Sewer Basis of Design Report

118th & Jomax (80 Acres)

ACCEPTED AS NOTED
City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258
10/03/2017.

prepared for:

Toll Brothers Inc.
8767 E. Via de Ventura, Suite 390
Scottsdale, Arizona 85258
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prepared by:

ARGUS CONSULTING
A CIVIL ENGINEERING COMPANY, PC

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480 596 1131

September 2017

10-PP-2017

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1.0 INTRODUCTION

1.1 General Description

This Sewer Basis of Design Report has been prepared to describe how sanitary sewer services will be provided to the proposed subdivision of 118th & Jomax (80 acres), for Toll Brothers' Arizona Construction Company. The project is located within the City of Scottsdale, Arizona. The project is approximately 80 acres with a total of 51 dwelling units and 16 offsite units. The project is currently R1-35, R1-43, R1-70 (ESL), R1-130 and R1-190 zoning districts. The property is located on rolling terrain. Northern and western portions of the property slope to the north and to the east. The southeast portion of the property slope to the east and to the south. The site is within the elevation range from 2750 to 2680.

This analysis will present the design requirements for the collection system for the entire project and offsite lots *See Figure 3: Sewer Distribution Map*.

1.2 Location

The project is located in a portion of the Southeast 1/4 of Section 34 and the Southwest 1/4 of Section 35, Township 5 North, Range 5 East of the Gila and Salt River Baseline and Meridian, Maricopa County, Arizona. It is bound on south by Jomax Road Alignment, west by 118th Street Alignment and residential dwellings, north by RedBird Road and rural residential dwellings and east by McDowell Sonoran Preserve. *See Figure 1: Vicinity Map.*

1.3 Purpose

This report has been prepared to analyze the construction of the sanitary sewer system that will serve this project. The report shall provide technical information for the sanitary sewer distribution system for the entire project. This report analyzes the final design for the sewer distribution system. The lift station detailed design will be completed during the construction document process. The city will operate the Lift Station. The lift station is to be designed per the City's Lift Station Design Criteria, Dated Oct. 15th, 2015.

2.0 COLLECTION SYSTEM DESCRIPTION

2.1 Existing Collection System

An Off-Site Wastewater Capacity Report for the project was approved by the City of Scottsdale Water Resources Administration on February 26, 2016. This report depicts the existing off-site collection system layout and capacities as well as the proposed off-site collection system for the project. See Appendix A for the approved Off-Site Wastewater Capacity Report. The east 40 acres of the property has been planned within the Master Wastewater Plan for the Sereno Canyon Development proposed by Crown Development. The property has been removed from this master plan. The project will convey the demand flows to an existing gravity line in East Four Peaks Road within the Desert Summit subdivision. The property demand flows will also include the existing dry sewer pipe line within the Jomax Road alignment and those properties adjacent to Redbird Road. *See Figure 2: Adjoining Area Map.*

2.2 Proposed Collection System

The proposed collection system will convey the wastewater demand flows within a gravity pipe system that is routed to a proposed lift station to be constructed between lots 33 and 34 near the northeast property corner of the 80 acres. The lift station will discharge the demand flows from the lift station to the existing gravity line in East Four Peaks Road within the Desert Summit subdivision. All pipes within the project are to be gravity 8-inch diameter sewer pipe lines. *See Figure 3: Sewer Distribution Map*.

3.0 BASIS OF DESIGN

3.1 Design Flow Rates

As per the City of Scottsdale this Basis of Sewer Design Report was prepared according Design Standards & Policies Manual, dated January 2010. The following is a summary of the design criteria upon which this study is based.

Basis of Sewer Design

- The total number of units = 67
- Per the City of Scottsdale design standards section 7-1.403 residential design flow will be 100 gallons per capita day with 2.5 persons per dwelling unit.
- A peaking factor of 4 will be used.

Sewer flow was calculated as follows:

Total units = 51

Cantabrica, East Redbird Road = 16

Total average day Flow = 100 gpcd x 2.5 persons x 67 units = 16,750 gpd

Average Daily Flow = 11.63 gpm = 0.0259 cfs

Peak Day Flow = 11.63 gpm x 4 = 46.53 gpm = 0.1037 cfs

Peak Hour Flow = 0.1037 cfs x 1.7 = 0.1763 cfs

The collection system design criterion is based on the City of Scottsdale DSPM. The following represents the design criteria for the collection system:

- Mean full flow velocity = 2.5 feet per second
- Peak Flow velocity = 10.0 feet per second maximum.
- The Manning's roughness coefficient, n=0.013 for all pipe materials.
- Maximum sewer capacity: d/D=65% at peak flow conditions.

* Manhole spacing shall be =<500 LF for sewer lines <18"

- The minimum drop in elevation from the invert to the outlet of a manhole shall be 0.1 feet.
- The minimum manhole diameter shall be 48 inches for manholes less than 10 feet deep and the pipe is less than 15 inches in diameter.
- MAG Standard 601 and 615 and any subsequent MAG specification and details, shall be followed for trench bedding.
- Minimum slopes: Use the minimum slope of 0.52% calculated from Manning's Formula using a sewage velocity of 2.5 feet per second when flowing full.
- Force Main shall be designed per the DSPM under section 7-1.303.
- Lift Station design shall include an allowance of 35 gpm per pump for swimming pool discharge.
- Line separation shall be designed per the DSPM under section 7-1.407.

3.2 Sewer Capacity

The 118th & Jomax (80 acres) project and adjacent developments will accumulate 16,750 gallons per day average day flow at buildout. At Peak Day Flows the development will accumulate 67,000 gallons per day at buildout for the development.

4.0 On-site Improvements

The collection system for the community is to be a gravity sewer system. The pipes shall be constructed within the proposed streets and dedicated sewer easements. The onsite gravity sewer collection system will collect and convey sewer flows to a proposed Lift Station that will be constructed between future lots #33 and #34 within a tract to be deeded to the City of Scottsdale. This lift station is to discharge the sewer flows within a 3-inch diameter force main. The force main will be constructed within the proposed street section for the project. The force main will connect to a proposed odor control discharge divergence structure located an tract to be deeded to the City of Scottsdale, along the east right of way line of 118th Street. From this structure, the flows will be discharge to a proposed gravity sewer pipe within 118th Street. Flows within this proposed off-site system are conveyed to the north along the 118th Street alignment to a manhole proposed to the east of the existing East Four Peaks Drive. From this proposed manhole an 8- inch gravity pipe will be constructed within the East Four Peaks Drive alignment to an existing manhole. The Dessert Summit HOA will be coordinated with prior to construction. See City of Scottsdale Sewer QS Map 49-56 at station 0+70 for the location of the existing sewer manhole within the East Four Peaks Drive roadway. See *Figure 3: Sewer Distribution* Map.

