW-2	CONDUIT	0	04:34	4.01	1.00	3.15	1.77	1.78	1.00	117 SURCHARGED
EtoSW-3	CONDUIT	0	04:34	4.82	1.00	3.15	1.82	1.73	0.78	0 > CAPACITY
EtoSW-4	CHANNEL	0	04:36	1.31	1.00	3.12	21.07	0.15	0.48	0 Calculated
EtoSW-5	CONDUIT	0	04:38	1.03	1.00	3.17	22.62	0.14	1.00	40 SURCHARGED
EtoSW-6	CONDUIT	0	04:35	1.01	1.64	3.18	16.00	0.20	1.00	151 SURCHARGED
NEtoE	CONDUIT	0	04:08	2.09	1.00	1.64	2.48	0.66	1.00	173 SURCHARGED
OFFtoOutlet-6	CONDUIT	0	04:26	5.52	1.00	37.38	157.35	0.24	0.54	0 Calculated
OnSitetoOffSite	CONDUIT	0	04:07	8.46	1.00	21.85	42.75	0.51	0.77	0 Calculated
XtoSD	CONDUIT	0	04:22	2.47	1.00	0.79	35.51	0.02	0.55	0 Calculated
E_Orifice	ORIFICE	0	03:55			0.94				
NE_Orifice	ORIFICE	0	03:49			0.35				
OFF-SITE_Orifice	ORIFICE	0	04:24			2.60				
SW_Orifice	ORIFICE	0	04:40			0.93				
X_Orifice	ORIFICE	0	04:22			0.79				
E_Weir	WEIR	0	04:34			7.45			0.55	
NE_Weir	WEIR	0	04:39			7.14			0.76	
OFF-SITE_Weir	WEIR	0	05:00			22.97			0.67	
SW_Weir	WEIR	0	04:07			21.09			0.24	
X_Weir	WEIR	0	00:00			0.00			0.00	

****
Highest Flow Instability Indexes
****
Link NE_Weir (8)
Link OFF-SITE_Weir (7)
Link SW_Orifice (5)
Link OFF-SITE_Orifice (4)
Link E_Weir (3)

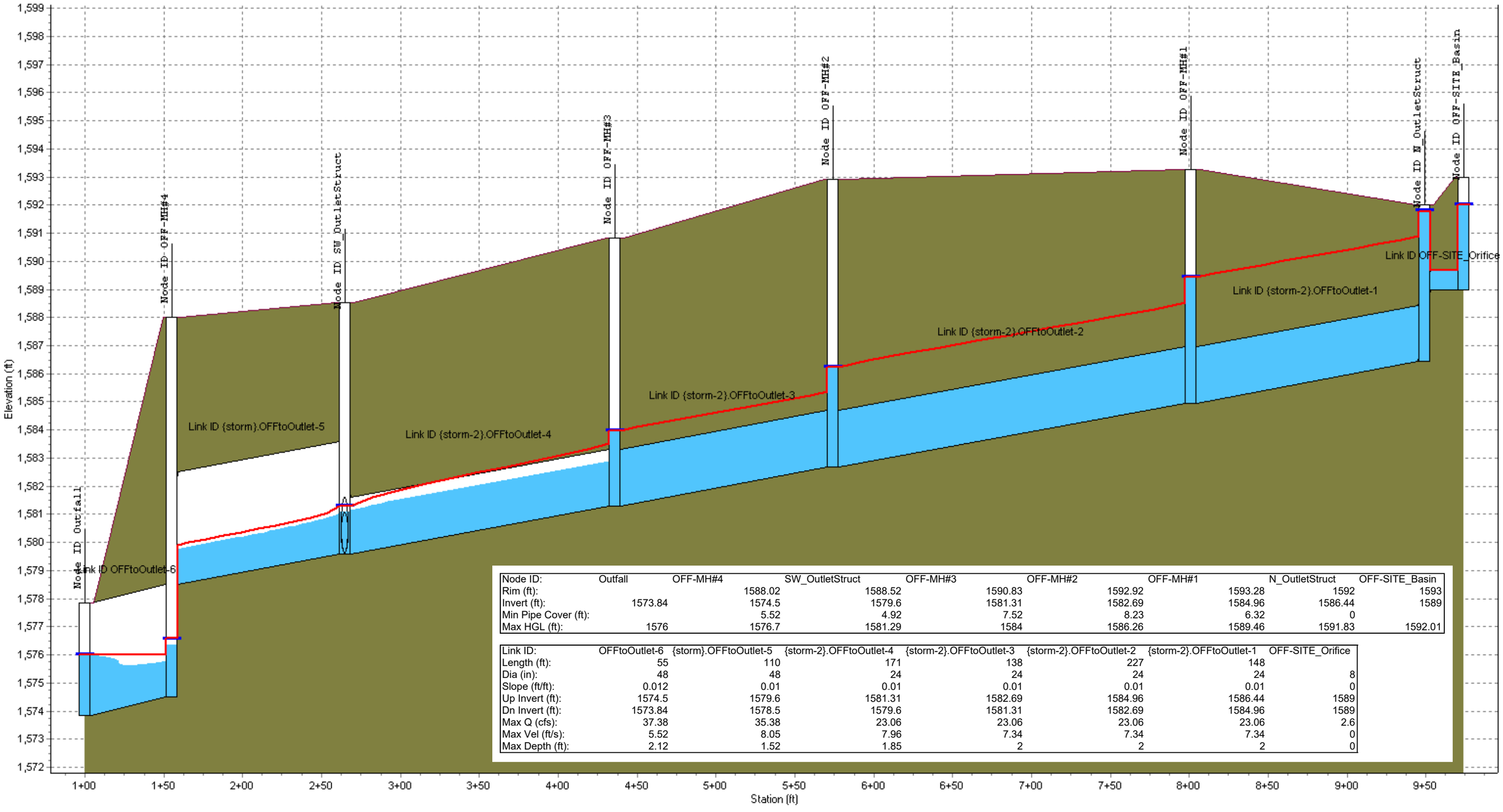
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-X is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.

```
  WARNING 110 : Initial water surface elevation defined for Storage Node E_Basin is below storage node invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node NE_Basin is below storage node invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node OFF-SITE_Basin is below storage node
invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node SW_Basin is below storage node invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit BasintoWeirStucture.
  WARNING 004 : Minimum elevation drop used for Conduit Bypass.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node
E_OutletStructure.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node
EtoSW_PipeInlet.

  Analysis began on:  Mon Jun  9 16:54:49 2025
  Analysis ended on:  Mon Jun  9 16:54:54 2025
  Total elapsed time: 00:00:05
```

Profile Plot

Primary Storm Sewer

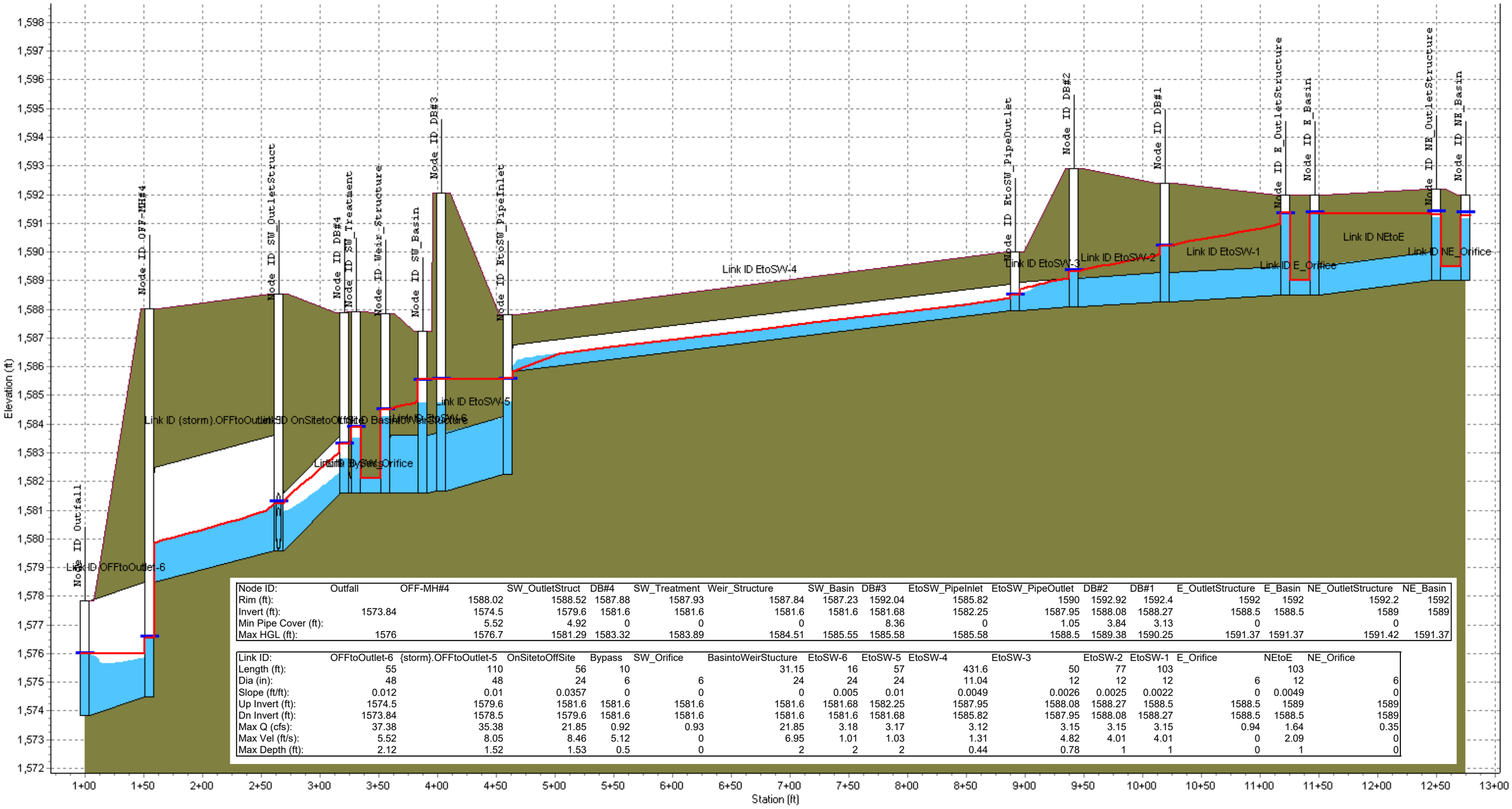


Node ID:	Outfall	OFF-MH#4	SW_OutletStruct	OFF-MH#3	OFF-MH#2	OFF-MH#1	N_OutletStruct	OFF-SITE_Basin
Rim (ft):		1588.02	1588.52	1590.83	1592.92	1593.28	1592	1593
Invert (ft):	1573.84	1574.5	1579.6	1581.31	1582.69	1584.96	1586.44	1589
Min Pipe Cover (ft):		5.52	4.92	7.52	8.23	6.32	0	
Max HGL (ft):	1576	1576.7	1581.29	1584	1586.26	1589.46	1591.83	1592.01

Link ID:	OFFtoOutlet-6	{storm}.OFFtoOutlet-5	{storm-2}.OFFtoOutlet-4	{storm-2}.OFFtoOutlet-3	{storm-2}.OFFtoOutlet-2	{storm-2}.OFFtoOutlet-1	OFF-SITE_Orifice
Length (ft):	55	110	171	138	227	148	
Dia (in):	48	48	24	24	24	24	8
Slope (ft/ft):	0.012	0.01	0.01	0.01	0.01	0.01	0
Up Invert (ft):	1574.5	1579.6	1581.31	1582.69	1584.96	1586.44	1589
Dn Invert (ft):	1573.84	1578.5	1579.6	1581.31	1582.69	1584.96	1589
Max Q (cfs):	37.38	35.38	23.06	23.06	23.06	23.06	2.6
Max Vel (ft/s):	5.52	8.05	7.96	7.34	7.34	7.34	0
Max Depth (ft):	2.12	1.52	1.85	2	2	2	0

Profile Plot

Primary Storm Sewer



Node ID:	Outfall	OFF-MH#4	SW_OutletStruct	DB#4	SW_Treatment	Weir_Structure	SW_Basin	DB#3	EtoSW_PipeInlet	EtoSW_PipeOutlet	DB#2	DB#1	E_OutletStructure	E_Basin	NE_OutletStructure	NE_Basin
Rim (ft):		1588.02	1588.52	1587.88	1587.93	1587.84	1587.23	1592.04	1585.82	1590	1592.92	1592.4	1592	1592	1592.2	1592
Invert (ft):	1573.84	1574.5	1579.6	1581.6	1581.6	1581.6	1581.6	1581.68	1582.25	1587.95	1588.08	1588.27	1588.5	1588.5	1589	1589
Min Pipe Cover (ft):		5.52	4.92	0	0	0		8.36	0	1.05	3.84	3.13	0		0	
Max HGL (ft):	1576	1576.7	1581.29	1583.32	1583.89	1584.51	1585.55	1585.58	1585.58	1588.5	1589.38	1590.25	1591.37	1591.37	1591.42	1591.37

Link ID:	OFFtoOutlet-6	{storm}.OFFtoOutlet-5	OnSitetoOffSite	Bypass	SW_Orifice	BasintoWeirStucture	EtoSW-6	EtoSW-5	EtoSW-4	EtoSW-3	EtoSW-2	EtoSW-1	E_Orifice	NEtoE	NE_Orifice
Length (ft):	55	110	56	10		31.15	16	57	431.6	50	77	103		103	
Dia (in):	48	48	24	6	6	24	24	24	11.04	12	12	12	6	12	6
Slope (ft/ft):	0.012	0.01	0.0357	0	0	0	0.005	0.01	0.0049	0.0026	0.0025	0.0022	0	0.0049	0
Up Invert (ft):	1574.5	1579.6	1581.6	1581.6	1581.6	1581.6	1581.68	1582.25	1587.95	1588.08	1588.27	1588.5	1588.5	1589	1589
Dn Invert (ft):	1573.84	1578.5	1579.6	1581.6	1581.6	1581.6	1581.6	1581.68	1585.82	1587.95	1588.08	1588.27	1588.5	1588.5	1589
Max Q (cfs):	37.38	35.38	21.85	0.92	0.93	21.85	3.18	3.17	3.12	3.15	3.15	3.15	0.94	1.64	0.35
Max Vel (ft/s):	5.52	8.05	8.46	5.12	0	6.95	1.01	1.03	1.31	4.82	4.01	4.01	0	2.09	0
Max Depth (ft):	2.12	1.52	1.53	0.5	0	2	2	2	0.44	0.78	1	1	0	1	0

Appendix H2-2 100-YR 24-HR Results

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... Banner_NexCore_24HR_Update.SPF
Description ..... Banner NexCore Off-Site Drainage Design
Storm Event: 24-hour

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date JAN-01-2025 00:00:00
Ending Date JAN-03-2025 12:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 0
Number of nodes 23
Number of links 27

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DB#1	JUNCTION	1588.27	1592.40	0.00	
DB#2	JUNCTION	1588.08	1592.92	0.00	
DB#3	JUNCTION	1581.68	1592.04	0.00	
DB#4	JUNCTION	1581.60	1587.88	0.00	
E_OutletStructure	JUNCTION	1588.50	1592.50	0.00	
EtoSW_PipeInlet	JUNCTION	1582.25	1586.74	0.00	
EtoSW_PipeOutlet	JUNCTION	1587.95	1590.00	0.00	
N_OutletStruct	JUNCTION	1586.44	1592.00	0.00	
NE_OutletStructure	JUNCTION	1589.00	1592.20	0.00	
OFF-MH#1	JUNCTION	1584.96	1593.28	0.00	
OFF-MH#2	JUNCTION	1582.69	1592.92	0.00	
OFF-MH#3	JUNCTION	1581.31	1590.83	0.00	
OFF-MH#4	JUNCTION	1574.50	1588.02	0.00	Yes
SW_OutletStruct	JUNCTION	1579.60	1588.52	0.00	
SW_Treatment	JUNCTION	1581.60	1587.93	0.00	
Weir_Structure	JUNCTION	1581.60	1587.84	0.00	
X_Outlet	JUNCTION	1586.00	1588.00	0.00	
Outfall	OUTFALL	1573.84	1577.84	0.00	
Basin-X	STORAGE	1586.00	1588.00	0.00	Yes
E_Basin	STORAGE	1588.50	1592.00	0.00	Yes
NE_Basin	STORAGE	1589.00	1592.00	0.00	Yes
OFF-SITE_Basin	STORAGE	1589.00	1593.00	0.00	Yes
SW_Basin	STORAGE	1581.60	1587.23	0.00	Yes

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
{storm}.OFFtoOutlet-5SW_OutletStruct	OFF-MH#4		CONDUIT	110.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-1N_OutletStruct	OFF-MH#1		CONDUIT	148.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-2OFF-MH#1	OFF-MH#2		CONDUIT	227.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-3OFF-MH#2	OFF-MH#3		CONDUIT	138.0	1.0000	0.0130
{storm-2}.OFFtoOutlet-4OFF-MH#3	SW_OutletStruct		CONDUIT	171.0	1.0000	0.0130
BasintoWeirStuctureSW_Basin	Weir_Structure		CONDUIT	31.1	0.0032	0.0130
Bypass	SW_Treatment	DB#4	CONDUIT	10.0	0.0100	0.0130

EtoSW-1	E_OutletStructure	DB#1	CONDUIT	103.0	0.2233	0.0130
EtoSW-2	DB#1	DB#2	CONDUIT	77.0	0.2468	0.0130
EtoSW-3	DB#2	EtoSW_PipeOutlet	CONDUIT	50.0	0.2600	0.0130
EtoSW-4	EtoSW_PipeOutlet	EtoSW_PipeInlet	CHANNEL	431.6	0.4935	0.0300
EtoSW-5	EtoSW_PipeInlet	DB#3	CONDUIT	57.0	1.0000	0.0130
EtoSW-6	DB#3	SW_Basin	CONDUIT	16.0	0.5000	0.0130
NEtoE	NE_OutletStructure	E_Basin	CONDUIT	103.0	0.4854	0.0130
OFFtoOutlet-6	OFF-MH#4	Outfall	CONDUIT	55.0	1.2000	0.0130
OnSitetoOffSite	DB#4	SW_OutletStruct	CONDUIT	56.0	3.5714	0.0130
XtoSD	X_Outlet	SW_OutletStruct	CONDUIT	56.0	11.4286	0.0130
E_Orifice	E_Basin	E_OutletStructure	ORIFICE			
NE_Orifice	NE_Basin	NE_OutletStructure	ORIFICE			
OFF-SITE_Orifice	OFF-SITE_Basin	N_OutletStruct	ORIFICE			
SW_Orifice	Weir_Structure	SW_Treatment	ORIFICE			
X_Orifice	Basin-X	X_Outlet	ORIFICE			
E_Weir	E_Basin	E_OutletStructure	WEIR			
NE_Weir	NE_Basin	NE_OutletStructure	WEIR			
OFF-SITE_Weir	OFF-SITE_Basin	N_OutletStruct	WEIR			
SW_Weir	Weir_Structure	DB#4	WEIR			
X_Weir	Basin-X	X_Outlet	WEIR			

****
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
{storm}.OFFtoOutlet-5	CIRCULAR	4.00	4.00	1	12.57	1.00	143.64
{storm-2}.OFFtoOutlet-1	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
{storm-2}.OFFtoOutlet-2	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
{storm-2}.OFFtoOutlet-3	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
{storm-2}.OFFtoOutlet-4	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
BasintoWeirStucture	CIRCULAR	2.00	2.00	1	3.14	0.50	1.28
Bypass	CIRCULAR	0.50	0.50	1	0.20	0.13	0.06
EtoSW-1	CIRCULAR	1.00	1.00	1	0.79	0.25	1.68
EtoSW-2	CIRCULAR	1.00	1.00	1	0.79	0.25	1.77
EtoSW-3	CIRCULAR	1.00	1.00	1	0.79	0.25	1.82
EtoSW-4	IRREGULAR	0.92	30.75	1	11.63	0.38	21.07
EtoSW-5	CIRCULAR	2.00	2.00	1	3.14	0.50	22.62
EtoSW-6	CIRCULAR	2.00	2.00	1	3.14	0.50	16.00
NEtoE	CIRCULAR	1.00	1.00	1	0.79	0.25	2.48
OFFtoOutlet-6	CIRCULAR	4.00	4.00	1	12.57	1.00	157.35
OnSitetoOffSite	CIRCULAR	2.00	2.00	1	3.14	0.50	42.75
XtoSD	CIRCULAR	1.50	1.50	1	1.77	0.38	35.51

****
Transect Summary
****

Transect EtoSWChannel
Area:

0.0004	0.0014	0.0032	0.0057	0.0089
0.0128	0.0174	0.0228	0.0288	0.0356
0.0431	0.0513	0.0602	0.0698	0.0801
0.0911	0.1029	0.1154	0.1285	0.1424
0.1570	0.1723	0.1883	0.2051	0.2225
0.2407	0.2595	0.2791	0.2994	0.3204
0.3422	0.3646	0.3877	0.4119	0.4375
0.4646	0.4931	0.5232	0.5548	0.5878
0.6223	0.6584	0.6959	0.7349	0.7753
0.8173	0.8607	0.9057	0.9521	1.0000

Hrad:

0.0243	0.0486	0.0729	0.0972	0.1215
0.1458	0.1701	0.1944	0.2187	0.2430
0.2673	0.2916	0.3159	0.3402	0.3645
0.3888	0.4131	0.4373	0.4616	0.4859
0.5102	0.5345	0.5588	0.5831	0.6074

0.6317	0.6560	0.6803	0.7046	0.7289
0.7532	0.7775	0.8018	0.8049	0.8069
0.8112	0.8175	0.8256	0.8352	0.8460
0.8580	0.8710	0.8849	0.8996	0.9150
0.9309	0.9475	0.9645	0.9821	1.0000

Width:

0.0146	0.0293	0.0439	0.0585	0.0732
0.0878	0.1025	0.1171	0.1317	0.1464
0.1610	0.1756	0.1903	0.2049	0.2195
0.2342	0.2488	0.2635	0.2781	0.2927
0.3074	0.3220	0.3366	0.3513	0.3659
0.3805	0.3952	0.4098	0.4245	0.4391
0.4537	0.4684	0.4830	0.5111	0.5417
0.5722	0.6028	0.6333	0.6639	0.6945
0.7250	0.7556	0.7861	0.8167	0.8472
0.8778	0.9083	0.9389	0.9694	1.0000

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	12.151	3.960
External Outflow	12.088	3.939
Initial Stored Volume	0.003	0.001
Final Stored Volume	0.067	0.022
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 Time Flooded minutes	Retention Time hh:mm:ss
DB#1	0.26	1.80	1590.07	0	12:31	0	0	0:00:00
DB#2	0.23	1.20	1589.28	0	12:42	0	0	0:00:00
DB#3	0.91	3.49	1585.17	0	12:07	0	0	0:00:00
DB#4	0.14	1.48	1583.08	0	12:07	0	0	0:00:00
E_OutletStructure	0.29	2.55	1591.05	0	12:31	0	0	0:00:00
EtoSW_PipeInlet	0.54	2.93	1585.18	0	12:07	0	0	0:00:00
EtoSW_PipeOutlet	0.17	0.54	1588.49	0	12:40	0	0	0:00:00
N_OutletStruct	0.45	4.77	1591.21	0	13:00	0	0	0:00:00
NE_OutletStructure	0.21	2.16	1591.16	0	12:41	0	0	0:00:00
OFF-MH#1	0.42	4.03	1588.99	0	13:02	0	0	0:00:00
OFF-MH#2	0.41	3.29	1585.98	0	13:01	0	0	0:00:00
OFF-MH#3	0.38	2.50	1583.81	0	12:50	0	0	0:00:00
OFF-MH#4	1.52	2.20	1576.70	0	00:00	0	0	0:00:00
SW_OutletStruct	0.35	1.56	1581.16	0	12:34	0	0	0:00:00
SW_Treatment	0.67	2.12	1583.72	0	12:07	0	0	0:00:00
Weir_Structure	0.98	2.80	1584.40	0	12:07	0	0	0:00:00
X_Outlet	0.04	0.15	1586.15	0	12:25	0	0	0:00:00
Outfall	2.16	2.16	1576.00	0	00:00	0	0	0:00:00
Basin-X	0.11	0.73	1586.73	0	12:25	0	0	0:00:00
E_Basin	0.44	2.56	1591.06	0	12:34	0	0	0:00:00
NE_Basin	0.23	2.10	1591.10	0	12:41	0	0	0:00:00
OFF-SITE_Basin	0.61	2.68	1591.68	0	13:00	0	0	0:00:00
SW_Basin	0.99	3.56	1585.16	0	12:07	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
DB#1	JUNCTION	0.00	2.96	0	12:34	0.00		
DB#2	JUNCTION	0.00	2.96	0	12:34	0.00		
DB#3	JUNCTION	0.00	2.98	0	12:41	0.00		

DB#4	JUNCTION	0.00	18.68	0	12:07	0.00
E_OutletStructure	JUNCTION	0.00	3.58	0	12:31	0.00
EtoSW_PipeInlet	JUNCTION	0.00	2.95	0	12:40	0.00
EtoSW_PipeOutlet	JUNCTION	0.00	2.96	0	12:32	0.00
N_OutletStruct	JUNCTION	0.00	22.52	0	12:51	0.00
NE_OutletStructure	JUNCTION	0.00	5.33	0	12:42	0.00
OFF-MH#1	JUNCTION	0.00	22.41	0	13:01	0.00
OFF-MH#2	JUNCTION	0.00	22.41	0	13:01	0.00
OFF-MH#3	JUNCTION	0.00	22.41	0	13:01	0.00
OFF-MH#4	JUNCTION	2.40	32.19	0	12:35	0.00
SW_OutletStruct	JUNCTION	0.00	30.75	0	12:34	0.00
SW_Treatment	JUNCTION	0.00	0.92	0	12:42	0.00
Weir_Structure	JUNCTION	0.00	18.68	0	12:07	0.00
X_Outlet	JUNCTION	0.00	0.74	0	12:25	0.00
Outfall	OUTFALL	0.00	32.20	0	12:35	0.00
Basin-X	STORAGE	4.60	4.60	0	12:00	0.00
E_Basin	STORAGE	10.10	10.10	0	12:03	0.00
NE_Basin	STORAGE	2.10	5.08	0	12:22	0.00
OFF-SITE_Basin	STORAGE	114.09	114.09	0	12:11	0.00
SW_Basin	STORAGE	24.90	25.95	0	12:01	0.00

Storage Node Summary

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded days	Time of Max Ponded hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. hh:mm:ss	Total Exfiltration 1000 ft³
Basin-X	7.121	31	0	12:25	0.995	4	0.74	0.00	0:00:00	0.000
E_Basin	13.830	64	0	12:34	1.931	9	4.14	0.00	0:00:00	0.000
NE_Basin	6.956	62	0	12:41	0.644	6	5.33	0.00	0:00:00	0.000
OFF-SITE_Basin	224.413	64	0	13:00	48.779	14	22.52	0.00	0:00:00	0.000
SW_Basin	25.789	73	0	12:07	6.174	17	18.68	0.00	0:00:00	0.000

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall	100.00	3.43	32.20
System	100.00	3.43	32.20

Link Flow Summary

Link ID	Element Type	Time of Peak Flow	Maximum Velocity	Length Factor	Peak Flow during	Design Flow	Ratio of Maximum	Ratio of Maximum Reported

Time	Condition		Occurrence	Attained		Analysis	Capacity	/Design	Flow	Surcharged
			days hh:mm	ft/sec		cfs	cfs	Flow	Depth	minutes
{storm}.OFFtoOutlet-5	CONDUIT		0 12:35	7.79	1.00	30.75	143.64	0.21	0.35	0 Calculated
{storm-2}.OFFtoOutlet-1	CONDUIT		0 13:01	7.13	1.00	22.41	22.62	0.99	1.00	87 SURCHARGED
{storm-2}.OFFtoOutlet-2	CONDUIT		0 13:01	7.13	1.00	22.41	22.62	0.99	1.00	86 SURCHARGED
{storm-2}.OFFtoOutlet-3	CONDUIT		0 13:01	7.13	1.00	22.41	22.62	0.99	1.00	81 SURCHARGED
{storm-2}.OFFtoOutlet-4	CONDUIT		0 13:01	7.73	1.00	22.41	22.62	0.99	0.89	0 Calculated
BasintoWeirStucture	CONDUIT	0	12:07	5.95	1.00	18.68	1.28	14.57	1.00	196 SURCHARGED
Bypass	CONDUIT	0	12:42	5.12	1.00	0.92	0.06	16.47	1.00	68 SURCHARGED
EtoSW-1	CONDUIT	0	12:34	3.77	1.00	2.96	1.68	1.76	1.00	130 SURCHARGED
EtoSW-2	CONDUIT	0	12:34	3.77	1.00	2.96	1.77	1.67	1.00	107 SURCHARGED
EtoSW-3	CONDUIT	0	12:32	4.65	1.00	2.96	1.82	1.63	0.77	0 > CAPACITY
EtoSW-4	CHANNEL	0	12:40	1.29	1.00	2.95	21.07	0.14	0.47	0 Calculated
EtoSW-5	CONDUIT	0	12:41	0.98	1.00	2.98	22.62	0.13	1.00	39 SURCHARGED
EtoSW-6	CONDUIT	0	12:48	0.95	1.64	3.00	16.00	0.19	1.00	169 SURCHARGED
NEtoE	CONDUIT	0	12:07	1.72	1.00	1.35	2.48	0.54	1.00	187 SURCHARGED
OFFtoOutlet-6	CONDUIT	0	12:35	4.97	1.00	32.20	157.35	0.20	0.54	0 Calculated
OnSitetoOffSite	CONDUIT	0	12:07	8.24	1.00	18.68	42.75	0.44	0.68	0 Calculated
XtoSD	CONDUIT	0	12:25	1.74	1.00	0.74	35.51	0.02	0.55	0 Calculated
E_Orifice	ORIFICE	0	11:57			0.93				
NE_Orifice	ORIFICE	0	17:25			0.17				
OFF-SITE_Orifice	ORIFICE	0	12:32			2.61				
SW_Orifice	ORIFICE	0	12:42			0.92				
X_Orifice	ORIFICE	0	12:25			0.74				
E_Weir	WEIR	0	12:31			3.58			0.42	
NE_Weir	WEIR	0	12:42			5.27			0.64	
OFF-SITE_Weir	WEIR	0	12:51			21.28			0.56	
SW_Weir	WEIR	0	12:07			17.88			0.22	
X_Weir	WEIR	0	00:00			0.00			0.00	

****
Highest Flow Instability Indexes
****
Link NE_Weir (8)
Link SW_Orifice (5)
Link OFF-SITE_Weir (2)
Link E_Orifice (2)
Link Bypass (1)

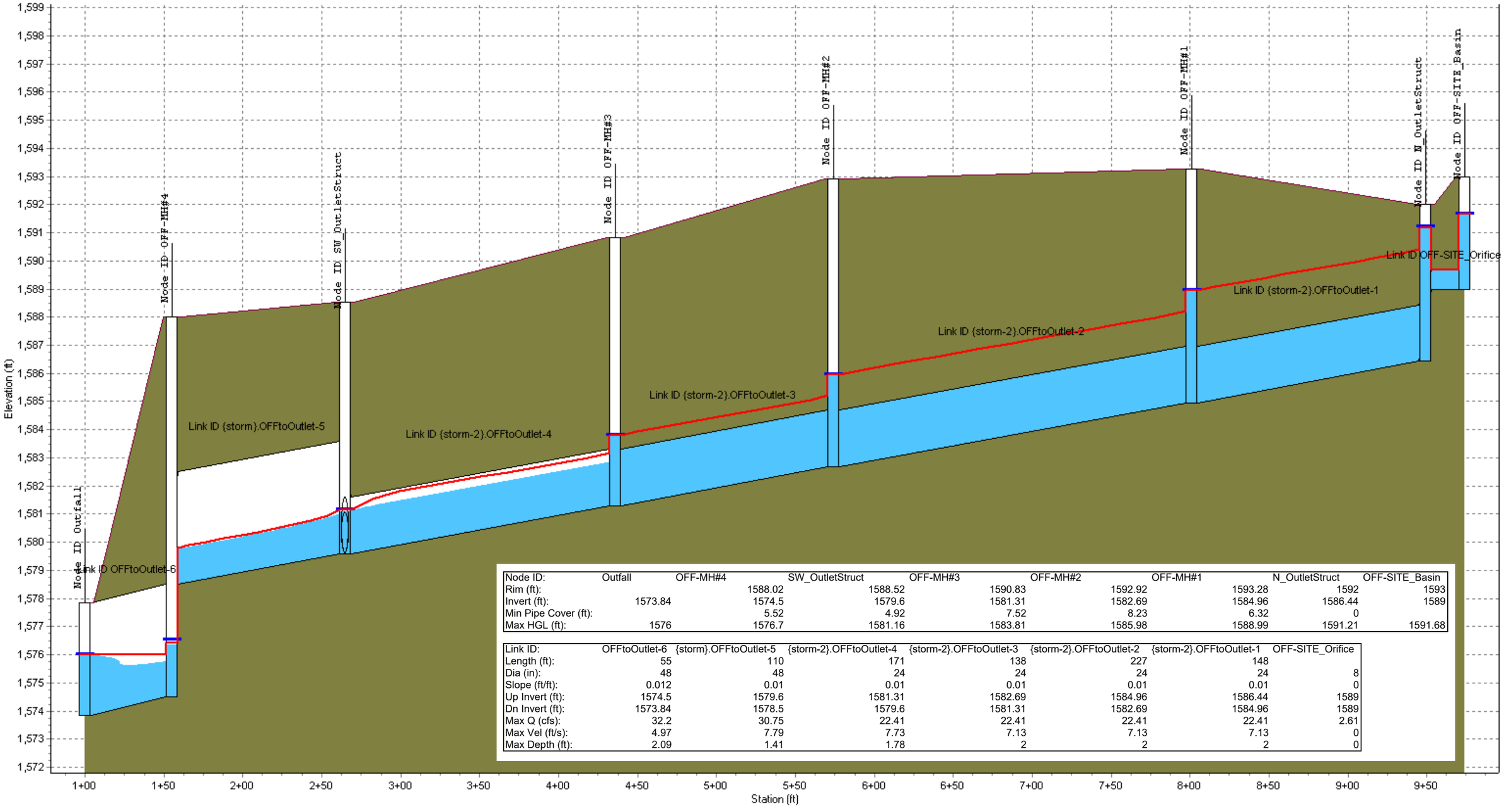
WARNING 110 : Initial water surface elevation defined for Storage Node Basin-X is below storage node invert elevation.
Assumed initial water surface elevation equal to invert elevation.

```
  WARNING 110 : Initial water surface elevation defined for Storage Node E_Basin is below storage node invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node NE_Basin is below storage node invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node OFF-SITE_Basin is below storage node
invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 110 : Initial water surface elevation defined for Storage Node SW_Basin is below storage node invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 004 : Minimum elevation drop used for Conduit BasintoWeirStucture.
  WARNING 004 : Minimum elevation drop used for Conduit Bypass.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node
E_OutletStructure.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node
EtoSW_PipeInlet.

  Analysis began on:  Mon Jun  9 17:01:20 2025
  Analysis ended on:  Mon Jun  9 17:01:26 2025
  Total elapsed time: 00:00:06
```

