

Wastewater Study

Sewer Basis of Design Prepared: February 2018

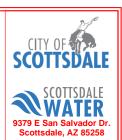
Asteria Highlands

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 Scott Anderson

DATE 2/26/2018

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1.0 INTRODUCTION

1.1 Project Description

The purpose of this sewer report is to support the proposed Asteria Highlands residential development. Asteria Highlands is adjacent to the future StoryRock Master Planned Community (formerly named Cavalliere Ranch), a development consisting of 462-acres of single family residential construction, and a future phase of the Sereno Canyon Master Plan.

Asteria Highlands is a proposed 40-acre single family residential subdivision consisting of 31 single family residential units. Asteria Highlands is proposed to be zoned R1-70 ESL (4 lots) and R1-35 ESL (27 lots). Sewer capacity for 13 of the 31 lots was previously approved and assured by the City of Scottsdale with the approval of Tiara Estates. All liens associated with the water and sewer improvements from Sereno Canyon have been released for the previous 13 lots. Capacity for the remaining 18 lots will be on a first come first serve basis for the existing lift station and will be subject to payback charges to Sereno Canyon.

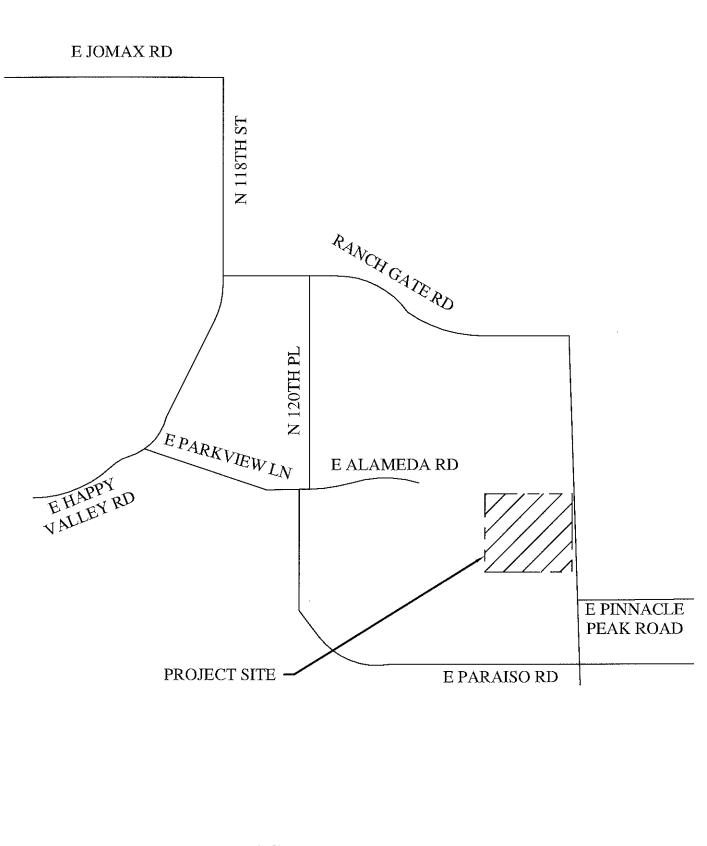
1.2 Project Location

Asteria Highlands is located within Section 11 of Township 4 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The site is bound to the north by Alameda Road alignment, and the east by 128th Street, to the South by undivided land, and to the West by existing Sereno Canyon single family residential subdivision (COS#2703-07-1). See **Figure 1: Vicinity Map.**

1.3 Scope of Sewer Plan

This report presents the basis of design criteria that will be used for the engineering design of the proposed Asteria Highlands development. This report will establish the final sewer system demands for the project and the sewer system infrastructure required to serve the development. Finally, the report will show the development of this site as a standalone project relative to the adjacent future development areas.

All design criteria that is presented in this report will conform to the City of Scottsdale Design Standards & Polices Manual (DS&PM).



$\frac{\text{VICINITY MAP}}{\text{NTS}}$



2.0 EXISTING SITE CONDITIONS AND SEWER SYSTEMS

2.1 Site Conditions

The project is undeveloped natural desert. Based on a review of City Quarter Section maps; no city wastewater infrastructure exists on-site. Many washes and rock features of varying sizes characterize the site. The on-site washes vary in size and depth, but generally flow from the southwest to the northeast or east through the site. Multiple ridgelines run though the site, in the general direction of southwest to northeast. Elevations across the Asteria Highlands site range from approximately 2775' in the southwest to 2695' in the northeast.