The proposed Lift Station will be designed per the minimum requirements of the Arizona Administration Code, Title 18, Chapter 9 "Water Pollution Control" and the City of Scottsdale Water Resources Department design standards. Per the approved Off-Site Wastewater Capacity Report, February 26, 2016 the maximum discharge from the proposed Lift Station shall not exceed 80 gpm. The total peak day flows for the project are calculated to be 46.53 gpm plus the required 35 gpm flow allowance for swimming pool discharge for 81.53 gpm. However, attached approved sewer capacity reports limits discharge to 80 gpm. Final design calculations for the Lift Station will be completed with the final design

design phase of the project. The elevation difference from the order control structure and the proposed Lift Station is 62 feet. The flow velocities in the force main must be between 4 and 6 feet per second. From preliminary design calculation, the Xylem, D3080 Vortex, centrifugal pump would be specified.

See Appendix B for calculations and a summary of the proposed system design and capacity. The appendix shows the proposed sewer slopes, projected peak flows fates, and pipe flow capacities meeting minimum design standards. Final hydraulics will be included in a Final Basis of Design Report.

Figure 1: Vicinity Map

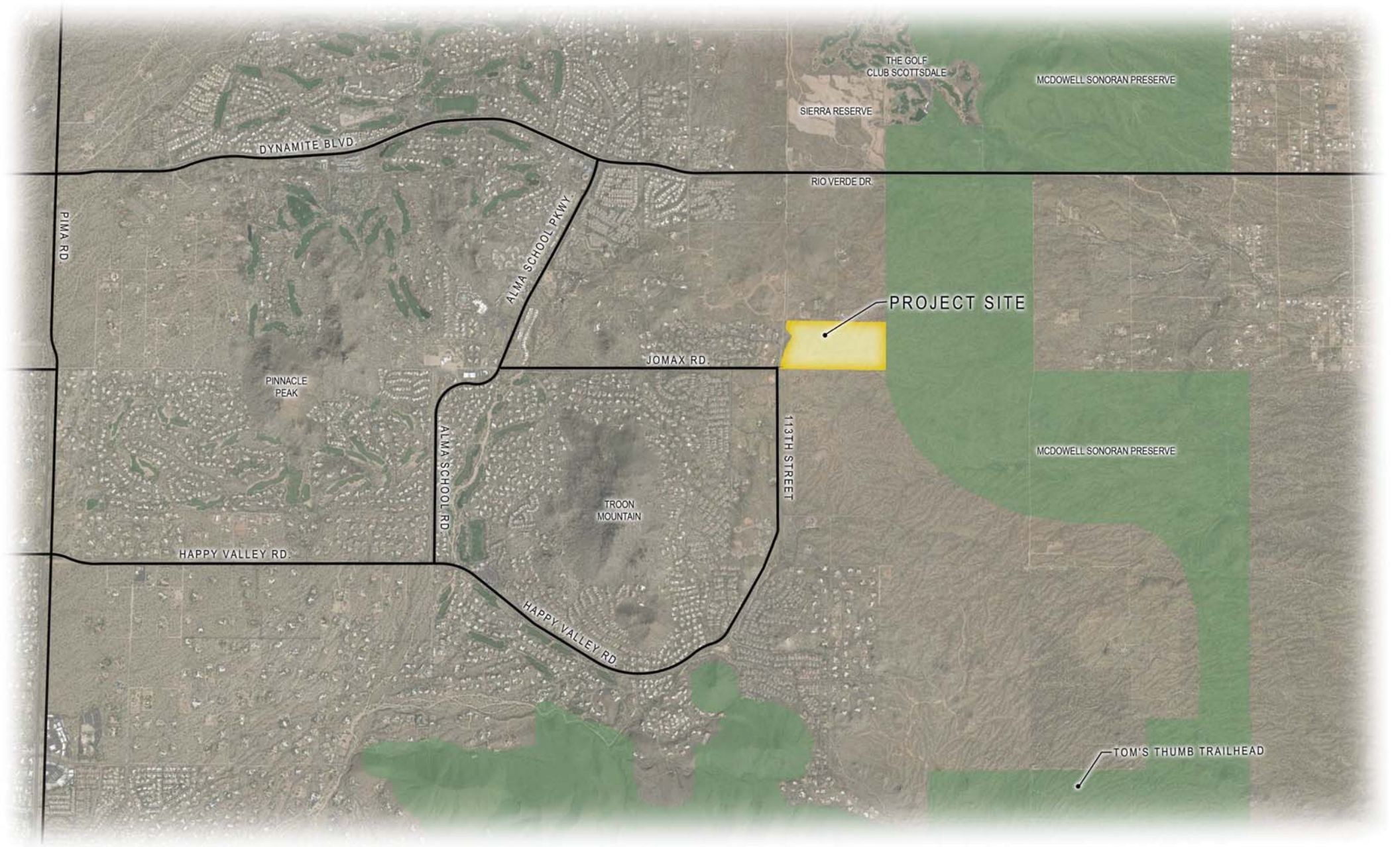

THE GOLF CLUB SCOTTSDALE
MCDOWELL SONORAN PRESERVE
SIERRA RESERVE
DYNAMITE BLVD.
RIO VERDE DR.
PIMA RD.
ALMA SCHOOL PKWY.
PROJECT SITE
JOMAX RD.
PINNACLE PEAK
ALMA SCHOOL RD.
113TH STREET
MCDOWELL SONORAN PRESERVE
TROON MOUNTAIN
HAPPY VALLEY RD.
HAPPY VALLEY RD.
TOM'S THUMB TRAILHEAD