Profile Plot

Primary Storm Sewer

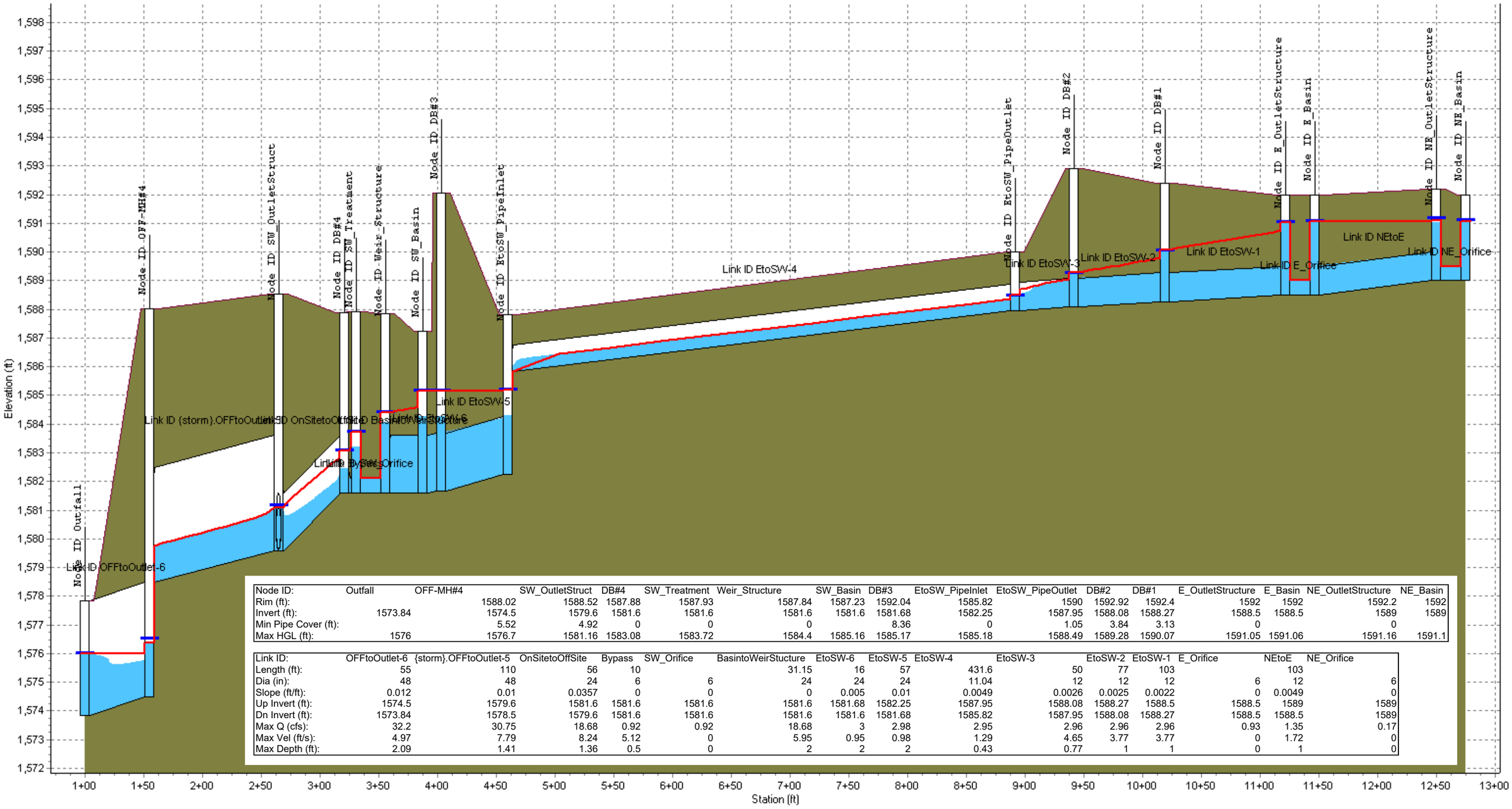


Node ID:	Outfall	OFF-MH#4	SW_OutletStruct	OFF-MH#3	OFF-MH#2	OFF-MH#1	N_OutletStruct	OFF-SITE_Basin
Rim (ft):		1588.02	1588.52	1590.83	1592.92	1593.28	1592	1593
Invert (ft):	1573.84	1574.5	1579.6	1581.31	1582.69	1584.96	1586.44	1589
Min Pipe Cover (ft):		5.52	4.92	7.52	8.23	6.32	0	
Max HGL (ft):	1576	1576.7	1581.16	1583.81	1585.98	1588.99	1591.21	1591.68

Link ID:	OFFtoOutlet-6	{storm}.OFFtoOutlet-5	{storm-2}.OFFtoOutlet-4	{storm-2}.OFFtoOutlet-3	{storm-2}.OFFtoOutlet-2	{storm-2}.OFFtoOutlet-1	OFF-SITE_Orifice
Length (ft):	55	110	171	138	227	148	
Dia (in):	48	48	24	24	24	24	8
Slope (ft/ft):	0.012	0.01	0.01	0.01	0.01	0.01	0
Up Invert (ft):	1574.5	1579.6	1581.31	1582.69	1584.96	1586.44	1589
Dn Invert (ft):	1573.84	1578.5	1579.6	1581.31	1582.69	1584.96	1589
Max Q (cfs):	32.2	30.75	22.41	22.41	22.41	22.41	2.61
Max Vel (ft/s):	4.97	7.79	7.73	7.13	7.13	7.13	0
Max Depth (ft):	2.09	1.41	1.78	2	2	2	0

Profile Plot

Primary Storm Sewer



Node ID:	Outfall	OFF-MH#4	SW_OutletStruct	DB#4	SW_Treatment	Weir_Structure	SW_Basin	DB#3	EtoSW_PipeInlet	EtoSW_PipeOutlet	DB#2	DB#1	E_OutletStructure	E_Basin	NE_OutletStructure	NE_Basin
Rim (ft):		1588.02	1588.52	1587.88	1587.93	1587.84	1587.23	1592.04	1585.82	1590	1592.92	1592.4	1592	1592	1592.2	1592
Invert (ft):	1573.84	1574.5	1579.6	1581.6	1581.6	1581.6	1581.6	1581.68	1582.25	1587.95	1588.08	1588.27	1588.5	1588.5	1589	1589
Min Pipe Cover (ft):		5.52	4.92	0	0	0		8.36	0	1.05	3.84	3.13	0		0	
Max HGL (ft):	1576	1576.7	1581.16	1583.08	1583.72	1584.4	1585.16	1585.17	1585.18	1588.49	1589.28	1590.07	1591.05	1591.06	1591.16	1591.1

Link ID:	OFFtoOutlet-6	{storm}.OFFtoOutlet-5	OnSitetoOffSite	Bypass	SW_Orifice	BasintoWeirStucture	EtoSW-6	EtoSW-5	EtoSW-4	EtoSW-3	EtoSW-2	EtoSW-1	E_Orifice	NEtoE	NE_Orifice
Length (ft):	55	110	56	10		31.15	16	57	431.6	50	77	103		103	
Dia (in):	48	48	24	6	6	24	24	24	11.04	12	12	12	6	12	6
Slope (ft/ft):	0.012	0.01	0.0357	0	0	0	0.005	0.01	0.0049	0.0026	0.0025	0.0022	0	0.0049	0
Up Invert (ft):	1574.5	1579.6	1581.6	1581.6	1581.6	1581.6	1581.68	1582.25	1587.95	1588.08	1588.27	1588.5	1588.5	1589	1589
Dn Invert (ft):	1573.84	1578.5	1579.6	1581.6	1581.6	1581.6	1581.6	1581.68	1585.82	1587.95	1588.08	1588.27	1588.5	1588.5	1589
Max Q (cfs):	32.2	30.75	18.68	0.92	0.92	18.68	3	2.98	2.95	2.96	2.96	2.96	0.93	1.35	0.17
Max Vel (ft/s):	4.97	7.79	8.24	5.12	0	5.95	0.95	0.98	1.29	4.65	3.77	3.77	0	1.72	0
Max Depth (ft):	2.09	1.41	1.36	0.5	0	2	2	2	0.43	0.77	1	1	0	1	0

Appendix I 500-Year Water Surface Elevation Analysis

Technical Memorandum

To:	Mark Koechling (SmithGroup)	**Date:**	05/27/2025
Copy:	Cody Edam, Aaron Zeligman (Banner Health)		
From:	Josh Papworth (Dibble)	**Project No.:**	1124152
	Shannon Mauck (Dibble)		
Subject:	**Banner Scottsdale Medical Center 500-Year Water Surface Elevation Analysis**		

1. Introduction



An estimation of the water surface elevation that could potentially occur during a 500-year storm event has been performed to support the design of the Banner Scottsdale Medical Center project, at the southwest corner of Hayden Rod and the Arizona State Route 101 (Loop 101) Freeway in Scottsdale Arizona. A portion of the project site, including the new hospital building, is located within a FEMA Zone AO Special Flood Hazard Area, with a designated depth of 1 foot and velocity of 3 feet per second (fps). As a FEMA 'critical facility' and ASCE-24 'essential facility', City of Scottsdale design standards require that the proposed hospital building's finished floor be at least as high as the greater of (1) an elevation 3 feet above the highest natural grade adjacent to the building and (2) the post-project 500-year water surface elevation. This memorandum documents the methodology, approach, and results of this analysis in support of a building permit from the City of Scottsdale. Additional background information for the project may be found in the project's drainage report.

2. Methodology & Approach

A simplified approach has been undertaken to produce a conservative estimate of the 500-year water surface elevation at the project site for comparison to the competing requirement computed as 3 feet above the highest adjacent natural grade (HAG). **Figure 1** provides the 500-year watershed for the project site.

Two pre-exiting, two-dimensional FLO-2D hydrology models were relevant to the analysis. The first, the Reata Wash Channel FLO-2D model, was completed in May 2020 and has been approved by FEMA. This model provides discharges for the mountainous area in the northeast portion of the contributing watershed. The second model, the Crossroads East Phase 1 FLO-2D model (a refinement of the Pinnacle Peak South ADMS FLO-2D model), was completed in support of the design of the Powerline Channel and Basin 53R in March 2020 and provides discharges for areas between Reata Wash and the project site. Additionally, the DDMSW models produced by Hubbard Engineering as a part of the Master Drainage Report – Phase 3 Update for the Cavasson Development were used for the 500-year analysis.

The current analysis employed the following methodology:

1. Rainfall data was updated to 500-year values within the Reata Wash Channel FLO-2D model to produce hydrographs for use in the downstream Crossroads East Phase 1 FLO-2D model.
2. Rainfall data was updated to 500-year values within the Crossroads East Phase 1 FLO-2D model, and 100-year inflow hydrographs were replaced with 500-year inflow hydrographs produced by the Reata Wash Channel FLO-2D model. Not all original flow transfer locations were updated with 500-year values, only those having potential impact at the project locations. These are shown on **Figure 1**.

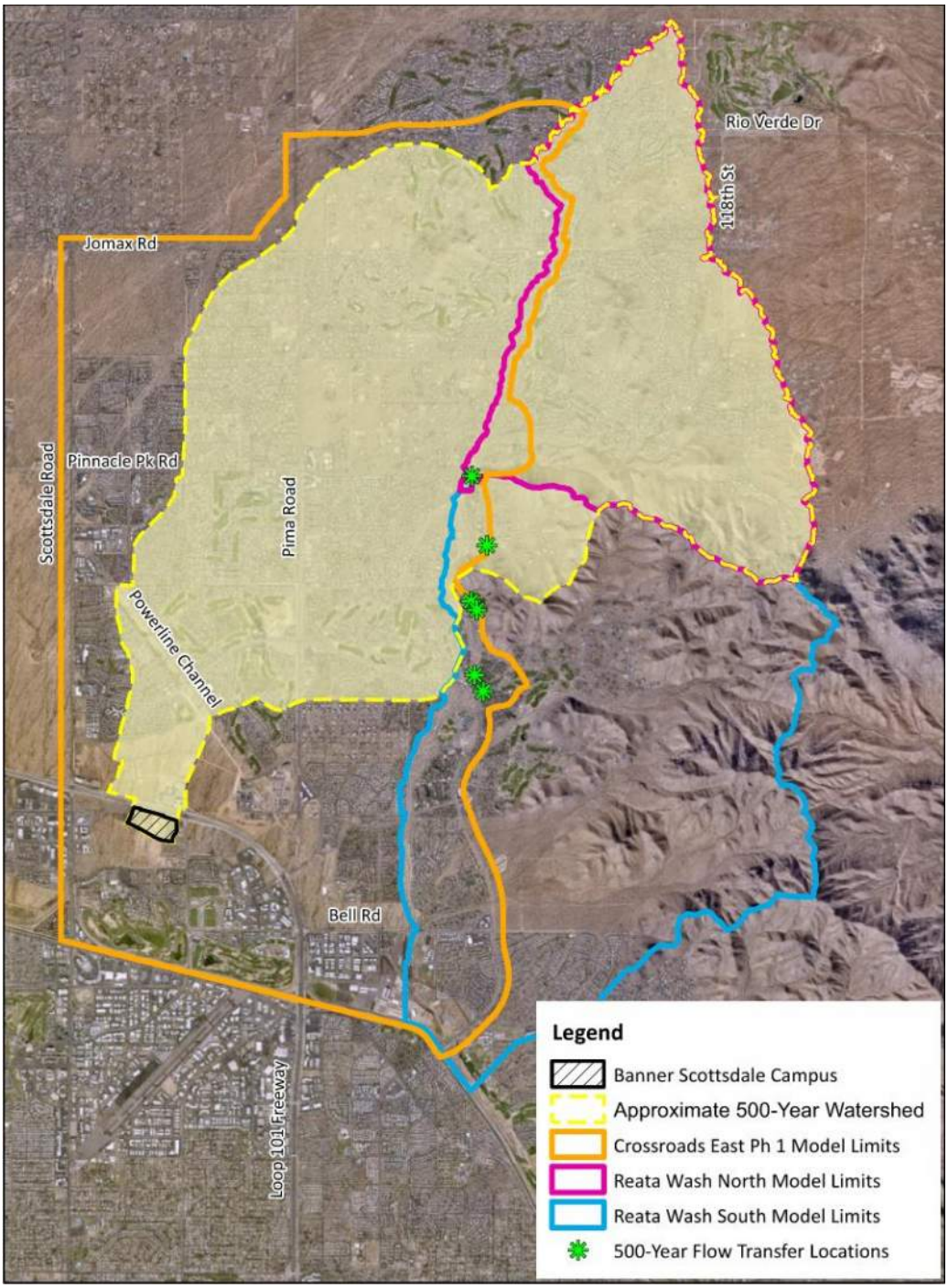


Figure 1: 500-Year Watershed

3. For both the Reata Wash Channel hydrology and the Crossroads East Phase 1 hydrology the 24-hour versions of the 100-year storm events produced higher discharges at Reata Wash inflow locations and the project site. Therefore, the 24-hour storm was selected for the 500-year analysis.
4. Infiltration parameters, including limiting infiltration depth, were not modified in either model. This was a conservative measure as larger storms inevitably result in more infiltration. Infiltration volume was limited to the 100-year volumes, resulting in a lower percentage infiltration and higher discharges than would likely occur if the limiting infiltration depth were increased.

5. The Crossroads East Phase 1 FLO-2D model did not model the Powerline Channel or Basin 53R explicitly as grid or inset 1-D channel elements. A FLO-2D levee element was used to direct off-site runoff along the Powerline Channel alignment to Basin 53R.
6. The current study used the same FLO-2D floodplain cross sections to extract updated FLO-2D 500-year flow rates for a capacity analysis of the Powerline Channel with a 1-D HEC-RAS model. It was found that the channel has capacity for the 500-year discharge with the exception of the headwater location at the Hayden Road culvert. Here 195 cubic feet per second (cfs) was calculated as leaving the channel using a lateral weir analysis within HEC-RAS. Being west of Hayden Road, this runoff will be directed southwesterly, consistent with the natural grade and the Nationwide development conveyance system.
7. The area immediately upstream of the Banner site, between the Powerline Channel and the Loop 101 Freeway, has undergone partial development since the completion of the Crossroads East Phase 1 FLO-2D model. This is the Cavasson development area. The existing condition and ultimate condition 100-year, 6-hour DDMSW models were obtained from the *Cavasson Master Drainage Report – Phase 3 Update*. These models provided up-to-date upstream sub-basin data for discharges that enter the Banner site through several culverts beneath the State Route 101 Freeway.
8. The ultimate condition versions of the Cavasson master plan models produced higher peak discharges than the existing condition model. Therefore, a 500-year, 24-hour DDMSW model was created by modifying the Cavasson master plan ultimate condition 100-year, 6-hour model.
9. Five FLO-2D floodplain cross sections were added to the Crossroads East Phase 1 FLO-2D model to produce five hydrographs that were used as upstream inputs to the 500-year, 24-hour Cavasson master plan model. A schematic of this model is provided as **Exhibit C-2** in **Attachment C**.
10. Peak discharges from the Cavasson master plan model were then used to create inflow hydrographs for a 2-D HEC-RAS version 6.2 model of the proposed design of the Banner site. The peak discharge that was found to overtop the Powerline Channel in Step 6 was added to the discharge at the easternmost culvert location.
11. Finally, the HEC-RAS model was run with the 500-year inflow hydrographs to determine the peak 500-year water surface elevations on the Banner Scottsdale Medical Center site.

3. Results & Recommendations

Figure 2 provides the resulting 500-year inundation area at the Banner Scottsdale Medical Center project site. The proposed hospital building finished floor elevation 1603.70, based on the HAG plus 3 feet requirement, is approximately 6 inches above the 500-year peak stage 1603.21, conservatively determined with this analysis. This analysis provides a conclusive determination that the HAG plus 3 feet requirement governs the finished floor determination for this project.

It should be noted that results presented herein were determined strictly for the Banner Scottsdale Medical Center project only and are intentionally conservative in nature. They should not be used for flood hazard engineering at any other location without first assessing the appropriateness of the assumptions documented herein to the subject location.

Supporting calculation results are provided as attachments to this memorandum. They are:

Attachment A - FLO-2D Results
Attachment B - Powerline Channel HEC-RAS Results
Attachment C - HEC-1 Model Documentation

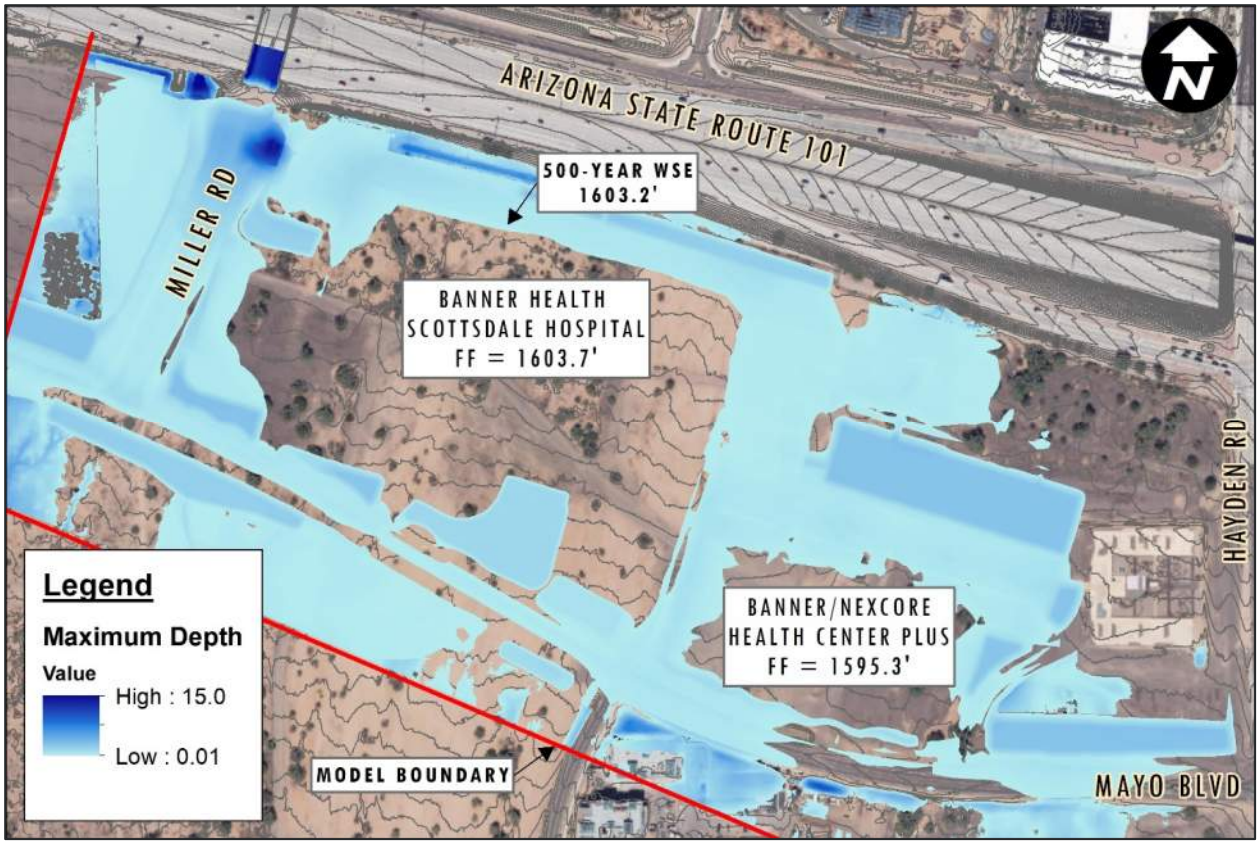
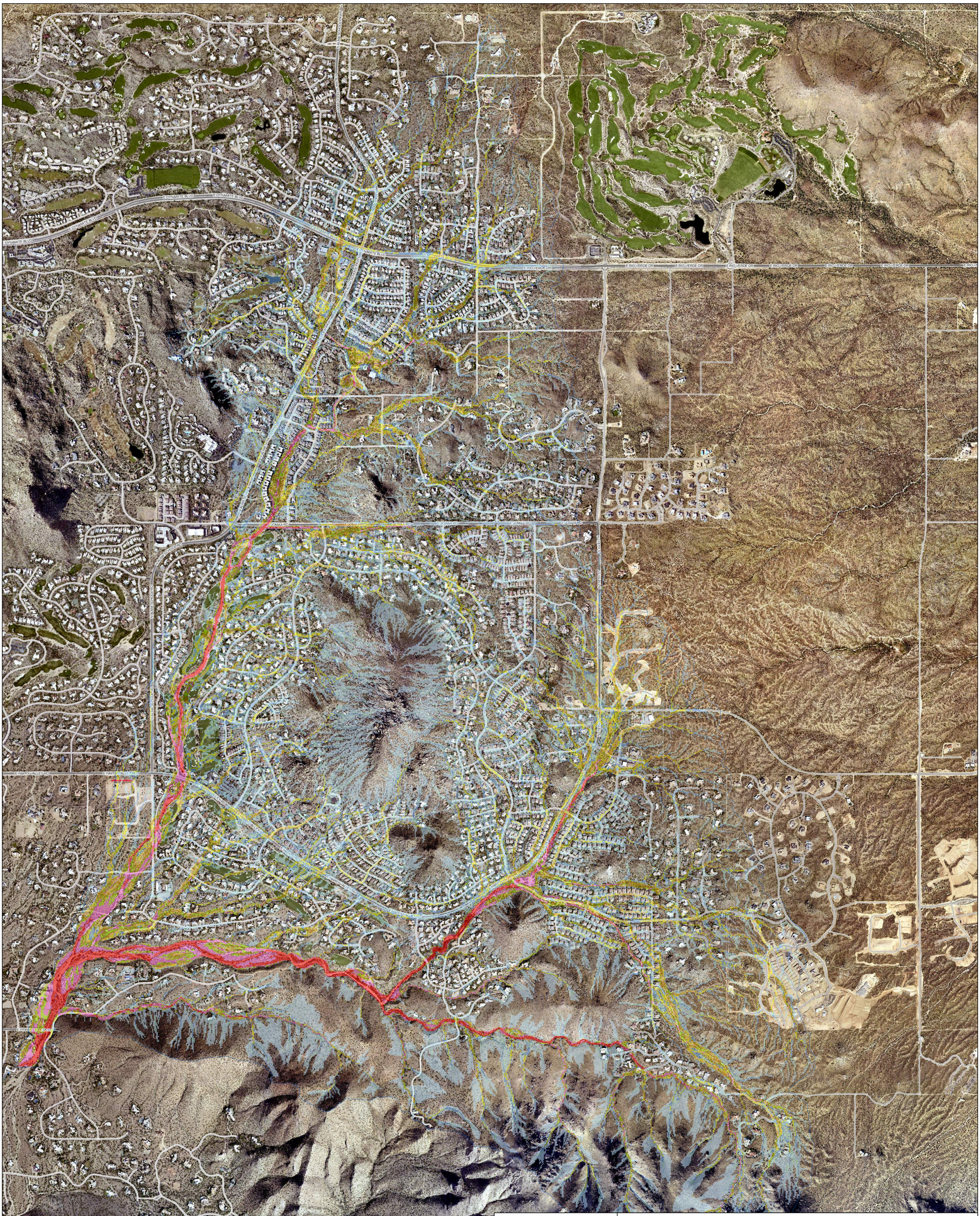


Figure 2: 500-Year Inundation Results

ATTACHMENT A
FLO-2D Results


E DYNAMITE BLVD
E RIO VERDE DR
N HAVASUPAI RD
N PIMA RD
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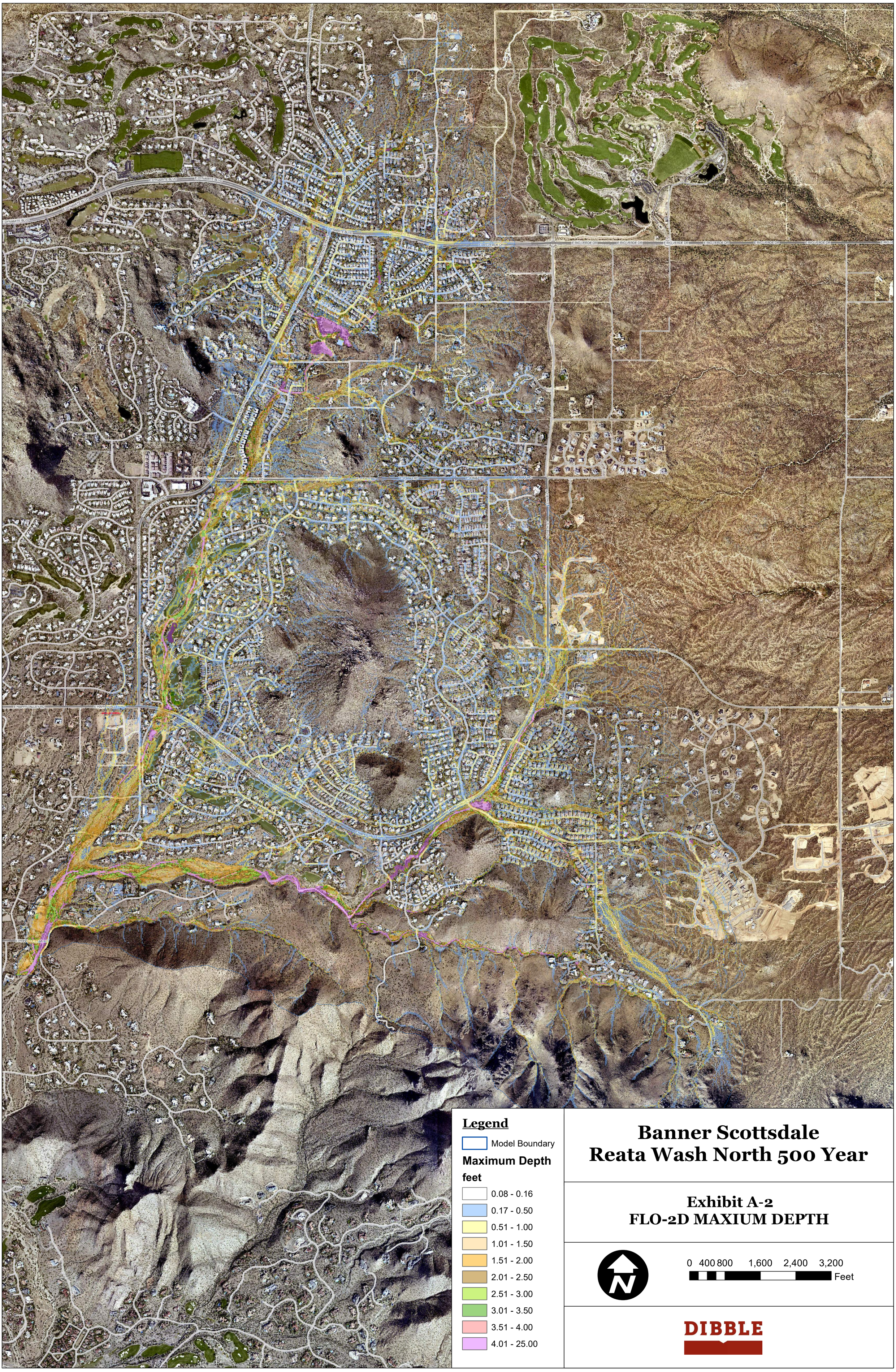
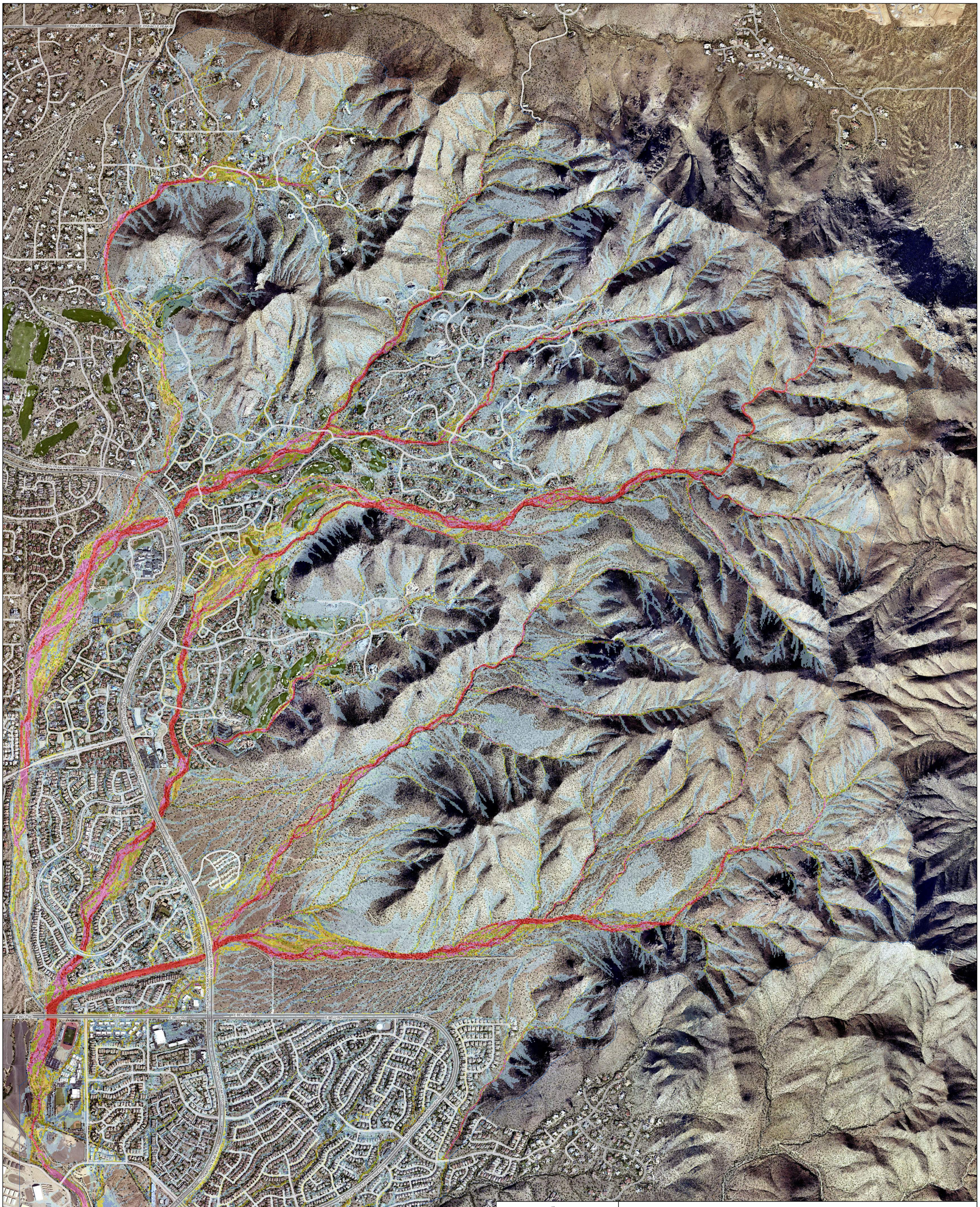
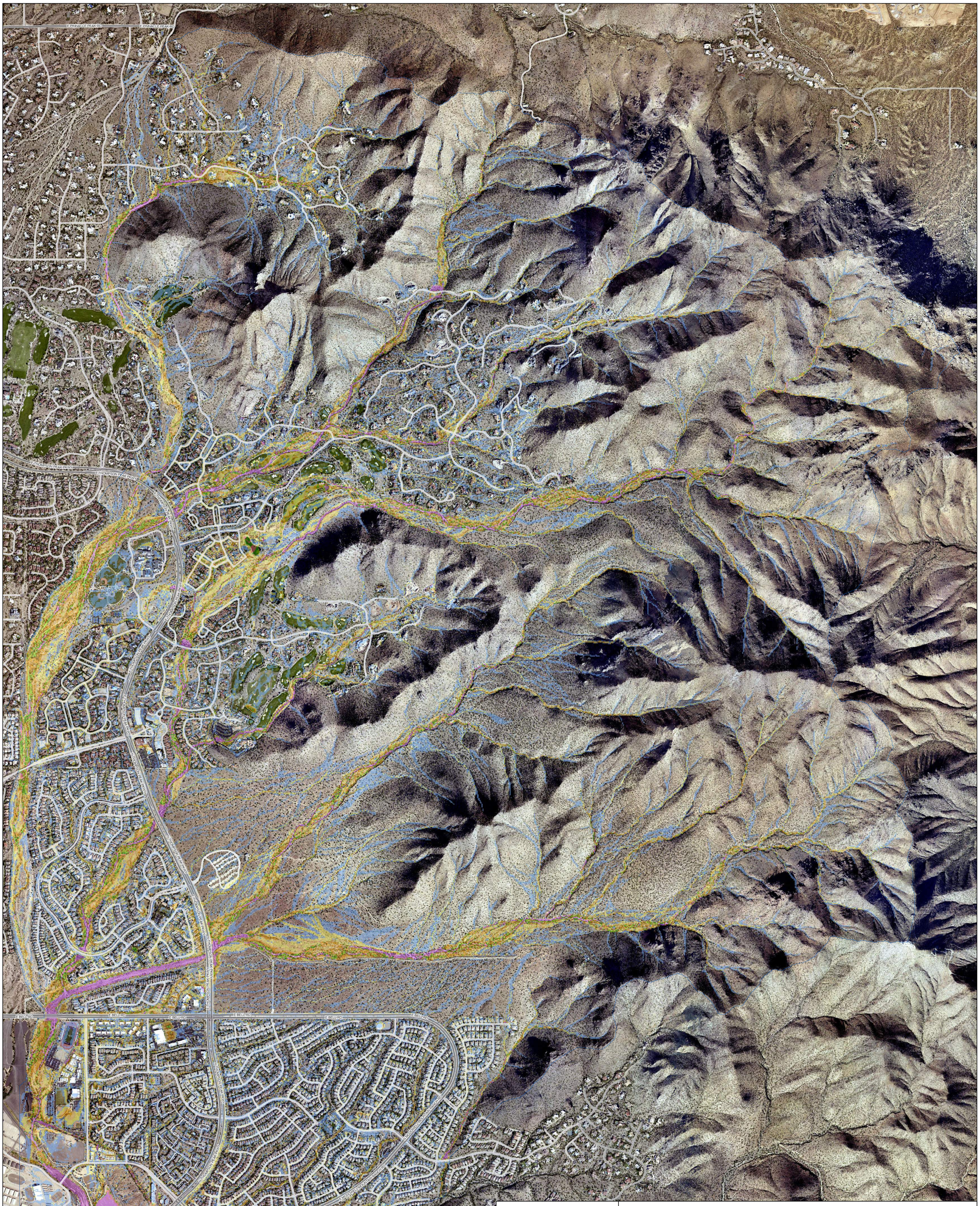
E JOMAX RD
N HAVASUPAI RD
N HAYDEN RD
N PIMA RD
N 124TH ST
N 128TH ST
E HAPPY VALLEY RD
E HAPPY VALLEY RD
E HAPPY VALLEY RD
E HAPPY VALLEY RD
E HAPPY VALLEY RD
E PINNACLE PEAK RD
Legend
Model Boundary
Peak Discharge (cfs)
<1
>1 - 5
>5 - 10
>10 - 25
>25 - 50
>50 - 75
>75 - 100
>100 - 150
>150 - 200
>200 - 500
>500
Banner Scottsdale
Reata Wash North 500 Year
Exhibit A-1
FLO-2D MAXIUM FLOW DISCHARGE
N
0 400 800 1,600 2,400 3,200
Feet
DIBBLE


