ROADMAP TO CENTRALIZATION

AIRPORT WATER RECLAMATION FACILITY EXPANSION PHASE 1 PRESCOTT, AZ

CITY PROJECT CIP11-009

JANUARY 2015

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CITY OF PRESCOTT, AZ
AIRPORT WATER RECLAMATION FACILITY - EXPANSION PHASE 1
CIP11-009: ROADMAP TO WRF CENTRALIZATION

Date: January 2015

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SECTION 1. Introduction

1.1 Introduction

The City of Prescott currently owns three wastewater treatment plants: the Hassayampa Water Reclamation Plant (WRP), the Sundog Wastewater Treatment Plant (WWTP) and the Airport Water Reclamation Facility (WRF). Hassayampa WRP is a relatively small scalping plant operated by a private entity for golf course effluent. The majority of the City wastewater flows are handled by the Airport and Sundog Plants. A previous report compiled from 2009 thru 2010 by Black & Veatch (B&V) and Carollo Engineers (CE) titled the "Capacity and Technology Master Plan", proved the viability of a centralized treatment scenario for the Airport and Sundog facilities. In December of 2010 the City contracted Waterworks Engineers (WWE) to provide the design of the Airport WRF Expansion Phase I. The design and subsequent construction of this project will provide the framework for future centralization of the two facilities if the City chooses to do so. This report pertains specifically to these two facilities and how centralization, if chosen by the City, can be achieved.

1.2 Purpose

The previously mentioned Capacity and Technology Master Plan compared non-centralized vs. centralized scenarios for the Airport WRF and Sundog WWTP. The comparison of these two options indicated an advantage for the centralized treatment at the Airport WRF. As part of the evaluation of these options, the City has included a task in its contract with WWE to produce a Roadmap to Centralization (Roadmap).

The purpose of this Roadmap is to provide a more detailed analysis of the centralization scenarios and the Capital Improvement Projects (CIP) necessary to achieve it. This will be accomplished by building on the concepts and recommendations first provided in the Capacity and Technology Master Plan.

The ultimate objective of the Roadmap is to provide a detailed step-by-step list of Capital Improvement Projects (CIP's) to achieve centralization including timeframes and anticipated costs. In addition, this report will serve as a record of temporary wastewater diversions scenarios that were analyzed, but not recommended due to cost or other factors.

The Airport WRF Phase I Expansion allowed the plant to produce Class A+ effluent that can be utilized to irrigate open-access turf sites. Sites, such as City parks and ball fields, were unable to utilize effluent from either the previous Airport WRF or the Sundog WWTP due to the previous Class B+ rating. A secondary objective of this report is to detail the additional users that could benefit from the Class A+ effluent and the costs associated with the effluent system expansion to serve them. Additionally, a comparison of the existing vs. potential effluent rates will be analyzed.

1.3 Background and Overview

The Airport WRF is located at 2800 Melville Road, Prescott, AZ 86301 in Township 15N, Range 1W, Section 30 of Yavapai County. The Sundog WWTP is located at 1500 Sundog Ranch Road, Prescott, AZ 86301 Township 14N, Range 2W, Section 23 of Yavapai County. See Figure 1-1 for a general vicinity map of the facilities and other pertinent sites.

The Airport WRF and Sundog WWTP are approximately 6 miles apart and are separated by the Granite Dells. The Sundog WWTP service area encompasses downtown and developed portions of Prescott, while the Airport WRF generally serves the North side of Prescott including future planned developments and undeveloped land. The previous Airport WRF was built in 1978, expanded in 1998 to a permitted capacity of 2.2 mgd average annual daily flow (AADF). However, as outlined in the wastewater master plan, the current Airport WRF has been reduced to 1.2 mgd capacity due to increased loading associated with increased influent BOD and TSS concentrations. The current Airport WRF Phase I Expansion has been designed and constructed to support either the centralized or decentralized concepts. For the Centralized option, the plant is planned for four-3.75 mgd trains with the first train completed in 2014. In case decentralization is adopted, only three trains will be built. The current expansion will allow the City to continue issuing additional building permits for this service area.

Figure 1-1 Vicinity Map

SECTION 2. Sundog WWTP Modifications

2.1 Introduction

Under the "Capacity and Technology Master Plan", two options were considered for the Sundog WWTP. The Decentralization option required improvements and expansion of this facility whereas the Centralization option recommended decommissioning the treatment aspect of this facility and converting the site to a lift station and equalization basins with limited screening and grit removal.

2.2 Purpose

The purpose of this section of the Roadmap is to identify the modifications, improvements and repurposing of the existing Sundog WWTP structures and facilities needed to accommodate the centralization concept.

2.3 Background and Overview

The Sundog WWTP is an aging facility that was last expanded in 1990 and was designed and permitted for a 6 mgd treatment capacity. The plant consists of the following treatment units:

- Headworks
- Bar screens
- Grit removal (vortex type)
- Primary Clarifiers
  - Conversion of existing final clarifiers
- Oxidation Ditches
  - Anoxic zones
  - Supplemental diffused aeration
  - Blower buildings
- Circular Final Clarifiers
- Return Activated Sludge (RAS) Gravity fed to Screw Pumps
- Waste Activated Sludge (WAS) / Scum Pump Station
- Traveling Bridge Filter
- Chlorine Contact Basins
- WAS Thickening (via gravity belt)
- Anaerobic Digestion
- Belt Filter Press
- Ultra-Violet (UV) disinfection
- Chlorine Gas disinfection (secondary)

The City has evaluated the potential longevity of the existing structures based on current conditions and structural integrity. It was determined that the headworks, bar screens, primary clarifiers and oxidation ditches are nearing their beneficial life and in need of major repairs or replacement. In 2012, the City has implemented process improvements to the oxidation ditches and filters in order to ensure compliance with the permit requirements.

As discussed in the Master Plan document, the City is evaluating the centralization concept which includes decommissioning the primary/secondary/tertiary processes (maintain preliminary treatment) at the current Sundog WWTP and diverting the flows to the Airport WRF. This will require the abandonment of the process units listed previously and the addition of the following facilities:

- Screening
- Grit removal
- Primary Equalization (repurposing the existing secondary clarifiers)
- Secondary Equalization (constructing a new equalization basin south of the existing digesters)
- Lift station; and
- Odor Control for the Headworks Facilities and Lift Station

2.4 Influent Flow Requirements

The influent flow requirements were compiled from various documents including the Sundog WWTP 1990 expansion project, the Collection System Model and the Capacity and Technology Master Plan. Each facility has a different peaking factor. However, when flows are combined and the lag in peaking factor from Sundog to Airport is considered, the combined peaking factor is 1.62. The influent flows provided in these documents are listed below in Table 2-1:

Table 2-1 Sundog WWTP Existing Conditions

Sundog WWTP Existing Conditions Hydraulic Design Flows - 1990 Expansion Project	
Annual average daily flow, mgd	6.0
Maximum month average daily (design) flow, mgd	6.5
Maximum day flow, mgd	12.0
Hydraulic capacity, peak (hour), mgd	15.0

The Collection System Master Plan and Capacity and Technology Master Plan have estimated the following hydraulic requirements for the Sundog WWTP Lift Station Sizing as shown in Table 2-2:

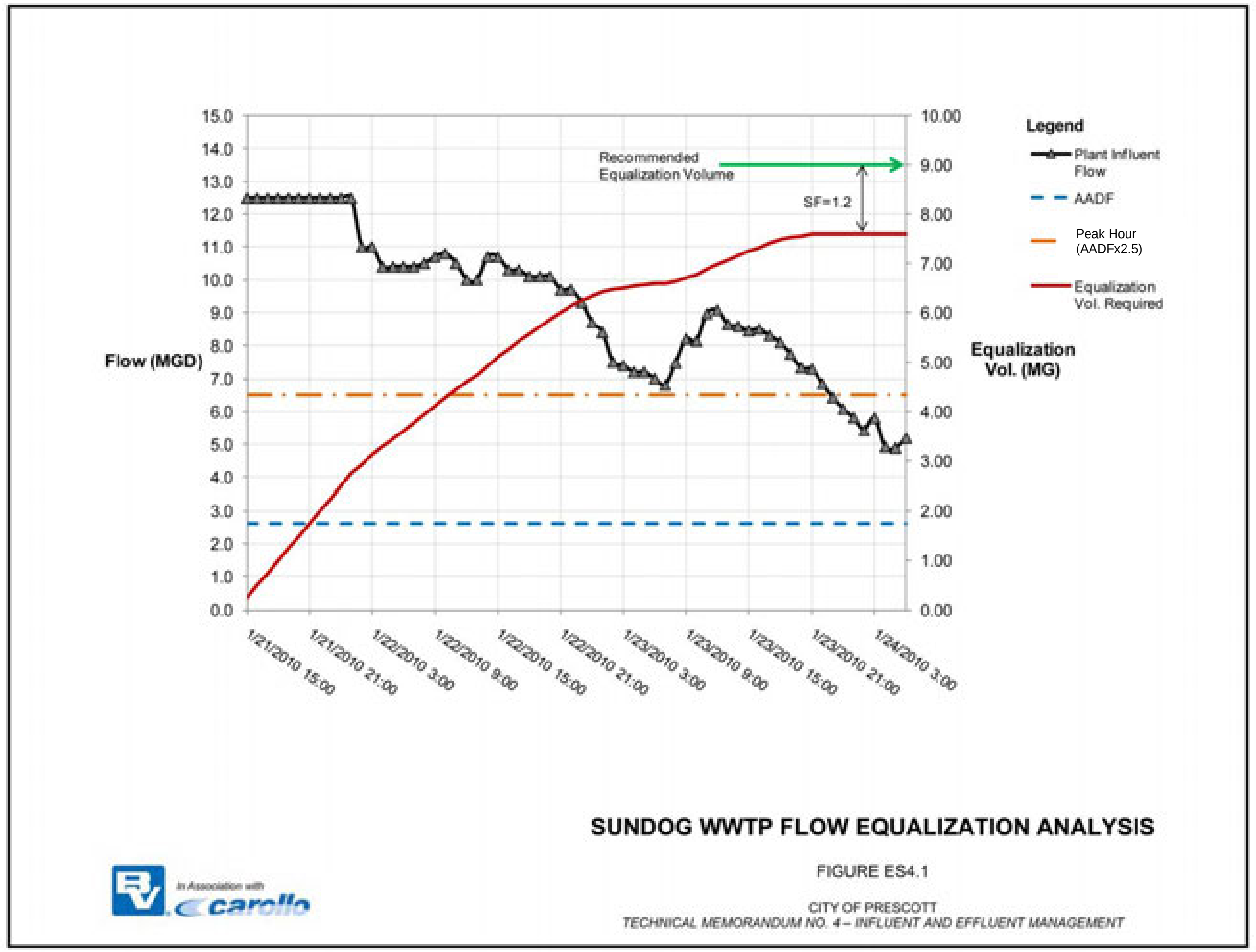
Table 2-2 Buildout Design Wastewater Flows and Peaking Factors

Buildout Design Wastewater Flows and Peaking Factors Centralized Treatment Feasibility Analysis				
Flow Criteria	**Airport WRF Buildout Flow, mgd(1)**	**Sundog WWTP Buildout Flow, mgd (1,2)**	**Combined Buildout Flow at Airport WRF, mgd(1,3)**	**Combined Hydraulic Peaking Factor (1,3)**
Annual Average Day Flow	9.6	5.4	15.0	1.00
Maximum Month Average Day	13.4	10.8	24.2	1.62
Peak Day	19.2	10.8	30.0	2.00
Peak Hour	28.8	10.8	39.6	2.64

Notes:
(1) Based on historical data analysis between January 2006 and April 2009. All peaking factors are relative to the annual average day flow.
(2) Based on the assumption that flow equalization facilities and/or collection system improvements result in peaking factors no greater than 2.0 for the Sundog WWTP service area flows.
(3) Based on the assumption that peak flows for the Airport WRF and Sundog WWTP service areas coincide when combined at the Airport WRF.

The graph below in Figure 2-1 shows the need for a 7.6 Mgal equalization volume based on the 2010 storm event (largest precipitation event in recent history and is also captured in the Master Plan). A 9 Mgal equalization volume was recommended to include a 20% safety factor which was considered to be industry standard by the Capacity and Technology Master Plan team.

Figure 2-1 Sundog WWTP Flow Equalization Analysis



This sizing, peaking factors and design associated with the Sundog influent flows were re-evaluated based on flow data obtained for Year 2010, 2011 and the flow values used in the 2013 Master Plan documents. Excerpts from the 2013 Masterplan flow data including a copy of Table 2-3 and Table 2-4 are shown below. The peak hour flows were developed using the maximum day flows listed in Table 2-3coupled with the peak hour factors developed in Table 2-4. The calculated flows are outlined in Table 2-5 below. These values should be finalized during the design and construction project for the equalization basins and associated facilities

Table 2-3 Wastewater Flow Projections Models

Wastewater Flow Projections City of Prescott 2013 Water and Wastewater Models (Masterplan Table 2.20)					
	Wastewater Flows, gpm				
	2012	2017	2023	2027	Buildout
Sundog Area					
Average Daily Dry Weather Flow	2.1	2.3	2.6	2.7	4.0
Maximum Day Wet Weather Flow	6.8	6.8	6.8	6.8	6.8
Sundog Area Total	**9.0**	**9.1**	**9.4**	**9.5**	**10.8**
Airport Area					
Average Daily Dry Weather Flow	1.0	1.1	1.2	1.3	6.6
Maximum Day Wet Weather Flow	1.3	1.3	1.3	1.3	1.3
Airport Area Total	**2.4**	**2.5**	**2.6**	**2.6**	**7.9**
Prescott Average Daily Dry Weather Total	**3.1**	**3.4**	**3.8**	**4.0**	**10.6**
Estimated Service Area Population	39,865	43,134	47,844	50,577	98,000

Notes:
(1) Average daily flows are based on 2012 wastewater treatment plant influent data.
(2) Wet weather flows are based on measured flows from the winter of 2004 – 2005.
(3) Estimated service area population for 2012 - 2027 from City of Prescott. Buildout population is based on the current maximum City water portfolio with the current gpcd of 152.
(4) Storm inflows measured in the 2004-2005 year are assumed to remain unchanged through buildout.
(5) Maximum Day wet weather flows are the same as the wet weather flows used in the 2008 Wastewater Collection System Model Study.

