

**FINAL Basis of Design Report**

- APPROVED
- APPROVED AS NOTED
- REVISE AND RESUBMIT



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 12/8/2023

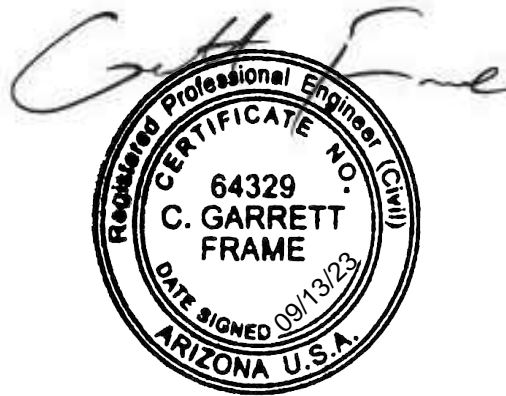
# Master and Final Wastewater Basis of Design Report

Legacy North

NWC Legacy Boulevard and Miller Road

Prepared for:

The Dinerstein Companies  
1010 S. Coast Highway 101, Ste 106  
Encinitas, CA 92024



Prepared by:

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





# Legacy North

## MASTER AND FINAL WASTEWATER BASIS OF DESIGN REPORT

SEPTEMBER 2023

Prepared By:

**Kimley»»Horn**

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## 1.0 INTRODUCTION

Kimley-Horn and Associates, Inc. has prepared this wastewater basis of design report for the proposed Legacy North development at the northwest corner of Legacy Boulevard and Miller Road in Scottsdale, Arizona. This report intends to demonstrate that the proposed project conforms to the City of Scottsdale design requirements.

The Legacy North Development encompasses approximately 18.52 net acres and contains a various multi-family residential buildings totaling 443 dwelling units as well as 11,200 square feet of leasing and amenity space. The project lies within a portion of the Northwest Quarter of Section 26, Township 4 North, Range 4 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. More specifically, the site is bounded on the west by an APS substation, on the south by Legacy Boulevard, on the north by a condominium subdivision complex, and east by undeveloped commercial land. See **Appendix A** for the Vicinity Map.

## 2.0 WASTEWATER COLLECTION SYSTEM

### 2.1 INTENT AND SCOPE

The intent of this section is to evaluate the proposed sewer infrastructure and wastewater design flows for the development. As a result of this analysis, it will be determined if the sewer infrastructure is capable of supporting the proposed development in accordance with the City of Scottsdale Design Standards & Policies Manual (**Reference 1**) and the approved Cavasson Master Wastewater Report (**Reference 2**).

### 2.2 SEWER INFRASTRUCTURE

There is an existing 8-inch PVC sewer main that transitions to a 12-inch PVC sewer main located in Legacy Boulevard along the south side of the project. There is an existing 12-inch PVC sewer main stub located in Miller Road alignment, just north of the Legacy Boulevard and Miller Road intersection. The sewer main in Legacy Road has 6 sewer stubs extending onto the project site. The existing sewer mains combine at an existing manhole at the intersection of Legacy Boulevard and Miller Road and flow southeast approximately 4,500 feet to a City of Scottsdale lift station.

An 8-inch PVC on-site private sewer main with 6-inch PVC sewer services will serve the proposed development. The Legacy North development will connect to two of the 8-inch PVC sewer main stubs in Legacy Boulevard and extend the sewer main through the site. Additionally, the existing sewer main in Miller Road will be extended along the site frontage with 8-inch PVC pipe. Two private sewer mains will connect to the proposed sewer main in Miller Road and extend through the site. Refer to **Appendix B** for the Preliminary Utility Plan.

## 2.3 WASTEWATER DESIGN FLOWS

The following calculations are based on information provided in Section 7-1.403 of the City of Scottsdale 2018 DSPM, **Reference 1** and the approved Cavasson Master Wastewater Report, **Reference 2**.

In addition to the unit demands, the Legacy North development will have a single 82,000 gallon pool which will result in an additional 100 gpm load to account for backwash. For calculation purposes, the pool backwash is limited to a maximum of 82,000 gallons applied to the daily total at a rate of 100 gpm. Peaking factors are not applied to the pool backwash demand.

Average Day Sewer Flow, according to 7-1.403A of the 2018 DSPM:

$$\text{Multifamily: } 100 \text{ gpcpd} * 1.7 \text{ persons per unit} = 170 \text{ gpd/unit}$$

$$\text{Legacy North Residential Demand: } (170 \text{ gpd/unit}) * (443 \text{ units}) = 75,310 \text{ gpd} = 52.30 \text{ gpm}$$

$$\text{Legacy North Pool Backwash: } 82,000 \text{ gpd @ } 100 \text{ gpm}$$

$$\text{Average Day (gpd)} = 75,310 \text{ gpd} + 82,000 \text{ gpd} = \mathbf{157,310 \text{ gpd}}$$

$$\text{Average Day (gpm)} = 52.30 \text{ gpm} + 100 \text{ gpm} = \mathbf{152.30 \text{ gpm}}$$

Peak Sewer Flow, with a peaking factor of 4 according to 7-1.403A of the 2018 DSPM:

$$\text{Peak Flow (gpd)} = (75,310 \text{ gpd} * 4) + 82,000 \text{ gpd} = \mathbf{383,240 \text{ gpd}}$$

$$\text{Peak Flow (gpm)} = (52.30 \text{ gpm} * 4) + 100 \text{ gpm} = \mathbf{309.20 \text{ gpm}}$$

The Cavasson Master Wastewater Report analyzed the proposed Legacy North development lot based on specific demand rates as coordinated with the City of Scottsdale staff. The calculations shown below apply these same rates to the development and are for reference only. They are provided to demonstrate that the proposed Legacy North development (Lot 3 in the Master Wastewater Report) will generate lower Average Day and Peak Day demands than calculated in the Cavasson Master Wastewater Report. The Master Wastewater report did not account for pool backwash at specific lots.

Multi-Family Wastewater Demands according to the Cavasson Master Wastewater Report:

$$80 \text{ gpcpd} * 1.7 \text{ persons/unit} * 23 \text{ units/AC} = 3,128 \text{ gal/AC/day}$$

$$\text{Peaking Factor: } 3.76$$

$$\text{Master Plan Lot 3 Average Daily Flow} = 3,128 \text{ gal/AC/day} * \sim 22.81 \text{ AC} = 71,352 \text{ gpd} (49.55 \text{ gpm})$$

$$\text{Master Plan Lot 3 Peak Day Demand} = 71,352 \text{ gpd} * 3.76 = 268,282 \text{ gpd} (186.31 \text{ GPM})$$

The Legacy North development proposes a Gross Residential Density of 21.56 units/AC. As shown in the calculations above, the Cavasson Master Wastewater Report contemplated a density of 23 units/AC. Therefore, the Legacy North development's wastewater demands will be lower than what was anticipated by the Master Report. See **Appendix D** for the Cavasson Master Wastewater Report.

## 2.4 ANALYSIS

A wastewater model of the Master Development was performed in the Cavasson Master Wastewater report by Hubbard Engineering. According to the Master Sewer Loads Exhibit located in Appendix C of the Master Wastewater Report, the Legacy North parcel is located on Lot 3 which has an anticipated peak day demand of 268,282 GPD. When calculating the sewer demands for Legacy North development using the same methodology as the Cavasson Master Wastewater report, the peak daily demand is 226,672 GPD. The peak day demand for the Legacy North site is less than what was previously anticipated in the Cavasson Master Wastewater Report. Therefore, the master development wastewater infrastructure is sufficient to serve the proposed development. See **Appendix D** for the Cavasson Master Wastewater Report.

In accordance with the City of Scottsdale's DSPM, all sanitary sewers within the city shall be designed and constructed such that the full flow velocity is not less than 2.5 ft/sec. The proposed sanitary sewer lines will be designed to maintain a maximum depth to diameter ratio (d/D) of 0.65 during the Peak Flow demand (**309.20 gpm**) calculated in Section 2.3 above. This Peak Flow demand includes pool backwash flows of 100 gpm.

Specifically, the proposed sewer pipes will be analyzed with Manning's Formula within Bentley's FlowMaster V8i software, utilized to verify the sewer capacity and flow velocity for the proposed sewer. The site was separated into four areas based on the ultimate outfall of each building. The area with the worst-case scenario was analyzed with the highest flow rate and smallest pipe diameter which occurs at Building N1 for a 6-inch sewer and when Building Y, Z, C1, D1, J1, K1, N1, and O1 combine into an 8" sewer. Refer to **Appendix A** for Utility Layout. Refer to **Table 1** below and **Appendix C** for results.

**Table 1 – Wastewater Analysis Results**

Pipe Diameter D (inches)	Flow Scenario	Flow Rate (gpm)	Flow Depth d (inches)	Flow Capacity (d/D)	Flow Velocity (ft/sec)
6" Min. Slope 1.50%	Peak Flow	100.00	2.3	0.38	3.13
	Full Flow	233.30	3.9	0.65	3.85
8" Min. Slope 1.00%	Peak Flow	175.56	3.1	0.39	3.09
	Full Flow	410.23	5.2	0.65	3.81

As seen from the results above and in **Appendix C**, the flow velocities and pipe capacities are within the acceptable design criteria.

## 3.0 CONCLUSION

This development proposes to connect the building sewer services to a private on-site sewer main that will discharge to an existing 8-inch PVC sewer main in Legacy Boulevard and a proposed 8-inch PVC sewer main in Miller Road. The existing 8-inch PVC sewer main and proposed 6-inch PVC private sewer services have adequate capacity for the flows generated by the proposed buildings. This development proposes to connect to the Cavasson Master Wastewater sewer main, which has adequate capacity to service the development.

## 4.0 REFERENCES

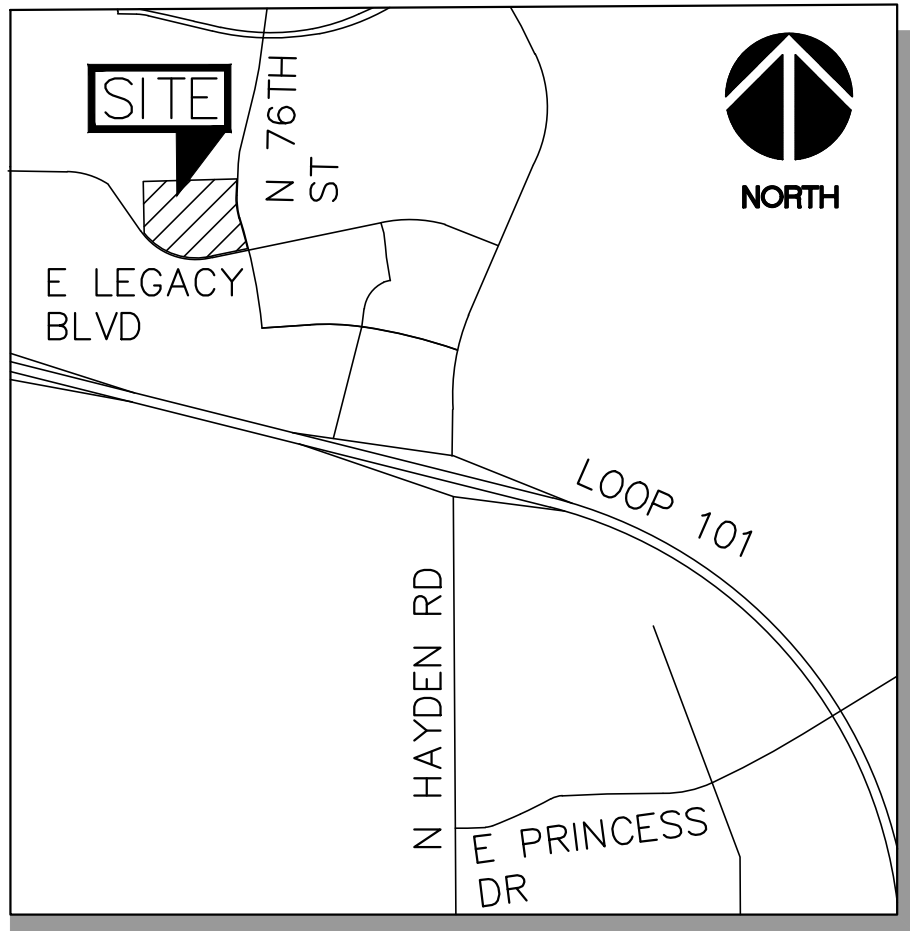
City of Scottsdale, *Design Standards and Policies Manual*. 2018.

Cavasson Master Wastewater Report, March 2019.

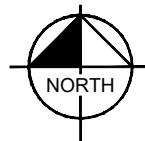
## APPENDIX A: Exhibits

**Exhibit 1 – Vicinity Map**

**Exhibit 2 – Utility Layout**

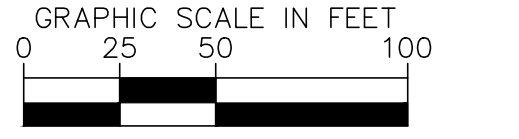
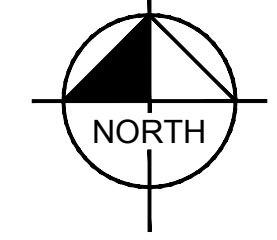


VICINITY MAP  
SCOTTSDALE, AZ  
N.T.S.



VICINITY MAP  
N.T.S.





**LEGEND**

- PROPERTY LINE
- RIGHT OF WAY LINE
- STREET CENTERLINE
- W EXISTING WATER LINE
- S EXISTING SANITARY SEWER MAIN
- W PROPOSED PUBLIC WATER LINE
- F PROPOSED PRIVATE FIRE LINE
- S PROPOSED SANITARY SEWER MAIN
- SEWER OUTFALL AREA LIMITS
- ⊙ EXISTING SANITARY SEWER MANHOLE
- ⊙ PROPOSED SANITARY SEWER MANHOLE
- ⊙ PROPOSED SANITARY SEWER CLEANOUT
- ⊙ EXISTING FIRE HYDRANT
- ⊙ PROPOSED FIRE DEPARTMENT CONNECTION
- ⊙ PROPOSED FIRE HYDRANT



K:\PHX\_Civil\291878000 - Legacy & Miller\CADD\Exhibits\Utility\_Layout.dwg Sep 14, 2023 Max.Holpert



**PUBLIC WATER MAIN NOTES**

- 1 INSTALL 8" CLASS 350 DIP WATER MAIN POLYWRAPPED, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
- 2 INSTALL 8"x6" TEE WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 3 INSTALL 8" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 4 INSTALL FIRE HYDRANT ASSEMBLY WITH VALVE PER MAG STD DET 360.
- 14 INSTALL 6" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
- 15 INSTALL 2" TYPE K SOFT COPPER WATER SERVICE LINE CONNECTION WITH 2" METER PER COS STD DET 2330.

**PRIVATE SEWER NOTES**

- 1 INSTALL 8" SDR-35 PVC PRIVATE SEWER MAIN.
- 2 INSTALL 6" SDR-35 PVC PRIVATE SEWER SERVICE.
- 3 INSTALL 48" SEWER MANHOLE PER MAG STD DET 420-2, INVERTS PER PLAN.
- 4 CONNECT TO BUILDING SEWER AT TWO WAY CLEANOUT. REF MEP PLANS FOR CONTINUATION.
- 5 SEWER CLEANOUT PER MAG STD DET 441.
- 6 INSTALL WYE CONNECTION, INVERT PER PLAN.

**PRIVATE FIRELINE NOTES**

- 1 INSTALL 6" CLASS 350 DIP FIRELINE POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
- 3 BUILDING FIRELINE CONNECTION. INSTALL RISER AND BACKFLOW PREVENTOR PER COS STD DET 2369 IN FIRE RISER ROOM. REF FIRE SPRINKLER PLANS FOR CONTINUATION.
- 4 INSTALL 6" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.

**PRIVATE WATER NOTES**

- 1 BUILDING DOMESTIC WATER CONNECTION, REF MEP PLANS FOR CONTINUATION.
- 2 INSTALL 3" SCH 40 PVC DOMESTIC WATER SERVICE.
- 3 INSTALL 2" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.

**CIVIL ENGINEER**

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**LAND SURVEYOR**

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**ARCHITECT**

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IRVINE, CA 92614  
PH: (949) 851-2133

**FLOOD INFORMATION**

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1320 L, DATED 10/16/2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "AO" IS DEFINED AS AREAS WITH BASE FLOOD ELEVATION OR DEPTH. (DEPTH1 FEET)(VEL 3 FEET/SECOND)

PENDING LOMR APPROVAL THIS PROPERTY WILL BE LOCATED IN FLOOD ZONE "X" IS DEFINED AS AREAS OF 0.2% ANNUAL CHANCE FLOOD HAZARD, AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTH LESS THAN ONE FOOT OR WITH DRAINAGE AREAS OF LESS THAN ONE SQUARE MILE.

**BASIS OF BEARING**

PER SURVEY INNOVATION GROUP, THE BASIS OF BEARING IS THE SOUTH LINE OF THE SOUTHEAST QUARTER OF SECTION 26, TOWNSHIP 4 NORTH, RANGE 4 EAST OF THE GLA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA, AS SHOWN IN BOOK 693, PAGE 3 MARICOPA COUNTY RECORDS.

SAID LINE BEARS SOUTH 89 DEGREES 58 MINUTES 20 SECONDS EAST.

**NOTES**

1. ADD 1500' TO ALL ELEVATIONS.
2. ALL ELEVATIONS ARE INVERT ELEVATIONS, UNLESS OTHERWISE NOTED.
3. SEE HEREON FOR LEGEND.
4. ALL PIPE CROSSING INFORMATION IS PRELIMINARY AND SUBJECT TO CHANGE DURING FINAL DESIGN.
5. STATIONS AND OFFSETS ARE BASED ON MILLER ROAD CENTERLINE.

**BENCHMARK**

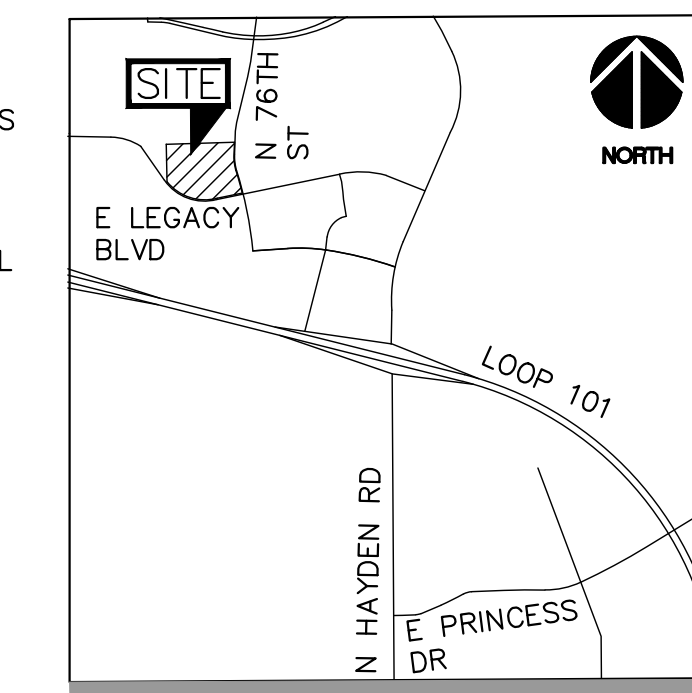
PER SURVEY INNOVATION GROUP, THE BENCHMARK IS:  
FOUND 2 1/2" STEEL PIPE 0.15' UP WITH 3 1/4" BLM BRASS CAP STAMPED "T4N R4E 1/4 S26 S35 1995"

ELEVATION = 1598.718 (NAVD88)

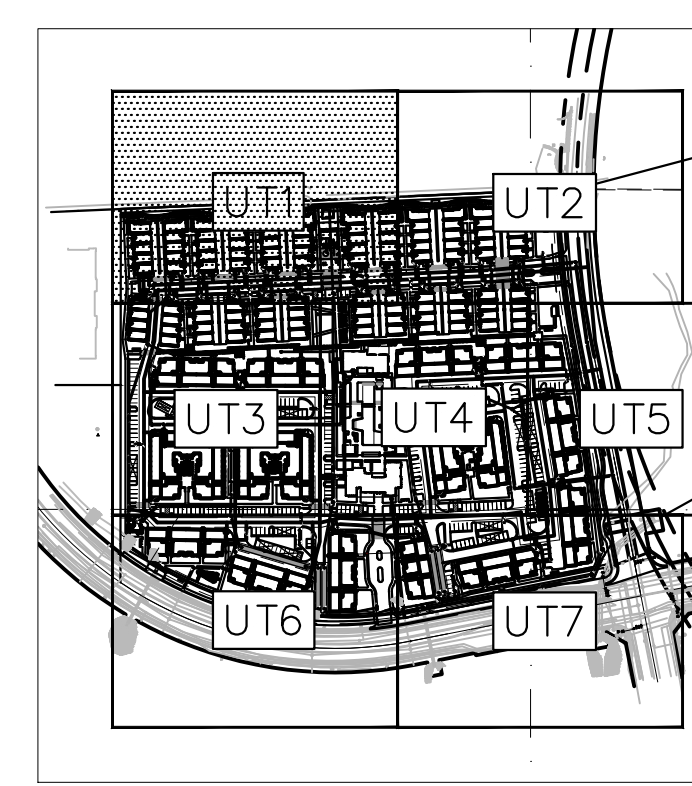
**LEGEND**

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---	RIGHT OF WAY LINE	— F —	PROPOSED FIRE LINE
---	STREET CENTERLINE	— DW —	PROPOSED DOMESTIC WATER LINE
---	EASEMENT LINE	⊗	EXISTING FIRE HYDRANT
---	EXISTING SANITARY SEWER MAIN	⊗	PROPOSED FIRE HYDRANT
---	EXISTING PUBLIC WATER MAIN	⊗	PROPOSED FIRE DEPARTMENT CONNECTION
---	EXISTING CABLE TV LINE	⊗	PROPOSED CATCH BASIN
---	EXISTING ELECTRIC LINE	⊗	EXISTING SANITARY SEWER MANHOLE
---	EXISTING STORM DRAIN	⊗	PROPOSED SANITARY SEWER MANHOLE
---	PROPOSED STORM DRAIN	⊗	
---	PROPOSED WATER MAIN	⊗	