Figure 2: Adjoining Area Map

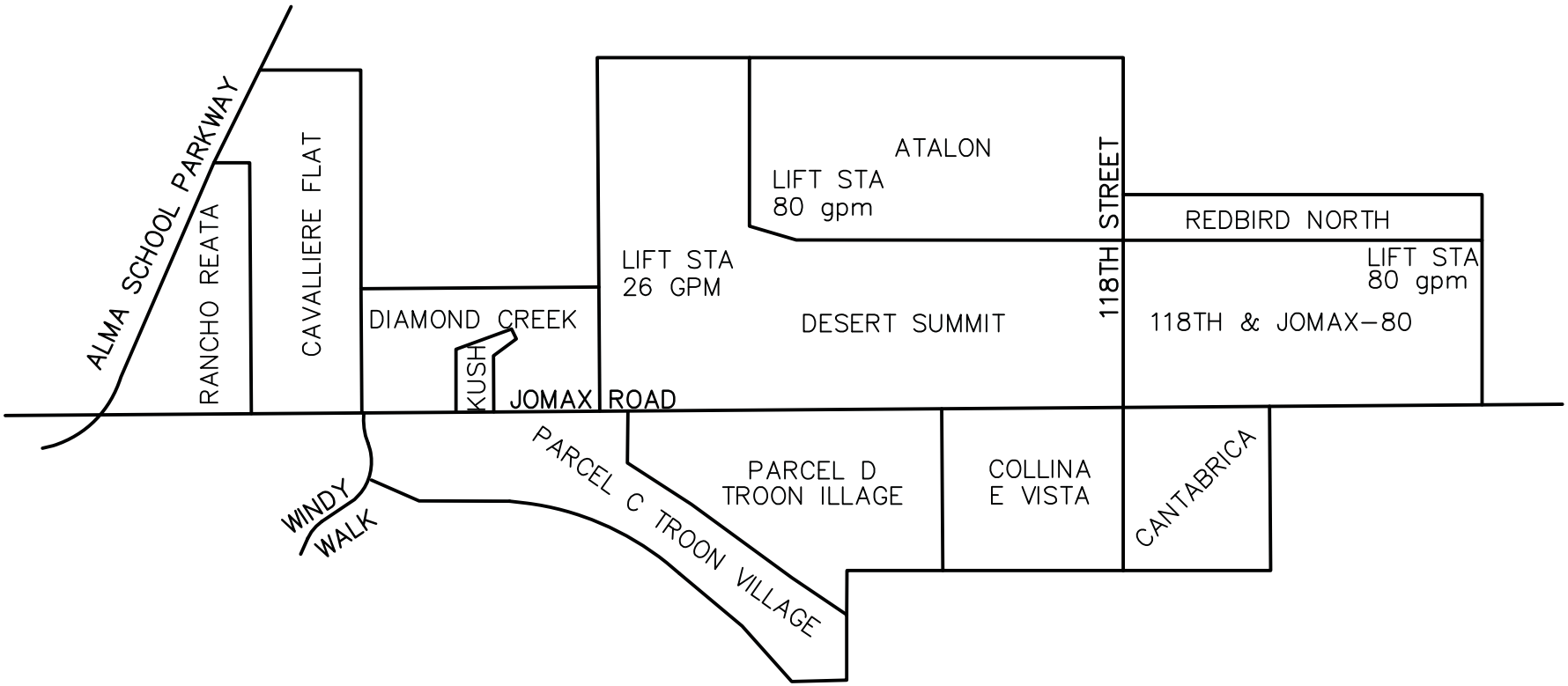


FIGURE 2

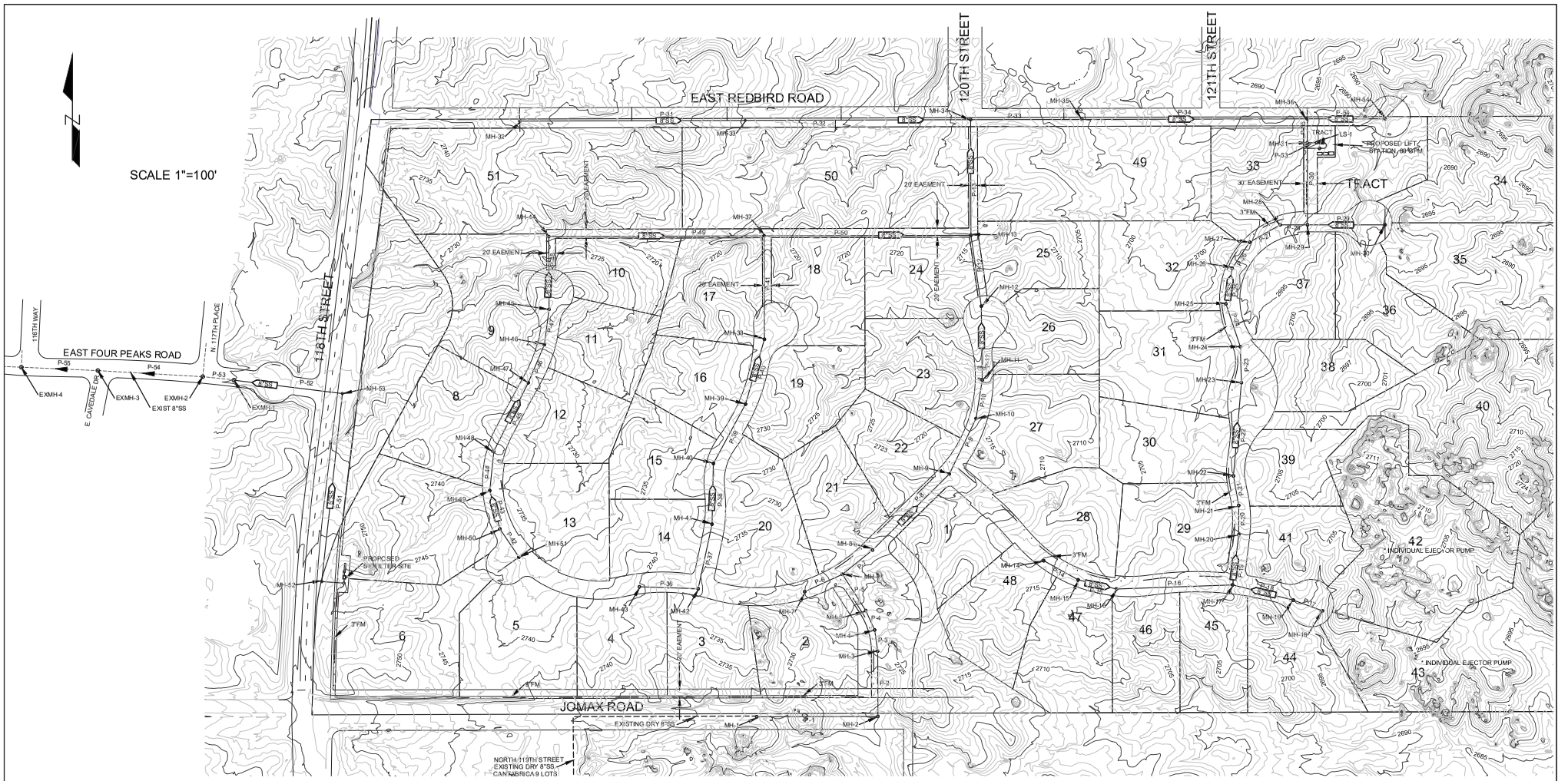
SITE PLAN

118TH & JOMAX–80

SCOTTSDALE – ARIZONA

DATE PLOTTED:

Figure 3: Sewer Distribution Map



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118th & JOMAX (80 ACRES)

FIGURE 3
SEWER DISTRIBUTION MAP

Designed by	Drawn by	
Date 6-2017	Job No.	Sheet 1 of 1

35476 BRIAN T. BERNARD 8/29/17 REGISTERED PROFESSIONAL ENGINEER ARIZONA, U.S.A. Expires 12/31/2018

F:\Eprive\Shared\118th & Jomax\Sewer\Preliminary sewer base file 6-6-17.dwg Sep 29, 2017 shw

Appendix A: Off-site Wastewater Capacity Report

Off-Site Wastewater

Capacity Report

118th & Jomax (80 acres)

EXPIRES 12/31/18

Prepared for:

Accepted As Noted

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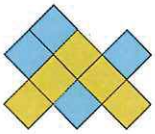

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2.26.16

February 2016

INTRODUCTION

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INTRODUCTION

This report has been prepared for the subject property consisting of approximately 80 acres of land situated at the northeast corner of 118th Street and Jomax Road, Scottsdale Arizona. This design report present an analysis of the existing sewer line in Jomax Road for disposal of wastewater from the proposed project.

The project is located within the City of Scottsdale in the Southeast quarter of the southeast quarter of Section 34 and the Southwest quarter of the Southwest quarter of Section 35, Township 5 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. Figure 1 show a Vicinity Map.

The project will be developed consistent with City of Scottsdale standards for R1-35, R1-43, and R1-70 (ESL) zoning districts. The project proposes approximately 63 Lots on 80 acres.

THE EAST 40AC ONLY. WILL REQUIRE HOA PERMISSIONS

The property is currently included in the master wastewater plan for the Sereno Canyon Development proposed by Crown Development. Under the current Master Plan there is no timetable for extension of service to the property. This report proposes removing the property from the Sereno Canyon Development Master Plan. The project will collect wastewater in a gravity system and route it to a lift station within the project. The lift station would discharge to an existing gravity line in East Four Peaks Road within the Desert Summit Subdivision. In addition to the subject property the existing dry sewer line in Jomax Road would be connected to the system. This line serves the Cantabrica Subdivision.

Previous developments in the area have identified potential capacity issues with lines downstream of this discharge point in Windy Walk Drive. City staff has requested capacity of lines be reviewed considering discharges from lift stations in Desert Summit, Atalon (Talon Ranch) and the herein proposed property impacting the lines simultaneously.

SITE DESCRIPTION

The subject property is located on rolling terrain. Northern and western portion slope to the north and east. Portion of the property to the southeast slope to the east and south. Site elevations range from 2750 to 2680.

WASTE WATER GENERATION

The residential flow rate is based upon information provided by the City of Scottsdale. Flows utilized for this report were taken from Table 2.4 of the City Wastewater Master Plan. Flows were calculated based on area and zoning classification. Copies of the tables are included in Appendix III.