Table 2-4 Peak Flows Comparison

Comparison of Measured and Calculated Peak Flows (Masterplan Table 5.6)				
WRF	Location/Basin	Estimated Population	Peak Calculated Per Arizona Administrative Code	Measured Peak
Sundog WRF – Upstream of VA	Hassayampa	3,750	2.0	1.6
	Prescott Heights	1,506	2.3	1.6
	Gurley	872	2.4	1.5
	Forest Trails	1,343	2.3	2.2
	Copper Basin	3,050	2.1	1.5
	Robinson	957	2.4	1.6
Sundog WRF – Between VA and Sundog WRF	City Lights	946	2.4	1.9
	Banning Creek	2,429	2.1	1.7
	Prescott Lakes Pkwy	2,584	2.1	2.3
Airport WRF	Pinion Oaks	1,177	2.3	1.9
	North Force Main	10,567	1.8	1.9
	Airport North	292	2.8	1.9

Flow peaking factors were calculated based on population weighted average. The peaking factors calculated are summarized in Table 2-5. The total Prescott Wetweather Peak Hour Flow values shown in the table do not account for the lag time expected in the collection system which provides additional conservatism. The flow values are used to estimate the equalization storage and pumping capacity required.

Table 2-5 Estimated Influent Peak Hour Flows

Estimated Influent Peak Hour Flows	Peak Flow Factor	2012	2017	2023	2027	Ultimate
Peak Hour – Dry Weather (MGD)						
Sundog WRF – Upstream of VA	1.64	2.26	2.48	2.80	2.91	4.31
Sundog WRF – Between VA and Sundog WRF	1.99	1.43	1.57	1.77	1.84	2.72
Total Sundog Peak Flow		3.69	4.04	4.57	4.75	7.03
Airport WRF Peak Flow	1.90	1.90	2.09	2.28	2.47	12.54
Total – Prescott Peak Flow Dry Weather		5.59	6.13	6.85	7.22	19.57
Peak Hour – Wetweather (MGD)						
Sundog WRF – Upstream of VA	1.64	9.58	9.80	10.12	10.23	11.63
Sundog WRF – Between VA and Sundog WRF	1.99	6.06	6.19	6.40	6.47	7.35
Total Sundog Peak Flow		15.64	15.99	16.52	16.70	18.98
Airport WRF Peak Flow	1.90	4.37	4.56	4.75	4.94	15.01
Total – Prescott Peak Flow Wetweather		20.01	20.55	21.27	21.64	33.99

2.5 Collection System Design Criterion (d/D)

The collection system hydraulic capacity was analyzed in the 2013 Master Plan. These documents used a d/D = 0.75 for a dry weather, peak hour flow condition. In addition, under this project, a d/D = 0.9 is used for a wet weather peak hour flow condition. These criteria will be used when evaluating various options associated with the proposed equalization and pumping facilities and their impact on the collection system, as discussed below.

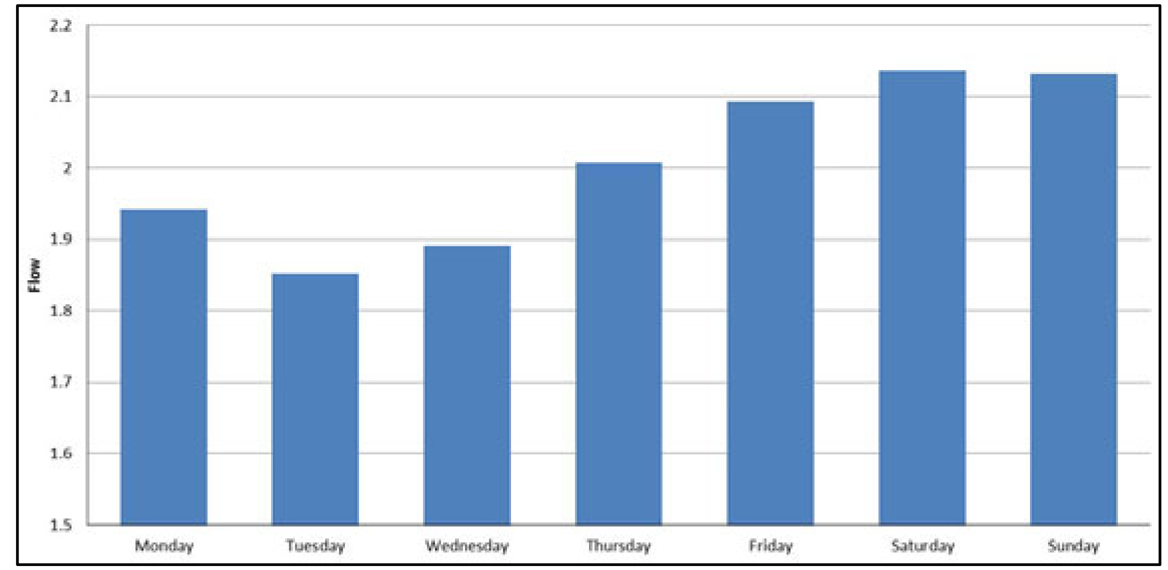
2.6 Equalization Analysis

The equalization analysis was developed to address daily fluctuations and wet weather events while maximizing the use of existing infrastructure in the collection system and at the Sundog WWTP.

The Sundog WWTP has two existing clarifiers which can be repurposed into equalization basins as a cost savings measure. Each clarifier has a diameter of 80 feet and total volume of 72,800 cubic feet. Assuming that 20% of the volume will be unusable due to space requirements for the equipment, launder, and free board, the total usable equalization volume of the two clarifiers will be about 871,200 gallons. Utilizing the clarifiers as equalization basins would assist in reducing the daily extremes of peak and low flow periods to create a more steady state flow at the Airport WRF.

An analysis of current average flows depicts a pattern of higher flows Friday through Sunday during the week, as shown in Figure 2-2.

Figure 2-2 Average Daily Flows



Data obtained from Sundog WWTP staff was used in modeling the impact on the clarifiers as equalization basins during two different scenarios – dry weather and wet weather. In both scenarios, the starting volume of the basins is equal to the minimum, 37,600 gallons. The two scenarios are detailed in the following sections.

2.6.1 Dry Weather

The Sundog WWTP dry weather condition was determined by analysis of the period from August 2, 2013 through August 16, 2013. During this timeframe the average flow rate was 2.01 million gallons per day (MGD). The current and ultimate dry weather flows were also obtained from the recent hydraulic model, and are estimated as follow:

- Current Condition – 2.1 mgd (AAD) and 3.69 (Peak Hr)
- Ultimate Condition - 4.0 mgd (AAD) and 7.03 (Peak Hr).

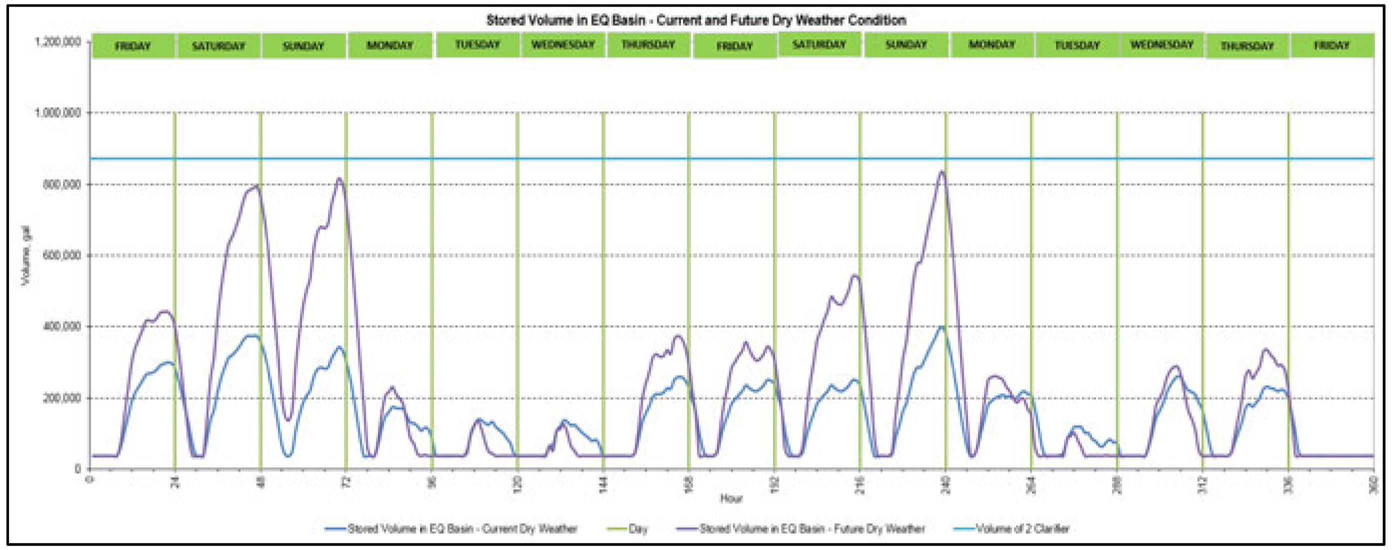
The results in Table 2-6 show that the required equalization volume does not exceed the actual volume provided by the two clarifiers.

Table 2-6 Required Dry Weather Equalization Volume Based on Pump Capacity

	Flow Condition	
Parameter	Current – 3.69 MGD	Ultimate – 7.03 MGD
Pumps Capacity	2.1 MGD	4.4 MGD
Required Equalization Volume, gal	398,017	836,470
Actual Equalization Volume, gal	871,200 (435,600 each tank)	871,200

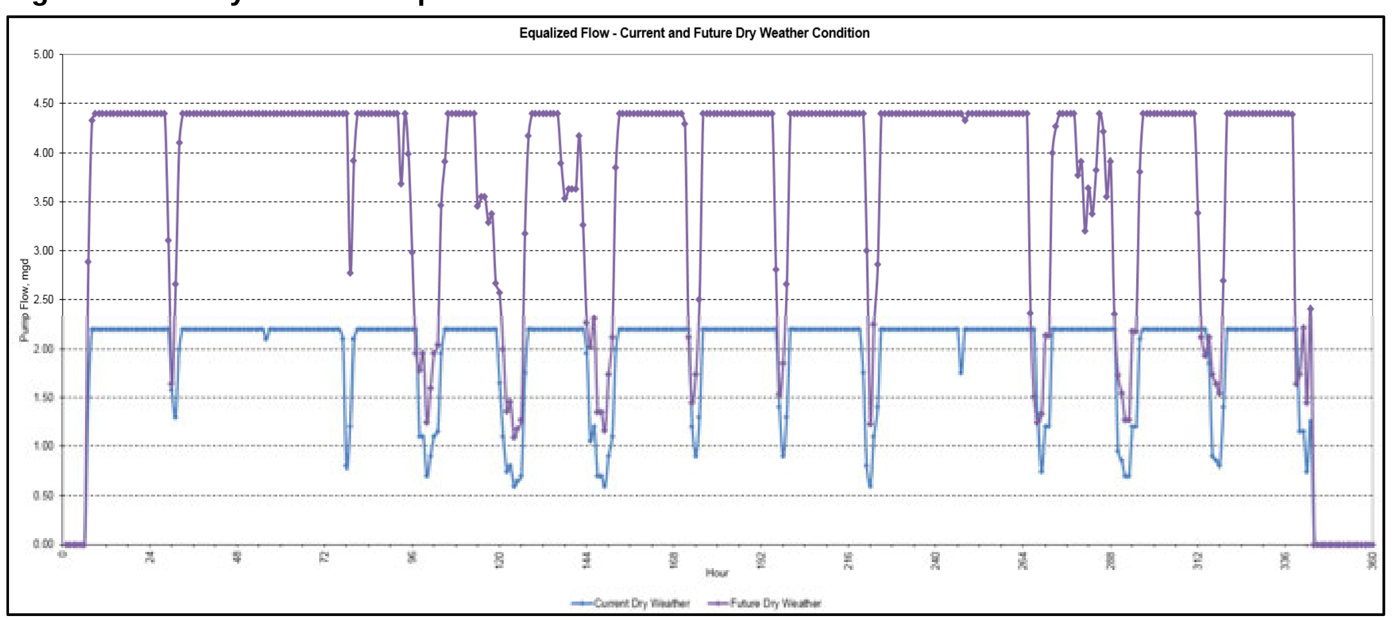
Figure 2-3 graphically depicts the stored volume in the equalization basins based on the conditions previously described. In dry weather conditions, both current and future, the maximum equalization volume provided by the clarifiers will not be exceeded.

Figure 2-3 Dry Weather: Stored Volume in Equalization Basins



Similarly, Figure 2-4 demonstrates the pump flow over time for both current and future dry weather conditions.

Figure 2-4 Dry Weather: Equalized Flow



2.6.2 Wet Weather

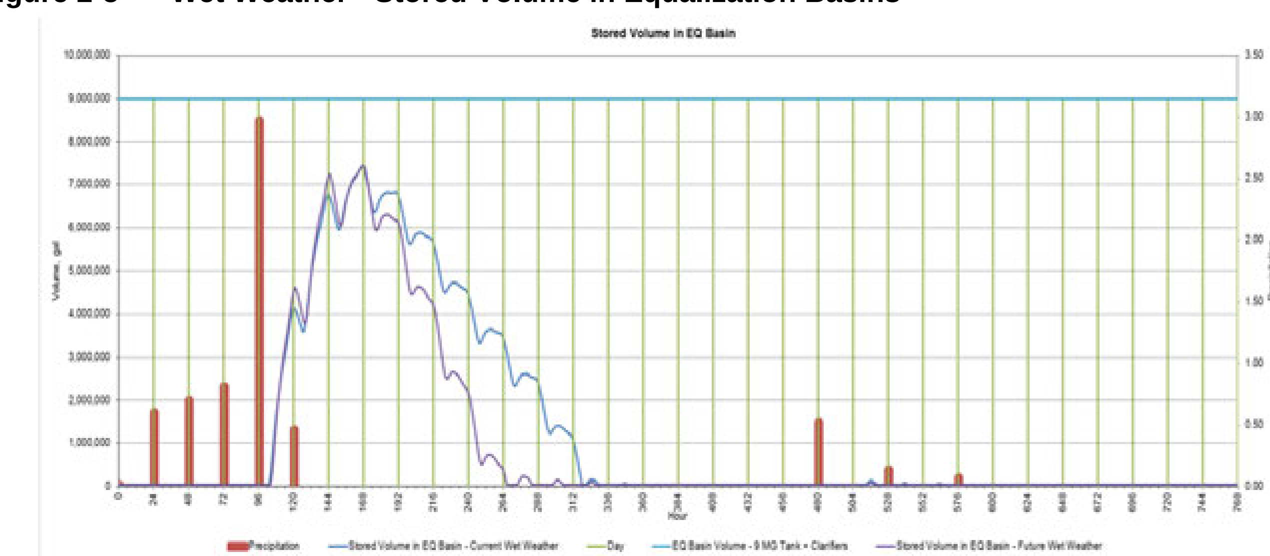
During wet weather events, overflow from the two clarifiers will be piped to the proposed equalization basin. Based on an analysis comparing varying pump conditions, the results in Table 2-7 show the required equalization volume needed.