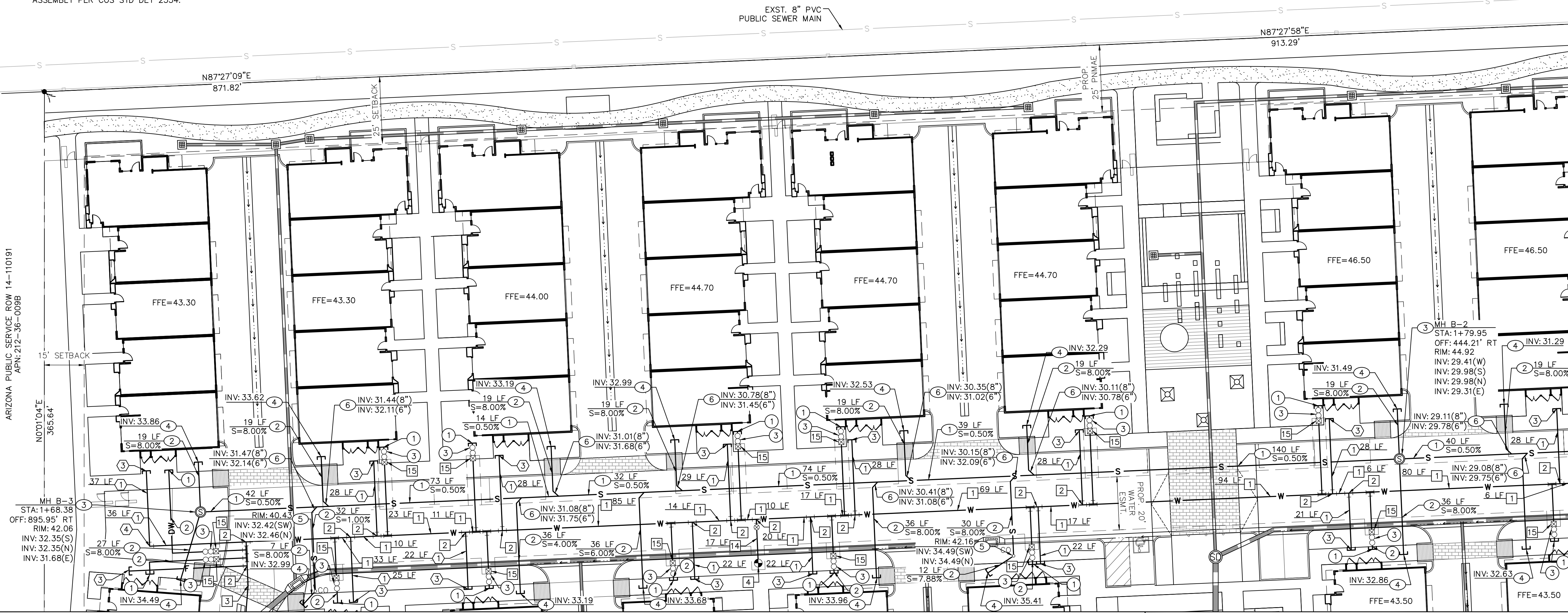
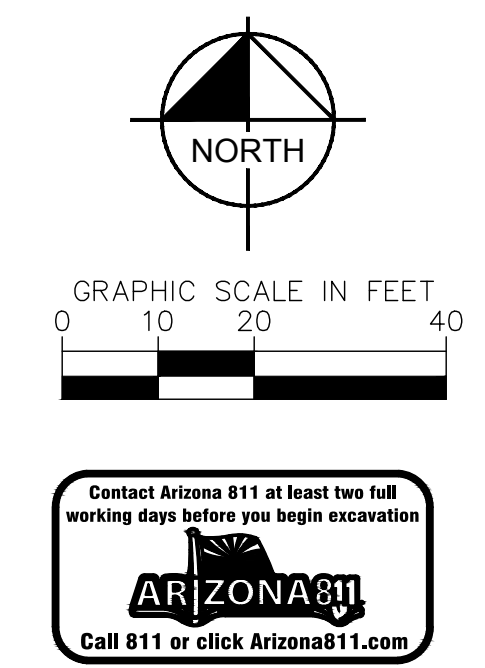
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VILLAGE AT GREYHAWK OWNERS ASSOCIATION  
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ZONING: R-5



VICINITY MAP  
SCOTTSDALE, AZ  
N.T.S.



KEY MAP  
N.T.S.



ARIZONA PUBLIC SERVICE BCW 14-110191  
APN: 212-36-008B

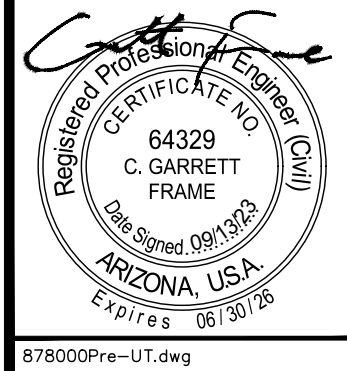
MATCH LINE: SEE SHEET UT2

MATCH LINE: SEE SHEET UT3

MATCH LINE: SEE SHEET UT4

NWC LEGACY BLVD AND MILLER ROAD  
**PRELIMINARY UTILITY PLAN**  
SCOTTSDALE, ARIZONA

PROJECT No.  
291878000  
SCALE (H): 1"=20'  
SCALE (V): NONE  
DRAWN BY: HDO  
DESIGN BY: RMH  
CHECK BY: CGF  
DATE: 09/13/23



APPR  
DATE  
BY  
DESCRIPTION  
REV

**PUBLIC WATER MAIN NOTES**

- 1 INSTALL 8" CLASS 350 DIP WATER MAIN POLYWRAPPED, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
- 2 INSTALL 8"x6" TEE WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 3 INSTALL 8" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 4 INSTALL FIRE HYDRANT ASSEMBLY WITH VALVE PER MAG STD DET 360.
- 9 CONNECT TO EXISTING 12" WATER MAIN WITH 12" BEND.
- 13 INSTALL 12"x8" TEE WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 14 INSTALL 6" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
- 15 INSTALL 2" TYPE K SOFT COPPER WATER SERVICE LINE CONNECTION WITH 2" METER PER COS STD DET 2330.
- 18 INSTALL 12" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN. 3' MINIMUM COVER.
- 20 INSTALL 1" TYPE K SOFT COPPER LANDSCAPE SERVICE LINE CONNECTION WITH 1" METER PER COS STD DET 2330.

**PRIVATE SEWER NOTES**

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- 4 CONNECT TO BUILDING SEWER AT TWO WAY CLEANOUT. REF MEP PLANS FOR CONTINUATION.
- 6 INSTALL WYE CONNECTION, INVERT PER PLAN.

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- 3 INSTALL 2" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.
- 4 INSTALL 1" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.

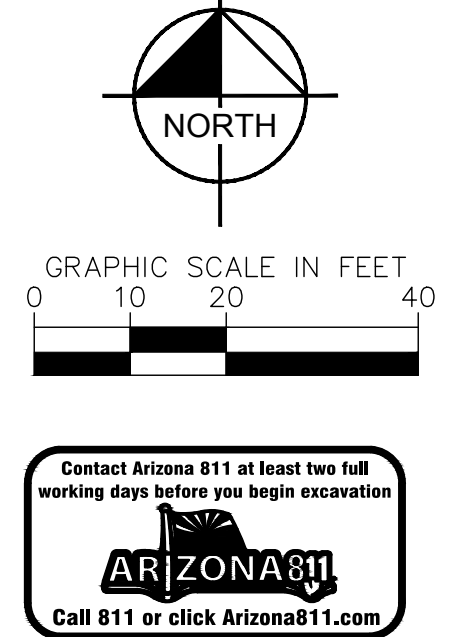
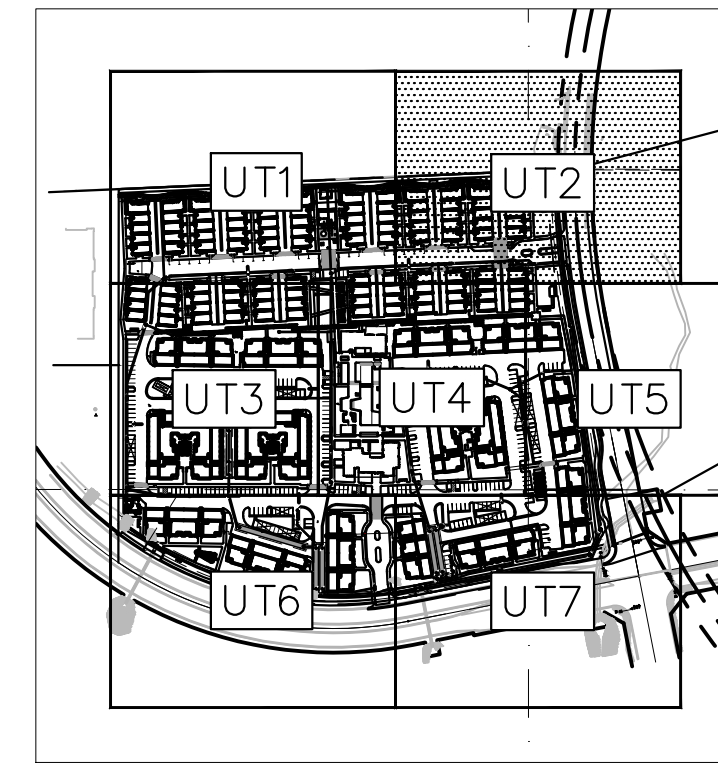
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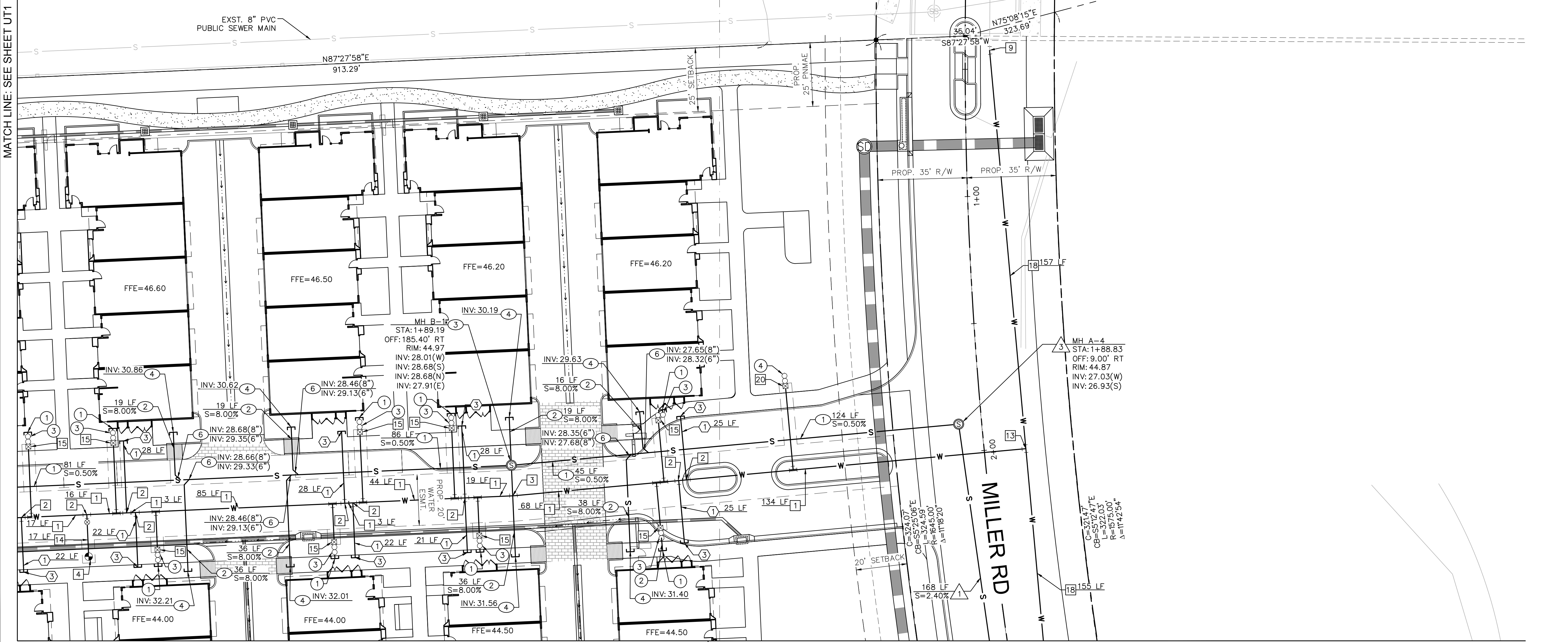
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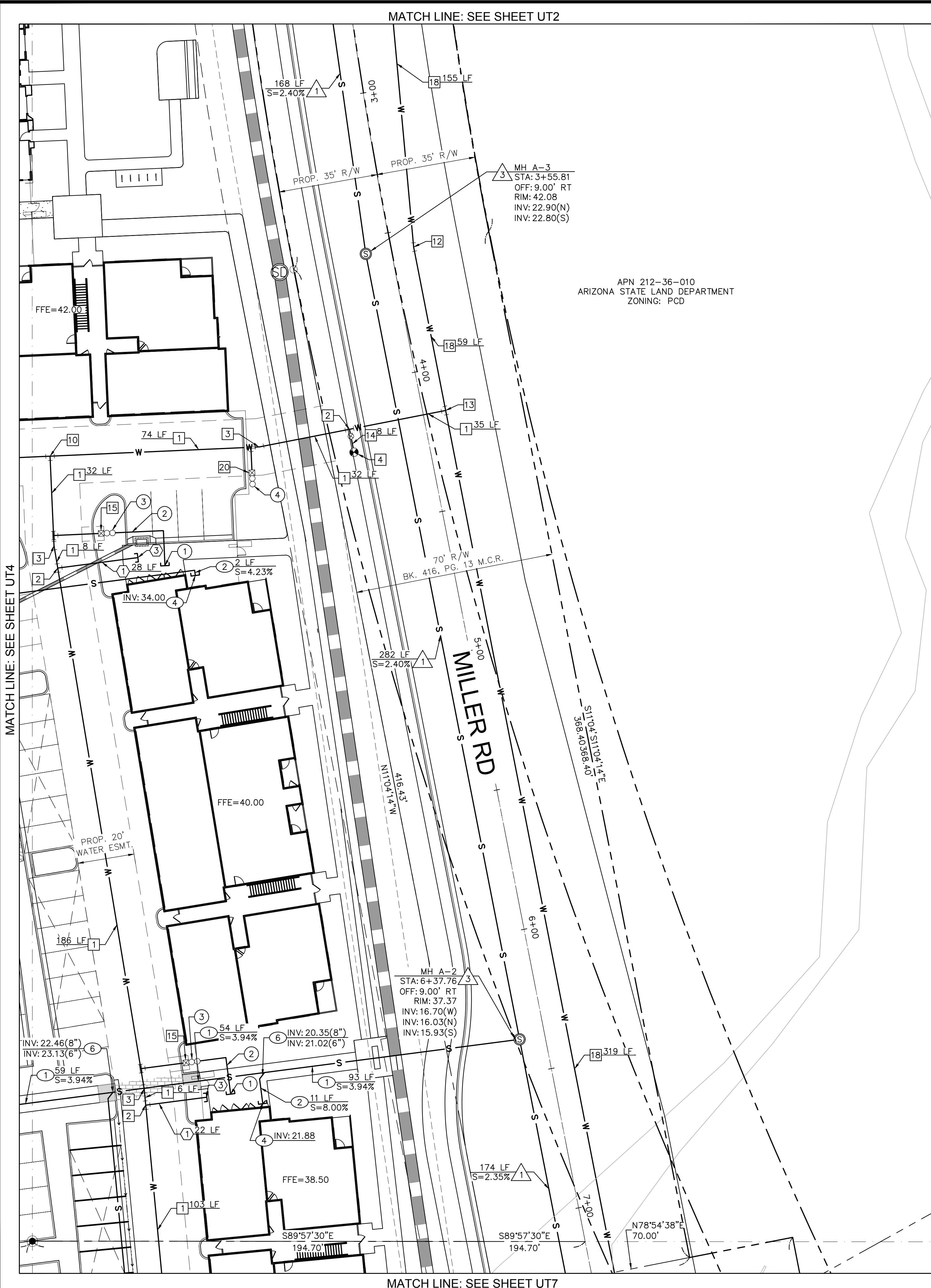
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**UT2**  
2 OF 7 SHEETS

**Kimley»Horn**  
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7740 North 16th Street, Suite 300  
Phoenix, Arizona 85020 (602) 944-5500





REV	DESCRIPTION	DATE	BY	APPR



MATCH LINE: SEE SHEET UT7

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- 3 INSTALL 8" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 4 INSTALL FIRE HYDRANT ASSEMBLY WITH VALVE PER MAG STD DET 360.
- 10 INSTALL 8"x8" TEE WITH THRUST BLOCKS PER MAG STD DET 380.
- 12 INSTAL 12" BEND WITH THRUST BLOCKS PER MAG STD DET 380.
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- 18 INSTALL 12" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN. 3' MINIMUM COVER.
- 20 INSTALL 1" TYPE K SOFT COPPER LANDSCAPE SERVICE LINE CONNECTION WITH 1" METER PER COS STD DET 2330.

**PRIVATE SEWER NOTES**

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**PRIVATE WATER NOTES**

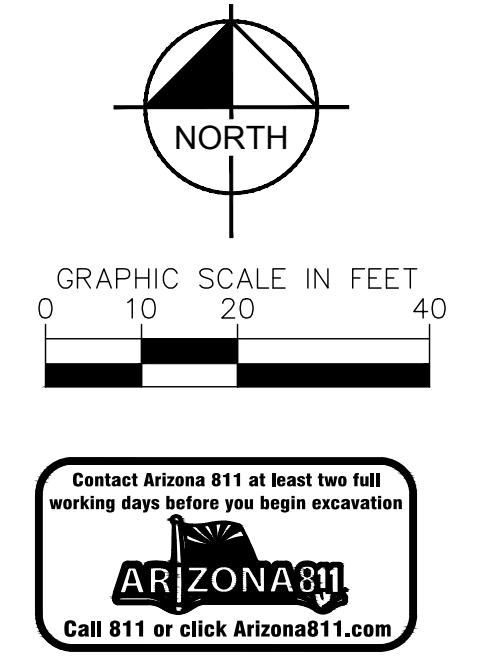
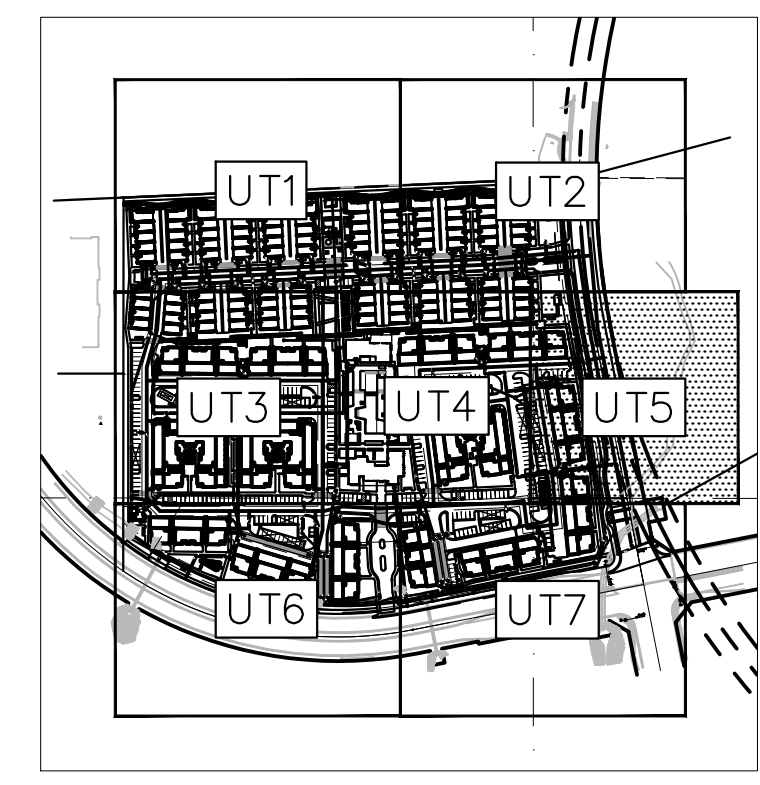
- 1 BUILDING DOMESTIC WATER CONNECTION, REF MEP PLANS FOR CONTINUATION.
- 2 INSTALL 3" SCH 40 PVC DOMESTIC WATER SERVICE.
- 3 INSTALL 2" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.
- 4 INSTALL 1" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.

**PUBLIC SEWER NOTES**

- 1 INSTALL 8" SDR-35 PVC PUBLIC SEWER MAIN.
- 3 INSTALL 48" SEWER MANHOLE PER MAG STD DET 420-2, INVERTS PER PLAN.

**NOTES**

1. ADD 1500' TO ALL ELEVATIONS.
2. ALL ELEVATIONS ARE INVERT ELEVATIONS, UNLESS OTHERWISE NOTED.
3. SEE SHEET UT1 FOR LEGEND.
4. ALL PIPE CROSSING INFORMATION IS PRELIMINARY AND SUBJECT TO CHANGE DURING FINAL DESIGN.
5. STATIONS AND OFFSETS ARE BASED ON MILLER ROAD CENTERLINE.