2.2 Adjacent Sanitary Systems

The Sereno Canyon development is located directly west of the project. Most of the infrastructure for Sereno Canyon has been constructed, though none of the lots have been developed. Wastewater generated by a large portion of Sereno Canyon is conveyed by gravity sewer to an existing lift station located on the east side of 128th Street approximately 350' north of Ranch Gate Road. From the lift station, wastewater flows are conveyed through an existing 6-inch force main west along the Happy Valley Road alignment. Flows are ultimately conveyed to the City of Scottsdale treatment facility located at Pima Road and Hualapai Drive.

2.3 Phasing and Existing Development

The Asteria Highlands project is planned as a standalone development from the future StoryRock and Sereno Canyon Phase 4 projects. The existing lift station along 128th Street near Ranch Gate Road has a planned capacity to accommodate up to 611 total units. The secured unit allocations for the existing lift station are as follows:

302 units have been allocated to Sereno Canyon.

13 units have been allocated to Asteria Highlands (formerly Tiara Estates)

297 open units (first come, first served)

Capacity for the remaining 18 lots of Asteria Highlands will be on a first come first serve basis from the remaining 297 units for the existing lift station and will be subject to payback charges to Sereno Canyon. All offsite facilities to convey the waste water flows to the existing lift station will need to be either installed or bonded prior to the recordation of the Asteria Highlands Final Plat.

3.0 PROPOSED WASTEWATER PLAN

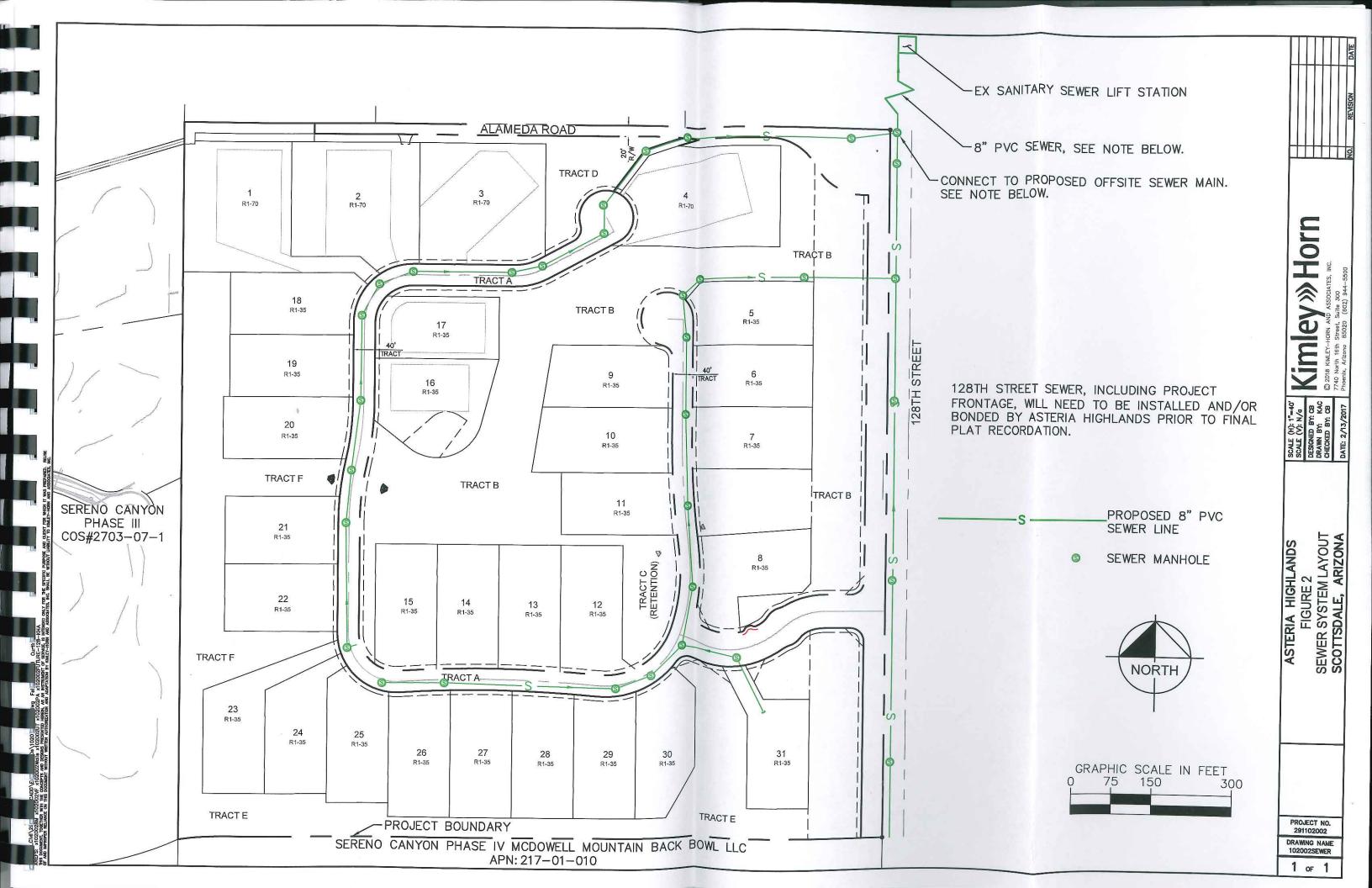
3.1 Asteria Highlands Proposed Collection System