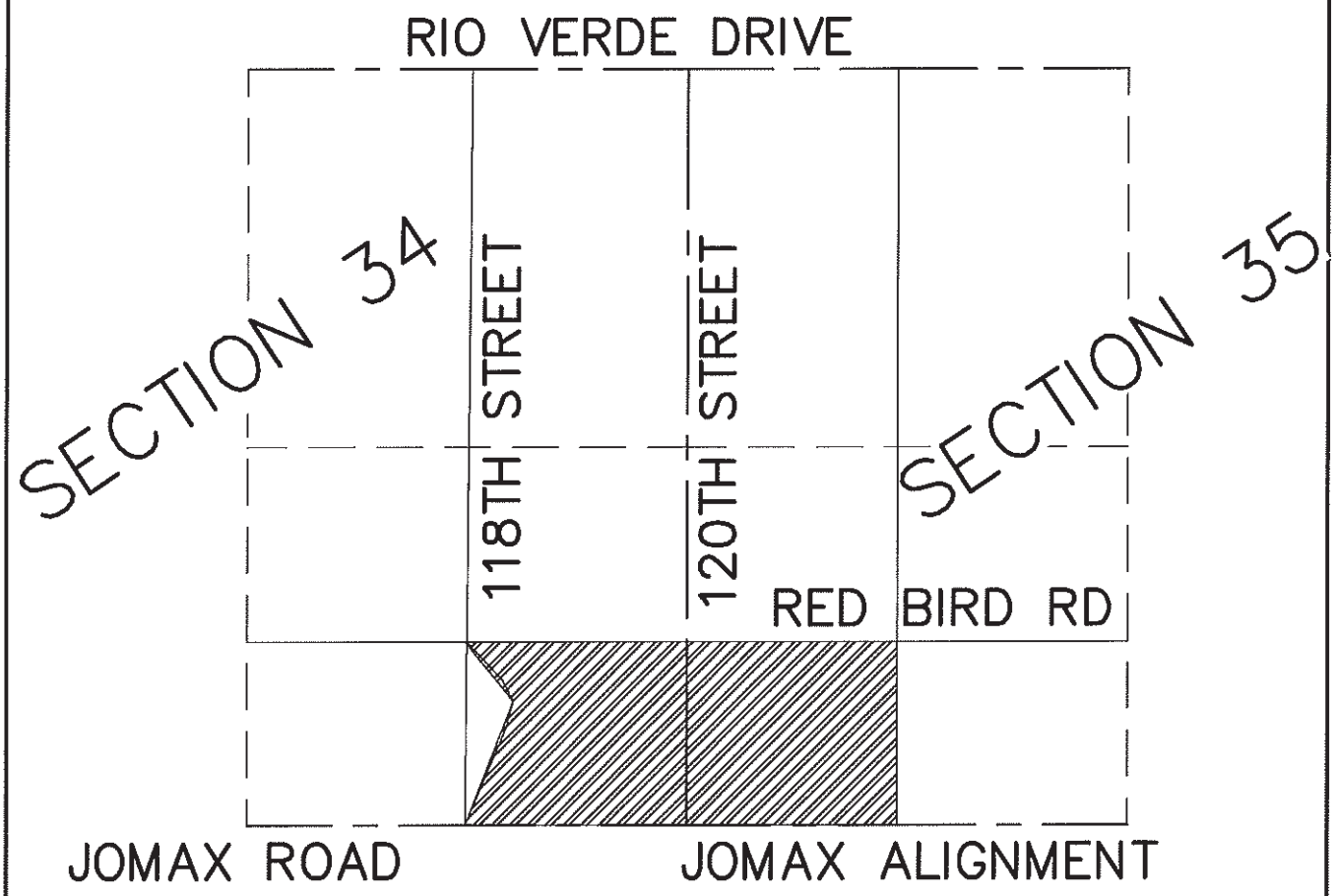

FIGURE 1
Vicinity Map

118th & Jomax–80

Scottsdale – Arizona

FILE NAME:
MACHINE NUMBER:
DATE PLOTTED:

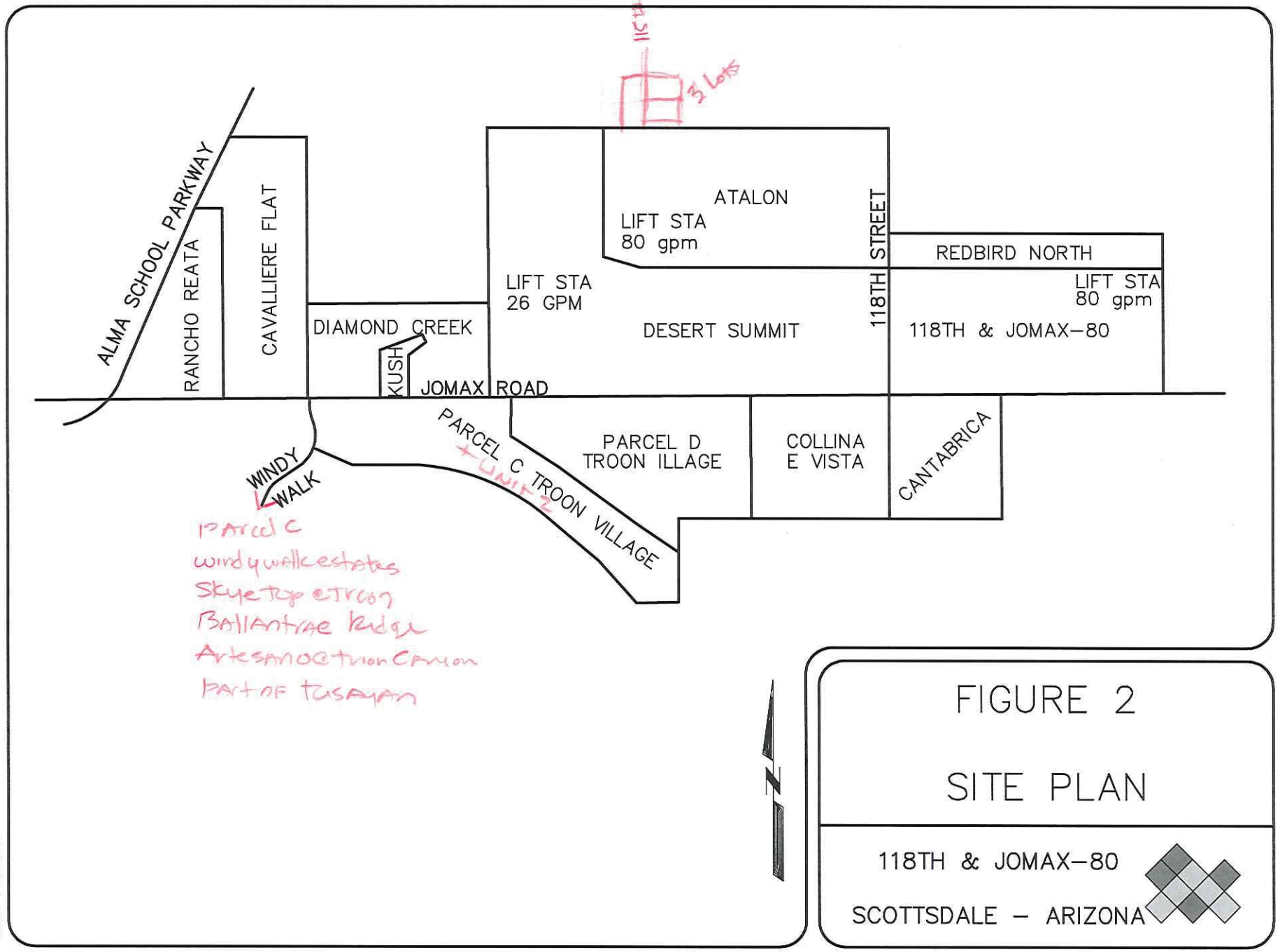

FIGURE 2

SITE PLAN

118TH & JOMAX–80

SCOTTSDALE – ARIZONA

DATE PLOTTED:

EXISTING SYSTEM

Sewer lines in Desert Summit, Desert Summit lift station, Atalon lift station, Parcels C and D of Troon Village at Windy Walk and Colina E Vista are collected in an existing 8" line in Jomax Road. The line turn south at 110th Street into Parcel D at Troon Village to Desert Troon Lane and Windy Walk Drive The portion of the line in Windy Walk Drive was identified in The Water and Wastewater Report for Colina E Vista by Kimley Horn & Associates as the section with most critical capacity issue. Results of calculations indicate the system cannot accept additional flow in this section from the subject property. Summary of existing flows to this point are provided in Table 1 below. See Calculations in Appendix I for existing flows in line to this point.