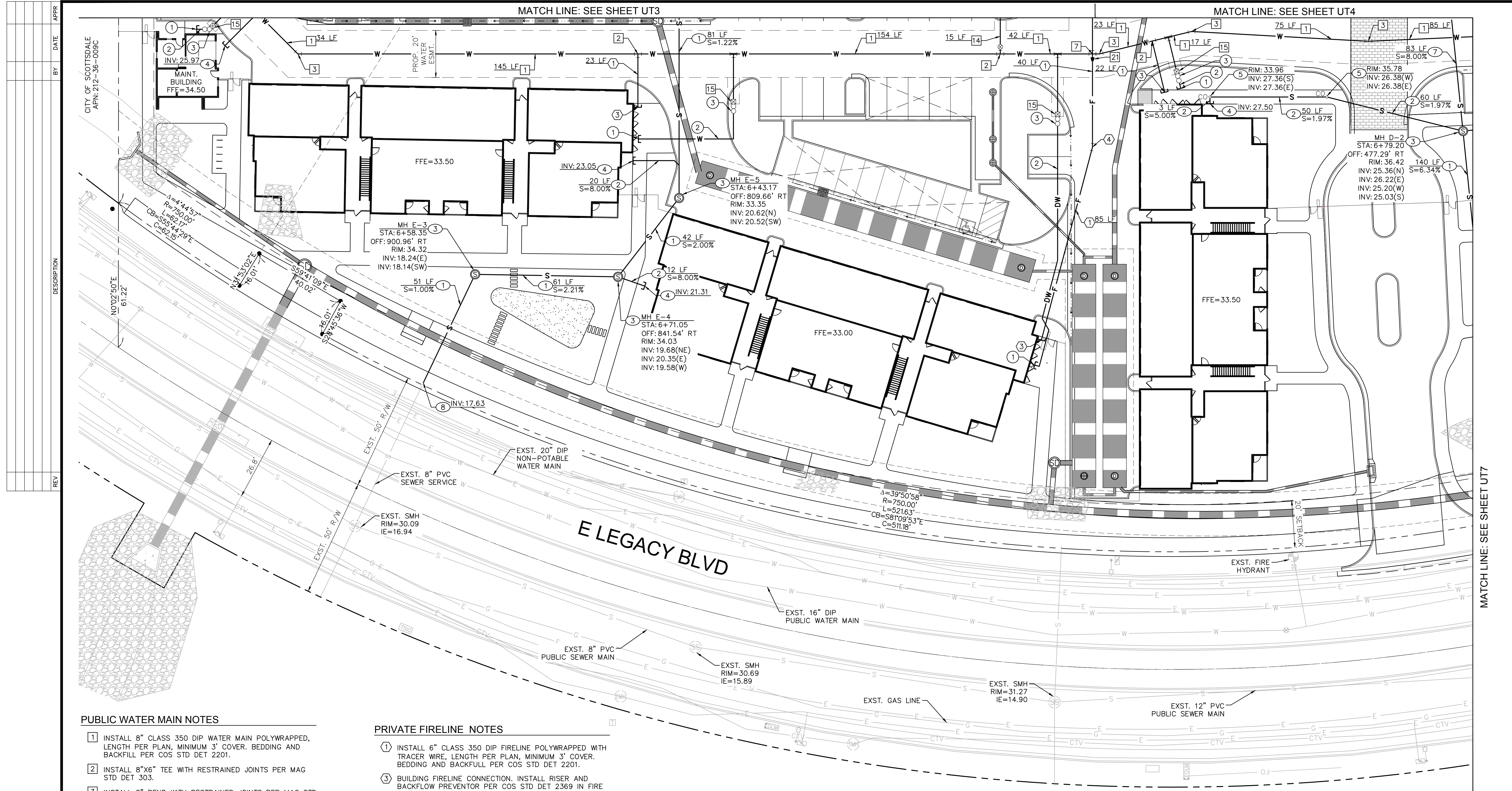
**Kimley»Horn**  
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7740 North 16th Street, Suite 300  
Phoenix, Arizona 85020 (602) 944-5500

NWC LEGACY BLVD AND MILLER ROAD  
**PRELIMINARY UTILITY PLAN**  
SCOTTSDALE, ARIZONA

PROJECT No.  
291878000  
SCALE (H): 1"=20'  
SCALE (V): NONE  
DRAWN BY: HDO  
DESIGN BY: RMH  
CHECK BY: CGF  
DATE: 09/13/23

Professional Engineer  
CERTIFICATE NO.  
64329  
C. GARRETT  
FRAME  
ARIZONA U.S.A.  
Expires 10/31/26

878000Pre-UT.dwg  
**UT5**  
5 OF 7 SHEETS



**PUBLIC WATER MAIN NOTES**

- 1 INSTALL 8" CLASS 350 DIP WATER MAIN POLYWRAPPED, LENGTH PER PLAN, MINIMUM 3' COVER, BEDDING AND BACKFILL PER COS STD DET 2201.
- 2 INSTALL 8"x6" TEE WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 3 INSTALL 8" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.
- 7 INSTALL 8"x8" CROSS CONNECTION WITH THRUST BLOCKS PER MAG STD DET 380.
- 14 INSTALL 6" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER, BEDDING AND BACKFILL PER COS STD DET 2201.
- 15 INSTALL 2" TYPE K SOFT COPPER WATER SERVICE LINE CONNECTION WITH 2" METER PER COS STD DET 2330.
- 21 INSTALL 8"x6" REDUCER.

**PRIVATE SEWER NOTES**

- 1 INSTALL 8" SDR-35 PVC PRIVATE SEWER MAIN.
- 2 INSTALL 6" SDR-35 PVC PRIVATE SEWER SERVICE.
- 3 INSTALL 48" SEWER MANHOLE PER MAG STD DET 420-2, INVERTS PER PLAN.
- 4 CONNECT TO BUILDING SEWER AT TWO WAY CLEANOUT. REF MEP PLANS FOR CONTINUATION.
- 5 SEWER CLEANOUT PER MAG STD DET 441.
- 7 PROPOSED 4" SDR 35 PVC PRIVATE SEWER SERVICE.
- 8 REMOVE PLUG AND CONNECT TO EXISTING SEWER STUB.

**PRIVATE FIRELINE NOTES**

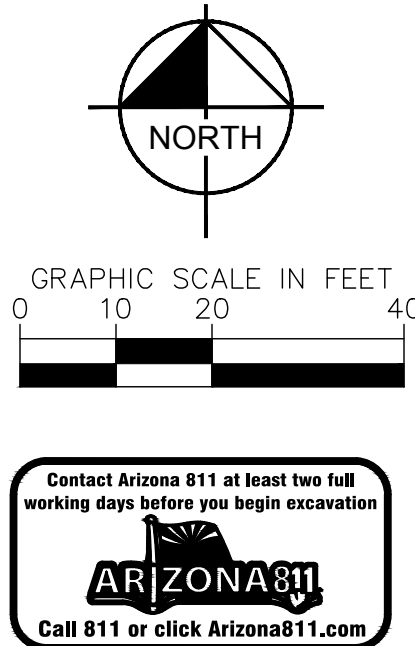
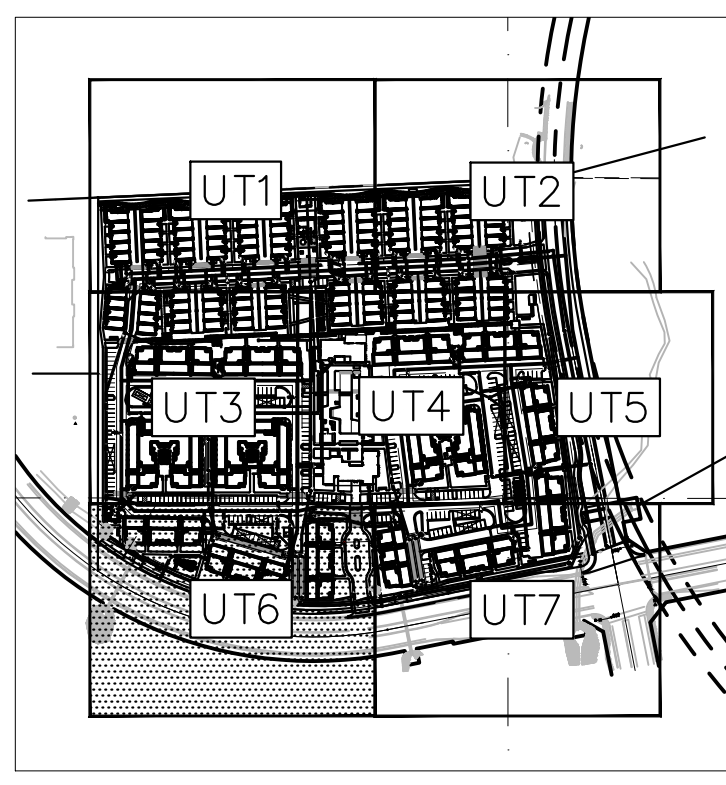
- 1 INSTALL 6" CLASS 350 DIP FIRELINE POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER, BEDDING AND BACKFILL PER COS STD DET 2201.
- 3 BUILDING FIRELINE CONNECTION. INSTALL RISER AND BACKFLOW PREVENTOR PER COS STD DET 2369 IN FIRE RISER ROOM. REF FIRE SPRINKLER PLANS FOR CONTINUATION.
- 4 INSTALL 6" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.

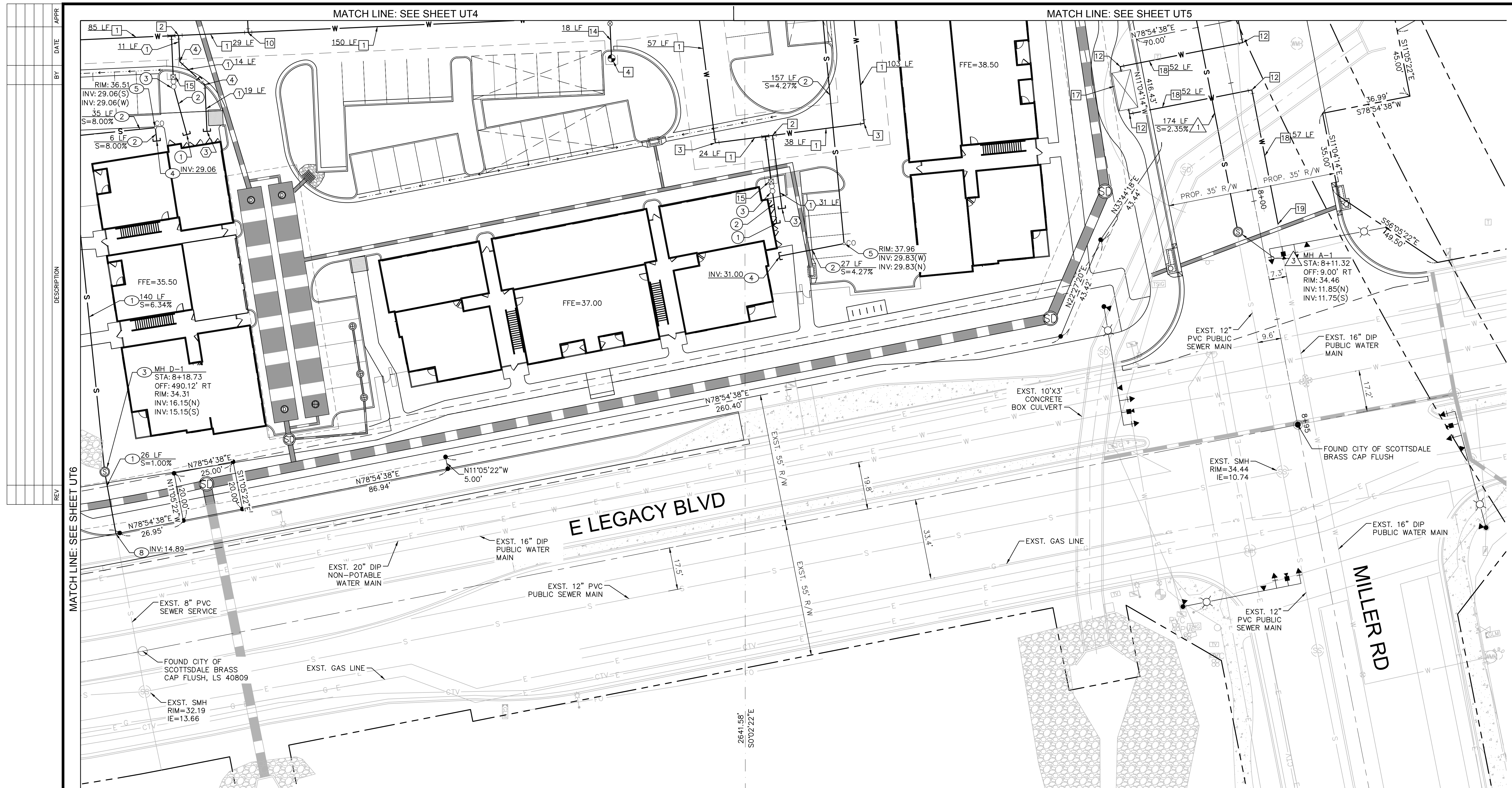
**PRIVATE WATER NOTES**

- 1 BUILDING DOMESTIC WATER CONNECTION, REF MEP PLANS FOR CONTINUATION.
- 2 INSTALL 3" SCH 40 PVC DOMESTIC WATER SERVICE.
- 3 INSTALL 2" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.

**NOTES**

- 1. ADD 1500' TO ALL ELEVATIONS.
- 2. ALL ELEVATIONS ARE INVERT ELEVATIONS, UNLESS OTHERWISE NOTED.
- 3. SEE SHEET UT1 FOR LEGEND.
- 4. ALL PIPE CROSSING INFORMATION IS PRELIMINARY AND SUBJECT TO CHANGE DURING FINAL DESIGN. STATIONS AND OFFSETS ARE BASED ON MILLER ROAD CENTERLINE.





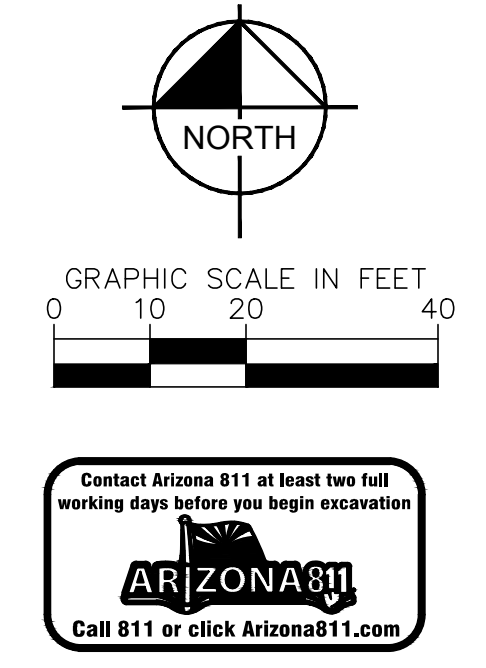
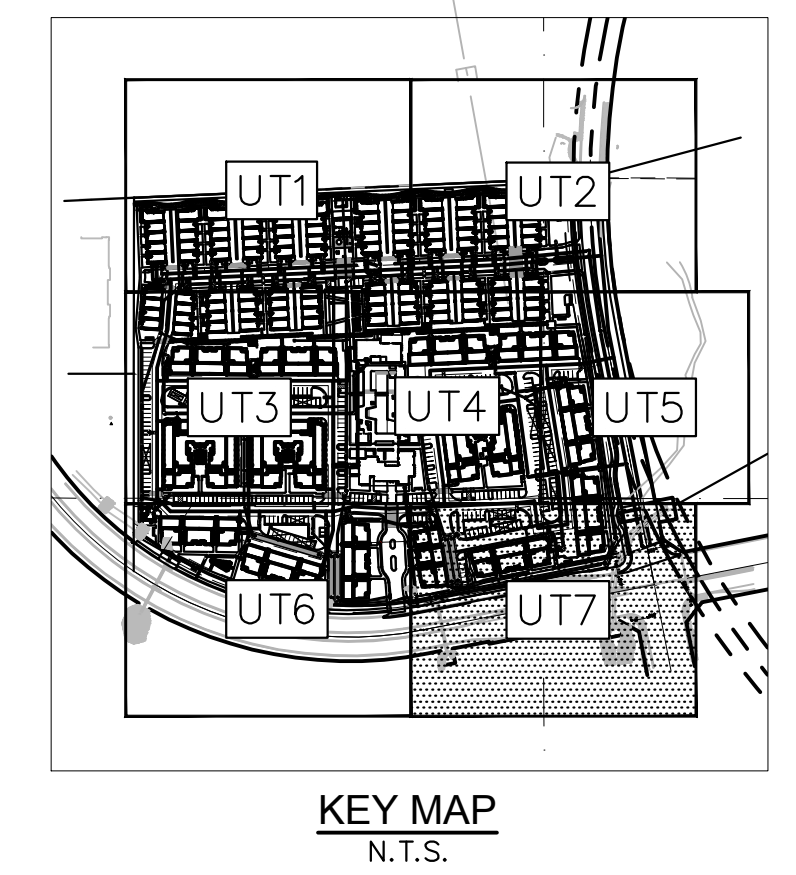
REV	DESCRIPTION	DATE	BY	APPR

- PUBLIC SEWER NOTES**
- INSTALL 8" SDR-35 PVC PUBLIC SEWER MAIN.
  - INSTALL 48" SEWER MANHOLE PER MAG STD DET 420-2, INVERTS PER PLAN.
- PRIVATE SEWER NOTES**
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  - INSTALL 3" SCH 40 PVC DOMESTIC WATER SERVICE.
  - INSTALL 2" REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY PER COS STD DET 2354.

- PUBLIC WATER MAIN NOTES**
- INSTALL 8" CLASS 350 DIP WATER MAIN POLYWRAPPED, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
  - INSTALL 8"x6" TEE WITH RESTRAINED JOINTS PER MAG STD DET 303.
  - INSTALL 8" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.
  - INSTALL FIRE HYDRANT ASSEMBLY WITH VALVE PER MAG STD DET 360.
  - INSTALL 8"x8" TEE WITH THRUST BLOCKS PER MAG STD DET 380.
  - INSTALL 12" BEND WITH THRUST BLOCKS PER MAG STD DET 380.
  - INSTALL 6" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
  - INSTALL 2" TYPE K SOFT COPPER WATER SERVICE LINE CONNECTION WITH 2" METER PER COS STD DET 2330.
  - PROPOSED PRESSURE REDUCING VALVE PER COS STD DETAIL 2342-1.
  - INSTALL 12" CLASS 350 DIP WATER MAIN POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, 3' MINIMUM COVER.
  - CONNECT TO EXISTING WATER MAIN WITH 16"x12" REDUCER WITH THRUST BLOCKS PER MAG STD DET 380.

- PRIVATE SEWER NOTES**
- INSTALL 8" SDR-35 PVC PRIVATE SEWER MAIN.
  - INSTALL 6" SDR-35 PVC PRIVATE SEWER SERVICE.
  - INSTALL 48" SEWER MANHOLE PER MAG STD DET 420-2, INVERTS PER PLAN.
  - CONNECT TO BUILDING SEWER AT TWO WAY CLEANOUT. REF MEP PLANS FOR CONTINUATION.
  - SEWER CLEANOUT PER MAG STD DET 441.
  - REMOVE PLUG AND CONNECT TO EXISTING SEWER STUB.
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- INSTALL 6" CLASS 350 DIP FIRELINE POLYWRAPPED WITH TRACER WIRE, LENGTH PER PLAN, MINIMUM 3' COVER. BEDDING AND BACKFILL PER COS STD DET 2201.
  - BUILDING FIRELINE CONNECTION. INSTALL RISER AND BACKFLOW PREVENTOR PER COS STD DET 2369 IN FIRE RISER ROOM. REF FIRE SPRINKLER PLANS FOR CONTINUATION.
  - INSTALL 6" BEND WITH RESTRAINED JOINTS PER MAG STD DET 303.

- NOTES**
- ADD 1500' TO ALL ELEVATIONS.
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Sewer Area A						
Type	# of Building	# DU per Bldg	# DUs	Demand <sup>1</sup> (GPD)	Average Daily Flow (GPM)	Peak Flow <sup>3</sup> (GPM)
I	2	40	80	170	9.44	37.78
II	4	20	80	170	9.44	37.78
III	0	15	0	170	0.00	0.0
IV	0	5	0	170	0.00	0.0
V	0	4	0	170	0.00	0.0
Pool					100.00	100.0
Area A Total	6	84	160		118.89	175.56

Sewer Area B						
Type	# of Building	# DU per Bldg	# DUs	Demand <sup>1</sup> (GPD)	Average Daily Flow (GPM)	Peak Flow <sup>3</sup> (GPM)
I	0	40	0	170	0	0.0
II	1	20	20	170	2.36	9.44
III	1	15	15	170	1.77	7.08
IV	0	5	0	170	0	0.0
V	0	4	0	170	0	0.0
Area B Total	2	84	35		4.13	16.53

Sewer Area C						
Type	# of Building	# DU per Bldg	# DUs	Demand <sup>1</sup> (GPD)	Average Daily Flow (GPM)	Peak Flow <sup>3</sup> (GPM)
I	1	40	40	170	5	18.89
II	5	20	100	170	12	47.22
III	0	15	0	170	0	0.0
IV	0	5	0	170	0	0.0
V	0	4	0	170	0	0.0
Area C Total	6	84	140	-	16.53	66.11

Sewer Area D						
Type	# of Building	# DU per Bldg	# DUs	Demand <sup>1</sup> (GPD)	Average Daily Flow (GPM)	Peak Flow <sup>3</sup> (GPM)
I	0	40	0	170	0	0.0
II	0	20	0	170	0	0.0
III	0	15	0	170	0	0.0
IV	12	5	60	170	7	28.33
V	12	4	48	170	6	22.67
Area D Total	24	84	108	-	12.75	51.00

I = 40 Unit Apartment Building  
 II = 20 Unit Apartment Building  
 III = 15 Unit Apartment Building  
 IV = 5 Unit Townhome Building  
 V = 4 Unit Townhome Building

## Worksheet for 6" Sewer - PDF

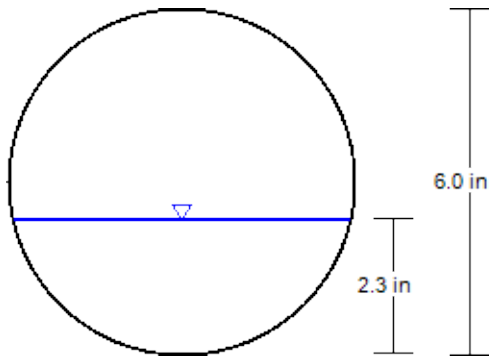
Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.013
Channel Slope	1.500 %
Diameter	6.0 in
Discharge	100.00 gpm
Results	
Normal Depth	2.3 in
Flow Area	0.1 ft <sup>2</sup>
Wetted Perimeter	0.7 ft
Hydraulic Radius	1.3 in
Top Width	0.49 ft
Critical Depth	2.8 in
Percent Full	39.1 %
Critical Slope	0.755 %
Velocity	3.13 ft/s
Velocity Head	0.15 ft
Specific Energy	0.35 ft
Froude Number	1.444
Maximum Discharge	331.78 gpm
Discharge Full	308.43 gpm
Slope Full	0.158 %
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	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	39.1 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.3 in
Critical Depth	2.8 in
Channel Slope	1.500 %
Critical Slope	0.755 %

# Cross Section for 6" Sewer - PDF

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.500 %
Normal Depth	2.3 in
Diameter	6.0 in
Discharge	100.00 gpm



V: 1  
H: 1

## Worksheet for 6" Sewer - Full Flow

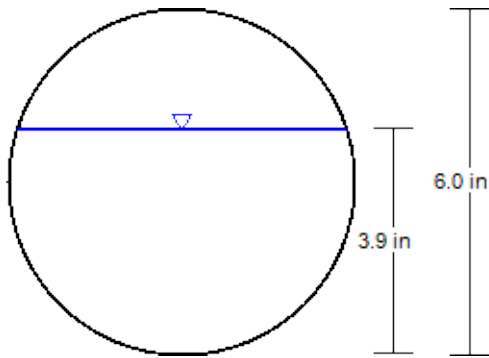
Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	1.500 %
Normal Depth	3.9 in
Diameter	6.0 in
Results	
Discharge	233.30 gpm
Flow Area	0.1 ft <sup>2</sup>
Wetted Perimeter	0.9 ft
Hydraulic Radius	1.7 in
Top Width	0.48 ft
Critical Depth	4.4 in
Percent Full	65.0 %
Critical Slope	1.081 %
Velocity	3.85 ft/s
Velocity Head	0.23 ft
Specific Energy	0.56 ft
Froude Number	1.274
Maximum Discharge	331.78 gpm
Discharge Full	308.43 gpm
Slope Full	0.858 %
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	N/A
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	3.9 in
Critical Depth	4.4 in
Channel Slope	1.500 %
Critical Slope	1.081 %

## Cross Section for 6" Sewer - Full Flow

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.500 %
Normal Depth	3.9 in
Diameter	6.0 in
Discharge	233.30 gpm