E DYNAMITE BLVD
E RIO VERDE DR
N HAYDEN RD
N PIMA RD
N SCOTTSDALE RD
E JOMAX RD
E HAPPY VALLEY RD
E PINNACLE PEAK RD
Legend
Model Boundary
Maximum Depth
feet
0.08 - 0.16
0.17 - 0.50
0.51 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 3.50
3.51 - 4.00
4.01 - 25.00
Banner Scottsdale
Reata Wash North 500 Year
Exhibit A-2
FLO-2D MAXIUM DEPTH
N
0 400 800 1,600 2,400 3,200
Feet
DIBBLE


E PINNACLE PEAK RD
E PINNACLE PEAK RD
E THOMPSON PEAK PKWY
E THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
E THOMPSON PEAK PKWY
E THOMPSON PEAK PKWY
E THOMPSON PEAK PKWY
E THOMPSON PEAK PKWY
E BELL RD
E BELL RD
E BELL RD
E BELL RD
E BELL RD
N MCDOWELL MOUNTAIN RANCH RD
E MCDOWELL MOUNTAIN RANCH RD
N THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
E PINNACLE PEAK RD
N HAYDEN RD
Legend
Model Boundary
Peak Discharge (cfs)
<1
>1 - 5
>5 - 10
>10 - 25
>25 - 50
>50 - 75
>75 - 100
>100 - 150
>150 - 200
>200 - 500
>500
Banner Scottsdale
Reata Wash South 500 Year
Exhibit A-3
FLO-2D MAXIUM FLOW DISCHARGE
N
0 400 800 1,600 2,400 3,200
Feet
DIBBLE


E PINNACLE PEAK RD
E PINNACLE PEAK RD
E THOMPSON PEAK PKWY
E THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
E BELL RD
E BELL RD
E BELL RD
E BELL RD
E BELL RD
E MCDOWELL MOUNTAIN RANCH RD
E MCDOWELL MOUNTAIN RANCH RD
N THOMPSON PEAK PKWY
N THOMPSON PEAK PKWY
N HAYDEN RD
E RAINTREE DR
E RAINTREE DR
N PIMA ROAD/SCOTTSDALE RANCH BLVD
Legend
Model Boundary
Maximum Depth
feet
0.08 - 0.16
0.17 - 0.50
0.51 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 3.50
3.51 - 4.00
4.01 - 25.00
Banner Scottsdale
Reata Wash South 500 Year
Exhibit A-4
FLO-2D MAXIUM DEPTH
N
0 400 800 1,600 2,400 3,200
Feet
DIBBLE

Legend

- Basin Boundary
- Model Boundary

Peak Discharge (cfs)

- <1
- >1 - 5
- >5 - 10
- >10 - 25
- >25 - 50
- >50 - 75
- >75 - 100
- >100 - 150
- >150 - 200
- >200 - 500
- >500

Banner Scottsdale Powerline Channel 500 Year

Exhibit A-5
FLO-2D MAXIUM FLOW DISCHARGE

0 400800 1,600 2,400 3,200 Feet

DIBBLE

Legend

- Basin Boundary
- Model Boundary

Maximum Depth

<VALUE>

- 0.08 - 0.16
- 0.17 - 0.50
- 0.51 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 2.50
- 2.51 - 3.00
- 3.01 - 3.50
- 3.51 - 4.00
- 4.01 - 25.00

Banner Scottsdale Powerline Channel 500 Year

Exhibit A-6
FLO-2D MAXIUM DEPTH

N

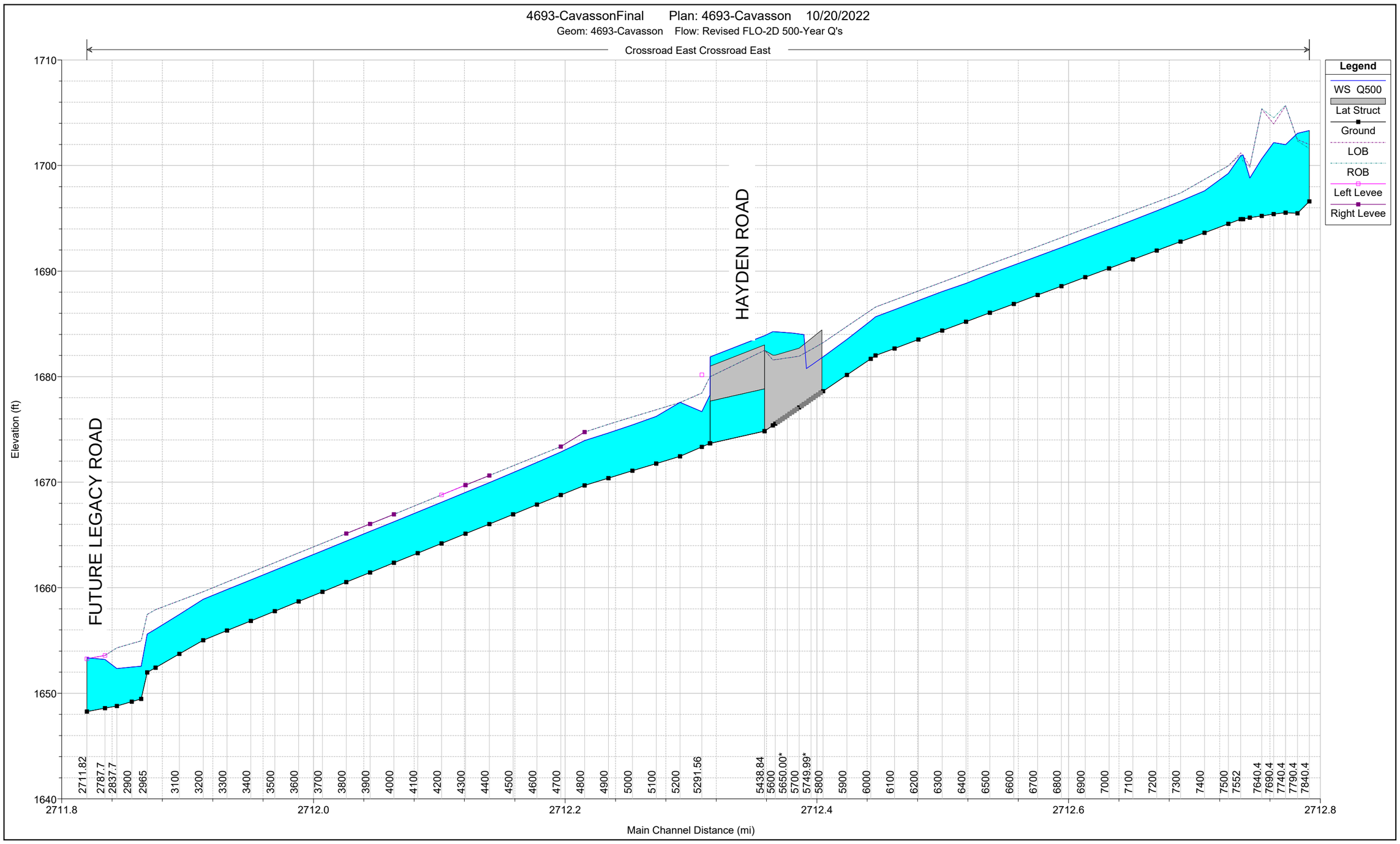
0 400800 1,600 2,400 3,200
Feet

DIBBLE

ATTACHMENT B
Powerline Channel HEC-RAS Results

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022

Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's



HEC-RAS Plan: 4693-Cavasso River: Crossroad East Reach: Crossroad East Profile: Q500

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Crossroad East	7840.4	Q500	1961.00	1696.60	1703.32	1700.30	1703.61	0.001138	4.35	452.73	177.53	0.33
Crossroad East	7790.4	Q500	1961.00	1695.47	1703.05		1703.54	0.000950	5.61	351.30	140.71	0.48
Crossroad East	7740.4	Q500	1961.00	1695.54	1701.98		1703.38	0.002486	9.49	206.73	43.82	0.77
Crossroad East	7690.4	Q500	1961.00	1695.40	1702.18	1700.79	1703.12	0.002219	7.79	251.60	58.60	0.66
Crossroad East	7640.4	Q500	1961.00	1695.23	1700.64	1700.64	1702.84	0.004293	11.91	164.72	37.66	1.00
Crossroad East	7590.4	Q500	1961.00	1695.06	1698.82	1700.08	1702.41	0.008861	15.19	129.14	46.72	1.61
Crossroad East	7562	Q500	1961.00	1694.92	1701.00	1698.19	1701.12	0.001199	2.78	705.66	196.37	0.26
Crossroad East	7552	Q500	1961.00	1694.92	1700.93		1701.11	0.000280	3.40	589.48	177.58	0.30
Crossroad East	7500	Q500	1961.00	1694.48	1699.25	1699.25	1700.93	0.003103	10.40	191.86	62.62	0.98
Crossroad East	7400	Q500	1961.00	1693.63	1697.61	1698.67	1700.38	0.006244	13.35	147.29	51.56	1.36
Crossroad East	7300	Q500	1961.00	1692.80	1696.63	1697.85	1699.68	0.007174	14.02	140.94	53.48	1.45
Crossroad East	7200	Q500	1961.00	1691.95	1695.71	1696.87	1698.92	0.007665	14.35	136.61	47.58	1.49
Crossroad East	7100	Q500	1961.00	1691.11	1694.83	1696.11	1698.13	0.007984	14.56	134.72	48.00	1.52
Crossroad East	7000	Q500	1961.00	1690.26	1693.96	1695.21	1697.31	0.008183	14.69	133.50	47.19	1.54
Crossroad East	6900	Q500	1961.00	1689.42	1693.11	1694.25	1696.49	0.008286	14.75	133.36	49.78	1.55
Crossroad East	6800	Q500	1961.00	1688.57	1692.24	1693.33	1695.65	0.008404	14.82	133.25	51.17	1.56
Crossroad East	6700	Q500	1961.00	1687.73	1691.41	1692.65	1694.82	0.008382	14.81	132.38	47.05	1.56
Crossroad East	6600	Q500	1961.00	1686.89	1690.57	1691.72	1693.97	0.008377	14.81	132.41	47.05	1.56
Crossroad East	6500	Q500	1961.00	1686.05	1689.73	1690.88	1693.13	0.008359	14.80	132.50	47.06	1.55
Crossroad East	6400	Q500	1961.00	1685.20	1688.83	1689.90	1692.28	0.008639	14.94	134.28	56.18	1.58
Crossroad East	6300	Q500	1961.00	1684.36	1688.06	1689.17	1691.41	0.008160	14.67	133.64	47.21	1.54
Crossroad East	6200	Q500	1961.00	1683.52	1687.21	1688.60	1690.58	0.008232	14.72	133.22	47.16	1.54
Crossroad East	6100	Q500	1961.00	1682.67	1686.35	1687.47	1689.75	0.008340	14.79	132.61	47.08	1.55
Crossroad East	6020	Q500	1961.00	1682.00	1685.68	1686.81	1689.08	0.008369	14.81	132.45	47.06	1.56
Crossroad East	6000	Q500	1961.00	1681.69	1685.29	1686.51	1688.89	0.009051	15.22	128.85	46.60	1.61
Crossroad East	5900	Q500	1961.00	1680.16	1683.53	1684.95	1687.80	0.011569	16.59	118.22	45.21	1.81
Crossroad East	5800	Q500	1961.00	1678.62	1681.88	1683.32	1686.54	0.013113	17.33	113.16	44.53	1.92
Crossroad East	5795		Lat Struct									
Crossroad East	5790.00*	Q500	1961.00	1678.47	1681.72	1683.17	1686.41	0.013214	17.37	112.87	44.51	1.92
Crossroad East	5780.00*	Q500	1961.00	1678.31	1681.55	1683.02	1686.27	0.013333	17.43	112.50	44.44	1.93
Crossroad East	5770.00*	Q500	1961.00	1678.16	1681.39	1682.87	1686.14	0.013424	17.47	112.26	44.43	1.94
Crossroad East	5760.00*	Q500	1961.00	1678.00	1681.23	1682.72	1686.00	0.013534	17.52	111.91	44.36	1.94
Crossroad East	5749.99*	Q500	1961.00	1677.85	1681.07	1682.57	1685.86	0.013615	17.56	111.70	44.35	1.95
Crossroad East	5740.00*	Q500	1961.00	1677.70	1680.92	1682.42	1685.72	0.013625	17.56	111.65	44.33	1.95
Crossroad East	5730.00*	Q500	1961.00	1677.54	1680.76	1682.26	1685.58	0.013727	17.61	111.34	44.27	1.96
Crossroad East	5720.00*	Q500	1960.53	1677.39	1683.99	1682.11	1684.70	0.000761	6.80	294.37	99.23	0.52
Crossroad East	5710.00*	Q500	1955.33	1677.23	1684.02		1684.68	0.000671	6.53	306.34	96.61	0.49
Crossroad East	5700	Q500	1948.42	1677.08	1684.05		1684.66	0.000598	6.29	317.68	93.94	0.47
Crossroad East	5690.00*	Q500	1940.19	1676.93	1684.08		1684.64	0.000535	6.04	329.82	99.04	0.44

HEC-RAS Plan: 4693-Cavasso River: Crossroad East Reach: Crossroad East Profile: Q500 (Continued)

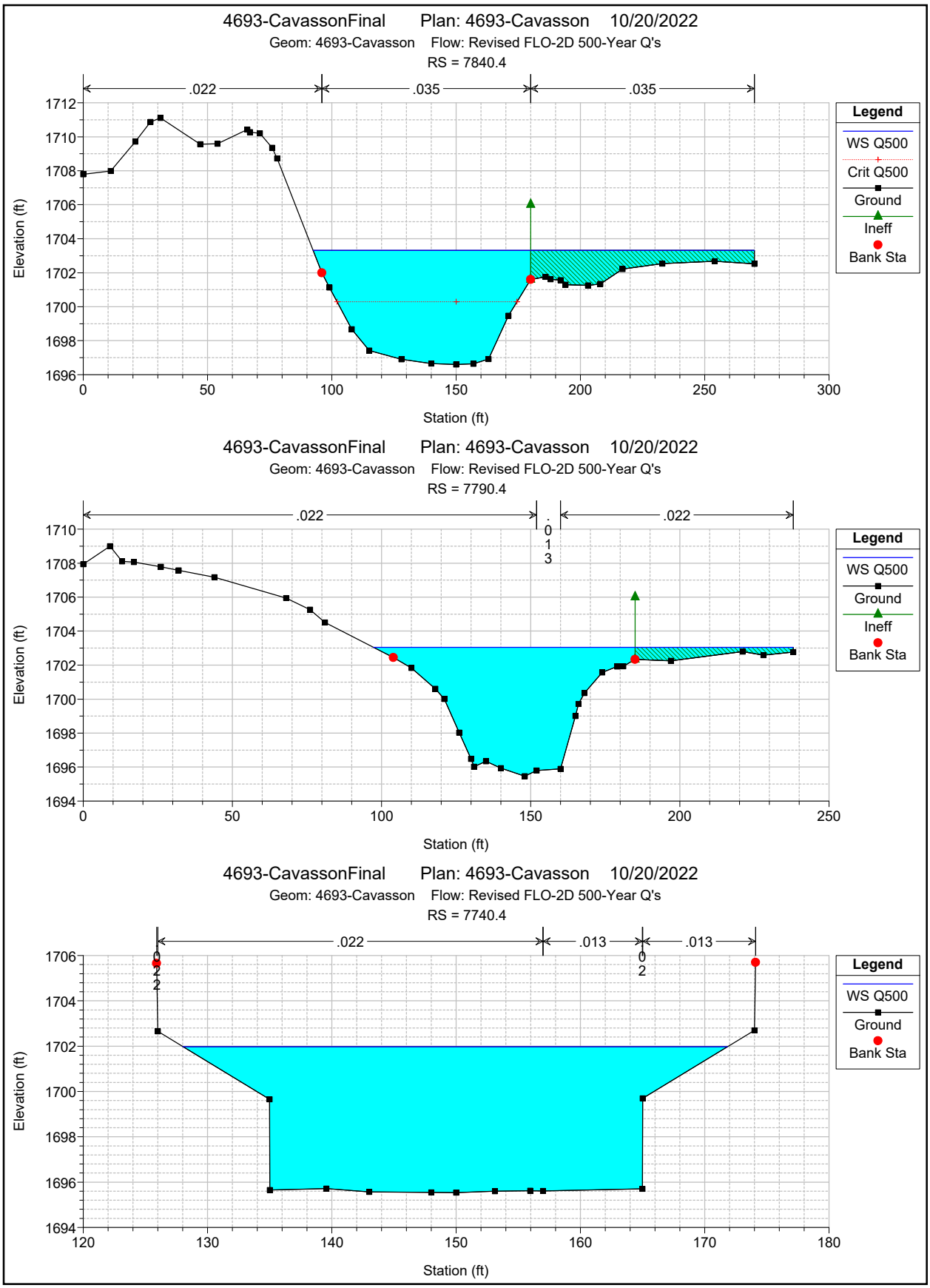
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Crossroad East	5680.00*	Q500	1931.11	1676.77	1684.10		1684.62	0.000478	5.80	342.37	104.26	0.42
Crossroad East	5670.00*	Q500	1921.18	1676.62	1684.13		1684.60	0.000429	5.57	354.87	109.59	0.40
Crossroad East	5660.00*	Q500	1910.39	1676.46	1684.15		1684.59	0.000386	5.36	367.68	117.85	0.38
Crossroad East	5650.00*	Q500	1898.76	1676.31	1684.16		1684.58	0.000350	5.17	381.46	130.90	0.36
Crossroad East	5640.00*	Q500	1886.28	1676.16	1684.18		1684.56	0.000316	4.97	396.41	141.07	0.35
Crossroad East	5630.00*	Q500	1872.91	1676.00	1684.20		1684.55	0.000283	4.77	412.51	147.54	0.33
Crossroad East	5620.00*	Q500	1858.65	1675.85	1684.22		1684.54	0.000255	4.58	428.63	153.48	0.31
Crossroad East	5610.00*	Q500	1843.50	1675.69	1684.23		1684.53	0.000229	4.39	445.20	159.16	0.30
Crossroad East	5600	Q500	1827.45	1675.54	1684.25		1684.52	0.000207	4.22	461.44	164.59	0.28
Crossroad East	5589.25	Q500	1809.59	1675.38	1684.26		1684.51	0.000187	4.06	473.95	165.55	0.27
Crossroad East	5555.25	Q500	1767.79	1674.84	1683.88	1679.40	1684.47	0.000534	6.14	288.01	31.86	0.36
Crossroad East	5438.84		Culvert									
Crossroad East	5325.56	Q500	1767.79	1673.68	1678.24	1678.24	1680.54	0.004024	12.17	145.21	31.85	1.01
Crossroad East	5291.56	Q500	1767.79	1673.34	1676.69	1677.80	1680.22	0.009601	15.06	117.36	45.09	1.65
Crossroad East	5200	Q500	2270.79	1672.45	1677.57	1677.57	1679.45	0.003211	11.00	206.47	57.72	1.01
Crossroad East	5100	Q500	2270.79	1671.76	1676.23	1676.88	1678.95	0.005388	13.22	171.73	51.82	1.28
Crossroad East	5000	Q500	2270.79	1671.08	1675.43	1676.20	1678.36	0.006000	13.74	165.28	51.07	1.35
Crossroad East	4900	Q500	2270.79	1670.39	1674.67	1675.79	1677.73	0.006367	14.03	161.84	50.67	1.38
Crossroad East	4800	Q500	2270.79	1669.70	1673.94	1675.01	1677.07	0.006575	14.19	160.00	50.45	1.40
Crossroad East	4700	Q500	2270.79	1668.78	1672.86	1674.15	1676.33	0.007602	14.94	151.97	49.48	1.50
Crossroad East	4600	Q500	2270.79	1667.87	1671.88	1673.20	1675.52	0.008136	15.31	148.37	49.04	1.55
Crossroad East	4500	Q500	2270.79	1666.95	1670.91	1672.38	1674.67	0.008534	15.57	145.88	48.74	1.59
Crossroad East	4400	Q500	2270.79	1666.03	1669.96	1671.25	1673.80	0.008777	15.72	144.44	48.56	1.61
Crossroad East	4300	Q500	2270.79	1665.12	1669.04	1670.01	1672.91	0.008865	15.78	143.93	48.50	1.61
Crossroad East	4200	Q500	2270.79	1664.20	1668.10	1669.50	1672.01	0.008988	15.85	143.23	48.41	1.62
Crossroad East	4100	Q500	2270.79	1663.28	1667.17	1668.66	1671.10	0.009065	15.90	142.80	48.36	1.63
Crossroad East	4000	Q500	2270.79	1662.36	1666.25	1667.51	1670.19	0.009098	15.92	142.62	48.34	1.63
Crossroad East	3900	Q500	2270.79	1661.45	1665.34	1666.68	1669.28	0.009098	15.92	142.62	48.34	1.63
Crossroad East	3800	Q500	2270.79	1660.53	1664.41	1665.63	1668.37	0.009168	15.97	142.23	48.29	1.64
Crossroad East	3700	Q500	2270.79	1659.61	1663.49	1664.94	1667.46	0.009193	15.98	142.10	48.27	1.64
Crossroad East	3600	Q500	2270.79	1658.70	1662.58	1663.98	1666.55	0.009193	15.98	142.10	48.27	1.64
Crossroad East	3500	Q500	2270.79	1657.78	1661.66	1662.90	1665.63	0.009187	15.98	142.13	48.28	1.64
Crossroad East	3400	Q500	2270.79	1656.86	1660.74	1662.32	1664.70	0.009178	15.97	142.18	48.28	1.64
Crossroad East	3300	Q500	2270.79	1655.95	1659.83	1661.33	1663.79	0.009178	15.97	142.18	48.28	1.64
Crossroad East	3200	Q500	2270.79	1655.03	1658.91	1660.33	1662.87	0.009158	15.96	142.29	48.30	1.64
Crossroad East	3100	Q500	2270.79	1653.73	1657.47	1659.29	1661.85	0.010580	16.79	135.22	47.41	1.75
Crossroad East	3000	Q500	2270.79	1652.43	1656.09	1657.63	1660.72	0.011461	17.27	131.47	46.93	1.82
Crossroad East	2965	Q500	2270.79	1651.97	1655.61	1657.78	1660.30	0.011665	17.38	130.66	46.83	1.83
Crossroad East	2940	Q500	2270.79	1649.47	1652.57	1654.61	1659.67	0.021103	21.39	106.18	43.58	2.42

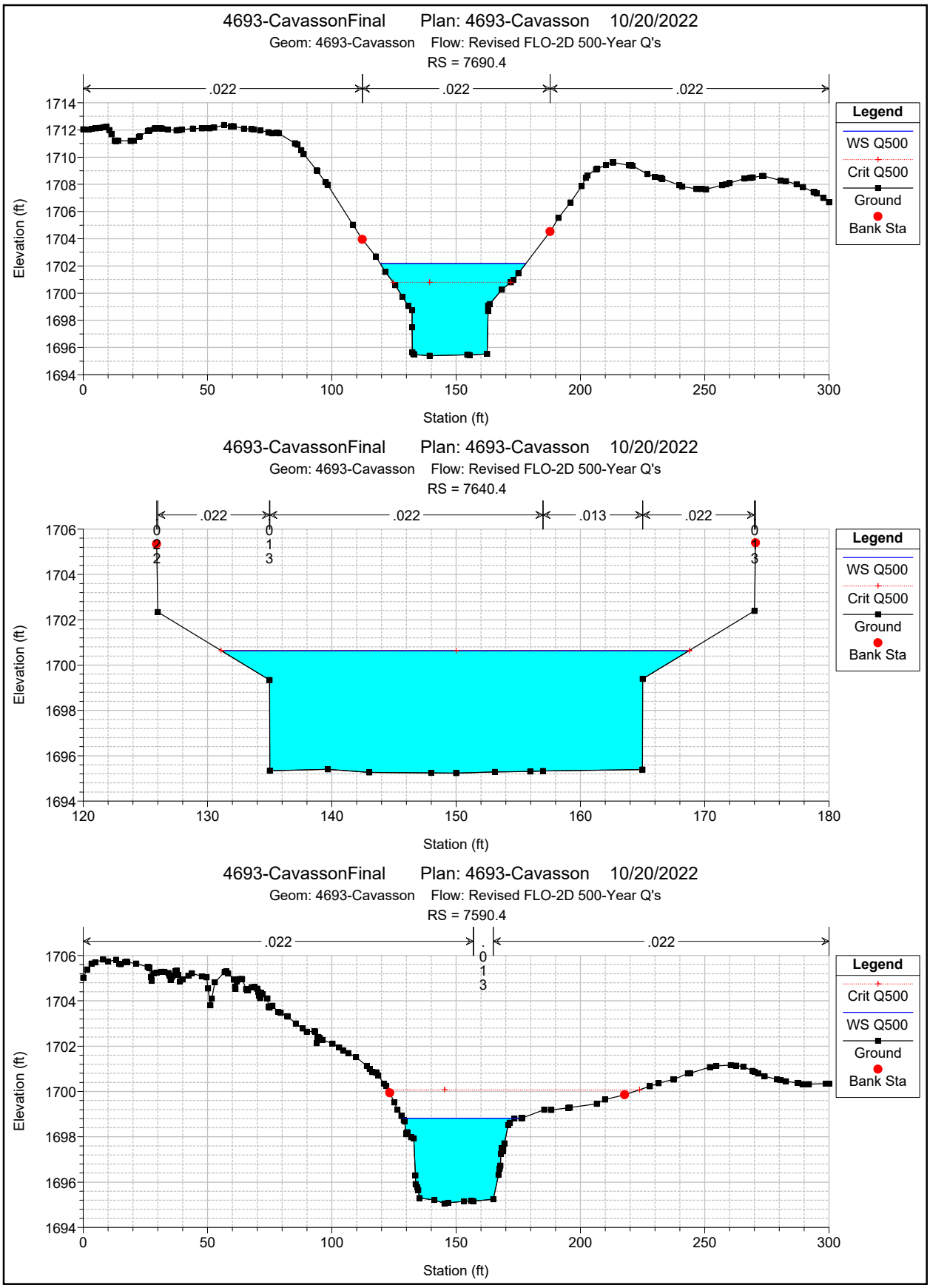
HEC-RAS Plan: 4693-Cavasso River: Crossroad East Reach: Crossroad East Profile: Q500 (Continued)

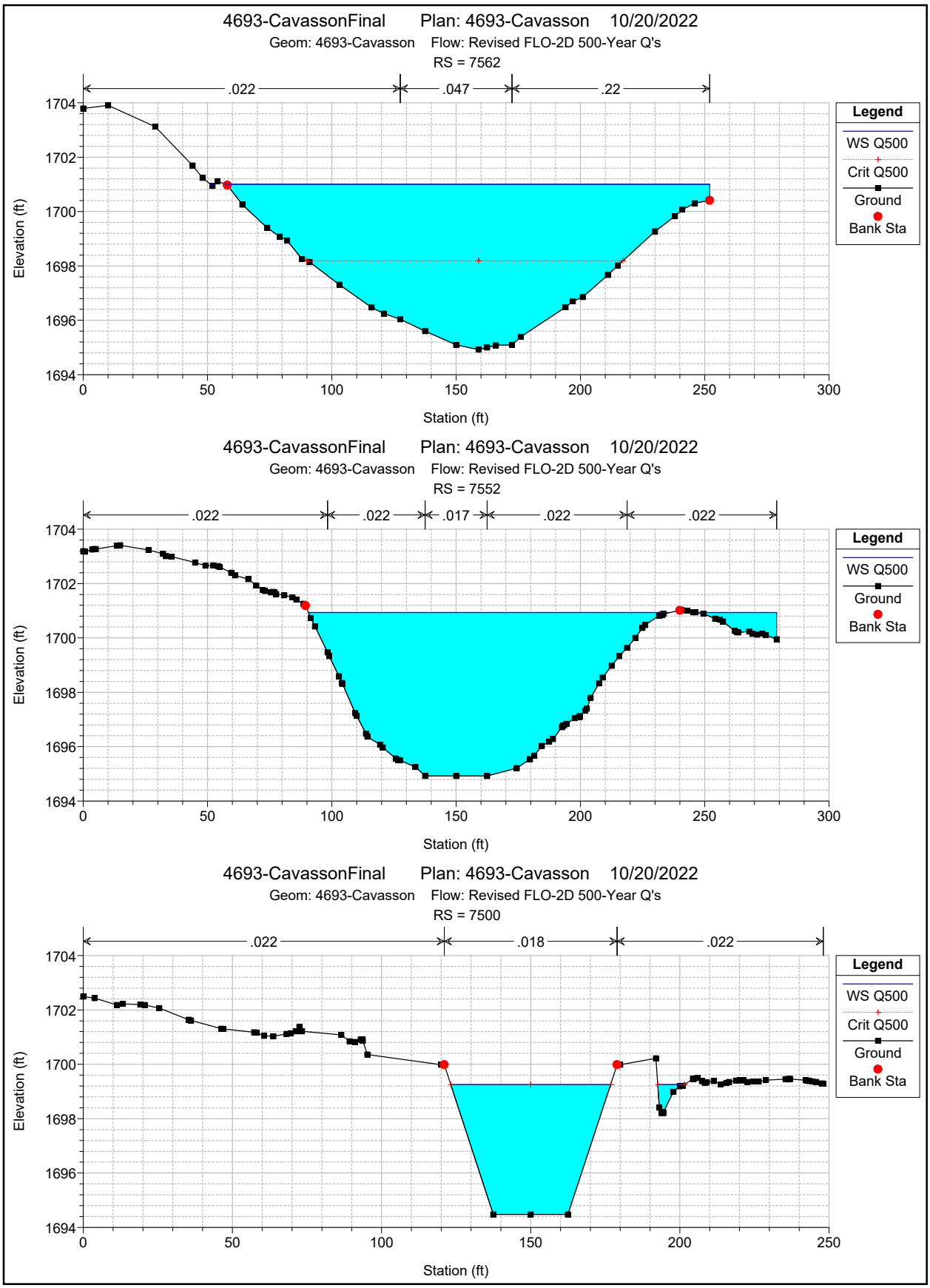
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Crossroad East	2900	Q500	2270.79	1649.21	1652.49	1654.35	1658.62	0.017077	19.86	114.31	44.69	2.19
Crossroad East	2837.7	Q500	2270.79	1648.80	1652.34	1653.93	1657.38	0.012880	18.00	126.19	46.25	1.92
Crossroad East	2787.7	Q500	2270.79	1648.59	1653.21	1654.00	1656.41	0.005781	14.37	158.07	43.47	1.33
Crossroad East	2711.82	Q500	2270.79	1648.26	1653.37	1653.67	1655.84	0.003930	12.61	180.11	76.86	1.11

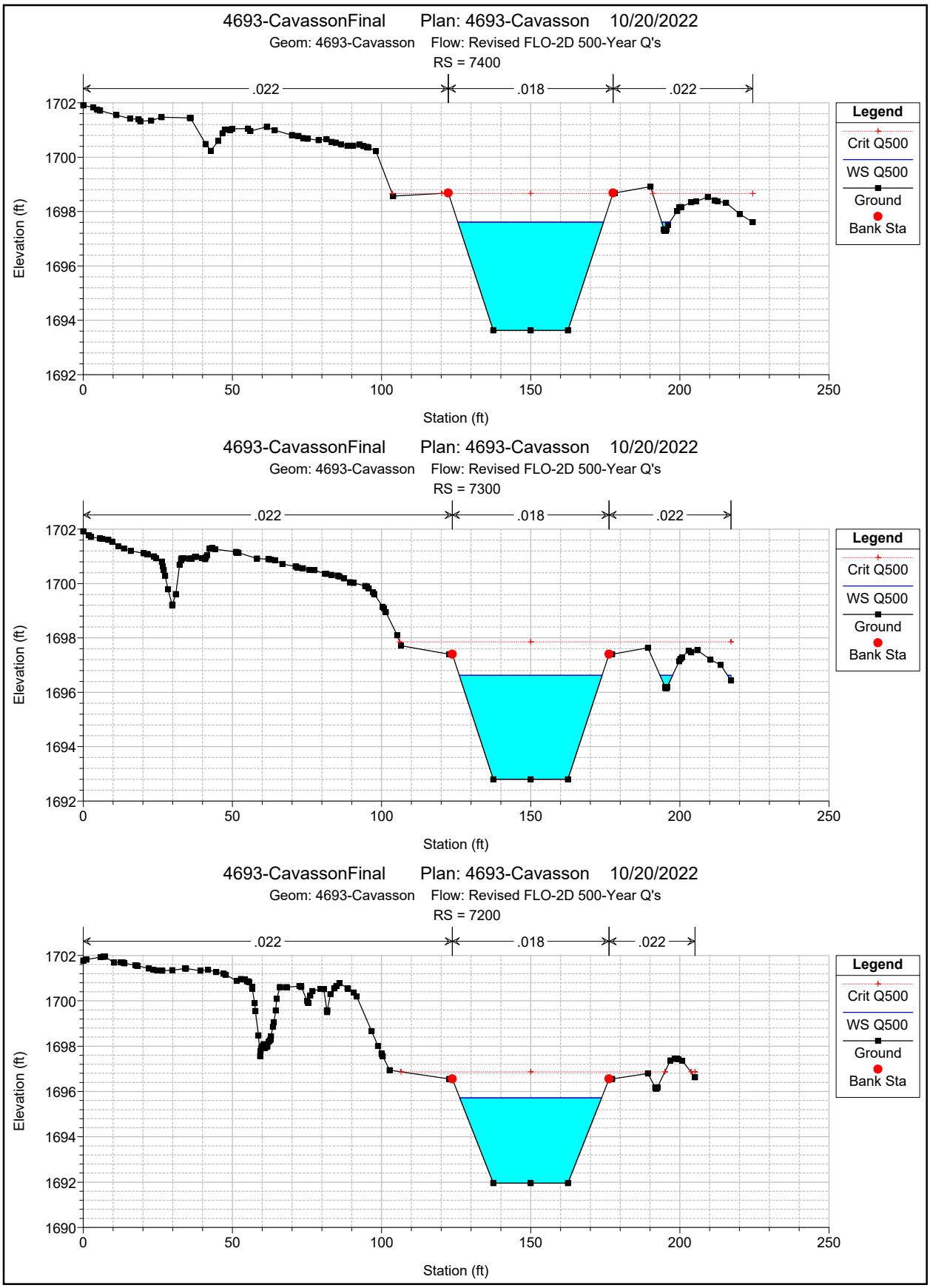
HEC-RAS Plan: 4693-Cavasso River: Crossroad East Reach: Crossroad East Profile: Q500