Table 2-7 Required Wet Weather Equalization Volume Based on Pump Capacity

	Flow Condition	
Parameter	Current – 15.64 MGD	Ultimate – 18.98 MGD
Pump Capacity	6.0	8.4
Required Equalization Volume, gal	7,430,000	7,440,000
Equalization Volume Recommended, gal (20% Safety Factor)	9,000,000	9,000,000
Starting Volume, gal	37,600	37,600
Minimum Volume, gal	37,600	37,600

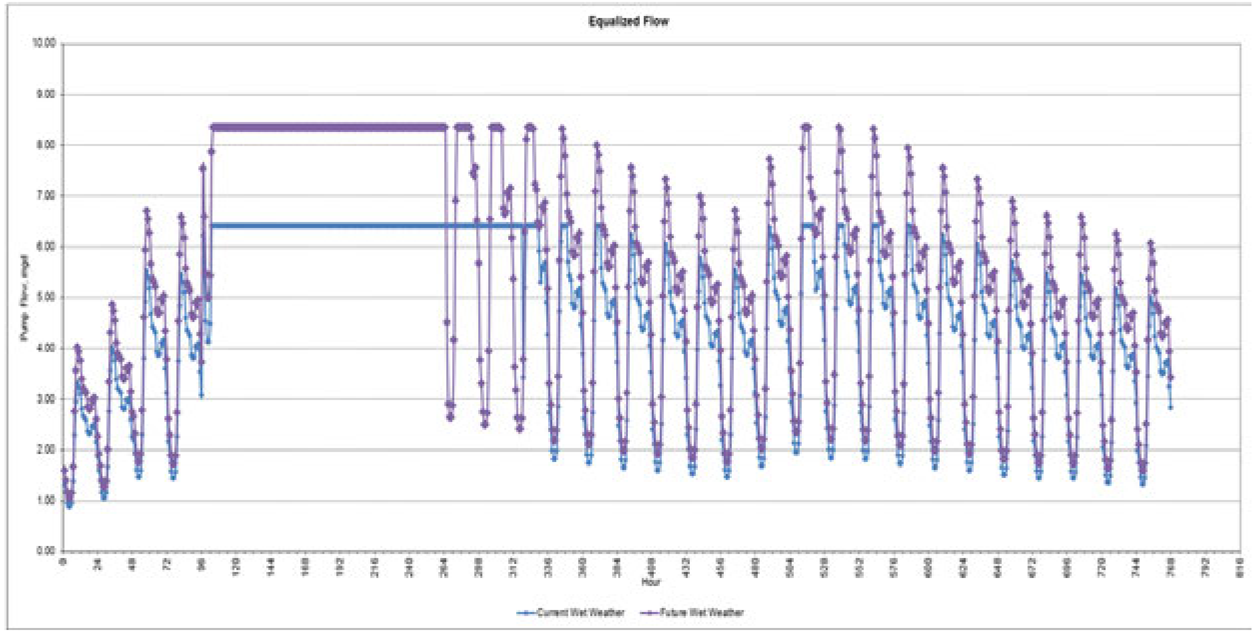
Figure 2-5 graphically depicts the stored volume in the equalization basins based on the conditions previously described. In both current and future wet weather conditions a 9 mgal equalization volume will be adequate. The graph also depicts the length of time that the high records of precipitation can be felt through the equalization system.

Figure 2-5 Wet Weather - Stored Volume in Equalization Basins



Similarly, Figure 2-6 demonstrates the pump flow over time for both current and future wet weather conditions.

Figure 2-6 Wet Weather: Equalized Flow



2.7 *Equalization and Pumping Facilities*

Two scenarios were developed that are intended to provide the pumping and equalization capacity needed:

- Scenario 1 – Equalization and Pumping located within the Sundog WWTP site
- Scenario 2 – Main pump station located in the vicinity of HWY 89 and HWY 69 (VA area) and equalization and secondary pumping located within the Sundog WWTP site.

2.7.1 Scenario 1 – Lift Station at Sundog WWTP Site

Influent flow will enter the Sundog WWTP site into the proposed Headworks Facility (screening and grit removal). It is critical to note that under this scenario, the Sundog WWTP influent Trunkmain should be upsized to handle the estimated peak flows without surcharging the manholes.

Screened effluent will be conveyed to the lift station that will pump the flow to the Airport WRF via a force/gravity main. The flow equalization will occur in two steps:

- Primary Equalization - This is the daily equalization that will flatten the daily dry weather peaks utilizing the existing secondary clarifiers.
- Secondary Equalization - This will be accomplished via a larger proposed basin to equalize flows larger than 8.4 mgd (this upper flow limit may be reduced during the final design of this facility).

Once either daily flows or wet-weather flows reduce below their determined flow rate, wastewater from the EQ basins will be conveyed to the lift station for ultimate disposal at the Airport WRF. Figure 2-7 depicts the process flow diagram. The design parameters associated with the screening facility, grit removal, lift station, and equalization are listed below.

2.7.2 Screening and Grit Removal

The screening and grit removal facilities are sized to handle influent peak flows upstream of the equalization basin and lift station. This will minimize the accumulation of grit and screening in all downstream facilities shown in Table 2-8.

Table 2-8 Screening and Grit Removal Sizing

Parameter, Unit	Value
No. of Fine Screens and Washer Compactors	2
No. of Grit System	1
Odor Control System	1

2.7.3 Lift Station

The lift station wet well and pumping equipment is sized to meet the following design criteria shown in Table 2-9:

Table 2-9 Lift Station Size

Parameter, Unit	Value
Minimum Flow (0.5 X Avg Flow) – mgd	2.0
Average Flow – mgd	4.4
Peak Hour Flow – mgd	8.4
Wetwell Volume (gallons)	45,000
No of Pumps	(3 + 1)
Start per Hour (max)	6

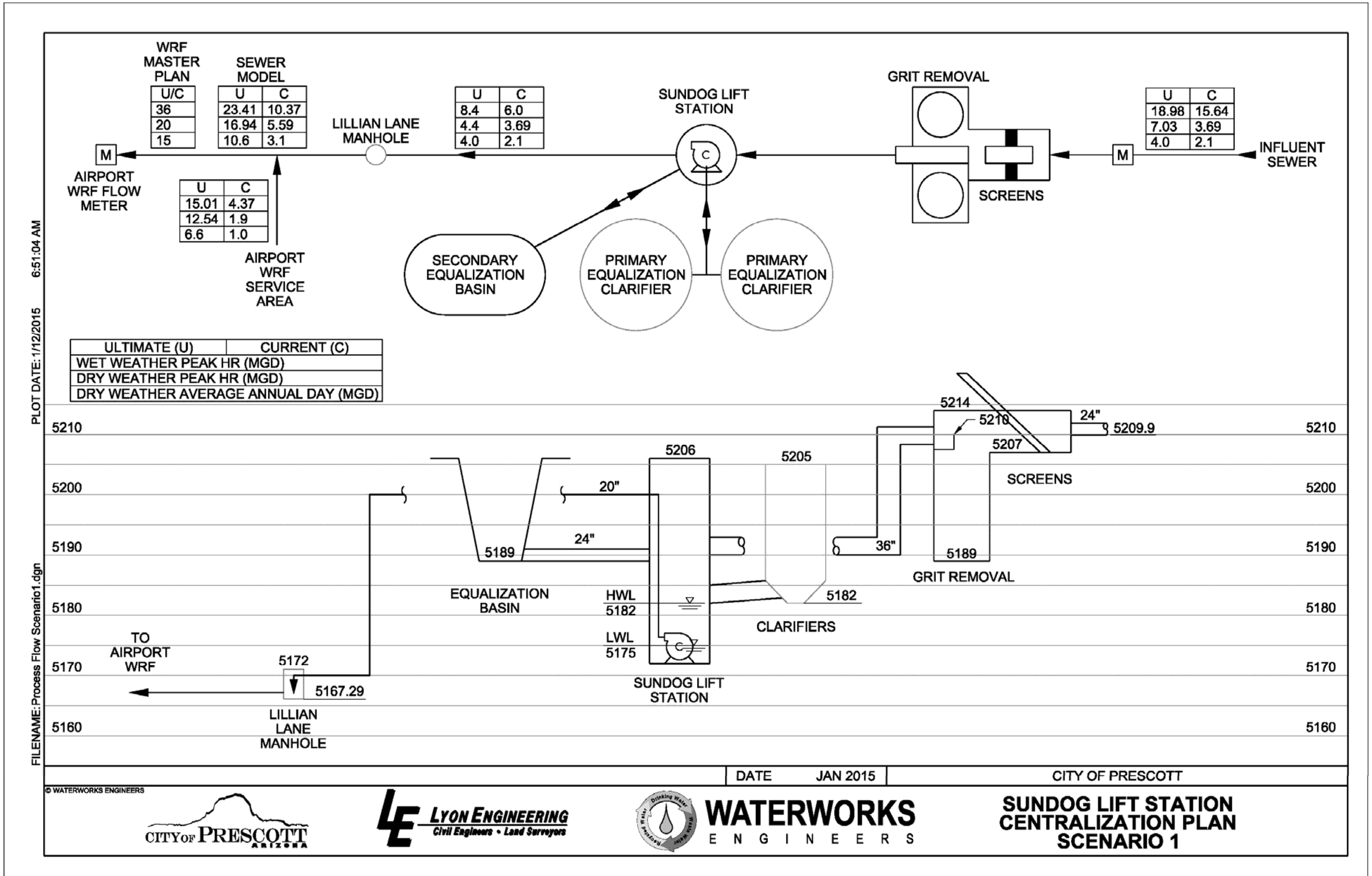
2.7.4 Equalization Basin

The equalization basin is proposed as a lined earthen basin with side slopes and will be operated in an interim basis during storm events and excess influent flows as shown in Table 2-10.

Table 2-10 Equalization Basin Configuration

Parameter, Unit	Value
Storage Capacity mgal	9
Length of Channel, ft / Width, ft	Varies
Depth, ft	15
Bottom Slope, ft	1% minimum
Side Slopes,	1 to 4
Lining System	UV Resistant, Synthetic

Figure 2-7 Process Flow Diagram – Scenario 1



Scenario 2 – VA Lift Station (at HWY 89) and Equalization at Sundog WWTP Site Description

The main lift station will be located in the area adjacent to the intersection of HWY 89 and HWY 69. The lift station will be sized to capture and convey the dry weather flow in addition to wet weather flow that is limited by the following:

- Hydraulic capacity of the existing Sundog WWTP influent trunkmain estimated at 8 mgd without causing a surcharge condition
- Capacity of the proposed lift station and forcemain
- Hydraulic capacity of the receiving gravity line – the current capacity available under dry weather condition is estimated at 3.2 mgd.
- Airport WRF treatment capacity.

The balance of the wet weather flow as well as the flows generated in the collection system area served by the sewer line located between the proposed lift station site and the Sundog WWTP site will be conveyed to the Sundog WWTP site and will be pumped by a secondary pump station.

The flow reaching the Sundog WWTP site will enter the existing secondary clarifiers used as equalization basins. A secondary lift station, potentially located in the RAS/WAS basement will pump the flow to the Airport WRF via a 18" force/gravity main serving the primary lift station. The flow equalization will occur in two steps:

- Primary Equalization - This is the daily equalization that will flatten the daily peaks utilizing the existing secondary clarifiers.
- Secondary Equalization - This will be accomplished via the larger, newly constructed basin to equalize flows in excess of 2.4 mgd (this flow limit may be reduced during final design of this facility).

Flowrates from the primary lift station and secondary pump station will be managed using the equalization basins to reduce the impact on the Airport WRF. Figure 2-1 depicts the process flow diagram.

2.8 Design Criteria

This section outlines the design parameters associated with the lift stations, and equalization.

2.8.1 Primary Lift Station (Hwy 89 and Hwy 69)

The lift station wet well and pumping equipment is sized to meet the following design criteria shown in Table 2-11:

Table 2-11 Primary Lift Station Size

Parameter, Unit	Value	
Flows	**Current**	**Ultimate**
Minimum (0.5 X Avg Flow) – mgd	0.69	1.32
Average – mgd	2.26	4.31
Influent Peak Hour – mgd	9.58	11.7
Pumped Peak Hour – mgd	7.64 to 9.58	11.0
Lift Station Wet Well		
Volume (gallons)	65,000	
Start per Hour (max)	6	
Pump Selection		
No of Pumps	(3 + 1)	
Size	3.7 mgd @ 140 ft	
HP/Pump	150	
% Speed Range	70-100%	

2.8.2 Existing Sewer Interceptor – Between the Primary Lift Station and Sundog WWTP Site

Flows generated in the area downstream of the lift station will be captured by the existing interceptor and conveyed to the Sundog WWTP site. In addition, an emergency overflow line will connect the lift station wetwell to the existing interceptor. This pipeline has an estimated maximum hydraulic capacity of 5600 gpm (8 mgd) without manhole surcharge.