V: 1  
H: 1

## Worksheet for 8" Sewer - PDF

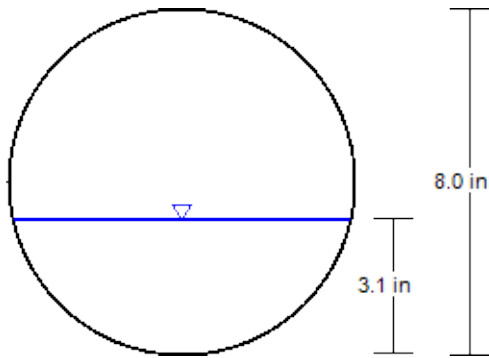
Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Diameter	8.0 in
Discharge	175.56 gpm
Results	
Normal Depth	3.1 in
Flow Area	0.1 ft <sup>2</sup>
Wetted Perimeter	0.9 ft
Hydraulic Radius	1.7 in
Top Width	0.65 ft
Critical Depth	3.5 in
Percent Full	39.1 %
Critical Slope	0.671 %
Velocity	3.09 ft/s
Velocity Head	0.15 ft
Specific Energy	0.41 ft
Froude Number	1.237
Maximum Discharge	583.40 gpm
Discharge Full	542.34 gpm
Slope Full	0.105 %
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	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	39.1 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.1 in
Critical Depth	3.5 in
Channel Slope	1.000 %
Critical Slope	0.671 %

# Cross Section for 8" Sewer - PDF

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Normal Depth	3.1 in
Diameter	8.0 in
Discharge	175.56 gpm



V: 1  
H: 1

## Worksheet for 8" Sewer - Full Flow

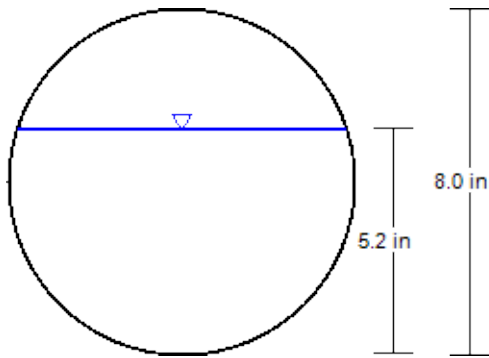
Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Normal Depth	5.2 in
Diameter	8.0 in
Results	
Discharge	410.23 gpm
Flow Area	0.2 ft <sup>2</sup>
Wetted Perimeter	1.3 ft
Hydraulic Radius	2.3 in
Top Width	0.64 ft
Critical Depth	5.4 in
Percent Full	65.0 %
Critical Slope	0.882 %
Velocity	3.81 ft/s
Velocity Head	0.23 ft
Specific Energy	0.66 ft
Froude Number	1.092
Maximum Discharge	583.40 gpm
Discharge Full	542.34 gpm
Slope Full	0.572 %
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	N/A
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	5.2 in
Critical Depth	5.4 in
Channel Slope	1.000 %
Critical Slope	0.882 %

## Cross Section for 8" Sewer - Full Flow

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	1.000 %
Normal Depth	5.2 in
Diameter	8.0 in
Discharge	410.23 gpm



V: 1  
H: 1



# CAVASSON

LOCATED NEAR THE NORTHWEST CORNER OF THE HAYDEN ROAD AND THE LOOP 101  
FRONTAGE ROAD INTERSECTION

## MASTER WASTEWATER REPORT

February 12, 2019  
REVISED: March 26, 2019

Project No.: 18114-001

PREPARED FOR:

**NATIONWIDE REALTY INVESTORS**  
**375 N. FRONT STREET**  
**COLUMBUS, OH 43215**  
**(614) 221-2008**

PREPARED BY:

**HUBBARD ENGINEERING**  
**1201 S. ALMA SCHOOL ROAD, SUITE 12000**  
**MESA, AZ 85210**  
**(480) 892-3313**  
MICHAEL S. WOLF



**H U B B**  
**E N G I N E E**

### FINAL Basis of Design Report

- APPROVED
- APPROVED AS NOTED
- REVISE AND RESUBMIT



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 scan

DATE 4/17/2019

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**FIGURES**

Figure 1.2	Site Vicinity Map
Figure 2.1	Wastewater Service Area Map

**APPENDICES**

Appendix A	Sewer Load Calculations
Appendix B	Sewer Capacity and Velocity Calculations
Appendix C	Correspondence with Sewer Lift Consultants

**EXHIBITS**

Exhibit 1	Future Build-Out Land Use Map
Exhibit 2	Master Sewer Infrastructure Map-12” [Cavasson Only]
Exhibit 3	Master Sewer Infrastructure Map-15” and 18”



# 1. INTRODUCTION

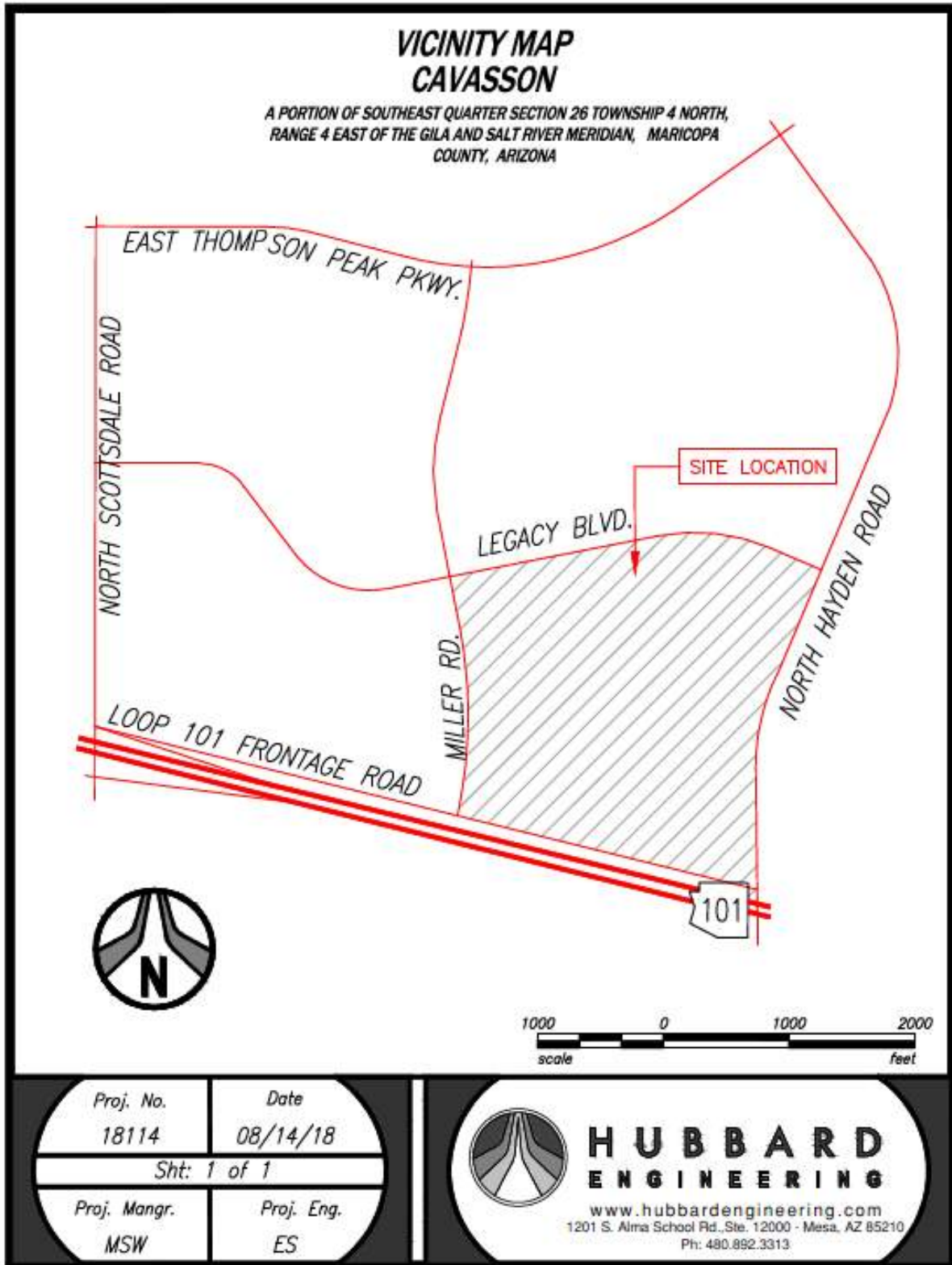
## 1.1 Project Scope

This report presents the results of a *Master Sewer Study* conducted by Hubbard Engineering at the request of Nationwide Realty Investors (“client”), for the Cavasson (“site”). The purpose of this report is to provide a detailed analysis for the existing and future sanitary sewer system for the Cavasson’s development as required for Design Review through the City of Scottsdale per the City of Scottsdale Ordinances 4346 and 4347. The Cavasson development is a fast-growing area with a future build-out area of approximately 136+/- acres. The project site currently has one discharge point for sanitary sewer and is located at the intersection of Legacy Boulevard and future 76<sup>th</sup> Street/ Miller Road. The sewer will ultimately discharge to a sewer lift station located outside the southeast corner of the site. The analysis of this report is comparative to the City of Scottsdale’s *2012 Water Reuse Master Plan Update*. This will serve as the overall Basis of Design for wastewater.

## 1.2 Site Description

The site is located in the southeast quarter of Section 26, Township 4N, Range 4E of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The project site is irregular in shape and encompasses approximately 136 acres. The site is currently undeveloped, and prior to Nationwide Realty Investor’s acquisition, was held in trust by the Arizona State Land Department (ASLD) as a portion of the overall Crossroads East development, which encompasses approximately 883 gross acres. The site has been rezoned as a Planned Community District. The project is bounded by the Loop 101 Freeway to the south, East Legacy Boulevard to the north, the Miller Road alignment to the west, and North Hayden Road to the east. The site location is shown in **Figure 1.1** on the *Vicinity Map*.

Figure 1.2 – Vicinity Map



P:\2018\18114\Exhibits\18114-Vmap.dwg Sep 14, 2018 - 1:19pm EShqalsi

### 1.3 Project Type

The Cavasson development is being developed by Nationwide Reality Investors as a master planned mixed use development with office, retail, hotels, and multifamily residential parcels and private roadways that run adjacent and through the development. The scope of the Master Wastewater Plan for the entire Cavasson development includes the analysis of the existing wastewater system infrastructure and the analysis, modeling and design of a proposed wastewater system for the Cavasson project site, as required by the stipulations identified in the City of Scottsdale Zoning Ordinance No. 4346. The project will be completed in a series of phases, beginning with the design and construction of Hayden Road, two proposed internal roads (Cavasson Boulevard and Claret Drive), and Miller Road. Also included with Phase 1 is the development of Parcel 1A, shown in **Exhibit 1**. The developments of Parcels 1B and 1C will follow in consecutive phases. The master wastewater analyses for the Cavasson project considered the future project phasing and development by assuming maximum permissible land use intensities as set forth in the City of Scottsdale stipulations under Scottsdale Resolution 11147 (PU V) CC 6-12-19 and then splitting the demands between smaller sub-parcels. As the sub-parcels develop within Cavasson, a separate wastewater analysis will be required to evaluate each parcel's system and wastewater demands. Any variance to the Master Wastewater Report will require an Addendum to the Master Wastewater Report and will be submitted at the same time as the site's Wastewater report.

### 1.4 Regulatory Issues

The following documents were utilized in the preparation of this report:

- City of Scottsdale, *Design Standards & Policies Manual*.
- City of Scottsdale, *Water Reuse Master Plan Update 2012*.
- Arizona Department of Environmental Quality (ADEQ), *Engineering Bulletin 11: Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works*
- Arizona Department of Environmental Quality (ADEQ), *Aquifer Protection Permit (APP) Program*
- Maricopa Association of Governments (MAG), *Uniform Standard Specifications and Details for Public Works Construction, 2016 Edition*
- *2008 Edition of the International Plumbing Code*
- City of Scottsdale, *Ordinance No. 4346*

## 2. EXISTING CONDITIONS

The City of Scottsdale has one public wastewater service area. The Cavasson development is located within the City of Scottsdale's Service Area, specifically within the city's Sub-basin 4 collection area. Refer to **Figure 2.1** for the City of Scottsdale's Wastewater Service Area Map. The City of Scottsdale has five sewage pumping facilities, all of which are used to ultimately convey wastewater flows to the city's reclamation facility within Scottsdale's Water Campus, located on Union Hills Drive and Pima Road. The facility's capacity is an average of 25 million gallons per day (mgd). Wastewater generated within Sub-basin 4 either flows by gravity to the North Pumpback Station (NPS) located at the Pima Road and the CAP canal where it is pumped to the north to the Water Campus WRP or is bypassed to the 91<sup>st</sup> Avenue WWTP. Wastewater generated from Cavasson will all flow to the NPS.

The NPS has a current pumping capacity of 34 mgd with an anticipated ultimate capacity of 47 mgd, per the CVL wastewater report (Ref. 3, pg. 8). It is stated in the CVL wastewater report that the NPS pumps approximately 16 to 18 mgd during peak periods. Wastewater is conveyed from NPS to the wastewater reclamation facility via two 30-inch force mains, one of which handles flows up to 18 mgd. The second force main is activated during times when NPS flows consistently exceed 20 mgd.

### 2.1 Existing Infrastructure

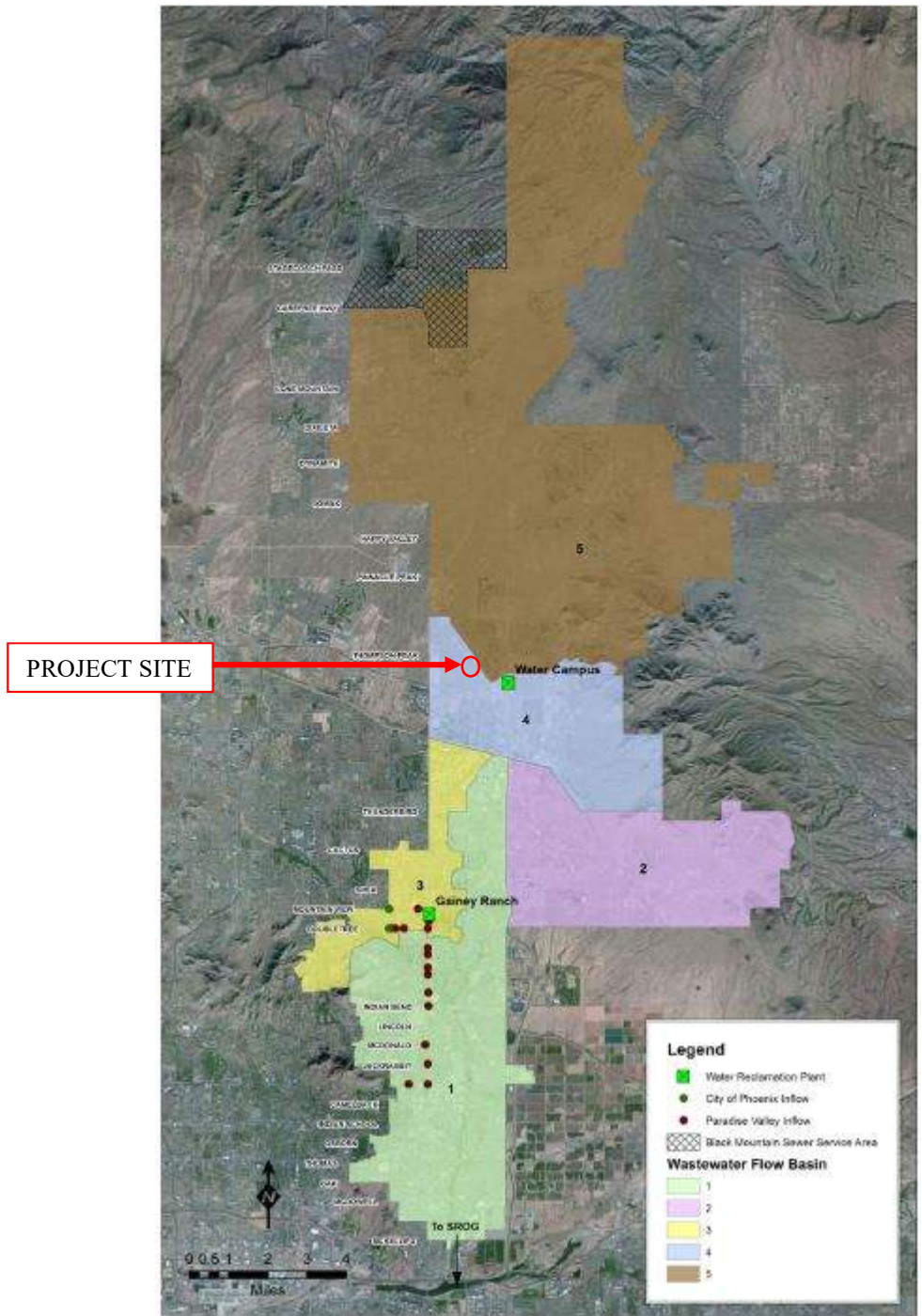
The existing wastewater system for the Cavasson development currently has an existing 12-inch sewer line in Hayden Road and existing dry 8-inch and 12-inch sewer lines along Legacy Boulevard (Ref..3, p.8). The sewer line along Miller Road will connect to the 12-inch sewer line. The existing sewer main in Hayden Road is built from the south of East Thompson Peak Parkway and runs down south to Princess where it connects to a 21-inch sewer line. It then continues south until it connects to the 24-inch sewer main on route to the NPS facility. Refer to **Exhibit 2** for existing infrastructure locations.

Information regarding the existing sanitary sewer system within and adjacent to the study area was gathered through existing field survey, the *City of Scottsdale Water Reuse Master Plan Update 2012*, and as stipulated in the *City of Scottsdale Design Standards and Policies Manual*, and review of as-built plans and quarter section maps. As-built information was used in locations where manholes could not be accessed. An overall planned infrastructure map of the system within the study area is shown in **Exhibit 2**. The exhibit shows the full build out of the future sewer mains and includes the existing sewer mains. The manhole rim elevations and inverts are tied to City of Scottsdale benchmark and vertical datum N.A.V.D. 88.

### 2.2 Zoning and Land Use

The Cavasson development consists of approximately 136 acres of undeveloped land and is currently zoned as PCP. There is a natural fall from northeast to southwest. The lots surrounding the site are also currently undeveloped.

**Figure 2.1 – Wastewater Service Area Map**  
*City of Scottsdale Water Reuse Master Plan (Fig. 1-3, pg.1-15)*



### 3. PROPOSED CONDITIONS

#### 3.1 Tie- Into Existing Wastewater System

Cavasson’s 15-inch main sewer line will tie into the existing 12-inch sewer line at the intersection of Miller Road and Legacy Boulevard, which is approximately twenty (20) feet below grade. The line will run south towards the intersection of Miller Road and Cavasson Boulevard, then run east until the next intersection with Claret Drive. The sewer transitions to an 18” line at MH#7 just west of the intersection of Cavasson Blvd. and Claret Drive. The sewer line will continue south towards the Loop 101 and then run east in a dedicated easement just north of the Loop 101 frontage road until it reaches Hayden Road. The proposed sewer line will run by gravity until this point and then continue to a proposed sewer lift station which will be designed by other engineering consultants. Hubbard and the consultants are collaborating the tie in location and invert between the two designed lines. The proposed location is indicated on **Exhibits 2 and 3** as Hubbard’s last proposed manhole, MH-21. The sewer’s highest invert, which will be located near the Hayden Road and Loop 101 frontage road intersection will fall approximately seven (7) feet below the existing sewer line invert.

An interim phase may be designed during the development of Phase 1 in which the Cavasson sewer line ties directly to the existing line in Hayden depending on the sewer lift timeline. An additional line along Cavasson Boulevard will run east and connect to the existing 12-inch sewer along Hayden Road. The sewer line will be completed during Phase 1 of the project development, prior to the addition of the new roadways (Miller, Cavasson Boulevard, Claret Drive).

#### 3.2 Land Use

The Cavasson development limits and proposed land use per delineated area are shown in **Exhibit 1**. Proposed land uses were determined from Nationwide’s development plans and the City of Scottsdale’s stipulations, as set forth in Resolution No. 1147. The existing and proposed demands were based on the existing and proposed land uses in **Exhibit 1** and were taken into consideration when evaluating the existing wastewater infrastructure system with existing conditions, as well as the future development. By using the maximum densities stipulated in the zoning case, the highest possible discharges are presented in this BOD. The land uses and their intensities from Resolution No. 11147 are shown in the following table:

Land Use Type (1)	Land Use Intensity (2)
Residential	1,200 – 1,600 dwelling units
Hotel	130 – 400 rooms
Retail & Service Uses	50,000 – 200,000 square feet
Office & Employment	800,000 – 1,800,000 square feet

### 3.3 Wastewater System Demands

#### 3.3.1 Unit Flows and Peaking Factors

The Cavasson development is located within the City of Scottsdale’s wastewater flow Sub-basin 4. The design unit flows were determined from the *City of Scottsdale Water Use Master Plan Update 2012* and were verified in coordination with the City of Scottsdale and the designer for the sewer lift station. Proposed development for the Cavasson project does not exceed the maximum densities stipulated by the City of Scottsdale. The peaking factor for the site was established by the sewer lift consultants who computed the value based on empirical data and observations of lots and areas with similar land use densities as the Cavasson development, and the lots surrounding the site. **Table 1** summarizes the design unit flows and peaking factors within the future planned development. See **Exhibit 2** for future planned Land Use Designations for Cavasson.

<b>Table 1: Sanitary Sewer System Unit Demands and Peaking Factors</b>		
Land Use Designation	Unit Flow Rate <i>(Ref.2)</i> [gpapd]	*Peaking Factor (PF)
Office- Major	1,001	2.60
Hotel	3,985	2.60
Multi-Family	4,216	**
Commercial/ Retail	1,173	2.60
<i>*Peaking factor provided by sewer lift consultant, which was derived and calculated from empirical data.</i>		
<i>**Peaking factor calculated for Multi-Family using Harmon's Formula; Population = 1.4 people/d.u. *23 d.u./ac utilizing cumulative upstream population</i>		
<i><b>MF Unit Flow Rate</b> is based on: 80 gpcpd * 1.7 per/d.u. * 31 d.u./acre = 4,216 gpapd. The Peaking factor was calculated with Harmon's using 1.4 persons/d.u. and 23 d.u. per/acre</i>		

In addition to the Cavasson development demands, the lots surrounding the development were considered in the wastewater analyses to ensure efficient infrastructure for future developments. Currently, the surrounding lots are undeveloped and do not contribute to the proposed system’s capacities. In the possibility that the surrounding lots will develop their sewer lines to connect to Cavasson’s proposed main line, the capacities and demands were also analyzed for the future development of these lots. These values were also compared and coordinated with the engineers designing the sewer lift station to the east of Hayden Road. As Phase 1 develops, the connection of and coordination of the inverts will be revisited. Assumptions on the surrounding

lot land use designations and densities were determined from coordinating with the City of Scottsdale's development plans and the approved zoning case. Future Lot 2 was assumed to have a similar density to the Cavasson development and was therefore analyzed in a similar manner with the same peaking factor. Lots 3 and 4, however, were assumed as residential areas with anticipated densities of 23 du/acre and 1.4 people/du. The peaking factor for these two lots was instead derived from Harmon's Formula, as shown in the following two equations:

$$PF = 1 + \frac{14}{(4 + P_1^{0.5})}$$

$$P_1 = \frac{\text{Population}}{1000}$$

$$PF_{Lot\ 3} = 3.76$$

$$PF_{Lot\ 4} = 3.45$$

These peaking factors were used in calculating the peak flows within the existing system for the existing conditions as well as the future ultimate build-out conditions. The calculations can be found in **Appendix A**. The peaking factors for the Multi-Family parcels within Cavasson were also calculated using the Harmon formula. The total population  $P_1$  used in the calculations were the aggregate sum of all multi-family parcels upstream contributing to that sewer line.