TABLE 1

Windy Walk Sewer						
Property	Zoning	Area Acre	High gpad	Flow gpad	GPM	CFS
Parcel C @Troon Village	Suburban	41.4	1215	50301	34.93	
Parcel D @Troon Village	Suburban	21.3	1215	25879.5	17.97	
Desert Summit	Rural	130.4	268	34947.2	24.27	
Desert Summit Lift Station	Rural		268		26.00	
Atalon Lift Station	Rural		268		80.00	
Collina E Vista	Rural	40	268	10720	7.44	
					190.62	0.42
118th & Jomax-80 Lift Station					80.00	0.18
Total Flow					270.62	0.60

PROPOSED SYSTEM

After consultation with City of Scottsdale staff it has been proposed a new line be constructed in Jomax Road connecting at 110th Street and extended westerly in Jomax to the recently completed line for the Cavalliere Flat project. This would direct flows from Desert Summit, Desert Summit Lift Station, Atalon Lift Station, Parcel C of Troon Village at Windy Walk, Colina E Vista and the subject property away from Windy Walk Drive and to Jomax Road Line and Alma School Parkway. Calculations were made to confirm this will not create capacity issues in the Jomax Line to Alma School Parkway. Calculations indicate the line does have sufficient capacity for estimated flows. Summary of existing flows to this point are provided in Table 2 below. See Calculations in Appendix II for existing flows in line to this point.

So 110TH + windywalk going South will be capped!

TABLE 2

Jomax Sewer						
Property	Zoning	Area Acre	High gpad	Flow gpad	GPM	CFS
Desert Summit	Rural	130.4	268	34947.20	24.27	
Desert Summit Lift Station	Rural		268		26.00	
Atalon Lift Station	Rural		268		80.00	
Collina E Vista	Rural	40	268	10720.00	7.44	
Rancho Reata	Urban	25.15	2060	51809.00	35.98	
Cavalliere Flat	Suburban	22.8	1215	27702.00	19.24	
Cavalliere Flat	Urban	24.1	2060	49646.00	34.48	
Diamond Creek	Rural	41.34	268	11079.12	7.69	
Kush	Suburban	4.46	1215	5418.90	3.76	
Parcel D @Troon Village	Suburban	21.3	1215	25879.5	17.97	
					256.83	0.572
Lift Station					80.00	0.178
Total Flow					336.83	0.750

Final LS Design Limited to 80gpm.

CONCLUSIONS

The Sewer Systems can be designed in accordance with the City of Scottsdale and Arizona Department of Health services standards.

Land use and wastewater flows are consistent with City of Scottsdale Master Plan for this area.

APPENDIX I
Windy Walk Drive Pipe Flows

Hydraulic Analysis Report

Project Data

Project Title: 118th & Jomax-80
Designer: Argus
Project Date: Monday, February 20, 2016
Project Units: U.S. Customary Units
Notes: 8" Sewer in Windy Walk Drive Slope 0.0024ft/ft

Input Parameters

Channel Type: Circular
Pipe Diameter: 0.6700 ft
Longitudinal Slope: 0.0024 ft/ft ? 8"
Manning's n: 0.0130
Flow: 0.4200 cfs

Result Parameters

Depth: 0.4131 ft
Area of Flow: 0.2281 ft^2
Wetted Perimeter: 1.2101 ft
Hydraulic Radius: 0.1885 ft
Average Velocity: 1.8411 ft/s
Top Width: 0.6515 ft
Froude Number: 0.5483
Critical Depth: 0.3016 ft
Critical Velocity: 2.7279 ft/s
Critical Slope: 0.0068 ft/ft
Critical Top Width: 0.67 ft
Calculated Max Shear Stress: 0.0619 lb/ft^2
Calculated Avg Shear Stress: 0.0282 lb/ft^2
D/d 0.4131/0.67=0.6166 Okay

Hydraulic Analysis Report

Project Data

Project Title: 118th & Jomax-80

Designer: Argus

Project Date: Monday, February 20, 2016

Project Units: U.S. Customary Units

Notes: 8" sewer Windy Walk Drive Slope 0.0024ft/ft

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.6700 ft

Longitudinal Slope: 0.0024 ft/ft

Manning's n: 0.0130

Flow: 0.6000 cfs

Result Parameters

Depth: 0.5492 ft

Area of Flow: 0.3093 ft^2

Wetted Perimeter: 1.5173 ft

Hydraulic Radius: 0.2039 ft

Average Velocity: 1.9397 ft/s

Top Width: 0.5151 ft

Froude Number: 0.4411

Critical Depth: 0.3638 ft

Critical Velocity: 3.0683 ft/s

Critical Slope: 0.0073 ft/ft

Critical Top Width: 0.67 ft

Calculated Max Shear Stress: 0.0823 lb/ft^2

Calculated Avg Shear Stress: 0.0305 lb/ft^2

D/d 0.5492/0.67 = 0.8197 Not Acceptable

APPENDIX II
Jomax Road Pipe Flows

Hydraulic Analysis Pipe Report

Project Data

Project Title: 118th & Jomax-80

Designer: Argus

Project Date: Monday, February 20, 2016

Project Units: U.S. Customary Units

Notes: 8" Sewer in Jomax Road west of Alma School Parkway Slope = 0.0052ft/ft

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.6700 ft

Longitudinal Slope: 0.0052 ft/ft ✓

Manning's n: 0.0130

Flow: 0.7500 cfs ✓

Result Parameters

Depth: 0.4742 ft

Area of Flow: 0.2668 ft^2

Wetted Perimeter: 1.3395 ft

Hydraulic Radius: 0.1992 ft

Average Velocity: 2.8112 ft/s

Top Width: 0.6094 ft

Froude Number: 0.7488

Critical Depth: 0.4086 ft

Critical Velocity: 3.3304 ft/s

Critical Slope: 0.0079 ft/ft

Critical Top Width: 0.65 ft

Calculated Max Shear Stress: 0.1539 lb/ft^2

Calculated Avg Shear Stress: 0.0646 lb/ft^2

D/d: ✓ 0.4742/0.67 = 0.7078 Acceptable ✓

APPENDIX III

Scottsdale Wastewater Unit Load Tables

Table 2-4 Scottsdale Wastewater Unit Loads

WASTEWATER UNIT LOADS PER LAND USE CATEGORY									
2008 Categories			2011 Categories						
Land Use Type	Sub-Category	Previous Zoning Category	Land Use Type	Zoning Category	Unit Load Estimate gpad	Weighted Average gpad	Average gpad	High gpad	Low gpad
Single Family Residential	1/5 - 1/3 du/ac	R1-190, R1-130	Rural Neighborhoods	R1-190	92	162	144	268	92
				R1-130	92				
	1/3 - 1/2 du/ac	R1-43, R1-70		R1-70	134				
				R1-43	134				
	1/2 - 1 du/ac	R1-35		R1-35	268				
	1 - 2 du/ac	R1-10, R1-18	Suburban Neighborhoods	R1-18	488	557	689	1,215	488
				R1-10	488				
	2 - 4 du/ac	R1-7, R1-5		R1-7	627				
				R1-5	627				
Patio Home and Townhouse Residential	4 - 6 du/ac	R2		R-2	1,215				
Townhouse Residential	6 - 8 du/ac	R-3, M-H	Urban Neighborhoods	M-H	1,328	1,754	1,541	2,060	1,328
				R-3	1,328				
Multi-Family Residential	8 - 12 du/ac	R-4, S-R, RCO-2		R-4	1,448				
	12 - 23 du/ac	R-5, RHD		R-5	2,060				