2.8.3 Secondary Lift Station

The existing RAS/WAS pump station will be retrofitted to a lift station that pump wastewater from the existing secondary clarifiers and the proposed EQ basins. Alternatively, a new lift station can be constructed. The lift station will use the clarifiers as wetwells and pumping equipment is sized to meet the following design criteria shown in Table 2-12:

Table 2-12 Secondary Lift Station Size

Parameter, Unit	Value
Flows	
Minimum (0.5 X Avg Flow) – mgd	0.7
Average – mgd	1.4
Peak Hour – mgd	2.4
Pump Selection	
No of Pumps	(2 + 1)
Size	1.2 mgd @ ft
HP/Pump	15
% Speed Range	70-100%

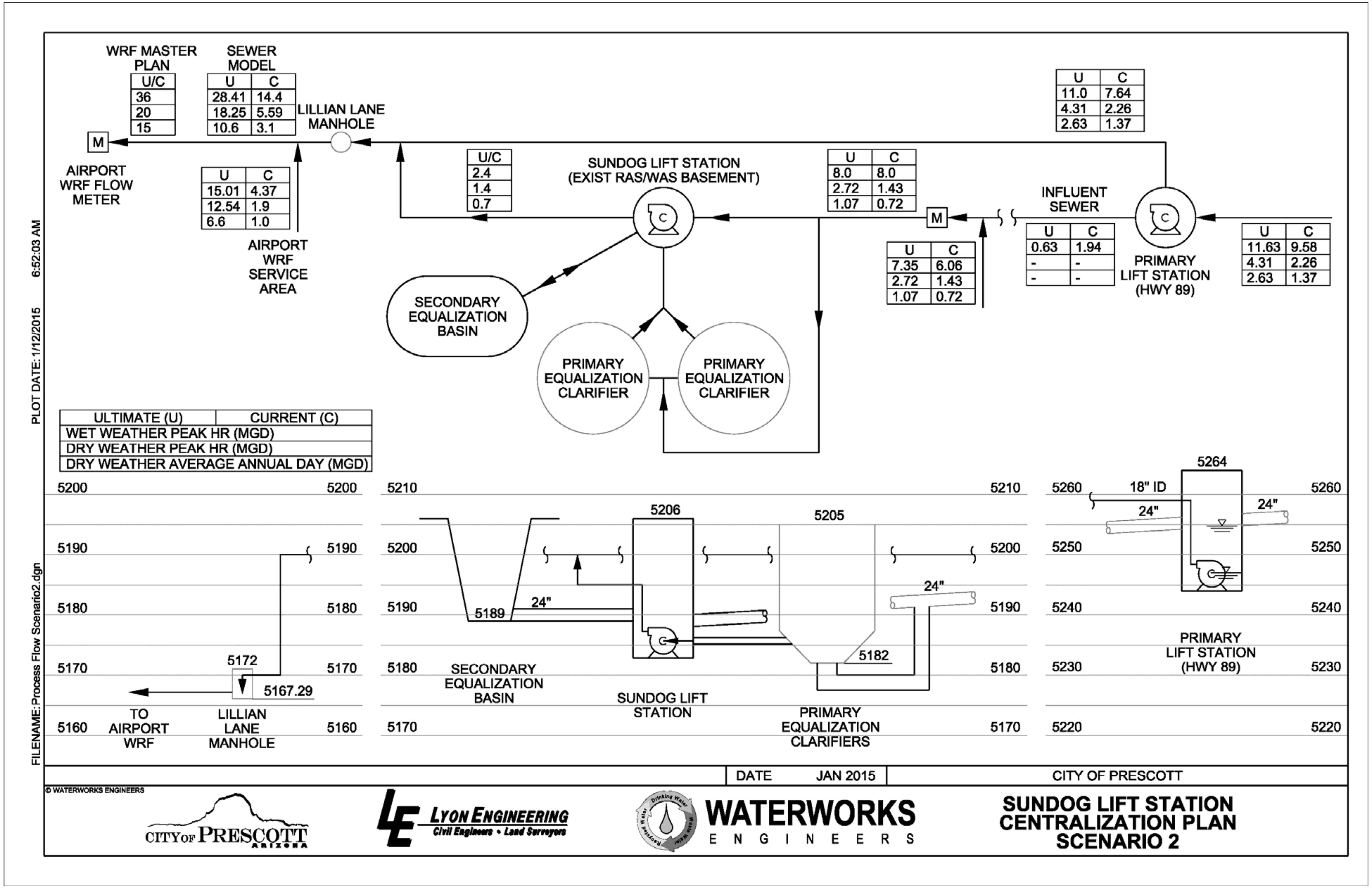
2.8.4 Equalization Basin

The equalization basin is proposed as a lined earthen basin with side slopes and will be operated in an interim basis during storm events and excess influent flows shown in Table 2-13.

Table 2-13 Equalization Basin Size

Parameter, Unit	Value
Storage Capacity mgal	9
Width, ft	Varies
Depth, ft	15
Length of Channel, ft	Varies
Bottom Slope, ft	1% minimum
Side Slopes,	1 to 4
Lining System	UV Resistant, Synthetic

Figure 2-8 Process Flow Diagram – Scenario 2



WRF MASTER PLAN U/C
36
20
15

SEWER MODEL U	C
28.41	14.4
18.25	5.59
10.6	3.1

U	C
15.01	4.37
12.54	1.9
6.6	1.0

U/C
2.4
1.4
0.7

U	C
8.0	8.0
2.72	1.43
1.07	0.72

U	C
7.35	6.06
2.72	1.43
1.07	0.72

U	C
0.63	1.94
-	-
-	-

U	C
11.0	7.64
4.31	2.26
2.63	1.37

U	C
11.63	9.58
4.31	2.26
2.63	1.37

SECTION 3. Collection System

3.1 Introduction

The existing City wastewater collection route and capacity is of particular interest when considering the viability of centralization. An existing Airport trunk sewer lies between the Sundog WWTP and the Airport WRF and is the shortest and most practical route that can be utilized to connect the two facilities. See Figure 3-1 for the Existing Airport Trunk Main Sewer Route.

3.2 Purpose

The purpose of this section of the Roadmap is to identify the route and capacity needed in the Airport trunk sewer to accommodate the centralization concept. In addition, several diversion options were analyzed to determine if they were feasible from a cost and time frame standpoint.

3.3 Background Overview

The existing Airport Trunk Main Sewer begins at the intersection of Lillian Lane and Hwy 89 (Point A, Figure 3-1) and travels in a North/Northeasterly direction to its terminus at the Airport WRF (Point E). The Point designations used on Figure 3-1 are for reference to specific stretches of the Airport trunk main. They are described as follows:

- Point A to B (Blue Segment): The recently completed (2009) stretch of 24-inch and 30-inch Hobas trunk main from Lillian Lane/Hwy 89 intersection to its terminus just east of Hwy 89 at Willow Creek, connects to the 1978 18-inch trunk main.
- Point B to C (Yellow Segment): This portion of the trunk main was completed in 1978 and consists of 18-inch VCP trunk main within an easement through private property extending from the 30-inch Hobas trunk main to a 1978 24-inch VCP trunk main.
- Point C to D (Magenta Segment): 1978 24-inch VCP trunk main through a private property up to a point where the future sewer route may deviate from the existing alignment.
- Point D to E (Magenta Segment): The remaining portion of the 1978 24-inch trunk main to its termination at the existing Airport WRF headworks.

3.4 Centralization - Force & Trunk Main Sewer Sizes

3.4.1 Scenario 1 – Lift Station at Sundog WWTP

The most practical route for centralization infrastructure between the Sundog and Airport facilities is along a path identified as the "Airport Trunk Main", see Figure 3-1.

The proposed Sundog Lift Station, required for centralization, will deliver at a maximum flow of 8.4 mgd. The new lift station will utilize VFD pumps to modulate the outflow to match the influent flow to the lift station. ADEQ requires that force main velocities be no less than 3 ft/s and no greater than 7 ft/s. A 8.4 mgd per day outflow will produce a velocity through an 18-inch force main of 7.4 ft/s. However 8.4 mgd is a peak flow condition and will not be a sustained flow. The lift station will operate at 4.4 mgd AADF at build out producing a velocity of 3.9 ft/s through the proposed 18-inch force main.

The proposed Sundog force main will discharge at a manhole where the flow will convert to gravity flow as shown in Figure 5-5 (Scenario 1), Point B. The trunk main section between this manhole and the Airport WRF will receive additional flows at various points. The sizing associated with this segment was accomplished using the maximum flow anticipated from the future Sundog Lift Station, 8.4mgd, plus the flows calculated in the 2013 Sewer Model Study. Section 5.4.6 covers in detail the location and sizing of this trunk main as part of the proposed CIP#5.

3.4.2 Scenario 2 – Primary Lift Station at VA and Equalization at Sundog WWTP Site

Similar to Scenario 1, Scenario 2 will use the additional capacity available in the 24-Inch Hobas and Airport Trunk Main to divert flow to the recently completed Airport WRF. This option is different because it would divert the average daily flow in the existing Sundog Trunk Main instead of peak flows, significantly reducing the flow to the Sundog WWTP, and alleviating existing capacity issues in the Sundog Trunk Main.

Referring to Figure 3-2, this option proposes intercepting the Sundog Trunk Main with a new regional lift station at Point A just west of Hwy 89 on Veteran Administration (VA) land. This lift station would then convey flow through a new 18-inch (ID) force main to a tie-in point, Point B, at the intersection of Lillian Lane and Hwy 89.

The downstream sewer mains will also have to be upsized to accommodate the peak hour, ultimate flow conditions. The line sizes were estimated between 36 inch and 42 inch.

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Figure 3-1 Existing Airport Trunk Main Sewer

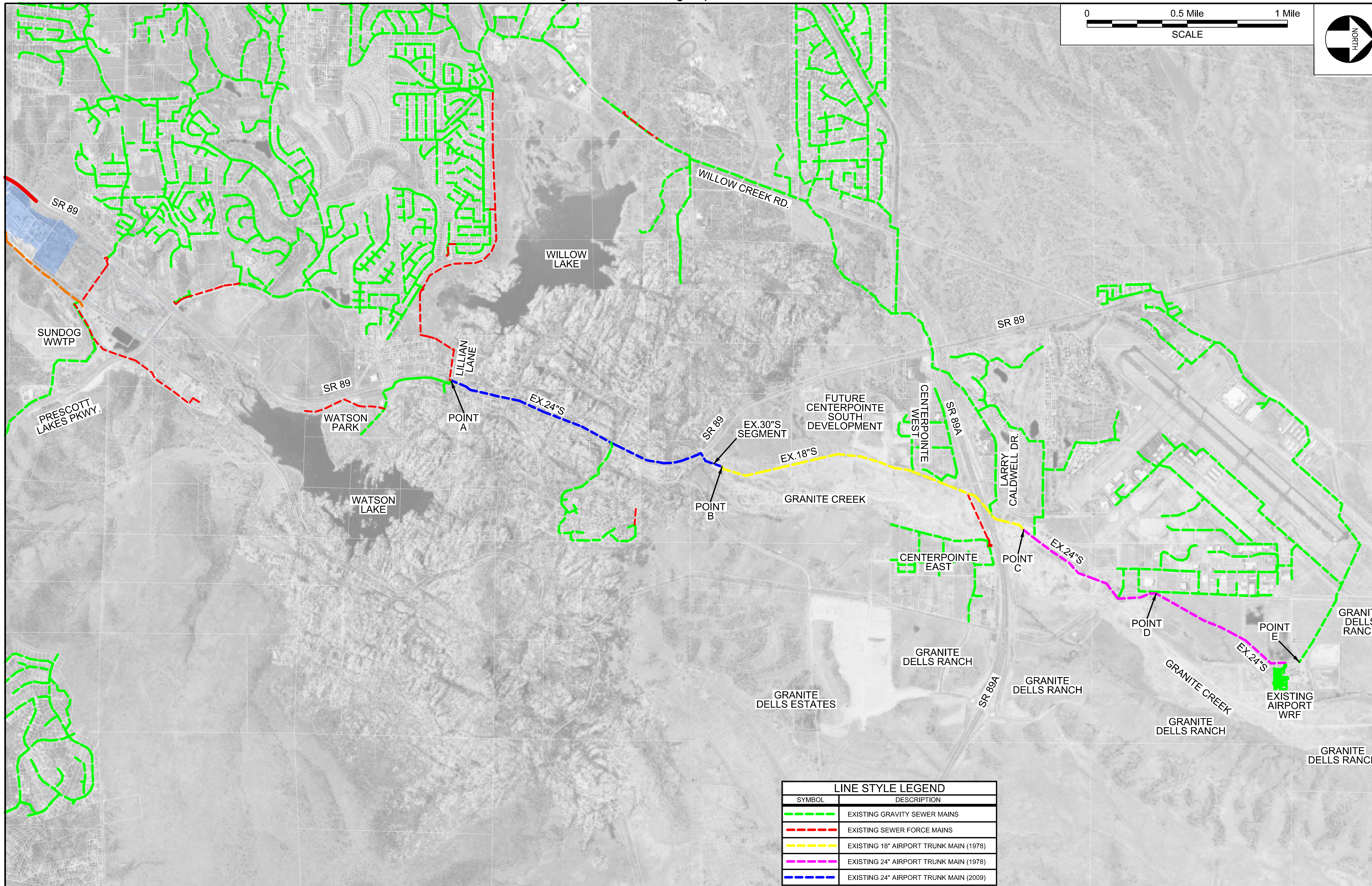

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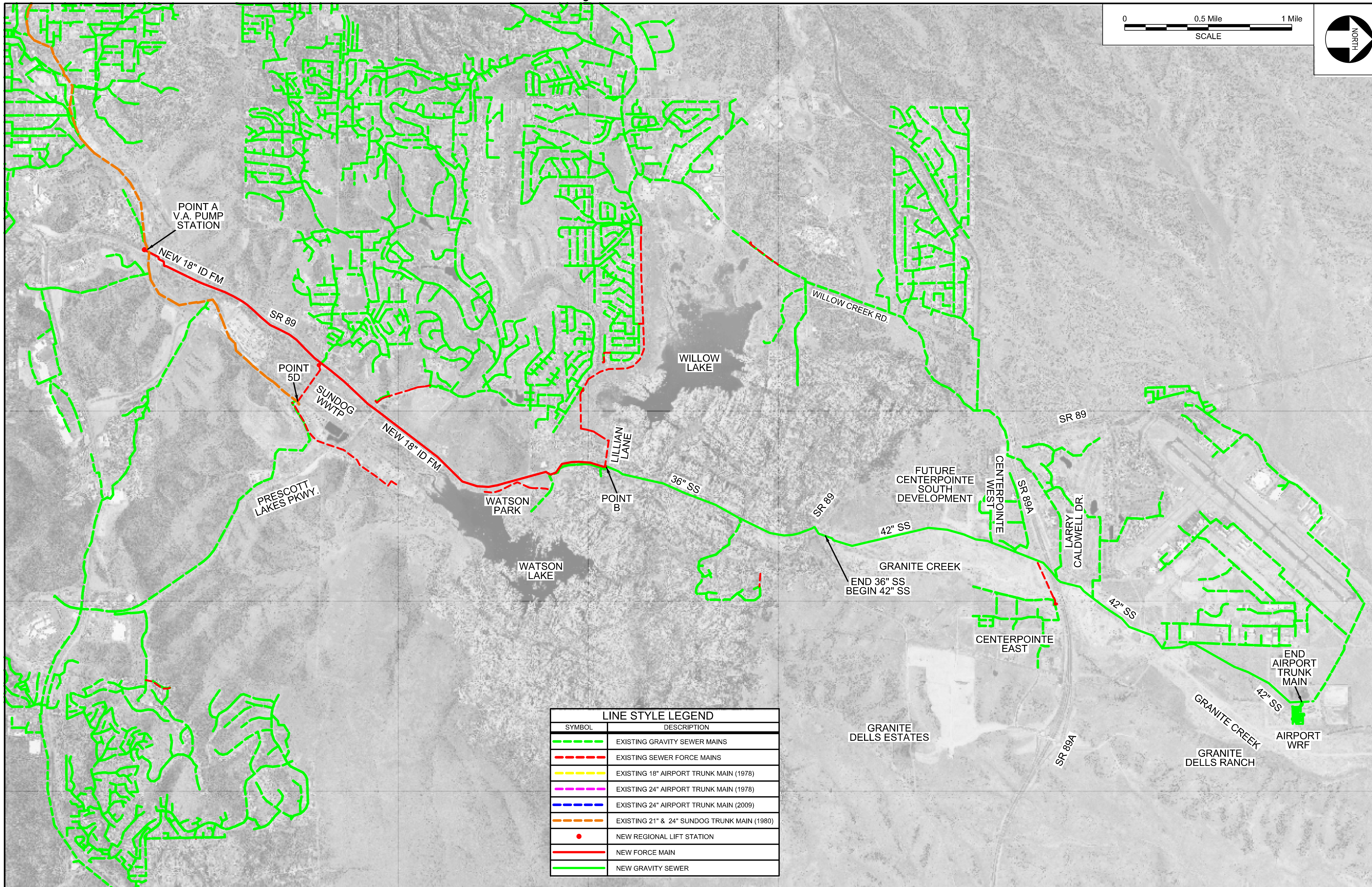
Figure 3-2 Centralization - Scenario 2