The Asteria Highlands proposed onsite collection system will consist of 8-inch SDR 35 sewer lines, routed through the project to serve all lots in Asteria Highlands. The gravity sewer lines will discharge into the 8-inch gravity line in 128th Street. All offsite facilities to convey the waste water flows to the existing lift station will need to be either installed or bonded prior to the recordation of the Asteria Highlands Final Plat.

See Figure 2: Sewer System Layout for sewer line and lift station location.

3.2 Offsite Sewer Connection

All offsite facilities to convey the waste water flows to the existing lift station will need to be either installed or bonded prior to the recordation of the Asteria Highlands Final Plat.



4.0 METHODOLOGY AND CALCULATIONS

4.1 Design Criteria

Average Day Demand design flows are calculated based on design criteria detailed within the City of Scottsdale Design Standards and Polices Manual (DS&PM). Per DS&PM Chapter 7, a design flow of 100 gallons per capita per day (gpcpd) and a residential density of 2.5 persons per dwelling unit shall be used. See Table 1 below for a summary of sewer demands.

Table 1 Onsite Sewer Demands

Land Use	Dwelling units (du)	Density (persons/du)	Population (persons)	Average Day Demand (gpd)	Peaking Factor	Peak Flow (gpd)	Peak Flow (gpm)
<2 du/ac	31	2.5	78	7,800	4	31,200	21.

Per the DS&PM, proposed sewer lines within the development were designed to achieve a full flow velocity of between 2.5 and 10 feet per second and maintain a maximum d/D ratio 0.65 when calculated with a Manning's "n" value of 0.013. To satisfy these requirements the proposed public 8-inch sewer will meet the design with a minimum slope of 0.0052 ft/ft (0.52%) and a maximum slope of 0.0833 ft/ft (8.33%).

4.2 Wastewater System Analysis

To determine the capacity of the proposed wastewater collection system, the peak design flow was analyzed using the minimum design pipe slope. At the minimum design slope of 0.0052 ft/ft, an 8-inch line has the capacity to convey approximately 426,000 gallons per day. An 8-inch line at the minimum design slope can convey the proposed peak design flow of 31,200 gallons per day at a normal depth of 1.28" or a d/D ratio of 0.16, at a velocity of 1.34 ft/s. See **Appendix A** for pipe capacity calculations.

5.0 CONCLUSIONS

- 1) The proposed Asteria Highlands wastewater collection system is in conformance with the City of Scottsdale DS&PM and the Arizona Administrative Code.
- 2) Gravity sewer will convey flows generated by Asteria Highlands to the existing City of Scottsdale Lift Station.
- 3) Design criteria established by the City of Scottsdale DS&PM and the Arizona Administrative Code was used as the basis of design.

6.0 REFERENCES

City of Scottsdale, Design Standards and Policies Manual, January 2010.

Arizona Administrative Code, Title 18, Chapter 9, September 2005.

Conceptual Master Wastewater System Report for Sereno Canyon, Wood Patel and Associates, September, 2005.

Sereno Canyon Amended Master Wastewater Report, LVA, February 2014.

Facility Payback Agreement for Sewer System Improvements in the Sereno Canyon Service Area, City of Scottsdale, 12/21/2010.