Table 2-4 Scottsdale Wastewater Unit Loads (Cont'd.)

WASTEWATER UNIT LOADS PER LAND USE CATEGORY									
2008 Categories			2011 Categories						
Land Use Type	Sub-Category	Previous Zoning Category	Land Use Type	Zoning Category	Unit Load Estimate gpad	Weighted Average gpad	Average gpad	High gpad	Low gpad
Mixed Use	Mixed Use	PRC, PNC, PCP, PCD, PCC, P.Co.C, P-1, P-2	Mixed-Use Neighborhoods	PNC	1,447	1,447	1,447	2098 1,447	1,447
				PRC	1,447				
				P.Co.C.	1,447				
			Mixed-Use High Rise	Mixed-Use High Rise	3,000	3,000	3,000	3,000	3,000
Destination Resort	10 - 25 rm/ac		Resorts/Tourism		861	3,982	1,941	3,985	861
Hotel / Resort	3 - 10 rm/ac	RH, RH-2			977				
	10 - 43 rm/ac	R-4R, M		R-4R	3985				
Churches	Churches		Cultural/ Institutional or Public		277	378	307	382	192
Community Service Facilities	Community Service Facilities	C-S, S-C, SC		S-C	192				
Institutional Facilities	Institutional Facilities	CC, C-O		C-O	378				
Schools	Schools				382				
Industrial	Major Industrial	I-1	Employment	I-1	752	926	953	1,574	561
	Minor Industrial	I-G		I-G	561				
Office	Major Office	O-S		C-2	1,001				
	Minor Office			C-1	878				
Utilities	Utilities			C-4	1,574				

Table 2-4 Scottsdale Wastewater Unit Loads (Cont'd.)

WASTEWATER UNIT LOADS PER LAND USE CATEGORY									
2008 Categories			2011 Categories						
Land Use Type	Sub-Category	Previous Zoning Category	Land Use Type	Zoning Category	Unit Load Estimate gpad	Weighted Average gpad	Average gpad	High gpad	Low gpad
Retail	Community	C-1, OR	Commercial	S-R	656	553	822	1,173	502
	General	C-2, C-2/P-3, C-2/P-4, S-S		S-S	1,173				
	Neighborhood	OC		C-3	502				
	Regional	RCO		C-S	680				
	Specialty/Tourism	RS		RS	1,100				
Improved Open Spaces	Golf Courses	Water	Developed Open Space	O-S	0	-	-	-	-
				P-2	0				
				P-1	0				
	Private Open and Recreation Areas	HC		O-S	0				
	Public Parks, etc.	W-P		O-S	0				
			Roads	O-S	0				
			Natural Open Space	O-S	0				

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

Appendix B: Proposed System Design and Capacity

Sewer Model Node Demand Assignment

Project: 118th and jomax
Location: Scottsdale, AZ

MH	# of Units	Persons Per Unit (PPU)	Total Pop.	Daily Flow Factor (gal/cap-day)	gallons/unit /day	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Peaking Factor	Demand Flow with peaking factor (gpm)	Demand Flow with peaking factor (cfs)
1	9	2.5	23	100	250	2250	1.56	4.00	6.250	0.0139
2	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
3	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
4	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
5	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
6	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
7	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
8	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
9	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
10	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
11	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
12	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
13	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
14	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
15	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
16	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
17	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
18	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
19	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
20	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
21	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
22	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
23	3	2.5	8	100	250	750	0.52	4.00	2.083	0.0046
24	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
25	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
26	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
27	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
28	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
29	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
30	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
31	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
32	3	2.5	8	100	250	750	0.52	4.00	2.083	0.0046
33	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
34	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
35	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
36	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
37	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
38	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
39	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
40	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
41	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
42	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
43	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
44	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
45	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
46	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
47	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
48	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
49	2	2.5	5	100	250	500	0.35	4.00	1.389	0.0031
50	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
51	3	2.5	8	100	250	750	0.52	4.00	2.083	0.0046
52	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
53	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
EXMH-1	1	2.5	3	100	250	250	0.17	4.00	0.694	0.0015
EXMH-2	3	2.5	8	100	250	750	0.52	4.00	2.083	0.0046
EXMH-3	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
EXMH-4	0	2.5	0	100	250	0	0.00	4.00	0.000	0.0000
Total	67		168			17,500	12.15		48.611	0.1083