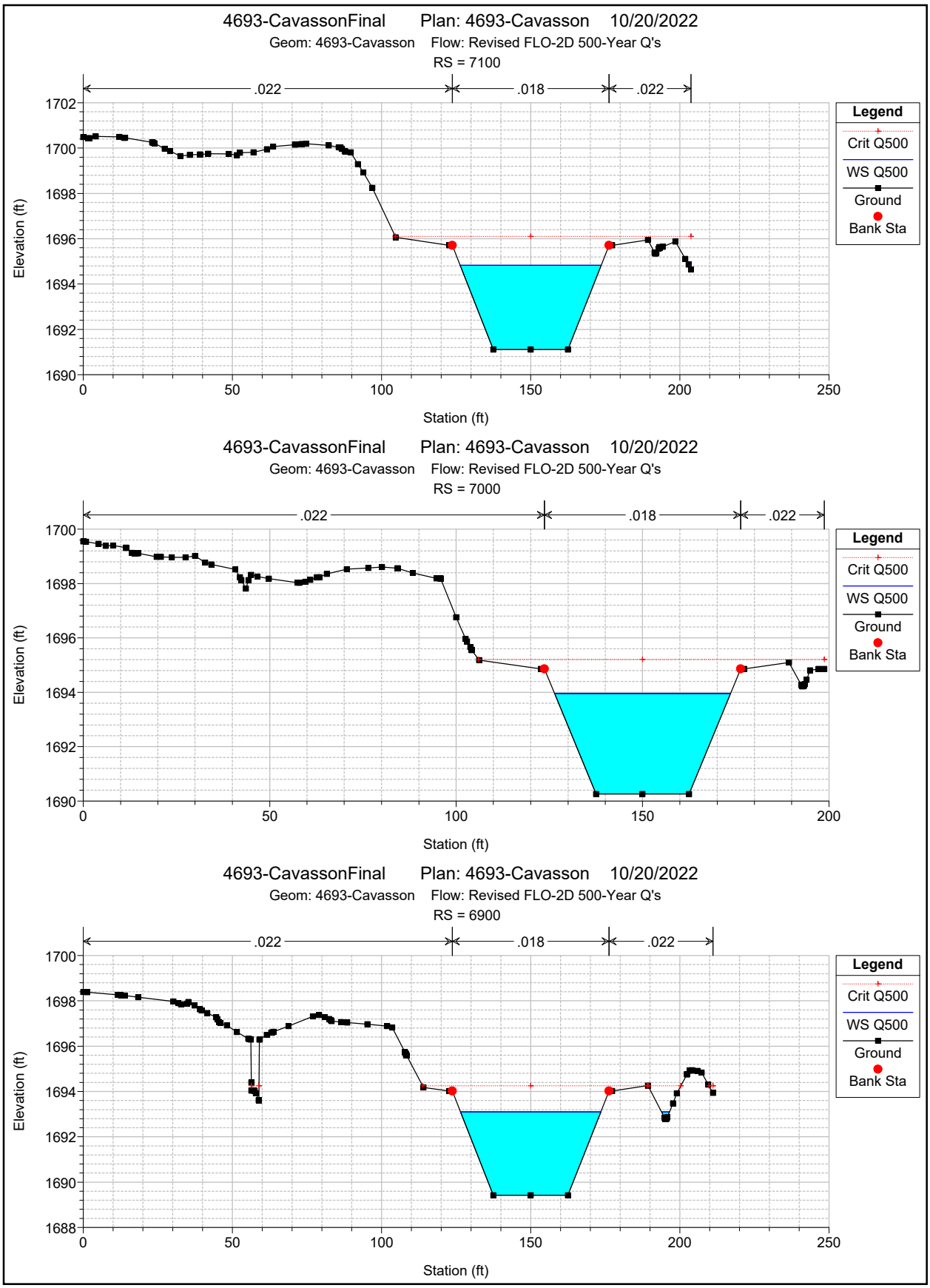
Reach	River Sta	Profile	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
			(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
Crossroad East	5795	Q500	1961.00	192.75	1767.79	192.75		167.46	2.23	1.72	1682.03	1686.48	1681.80	1684.47	1683.88

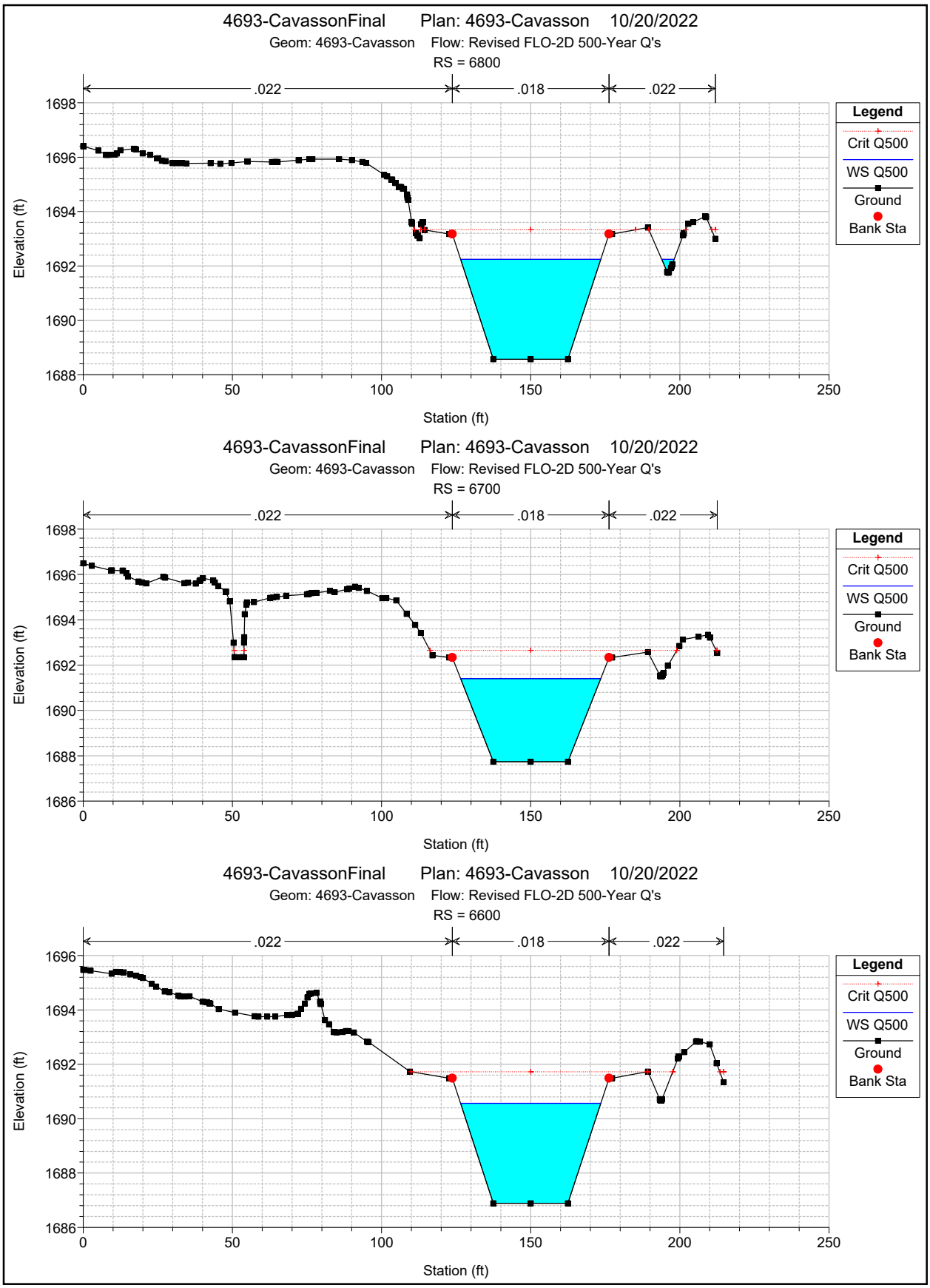

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7840.4
.022
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q500
Crit Q500
Ground
Ineff
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7790.4
.022
.013
.022
Elevation (ft)
Station (ft)
Legend
WS Q500
Ground
Ineff
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7740.4
.022
.013
.013
Elevation (ft)
Station (ft)
Legend
WS Q500
Ground
Bank Sta

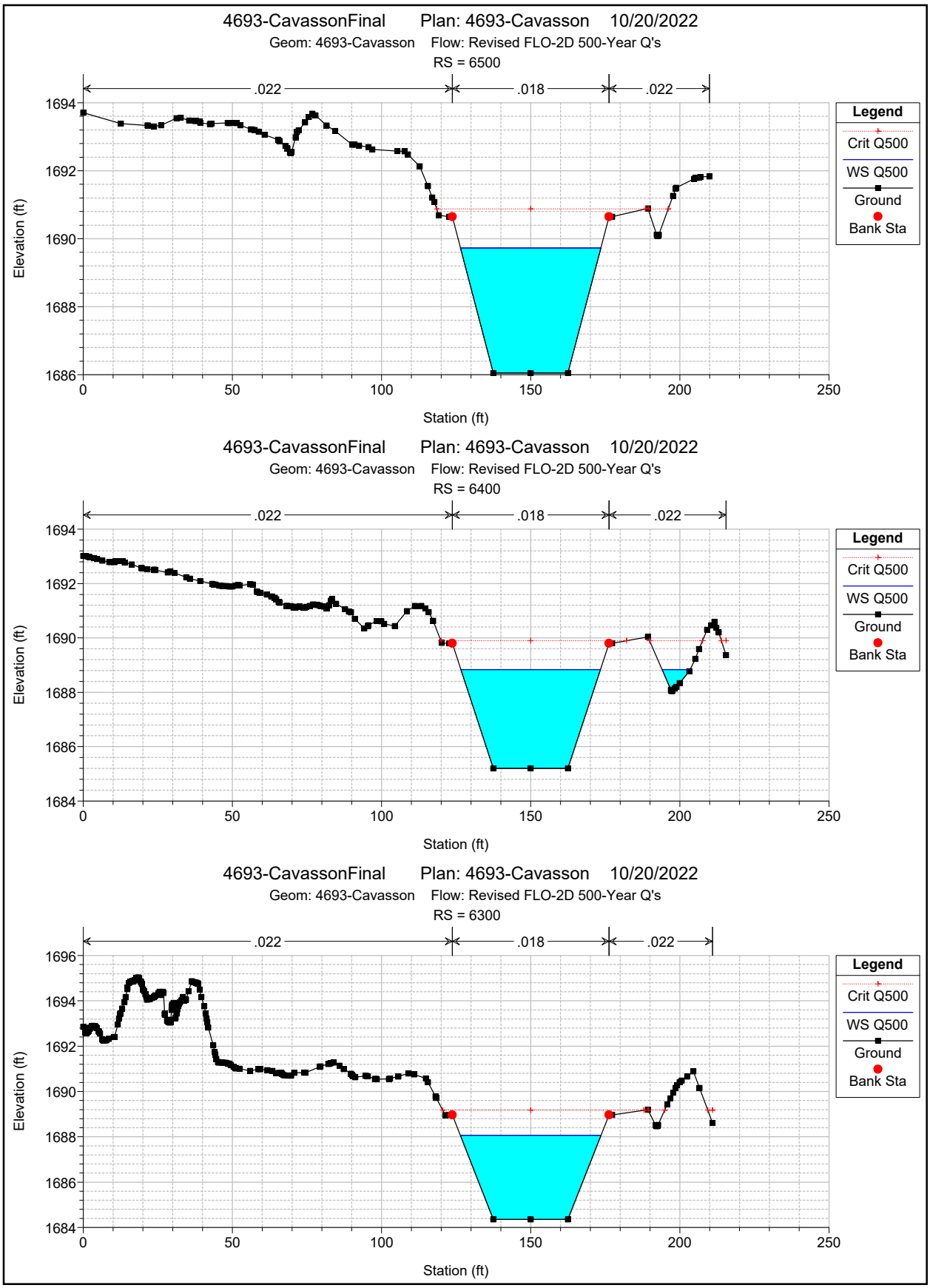

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7690.4
.022
.022
.022
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7640.4
.022
.022
.013
.022
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7590.4
.022
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)

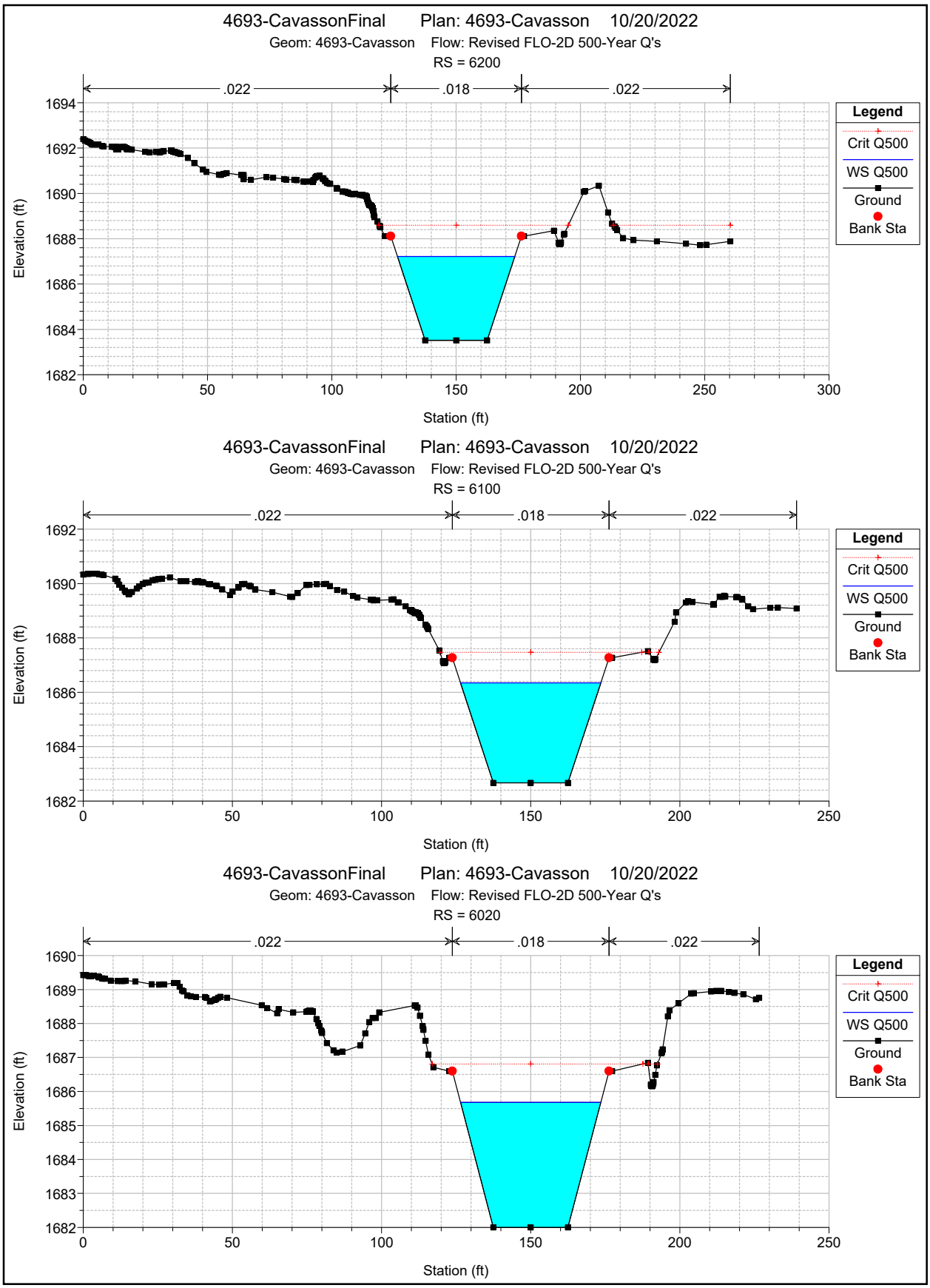

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7562
.022
.047
.22
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7552
.022
.022
.017
.022
.022
Legend
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7500
.022
.018
.022
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7400
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7300
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7200
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta

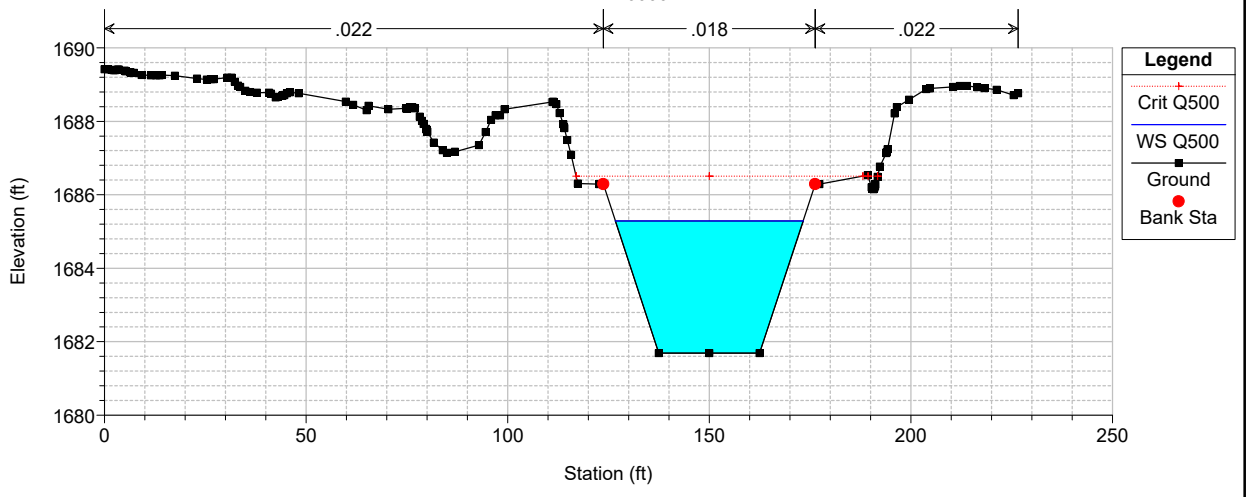

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7100
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 7000
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6900
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6800
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6700
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6600
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta

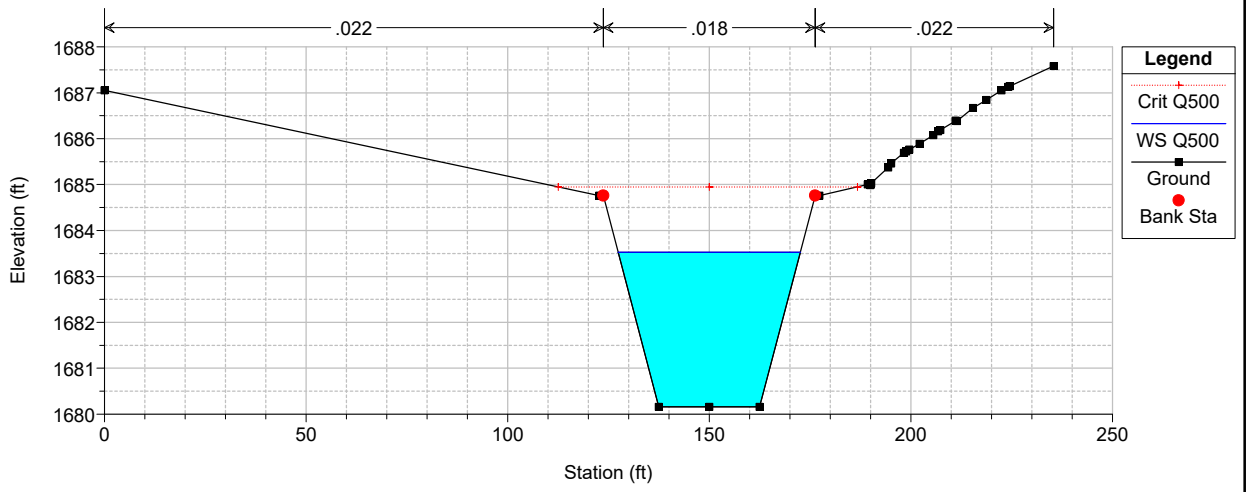

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6500
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6400
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6300
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6200
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6100
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6020
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta

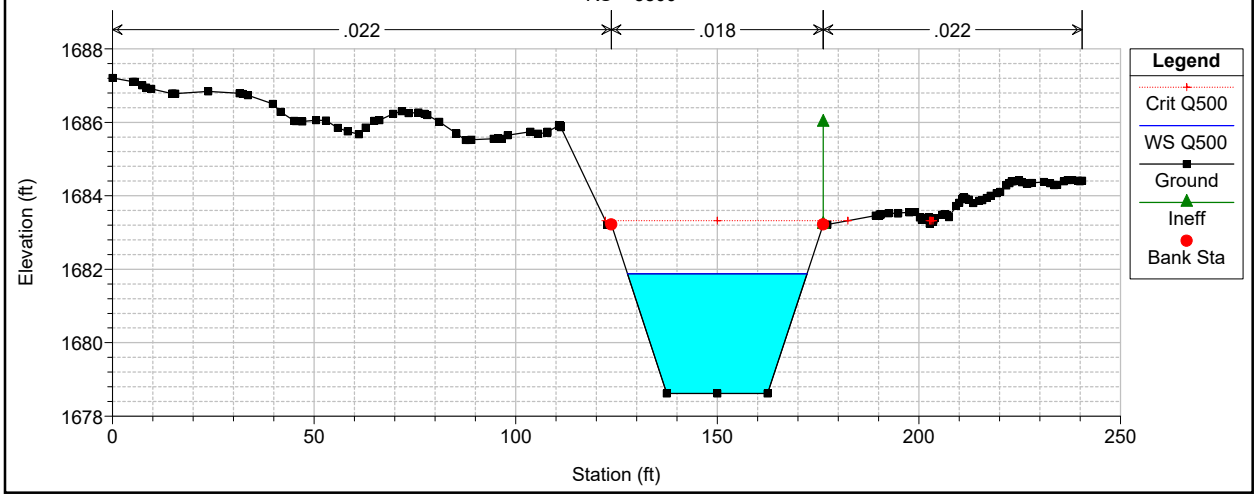
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 6000

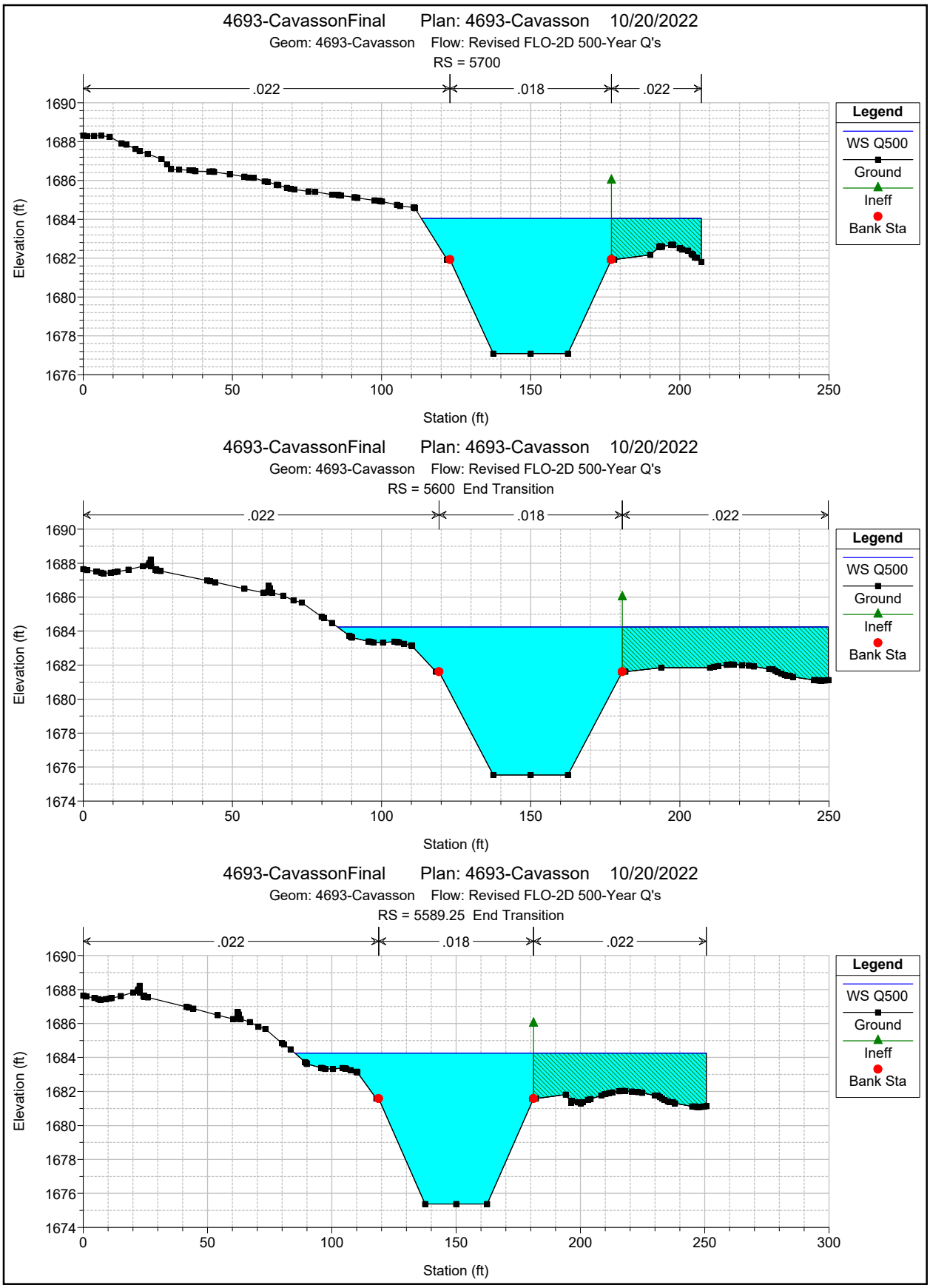


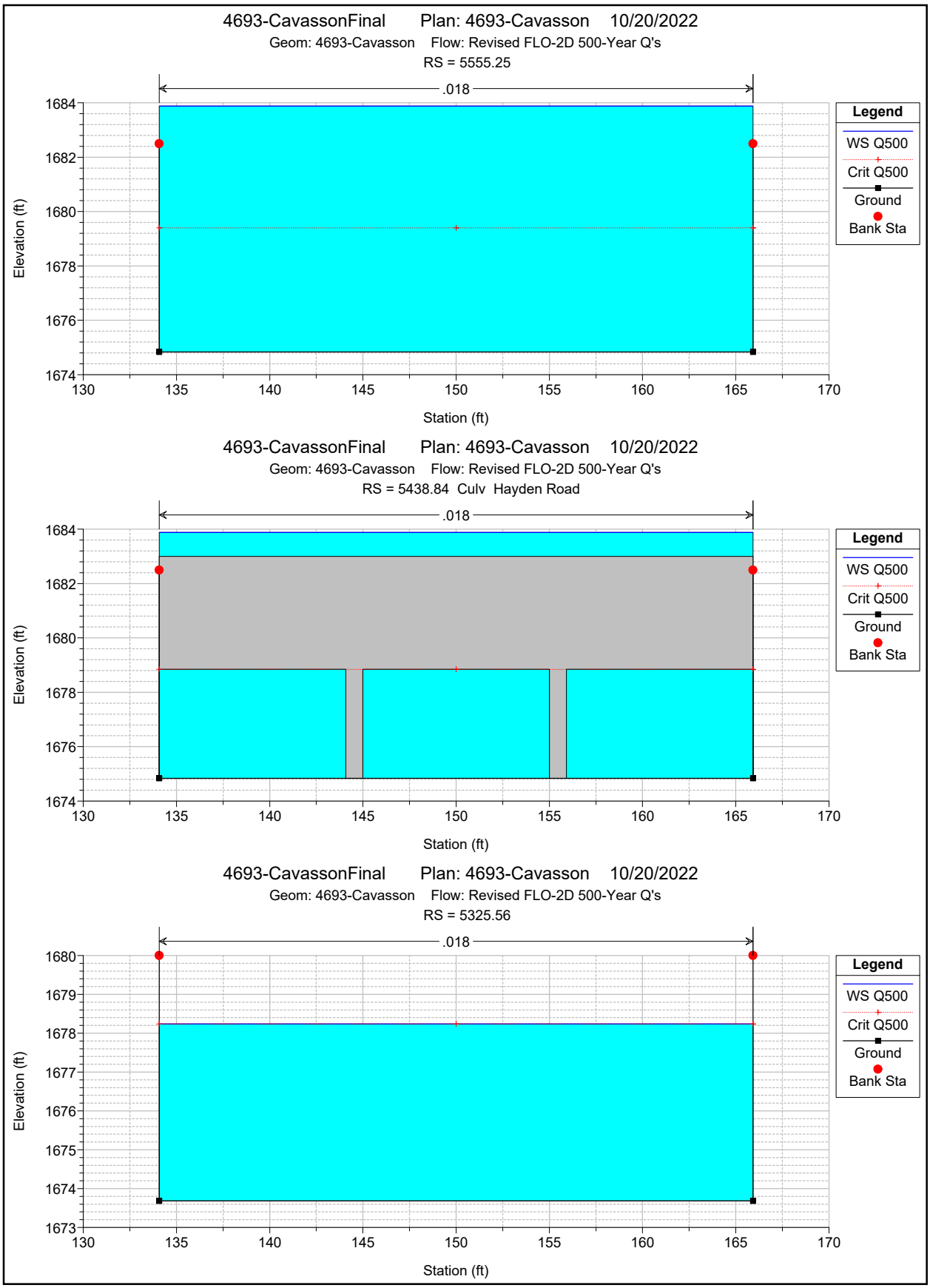
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5900

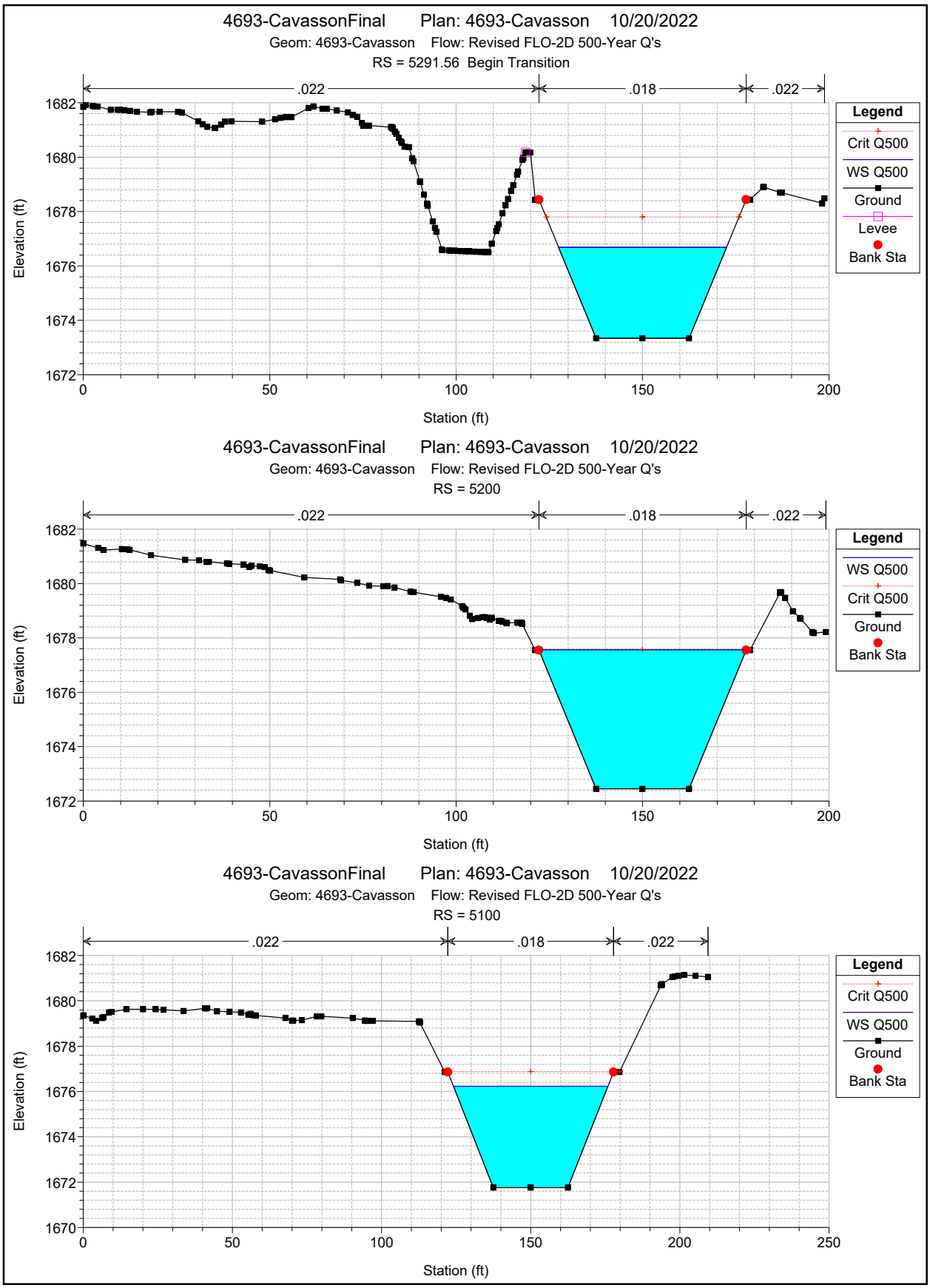


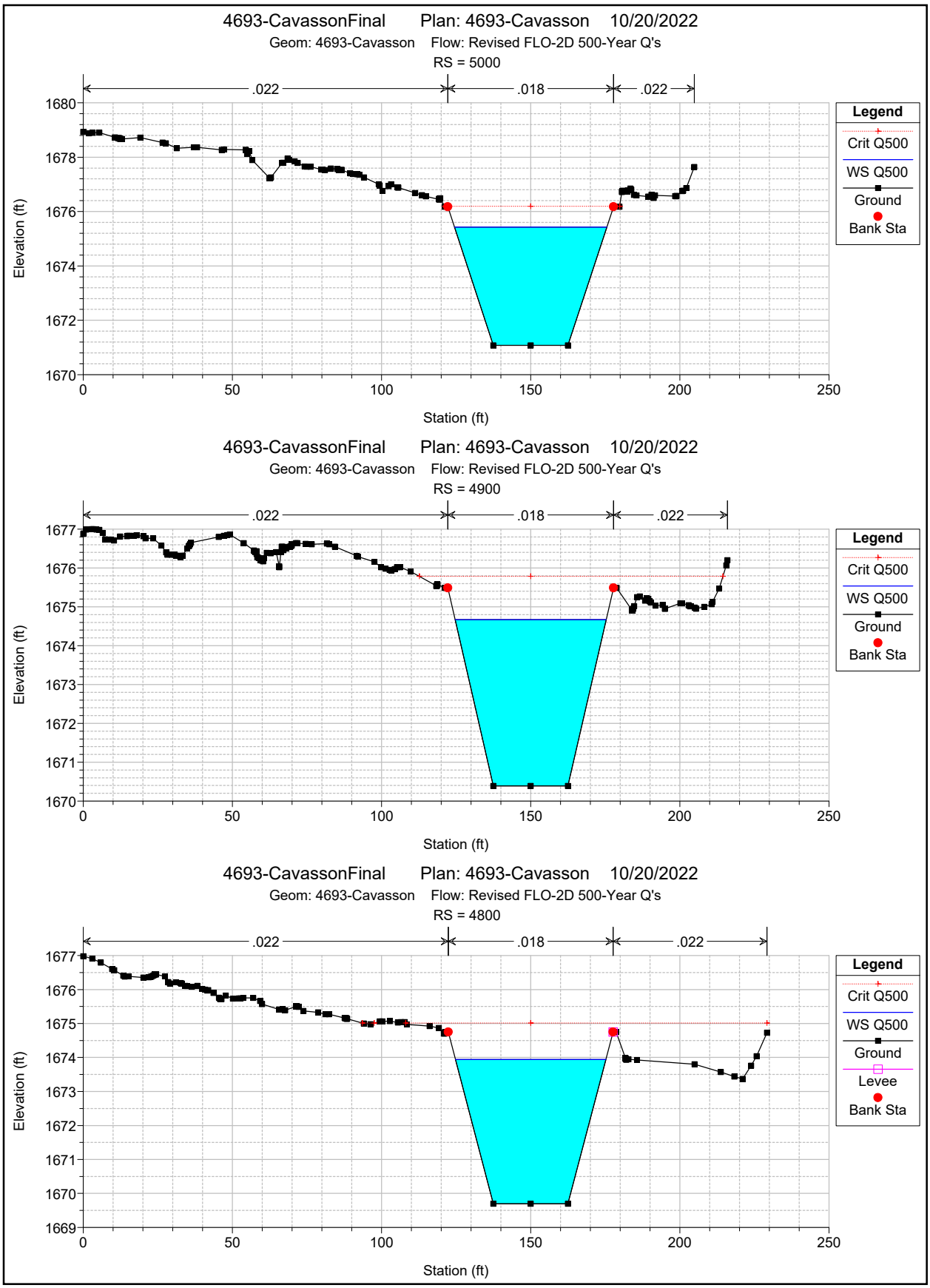
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5800