Appendix A – Sewer Capacity Calculations

Project Description			
Friction Method	Manning Formula		
Solve For	Normal Depth		
Input Data			
Roughness Coefficient		0.013	
Channel Slope		0.00520	ft/ft
Diameter		8.00	in
Discharge		0.0312	mgd
Results			
Normal Depth		1.28	in
Flow Area		0.04	ft²
Wetted Perimeter		0.55	ft
Hydraulic Radius		0.79	in
Top Width		0.49	ft
Critical Depth		0.10	ft
Percent Full		16.0	%
Critical Slope		0.00690	ft/ft
Velocity		1.34	ft/s
Velocity Head		0.03	ft
Specific Energy		0.13	ft
Froude Number		0.87	
Maximum Discharge		0.94	ft³/s
Discharge Full		0.87	ft³/s
Slope Full		0.00002	ft/ft
Flow Type	SubCritical		
GVF Input Data			
Downstream Depth		0.00	in
Length		0.00	ft
Number Of Steps		0	
GVF Output Data			
Upstream Depth		0.00	in
Profile Description	•		
Profile Headloss		0.00	ft
Average End Depth Over Rise		0.00	%
Normal Depth Over Rise		15.98	%
Downstream Velocity		Infinity	ft/s

Worksheet for 8-Inch Actual Depth - Minimum Slope

GVF Output Data

 Upstream Velocity
 Infinity
 ft/s

 Normal Depth
 1.28
 in

 Critical Depth
 0.10
 ft

 Channel Slope
 0.00520
 ft/ft

 Critical Slope
 0.00690
 ft/ft

Wo	orksheet for 8-Inc	h Full - N	linimum Slope
Project Description			
Friction Method	Manning Formula		
Solve For	Discharge		
Input Data			
Roughness Coefficient		0.013	
Channel Slope		0.00520	ft/ft
Normal Depth		8.00	in
Diameter		8.00	in
Results			
Discharge		0.5632	mgd
Flow Area		0.35	ft²
Wetted Perimeter		2.09	ft
Hydraulic Radius		2.00	in
Top Width		0.00	ft
Critical Depth		0.44	ft
Percent Full		100.0	%
Critical Slope		0.00857	ft/ft
Velocity		2.50	ft/s
Velocity Head		0.10	ft
Specific Energy		0.76	ft
Froude Number		0.00	
Maximum Discharge		0.94	ft³/s
Discharge Full		0.87	ft³/s
Slope Full		0.00520	ft/ft
Flow Type	SubCritical		
GVF Input Data			
Downstream Depth		0.00	in
Length	•	0.00	ft
Number Of Steps		0	
GVF Output Data			
Upstream Depth		0.00	in
Profile Description			
Profile Headloss		0.00	ft
Average End Depth Over Rise		0.00	%
Normal Depth Over Rise		100.00	%

Infinity ft/s

Downstream Velocity

Worksheet for 8-Inch Full - Minimum Slope

GVF Output Data		
Upstream Velocity	Infinity	ft/s
Normal Depth	8.00	in
Critical Depth	0.44	ft

Channel Slope 0.00520 ft/ft

Critical Slope 0.00857 ft/ft

Wo	orksheet for 8-Inch Ful	I -M	aximum Slope
Project Description			
Friction Method	Manning Formula		
Solve For	Discharge		
Input Data			
Roughness Coefficient		0.013	
Channel Slope	0.0	08333	ft/ft
Normal Depth		8.00	in
Diameter		8.00	Ín
Results			
Discharge	1	.7050	mgd
Flow Area		0.35	ft²
Wetted Perimeter		2.09	ft
Hydraulic Radius		2.00	in
Top Width		0.00	ft
Critical Depth		0.65	ft
Percent Full		65.0	%
Critical Slope	0.0	04252	ft/ft
Velocity		9.99	ft/s
Velocity Head		1.55	ft
Specific Energy		2.22	ft
Froude Number		3.15	
Maximum Discharge		3.75	ft³/s
Discharge Full		3.49	ft³/s
Slope Full	0.0	04766	ft/ft
Flow Type	SuperCritical		
GVF Input Data			
Downstream Depth		0.00	in
Length		0.00	ft
Number Of Steps		0	
GVF Output Data		. 46.3.4.5. 2022. Sp	
Upstream Depth		0.00	in
Profile Description			
Profile Headloss		0.00	ft
Average End Depth Over Rise		0.00	%
Normal Depth Over Rise		65.00	%
Downstream Velocity		Infinity	ft/s
·· ••		-	

Worksheet for 8-Inch Full -Maximum Slope

GVI Output Data			
Upstream Velocity	Infinity	ft/s	
Normal Depth	8.00	in	
Critical Depth	0.65	ft	

0.08333 ft/ft Channel Slope 0.04252 ft/ft Critical Slope