The unit flows for the Multi-family parcels in Cavasson were calculated by taking the maximum unit count (1,600 units) and dividing it by the total multi-family area. This came out to 31 d.u./acre. The calculation for the Average Daily Demand [ADD] is as follows:

$$80 \text{ gpcpd} * 1.7 \text{ persons/d.u.} * 31 \text{ d.u.} = 4,216 \text{ gpapd.}$$

For the peaking factor the Harmon's equation for the Cavasson multi-family parcels was calculated using the standard R-5 zoning of 1.4 people/d.u. and 23 d.u./acre. This results in a lower total population which gives a higher Peak Factor in the equation. The peak factor was then applied to the ADD to arrive at the Peak Daily Demand (PDD). **Table 2** shows the cumulative population and the calculated peaking factor.

### 3.3.2 Average Day Demand and Peak Daily Demand

Average day and peak flow demands for the planned conditions were calculated utilizing the aforementioned unit flow rates. In addition to the unit flow rates, the *Water Reuse Master Plan* discussed incorporating a Future Development Multiplier (FDM) for character areas, such as Scottsdale Airpark, Downtown/ McDowell Corridor, South Scottsdale, and East Shea, in anticipation of revitalization and future development in these areas. Following meetings with the City of Scottsdale, it was determined that an FDM should be derived from the proposed FAR for the lots south of Legacy Blvd. rather than using the factor used in the report. The proposed 0.85 FAR was compared to the city's zoning ordinance maximum 0.8 FAR. Dividing the proposed FAR by the city's maximum results in an increased factor of 1.06. This factor was then used as the FDM. The FDM was not applied to the lots north of Legacy Boulevard.

The following equations were used to compute the ADD and PDD:

$$ADD (gpd) = Unit\ Flow (gpapd) \times Area (acres) \times FDM$$

$$PDD (gpd) = Average\ Daily\ Flow (gpd) \times Peaking\ Factor$$

The total final sanitary sewer loadings per sub parcel of the Cavasson development are thus computed and summarized in **Table 2**.

<b>Table 2 - Total Wastewater Demands (GPD) - Based on M.F. using 1.7 persons/d.u. for ADD &amp; 1.4 persons/d.u. in Population for Harmons</b>							
Parcel Number	Land Use Designation	Area [sq.ft]	Area [acres]	ADD	PDD	Total M.F.	Individual Peaking
				[gpd]	(ADD*PF) [gpd]	Population Contributing [P]	Factor of all population contributing (PF)
1A-1	Office- Major	288,410	6.62	7,041.83	18,308.75	-	2.60
1A-2	Multi-Family	106,900	2.45	10,993.12	46,942.60	79	4.27
1A-3	Office- Major	210,817	4.84	5,147.32	13,383.02	-	2.60
1A-4	Office- Major	111,089	2.55	2,712.36	7,052.12	-	2.60
1A-5	Multi-Family	164,129	3.77	16,878.21	56,802.99	3,681	3.37
1A-6	Garage	203,541	4.67	0.00	0.00	-	N/A
1A-7	Hotel	127,754	2.93	12,417.75	32,286.14	-	2.60
1A-8	Commercial/ Retail	104,393	2.40	2,986.82	7,765.73	-	2.60
1B-1	Office- Major	421,088	9.67	10,281.29	26,731.36	-	2.60
1B-2	Multi-Family	431,364	9.90	44,359.36	149,858.11	3,559	3.38
1B-3	Garage	170,109	3.91	0.00	0.00	-	N/A
1C-1	Multi-Family	873,411	20.05	89,817.33	306,612.95	3,240	3.41
1C-2	Office- Major	222,112	5.10	5,423.09	14,100.04	-	2.60
1C-3	Hotel	151,582	3.48	14,733.87	38,308.06	-	2.60
1C-4	Commercial/ Retail	342,879	7.87	9,810.24	25,506.61	-	2.60
1C-5	Office- Major	215,746	4.95	5,267.66	13,695.91	-	2.60
1C-6	Multi-Family	156,694	3.60	16,113.62	68,088.99	116	4.23
1C-7	Multi-Family	191,303	4.39	19,672.63	82,609.95	141	4.20
1C-8	Multi-Family	352,473	8.09	36,246.60	145,752.78	402	4.02
1C-9	Office- Major	57,433	1.32	1,402.28	3,645.93	-	2.60
1C-10	Commercial/ Retail	154,919	3.56	4,432.46	11,524.39	-	2.60
<b>Total</b>				315,738	1,068,976		
<i>A 1.06 multiplying factor was applied to the ADD to account for the FAR of 0.85.</i>							
<i>*Garage not included in sewer analysis since there is no demand</i>							
		23	du/acre	Dwelling unit density per CVL COS MWR			
		1.4	persons/du	Population density per COS DSPM - 23 du/acre			
<i>Harmon's Formula:</i>							
	Peaking Factor=	$1 + 14 / (4 + P_1^{0.5})$					
	P <sub>1</sub> =	Population/1,000					

The ADD and PDD for the lots surrounding the Cavasson site are shown in the following table:

<b>Total Contributing Wastewater Demands (GPD)-Estimates- per CVL Crossroads East Wastewater Plan Update</b>							
Parcel Number	Land Use Designation <sup>1</sup>	Area [sq.ft]	Area [acres]	ADDMM <sup>1</sup>	Peak Flow <sup>1</sup>	ADD	PDD
				[gpad]	[gpad]	[gpd]	(ADD*PF) [gpd]
Lot 2	Mixed-Use	2,555,866	56.35	3,000	7,800	179,604	466,970
Lot 3	Multi-Family	993,630	22.81	3,128	11,761	71,352	268,282
Lot 4	Multi-Family	2,516,643	57.77	3,128	10,792	180,718	623,476
<b>Total</b>						<b>431,673</b>	<b>1,358,727</b>
<i>1. Land use designation and unit wastewater flows derived from Table 2. Wastewater Generation Unit Factors from the CVL Crossroads East Wastewater Master Plan Update, 2012, Table 2-4 Scottsdale Wastewater Unit Loads – COS 2012 Water Reuse Master Plan Update UPDATED to use: 80 gal/per*1.7 per/d.u.*23 d.u./ac. [Per Scott Anderson email 03/26/19 for ADD] Peak factor provided by Wilson Engineering</i>							

### 3.4 Pipe Capacity

Following the sewer load calculations, pipe capacities for each segment of wastewater pipe within the study area were calculated using the Manning’s Equation, as described in **Section 4.1** of this report. Considering the demands of only the Cavasson development, a 12-inch sewer line was computed to be sufficient in the design. However, considering the future conditions of the surrounding lots, a 15-inch and 18-inch line would be more suitable. Even at an 18-inch line, the flows from only the Cavasson development meet the minimum velocity (2.5 fps) , maximum depth ratio ( $d/D = 0.70$ ) and Scottsdale’s design criteria. The layout for the proposed 12-inch line is shown in **Exhibit 2** and the layout for the increased line sizes to account for the surrounding developments is shown in **Exhibit 3**. A complete summary of these calculations can be found in **Appendix A**.

The existing 12-inch sewer line in Hayden Road and the existing 12-inch sewer lines in Legacy Boulevard Road will have the future planned flows from the Cavasson development area, shown in **Table 4**. As-built plans and quarter section maps were used to determine the inverts and slopes of the existing sewer mains in Hayden Road and Legacy Boulevard.

<b>Table 4 – Sewer Line Capacities</b>		
<b>Existing Sewer Line Capacities</b>	<b>Planned Future Peak Flows from Cavasson Development</b>	<b>Pipe Capacity Flowing Full</b>
	<b>(mgpd)</b>	<b>(mgpd)</b>
Hayden Road – 12-inch	0.019	4.32
Legacy Boulevard (E-W) – 12-inch	0.631	2.86
Legacy Boulevard (W-E) – 12-inch	0.011	1.43
<b>TOTAL</b>	<b>0.661</b>	

### 3.5 Wastewater System Summary

In general, the existing wastewater collection system within the study area has sufficient capacity to convey wastewater flows generated by the planned improvements for the Cavasson development Area. A summary of the performance criteria for the existing system can be found in **Table 5**.

Table 5 – Planned Wastewater System Performance Summary			
Criteria	Maximum	Minimum	Average
Full Flow Velocity (ft/s)	8.40	2.70	5.82
Full Flow Capacity (cfs)	6.60	2.20	4.57

In the analysis of the existing wastewater system, all pipe segments that were evaluated meet the City of Scottsdale’s minimum requirements for slope and full flow velocity.

## 4. DESIGN CRITERIA

The criteria used to evaluate the existing and future sanitary sewer system within the study area is described below and is the same criteria used in the City of Scottsdale’s *Water Reuse Master Plan Update 2012* and as stipulated in the City of Scottsdale *Design Standards and Policies Manual*.

### 4.1 Pipe Capacities

Pipe capacities of the existing system were calculated using the Manning’s Equation;

$$Q = \frac{k}{n} R_h^{2/3} S^{1/2} A$$

where:

$Q$  = flow rate, ft<sup>3</sup>/s;

$k$  = conversion factor = 1.4859 ft<sup>1/3</sup>/s;

$n$  = headloss coefficient;

$R_h$  = hydraulic radius, ft;

$S$  = slope, ft/ft;

$A$  = pipe cross sectional area, ft.

A summary of the calculated full flow pipe capacities for each pipe section can be found in **Appendix A**.

## 4.2 Flow Depth

As described in the City of Scottsdale’s *Design Standards and Policies Manual* and the *City of Scottsdale Water Use Master Plan Update 2012*, it is common practice to adopt variable depth criteria for various pipe sizes, expressed as a ratio of maximum depth flow (d) to pipe diameter (D) (Ref. 1, p.515). New sewer lines with a diameter greater than 12-inch are not to exceed a ratio of 0.70 for the ultimate peak flow condition, as this allows for system infiltration and inflow. Analysis of pipes less than 12-inch shall have a maximum permissible ratio of 0.65. The design ratios (d/D) for each pipe section within the study area were calculated for future build-out conditions. A summary of these calculations can be found in **Appendix A**.

## 4.3 Velocity

In accordance with the City of Scottsdale’s *Design Standards and Policies Manual*, all sanitary sewers within the city shall be designed and constructed such that the mean velocity in the pipe, when flowing half full, shall not be less than two and a half (2.5) feet per second (fps). At this velocity, the sewer flow will typically provide adequate scouring to clean the pipe. This is standard practice in the design and analysis of sanitary sewer systems as it is greater than the minimum velocity which allows the pipe to be “self-cleaning” and minimizes the settlement of solids within the pipe. Additionally, the velocity of the peak flow will not exceed 10 fps. Due to the hydraulics of a circular pipe, the velocity for half-full pipe flow approaches the velocity of nearly full pipe flow. **Table 6** shows the minimum slopes for sanitary sewers to maintain self-cleaning velocities at full flow (d/D=1.0) calculated using Manning’s Equation.

Pipe Size (inches)	Minimum Slope (ft/ft)	Pipe Capacity	
		(mgd)	(cfs)
8	0.0052	0.28	0.44
10	0.0039	0.44	0.68
12	0.0030	0.64	0.98
14	0.0025	0.86	1.34
15	0.0022	0.99	1.53
16	0.0012	1.13	1.74
18	0.0010	1.43	2.21
20	0.0010	1.76	2.73
21	0.0014	1.94	3.00
24	0.0012	3.93	3.93
27	0.0010	3.22	4.97
30	0.0009	3.97	6.14

Full flow velocities for the entire planned wastewater system were calculated for each existing section of pipe using either as-built information from plans or data also acquired in the field survey and each proposed pipe section was designed per the City of Scottsdale’s *Design Standards and Policies Manual*. A summary of these calculations is included in **Appendix A**, and sections of pipe which result in a full flow velocity of less than two and a half (2.5) feet per second are mentioned in Section 2.4. These lines were only analyzed to show how much additional flow will be directed to these pipes when the area is fully developed and that the pipes could handle the additional flows.

#### 4.4 Manhole Spacing

In accordance with the City of Scottsdale’s *Design Standards and Policies Manual*, all new sanitary sewer manholes shall be installed at distances not exceeding those shown in **Table 7**.

<b>Pipe Size</b>	<b>Maximum Spacing</b>
8” – 15”	500 ft.
18” – 30”	600 ft.
36” – 60”	800 ft.
Over 60”	1,300 ft.

#### 4.5 Manhole Depths and Inverts

The City of Scottsdale’s *Design Standards and Policies Manual* requires that the minimum cover of the crown of a sewer pipe is to be four (4) feet to finish grade. These standards also state a maximum drop of twenty-four (24) inches between inverts without the use of a drop connection and that manholes with ninety-degree bends require a minimum 0.1-foot drop across the manhole.

A summary of the existing and proposed sewer depths and manhole inverts can be found in **Appendix A**.

#### 4.6 Criteria Summary

**Table 8** shows a summary of the criteria used in evaluating the sanitary sewer system within the study area.

<b>Table 8 – Sanitary Sewer System Evaluation Criteria Summary<sup>(Ref.2)</sup></b>			
<b>Minimum Slopes for Circular Pipes Flowing Full</b>			
<b>Pipe Size</b>	<b>Minimum Slope</b>	<b>Pipe Capacity</b>	
<b>(inches)</b>	<b>(ft/ft)</b>	<b>(mgd)</b>	<b>(cfs)</b>
8	0.0052	0.28	0.44
10	0.0039	0.44	0.68
12	0.0030	0.64	0.98
14	0.0025	0.86	1.34
15	0.0022	0.99	1.53
16	0.0012	1.13	1.74
18	0.0010	1.43	2.21
20	0.0010	1.76	2.73
21	0.0014	1.94	3.00
24	0.0012	3.93	3.93
27	0.0010	3.22	4.97
<b>Flow Depth Ratios (d/D)</b>			
New Sewer Pipes, Diameter less than 12 inches			0.65
New Sewer Pipes, Diameter 12 inches and higher			0.70
Existing Sewer Pipes in Developed Areas			0.70
<b>Headloss Coefficient (Manning's 'n')</b>			
Gravity Pipes			0.013
<b>Manhole Depths and Inverts</b>			
Minimum cover over crown of sewer pipe			4.0'
Maximum drop across manhole without drop connection			24"
Minimum drop across manhole			0.10'
<b>Peaking Factors</b>			
Cavasson			2.60
Lot 2			2.60
Lot 3			3.76
Lot 4			3.45

## 5. SUMMARY AND CONCLUSIONS

A summary of the wastewater system analysis in this report is presented below.

1. Design unit flows were determined from the approved City of Scottsdale's *2012 Water Reuse Master Plan Update Final* report (Table 2).
2. The site is located in the City of Scottsdale's wastewater Sub-basin 4.
3. A 12-inch water line is sufficient for the maximum loads for the Cavasson site. However, a 15-inch and 18-inch line was designed to consider the future development of surrounding lots and upsizing of these lines should be part of a payback agreement.
4. A sewer lift station to the east of Hayden is being designed. Hubbard is collaborating the tie-in location and invert with the City's consultant.
5. Pipe capacity was determined for the proposed site conditions and for the expectation that lots surrounding Cavasson will develop.
6. The existing system is sufficient to accommodate the additional flow generated from planned future improvements within the study area, in accordance with the land use classifications identified in the City's current General Plan.

## 6. References

1. City of Scottsdale, *Design Standards & Policies Manual*, January 18, 2018.
2. Carollo Engineers, *City of Scottsdale Water Reuse Master Plan Update 2012*, 2012.
3. Coe & Van Loo Consultants, Inc. (CVL) *Arizona State Land Department- Crossroads East Wastewater Master Plan Update*, April 13, 2008.
4. Arizona Department of Environmental Quality (ADEQ). *Engineering Bulletin 11: Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works*. May 1978.
5. Arizona Department of Environmental Quality (ADEQ). *Aquifer Protection Permit (APP) Program*.
6. Maricopa Association of Governments (MAG). *Uniform Standard Specifications and Details for Public Works Construction*. January 2016.
7. International Code Council. *2012 Edition of the International Plumbing Code*. January 1, 2012
8. City of Scottsdale, *Ordinance No. 4346*, June 17, 2018.
9. City of Scottsdale, *Ordinance No. 1147*, June 17, 2018.



**SEWER DEMAND CALCULATION SHEET**  
**Cavasson Master Sewer Plan**  
**HUBBARD ENGINEERING**  
**PROJECT NO. 18114-001**

- References:** 1. City of Scottsdale, Design Standards and Policies Manual, 2018  
 2. Carollo, City of Scottsdale 2012 Water Reuse Master Plan Update Final  
 Table 2-4

**Calculations:**

Proposed FAR	0.85
Max FAR Stipulated	0.80
Future Development Multiplier	1.06

Sanitary Sewer System Unit Demands and Peaking Factors		
Land Use Designation	Unit Flow Rate <i>(Ref.2)</i> [gpcpd]	*Peaking Factor (PF)
Office- Major	1,001	2.60
Hotel	3,985	2.60
Multi-Family	4,216	**
Commercial/ Retail	1,173	2.60
<i>*Peaking factor provided by sewer lift consultant, which was derived and calculated from empirical data.</i>		
<i>**Peaking factor calculated for Multi-Family using Harmon's Formula: Population = 1.4 people/d.u.*23 d.u./ac utilizing cumulative upstream population</i>		
<i>MF Unit Flow Rate is based on: 80 gpcpd * 1.7 per/d.u. * 31 d.u./acre = 4,216 gpcpd. The Peaking factor was calculated with Harmon's using 1.4 persons/d.u. and 23 d.u. per/acre</i>		

Average Day Demand = (Unit Flow Rate\*Acres\*1.06) [gpd]  
 Peak Day Demand = Average Day Demand\*PF [gpd]

Table 2 - Total Wastewater Demands (GPD) - Based on M.F. using 1.7 persons/d.u. for ADD & 1.4 persons/d.u. in Population for Harmons							
Parcel Number	Land Use Designation	Area [sq.ft]	Area [acres]	ADD [gpd]	PDD (ADD*PF) [gpd]	Total M.F. Population Contributing [P]	Individual Peaking Factor of all population contributing (PF)
1A-1	Office- Major	288,410	6.62	7,041.83	18,308.75	-	2.60
1A-2	Multi-Family	106,900	2.45	10,993.12	46,942.60	79	4.27
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1A-4	Office- Major	111,089	2.55	2,712.36	7,052.12	-	2.60
1A-5	Multi-Family	164,129	3.77	16,878.21	56,802.99	3,681	3.37
1A-6	Garage	203,541	4.67	0.00	0.00	-	N/A
1A-7	Hotel	127,754	2.93	12,417.75	32,286.14	-	2.60
1A-8	Commercial/ Retail	104,393	2.40	2,986.82	7,765.73	-	2.60
1B-1	Office- Major	421,088	9.67	10,281.29	26,731.36	-	2.60
1B-2	Multi-Family	431,364	9.90	44,359.36	149,858.11	3,559	3.38
1B-3	Garage	170,109	3.91	0.00	0.00	-	N/A
1C-1	Multi-Family	873,411	20.05	89,817.33	306,612.95	3,240	3.41
1C-2	Office- Major	222,112	5.10	5,423.09	14,100.04	-	2.60
1C-3	Hotel	151,582	3.48	14,733.87	38,308.06	-	2.60
1C-4	Commercial/ Retail	342,879	7.87	9,810.24	25,506.61	-	2.60
1C-5	Office- Major	215,746	4.95	5,267.66	13,695.91	-	2.60
1C-6	Multi-Family	156,694	3.60	16,113.62	68,088.99	116	4.23
1C-7	Multi-Family	191,303	4.39	19,672.63	82,609.95	141	4.20
1C-8	Multi-Family	352,473	8.09	36,246.60	145,752.78	402	4.02
1C-9	Office- Major	57,433	1.32	1,402.28	3,645.93	-	2.60
1C-10	Commercial/ Retail	154,919	3.56	4,432.46	11,524.39	-	2.60
<b>Total</b>				315,738	1,068,976		

A 1.06 multiplying factor was applied to the ADD to account for the FAR of 0.85.