3.5 Other Diversion Options Analyzed

As an interim alternative to centralization several wastewater diversion options were analyzed. The purpose of this analysis was to determine if there were viable capital improvement projects that would, in the short term, mitigate the impact of peak wastewater flows at the Sundog facility.

The current capacity and inflow to the Willow Lake Regional, Prescott Lakes Regional, and Willow Lake Estates Lift Stations will be a key component in determining the feasibility of any diversion options considered. These three lift stations outfall into a shared 14-inch force main that in turn outfalls to a 24-inch gravity trunk main in Hwy 89, and the 18-inch Airport Trunk main. Utilizing several parameters we can determine the average day wastewater inflow into each lift station. These parameters include: pump capacity (pump curves); as-built wet well volume; pump elevation settings; and 2011 pump run times and cycle counts for the entire year. This data can then be input into the following formula to determine the wastewater inflow:

$$\frac{Wet\ Well\ Volume}{Pump\ Capacity - Wastewater\ Inflow} = Pump\ Run\ Time$$

This converts to:

$$Wastewater\ Inflow = Pump\ Capacity - \frac{Wet\ Well\ Volume}{Pump\ Run\ Time}$$

The lift station data and calculated wastewater inflows have been summarized in Table C-5 in Appendix C. With this information we have analyzed the following four diversion options:

3.5.1 Option 1: Sundog Peak Flow Diversion to 24-inch Hobas Main

Based on observed information from 2010, the Sundog WWTP has an AADF of 2.58 mgd with peaks in excess of 10 mgd (the maximum gauge reading on the Sundog flow meter) during large storm events. City staff has manually read the gauge and observed peak flows of approximately 12 mgd during past storm events. The permitted treatment capacity of Sundog is 6.0 mgd, however due to the increased influent strength the plant can currently only treat 3.2 mgd leaving 8.8 mgd that would need to be mitigated by equalization. The theory of this option is that there is available capacity in the 24-inch & 30-inch Hobas gravity trunk mains in Hwy 89 and the 18-inch & 24-inch Airport Trunk Main to handle some peak flow diversion from the Sundog WWTP.

Referring to Figure 3-2, Option 1 proposes to intercept the Sundog trunk main flow with a bypass structure before the Sundog head works, Point 1A, that will divert flows exceeding 3.2 mgd to a new lift station. This lift station would then convey flow through a new 18-inch force main to a tie-in point, Point 1B, with a new 30-inch gravity sewer main which will then convey flow to the existing 24-inch Hobas trunk sewer main at the intersection of Lillian Lane and Hwy 89, Point 1C.

Real time flow metering was done only to determine peaking factors in specific areas of the City wastewater system. For this option we can calculate an approximate worst case current flow condition by adding the existing pump capacities of the lift stations that discharge into the 24-inch & 30-inch Hobas mains. These lift stations and their flows are detailed in the 2013 Master Plan and include the following:

- Willow Lake Regional Lift Station (WLRLS): Pump Capacity = 1800 gpm
- Prescott Lakes Regional Lift Station (PLRLS): Pump Capacity = 3300 gpm
- Willow Lake Estates Lift Station (WLELS): Pump Capacity = 180 gpm

City operations staff has indicated that the WLELS runs with no discharge output when the WLRLS and PLRLS are running simultaneously. Therefore, disregarding the WLELS pump flow, the WLRLS and PLRLS yield a total combined flow of 5100 gpm, or 7.35 mgd that can be assumed for the worst case flow condition affecting the 24-inch & 30-inch Hobas mains and immediate downstream portion of the 18-inch Airport Trunk Main. The following data is the worst case as-built slope and full flow capacity for the described reaches:

- 24-inch Hobas @ 0.38% yields a full flow capacity of 9.1 mgd
- 30-inch Hobas @ 0.14% yields a full flow capacity of 9.9 mgd (Only one reach has this size)
- 18-inch Airport Trunk Main (immediately downstream of the 30-inch Hobas) @ 0.441% yields a full flow capacity of 4.5 mgd (note: There are 2 stretches of 18-inch sewer main further downstream with flatter slopes of 0.121% and 0.124%. These have been disregarded since they could be readily upsized or realigned.)

The 18-inch Airport Trunk Main has the least capacity of 4.5 mgd, considerably less than the combined lift station flow of 7.35 mgd. This portion of the 18-inch Airport Trunk Main chosen for analysis is one of the flattest, and is representative of multiple reaches up and downstream having slopes that are only slightly greater than 0.441%. It is feasible to replace these mains with a larger CIP in the future, as detailed in Section 5.4.6 as CIP#5. Therefore this option is not feasible due to the existing over capacity condition of the Airport Trunk Main sewer.

3.5.2 Option 2: Willow Lake Road Trunk Main, PL Regional LS Upgrade, Sundog LS and FM

Option 2 is very similar to Option 1. The goal is to mitigate the peak flows at the Sundog WWTP during large storm events by diverting flow via a new lift station, force main, and gravity mains from Sundog to the 24-inch Hobas main in Hwy 89. The difference is that Option 2 goes one step further than Option 1 by trying to lessen the existing wastewater flows to the 24-inch & 30-inch Hobas gravity trunk mains and the over capacity 18-inch Airport Trunk Main. Referring to Figure 3-2, this option theorizes that by eliminating the Willow Creek Regional lift station (WLRLS) and the Willow Lake Estates lift station (WLELS) via a new gravity trunk sewer main to the Prescott Lakes Regional lift station (PLRLS), you can add an additional wet well at the PLRLS big enough to store the additional flow and discharge at a decreased flow rate, thus increasing the available capacity of the downstream trunk mains for additional Sundog flows. Currently the three existing lift stations share a 14-inch force main and operate independently of one another.

Referring to Figure 3-2, Option 2 proposes intercepting gravity wastewater flow just upstream of the Willow Lake Regional lift station, Point 2A, and conveying the flow via a new 24-inch gravity main eastward along Willow Lake Road, intercepting the flow from the WLELS along the way, Point 2B, and terminating at a new wet well added to the PLRLS, Point 2C. The PLRLS could operate on VFD's and therefore could be adjusted to lower the outflow of its pumps. The remaining improvements for Option 2 include the same improvements outlined in Option 1 as Points 1A, 1B, and 1C.

As mentioned in Option 1, the worst case capacity of the 18-inch Airport Trunk Main is 4.5 mgd. To make Option 2 feasible we have assumed that at least half of this capacity, 2.25 mgd or 1562 gpm, would need to be available to make this diversion a viable project. This would also require that the PLRLS pumps be turned down to equal this outflow condition. This is possible since the pumps could operate on VFD's, however additional wet well volume will need to be added to compensate for the necessary storage, along with an aeration system. Referring to Table C-5 in Appendix C, the calculated peak wastewater inflow to the three lift station totals 4,035 gpm. Using the peak flow that can be anticipated at the PLRLS after the new gravity main improvements (the flow that the PLRLS would be turned down to) and a 60 minute cycle time to match an assumed peak hour flow condition, we can modify the ADEQ lift station wet well design formula to determine the new wet well volume needed:

Original formula:

$$\frac{Pump\ Cycle\ Time\ x\ Pump\ Capacity}{4} = Wet\ Well\ Volume$$

Revised formula:

$$\frac{60\ min.x\ (4035\ gpm - 1562\ gpm)}{4} = 37{,}095\ gallons$$

Based on this calculation, 37,095 gallons or 4959 cf of total wet well volume would be required. The current PLRLS wet well is 720 cf, requiring 4,239 cf of new volume. Assuming the same depth of storage, 5 ft, the new wet well would have a surface area of 29.1 ft x 29.1 ft. Utilizing the same as-built elevations as the existing PLRLS, the new wet well vault would measure 29.1 ft x 29.1 ft x 18.5 ft deep, with 16-inch thick concrete walls. This yields a concrete volume of 211 cy, and an estimated steel weight of 22,000 lbs.

The estimated cost of the new gravity sewer main from the WLRLS, wet well at PLRLS, Sundog Lift Station, Sundog force main and gravity mains is $11.6 million, see Table B-3 in Appendix B. This project would only provide a partial mitigation, 2.25 mgd, of the total 8.8 mgd peak flow mitigation needed. In comparison, CIP#3 detailed in Section 5.4.4, would provide full mitigation of the Sundog WWTP peak flow at a cost of $5.3 million, see Table B-3 in Appendix B, a savings of $6.3 million. Therefore in comparison to CIP#3, we do not consider Option 2 a viable project at this time. However, it should be noted that of the four alternative options analyzed, Option 2 is the only previously identified CIP in the City's 5-year Capital Program. Therefore this Option is not truly an interim solution, but a necessary and future CIP to improve the infrastructure and O&M costs associated with the WLRLS, WLELS, and the existing 14-inch force main.

3.5.3 Option 3: Sundog Peak Flow Diversion to Prescott Lakes

Option 3 is similar to Options 1 & 2, having the same goal of mitigating the peak flows at the Sundog WWTP during large storm events by diverting flow via a new lift station. However, Option 3 proposes to divert wastewater flow to an existing 4-inch force main at the intersection of Prescott Lakes Parkway (PLP) and Hwy 89, or to an existing 8-inch gravity main at the intersection of PLP and Blooming Hills Drive.

Referring to Figure 3-2, Option 3 proposes to intercept the Sundog trunk main flow with a bypass structure before the Sundog head works, Point 3A, that will divert flows exceeding 3.2 mgd to a new lift station. This lift station would then convey flow through a new 4-inch force main to a tie-in point, Point 3B, with an existing 4-inch force main in PLP, or continue northwesterly in PLP to a tie-in point with an existing 8-inch gravity sewer main at Point 3C. The 8-inch gravity main outfall will be analyzed if the 4-inch force main does not convey enough capacity to make it a worthwhile alternative.

Per ADEQ parameters a force main cannot have flow velocities less than 3 fps and greater than 7 fps. A 4-inch force main flowing at 7 fps conveys a flow of 271 gpm, or 0.39 mgd. This capacity is well below the 8.8 mgd flow necessary to mitigate peak flows at the Sundog WWTP.

As previously mentioned a new 6-inch force main could be constructed in PLP to Point 3C and an existing 8-inch sewer main, as an alternative to the existing 4-inch force main connection. The flattest sloped stretch of 8-inch sewer main (2.09%) in PLP occurs just past the intersection of PLP and Smoke Tree Lane, Point 3D. This main will convey 1.13 mgd at full flow capacity. According to the Prescott Lakes Master Sewer Analysis, 0.39 mgd of wastewater flow has already been committed to this stretch of sewer main, leaving 0.74 mgd of available capacity. At this capacity, this option is not considered feasible due to the small flow (0.74 mgd) vs. peak flow (8.8 mgd) that could be utilized for mitigation.

3.5.4 Option 4: Willow Creek Lift Station Flow Diversion and Equalization

Option 4 is similar to Options 1 thru 3, with the same goal of mitigating peak flows at the Sundog WWTP during large storm events by diverting flow via a new lift station. This option is different because flow from the WLRLS and WLELS will be diverted away from the lesser capacity sections of the Airport Trunk main. This diversion, combined with reducing the outflow from the PLRLS, will increase the available capacity of the Airport Trunk main sewer.

Referring to Figure 3-2, Option 4 proposes to intercept gravity wastewater flow just upstream of the WLRLS, Point 4A, with a new equalization vault sized large enough to ensure that the existing pumps run on the low range setting of 1235 gpm, or 1.8 mgd. The WLELS, Point 4B, will be taken off-line and a new 8-inch gravity main will be installed to flow westward along Willow Lake Road to the new vault at Point 4A. A new 10-inch force main will tie into the existing 14-inch force coming out of the WLRLS, Point 4C, and head northward through City property until reaching the Willow Creek Road right-of-way where it will continue northward to its outfall at the existing 12-inch Rifle Ranch trunk main at Point 4D. The remaining improvements for Option 4 include the same improvements outlined in Option 1 as Points 1A, 1B, and 1C.

The 2013 Wastewater Master plan indicated several reaches of existing sewer main that needed replacing in the stretch between the confluence of the Pinon Oaks and Rifle Ranch sewer mains (Point 4E) and the eastward extension along Hwy 89A and Larry Caldwell Drive to a terminus at the Airport Trunk main, Point 4F. The master plan determined a worst case future flow through this sewer stretch of 1691 gpm, or 2.4 mgd. Several reaches in this stretch have flat sloped sewer, with a worst case of 0.293%, yielding a full flow capacity of 1.25 mgd. With a proposed outflow of 1.8 mgd from the WLRLS, the combined flow would be equal to 4.2 mgd (2.4 + 1.8) in the worst case future condition. Therefore, the existing sewer main does not have enough capacity for the proposed increased flow. This stretch of sewer has been identified as a future CIP for the City, however it is based on future growth and is not currently in the 5-year plan. The WLRLS decommissioning and Willow Lake Road trunk sewer main, described in Option 2, is a CIP that is currently in the City's 5-year plan. Therefore it is not feasible to construct this option as a short term solution for the Sundog WWTP peak flow mitigation.