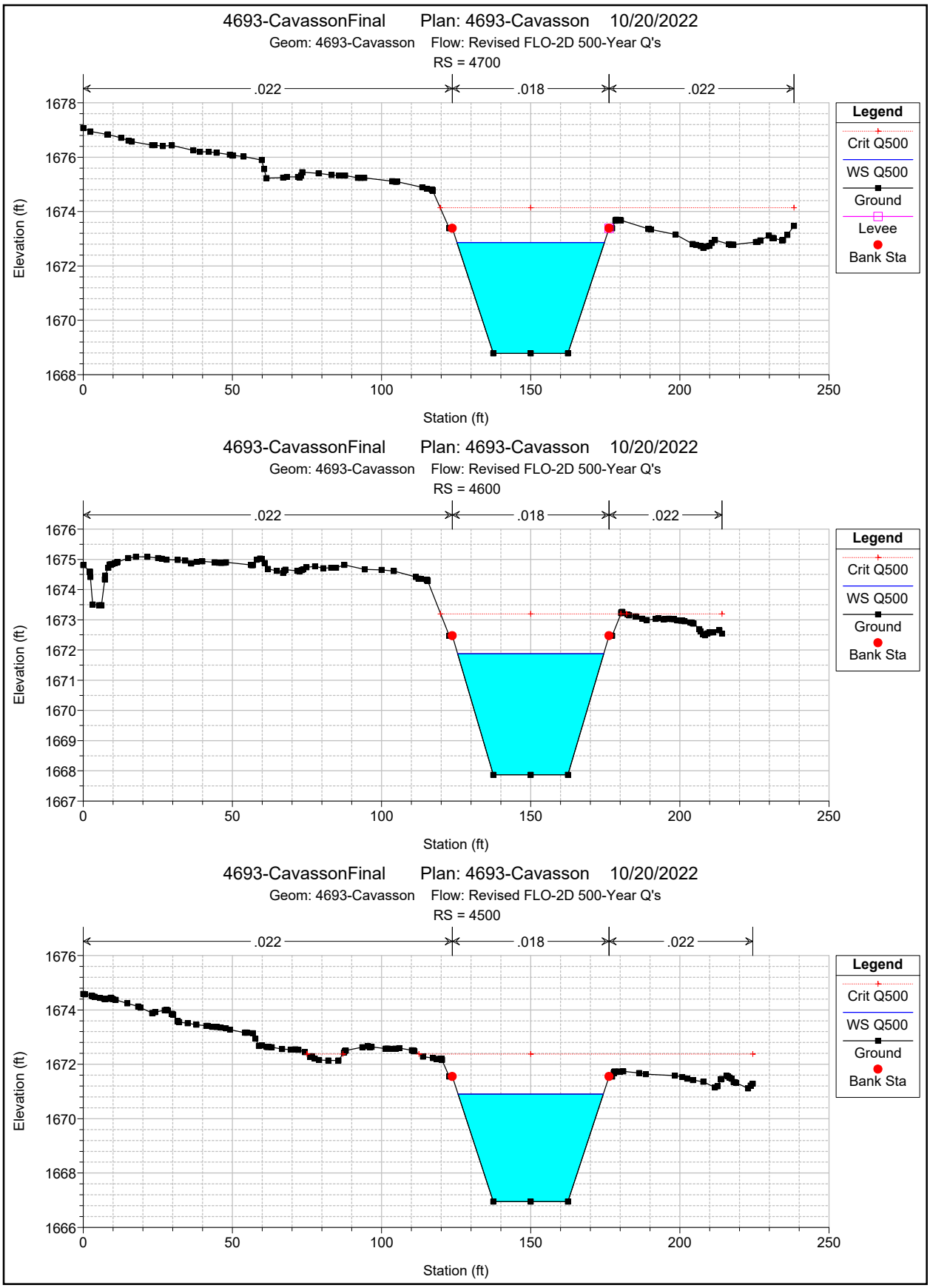



4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5700
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
WS Q500
Ground
Ineff
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5600 End Transition
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
WS Q500
Ground
Ineff
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5589.25 End Transition
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
WS Q500
Ground
Ineff
Bank Sta

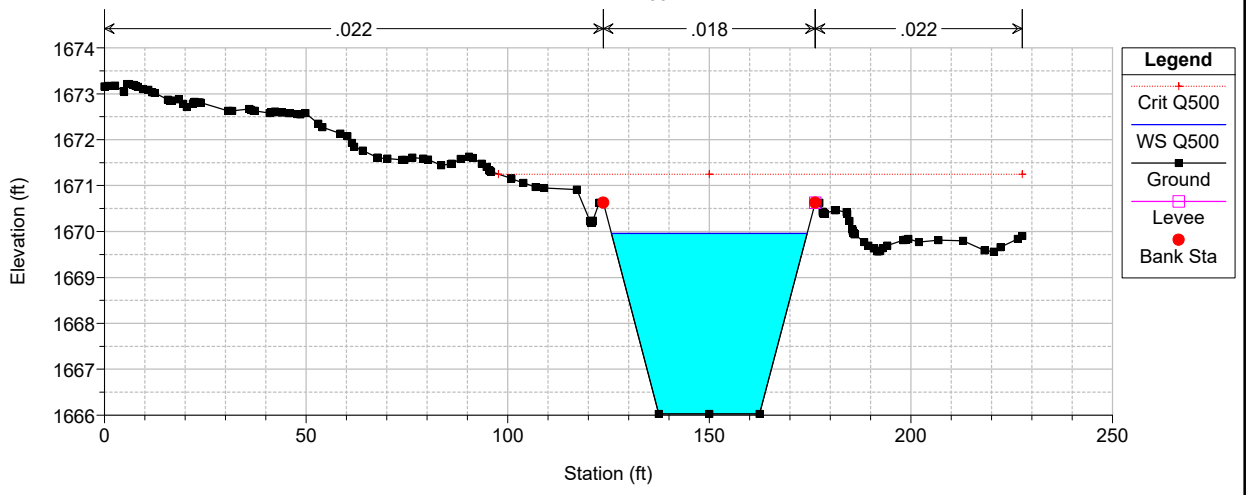

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5555.25
.018
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5438.84 Culv Hayden Road
.018
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5325.56
.018
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5291.56 Begin Transition
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5200
.022
.018
.022
Legend
WS Q500
Crit Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5100
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)

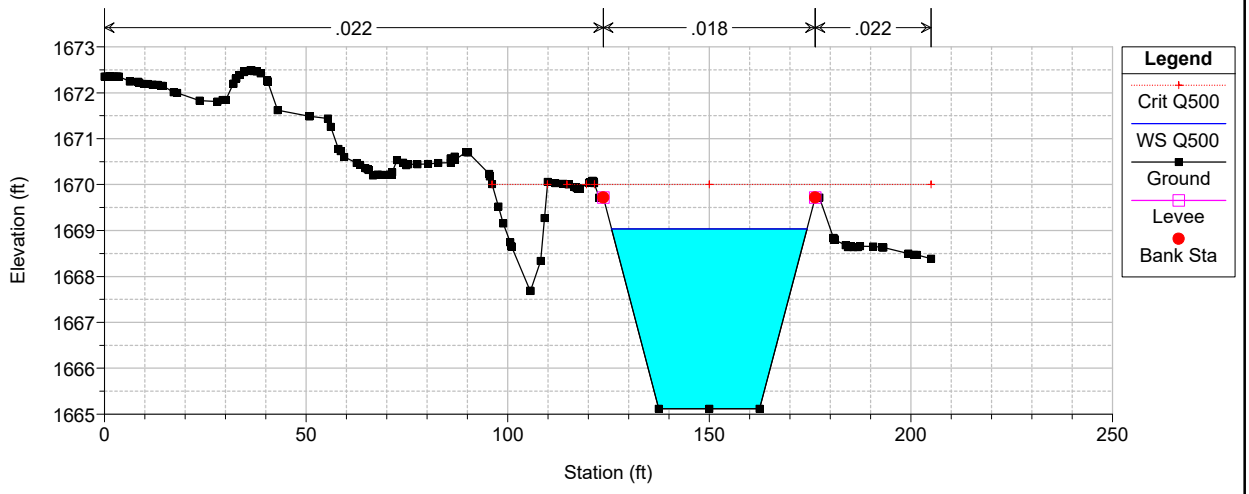

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 5000
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4900
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4800
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Bank Sta


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4700
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4600
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4500
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta

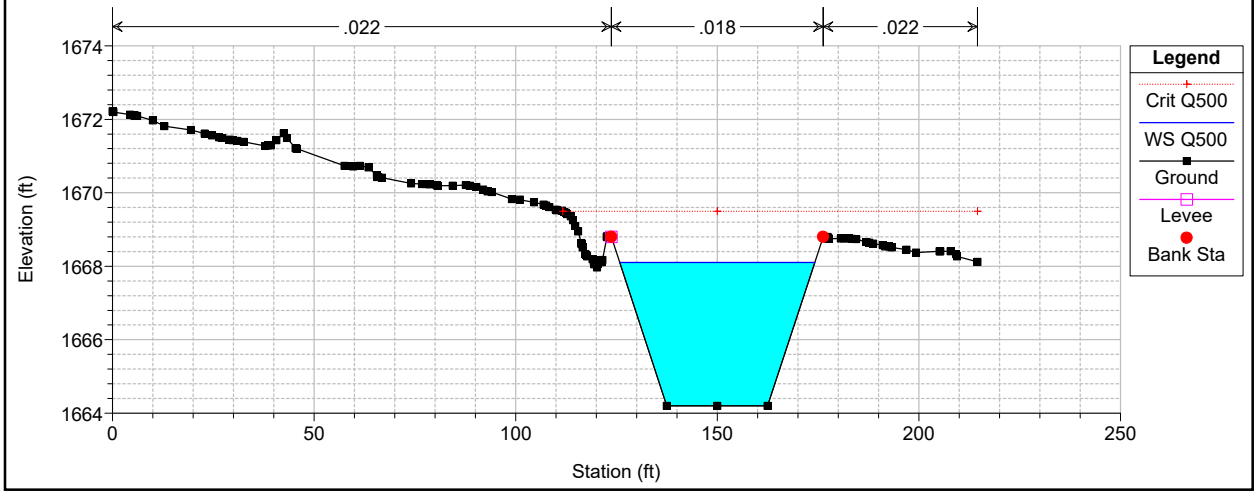
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4400

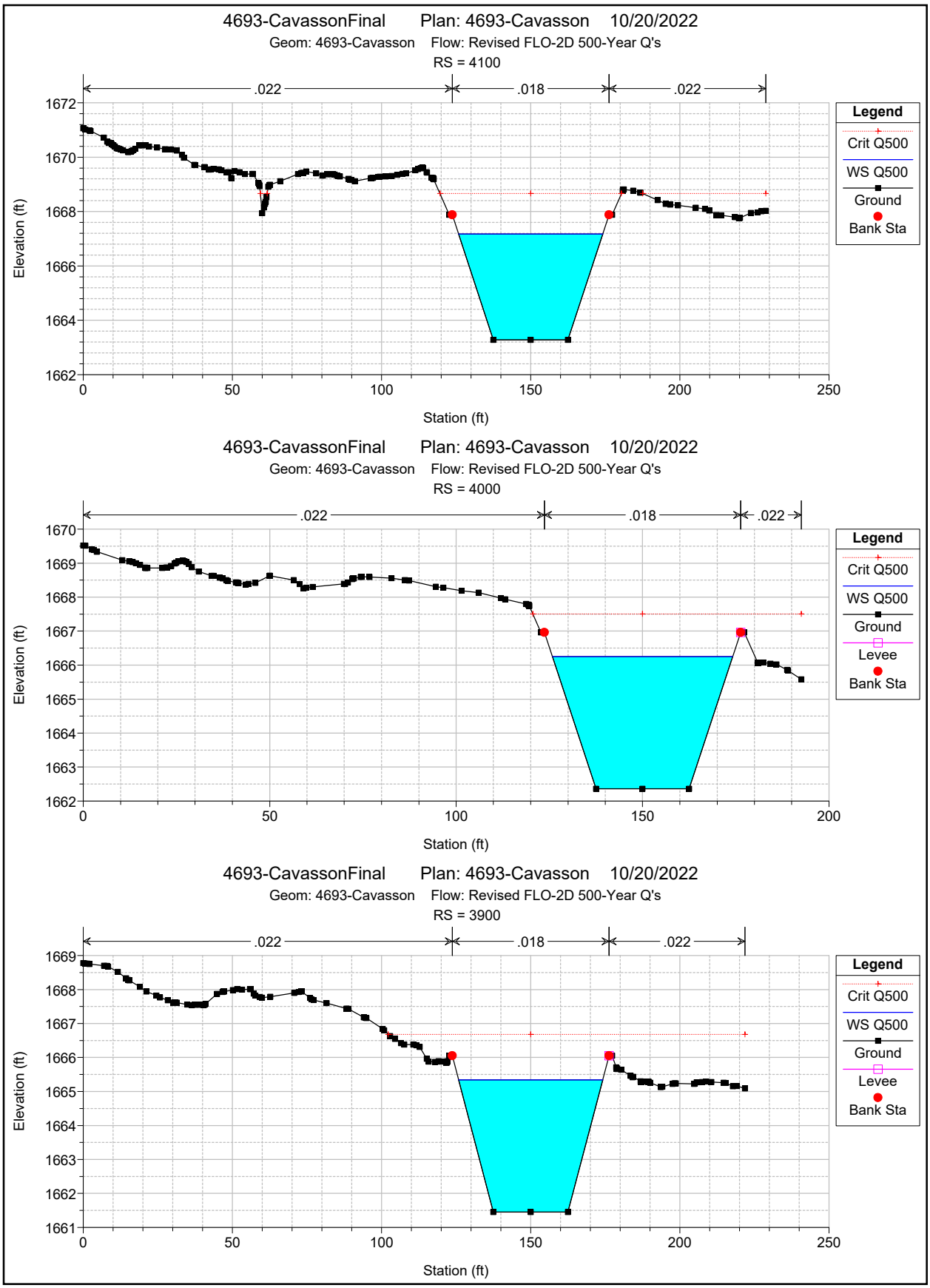


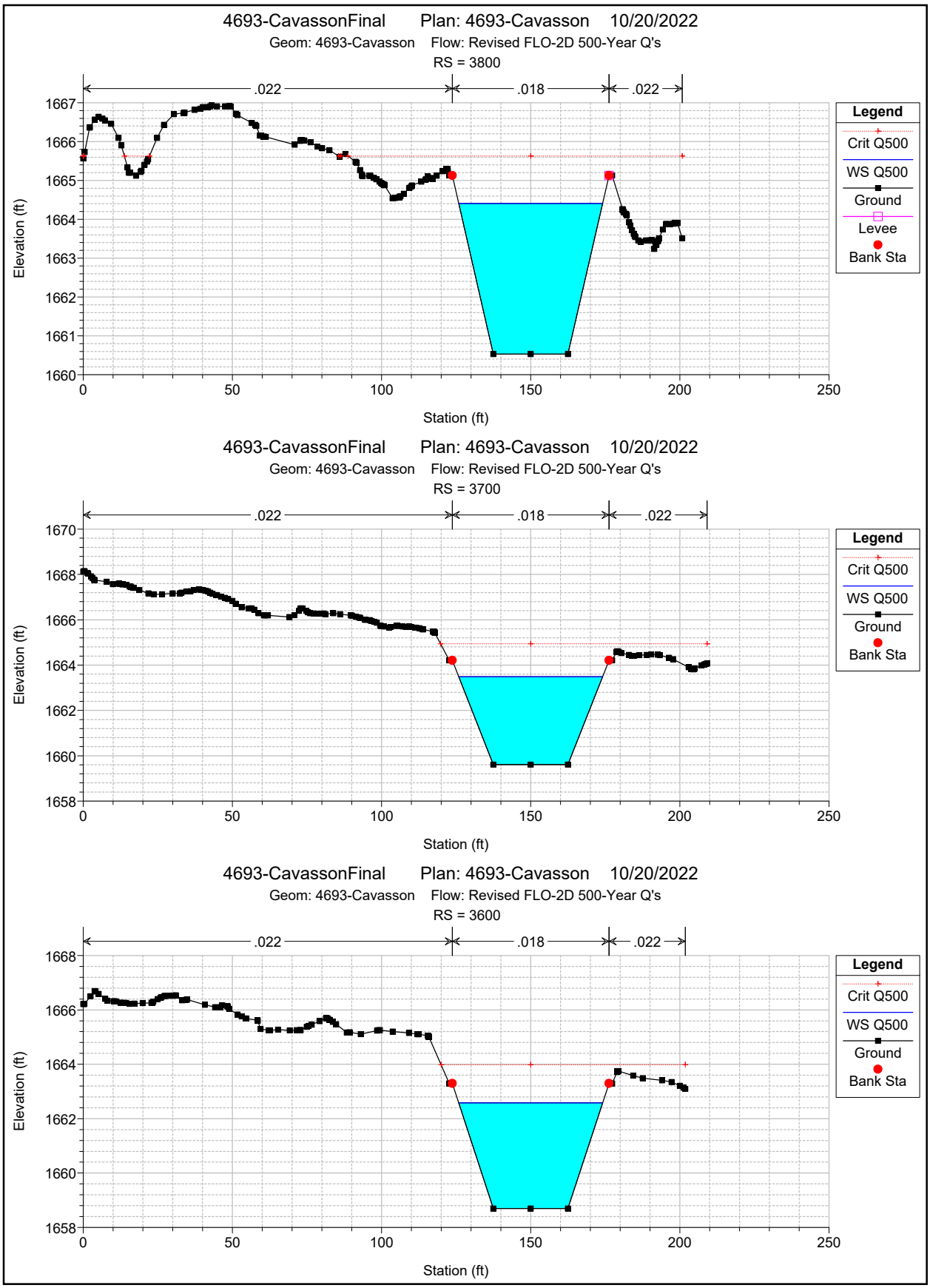
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4300

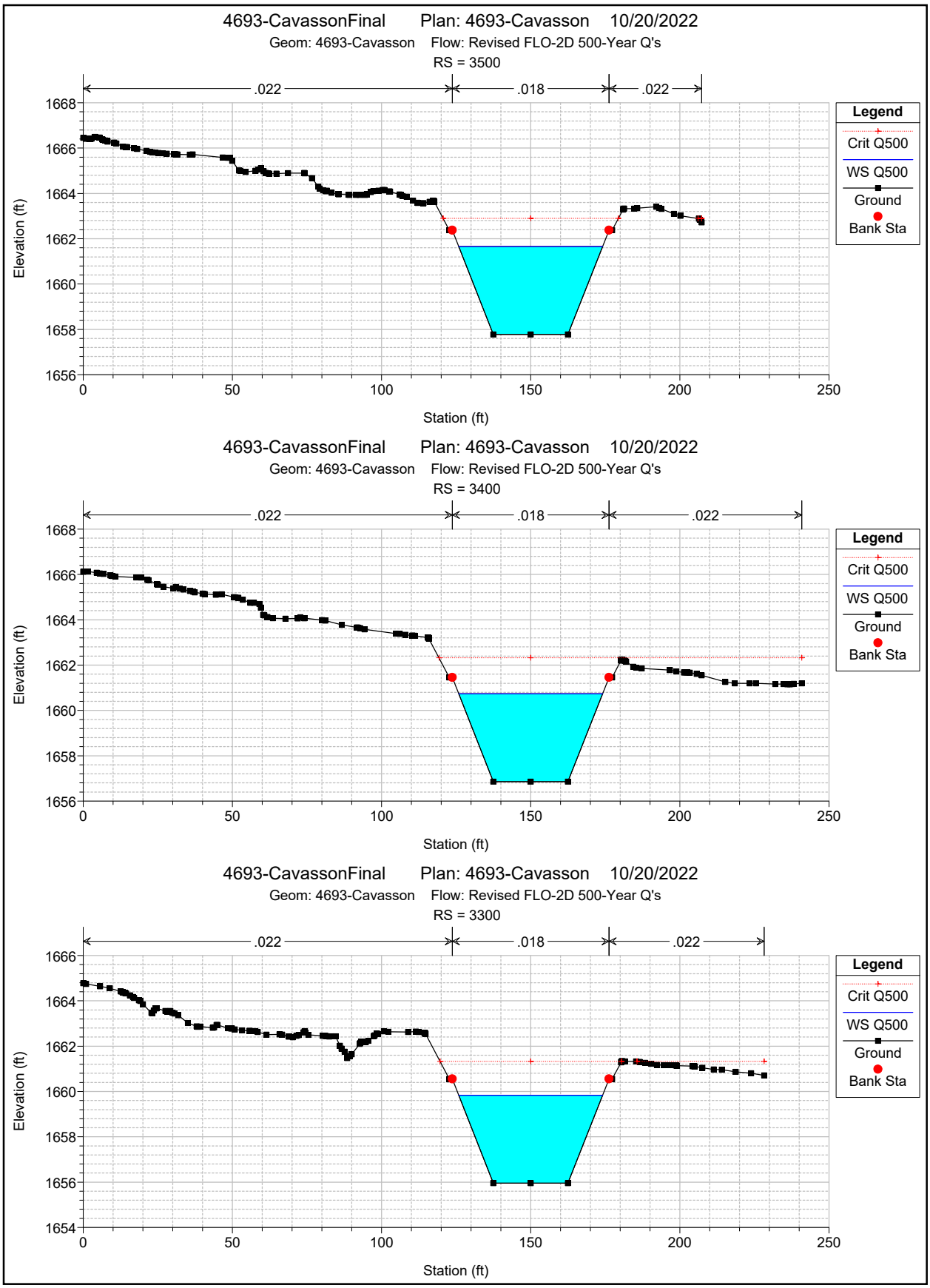


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4200




4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4100
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 4000
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3900
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Bank Sta

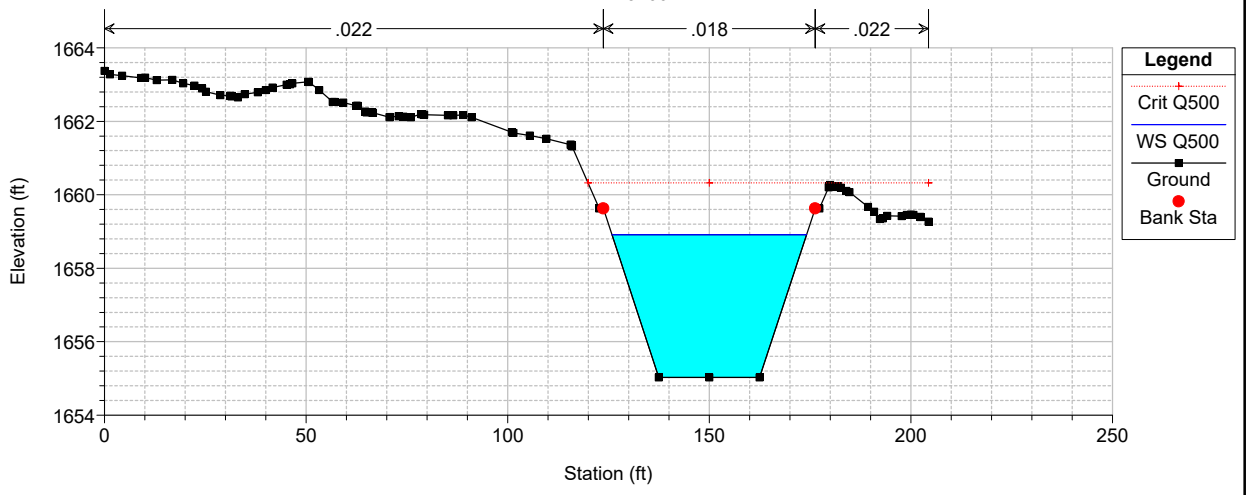

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3800
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3700
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3600
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3500
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3400
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 3300
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)

4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022

Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's

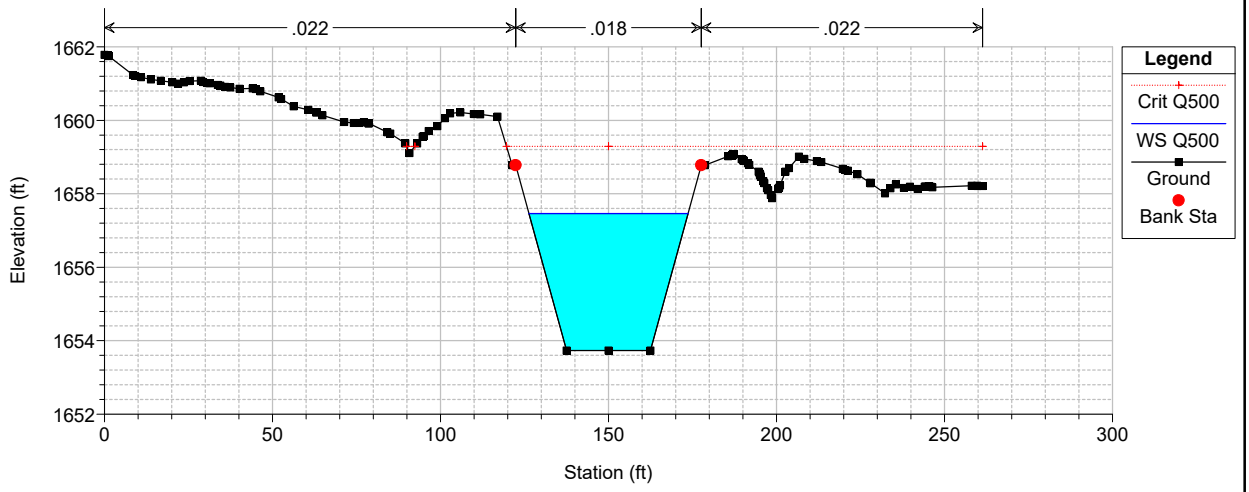
RS = 3200



4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022

Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's

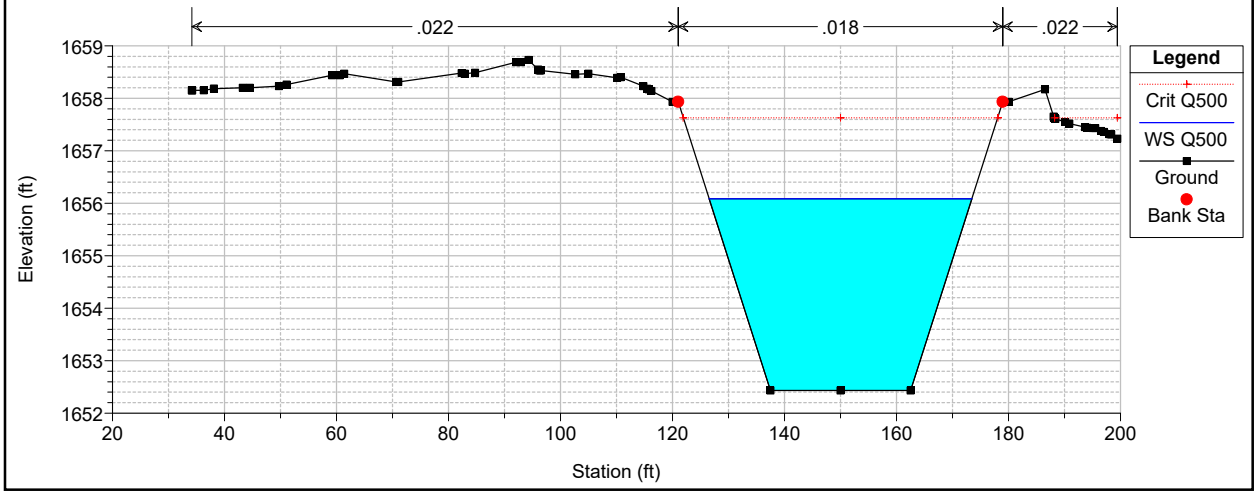
RS = 3100

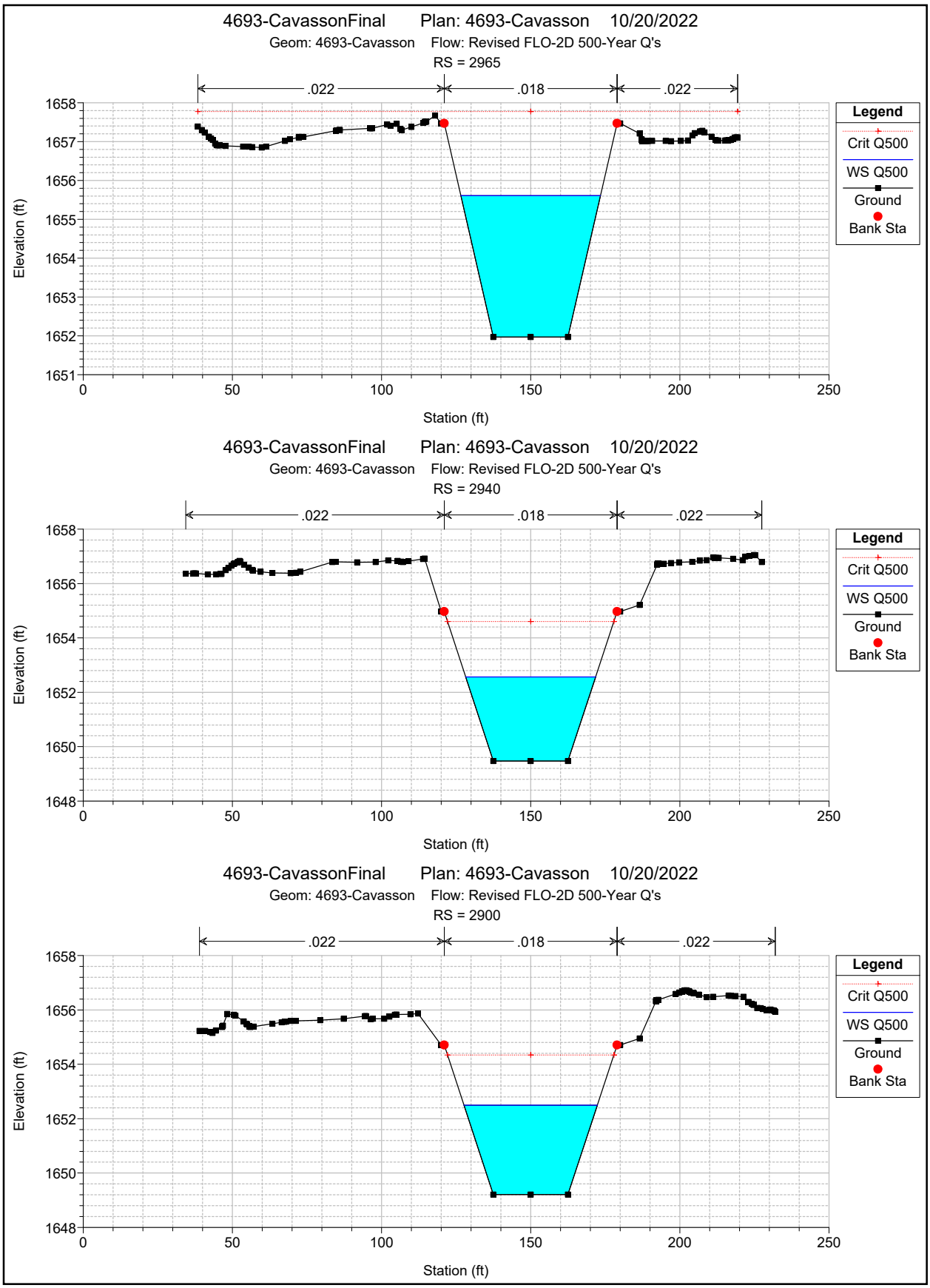


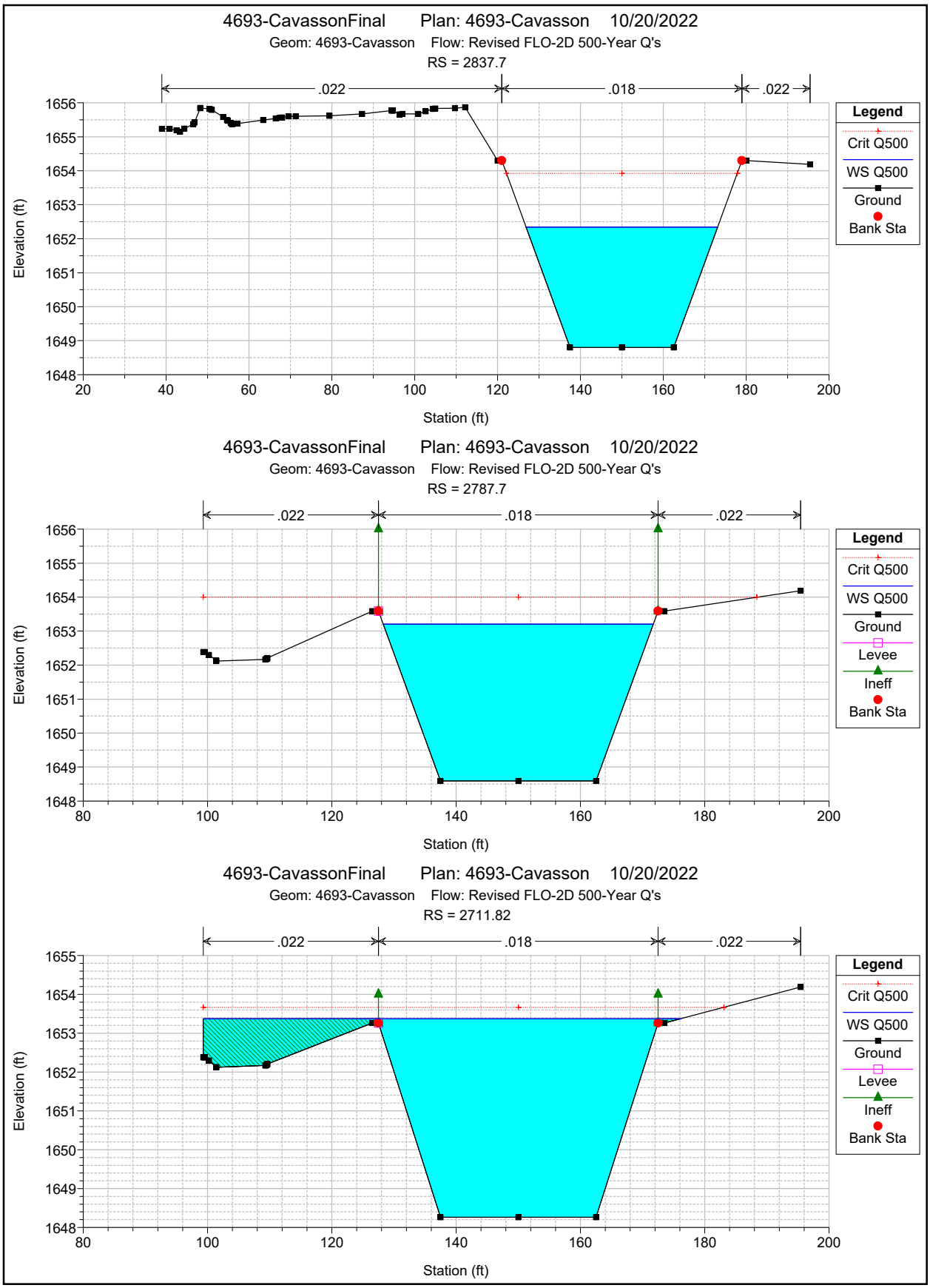
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022

Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's

RS = 3000

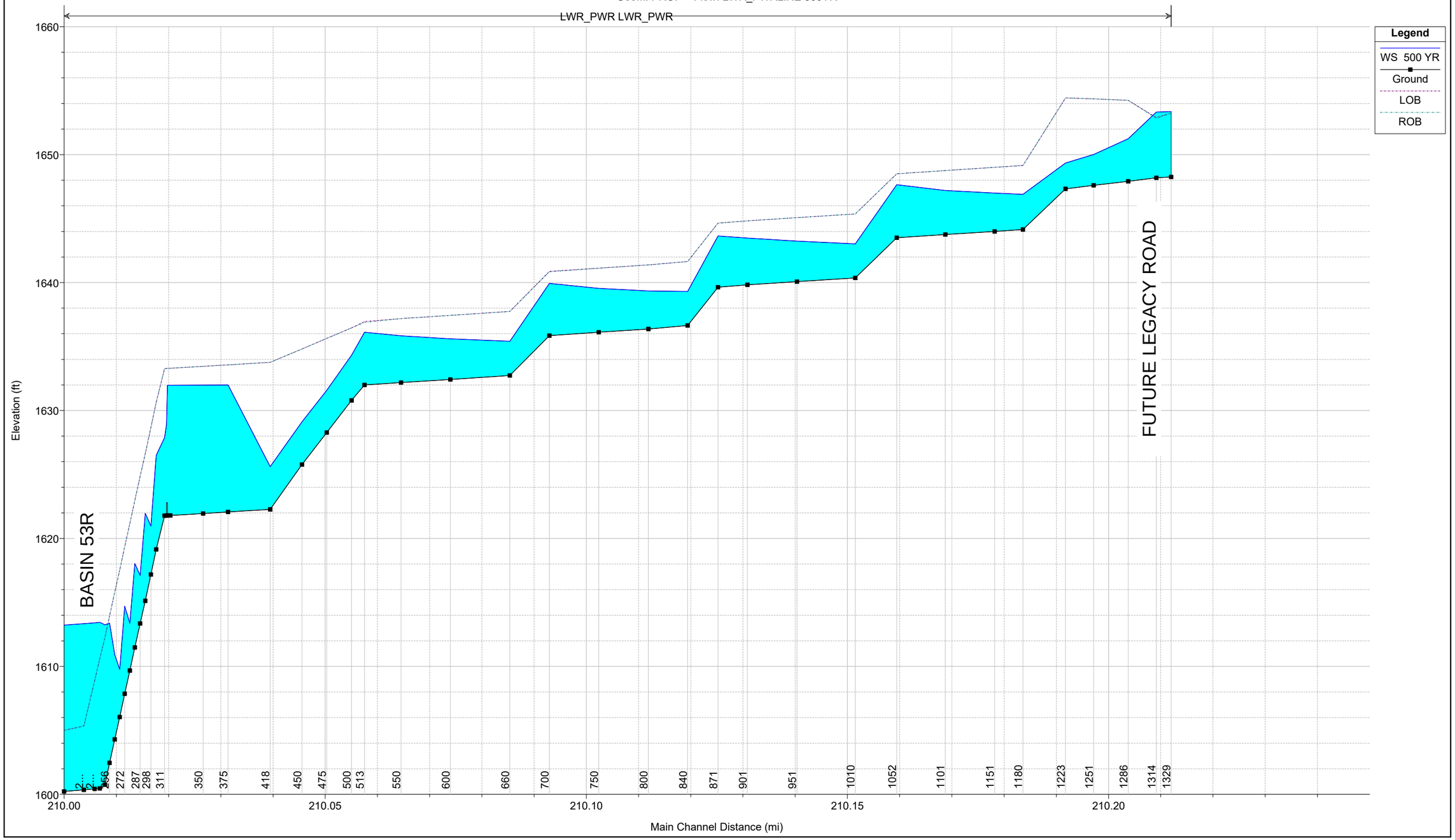



4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 2965
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 2940
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 2900
.022
.018
.022
Legend
Crit Q500
WS Q500
Ground
Bank Sta
Elevation (ft)
Station (ft)


4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 2837.7
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 2787.7
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Ineff
Bank Sta
4693-CavassonFinal Plan: 4693-Cavasson 10/20/2022
Geom: 4693-Cavasson Flow: Revised FLO-2D 500-Year Q's
RS = 2711.82
.022
.018
.022
Elevation (ft)
Station (ft)
Legend
Crit Q500
WS Q500
Ground
Levee
Ineff
Bank Sta

LOWER_PWRLINE Plan: PROP 10/20/2022

Geom: PROP Flow: LWR_PWRLINE 500YR

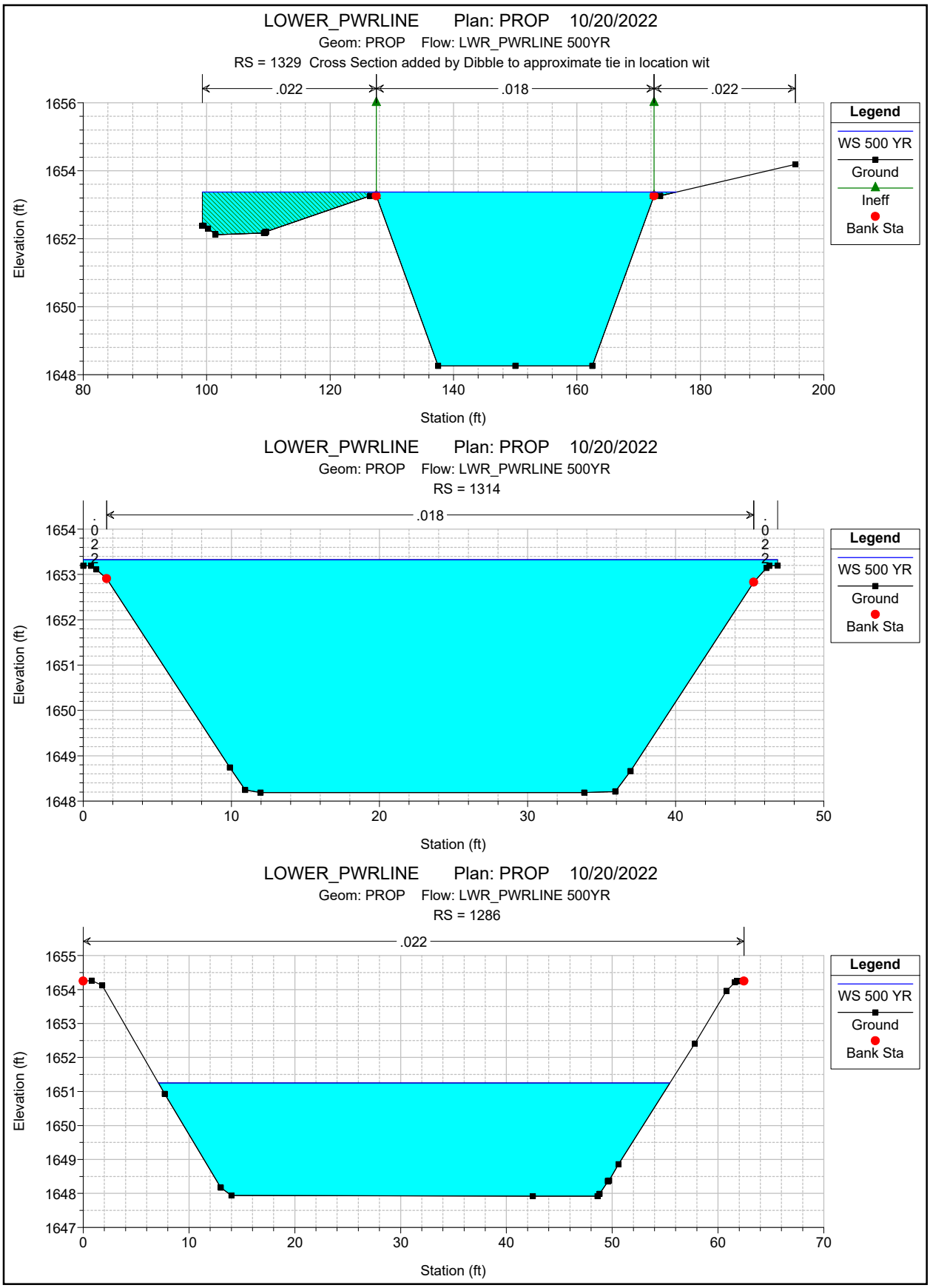


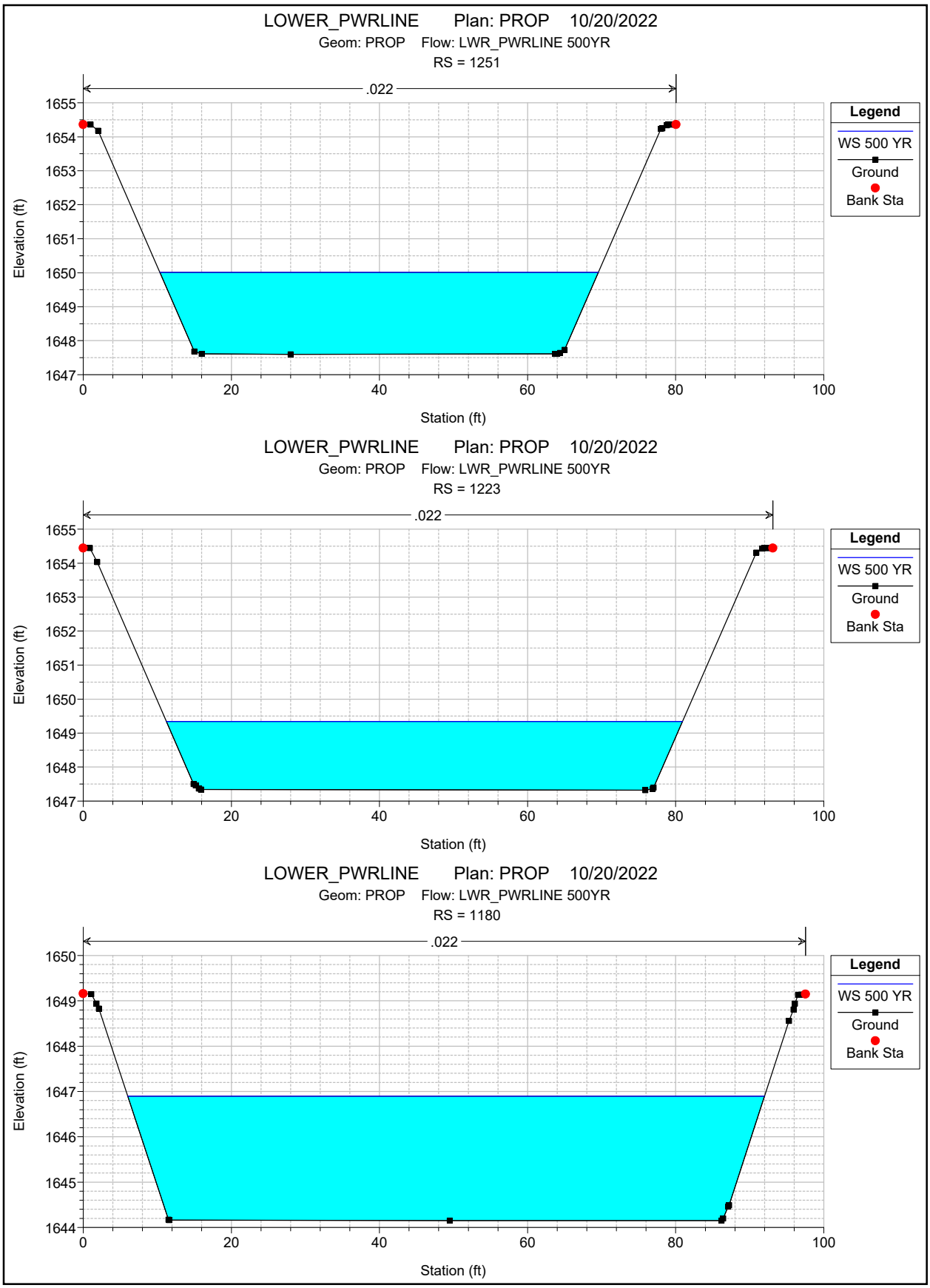
HEC-RAS Plan: PROP River: LWR_PWR Reach: LWR_PWR Profile: 500 YR

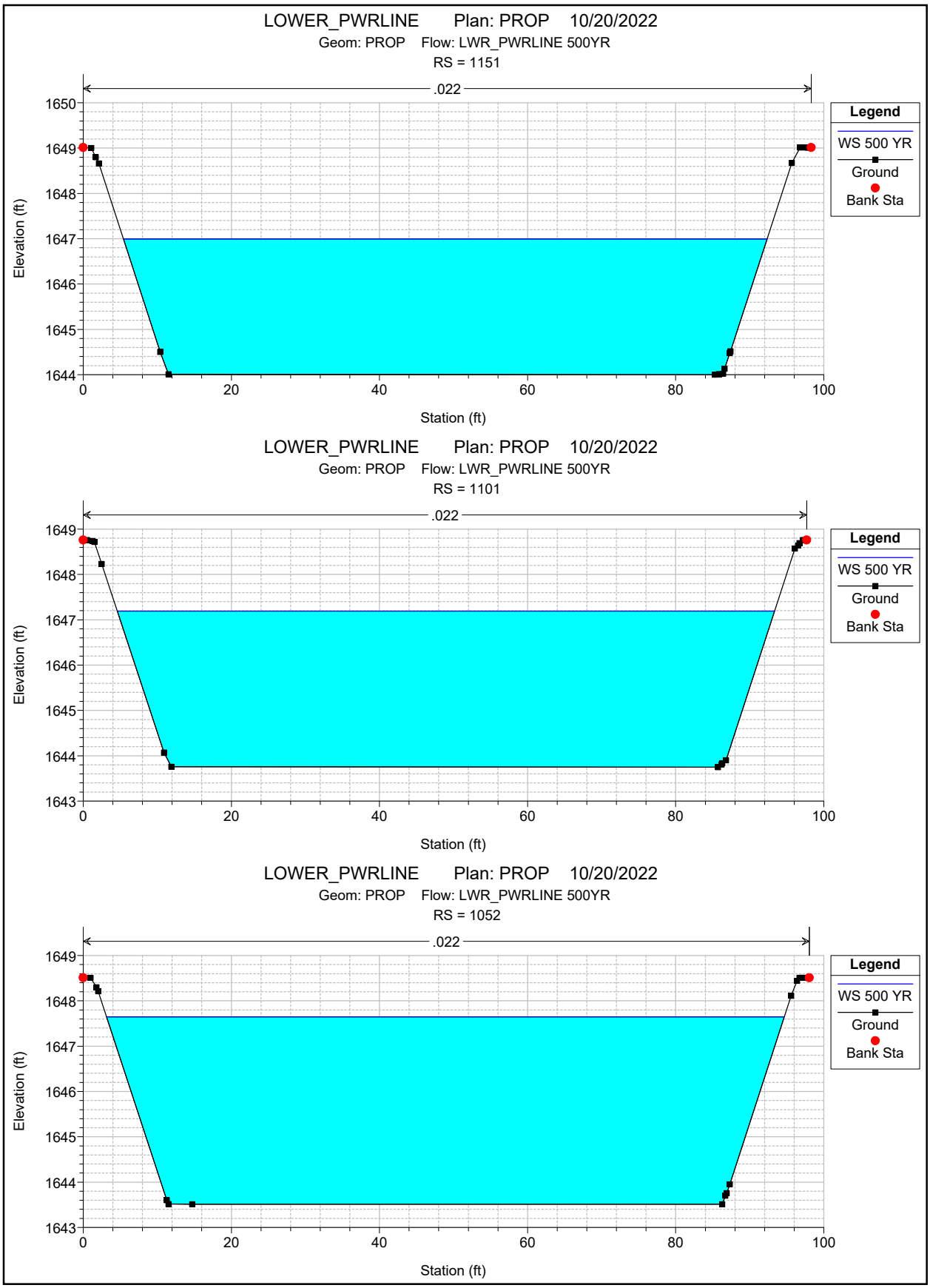
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LWR_PWR	1329	500 YR	2271.00	1648.26	1653.37	1653.66	1655.85	0.003942	12.62	179.95	76.78	1.11
LWR_PWR	1314	500 YR	2271.00	1648.19	1653.32	1653.59	1655.78	0.003731	12.57	181.32	46.88	1.09
LWR_PWR	1286	500 YR	2271.00	1647.92	1651.25	1652.53	1655.41	0.015013	16.36	138.77	48.34	1.70
LWR_PWR	1251	500 YR	2271.00	1647.60	1650.01	1651.42	1654.70	0.023607	17.38	130.69	59.21	2.06
LWR_PWR	1223	500 YR	2271.00	1647.32	1649.34	1650.67	1653.95	0.028219	17.22	131.92	69.67	2.21
LWR_PWR	1180	500 YR	4279.00	1644.15	1646.90	1648.61	1652.73	0.023877	19.38	220.79	85.99	2.13
LWR_PWR	1151	500 YR	4279.00	1644.00	1647.00	1648.46	1651.85	0.017881	17.68	241.98	86.93	1.87
LWR_PWR	1101	500 YR	4279.00	1643.75	1647.19	1648.21	1650.79	0.011139	15.21	281.42	88.77	1.51
LWR_PWR	1052	500 YR	4279.00	1643.51	1647.65	1647.97	1650.05	0.005962	12.43	344.12	91.53	1.13
LWR_PWR	1010	500 YR	4279.00	1640.36	1643.03	1644.82	1649.22	0.026145	19.95	214.50	85.69	2.22
LWR_PWR	951	500 YR	4279.00	1640.07	1643.24	1644.53	1647.52	0.014639	16.59	257.94	87.73	1.71
LWR_PWR	901	500 YR	4279.00	1639.82	1643.48	1644.28	1646.62	0.009041	14.22	300.89	89.63	1.37
LWR_PWR	871	500 YR	4279.00	1639.63	1643.64	1644.11	1646.23	0.006702	12.91	331.34	91.00	1.19
LWR_PWR	840	500 YR	4279.00	1636.64	1639.31	1641.12	1645.51	0.026237	19.96	214.36	85.72	2.23
LWR_PWR	800	500 YR	4279.00	1636.37	1639.35	1640.84	1644.26	0.018169	17.77	240.75	86.89	1.88
LWR_PWR	750	500 YR	4279.00	1636.12	1639.55	1640.58	1643.17	0.011290	15.27	280.18	88.70	1.51
LWR_PWR	700	500 YR	4279.00	1635.85	1639.93	1640.33	1642.43	0.006321	12.67	337.70	91.28	1.16
LWR_PWR	660	500 YR	4279.00	1632.74	1635.42	1637.20	1641.60	0.026113	19.94	214.61	85.67	2.22
LWR_PWR	600	500 YR	4279.00	1632.43	1635.60	1636.89	1639.88	0.014625	16.59	257.89	87.63	1.71
LWR_PWR	550	500 YR	4279.00	1632.18	1635.85	1636.64	1638.98	0.009001	14.20	301.28	89.62	1.37
LWR_PWR	513	500 YR	4279.00	1632.00	1636.11	1636.46	1638.54	0.006066	12.51	342.14	91.43	1.14
LWR_PWR	500	500 YR	4279.00	1630.79	1634.32	1635.48	1638.28	0.011767	15.96	268.04	81.14	1.55
LWR_PWR	475	500 YR	4279.00	1628.28	1631.58	1633.39	1637.69	0.019696	19.83	215.83	67.88	1.96
LWR_PWR	450	500 YR	4279.00	1625.78	1629.13	1631.37	1636.95	0.025262	22.44	190.65	58.03	2.18
LWR_PWR	418	500 YR	4279.00	1622.27	1625.62	1628.36	1635.78	0.033879	25.58	167.30	50.00	2.47
LWR_PWR	375	500 YR	4279.00	1622.07	1632.00	1628.16	1633.16	0.001191	8.62	496.60	50.00	0.48
LWR_PWR	350	500 YR	4279.00	1621.95	1631.99		1633.12	0.001154	8.52	501.98	50.00	0.47
LWR_PWR	317	500 YR	4279.00	1621.80	1631.97	1627.91	1633.07	0.001109	8.41	508.66	50.00	0.46
LWR_PWR	314		Inl Struct									
LWR_PWR	311	500 YR	4279.00	1621.78	1627.89	1627.89	1630.94	0.055347	14.02	305.22	50.00	1.00
LWR_PWR	303	500 YR	4279.00	1619.14	1626.50	1627.05	1630.22	0.120679	15.47	276.53	50.00	1.16
LWR_PWR	298	500 YR	4279.00	1617.18	1620.97	1623.28	1628.88	0.243791	22.56	189.69	50.00	2.04
LWR_PWR	292	500 YR	4279.00	1615.13	1621.96	1623.13	1626.70	0.198709	17.47	244.99	50.00	1.39
LWR_PWR	287	500 YR	4279.00	1613.36	1617.12	1619.46	1625.18	0.251531	22.78	187.82	50.00	2.07
LWR_PWR	282	500 YR	4279.00	1611.48	1618.04	1619.39	1623.12	0.197828	18.08	236.67	50.00	1.47
LWR_PWR	277	500 YR	4279.00	1609.67	1613.38	1615.78	1621.66	0.262477	23.09	185.30	50.00	2.11
LWR_PWR	272	500 YR	4279.00	1607.86	1614.70	1615.86	1619.41	0.196979	17.42	245.66	50.00	1.39
LWR_PWR	266	500 YR	4279.00	1606.04	1609.78	1612.14	1617.93	0.255840	22.91	186.81	50.00	2.09

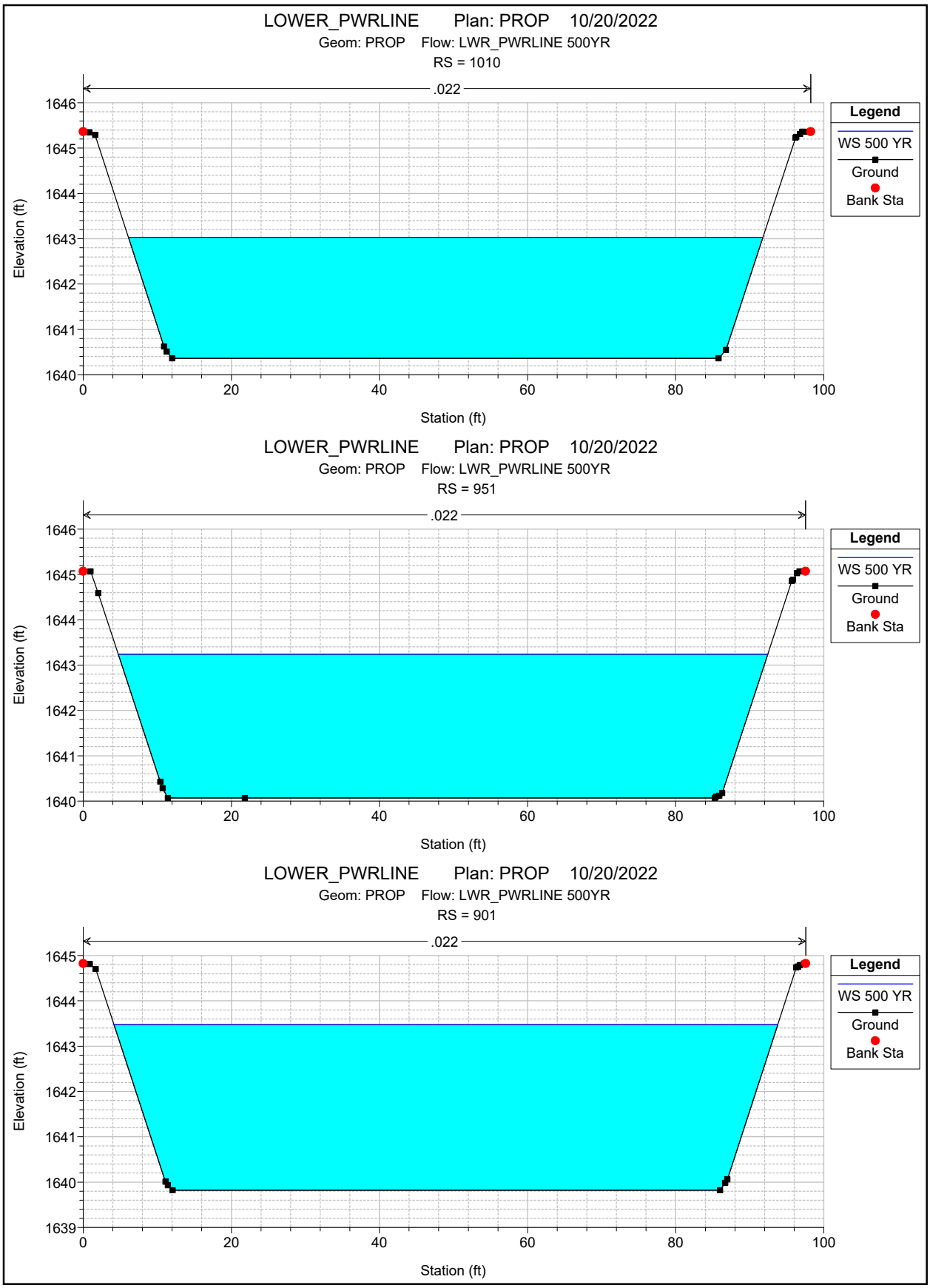
HEC-RAS Plan: PROP River: LWR_PWR Reach: LWR_PWR Profile: 500 YR (Continued)

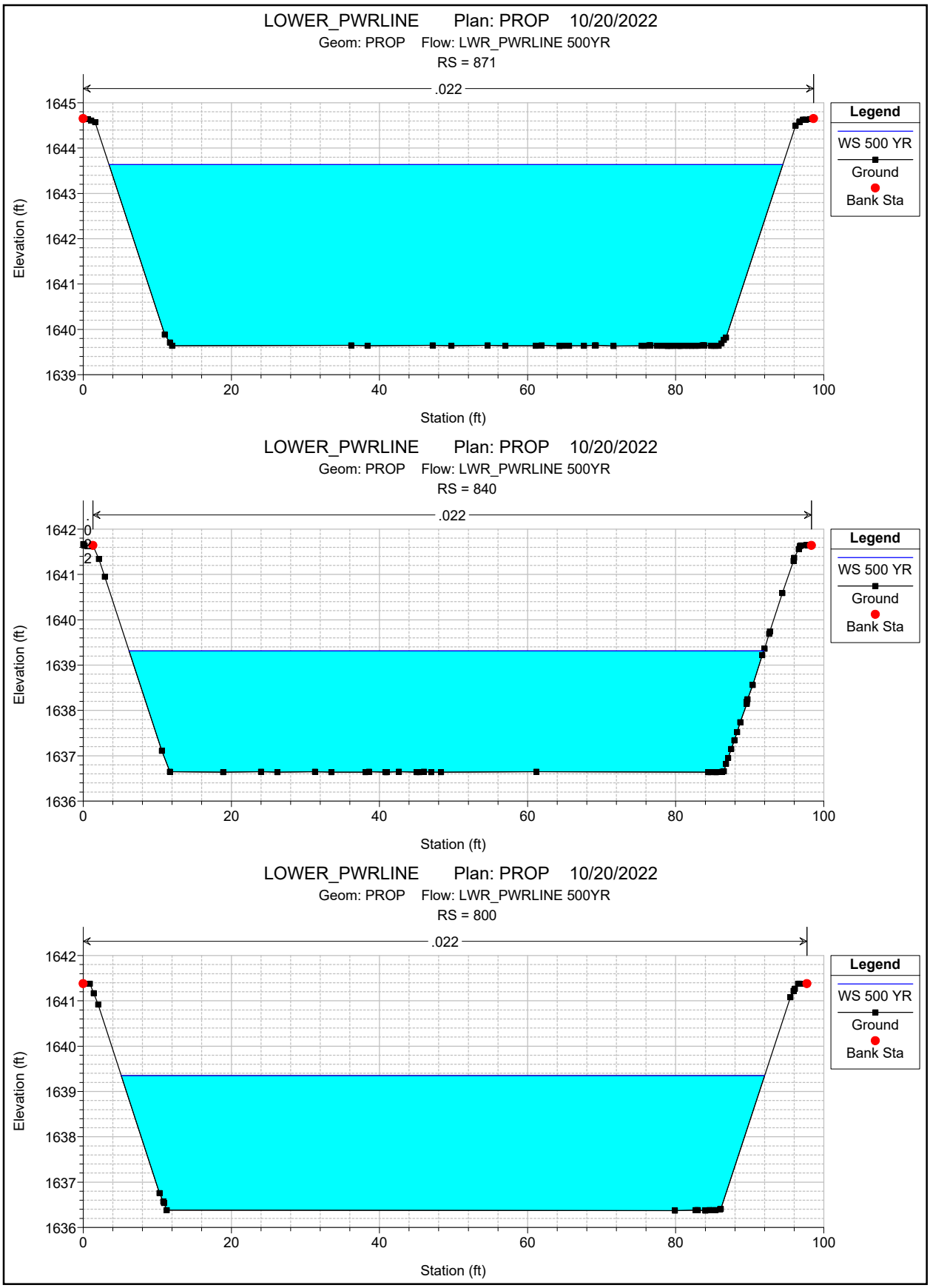
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LWR_PWR	261	500 YR	4279.00	1604.30	1610.92	1612.21	1615.87	0.190349	17.86	239.55	50.00	1.44
LWR_PWR	256	500 YR	4279.00	1602.46	1613.39	1608.56	1614.34	0.009638	7.83	546.25	50.00	0.42
LWR_PWR	251	500 YR	4279.00	1600.76	1613.25		1614.27	0.017870	8.10	528.22	50.00	0.44
LWR_PWR	246	500 YR	4279.00	1600.47	1613.44		1614.12	0.005854	6.60	648.57	50.00	0.32
LWR_PWR	241	500 YR	4279.00	1600.43	1613.41		1614.09	0.005942	6.61	647.14	50.00	0.32
LWR_PWR	230	500 YR	4279.00	1600.35	1613.35		1614.02	0.005822	6.58	649.84	50.00	0.32
LWR_PWR	210	500 YR	4279.00	1600.22	1613.23	1606.33	1613.90	0.005803	6.58	650.57	50.00	0.32

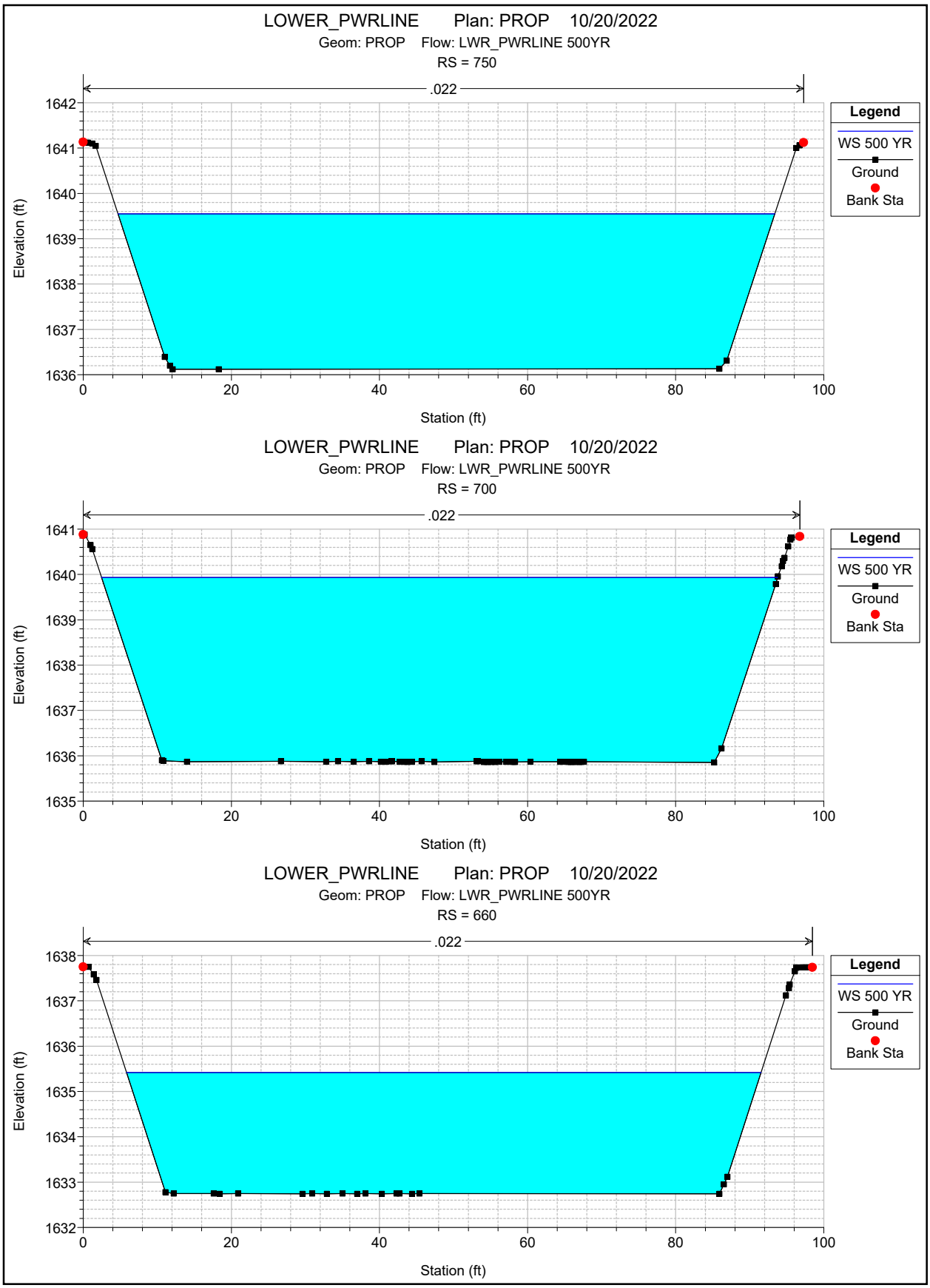

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1329 Cross Section added by Dibble to approximate tie in location wit
.022
.018
.022
Legend
WS 500 YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1314
.018
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1286
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)

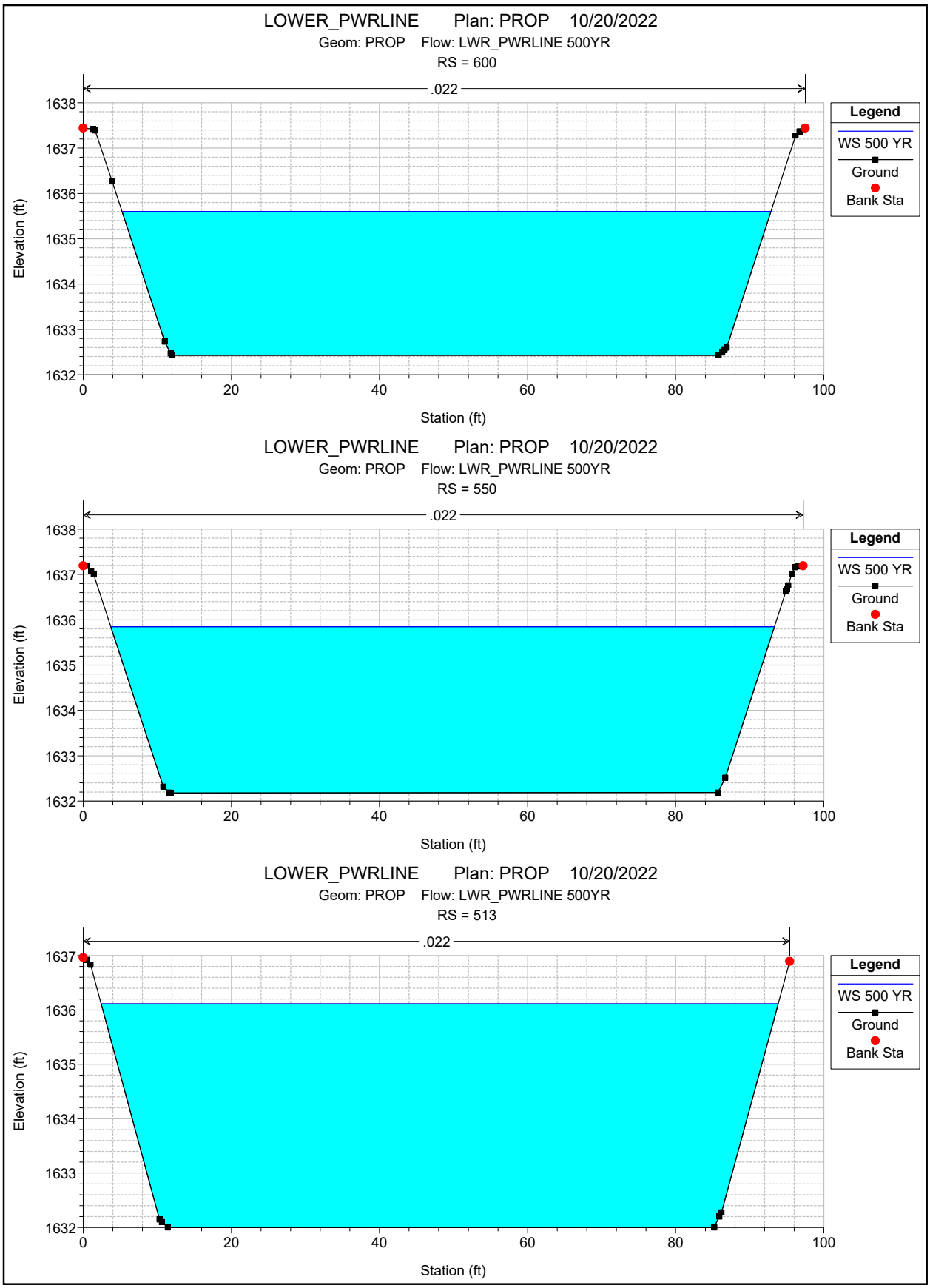

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1251
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1223
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1180
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta

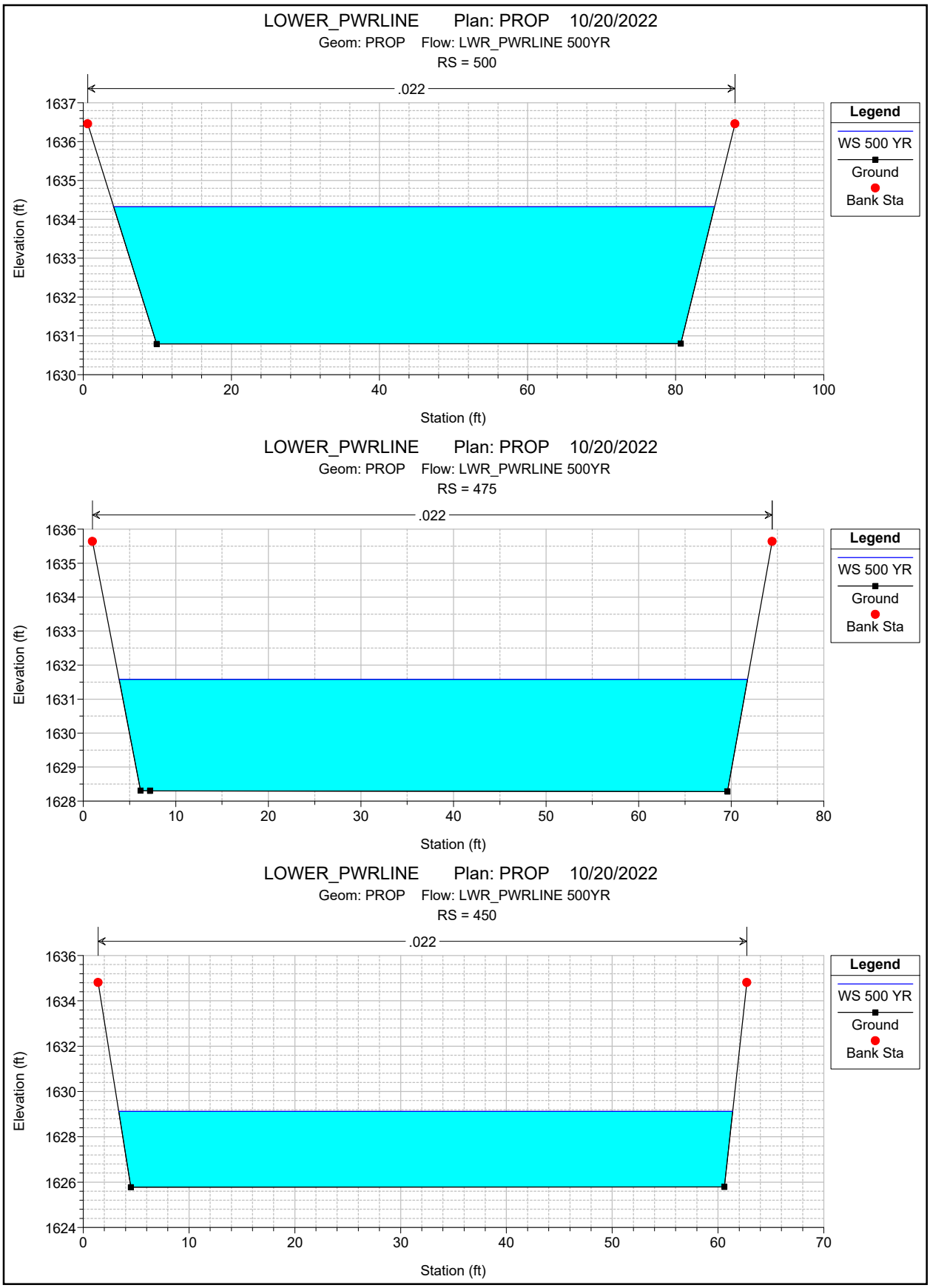

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1151
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1101
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1052
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)

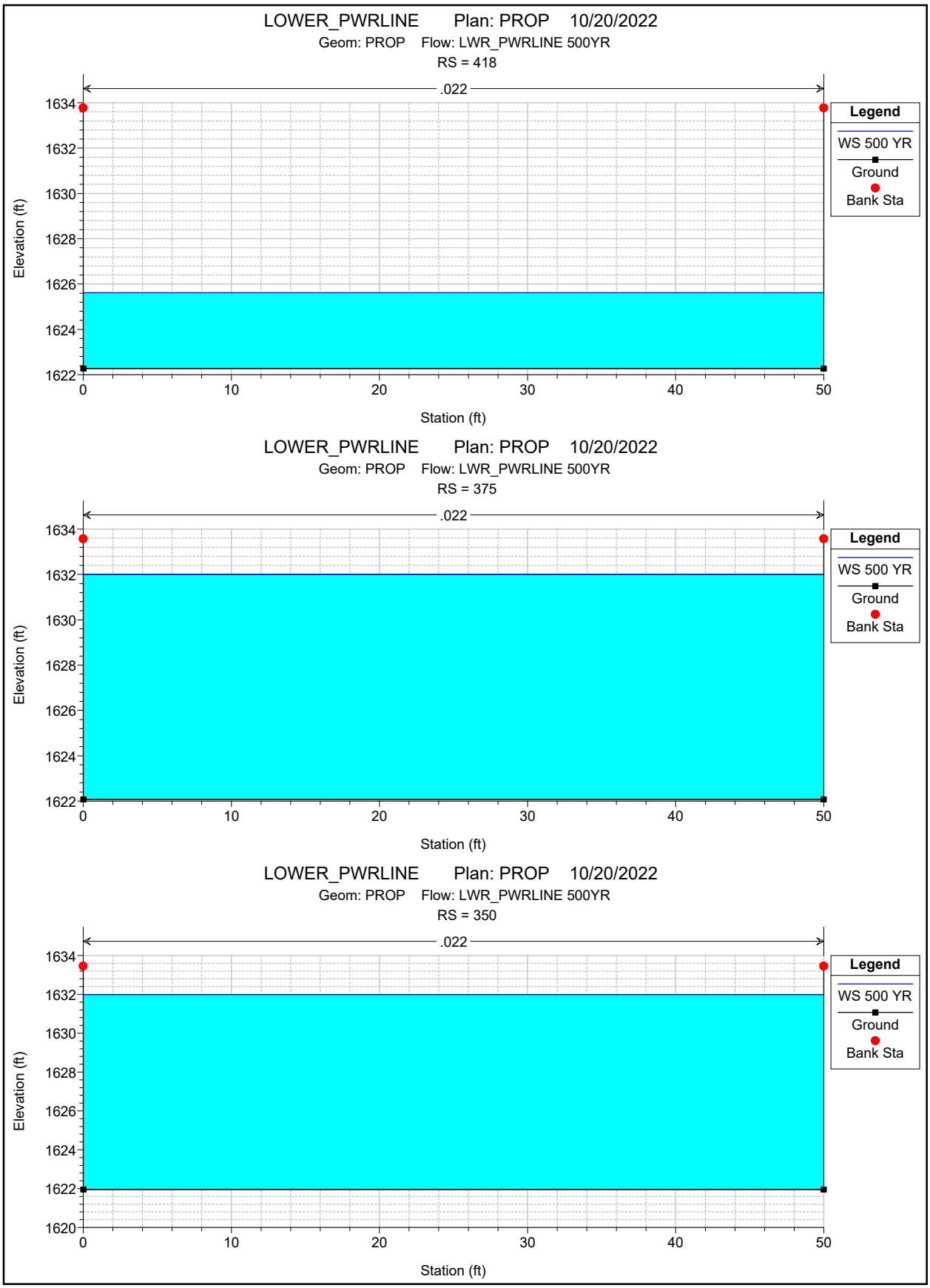

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 1010
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 951
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 901
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)

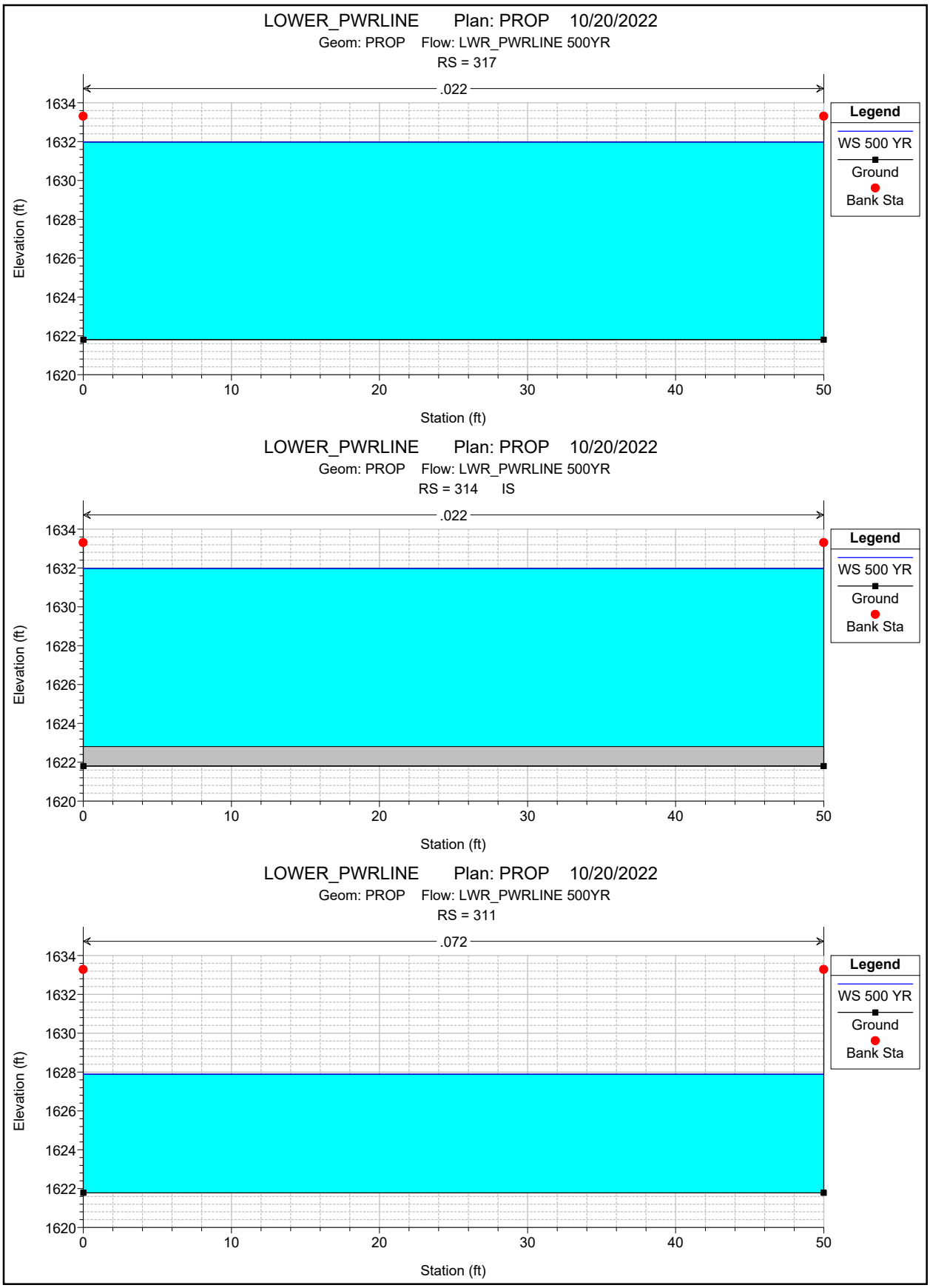

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 871
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 840
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 800
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta

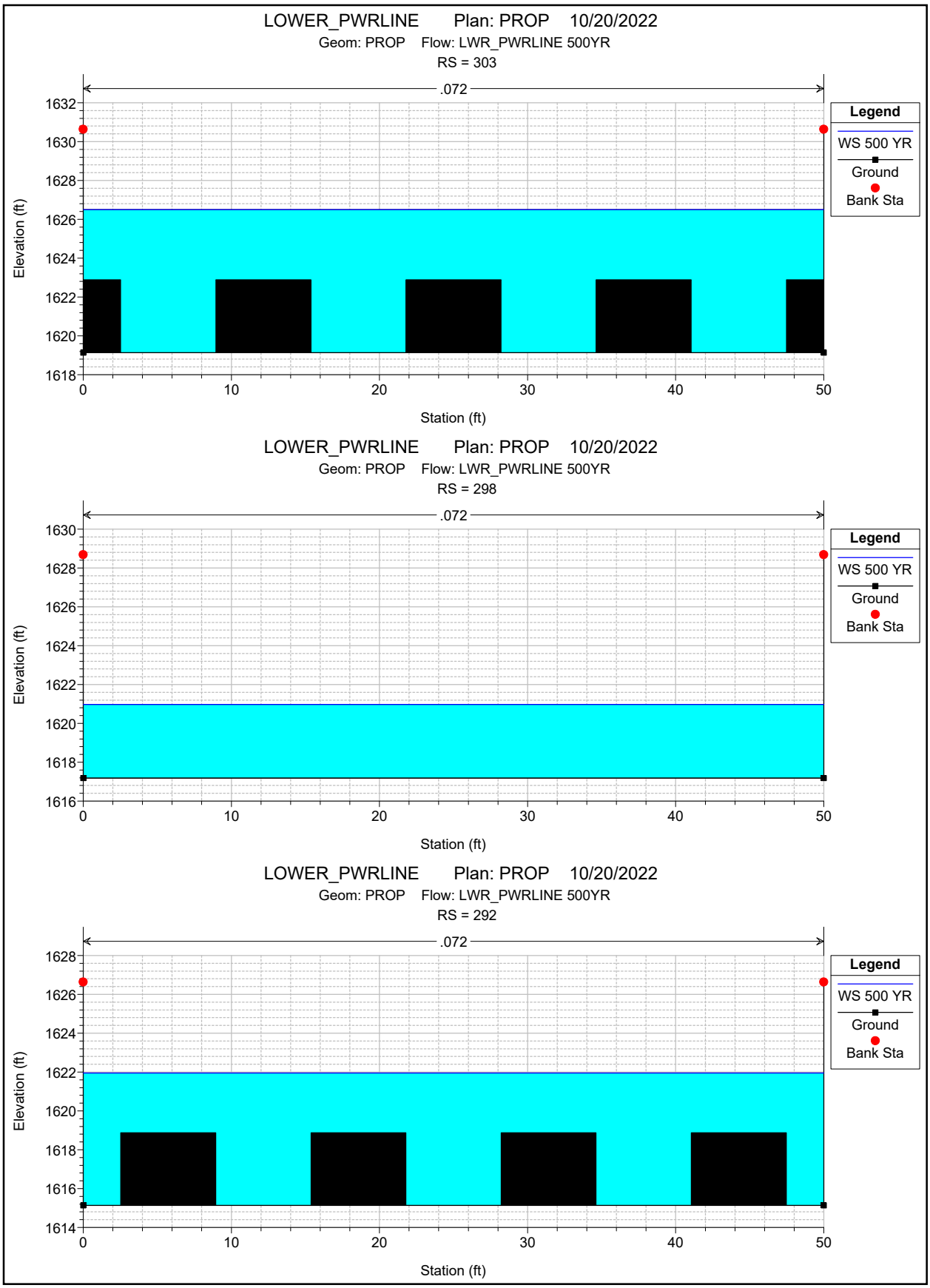

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 750
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 700
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 660
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta

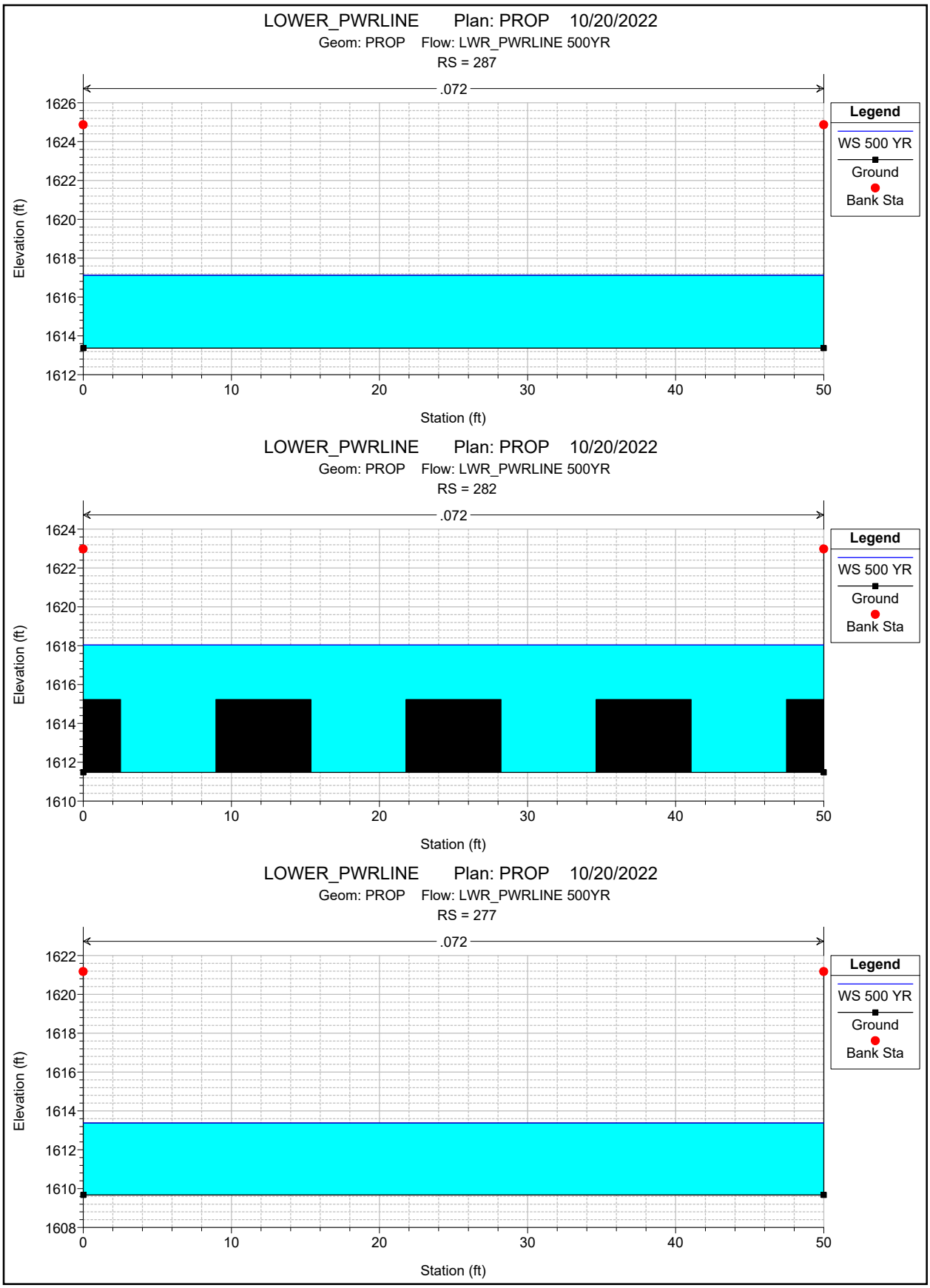

LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 600
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 550
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 513
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)


LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 500
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 475
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 450
.022
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta


LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 418
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 375
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 350
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)


LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 317
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 314 IS
.022
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 311
.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)


LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 303
.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 298
.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 292
.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 287
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Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 282
.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
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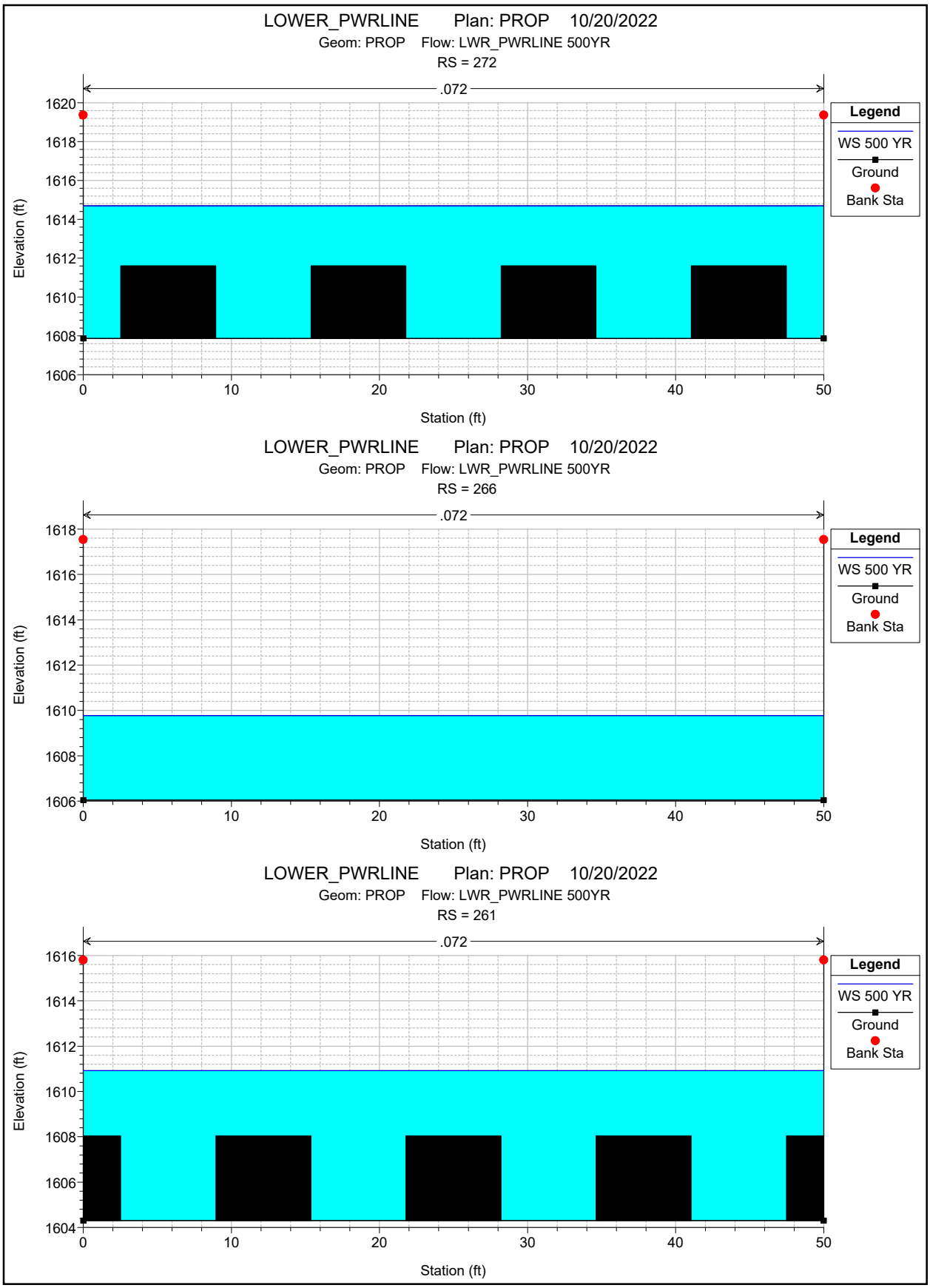
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 272
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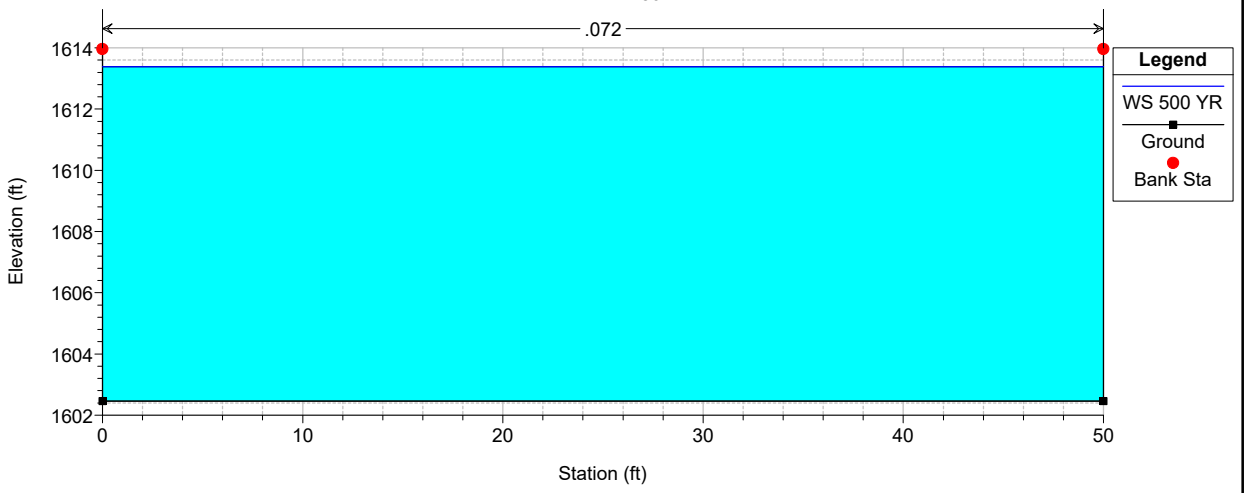
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 266
.072
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 261
.072
Elevation (ft)
Station (ft)
Legend
WS 500 YR
Ground
Bank Sta

LOWER_PWRLINE Plan: PROP 10/20/2022

Geom: PROP Flow: LWR_PWRLINE 500YR

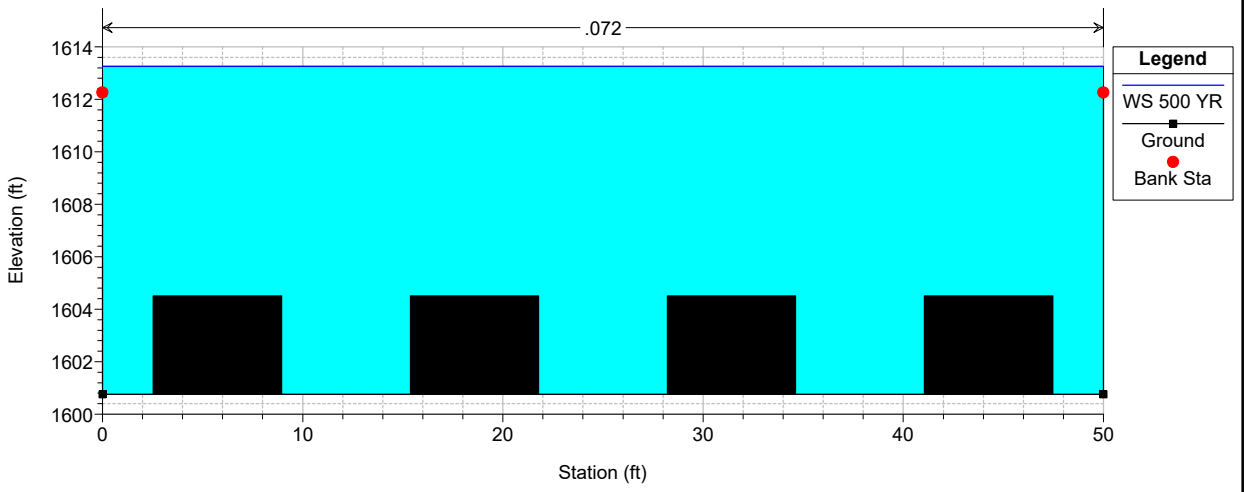
RS = 256



LOWER_PWRLINE Plan: PROP 10/20/2022

Geom: PROP Flow: LWR_PWRLINE 500YR

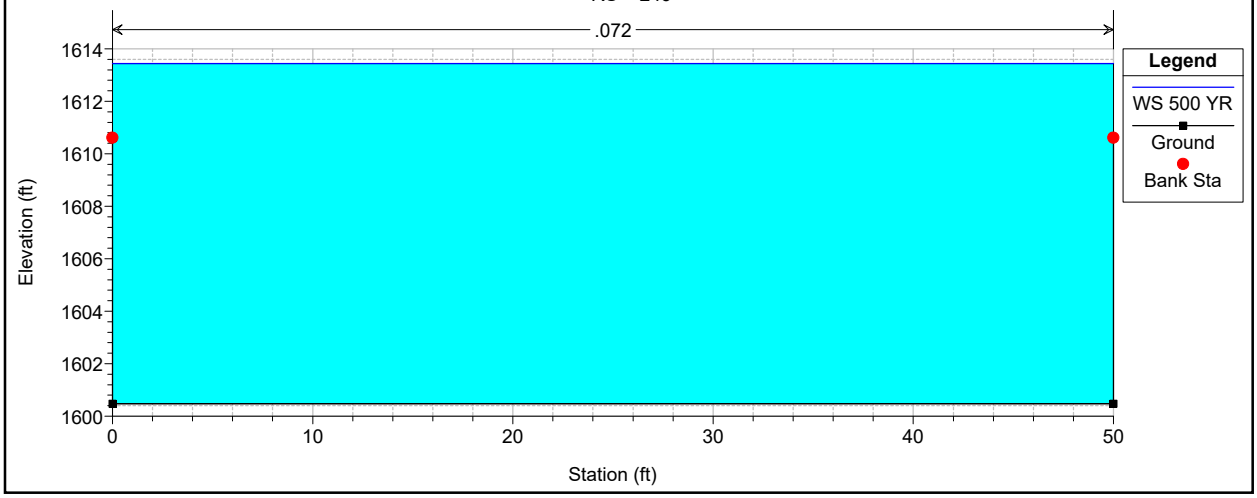
RS = 251

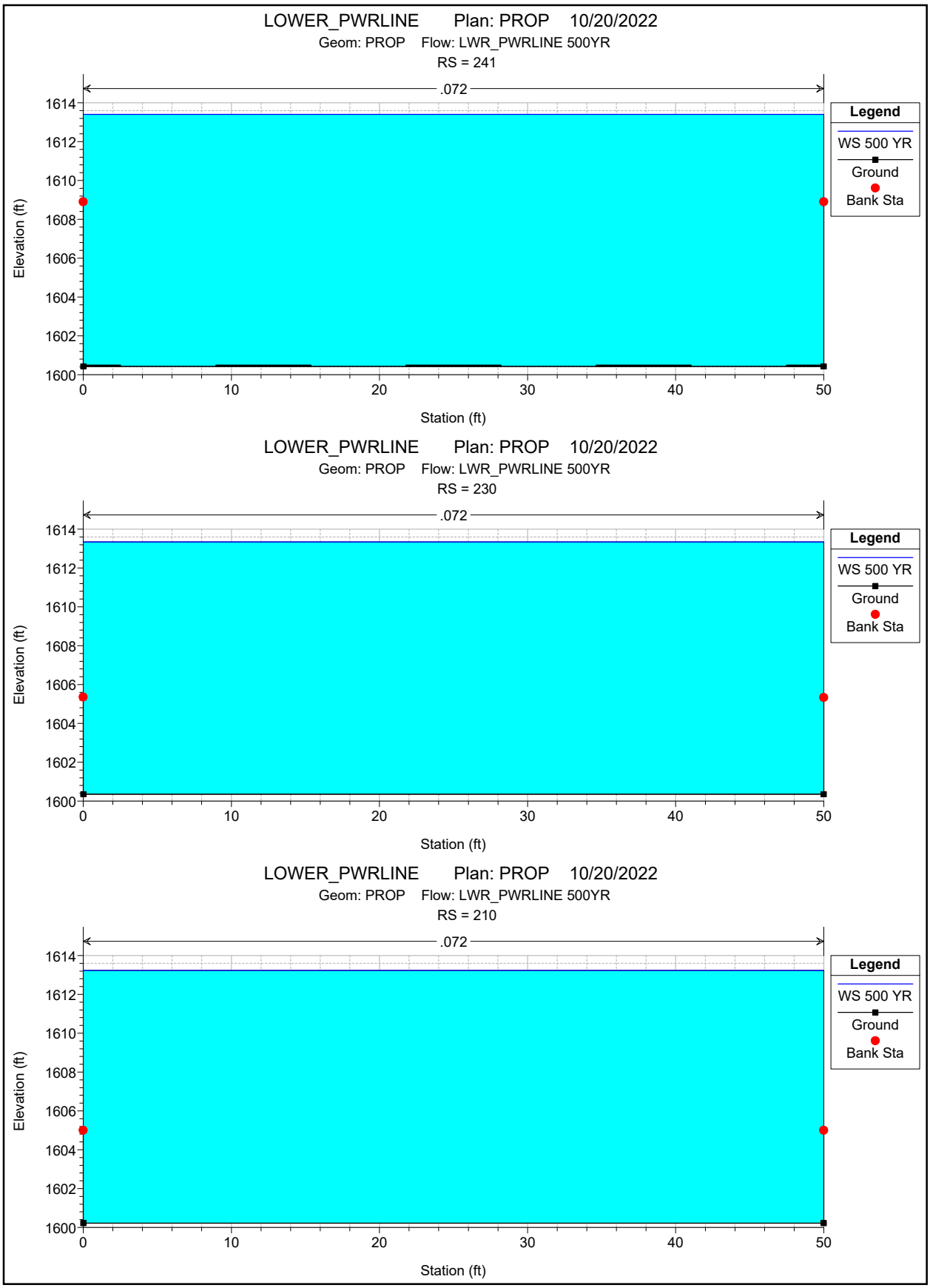


LOWER_PWRLINE Plan: PROP 10/20/2022

Geom: PROP Flow: LWR_PWRLINE 500YR

RS = 246

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Geom: PROP Flow: LWR_PWRLINE 500YR
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Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
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.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
LOWER_PWRLINE Plan: PROP 10/20/2022
Geom: PROP Flow: LWR_PWRLINE 500YR
RS = 210
.072
Legend
WS 500 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)

ATTACHMENT C
HEC-1 Model Documentation



BANNER/NEXCORE HEALTH CENTER PLUS
EXHIBIT C-1 - SUBBASIN MAP

DIBBLE

Sub-Basins
1-Foot Topographic Contours
Time of Concentration Flow Path

400 200 0 400 Feet

N

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Date Saved: 2/29/2024 3:00:55 PM