\*Garage not included in sewer analysis since there is no demand

23	du/acre	Dwelling unit density per CVL COS MWR
1.4	persons/du	Population density per COS DSPM - 23 du/acre
<b>Harmon's Formula:</b>		
Peaking Factor=	$1+14/(4+P_1^{0.5})$	
P <sub>1</sub> =	Population/1,000	
Peaking Factor:	2.60	Lot 2
Peaking Factor:	3.76	Lot 3
Peaking Factor:	3.45	Lot 4
		Calculated per Harmon's Formula
	Lot 2	ADD = (ADMM*Acres*1.06) [gpd]
	Lots 3 & 4	ADD = (ADMM*Acres) [gpd]

Total Contributing Wastewater Demands (GPD)-Estimates- per CVL Crossroads East Wastewater Plan Update							
Parcel Number	Land Use Designation <sup>1</sup>	Area [sq.ft]	Area [acres]	ADMM <sup>1</sup> [gpcpd]	Peak Flow <sup>1</sup> [gpcpd]	ADD [gpd]	PDD (ADD*PF) [gpd]
Lot 2	Mixed-Use	2,555,866	56.35	3,000	7,800	179,604	466,970
Lot 3	Multi-Family	993,630	22.81	3,128	11,761	71,352	268,282
Lot 4	Multi-Family	2,516,643	57.77	3,128	10,792	180,718	623,476
<b>Total</b>						<b>431,673</b>	<b>1,358,727</b>
<i>1. Land use designation and unit wastewater flows derived from Table 2. Wastewater Generation Unit Factors from the CVL Crossroads East Wastewater Master Plan Update, 2012, Table 2-4 Scottsdale Wastewater Unit Loads – COS 2012 Water Reuse Master Plan Update UPDATED to Use: 80 gal/per*1.7 per/d.u.*23 d.u./ac. [Per Scott Anderson email 03/26/19 for ADD] Peak factor provided by Wilson Engineering</i>							



**SANITARY SEWER SYSTEM ANALYSIS (PROPOSED CONDITION-18-INCH LAYOUT-0.16%)**  
**Cavasson Master Sewer Plan**  
**HUBBARD ENGINEERING**  
**PROJECT NO.18114-001**

**Project Name:** Cavasson Master Sewer Plan  
**Project No:** 18114-001

**Prepared By:** ES  
**Revised By:** MSW

**Date:** 12/5/2018  
**Date:** 3/27/2019

**Purpose:** Develop a sewer design analysis based on as-built sewer information for the existing service area. (Ref. 3)

**Criteria:** Minimum Velocity = 2.5 [ft/s] (Flowing Full)  
 Maximum Velocity = 10 [ft/s] (Flowing Full)  
 Manning's 'n' = 0.013 (Flowing Full)

**Assumptions:** 1. Existing 12" line in Legacy and 12" line in Hayden are currently dry.

**References:** 1. City of Scottsdale, Design Standards and Policies Manual, 2018  
 2. Carollo, City of Scottsdale 2012 Water Reuse Master Plan Update Final  
 3. Hayden Road As-Built, May 2005  
 4. Legacy Road As-Built, June 2009

**Note:** " \* " - denotes onsite manhole nodes for the purpose of demonstrating preliminary design.

**Attachments:**

Tie in at Legacy/ Miller intersction to Hayden/Frontage Intersection

Sewer Analysis (Proposed Condition)																							
Upstream Manhole I.D.	Downstream Manhole I.D.	Contributing Area	Contributing Area [acres]	RIM Upstream Manhole I.D.	RIM Downstream Manhole I.D.	Inv Upstream Manhole I.D.	Inv Downstream Manhole I.D.	Pipe Size [in]	Manning's n	Cover [ft]	Line I.D.	Length [ft]	Slope [ft/ft]	ADF [mgpd]	Cumulative ADF [mgpd]	Peaking Factor	PDF [mgd]	Cumulative Peak [mgpd]	Pipe Capacity Flowing Full [mgpd]	Depth [in]	d/D [Max = 0.70]	Full Flow Velocity [ft/s]	Pipe Capacity [cfs]
SSMH#7	MH-1	1C-2,1C-5,Lot 3, Lot 4	98.6	1634.50	1634.30	1610.87	1605.05	12	0.013	22.63	Line 1	74.60	0.07800	0.26276	0.26276	3.50	0.920	0.91955	6.431	3.06	0.26	12.70	9.97
MH-1	MH #2	1C-1, Lot 2	78.7	1634.30	1629.26	1610.19	1609.36	15	0.013	22.86	Line 2	309.00	0.00270	0.26942	0.53218	2.87	0.774	1.69314	2.169	9.97	0.66	2.70	3.31
MH #2	MH #3	-		1629.26	1624.90	1609.26	1607.72	15	0.013	18.75	Line 3	266.50	0.00270	0.00000	0.53218	0.00	0.000	1.69314	2.169	9.97	0.66	2.70	3.31
MH #3	MH #4	-		1624.90	1620.54	1608.44	1607.72	15	0.013	15.21	Line 4	266.50	0.00270	0.00000	0.53218	2.87	0.000	1.69314	2.169	9.97	0.66	2.70	3.31
MH #4	MH #5	1B-2	9.9	1620.54	1624.21	1607.62	1608.38	15	0.013	11.67	Line 5	414.00	0.00300	0.04436	0.57654	3.38	0.150	1.84299	2.287	10.20	0.68	2.90	3.56
MH #5	MH #6	-		1624.21	1629.21	1608.28	1605.04	15	0.013	14.68	Line 6	414.20	0.00300	0.00000	0.57654	0.00	0.000	1.84299	2.287	10.20	0.68	2.90	3.56
MH #6	MH #7	-		1629.21	1632.29	1604.94	1604.11	15	0.013	23.02	Line 7	253.40	0.00330	0.00000	0.57654	0.00	0.000	1.84299	2.398	9.86	0.66	3.00	3.68
MH #7	MH #8	1C-8, 1C-7,1C-6	15.7	1632.29	1633.13	1604.01	1603.64	18	0.013	26.78	Line 8	232.25	0.00330	0.07203	0.64857	4.12	0.296	2.13945	3.900	9.51	0.53	3.40	6.01
MH #8	MH #9	1A-5, 1A-2	6.2	1633.13	1628.84	1603.54	1602.68	18	0.013	28.09	Line 9	232.20	0.00370	0.02787	0.67644	3.72	0.104	2.24319	4.129	9.46	0.53	3.60	6.36
MH #9	MH #10	-		1628.84	1621.44	1602.58	1601.29	18	0.013	24.76	Line 10	348.50	0.00370	0.00000	0.67644	0.00	0.000	2.24319	4.129	9.46	0.53	3.60	6.36
MH #10	MH #11	1A-4,B-1	12.2	1621.44	1613.25	1601.19	1599.74	18	0.013	18.75	Line 11	392.00	0.00370	0.01299	0.68944	2.60	0.034	2.27698	4.129	9.54	0.53	3.60	6.36
MH #11	MH #12	-		1613.25	1611.97	1599.64	1599.24	18	0.013	12.11	Line 12	107.10	0.00370	0.00000	0.68944	0.00	0.000	2.27698	4.129	9.54	0.53	3.60	6.36
MH #12	MH #14	-		1611.97	1610.09	1599.14	1597.86	18	0.013	11.33	Line 13	318.10	0.00370	0.00000	0.68944	0.00	0.000	2.27698	4.129	9.54	0.53	3.60	6.36
MH #14	MH #16	1A-3	4.8	1610.09	1610.64	1597.76	1596.08	18	0.013	10.83	Line 14	283.40	0.00370	0.00515	0.69459	0.00	0.013	2.29036	4.129	9.57	0.53	3.60	6.36
MH #16	MH #17	1A-1	6.6	1610.64	1611.08	1595.98	1595.56	18	0.013	13.16	Line 15	112.40	0.00370	0.00704	0.70163	0.00	0.018	2.30867	4.129	9.62	0.53	3.60	6.36
MH #17	MH #19	-		1611.08	1613.67	1595.46	1593.66	18	0.013	14.12	Line 16	126.60	0.00370	0.00000	0.70163	0.00	0.000	2.30867	4.129	9.62	0.53	3.60	6.36
MH #19	MH #20	-		1613.67	1610.25	1593.56	1592.37	18	0.013	18.61	Line 17	320.80	0.00370	0.00000	0.70163	0.00	0.000	2.30867	4.129	9.62	0.53	3.60	6.36
MH #20	MH #21	-		1610.25	1614.65	1592.27	1591.79	18	0.013	16.48	Line 18	129.60	0.00370	0.00000	0.70163	0.00	0.000	2.30867	4.129	9.62	0.53	3.60	6.36

Tie in to Proposed Manhole in Proposed Roadway 1 to Proposed Roadway/Hayden Road Intersection

Sewer Analysis (Proposed Condition)																							
Upstream Manhole I.D.	Downstream Manhole I.D.	Contributing Area	Contributing Area [acres]	RIM Upstream Manhole I.D.	RIM Downstream Manhole I.D.	Inv Upstream Manhole I.D.	Inv Downstream Manhole I.D.	Pipe Size [in]	Manning's n	Cover [ft]	Line I.D.	Length [ft]	Slope [ft/ft]	ADF [mgd]	Cumulative ADF [mgd]	Peaking Factor	PDF [mgd]	Cumulative Peak [mgd]	Pipe Capacity Flowing Full [mgpd]	Depth	d/D	Full Flow Velocity [ft/s]	Pipe Capacity [cfs]
SSMH#22	MH#23	1C-9, 1C-3, 1A-7, 1A-8	10.1	1634.67	1633.50	1622.25	1620.62	12	0.013	11.42	Line 20	448.20	0.00300	0.03154	0.03154	2.60	0.082	0.08201	1.261	2.07	0.17	2.50	1.96
SSMH #13	SSMH #7	1C-4,1C-10	11.4	1651.88	1654.88	1646.56	1644.59	12	0.013	4.32	EX. 13-14	498.00	0.00390	0.01424	0.01424	2.60	0.037	0.03703	1.438	1.33	0.11	2.80	2.20

**SANITARY SEWER SYSTEM ANALYSIS (PROPOSED CONDITION-12-INCH LAYOUT)**  
**Cavasson Master Sewer Plan**  
**HUBBARD ENGINEERING**  
**PROJECT NO.18114-001**

**Project Name:** Cavasson Master Sewer Plan  
**Project No:** 18114-001

**Prepared By:** ES  
**Revised By:** MSW

**Date:** 12/5/2018  
**Date:** 3/27/2019

**Purpose:** Develop a sewer design analysis based on as-built sewer information for the existing service area. (Ref. 1)

**Criteria:** Minimum Velocity = 2.5 [ft/s] (Flowing Full)  
 Maximum Velocity = 10 [ft/s] (Flowing Full)  
 Manning's 'n' = 0.013 (Flowing Full)

**Assumptions:** 1. Existing 12" line in Legacy and 12" line in Hayden are currently dry.

**References:** 1. City of Scottsdale, Design Standards and Policies Manual, 2018  
 2. Carollo, City of Scottsdale 2012 Water Reuse Master Plan Update Final  
 3. Hayden Road As-Built, May 2005  
 4. Legacy Road As-Built, June 2009

**Note:** "\*" - denotes onsite manhole nodes for the purpose of demonstrating preliminary design.

**Attachments:**

Tie in at Legacy/ Miller intersection to Hayden/Frontage Intersection

Sewer Analysis (Proposed Condition)																							
Upstream Manhole I.D.	Downstream Manhole I.D.	Contributing Area	Contributing Area [acres]	RIM Upstream Manhole I.D.	RIM Downstream Manhole I.D.	Inv Upstream Manhole I.D.	Inv Downstream Manhole I.D.	Pipe Size [in]	Manning's n	Cover [ft]	Line I.D.	Length [ft]	Slope [ft/ft]	ADF [mgpd]	Cumulative ADF [mgpd]	Peaking Factor	PDF [mgd]	Cumulative Peak [mgpd]	Pipe Capacity Flowing Full [mgpd]	Depth [in]	d/D [Max = 0.70]	Full Flow Velocity [ft/s]	Pipe Capacity [cfs]
SSMH#7	MH-1	1C-2,1C-5,1C-7,1C-6	785,854	1634.50	1634.30	1610.87	1605.05	12	0.013	22.63	Line 1	74.60	0.07800	0.04648	0.04648	3.84	0.178	0.17849	6.431	1.37	0.11	12.70	9.97
MH-1	MH #2	1C-1	873,411	1634.30	1629.26	1610.19	1609.36	12	0.013	23.11	Line 2	309.00	0.00300	0.08982	0.13629	3.41	0.307	0.48511	1.261	5.16	0.43	2.50	1.96
MH #2	MH #3	-	-	1629.26	1624.90	1609.26	1607.72	12	0.013	19.00	Line 3	266.50	0.00300	0.00000	0.13629	0.00	0.000	0.48511	1.261	5.16	0.43	2.50	1.96
MH #3	MH #4	-	-	1624.90	1620.54	1608.44	1607.72	12	0.013	15.46	Line 4	266.50	0.00300	0.00000	0.13629	3.41	0.467	0.95208	1.261	7.79	0.65	2.50	1.96
MH #4	MH #5	1B-2	431,364	1620.54	1624.21	1607.62	1608.38	15	0.013	11.67	Line 5	414.00	0.00300	0.04436	0.18065	3.38	0.150	1.10194	2.287	7.34	0.49	2.90	3.56
MH #5	MH #6	-	-	1624.21	1629.21	1608.28	1605.04	15	0.013	14.68	Line 6	414.20	0.00300	0.00000	0.18065	0.00	0.000	1.10194	2.287	7.34	0.49	2.90	3.56
MH #6	MH #7	-	-	1629.21	1632.29	1604.94	1604.11	15	0.013	23.02	Line 7	253.40	0.00330	0.00000	0.18065	0.00	0.000	1.10194	2.398	7.14	0.48	3.00	3.68
MH #7	MH #8	1C-8	352,473	1632.29	1633.13	1604.01	1603.64	15	0.013	27.03	Line 8	232.25	0.00330	0.03625	0.21690	4.02	0.146	1.24769	2.398	7.68	0.51	3.00	3.68
MH #8	MH #9	1A-2,1A-5	271,029	1633.13	1628.84	1603.54	1602.68	15	0.013	28.34	Line 9	232.20	0.00370	0.02787	0.24477	3.72	0.104	1.35143	2.539	7.78	0.52	3.20	3.93
MH #9	MH #10	-	-	1628.84	1621.44	1602.58	1601.29	15	0.013	25.01	Line 10	348.50	0.00370	0.00000	0.24477	0.00	0.000	1.35143	2.539	7.78	0.52	3.20	3.93
MH #10	MH #11	1A-4,1A-3,A-1,B-1	1,031,404	1621.44	1613.25	1601.19	1599.74	15	0.013	19.00	Line 11	392.00	0.00370	0.02518	0.26995	2.60	0.065	1.41691	2.539	8.01	0.53	3.20	3.93
MH #11	MH #12	-	-	1613.25	1611.97	1599.64	1599.24	15	0.013	12.36	Line 12	107.10	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93
MH #12	MH #14	-	-	1611.97	1610.09	1599.14	1597.86	15	0.013	11.58	Line 13	318.10	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93
MH #14	MH #16	-	-	1610.09	1610.64	1597.76	1596.08	15	0.013	11.08	Line 14	283.40	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93
MH #16	MH #17	-	-	1610.64	1611.08	1595.98	1595.56	15	0.013	13.41	Line 15	112.40	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93
MH #17	MH #19	-	-	1611.08	1613.67	1595.46	1593.66	15	0.013	14.37	Line 16	126.60	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93
MH #19	MH #20	-	-	1613.67	1610.25	1593.56	1592.37	15	0.013	18.86	Line 17	320.80	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93
MH #20	MH #21	-	-	1610.25	1614.65	1592.27	1591.79	15	0.013	16.73	Line 18	129.60	0.00370	0.00000	0.26995	0.00	0.000	1.41691	2.539	8.01	0.53	3.20	3.93

This Segment of pipe is the same for Cavasson Use only as the Ultimate Design oversizing

Tie in to Proposed Manhole in Proposed Roadway 1 to Proposed Roadway/Hayden Road Intersection

Sewer Analysis (Proposed Condition Contributing)																							
Upstream Manhole I.D.	Downstream Manhole I.D.	Contributing Area	Contributing Area [acres]	RIM Upstream Manhole I.D.	RIM Downstream Manhole I.D.	Inv Upstream Manhole I.D.	Inv Downstream Manhole I.D.	Pipe Size [in]	Manning's n	Cover [ft]	Line I.D.	Length [ft]	Slope [ft/ft]	ADF [mgd]	Cumulative ADF [mgd]	Peaking Factor	PDF [mgd]	Cumulative Peak [mgd]	Pipe Capacity Flowing Full [mgpd]	Depth [in]	d/D [Max = 0.75]	Full Flow Velocity [ft/s]	Pipe Capacity [cfs]
MH#22	MH#23	1C-9,1C-3,1A-7,1A-8	409,905.50	1634.70	1628.00	1610.87	1609.94	12	0.013	22.83	Line 1	308.97	0.00300	0.01370	0.01370	3.94	0.054	0.05400	1.261	1.69	0.14	2.50	1.96
SSMH #13	SSMH #7	1C-4,1C-10	497,797.83	1651.88	1654.88	1646.56	1644.59	8	0.013	4.65	EX. 13-14	498.00	0.00390	0.00820	0.00820	4.76	0.039	0.03900	0.488	1.53	0.19	2.20	0.77

**SANITARY SEWER SYSTEM ANALYSIS (EXISTING LINES)**  
**Cavasson Master Sewer Plan**  
**HUBBARD ENGINEERING**  
**PROJECT NO.18114-001**

**Project Name:** Cavasson Master Sewer Plan  
**Project No:** 18114-001

**Prepared By:** ES  
**Revised By:** MSW

**Date:** 12/5/2018  
**Date:** 2/12/2019

**Purpose:** Develop a sewer design analysis based on as-built sewer information for the existing service area. (Ref. 3)

**Criteria:** Minimum Velocity = 2.5 [ft/s] (Flowing Full)  
Maximum Velocity = 10 [ft/s] (Flowing Full)  
Manning's 'n' = 0.013 (Flowing Full)

**Assumptions:** 1. Existing 12" line in Legacy and 12" line in Hayden are currently dry.

**References:** 1. City of Scottsdale, Design Standards and Policies Manual, 2018  
2. Carollo, City of Scottsdale 2012 Water Reuse Master Plan Update Final  
3. Hayden Road As-Built, May 2005  
4. Legacy Road As-Built, June 2009

**Note:** " \* " - denotes onsite manhole nodes for the purpose of demonstrating preliminary design.

**Attachments:** Capacities of existing sewer lines with Cavasson site contributions. 0.972

Sewer Analysis (Existing-Legacy to Hayden)																							
Upstream Manhole I.D.	Downstream Manhole I.D.	Contributing Area	Contributing Area [acres]	RIM Upstream Manhole I.D.	RIM Downstream Manhole I.D.	Inv Upstream Manhole I.D.	Inv Downstream Manhole I.D.	Pipe Size [in]	Manning's n	Cover [ft]	Line I.D.	Length [ft]	Slope [ft/ft]	ADF [mgd]	Cumulative ADF [mgd]	Peaking Factor	PDF [mgd]	Cumulative Peak [mgd]	Pipe Capacity Flowing Full [mgpd]	Depth [in]	d/D [Max = 0.70]	Full Flow Velocity [ft/s]	Pipe Capacity [cfs]
SSMH-13	SSMH-7	1C-4,1C-10	497,798	1655.28	1654.88	1646.56	1644.59	12	0.013	7.72	Legacy (W-E)	498.00	0.00390	0.01424	0.01424	2.60	0.037	0.03703	1.438	1.33	0.11	2.80	2.20
SSMH-7	SSMH-6	1C-4,1C-10	497,798	1654.88	1649.82	1644.53	1639.34	12	0.013	9.35	HAYDEN	309.00	0.01800	0.00000	0.01424	0.00	0.000	0.03703	3.089	0.92	0.08	6.10	4.79
SSMH-6	SSMH-5	1C-4,1C-10	497,798	1649.82	1641.14	1638.94	1629.99	12	0.013	9.88	HAYDEN	490.00	0.01900	0.00000	0.01424	0.00	0.000	0.03703	3.174	0.91	0.08	6.30	4.95
SSMH-5	SSMH-4	1C-4,1C-10	497,798	1641.14	1634.35	1629.95	1620.75	12	0.013	10.19	HAYDEN	482.00	0.01900	0.00000	0.01424	0.00	0.000	0.03703	3.174	0.91	0.08	6.30	4.95
SSMH-4	SSMH-3	1C-4,1C-10,1C-9,1C-3,1A-7,1A-8	938,959	1634.35	1630.02	1620.83	1613.39	12	0.013	12.52	HAYDEN	489.00	0.01520	0.04578	0.06003	1.79	0.082	0.11904	2.839	1.68	0.14	5.60	4.40
SSMH-3	SSMH-2	1C-4,1C-10,1C-9,1C-3,1A-7,1A-8	938,958.75	1630.02	1617.95	1613.39	1606.15	12	0.013	15.63	HAYDEN	485.00	0.01490	0.00000	0.06003	0.00	0.000	0.11904	2.811	1.68	0.14	5.50	4.32
SSMH-2	SSMH-1	1C-4,1C-10,1C-9,1C-3,1A-7,1A-8	938,958.75	1617.95	1614.95	1603.96	1600.61	12	0.013	12.99	HAYDEN	102.00	0.02160	0.00000	0.06003	0.00	0.000	0.11904	3.384	1.54	0.13	6.70	5.26
SSMH-1	EX-SSMH	1C-4,1C-10,1C-9,1C-3,1A-7,1A-8	938,958.75	1614.91	1614.65	1600.61	1604.00	12	0.013	13.30	HAYDEN	97.00	0.03450	0.00000	0.06003	0.00	0.000	0.11904	4.277	1.38	0.11	8.40	6.60

Sewer Analysis (Existing-Legacy to Miller)																							
Upstream Manhole I.D.	Downstream Manhole I.D.	Contributing Area	Contributing Area [acres]	RIM Upstream Manhole I.D.	RIM Downstream Manhole I.D.	Inv Upstream Manhole I.D.	Inv Downstream Manhole I.D.	Pipe Size [in]	Manning's n	Cover [ft]	Line I.D.	Length [ft]	Slope [ft/ft]	ADF [mgd]	Cumulative ADF [mgd]	Peaking Factor	PDF [mgd]	Cumulative Peak [mgd]	Pipe Capacity Flowing Full [mgpd]	Depth [in]	d/D [Max = 0.70]	Full Flow Velocity [ft/s]	Pipe Capacity [cfs]
SSMH-12	SSMH-11	1C-2,1C-5,1C-7,1C-6, Lot 3, Lot 4	937,436	1651.79	1654.88	1644.33	1639.60	12	0.013	6.46	Legacy (E-W)	307.00	0.01540	0.29855	0.29855	3.58	1.070	1.07025	2.857	5.09	0.42	5.60	4.40
SSMH-11	SSMH-10	-	-	1649.51	1646.76	1639.57	1633.90	12	0.013	8.94	Legacy (E-W)	379.00	0.01500	0.00000	0.29855	0.00	0.000	1.07025	2.820	5.13	0.43	5.60	4.40
SSMH-10	SSMH-9	-	-	1646.76	1642.60	1633.81	1626.42	12	0.013	11.95	Legacy (E-W)	499.00	0.01540	0.00000	0.29855	0.00	0.000	1.07025	2.857	5.09	0.42	5.60	4.40
SSMH-9	SSMH-8	-	-	1642.60	1638.28	1626.09	1618.60	12	0.013	15.51	Legacy (E-W)	501.00	0.01500	0.00000	0.29855	0.00	0.000	1.07025	2.820	5.13	0.43	5.60	4.40
SSMH-8	SSMH-7	-	-	1634.35	1630.02	1618.55	1611.09	12	0.013	14.80	Legacy (E-W)	489.00	0.01520	0.00000	0.29855	0.00	0.000	1.07025	2.839	5.11	0.43	5.60	4.40

**Appendix C**  
Correspondence with Sewer Lift Consultants  
*Cavasson*

## EMA Shqalsi

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**From:** Yamani, Srikanth <srikanth.yamani@wilson-engineers.com>  
**Sent:** Thursday, October 18, 2018 10:29 AM  
**To:** Ema Shqalsi  
**Cc:** Todd, Steve M.; Willgohs, Martin O.  
**Subject:** RE: NRCI Campus-Sewer Capacities/Inverts and Water Demands

Ema,

We looked into your Average Daily Demand (ADD) values and they look close to our numbers (although the acreage for the Lots 1,2,3, and 4 vary slightly).