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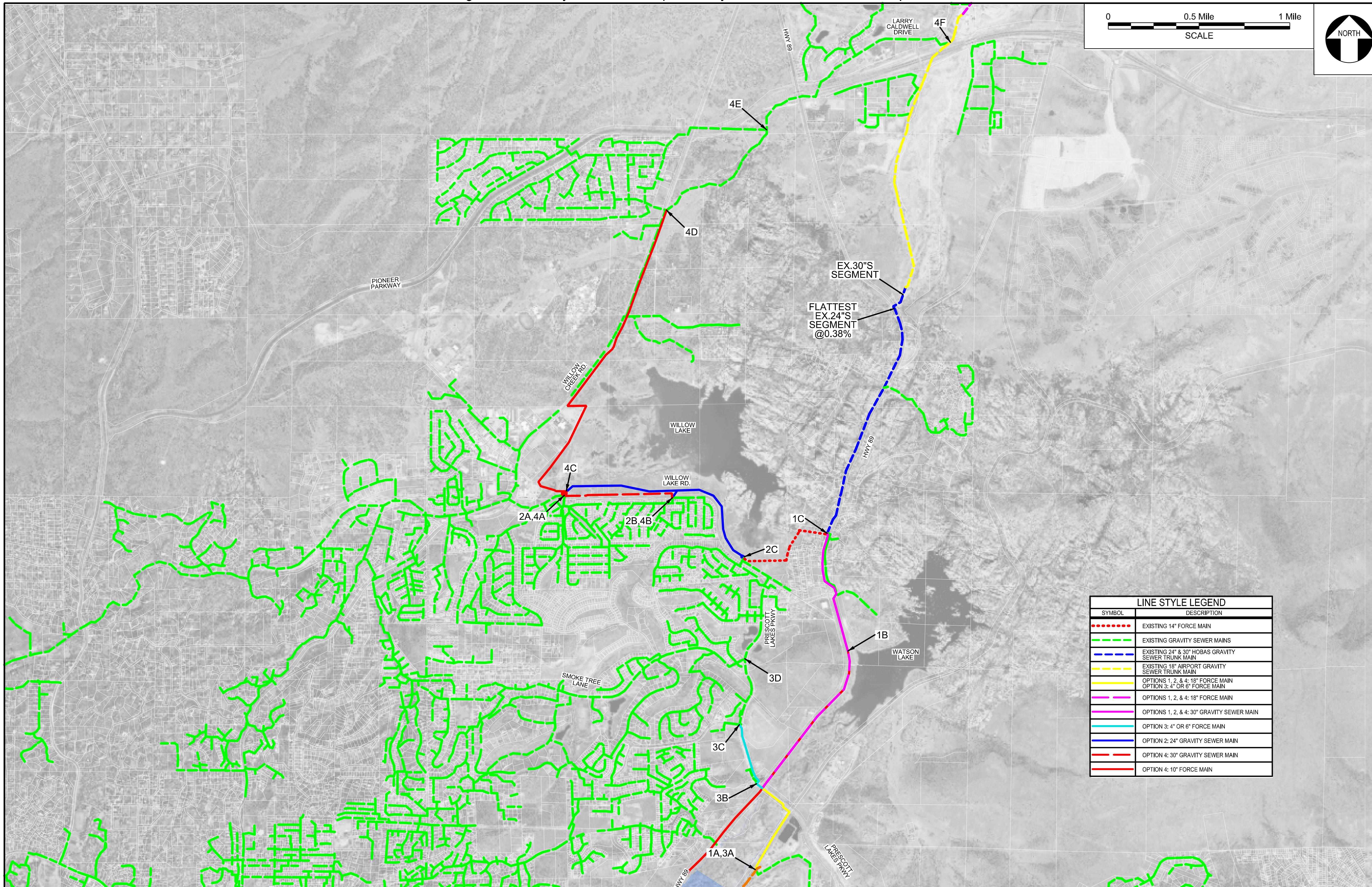
Figure 3-3 Project Location Map for Analyzed Wastewater Diversion Options



SECTION 4. Effluent Water System

4.1 Introduction

The City of Prescott Sundog WWTP and Airport WRF were recently upgraded to produce class A+ effluent that is delivered to Antelope Hills Golf Course (AHGC), Prescott Lakes Golf Course (PLGC), Hanson Materials, and to the percolation recharge basins located at the Airport WRF. PLGC currently receives effluent from Sundog, while AHGC receives effluent from both facilities. The golf courses are classified as closed-access turf and therefore can utilize the lower quality Class B effluent that was previously produced by both facilities. Class A+ effluent can be utilized to irrigate open-access turf areas such as City parks & fields and Embry-Riddle Aeronautical University (ERAU) athletic fields and landscaping.

4.2 Purpose

The purpose of this section is to identify potential new effluent users, determine the scope and estimated costs associated with extending service to them, and analyze the long term cost benefit of using effluent versus potable water for these users. Currently City and ERAU facilities are irrigated with potable water and are billed at the current domestic residential rates. These rates are based on a monthly fixed charge per meter size and a graduated scale per every 1,000 gallons consumed. The City water rates for years 2011 through 2013 are shown in Appendix A.

4.3 Background and Overview

The City of Prescott currently utilizes 13 miles of effluent delivery mains ranging from 8-inch to 24-inch in size. Referring to Figure 4-1, the following effluent systems reaches have been identified:

- Point A to B: The Sundog 24-inch gravity effluent main to its transition to an 18-inch effluent main.
- Point B to C: The Sundog 18-inch gravity effluent main to its terminus at the Airport WRF percolation recharge basins.
- Point D to E: The Prescott Lakes effluent pump station tap on the Sundog 24-inch main and pumping through an 8-inch effluent main to its terminus at the PLGC Hole #18 Lake.
- Point F to G: A 12-inch gravity effluent main branches off of the Sundog 18-inch main to its terminus just north of the northern boundary of ERAU along Willow Creek Road. This line is full but inactive, and is occasionally utilized by contractors for construction water.
- Point H to I: A 12-inch gravity effluent main branches off of the Sundog 18-inch main to its terminus at the AHGC South Course Hole #7 Lake.
- Point J to K: A 12-inch effluent main from the existing Airport WRF effluent pump station to its terminus at the AHGC North Course Hole #5 Lake.
- Point L: A 18-inch plug valve is on the 18-inch Sundog main and is manually close-throttled in order to keep the effluent main full to a point past the Prescott Lakes effluent pump station located at Point D. This is necessary due to occasional cavitation problems at the pump station as a result of the gravity flow design of the 18-inch Sundog main and corresponding low flows from the Sundog WWTP.

4.4 Centralized Treatment Scenario

Centralized treatment located at the Airport WRF would provide an opportunity for Class A+ effluent to be distributed throughout the existing and proposed extensions of the City of Prescott effluent system. The following scenarios 4.4.1 through 4.4.4 assume that the infrastructure for centralization is in place, Sundog WWTP has been decommissioned and the Sundog Lift Station is in operation. Scenario 4.5.5 represents an optional bypass scenario that would allow Class A+ effluent to be delivered to new users before centralization has taken place. Scenarios were assigned phase numbers based on their proximity to the existing Sundog 12-inch effluent main and the logical progression of construction for effluent system expansion.

4.4.1 Airport WRF Expansion Phase 1 & Airport Water Tank and Booster Station Conversion ~ A+ Effluent

With the completion of the Airport WRF Expansion Phase 1, Class A+ effluent can be delivered to potential new effluent users that currently are unable to use the lower Class effluent. As part of this project the existing Airport Water Tank and Booster Station were converted from City water facilities to effluent facilities, see Figure 5-2. This is advantageous in many ways. First, the pumping head requirements for the new WRF effluent pumps will be relatively smaller due to the shorter distance and lower elevation of the Airport Tank. This will allow for smaller horsepower pumps and lower utility costs. Second, the 1.5 million gallon tank will provide extra storage of effluent that can be called upon during heavy summer irrigation demands. Third, the existing booster pump station is capable of delivering 1600 gpm or 2.4 mgd, with both pumps running, to an elevation higher than the existing Sundog effluent holding ponds. This is an important component since centralization will require pumping Airport WRF effluent back through the Sundog mains to continue servicing the Prescott Lakes effluent pump station.

4.4.2 Rifle Ranch Extension to ERAU, Pioneer Park, & Kuebler Field (Phase I)

The first phase of the effluent system expansion would entail an extension from the existing 12-inch Sundog main at Willow Creek Road (Point A) approximately 671 lf into the NE corner of the ERUA campus, see Figure 4-2. From this point an irrigation pump station would be installed (Point B) and a further 8995 lf of 8-inch main extensions to the ERAU athletic fields (Point C), Pioneer Park (Point D), and Kuebler Field (Point E). This pump station is necessary since the elevation of the future Sundog effluent storage tank (see Section 5.4.6, CIP#6) will be lower than the elevation necessary to provide gravity flow delivery for irrigation of these facilities.

4.4.3 Heritage Park Extension (Phase II)

With the completion of the pump station in Phase I (see Figure 4-2, Point B), approximately 2665 lf of 12-inch effluent main could be extended southward on Willow Creek Road to Point F. From this point an 8-inch effluent main would be extended to its terminus at the Heritage Park complex, Point G.

4.4.4 Willow Creek Park Extension (Phase III)

With the completion of the Heritage Park extension in Phase II (see Figure 4-2, Point G), approximately 4342 lf of 12-inch effluent main could be further extended southward on from Point F at Willow Creek Road to the Willow Creek Park entrance at Point H. From this point approximately 410 lf of 4-inch effluent main would be extended eastward to the existing irrigation facilities (Point I).

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Figure 4-1 Existing Effluent System Map