BANNER/NEXCORE HEALTH CENTER PLUS
EXHIBIT C-2 - HEC-1 NETWORK

DIBBLE

HEC-1 Combine Point
HEC-1 Diversion
HEC-1 Routing
Sub-Basins

400200 0 400 Feet

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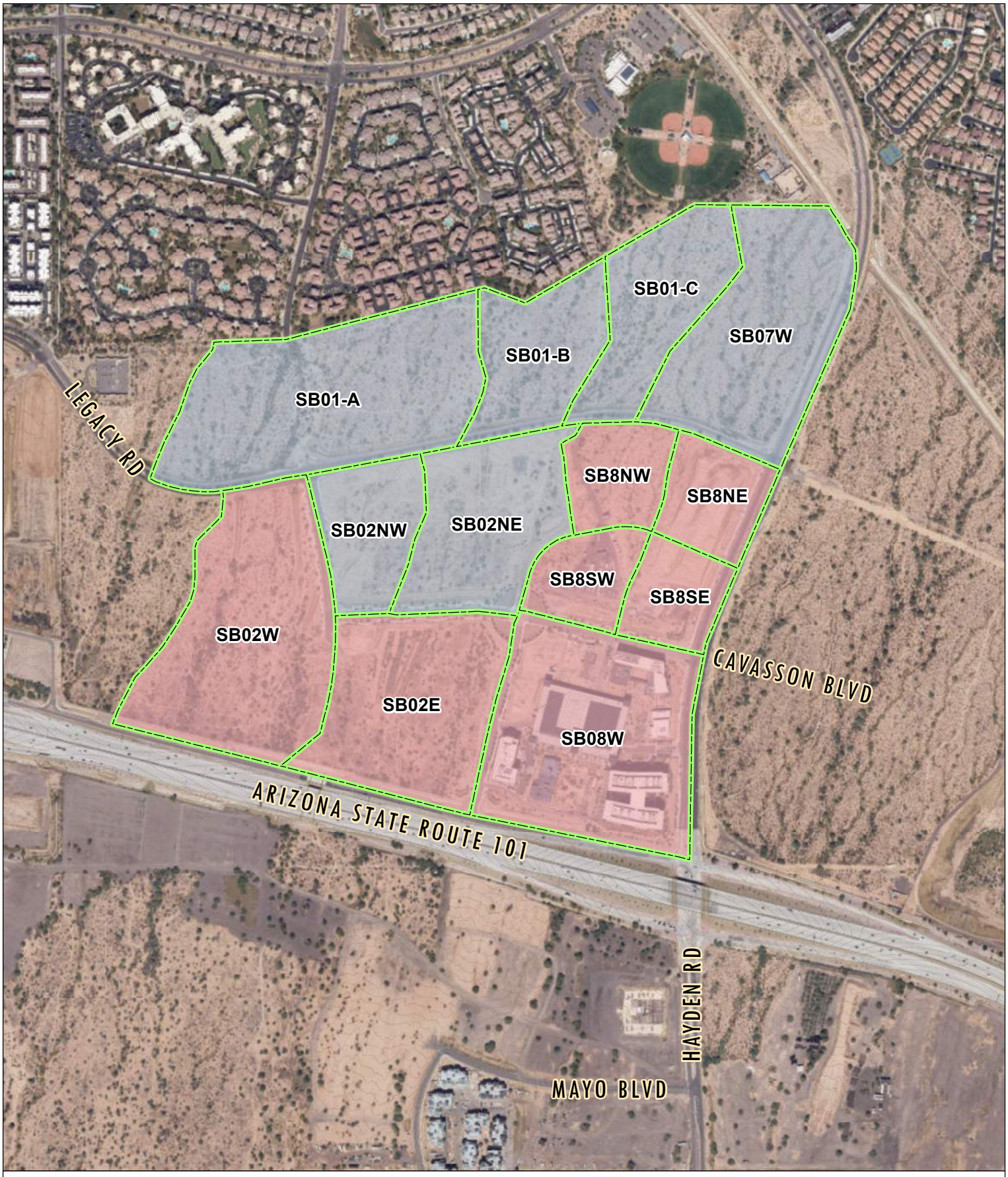
Date Saved: 7/20/2023 11:46:20 AM



BANNER/NEXCORE HEALTH CENTER PLUS
EXHIBIT C-3 - LAND USE MAP

DIBBLE

Sub-Basins
1-Foot Topographic Contours
Commercial
Multi-Family

400 200 0 400 Feet

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Date Saved: 7/20/2023 5:07:16 PM



BANNER/NEXCORE HEALTH CENTER PLUS
EXHIBIT C-4 - SOILS MAP

DIBBLE

Sub-Basins
Gilman loams
Momoli gravelly sandy loam, 1 to 5 percent slopes

400 200 0 400 Feet

Path: J:\2021\1121151 Banner Scottsdale Campus\GIS\Exhibits\FloodControl\500-year Exhibits\Hayden 2\Soils Map.mxd

Date Saved: 7/20/2023 5:14:08 PM

ID	Method	Duration	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	500 Yr
DEFAULT	NOAA14	5 MIN	0.349	0.418	0.511	0.583	0.656	0.827
	NOAA14	10 MIN	0.530	0.636	0.778	0.887	0.998	1.259
	NOAA14	15 MIN	0.658	0.789	0.965	1.099	1.237	1.561
	NOAA14	30 MIN	0.886	1.063	1.299	1.480	1.666	2.102
	NOAA14	1 HOUR	1.096	1.315	1.608	1.832	2.062	2.601
	NOAA14	2 HOUR	1.251	1.490	1.814	2.060	2.315	2.911
	NOAA14	3 HOUR	1.339	1.588	1.936	2.212	2.498	3.211
	NOAA14	6 HOUR	1.549	1.817	2.182	2.465	2.760	3.470
	NOAA14	12 HOUR	1.734	2.016	2.399	2.690	2.993	3.704
	NOAA14	24 HOUR	2.097	2.476	3.005	3.425	3.865	4.962

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	500 Yr
Major Basin ID: 01																		
SB01-C	0.028	0.33	96.4	96.4	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.280	0.261	0.241	0.227	0.215	0.193
												Vel (f/s)	1.73	1.85	2.01	2.13	2.25	2.51
												R (Hrs)	0.285	0.263	0.241	0.226	0.213	0.189
SB01-B	0.024	0.28	114.5	114.5	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.249	0.231	0.214	0.202	0.191	0.172
												Vel (f/s)	1.65	1.78	1.92	2.03	2.15	2.39
												R (Hrs)	0.239	0.221	0.202	0.189	0.178	0.158
SB01-A	0.062	0.28	121.1	121.1	URBAN	0.030	0.25	0.25	4.12	0.526	45	**Tc (Hrs)**	0.231	0.216	0.199	0.188	0.178	0.160
												Vel (f/s)	1.78	1.90	2.06	2.18	2.31	2.57
												R (Hrs)	0.128	0.119	0.109	0.102	0.096	0.085
SB02NE	0.034	0.39	72.4	72.4	URBAN	0.032	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.333	0.310	0.286	0.270	0.256	0.230
												Vel (f/s)	1.72	1.85	2.00	2.12	2.23	2.49
												R (Hrs)	0.353	0.326	0.299	0.280	0.263	0.234
SB02NW	0.020	0.19	85.9	85.9	URBAN	0.033	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.224	0.208	0.193	0.182	0.172	0.155
												Vel (f/s)	1.24	1.34	1.44	1.53	1.62	1.80
												R (Hrs)	0.173	0.160	0.146	0.137	0.129	0.115
SB02E	0.045	0.36	82.0	82.0	URBAN	0.031	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.272	0.257	0.240	0.228	0.218	0.199
												Vel (f/s)	1.94	2.05	2.20	2.32	2.42	2.65
												R (Hrs)	0.225	0.211	0.196	0.186	0.177	0.159
SB02W	0.058	0.35	87.6	87.6	URBAN	0.114	0.10	0.25	4.33	0.513	80	**Tc (Hrs)**	0.515*	0.487*	0.454*	0.433*	0.414	0.377
												Vel (f/s)	1.00	1.05	1.13	1.19	1.24	1.36
												R (Hrs)	0.388	0.364	0.337	0.320	0.304	0.275
SB8NW	0.015	0.15	82.8	82.8	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.184	0.173	0.162	0.154	0.147	0.134
												Vel (f/s)	1.20	1.27	1.36	1.43	1.50	1.64
												R (Hrs)	0.135	0.127	0.118	0.112	0.106	0.096
SB8NE	0.015	0.14	85.1	85.1	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.176	0.166	0.155	0.148	0.141	0.129
												Vel (f/s)	1.17	1.24	1.32	1.39	1.46	1.59
												R (Hrs)	0.122	0.115	0.106	0.101	0.096	0.086

* Non default value or value out of range

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	500 Yr
Major Basin ID: 01																		
SB8SW	0.013	0.14	115.9	115.9	URBAN	0.034	0.10	0.25	4.03	0.608	80	**Tc (Hrs)**	0.160	0.151	0.141	0.134	0.128	0.117
												Vel (f/s)	1.28	1.36	1.46	1.53	1.60	1.75
												R (Hrs)	0.119	0.112	0.104	0.098	0.093	0.084
SB8SE	0.013	0.16	104.4	104.4	URBAN	0.034	0.10	0.25	4.03	0.607	80	**Tc (Hrs)**	0.176	0.166	0.156	0.148	0.142	0.129
												Vel (f/s)	1.33	1.41	1.50	1.59	1.65	1.82
												R (Hrs)	0.148	0.139	0.129	0.122	0.116	0.105
SB08W	0.060	0.34	64.1	64.1	URBAN	0.030	0.10	0.25	4.22	0.540	80	**Tc (Hrs)**	0.280	0.264	0.247	0.235	0.225	0.205
												Vel (f/s)	1.78	1.89	2.02	2.12	2.22	2.43
												R (Hrs)	0.189	0.177	0.164	0.155	0.148	0.134
SB07W	0.048	0.31	98.7	98.7	URBAN	0.031	0.25	0.25	4.03	0.562	45	**Tc (Hrs)**	0.265	0.247	0.228	0.215	0.204	0.183
												Vel (f/s)	1.72	1.84	1.99	2.11	2.23	2.48
												R (Hrs)	0.187	0.173	0.159	0.149	0.140	0.124

Banner Healthcare
Drainage Design Management System
LAND USE
Project Reference: BANNER 24HR ULT

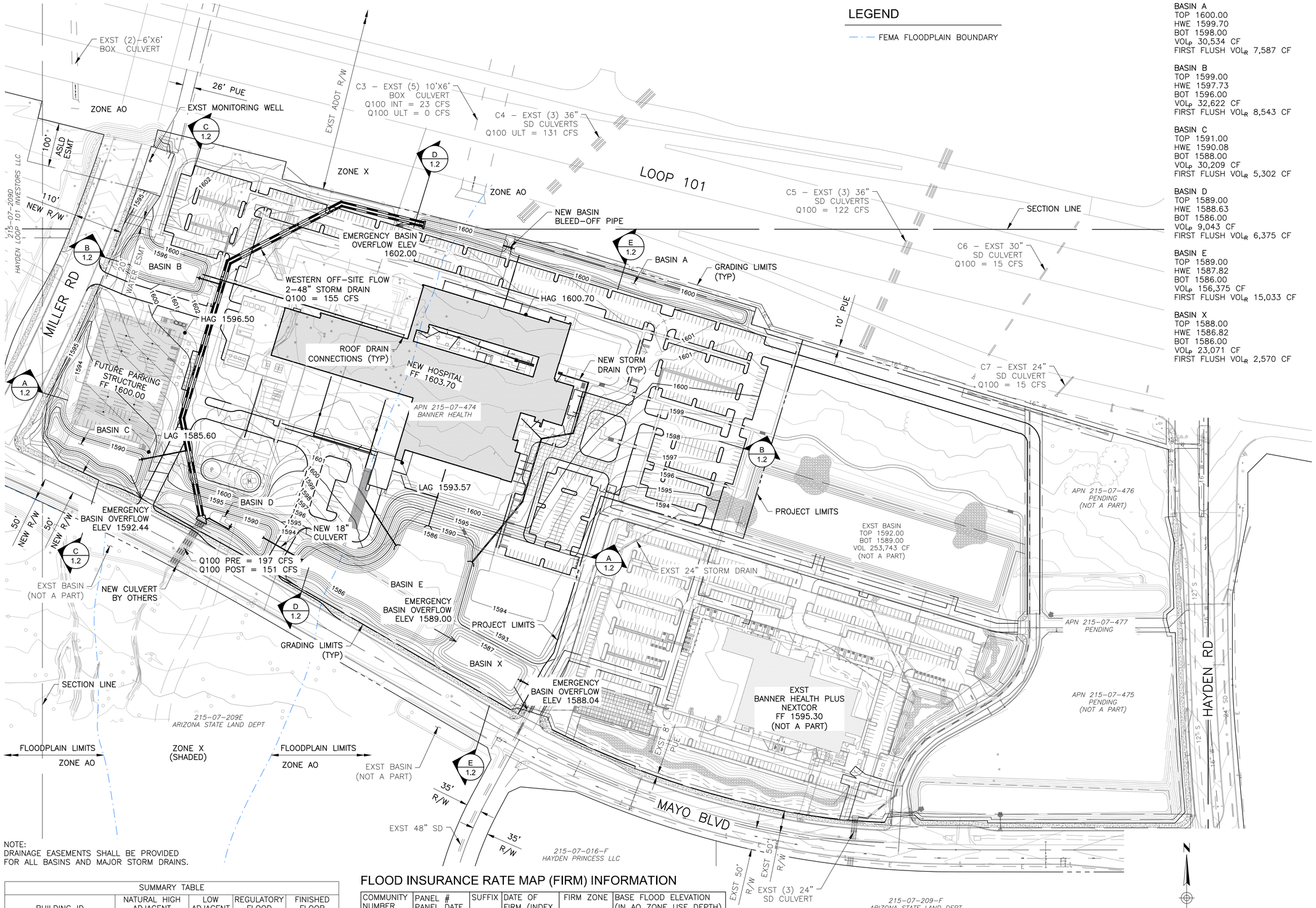
Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
Major Basin ID: 01									
SB01-A	180	0.0622	100.0	0.25	45	50.0	NORMAL	0.030	High Density Residential - Multi Family (10-15 du per acre)
		0.0622	**100.0**						
SB01-B	180	0.0245	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
		0.0245	**100.0**						
SB01-C	180	0.0275	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
		0.0275	**100.0**						
SB02E	200	0.0450	100.0	0.10	80	60.0	NORMAL	0.031	General Commercial (Commercial where no detail available)
		0.0450	**100.0**						
SB02NE	180	0.0343	100.0	0.25	45	50.0	NORMAL	0.032	High Density Residential - Multi Family (10-15 du per acre)
		0.0343	**100.0**						
SB02NW	180	0.0197	100.0	0.25	45	50.0	NORMAL	0.033	High Density Residential - Multi Family (10-15 du per acre)
		0.0197	**100.0**						
SB02W	200	0.0583	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
		0.0583	**100.0**						
SB07W	180	0.0477	100.0	0.25	45	50.0	NORMAL	0.031	High Density Residential - Multi Family (10-15 du per acre)
		0.0477	**100.0**						
SB08W	200	0.0601	100.0	0.10	80	60.0	NORMAL	0.030	General Commercial (Commercial where no detail available)
		0.0601	**100.0**						
SB8NE	200	0.0153	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
		0.0153	**100.0**						
SB8NW	200	0.0150	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)

* Non default value

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb	Description
Major Basin ID: 01									
		0.0150	**100.0**						
SB8SE	200	0.0134	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
		0.0134	**100.0**						
SB8SW	200	0.0131	100.0	0.10	80	60.0	NORMAL	0.034	General Commercial (Commercial where no detail available)
		0.0131	**100.0**						

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)	Comments
Major Basin ID: 01									
SB01-A	645	55	64555	0.011	18.20	0.270	-	100	
	645	90	64590	0.051	81.80	0.390	-	100	
SB01-B	645	90	64590	0.025	100.00	0.390	-	100	
SB01-C	645	90	64590	0.028	100.00	0.390	-	100	
SB02E	645	90	64590	0.045	100.00	0.390	-	100	
SB02NE	645	90	64590	0.034	100.00	0.390	-	100	
SB02NW	645	90	64590	0.020	100.00	0.390	-	100	
SB02W	645	55	64555	0.027	46.40	0.270	-	100	
	645	90	64590	0.031	53.60	0.390	-	100	
SB07W	645	90	64590	0.048	100.00	0.390	-	100	
SB08W	645	55	64555	0.020	33.30	0.270	-	100	
	645	90	64590	0.040	66.70	0.390	-	100	
SB8NE	645	90	64590	0.015	100.00	0.390	-	100	
SB8NW	645	90	64590	0.015	100.00	0.390	-	100	
SB8SE	645	55	64555	0.000	0.70	0.270	-	100	
	645	90	64590	0.013	99.30	0.390	-	100	
SB8SW	645	90	64590	0.013	100.00	0.390	-	100	

ID	Type	Area (sq mi)	Discharge cfs 5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	500 Yr
Major Basin 01								
X188	Hydrograph	0.24						213
X189	Hydrograph	0.10						20
HYDRO	Combined	0.24						226
SB01-A	Hydrograph	0.06						177
DT01A	Diversion	0.06						3
SB01A	Hydrograph	0.06						177
CP-1	Combined	0.30						314
R1A-2W	Routed	0.30						309
SB02NW	Hydrograph	0.02						54
DT02NW	Diversion	0.02						1
SB02NW	Hydrograph	0.02						54
CP-02W	Combined	0.32						363
R2W-2	Routed	0.32						359
X191	Hydrograph	0.10						99
SB01-C	Hydrograph	0.03						63
DT01C	Diversion	0.03						2
SB01C	Hydrograph	0.03						63
CP-01C	Combined	0.03						160
R1C-1B	Routed	0.03						160
X190	Hydrograph	0.10						52
SB01-B	Hydrograph	0.02						59
DT01B	Diversion	0.02						1
SB01B	Hydrograph	0.02						59
CP-01B	Combined	0.05						265
R1B-2N	Routed	0.05						265
SB02NE	Hydrograph	0.03						70
DT02NE	Diversion	0.03						2
SB02NE	Hydrograph	0.03						70
CP-02N	Combined	0.14						334
R2N-2	Routed	0.14						331
SB02E	Hydrograph	0.05						117
DT02E	Diversion	0.05						2
SB02E	Hydrograph	0.05						117
SB02W	Hydrograph	0.06						116
CP-02	Combined	0.51						910
X192	Hydrograph	0.10						19
SB07W	Hydrograph	0.05						126
DT07W	Diversion	0.05						3
SB07W	Hydrograph	0.05						126
CP07W	Combined	0.05						137
R7W-CP	Routed	0.05						94
SB8NW	Hydrograph	0.01						45
DT8NW	Diversion	0.01						1
SB8NW	Hydrograph	0.01						45
R8NW8N	Routed	0.01						45
SB8NE	Hydrograph	0.01						46
DT8NE	Diversion	0.01						1
SB8NE	Hydrograph	0.01						46
R8NE8N	Routed	0.01						46
SB8SW	Hydrograph	0.01						41
DT8SW	Diversion	0.01						1
SB8SW	Hydrograph	0.01						41
SB8SE	Hydrograph	0.01						39
DT8SE	Diversion	0.01						1
SB8SE	Hydrograph	0.01						39
CP-08N	Combined	0.06						169
R8N-8W	Routed	0.06						169
SB08W	Hydrograph	0.06						165
DT08W	Diversion	0.06						3
SB08W	Hydrograph	0.06						165
CP-08W	Combined	0.12						332



NOTE:
DRAINAGE EASEMENTS SHALL BE PROVIDED FOR ALL BASINS AND MAJOR STORM DRAINS.

SUMMARY TABLE				
BUILDING ID	NATURAL HIGH ADJACENT GRADE	LOW ADJACENT GRADE	REGULATORY FLOOD DATUM	FINISHED FLOOR ELEVATION
HOSPITAL	1600.70	1593.57	1603.70	1603.70
FUTURE PARKING GARAGE	1596.50	1585.60	1597.50	1600.00

NOTE: ALL ELECTROMECHANICAL EQUIPMENT PAD ELEVATIONS SHALL BE SET AT OR ABOVE REGULATORY FLOOD DATUM ELEVATION.

FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

COMMUNITY NUMBER	PANEL # PANEL DATE	SUFFIX	DATE OF FIRM (INDEX DATE)	FIRM ZONE	BASE FLOOD ELEVATION (IN AO ZONE USE DEPTH)
045012	1320 4/30/2024	L	2/8/2024	AO	DEPTH 1
045012	1320 4/30/2024	L	2/8/2024	X (SHADED)	N/A

ENGINEER'S FEMA CERTIFICATION

THE LOWEST FLOOR ELEVATION(S) AND/OR FLOOD PROOFING ELEVATION(S) ON THIS PLAN ARE SUFFICIENTLY HIGH TO PROVIDE PROTECTION FROM FLOODING CAUSED BY A 100-YEAR STORM, AND ARE IN ACCORDANCE WITH SCOTTSDALE REVISED CODE, CHAPTER 37 - FLOODPLAIN AND STORM WATER REGULATION.

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811 Call 811 or click Arizona811.com

Plot Date: 6/10/2025 4:31:17 PM G:\2024\1124152_Banner_Health_Scottsdale\CAD\1124152-H4-PRELIM G&D.dwg

Banner Health
Medical Center

SCOTTSDALE CAMPUS HOSPITAL
NW Corner of Hayden Rd. and Mayo Blvd.
Scottsdale, Arizona 85255

SMITHGROUP
455 NORTH THIRD STREET
SUITE 250
PHOENIX, AZ 85004
602.265.2200
smithgroup.com

DIBBLE
CIVIL
1626 N LITCHFIELD ROAD
SUITE 150
GOODYEAR, AZ 85395
623.935.2258
dibblecorp.com

ISSUED FOR	REV	DATE
ENTITLEMENT REVIEW		14JUL25

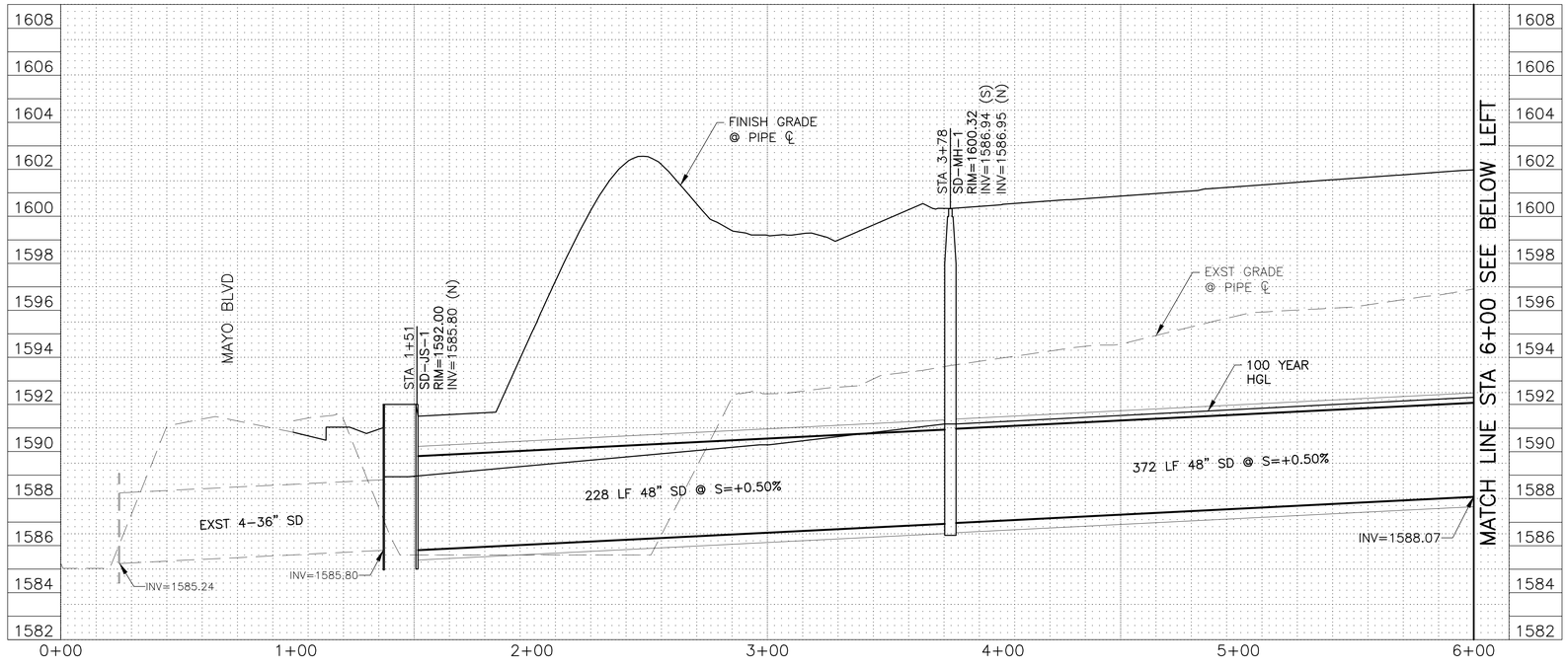
SEALS AND SIGNATURES

NOT FOR CONSTRUCTION

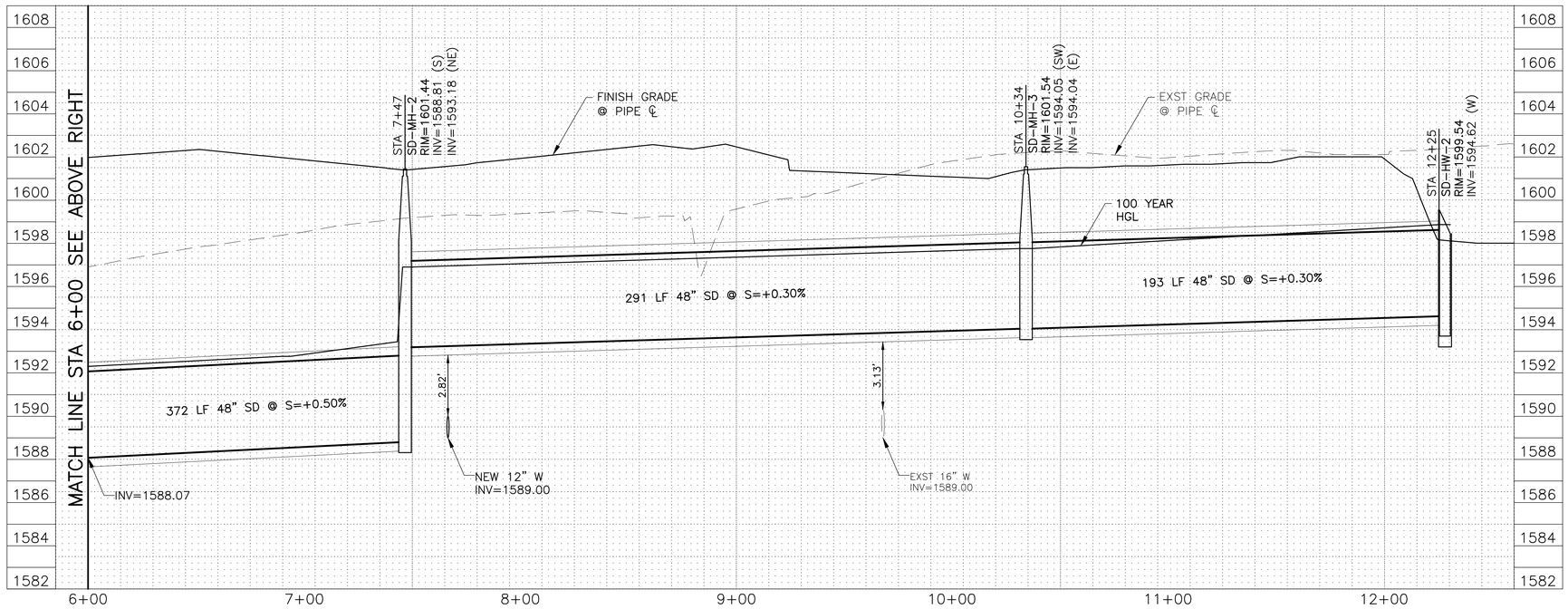
SHEET TITLE
PRELIMINARY GRADING & DRAINAGE

PROJECT NUMBER
PC1.0

SHEET NUMBER



WESTERN OFF-SITE FLOW STORM DRAIN



WESTERN OFF-SITE FLOW STORM DRAIN

0' 15' 30' 60'

SCALE: 1"=30' H
1"=3' V

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA 811
Call 811 or click Arizona811.com

Plot Date: 6/10/2025 4:31:19 PM G:\2024\1124152_Banner_Health_Scottsdale\CAD\1124152-H4-PRELIM G&D.dwg

Banner Health
Medical Center

SCOTTSDALE CAMPUS HOSPITAL
NW Corner of Hayden Rd. and Mayo Blvd.
Scottsdale, Arizona 85255

SMITHGROUP
455 NORTH THIRD STREET
SUITE 250
PHOENIX, AZ 85004
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smithgroup.com

DIBBLE
CIVIL
1626 N LITCHFIELD ROAD
SUITE 150
GOODYEAR, AZ 85395
623.935.2258
dibblecorp.com

ISSUED FOR	REV	DATE
ENTITLEMENT REVIEW		14JUL25

SEALS AND SIGNATURES

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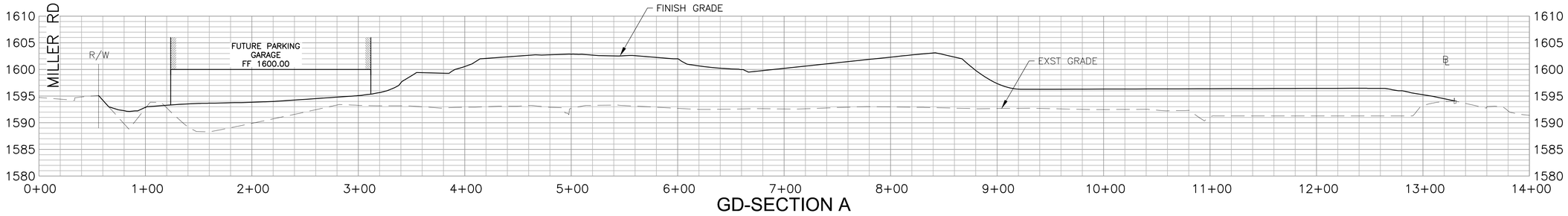
SHEET TITLE

STORM DRAIN PROFILES

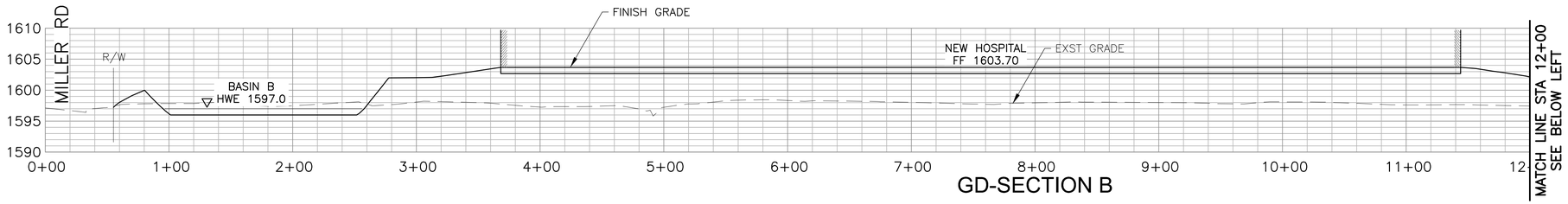
PROJECT NUMBER

PC1.1

SHEET NUMBER



GD-SECTION A



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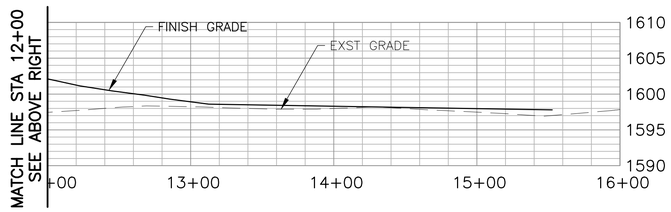

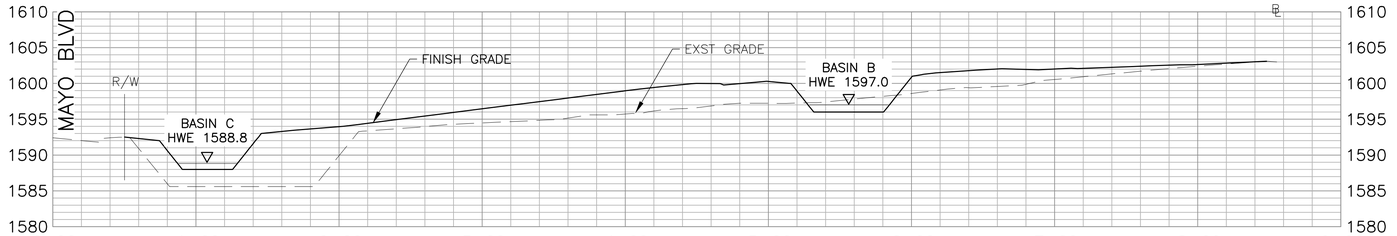

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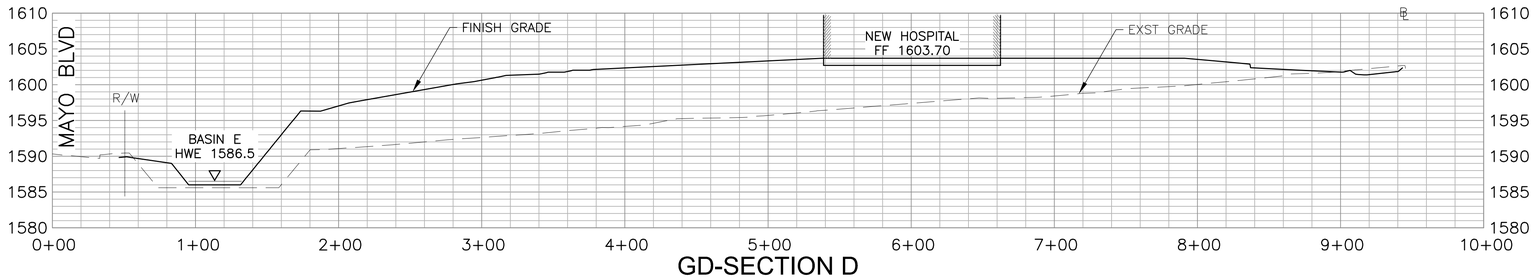
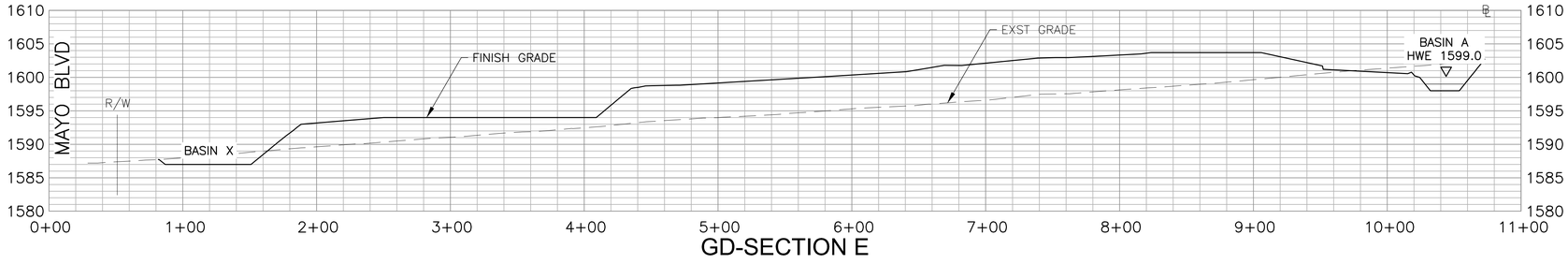


GD-SECTION D



GD-SECTION E

0' 25' 50' 100'

SCALE: 1"=50' H
1"=10' V

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ARIZONA811
Call 811 or click Arizona811.com

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Banner Health
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SEALS AND SIGNATURES

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SHEET TITLE

CROSS SECTIONS

PROJECT NUMBER

PC1.2

SHEET NUMBER