The invert for 18" line on your attachments shows 1595.83 but your email below indicates 1596.20. Let us know. We will rely on your invert elevations for continuation of sewer lines from SE corner of Hayden to the proposed lift station.

Let us know if you have any questions or comments. Thanks

Srikanth Yamani, P.E.  
Project Manager  
**Wilson Engineers**  
9633 S. 48th St. #290  
Phoenix, AZ 85044  
Ph: 480-893-8860

---

**From:** Todd, Steve M.  
**Sent:** Monday, October 15, 2018 8:18 AM  
**To:** Willgohs, Martin O. <Martin.Willgohs@wilson-engineers.com>; Yamani, Srikanth <srikanth.yamani@wilson-engineers.com>  
**Subject:** FW: NRCI Campus-Sewer Capacities/Inverts and Water Demands

Stephen M. Todd, P.E.  
**Wilson Engineers**  
9633 S. 48th St., Suite 290  
Phoenix, AZ 85044  
480-893-8860 (Office)  
480-893-8968 (Fax)  
602-882-1732 (Cell)

---

**From:** Ema Shqalsi <eshqalsi@hubbardengineering.com>  
**Sent:** Friday, October 12, 2018 1:28 PM  
**To:** Todd, Steve M. <Steve.Todd@wilson-engineers.com>  
**Subject:** NRCI Campus-Sewer Capacities/Inverts and Water Demands

Hi Steve,

We completed our capacity calculations and found that for the NRI Campus demands only, a 12" at 0.35% (City of Scottsdale Master Plan stipulates minimum of 0.3%) would work for the site. However, including the demands from Lots 2, 3, we calculated a 15" line at 0.27% going South along Miller and an 18" the rest of line to the Hayden/Frontage intersection (Exhibit 3).

With only the demands from NRI Campus, an 18" pipe would give us a flow depth of 6.47in at velocity of about 2.8ft/s at the minimum slope we used, 0.3%, meeting the Scottsdale standards.

I also used our sewer load estimates for Lots 2,3, and 4 as they did not seem too far off from Wilson's estimates.

With the 12", we're hitting the SE corner of Hayden (53.05 ft south of the existing manhole) at an invert of 1594.52. With the 18", we have an invert of 1596.20. Does Wilson have an idea yet of what invert they need for their design?

Also, while you are reviewing our sewer calculations (loads and capacities), I also wanted to send over our water demands. We followed the Scottsdale Design Standards and Policies Manual for these calculations, so they are comparatively higher than our sewer.

Please let me know what you think and if the design works with your sewer lift calculations and configurations, or if you have any questions or concerns.

Best,

**Ema Shqalsi, E. I. T**

Civil Engineer



1201 S. Alma School Rd., Suite 12000  
Mesa, Arizona 85210

**phone** 480 892 3313  
**cell** 602 750 1078  
**fax** 480 892 7051

[www.hubbardengineering.com](http://www.hubbardengineering.com)

## Michael S. Wolf

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**From:** Anderson, Scott L <scan@scottsdaleaz.gov>  
**Sent:** Tuesday, March 26, 2019 4:32 PM  
**To:** Hayes, Eliana; Michael S. Wolf  
**Cc:** Brent Steffenhagen; Yamani, Srikanth; Todd, Steve M.; Bloemberg, Greg  
**Subject:** RE: Cavasson Waterwater Flows

**Categories:** FYI-Info to keep Handy

Michael,

I have been following you emails with Eliana. At one point last week you mentioned using the loading rate of 2,060 gpcpd which came from our *2012 Water Reuse Master Plan*. These numbers are meant to be applied city-wide, over areas much larger than the Cavasson Master Plan, or even the service area of the sewer lift station.

I am much more comfortable with the calculation that Eliana used:

$80 \text{ gpcpd} * 1.7 \text{ persons/DU} * 31 \text{ DU/acre}$

This is much closer to the design criteria we use for every other sewer lift station in the City.

Please proceed using this calculation for the seven multi-family parcels within Cavasson and the other three multi-family lots within the sewer lift station service area.

Scott

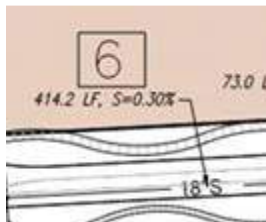
---

**From:** Hayes, Eliana <EHayes@Scottsdaleaz.gov>  
**Sent:** Monday, March 25, 2019 9:27 AM  
**To:** Michael S. Wolf <mwolf@hubbardengineering.com>; Anderson, Scott L <scan@scottsdaleaz.gov>  
**Cc:** Brent Steffenhagen <bsteffenhagen@hubbardengineering.com>; Yamani, Srikanth <srikanth.yamani@wilson-engineers.com>; Todd, Steve M. <Steve.Todd@wilson-engineers.com>; Bloemberg, Greg <GBLO@Scottsdaleaz.gov>  
**Subject:** RE: Cavasson Waterwater Flows

Hello Michael and thank you for added clarification.

The Nationwide waste generation numbers must have changed from those sent over on Mar 20<sup>th</sup>, based on most recent PDD totals given below.

I concur with 15" capacity analysis. I'm assuming pipe segments 6-11 illustrated as 18" are incorrect + will be corrected in resubmitted master plan:



Also a retitling of exhibit to remove reference to 18":

MARCH 21, 2019

CONCEPTUAL SEWER LAYOUT-15" and 18"  
EXHIBIT 3

I have a call in to WR to discuss with them further to make sure we are all on the right page. I'll or they'll follow up accordingly.

Thank you - Eliana

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**From:** Michael S. Wolf <[mwolf@hubbardengineering.com](mailto:mwolf@hubbardengineering.com)>  
**Sent:** Friday, March 22, 2019 9:28 AM  
**To:** Hayes, Eliana <[EHayes@Scottsdaleaz.gov](mailto:EHayes@Scottsdaleaz.gov)>; Anderson, Scott L <[scan@scottsdaleaz.gov](mailto:scan@scottsdaleaz.gov)>  
**Cc:** Brent Steffenhagen <[bsteffenhagen@hubbardengineering.com](mailto:bsteffenhagen@hubbardengineering.com)>; Yamani, Srikanth <[srikanth.yamani@wilson-engineers.com](mailto:srikanth.yamani@wilson-engineers.com)>; Todd, Steve M. <[Steve.Todd@wilson-engineers.com](mailto:Steve.Todd@wilson-engineers.com)>; Bloemberg, Greg <[GBLO@Scottsdaleaz.gov](mailto:GBLO@Scottsdaleaz.gov)>  
**Subject:** RE: Cavasson Waterwater Flows

Good morning Eliana. I believe I see the difference in the flows we are generating. I put together an exhibit which shows where we applied the sewer loads (attached) along with how I numbered the pipes so that tracing where the flows are coming from is a little easier.. Here is a quick table for the sewer which comes from Legacy, down Miller and down Claret which shows how we routed them:

Street Segment	Sewer Line Segments	Contributing Sewer Areas
Legacy	Legacy	Lot 3, Lot 4, 1C-2, 1C-5
Miller	1,2,3	Lot 3, Lot 4, 1C-2, 1C-5, <b>+1C-1 +Lot 2</b>
Cavasson West	4,5,6,7	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, <b>+1B-2</b>
Claret North	8	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, <b>+1C-7 +1C-6 +1C-8</b>
Claret South	9,10,11,12	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, 1C-7, 1C-6, 1C-8, <b>+1B-</b>
Fire Drive West	12,14,15	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, 1C-7, 1C-6, 1C-8, 1B-1,
Fire Drive East	16,17,18,19->MH-Tie	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, 1C-7, 1C-6, 1C-8, 1B-1, <b>1</b>

If I worked backwards from your numbers right, it looks like 1C-2 and 1C-5 were omitted from your table for contributing down the Miller sewer. There are existing stubs to these parcels which are then conveyed back to the west to Legacy and Miller. We are also sewer 1C-7 and 1C-6 through 1C-8, so they discharge at the intersection of Cavasson and Claret.

As far as our pipe capacity for the line sizing, we are running the 15" sewer at 0.0037 ft/ft. I am coming up with a d/D of 0.66 and a full flow capacity of 2.539 mgd. I marked the discharge location (MH) where Wilson is picking up the sewer, from both the East run and the West run.

Please let me know if this clarifies everything or if we need to discuss. Thank you.

---

**From:** Hayes, Eliana <[EHayes@Scottsdaleaz.gov](mailto:EHayes@Scottsdaleaz.gov)>  
**Sent:** Thursday, March 21, 2019 12:47 PM  
**To:** Michael S. Wolf <[mwolf@hubbardengineering.com](mailto:mwolf@hubbardengineering.com)>; Anderson, Scott L <[scan@scottsdaleaz.gov](mailto:scan@scottsdaleaz.gov)>  
**Cc:** Brent Steffenhagen <[bsteffenhagen@hubbardengineering.com](mailto:bsteffenhagen@hubbardengineering.com)>; Yamani, Srikanth <[srikanth.yamani@wilson-engineers.com](mailto:srikanth.yamani@wilson-engineers.com)>; Todd, Steve M. <[Steve.Todd@wilson-engineers.com](mailto:Steve.Todd@wilson-engineers.com)>; Bloemberg, Greg <[GBLO@Scottsdaleaz.gov](mailto:GBLO@Scottsdaleaz.gov)>  
**Subject:** RE: Cavasson Waterwater Flows

Hello Michael –

Can you please clarify which pipe you are referring to when making the statement:

Total outflow in new pipe crossing Hayden Road:

ADD = 661,346 gpd

PDD = 2,123,229 gpd

The pipe crossing Nationwide parcel into Hayden should only be seeing a PDD of about 1,695,220 (quick math). Your not referring to this new pipe?

Also, can you please clarify which pipe you are referring to when making this statement:

Please note that the maximum pipe size is still 15", but we are right at the threshold for D/d (0.67) leaving the site.

Again, based on my calculations, these are the following line segment, pipe, sizes that should be constructed by development (taking into account future flows from lots 2, 3, + 4):

SEWER LINE SEGMENTS	SEWER LINE SIZE REQUIRED
1, 2, 3	15"
4, 5, 6, 7	15"
8, 9, 10	18"
11, 12, 14	18"
16, 17	18"
19,20,21	18"

Please clarify.

Thank you - Eliana

---

**From:** Michael S. Wolf <[mwolf@hubbardengineering.com](mailto:mwolf@hubbardengineering.com)>  
**Sent:** Wednesday, March 20, 2019 3:58 AM  
**To:** Hayes, Eliana <[EHayes@Scottsdaleaz.gov](mailto:EHayes@Scottsdaleaz.gov)>; Anderson, Scott L <[scan@scottsdaleaz.gov](mailto:scan@scottsdaleaz.gov)>  
**Cc:** Brent Steffenhagen <[bsteffenhagen@hubbardengineering.com](mailto:bsteffenhagen@hubbardengineering.com)>; Yamani, Srikanth <[srikanth.yamani@wilson-engineers.com](mailto:srikanth.yamani@wilson-engineers.com)>; Todd, Steve M. <[Steve.Todd@wilson-engineers.com](mailto:Steve.Todd@wilson-engineers.com)>; Bloemberg, Greg <[GBLO@Scottsdaleaz.gov](mailto:GBLO@Scottsdaleaz.gov)>  
**Subject:** RE: Cavasson Waterwater Flows

Eliana, I agree with your assessment and appreciate you running the options with us. We will use the following:  
M.F. Unit Flow Rate = 80 gpcpd \* 1.7 person/d.u. \* 31 d.u./acre = 4,216 gpcpd <= Maximize the ADD  
Peaking Factor Population = 1.4 persons/d.u. \* 23 d.u./acre \* acreage <= Minimize the population which Maximizes the Peaking Factor in Harmons.

We will use the ADD, PDD and P.F. as provided by Wilson Eng. and we will use the 1.4 persons/d.u. \* 23 d.u./acre \* acreage for the upstream population on Lot 3 and 4 when adding up our cumulative population applied to Harmon's equation. Below are the calculation results based on the above criteria. Please note that the maximum pipe size is still 15", but we are right at the threshold for D/d (0.67) leaving the site.

**Table 2 - Total Wastewater Demands (GPD) - Based on M.F. using 1.7 persons/d.u. for ADD & 1.4 persons/d.u. for PDD**

Parcel Number	Land Use Designation	Area [sq.ft]	Area [acres]	ADD [gpd]	PDD [gpd] (ADD*P.F.)
1A-1	Office- Major	288,410	6.62	7,041.83	18,308.75
1A-2	Multi-Family	106,900	2.45	10,993.12	46,942.60
1A-3	Office- Major	210,817	4.84	5,147.32	13,383.02
1A-4	Office- Major	111,089	2.55	2,712.36	7,052.12
1A-5	Multi-Family	164,129	3.77	16,878.21	56,802.99
1A-6	Garage	203,541	4.67	0.00	0.00
1A-7	Hotel	127,754	2.93	12,417.75	32,286.14
1A-8	Commercial/ Retail	104,393	2.40	2,986.82	7,765.73
1B-1	Office- Major	421,088	9.67	10,281.29	26,731.36
1B-2	Multi-Family	431,364	9.90	44,359.36	149,858.11
1B-3	Garage	170,109	3.91	0.00	0.00
1C-1	Multi-Family	873,411	20.05	89,817.33	306,612.95
1C-2	Office- Major	222,112	5.10	5,423.09	14,100.04
1C-3	Hotel	151,582	3.48	14,733.87	38,308.06
1C-4	Commercial/ Retail	342,879	7.87	9,810.24	25,506.61
1C-5	Office- Major	215,746	4.95	5,267.66	13,695.91
1C-6	Multi-Family	156,694	3.60	16,113.62	68,088.99
1C-7	Multi-Family	191,303	4.39	19,672.63	82,609.95
1C-8	Multi-Family	352,473	8.09	36,246.60	145,752.78
1C-9	Office- Major	57,433	1.32	1,402.28	3,645.93
1C-10	Commercial/ Retail	154,919	3.56	4,432.46	11,524.39
<b>Total</b>				315,738	1,068,976

**Total Contributing Wastewater Demands (GPD)-Estimates- per CVL Crossroads East Wastewater Treatment Plant**

Parcel Number	Land Use Designation <sup>1</sup>	Area [sq.ft]	Area [acres]	ADDMM <sup>1</sup> [gpad]	Peak Flow <sup>1</sup> [gpad]	AL <sup>1</sup> [gpd]
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Lot 2	Mixed-Use	2,555,866	56.35	3,000	7,800	179
Lot 3	Multi-Family	993,630	22.81	2,060	7,746	46,
Lot 4	Multi-Family	2,516,643	57.77	2,060	7,107	119
<b>Total</b>						<b>345</b>

Total outflow in new pipe crossing Hayden Road:

ADD = 661,346 gpd

PDD = 2,123,229 gpd

Please note that our final numbers vary slightly from what you calculated only because the areas for each “parcel” changed slightly during the master planning process. If this looks acceptable I will begin updating all of the text and exhibits in the Master Report. Thank you.

Michael

---

**From:** Hayes, Eliana <[EHayes@Scottsdaleaz.gov](mailto:EHayes@Scottsdaleaz.gov)>

**Sent:** Tuesday, March 19, 2019 4:44 PM

**To:** Michael S. Wolf <[mwolf@hubbardengineering.com](mailto:mwolf@hubbardengineering.com)>; Anderson, Scott L <[scan@scottsdaleaz.gov](mailto:scan@scottsdaleaz.gov)>

**Cc:** Brent Steffenhagen <[bsteffenhagen@hubbardengineering.com](mailto:bsteffenhagen@hubbardengineering.com)>; Yamani, Srikanth <[srikanth.yamani@wilson-engineers.com](mailto:srikanth.yamani@wilson-engineers.com)>; Todd, Steve M. <[Steve.Todd@wilson-engineers.com](mailto:Steve.Todd@wilson-engineers.com)>; Bloemberg, Greg <[GBLO@Scottsdaleaz.gov](mailto:GBLO@Scottsdaleaz.gov)>

**Subject:** RE: Cavasson Waterwater Flows

Hello Michael –

For comparison, the Hubbard proposed revised sewer demand approach is still less than what it would be if sewer demand were determined based on 80 gallons per capita per day (reduced from 105 gallons per capita per day as stated in DSPM) and 1.4 persons per dwelling unit @ 31DU/acre.

I do not recommend increasing the population for peaking factor equation only as this just reduces sewer demands. In our discussion this morning, I was under the impression that increasing the per dwelling unit count would increase the Average Demand based on a per capita calculation which is not what is proposed, or has been used for this project. Therefore I would only recommend 1.4 persons per dwelling unit for peaking factor calculations based on proposed sewer demand calculations.

I’m still not sure why we are being ‘frugal’ with sewer demand calculations yet are proposing collection system infrastructure in excess of these sewer demand calculations.

As an fyi, I have run the sewer demand calculations based on 80 gallons per capita per day and 1.7 persons per dwelling unit @ 31 DU/acre (1600 DUs/52 acres) and compared those sewer demands to sewer master plan exhibit 3 proposed pipe sizes and the sizes sufficiently cover this demand, all while following the city’s D/d capacity restrictions (MF peaking factor based on all multi-family population):

Parcel Number	Land Use Designation	Area [sq.ft]	Area [acres]	POPULATION	ADD	PEAKING FACTOR
					[gpd]	
1A-1	Office- Major	445,000	10.22	–	10,865.14	
1A-2	Multi-Family	168,960	3.88	204.48	16,358.08	3.46
1A-3	Office- Major	314,500	7.22		7,678.84	

1A-4	Office- Major	164,500	3.78		4,016.44	
1A-5	Multi-Family	238,138	5.47	288.27	23,061.52	3.46
1A-6	Garage	203,541	4.67		0.00	
1A-7	Hotel	29,508	0.68		2,868.20	
1A-8	Commercial/ Retail	47,167	1.08		1,349.51	
1B-1	Office- Major	544,000	12.49		13,282.32	
1B-2	Multi-Family	613,685	14.09	742.54	59,403.44	3.46
1B-3	Garage	170,109	3.91		0.00	
1C-1	Multi-Family	873,411	20.05	1056.64	84,530.80	3.46
1C-2	Office- Major	97,000	2.23		2,368.36	
1C-3	Hotel	17,639	0.40		1,714.55	
1C-4	Commercial/ Retail	92,917	2.13		2,658.49	
1C-5	Office- Major	80,500	1.85		1,965.49	
1C-6	Multi-Family	101,055	2.32	122.26	9,781.12	3.46
1C-7	Multi-Family	146,873	3.37	177.60	14,207.92	3.46
1C-8	Multi-Family	195,752	4.49	236.62	18,929.84	3.46
1C-9	Office- Major	54,500	1.25		1,330.67	
1C-10	Commercial/ Retail	59,916	1.38		1,714.28	
<b>Total</b>					278,085	

3.46
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Please let me know what I am missing. As stated in meeting this morning, the lift station design sewer demand can be calculated separately from the collection system calculations.

Thank you - Eliana

**From:** Michael S. Wolf <[mwolf@hubbardengineering.com](mailto:mwolf@hubbardengineering.com)>  
**Sent:** Tuesday, March 19, 2019 2:41 PM  
**To:** Anderson, Scott L <[scan@scottsdaleaz.gov](mailto:scan@scottsdaleaz.gov)>; Hayes, Eliana <[EHayes@Scottsdaleaz.gov](mailto:EHayes@Scottsdaleaz.gov)>  
**Cc:** Brent Steffenhagen <[bsteffenhagen@hubbardengineering.com](mailto:bsteffenhagen@hubbardengineering.com)>; Yamani, Srikanth <[srikanth.yamani@wilson-engineers.com](mailto:srikanth.yamani@wilson-engineers.com)>; Todd, Steve M. <[Steve.Todd@wilson-engineers.com](mailto:Steve.Todd@wilson-engineers.com)>; Bloemberg, Greg <[GBLO@Scottsdaleaz.gov](mailto:GBLO@Scottsdaleaz.gov)>  
**Subject:** Cavasson Waterwater Flows

Good afternoon all, in an effort to lock in the sewer loading rates for the Multi-family component of the development, we present the following to get sign-off to move forward.

The Zoning of the M.F. areas; R-5 or 23. D.u./acre, the zoning case stipulates that 1,600 d.u.'s is the maximum for this site.

The site master plan included with the Master Sewer Report currently indicates 52.25 acres designated as M.F. usage. If we calculate an equivalent maximum M.F. acreage based on the R-5 zoning density of 23 du/acre with a maximum of 1,600 d.u.'s, as indicated above, we would have the following:

$$1,600 \text{ d.u. (max)} / 23 \text{ d.u./acre} = 69.57 \text{ acres maximum of M.F. usage.}$$

Now if we apply the design unit flow of 2,060 gpad (Ref. – 2012 Scottsdale Water Reuse Master Plan) to the maximum calculated M.F. acreage -> 2,060 gpad \* 69.57 acres = **143,315 gpd**

Converting that back to Cavasson's site specific acreage: 143,315 gpd / 52.25 acres = 2,742.8 gpapd => Use **2,745 gpapd** sewer design unit flow for multi-family use within the Cavasson development.

In the original report we used 2,060 gpapd, now we will use 2,745 gpapd, this is a 25% increase.

For the Multi-family population, instead of using 1.4 persons/d.u. we will use 1.7 persons/d.u. for the peaking flow calculation in Harmon's. This comes right out of Section 7-1.403 of the 2018 Scottsdale DSPM for the low end of Multi-family.

Please let us know if this is agreeable, and we will finalize any changes. Thank you.