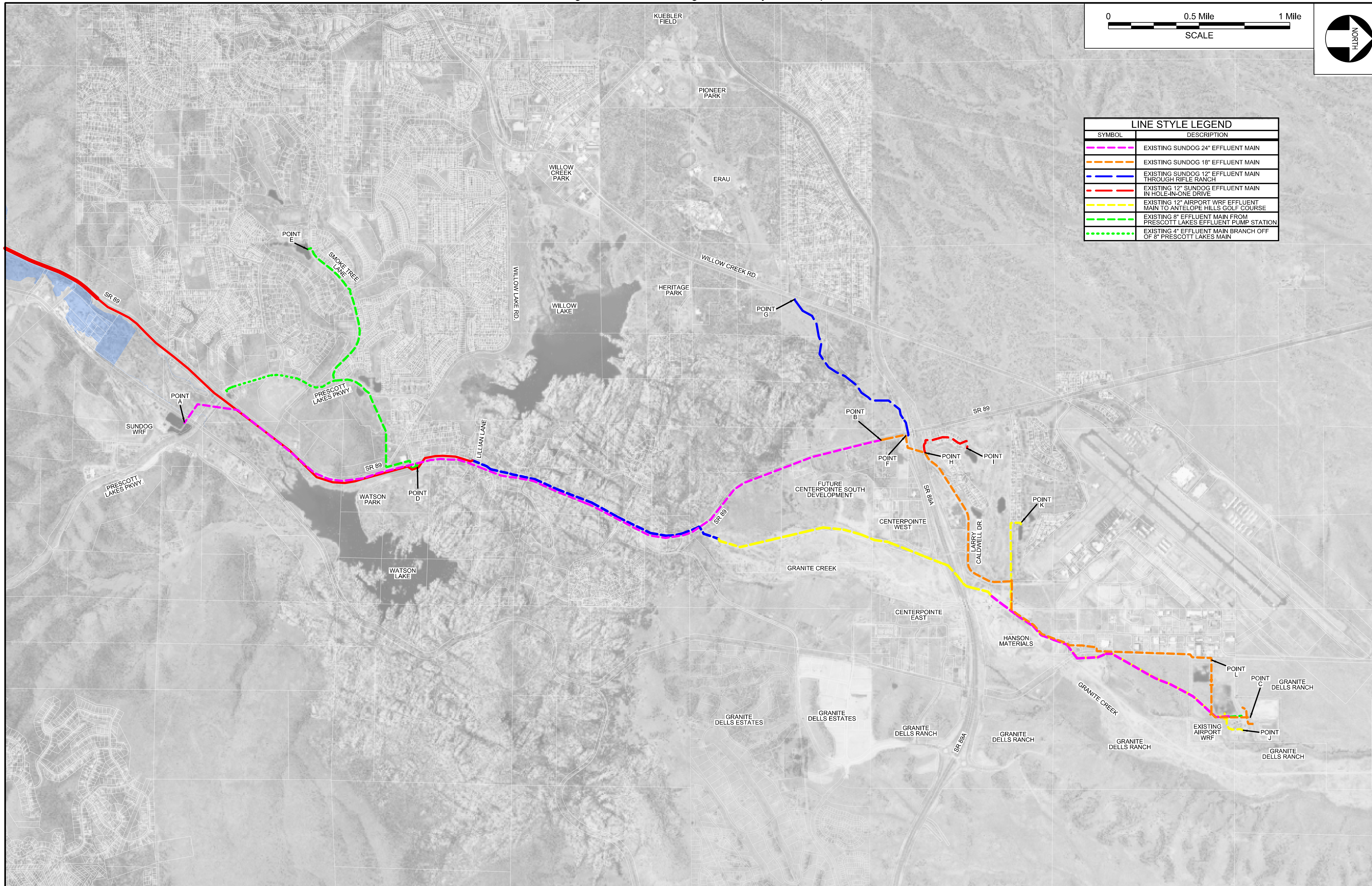

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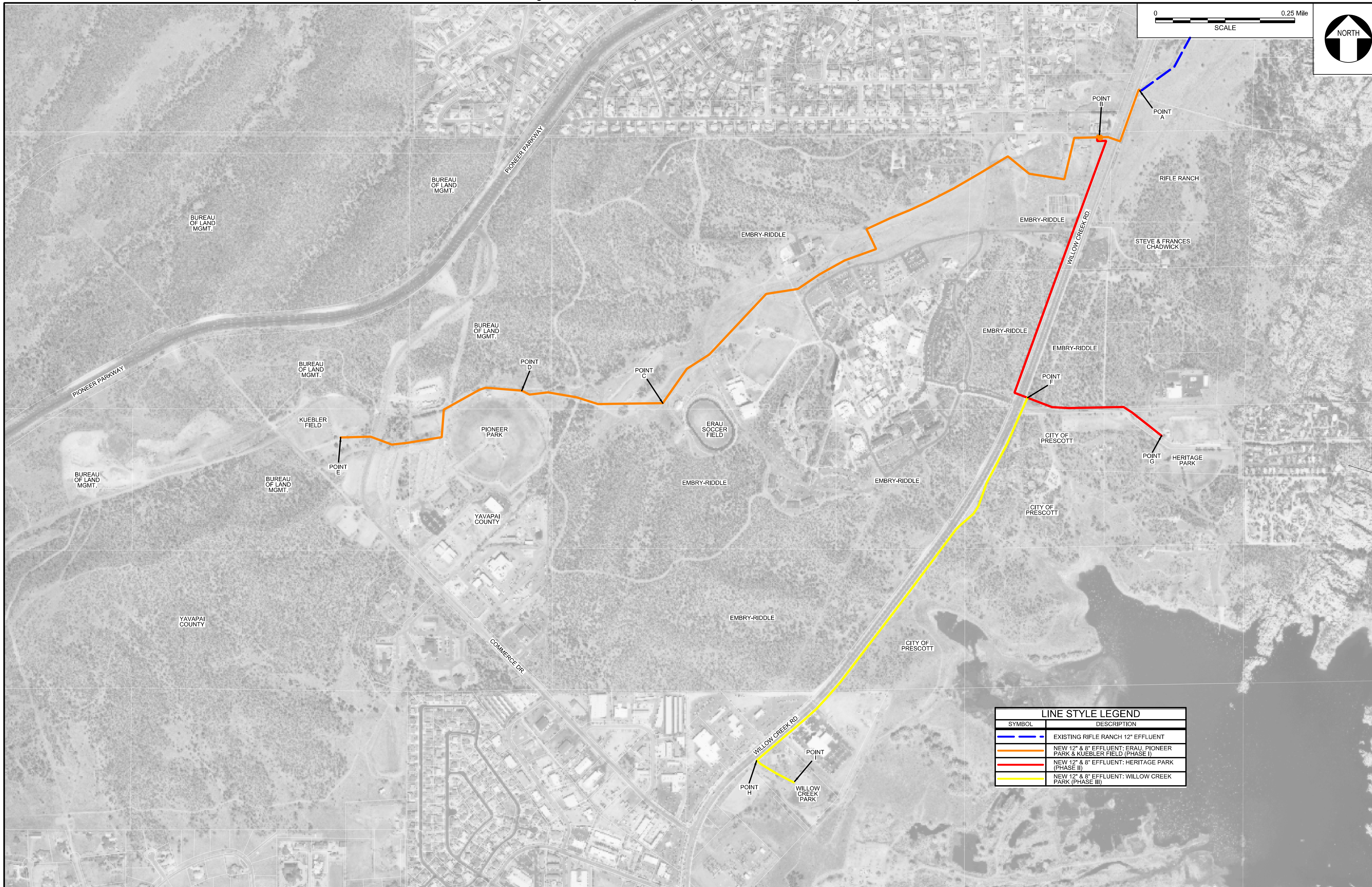
Figure 4-2 Proposed Expansion and New Users Map



4.4.5 Optional Sundog Effluent Main Temporary Bypass

If the City wishes to provide effluent delivery to new users before centralization and the decommissioning of the Sundog WWTP, there is an alternative available that will facilitate this scenario. As part of the Airport WRF Phase I Expansion project a new 14-inch effluent main was extended from the existing Airport water booster station to the existing 18-inch Sundog effluent main (Point A, Figure 4-3, Inset #1). This booster station will be converted to an effluent booster station per CIP#2 discussed in Section 5.4.2, and shown in Figure 5-2. The tie-in to the Sundog effluent main included a check valve on the new 14-inch effluent main from the booster station to isolate Sundog effluent from Airport effluent. Just before the check valve, an 14-inch x 12-inch tee was installed (Point A) to allow for the extension of 1700 lf of 12-inch effluent main to Point B, a tie-in with the existing Airport WRF 12-inch effluent main. This connection enabled Class A+ effluent to be delivered through the existing 12-inch main that serves the AHGC north course Hole #5 lake. The existing 12-inch main crosses the existing Sundog WWTP 18-inch effluent main on the west side of Wilkinson Road across from the entrance to Hanson Materials (Point C, Figure 4-3). At this crossing point there exists an 18-inch x 12-inch tee and 12-inch gate valve that is currently closed and covered with a blind flange. Referring to the inset on Figure 5-2, this inter-connection was completed during the construction of the Airport WRF Expansion Phase I, and was included in CIP#2 (Section 5.4.2 of this report). This connection also included a 12-inch branch installed specifically for the option of a temporary bypass of the Sundog 18-inch effluent main. From this 12-inch branch (Point C), 6193 lf of 12-inch effluent main was installed parallel to the existing Sundog 18-inch main along Wilkinson and Larry Caldwell Drive to Point D, a tie-in with the Hole-in-One Drive existing 12-inch effluent main, and under Hwy 89 & 89A to a tie-in with the ERAU existing 12-inch effluent main, Point E. This would isolate the Sundog 18-inch effluent main from its existing 12-inch branches, allowing Sundog WWTP effluent to continue flowing to the recharge basins at the Airport WRF, and avoid the mixing of Sundog Class B effluent with the new Airport WRF Class A+ effluent.

An additional item that would be required for the bypass alternative is a new 100,000 gallon storage tank at the location of the proposed irrigation pump station, Point F, Figure 4-3, Inset #2. The bypass scenario would deliver effluent via the converted Airport booster station that will not run continuously. Therefore a buffer tank would be necessary to deliver irrigation volume when called upon from the new irrigation pump station. Without the new effluent tank specified in CIP#6, Figure 5-6, and with the separation of the 18-inch Sundog effluent main, there will not be a source to deliver a consistent static pressure to the irrigation pump station.

4.4.6 Effluent Extension Preliminary Cost Estimates

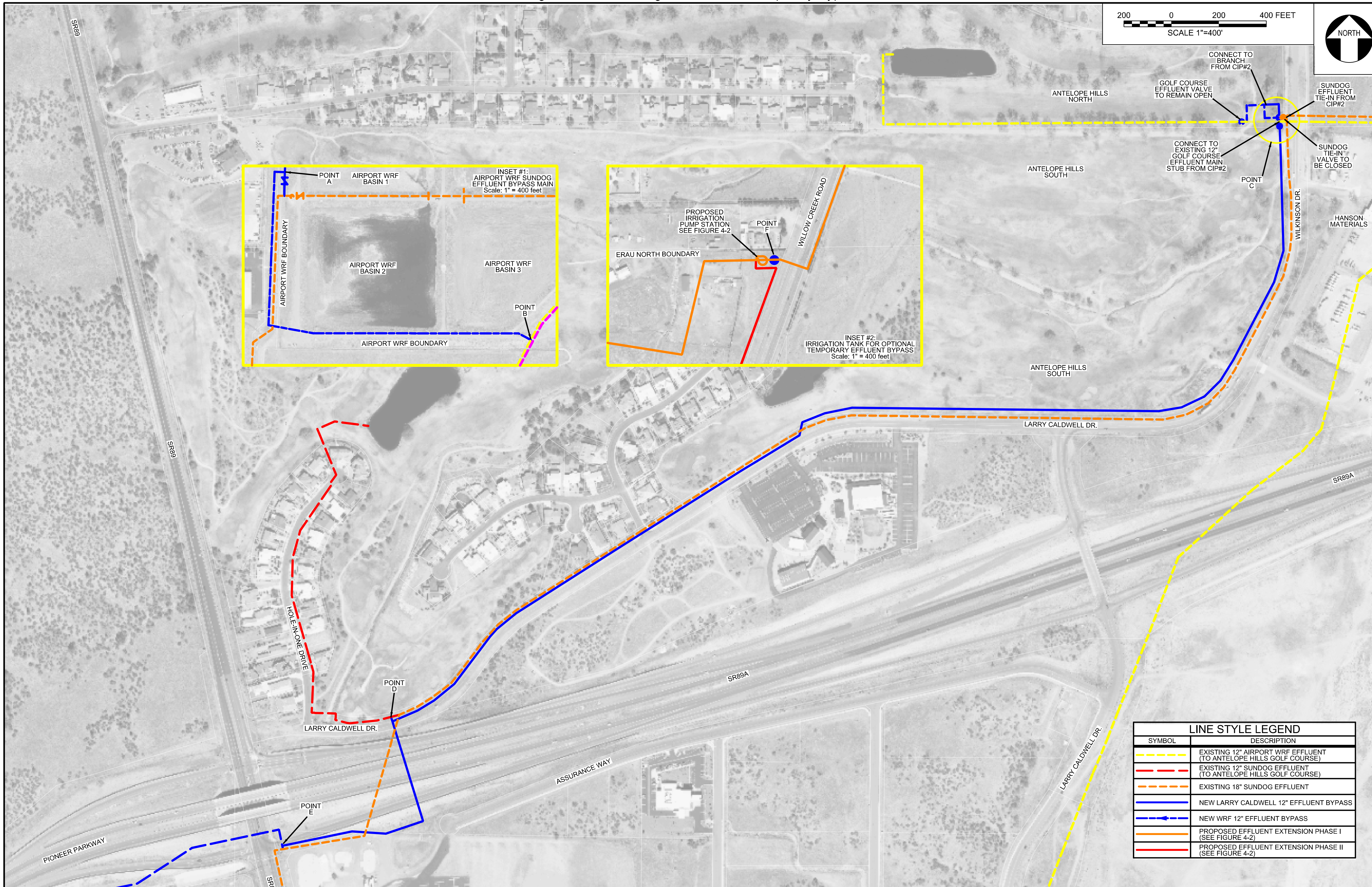
The following preliminary cost estimates are for the previously mentioned Phases I, II, & III and the optional Sundog effluent main temporary bypass. It should be noted that these estimates are based on the phasing as shown in Table 4-1. For example, we have assumed that the irrigation booster station will be built in Phase I, and therefore is not included in the cost of the other phases. Additionally, we have not included the cost associated with any right-of-way or utility easement acquisition.

Table 4-1 Summary of Effluent System Expansion Preliminary Cost Estimates

Effluent Extension Phase	Cost ($M)
Phase I - Rifle Ranch Extension to ERAU, Pioneer Park & Kuebler Field	$1.21
Phase II - Heritage Park Extension	$0.56
Phase III - Willow Creek Park Extension	$0.60
Total all Phases=	**$2.37**
Optional - Sundog Effluent Main Temporary Bypass	$1.48

1. Costs do not include right-of-way or utility easement acquisition
2. Costs assume Phasing order as shown
3. Detailed breakdown of cost estimates is located in Table B-1 in Appendix B
4. Watson Park is not included in this table since it can already be served by the Prescott Lakes Effluent Pump Station once flow in the Sundog effluent main has been reversed, See CIP#6, Section 5.4.7, Figure 5-6

Figure 4-3 Sundog Effluent Main Temporary Bypass



4.5 Cost Benefit Comparison – New Effluent Users

In order to justify the expense of adding new users to the existing City effluent system, several factors must be analyzed and weighed against each other. Though the cost of extending the system will be relatively high, the long term benefits could be substantial. For example, Pioneer Park, Willow Creek Park, Kuebler Field, Heritage Park and ERAU all currently use potable water for irrigation. This is not only costly due to the standard City water rates being applied for billing, but also because there is a substantial cost associated with delivery of the water to the users from the Chino Valley water production facility. These costs include pumping of water from the aquifer, treating and storing the water at the facility, and pumping the water approximately 13.5 miles into Prescott. By utilizing effluent that is already the product of the water reclamation process, the O&M and costs associated with each gallon delivered would be substantially lower. Additionally, this will reduce the water pumped from the aquifer, helping alleviate an on-going concern regarding assured water supplies to Arizona communities.

4.5.1 Current Effluent Users and Rate Structure

There currently are three, full time users of the City effluent system. Two of the users are golf courses which include Prescott Lakes, a private 18-hole golf course, and Antelope Hills, the City owned public 36-hole golf course. The third user is Hanson Materials, a sand, gravel, and concrete operation located on Larry Caldwell Drive just north of Hwy 89A. Contractors occasionally utilize the City effluent for construction water. Since their usage is relatively low and infrequent it will not be considered for the cost benefit comparison. The PLGC and AHGC pay approximately the same rate for effluent based on a set allotment of effluent per month plus any supplemental effluent needed during peak irrigation months. Hanson Materials pays approximately the same rate as the golf courses but does not have a rate for supplemental effluent beyond their monthly allotment of 20 ac-ft. A review of usage history for the golf courses indicates that supplemental effluent is rarely called for and therefore was not considered in our analysis. Rates are increased on a yearly basis utilizing the Consumer Price Index. The 2012 rate for effluent is $315.27 per acre-foot, or $0.97 per 1000 gallons, the 2011 rate was $303.03. For comparison purposes the 2011 effluent rate for Prescott Lakes will be used to match the data used for the cost of water. The current agreement for sale of effluent to Prescott Lakes is due to expire in February of 2016, but can be extended for two additional twenty-year terms, subject to adjustments in payment terms. Refer to Table A-1 in Appendix A for the current graduated effluent rates.

4.5.2 Proposed Effluent Users Current Water Usage for Irrigation

The City of Prescott provided water usage data and Water Department billings for multiple years to be used in this report. For our analysis we have chosen to use the 2011 City fiscal year which runs from July 1, 2010 to June 30, 2011. This fiscal year is considered conservative due to the improved efficiency of water usage by Parks & Recreation staff during the year to better conserve water. Additionally, at the time of this report this is the most current fiscal year available and therefore reflects the current trend of irrigation use.Table 4-2 shows the total gallons of water used by the proposed effluent users for FY2011. This table is a summary of the fiscal year, refer to Table C-1 in Appendix C for a detailed month to month data for irrigation uses by proposed effluent users.