PIPE FLOW CALCULATIONS

118TH AND JOMAX 80 ACRES
SCOTTSDALE, AZ

From MH	To MH	Pipe	Tributary Pipes	Peak Cumulative Flow (cfs)	Upstream Invert	Downstream Invert	Pipe Length (ft)	Pipe Slope	Pipe Diameter (in)	Depth to Diameter Ratio (d/D)	Peak Flow Velocity (ft/s)
MH-1	MH-2	P-1	CANTABRICA	0.0139	2721.07	2716.50	268.8	1.700%	8	0.075	1.16
MH-2	MH-3	P-2		0.0139	2716.50	2715.60	145.0	0.621%	8	0.09	0.88
MH-3	MH-4	P-3		0.0139	2715.60	2715.30	47.4	0.633%	8	0.075	0.83
MH-4	MH-5	P-4		0.0139	2715.30	2715.00	47.4	0.633%	8	0.075	0.83
MH-5	MH-6	P-5		0.0139	2715.00	2714.50	95.6	0.523%	8	0.09	0.88
MH-7	MH-6	P-6		0.0155	2720.00	2714.50	92.0	5.978%	8	0.06	1.79
MH-6	MH-8	P-7	P-5,P-6	0.0155	2714.50	2714.00	86.0	0.581%	8	0.09	0.98
MH-8	MH-9	P-8		0.0170	2714.00	2710.40	239.7	1.502%	8	0.075	1.41
MH-9	MH-10	P-9		0.0201	2710.40	2709.40	136.6	0.732%	8	0.105	1..02
MH-10	MH-11	P-10		0.0232	2709.40	2708.90	86.9	0.575%	8	0.12	0.96
MH-11	MH-12	P-11		0.0248	2708.90	2707.00	163.7	1.161%	8	0.105	1.26
MH-12	MH-13	P-12		0.0263	2707.00	2706.10	159.0	0.566%	8	0.12	1.09
MH-13	MH-34	P-13	P-12, P-50	0.0572	2706.10	2699.60	256.5	2.534%	8	0.12	2.36
MH-14	MH-15	P-14		0.0015	2705.40	2703.90	87.3	1.718%	8	0.03	0.48
MH-15	MH-16	P-15		0.0046	2703.90	2702.40	87.3	1.718%	8	0.045	0.8
MH-16	MH-17	P-16		0.0062	2702.40	2694.60	257.9	3.024%	8	0.045	1.08
MH-18	MH-19	P-17		0.0031	2695.80	2695.4	68.5	0.584%	8	0.045	0.54
MH-19	MH-17	P-18		0.0046	2695.40	2694.60	138.9	0.576%	8	0.06	0.53
MH-17	MH-20	P-19	P-16, P-17	0.0124	2694.60	2694.00	112.0	0.536%	8	0.09	0.79
MH-20	MH-21	P-20		0.0155	2694.00	2693.65	65.0	0.538%	8	0.104	0.79
MH-21	MH-22	P-21		0.0155	2693.65	2693.30	66.4	0.527%	8	0.104	0.79
MH-22	MH-23	P-22		0.0186	2693.30	2692.2	207.9	0.529%	8	0.104	0.94
MH-23	MH-24	P-23		0.0232	2692.20	2691.75	80.0	0.562%	8	0.12	0.96
MH-24	MH-25	P-24		0.0232	2691.75	2691.1	100.0	0.650%	8	0.12	0.96
MH-25	MH-26	P-25		0.0232	2691.10	2690.5	80.0	0.750%	8	0.104	1.01
MH-26	MH-27	P-26		0.0248	2690.50	2689.8	70.0	1.000%	8	0.104	1.26
MH-27	MH-28	P-27		0.0248	2689.80	2688.6	78.0	1.538%	8	0.09	1.57
MH-28	MH-29	P-28		0.0263	2688.60	2688.2	60.5	0.661%	8	0.12	1.09
MH-30	MH-29	P-29		0.0031	2689.20	2688.2	172.0	0.581%	8	0.044	0.54
MH-29	MH-31	P-30	P-28,P-29	0.0325	2688.20	2684.8	182.3	1.865%	8	0.104	1.65
MH-32	MH-33	P-31		0.0046	2726.14	2712.8	500.0	2.668%	8	0.03	0.99
MH-33	MH-34	P-32		0.0077	2712.80	2699.6	500.0	2.640%	8	0.045	1.08
MH-34	MH-35	P-33	P-13, P-32	0.0665	2699.60	2693.9	246.8	2.310%	8	0.135	2.26
MH-35	MH-36	P-34		0.0681	2693.90	2685.2	500.0	1.740%	8	0.15	2.01
MH-54	MH-36	P-54		0.0015	2693.90	2685.2	172.0	5.058%	8	0.03	0.48
MH-36	MH-31	P-35	P-34, P-54	0.0712	2685.20	2684.8	53.0	0.755%	8	0.18	1.66
MH-43	MH-42	P-36		0.0015	2730.70	2727.2	130.5	2.682%	8	0.03	0.48
MH-42	MH-41	P-37		0.0031	2727.20	2725.9	146.6	0.887%	8	0.045	0.54
MH-41	MH-40	P-38		0.0062	2725.90	2724.8	134.4	0.818%	8	0.06	0.72
MH-40	MH-39	P-39		0.0077	2724.80	2722.95	150.0	1.233%	8	0.06	0.89
MH-39	MH-38	P-40		0.0108	2722.95	2719.6	150.0	2.233%	8	0.06	1.25
MH-38	MH-37	P-41		0.0108	2719.60	2709.7	229.5	4.314%	8	0.06	1.16
MH-51	MH-50	P-42		0.0046	2729.50	2729	75.2	0.665%	8	0.06	0.53
MH-50	MH-49	P-43		0.0046	2729.00	2728.5	88.0	0.568%	8	0.06	0.53
MH-49	MH-48	P-44		0.0077	2728.50	2728	88.0	0.568%	8	0.075	0.64
MH-48	MH-47	P-45		0.0093	2728.00	2727.1	170.1	0.529%	8	0.075	0.77
MH-47	MH-46	P-46		0.0108	2727.10	2726.6	91.9	0.544%	8	0.09	0.69
MH-46	MH-45	P-47		0.0108	2726.60	2726.1	78.8	0.635%	8	0.075	0.83
MH-45	MH-44	P-48		0.0139	2726.10	2719.1	161.6	4.332%	8	0.06	1.61
MH-44	MH-37	P-49		0.0155	2719.10	2709.7	477.6	1.968%	8	0.075	1.29
MH-37	MH-13	P-50	P-41, P-49	0.0294	2709.70	2706.1	460.8	0.781%	8	0.12	1.21
MH-31	LS-1	P-53	P-35, P-30	0.1037	2684.80	2684.3	20.0	2.500%	8	0.16	2.66
LS-1	MH-52	3"FM		0.1816	2684.80	2743	3938.5	-1.478%	3		
MH-52	MH-53	P-51		0.1816	2740.43	2738.25	420.0	0.519%	8	0.22	3.05
MH-53	EXMH-1	P-52		0.1816	2738.15	2736.89	242.4	0.520%	8	0.31	1.92
EXMH-1	EXMH-2	P-53		0.1831	2736.79	2736.20	70.0	0.843%	8	0.28	2.22
EXMH-2	EXMH-3	P-54		0.1877	2736.10	2735.30	233.0	0.343%	8	0.36	1.65
EXMH-3	EXMH-4	P-55		0.1877	2735.20	2733.03	170.0	1.276%	8	0.25	2.64

~0.31