Parcel Number	Land Use Designation	Area [sq.ft]	Area [acres]	ADD [gpd]	PDD (ADD*PF) [gpd]	Total M.I. Population Contribution [P]
1A-1	Office- Major	288,410	6.62	7,041.83	18,308.75	N/A
1A-2	Multi-Family	106,900	2.45	7,157.52	30,408.27	96
1A-3	Office- Major	210,817	4.84	5,147.32	13,383.02	N/A
1A-4	Office- Major	111,089	2.55	2,712.36	7,052.12	N/A
1A-5	Multi-Family	164,129	3.77	10,989.25	36,543.79	4,082
1A-6	Garage	203,541	4.67	0.00	0.00	N/A
1A-7	Hotel	127,754	2.93	12,417.75	32,286.14	N/A
1A-8	Commercial/ Retail	104,393	2.40	2,986.82	7,765.73	N/A
1B-1	Office- Major	421,088	9.67	10,281.29	26,731.36	N/A
1B-2	Multi-Family	431,364	9.90	28,881.98	97,637.22	3,538
1B-3	Garage	170,109	3.91	0.00	0.00	N/A
1C-1	Multi-Family	873,411	20.05	58,479.26	195,303.82	3,935
1C-2	Office- Major	222,112	5.10	5,423.09	14,100.04	N/A
1C-3	Hotel	151,582	3.48	14,733.87	38,308.06	N/A
1C-4	Commercial/ Retail	342,879	7.87	9,810.24	25,506.61	N/A
1C-5	Office- Major	215,746	4.95	5,267.66	13,695.91	N/A
1C-6	Multi-Family	156,694	3.60	10,491.43	44,063.76	141
1C-7	Multi-Family	191,303	4.39	12,808.67	53,430.73	172
1C-8	Multi-Family	352,473	8.09	23,599.84	93,917.55	488
1C-9	Office- Major	57,433	1.32	1,402.28	3,645.93	N/A
1C-10	Commercial/ Retail	154,919	3.56	4,432.46	11,524.39	N/A
<b>Total</b>				234,065	763,613	

**Michael S. Wolf, P.E.**  
Director of Land Development



1201 S. Alma School Rd., Suite 12000  
Mesa, Arizona 85210

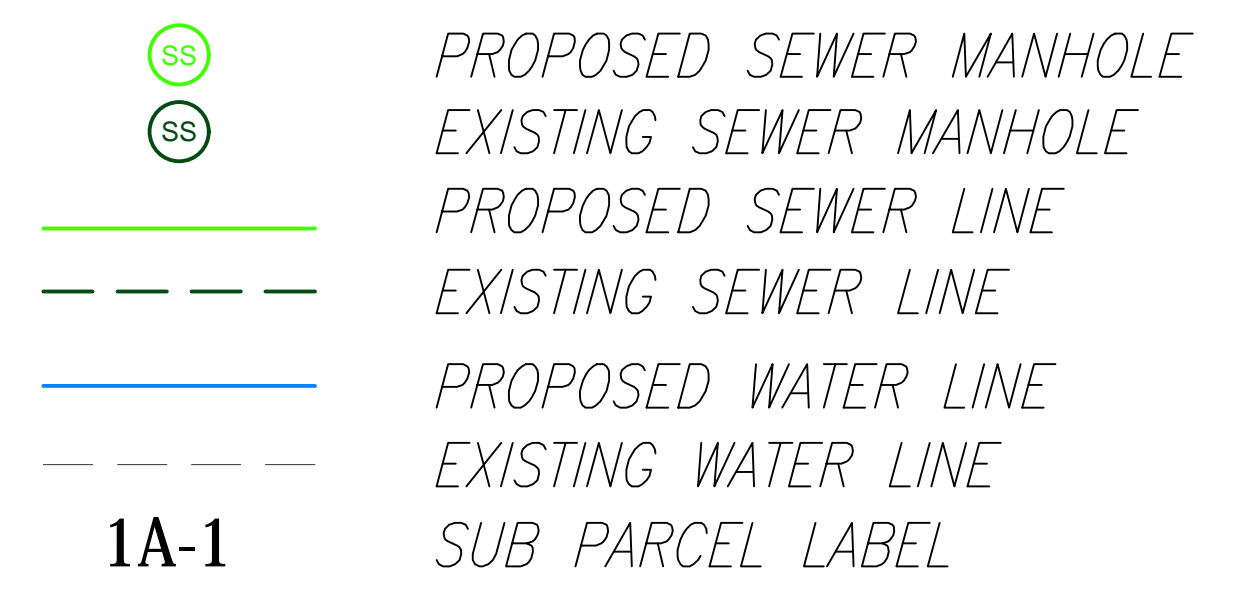
**phone** 480 892 3313  
**direct** 480 398 3836  
**cell** 602 695 4783  
**fax** 480 892 7051  
[www.hubbardengineering.com](http://www.hubbardengineering.com)



Total Contributing Wastewater Demands (GPD)-Estimates- per CVL Crossroads East Wastewater Plan Update							
Parcel Number	Land Use Designation1	Area [sq.ft]	Area [acres]	ADDMM1	Peak Flow1	ADD	PDD (ADD*PF)
				[gpad]	[gpad]	[gpd]	[gpd]
Lot 2	Mixed-Use	2,555,866	56.35	3,000	7,800	179,604	466,970
Lot 3	Multi-Family	993,630	22.81	3,128	11,761	71,352	268,282
Lot 4	Multi-Family	2,516,643	57.77	3,128	10,792	180,718	623,476
<b>Total</b>						<b>431,673</b>	<b>1,358,727</b>

1. Land use designation and unit wastewater flows derived from Table 2. Wastewater Generation Unit Factors from the CVL Crossroads East Wastewater Master Plan Update, 2012, Table 2-4 Scottsdale Wastewater Unit Loads - COS 2012 Water Reuse Master Plan Update. UPDATED to Use: 80 gal/per\*1.7 per/d.u.\*23 d.u./ac. [Per Scott Anderson email 03/26/19 for ADD] Peak factor provided by Wilson Engineering

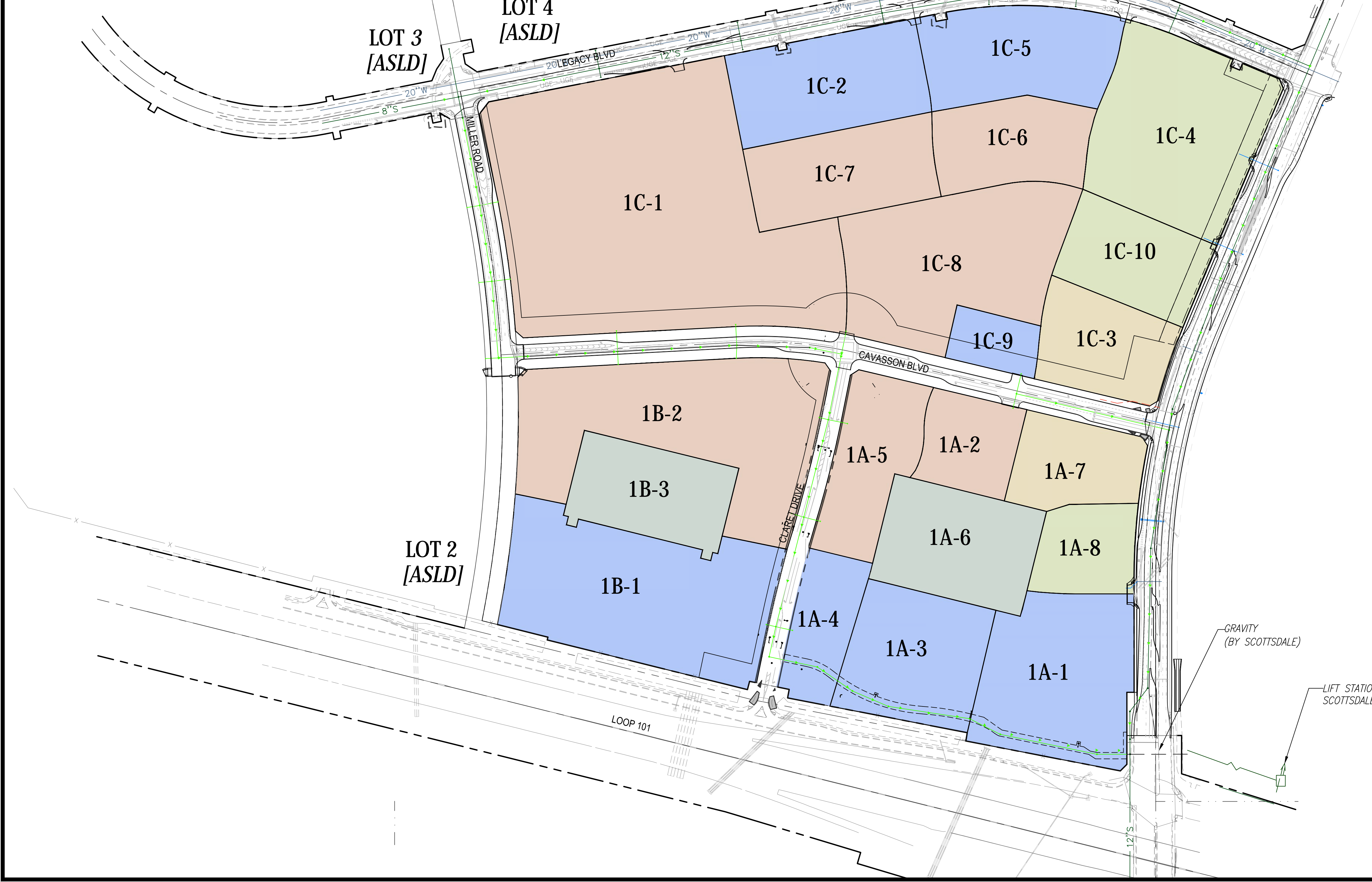
Street Segment	Sewer Line Segments	Contributing Sewer Areas	ADD CUMM. Total	PDD CUMM. Total
Legacy	Legacy	Lot 3, Lot 4, 1C-2, 1C-5	262,760	919,554
Miller	1,2,3	Lot 3, Lot 4, 1C-2, 1C-5, +1C-1 +Lot 2	532,181	1,693,136
Cavasson West	4,5,6,7	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, +1B-2	576,540	1,842,994
Claret North	8.0000	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, +1C-7 +1C-6 +1C-8	648,573	2,139,446
Claret South	9,10,11,12	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, 1C-7, 1C-6, 1C-8, +1B-1 +1A-4 +1A-5 +1A-2	689,438	2,276,975
Fire Drive West	12,14,15	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, 1C-7, 1C-6, 1C-8, 1B-1, 1A-4, 1A-5, +1A-3	694,585	2,290,358
Fire Drive East	16,17,18,19->MH-Tie	Lot 3, Lot 4, 1C-2, 1C-5, 1C-1, Lot 2, 1B-2, 1C-7, 1C-6, 1C-8, 1B-1, 1A-4, 1A-5, 1A-3, +1A-1	701,627	2,308,667



Sanitary Sewer System Unit Demands and Peaking Factors			23.0	du/acre
Land Use Designation	Unit Flow Rate (Ref.2) [gpad]	*Peaking Factor (PF)	1.4	persons/du
Office- Major	1,001	2.60	Harmon's Formula: Peaking Factor= 1+14/(4+P1^0.5)	
Hotel	3,985	2.60	P1= Population/1,000	
Multi-Family	4,216	####	Peaking Factor: 2.60	Lot 2
Commercial/ Retail	1,173	2.60	Peaking Factor: 3.76	Lot 3
*Peaking factor provided by sewer lift consultant, which was derived and calculated from empirical data.			Peaking Factor: 3.45	Lot 4
**Peaking factor calculated for Multi-Family using Harmon's Formula: Population = 1.4 people/d.u.*23 d.u./ac utilizing cumulative upstream population				
MF Unit Flow Rate is based on: 80 gpcpd * 1.7 per/d.u. * 31 d.u./acre = 4,216 gpad. The Peaking factor was calculated with Harmon's using 1.4 persons/d.u. and 23 d.u. per/acre				

Table 2 - Total Wastewater Demands (GPD) - Based on M.F. using 1.7 persons/d.u. for ADD & 1.4 persons/d.u. in Population for Harmons

Parcel Number	Land Use Designation	Area [sq.ft]	Area [acres]	ADD	PDD (ADD*PF)	Total M.F. Population Contributing	Individual Peaking Factor of all population contributing
				[gpd]	[gpd]	[P]	(PF)
1A-1	Office- Major	288,410	6.62	7,041.83	18,308.75	-	2.60
1A-2	Multi-Family	106,900	2.45	10,993.12	46,942.60	79	4.27
1A-3	Office- Major	210,817	4.84	5,147.32	13,383.02	-	2.60
1A-4	Office- Major	111,089	2.55	2,712.36	7,052.12	-	2.60
1A-5	Multi-Family	164,129	3.77	16,878.21	56,802.99	3,681	3.37
1A-6	Garage	203,541	4.67	0.00	0.00	-	N/A
1A-7	Hotel	127,754	2.93	12,417.75	32,286.14	-	2.60
1A-8	Commercial/ Retail	104,393	2.40	2,986.82	7,765.73	-	2.60
1B-1	Office- Major	421,088	9.67	10,281.29	26,731.36	-	2.60
1B-2	Multi-Family	431,364	9.90	44,359.36	149,858.11	3,559	3.38
1B-3	Garage	170,109	3.91	0.00	0.00	-	N/A
1C-1	Multi-Family	873,411	20.05	89,817.33	306,612.95	3,240	3.41
1C-2	Office- Major	222,112	5.10	5,423.09	14,100.04	-	2.60
1C-3	Hotel	151,582	3.48	14,733.87	38,308.06	-	2.60
1C-4	Commercial/ Retail	342,879	7.87	9,810.24	25,506.61	-	2.60
1C-5	Office- Major	215,746	4.95	5,267.66	13,695.91	-	2.60
1C-6	Multi-Family	156,694	3.60	16,113.62	68,088.99	116	4.23
1C-7	Multi-Family	191,303	4.39	19,672.63	82,609.95	141	4.20
1C-8	Multi-Family	352,473	8.09	36,246.60	145,752.78	402	4.02
1C-9	Office- Major	57,433	1.32	1,402.28	3,645.93	-	2.60
1C-10	Commercial/ Retail	154,919	3.56	4,432.46	11,524.39	-	2.60
<b>Total</b>				<b>315,738</b>	<b>1,068,976</b>		



March 26, 2019

### MASTER SEWER LOADS EXHIBIT 1

**HUBBARD ENGINEERING**  
www.hubbardengineering.com

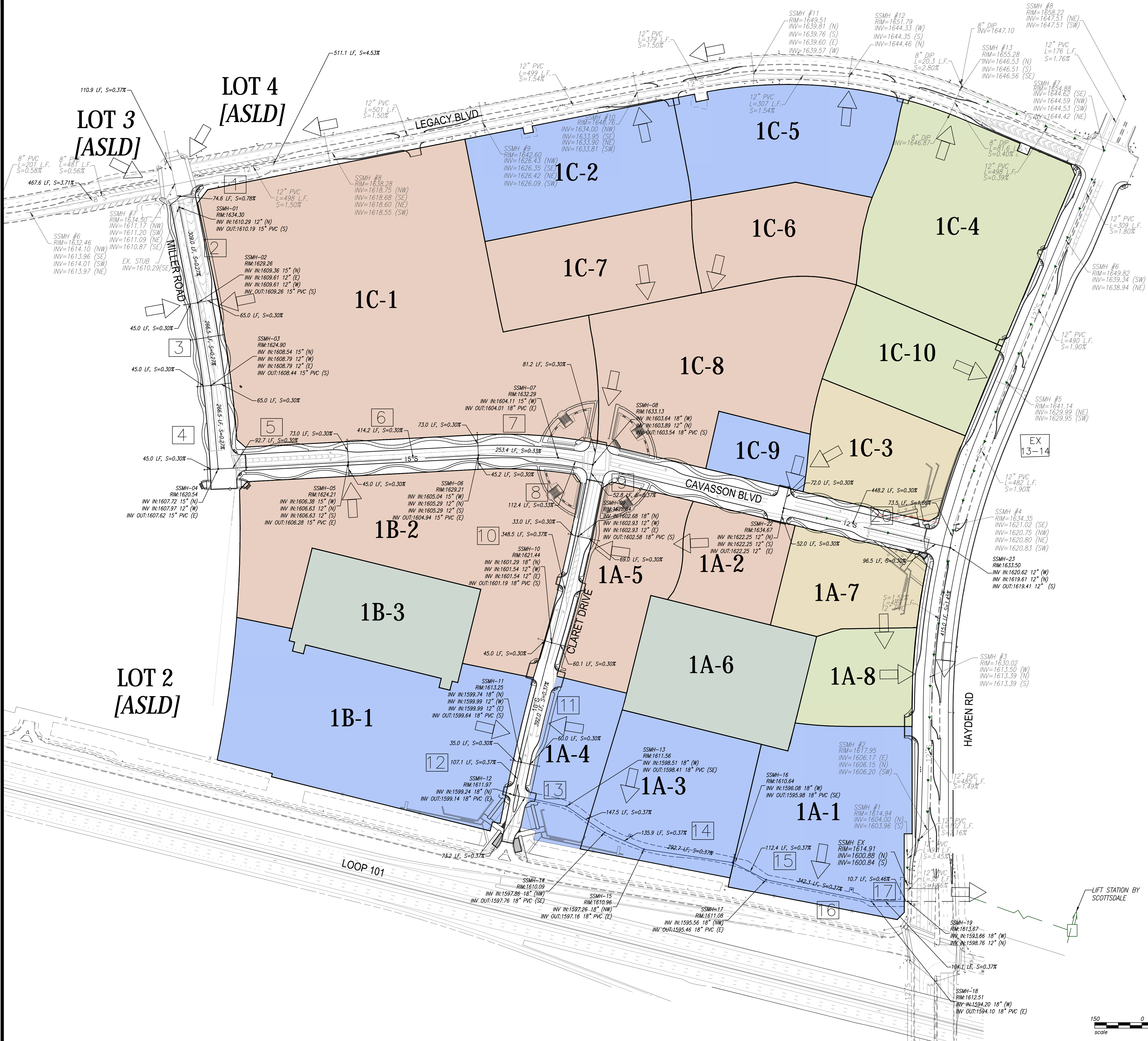
1201 S. Alma School Rd., Suite 12000  
Mesa, AZ 85210  
Ph: 480.892.3313



Parcel Number	Area [sq.ft]	ADD [gpd]	PDD [gpd]	
1C-9	57,433	1,402	3,646	Hayden
1C-3	151,582	14,734	38,308	
1A-7	127,754	12,418	32,286	
1A-8	104,393	2,987	7,766	
<b>Total To MH-22</b>	<b>441,161</b>	<b>31,541</b>	<b>82,006</b>	
1C-4	342,879	9,810	25,507	Legacy
1C-10	154,919	4,432	11,524	
<b>Total to SSMH#13</b>	<b>497,798</b>	<b>14,243</b>	<b>37,031</b>	
1C-2	222,112	5,423	14,100	
1C-5	215,746	5,268	13,696	
1C-7	191,303	19,673	82,610	
1C-6	156,694	16,114	68,089	
<b>Total to SSMH#7</b>	<b>785,854</b>	<b>46,477</b>	<b>178,495</b>	
1C-1	873,411	89,817	306,613	
<b>Total to MH-1</b>	<b>873,411</b>	<b>89,817</b>	<b>306,613</b>	
1B-2	431,364	44,359	149,858	Proposed Line
<b>Total to MH-4</b>	<b>431,364</b>	<b>44,359</b>	<b>149,858</b>	
1C-8	352,473	36,247	145,753	
<b>Total to MH-7</b>	<b>352,473</b>	<b>36,247</b>	<b>145,753</b>	
1A-5	164,129	16,878	56,803	
1A-2	106,900	10,993	46,943	
<b>Total to MH-9</b>	<b>271,029</b>	<b>27,871</b>	<b>103,746</b>	
1B-1	421,088	10,281	26,731	
1A-4	111,089	2,712	7,052	
1A-3	210,817	5,147	13,383	
1A-1	288,410	7,042	18,309	
<b>Total to MH-10</b>	<b>1,031,404</b>	<b>25,183</b>	<b>65,475</b>	
<b>TOTAL</b>		<b>315,738</b>	<b>1,068,976</b>	

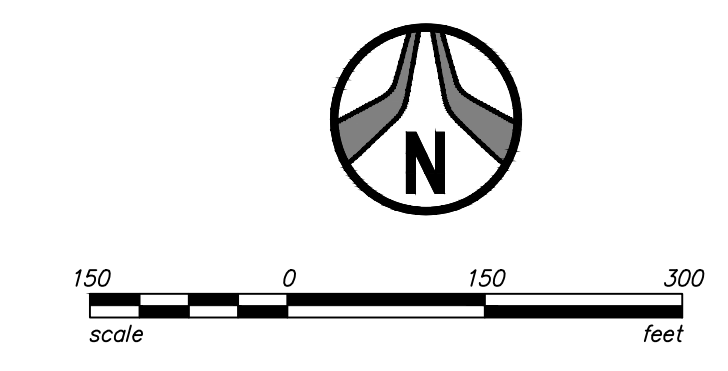
- MH-1 PROPOSED SEWER MANHOLE
- SSMH 1 EXISTING SEWER MANHOLE
- PROPOSED SEWER LINE
- - - EXISTING SEWER LINE
- 1A-1 SUB PARCEL LABEL

March 27, 2019  
**SEWER LAYOUT-12" [CAVASSON ONLY]**  
**EXHIBIT 2**



Parcel Number	ADD [gpd]	PDD [gpd]	
1C-9	1,402	3,646	CAVASSON EAST
1C-3	14,734	38,308	
<b>Total To MH-22</b>	<b>16,136</b>	<b>41,954</b>	
1C-4	9,810	25,507	HAYDEN NORTH
1C-10	4,432	11,524	
<b>Total to SSMH#5</b>	<b>14,243</b>	<b>37,031</b>	
1A-7	12,418	32,286	HAYDEN SOUTH
1A-8	2,987	7,766	
<b>Total To SSMH#2</b>	<b>45,783</b>	<b>119,037</b>	
1C-5	5,268	13,696	LEGACY EAST
1C-2	5,423	14,100	
Lot 4	180,718	623,476	
Lot 3	71,352	268,282	
<b>Total to SSMH#7</b>	<b>262,760</b>	<b>919,554</b>	
<b>Total to MH-01</b>	<b>352,577</b>	<b>1,226,167</b>	MILLER
Lot 2	179,604	466,970	
<b>Total to MH-03</b>	<b>532,181</b>	<b>1,693,136</b>	
1B-2	44,359	149,858	CAVASSON WEST
<b>Total to MH-04</b>	<b>576,540</b>	<b>1,842,994</b>	
1C-7	19,673	82,610	CLARET
1C-6	16,114	68,089	
1C-8	36,247	145,753	
<b>Total to MH-08</b>	<b>648,573</b>	<b>2,139,446</b>	
1A-5	16,878	56,803	FIRE LANE
1A-2	10,993	46,943	
<b>Total to MH-09</b>	<b>676,444</b>	<b>2,243,192</b>	
1B-1	10,281	26,731	HAYDEN SOUTH
1A-4	2,712	7,052	
<b>Total to MH-12</b>	<b>689,438</b>	<b>2,276,975</b>	
1A-3	5,147	13,383	CAVASSON WEST
<b>Total to MH-15</b>	<b>694,585</b>	<b>2,290,358</b>	
1A-1	7,042	18,309	
<b>Total to MH-17</b>	<b>701,627</b>	<b>2,308,667</b>	
<b>Total to MH-19</b>	<b>747,411</b>	<b>2,427,704</b>	MH-17 + SSMH#2 TO EAST SIDE OF HAYDEN
<b>TOTAL</b>	<b>747,411</b>	<b>2,427,704</b>	

- 1 SEWER RUN I.D.
- SS SSMH-1 PROPOSED SEWER MANHOLE
- SSMH #1 EXISTING SEWER MANHOLE
- SS PROPOSED SEWER LINE
- EXISTING SEWER LINE
- 1A-1 SUB PARCEL LABEL



MARCH 26, 2019  
**MASTER SEWER LAYOUT-15" and 18"**  
**EXHIBIT 3**