Table 4-2 FY2011 Potable Water Usage for Irrigation by Potential Effluent Users

Proposed Effluent User	FY2011 Gallons of Water Consumed
ERAU	19,939,759
Heritage Park	4,298,543
Willow Creek Park	1,380,680
Kuebler Field (including future field)	5,327,106
Pioneer Park	13,069,065
Watson Park	2,842,178
Total=	**46,857,331**

1. Data provided by Shaun Rydell, Water Conservation Coordinator for the City of Prescott

4.5.3 Cost Benefit Analysis

In order to consider extending effluent service to new users and adding to the City effluent system, a cost benefit analysis must be performed. This analysis will need to include many assumptions and will be preliminary in nature. Not every possible factor will be included in the analysis. Simplified calculations of a specified time frame, FY2011, will be used as a starting point for consideration of a future, more detailed study that is beyond the scope of this report. The following factors have been used in our cost benefit analysis:

A. **FY2011 Cost per 1000 gallons to deliver potable water to Prescott from the Chino Valley Water Production Facility.** This item has been derived by dividing the total cost of FY2011 electricity billings by the volume of water delivered per user. Many other factors could be weighed into these items including manpower, arsenic treatment, disinfection and routine maintenance. However, electricity costs outweigh these factors enough to consider them the primary cost concern for this cost benefit analysis, which is preliminary in nature. See Table B-2 in Appendix B.
B. **FY2011 Cost per 1000 gallons to deliver potable water from the existing Airport Booster Station.** This item was calculated using multiple factors. First the APS billing amount for each month was divided by the kilowatt-Hours (kWH) used for that month. This value along with the pump efficiency, motor efficiency, and head pumped in feet, was used in a formula that determines the cost of pumping water per 1,000 gallon. See Table B-2 in Appendix B.
C. **FY2011 Cost per 1000 Gallons to deliver effluent water from the future ERAU irrigation pump station.** This item was calculated using the same formula used for Item B, however an average kWH per cost was used from Item B along with an assumed pump efficiency and motor efficiency. The head pumped in feet that is needed to deliver 40 psi minimum to future effluent users is determined in Table C-2 in Appendix C. See Table B-2 in Appendix B for electrical calculations.
D. **Current cost per acre-foot (converted to cost per 1000 gallons) of effluent charged to the Prescott Lakes and Antelope Hills Golf Courses.** Item D is taken directly from the effluent agreements between the City, Prescott Lakes and Antelope Hills that contains a detailed rate schedule based on the year of delivery.
E. **FY2011 Volume of water used by the potential effluent users identified in Section 4.5.2.** This item was provided by the City of Prescott.
F. **FY2011 City of Prescott Water Department billings for irrigation uses to the potential effluent users.** This item was provided by the City of Prescott.
G. It is important to note that this analysis does not take into consideration water quality. It is expected that higher quantities of effluent will be needed to compensate for higher salinity and lower water quality.

With the above items in hand, we were able to produce the following summary tables Table 4-3, and Table 4-4 for comparison of potable water vs. effluent for use as irrigation.

Table 4-3 Comparison of Potable Water Billing vs. Effluent Billing for Irrigation by Potential Effluent Users in FY2011

Potential Effluent User	FY2011 Gallons of Potable Water Consumed	FY2011 Billing for Potable Water	FY2011 Equivalent Effluent Billing	FY2011 Potable Water vs. Effluent Billing Ratio
ERAU	19,939,759	$141,693	$18,724	7.6
Heritage Park	4,298,543	$21,548	$4,036	5.3
Willow Creek Park	1,380,680	$6,831	$1,297	5.3
Kuebler Field(s)	5,327,106	$26,562	$5,002	5.3
Pioneer Park	13,069,065	$68,578	$12,272	5.3
Watson Park	2,842,178	$12,707	$2,669	4.8
Weighted Average Based on Potable Water Billings=				**6.5**

1. Effluent rates for Prescott Lakes Golf Course go up every year effective March 1st.
2. Effluent billing rate applied to the water consumption is based on the average of the rates applied to Prescott Lakes during the same timeframe.

Table 4-4 Comparison of Electricity Costs for Delivery of Potable Water vs. Effluent for Irrigation by Potential Effluent Users in FY2011

Potential Effluent User	FY2011 Gallons of Potable Water Consumed for Irrigation	Elec.$/1000 gallons of water pumped from Chino Valley	FY2011 Elec. $ potable water	Elec. $/1000 gallons of water pumped from Airport Booster Sta.	Equivalent FY2011 Elec. $/1000 gallons of effluent pumped from Airport Booster & future ERAU Pump Station	Ratio of Water vs. Effluent Electrical Cost
ERAU	19,939,759	$0.46	$9,139	$0.23	$4,619	2.0
Heritage Park	4,298,543	$0.46	$1,970	$0.23	$996	2.0
Willow Creek Park	1,380,680	$0.46	$633	$0.23	$320	2.0
Kuebler Field(s)	5,327,106	$0.46	$2,442	$0.23	$1,234	2.0
Pioneer Park	13,069,065	$0.46	$5,990	$0.23	$3,028	2.0

1. Watson Park is not included in this spreadsheet since it will be serviced by the existing Prescott Lakes Effluent Pump Station.

4.5.4 Future Rate Analysis

Referring to Table 4-5, it seems apparent that the City should consider a further study of effluent rates for existing and potential effluent users given the existing billing ratio weighted average of 6.5:1. Granted, the water vs. effluent ratio identified in the Table 4-3 is based on many assumptions and does not consider the impact on the City's recharge credits, water portfolio, or the public perception of effluent being used for irrigation. Further evaluation should consider contract terms to determine whether the terms result in a fair and accurate charge for the effluent in relationship to the City's cost to deliver effluent and maintain the infrastructure.

Table 4-4 is preliminary in nature and would need a more detailed study of electrical costs associated with the Chino Valley water facility, the Airport Booster Station, and the future ERAU Irrigation Pump Station. That being said, this table is a fairly accurate indicator of water vs. effluent electrical cost savings to the City of Prescott. Per Table 4-4, a savings factor of 2.0 can be anticipated by pumping effluent from the Airport Booster and future ERAU Irrigation Pump Station vs. the current delivery method of pumping water from the Chino Valley water production facility.

For reference purposes we have included Table 4-5 below to provide the City with a comparison of 2011 effluent rates vs. other municipalities in Arizona. As can be seen in the table, Prescott rates are lower than several of the comparable communities.

Table 4-5 Arizona Municipalities Effluent Rate Comparison

Municipality	Rate per 1000 gallons	Equivalent Rate per Acre-Foot	City of Prescott 2011 Rate per Acre-Foot	Ratio of Prescott vs. other Municipalities Effluent Rates
Flagstaff (golf courses)	$1.07	$348.68	$309.09	89%
Flagstaff (NAU Fields)	$1.29	$420.38	$309.09	74%
Gilbert	$0.32	$104.28	$309.09	296%
Mesa 1	$0.95	$309.58	$309.09	100%
Mesa 2	$1.32	$430.15	$309.09	72%
Peoria	$1.05	$342.17	$309.09	90%
Lake Havasu City	$0.44	$144.07	$309.09	215%

1. The City of Flagstaff has a multiple effluent rates based on user types and location within or out of City limits. For this table we have chosen the rates most applicable to current and future City of Prescott effluent users.
2. The City of Mesa has multiple rates based on effluent zones. For this table we utilized the two tables most applicable to the City of Prescott scenarios.

4.5.5 Effluent Available for Future Irrigation Uses

As a result of the voter approved Proposition 400 ballot measure in November 2005, the City of Prescott must recharge all wastewater effluent produced by new developments over 200 acres annexed into the City. This essentially caps the amount of effluent that can be utilized for irrigation purposes based on current wastewater flows to City wastewater facilities and anticipated flows from previously annexed, but undeveloped land within City limits. As of the date of this report the combined annual average daily flow (AADF) to the Sundog and Airport facilities is 3.7 mgd (2.5 mgd + 1.2 mgd respectively). For the purposes of this discussion we will only consider this flow as the baseline of effluent available for future irrigation users.

Referring to Table C-1 in Appendix C, Prescott Lakes and Antelope Hills Golf Courses combined for a FY2011 annual average daily demand (AADD) of 1,059,362 gallons or 1.06 mgd per day. The peak month of FY2011 was June, which had an average daily demand (ADD) of 2,557,133 gallons or 2.56 mgd. Hanson Materials has a set allotment of 20 acre-feet of effluent per month or 0.21 mgd. The maximum allotment is rarely used but to be conservative we have assumed that it will be, since it is effluent that is guaranteed for their use. Assuming that the future effluent users identified in Table C-1 are connected to the effluent system, the FY2011 AADD for their usage would be 128,376 gallons or 0.13 mgd, with a peak month in July of FY2011 of 336,583 gallons or 0.34 mgd. To be conservative we have chosen to combine the peak month flows from FY2011 for the golf courses, the allotment for Hanson Materials, and future effluent users, yielding 3.10 mgd, as the worst case ADD demand on the effluent system. With a combined AADF of 3.7 mgd from the Sundog WWTF and the Airport WRF this leaves 0.6 mgd available for potential effluent users not identified in the Roadmap. As a frame of reference, Kuebler Field has 106,700 sf of turf area and in the peak month of FY2011 (July) used 614,033 gallons for irrigation, this equates to an ADD of 0.02 mgd. Assuming the same size ball field, peak month irrigation usage, and the AADF of 0.6 mgd of effluent available for irrigation, the City would in theory have capacity for an additional 30 Kuebler equivalent ball fields. See Table C-3 in Appendix C.

These calculations are based on the AADF to the Sundog and Airport wastewater facilities vs. the worst case combined peak month ADD for the golf courses, Hanson Materials, and future effluent users. We consider this method to be very conservative in nature considering there are several areas within pre-November 2005 annexed City limits that are undeveloped land or, are developed subdivisions with no homes constructed. As growth returns to the City, no matter the rate, wastewater flows will increase and more effluent will be available for irrigation purposes.

Finally, if a scenario did occur where all available effluent was used for irrigation, it would offset potable water demand but would reduce the available recharge. This would have some impact on the City of Prescott's water portfolio and recharge credit. These implications are beyond the scope of this report and would need to be studied at a later date if such an irrigation scenario is pursued.

SECTION 5. Centralized Concept Roadmap

5.1 Introduction

As previously mentioned in Section 1.1, the 2011 "Capacity and Technology Master Plan", proved the viability of centralized treatment. Centralized treatment refers to the single facility treatment of wastewater that is currently served by two facilities, the Sundog Wastewater Treatment Plant (WWTP) and the Airport Water Reclamation Facility (WRF).

5.2 Purpose

The purpose of the Centralized Concept Roadmap (Roadmap) is to define the scope, time frame, and estimated costs associated with the centralized treatment concept. These items are dictated by several factors including but not limited to; current capacity of the City treatment facilities and infrastructure, projected population growth, and the City of Prescott General Plan.

5.3 Background and Overview

5.3.1 2011 Capacity and Technology Master Plan

The 2011 "City of Prescott Sundog WWTP and Airport WRF Capacity and Technology Master Plan" Technical Memorandum 6 (TM 6) discussed in detail alternative routes for conveying wastewater flows from the Sundog WWTP to the Airport WRF. However each alternative analyzed did not seem to address the issue of maintaining effluent flow from Sundog to the Airport recharge basins while the new conveyance infrastructure was under construction. In this report, we have narrowed down the alternatives for centralization to one clear path with multiple stages of Capital Improvement Projects (CIP). Section 5.4 provides in detail how centralization can be accomplished.

5.4 Timeline of Capital Improvement Projects

The following list is a chronological order of Capital Improvement Projects (CIP) that would be necessary for the transition to centralized treatment. A brief description of each CIP is listed including preliminary costs for the improvements. Following the descriptions are Figures 5-1 thru 5-6 which graphically depict the proposed CIPs. Refer to Table B-3 in Appendix B for a detailed cost estimate for each CIP.

5.4.1 CIP #1 – New Zone 12 Water Tank

This project (Figure 5-1) is included in the City's water fund and has been completed in FY 2013. Since it is not a wastewater project there is not a direct benefit to the wastewater system and the centralization scenario. However it is a necessary first step for the completion of CIP #2. The low bid for this project was $3,156,755.

5.4.2 CIP #2 – Airport Tank & Booster Station Conversion

The Zone 12 tank identified in CIP #1 was specifically designed to eliminate the need for the existing Airport Tank and Booster Station (ATBS). The adjacent location of the ATBS to the Airport WRF makes it an ideal choice for future storage and pumping of Class A+ effluent. Referring to Figure 5-2, the scope of this project includes:

- A new 14-inch effluent tank fill main to the existing tank from the new Airport WRF effluent pump station
- A new 14-inch reuse main from the existing booster station to a tie-in point on the high pressure side of the existing Sundog 18-inch effluent main. A check valve will also be installed at the tie-in point that will prevent Sundog effluent from back flowing into the new Airport effluent reuse main.
- The existing plug valve is currently being throttled down to keep the Sundog main full to a point past the Prescott Lakes effluent pump station tie-in point adjacent to the Willow Lake Road roundabout. This valve will remain in place and continue to be manually operated.
- Installation of an inter-tie between the existing 12-inch Airport effluent main that delivers to the Antelope Hills north golf course, and the 18-inch Sundog effluent main. This connection will serve several functions; it allows Sundog effluent to be delivered to the Antelope Hills north course, provides the option to turn off the existing 12-inch Airport effluent main, and will allow Class A+ effluent to be delivered to the golf course once flow in the Sundog main is reversed per CIP #6.

The booster station in its existing configuration is capable of delivering 800 gpm (1.15 mgd) to an elevation higher than the current Sundog effluent ponds. This will allow the reversal of effluent flow back through the existing Sundog 18-inch effluent main that is described in Section 5.4.6, CIP#6. CIP#2 was included in the Airport WRF Phase 1 Expansion and was completed in FY 2014.

5.4.3 CIP #3A - Sundog Equalization Basin and Lift Station (Scenario 1)

As discussed in Section 2 and depicted in Figure 5-3, a 9.0 million gallon equalization basin would be constructed at the site of the existing and abandoned sludge drying beds. A lift station would be constructed adjacent to the pond to pump equalized storage back to the existing S.S. pump station once the storm surge has receded, approximately 2 to 3 days. This lift station would be designed and built in a way that would accommodate future upgrades outlined in CIP#6. An extension of the non-potable water system at the Sundog WWTP would be required for cleaning of the equalization basin after storm events. Estimated cost of this project is $5.3 million. This project will also require the upgrades of the Sundog trunkmain which is estimated at $7.0 million.

5.4.4 CIP #3B – VA Lift Station (Scenario 2)

As discussed in Section 3, Scenario 2 includes a lift station upstream of the VA area and equalization at the Sundog WWTP site. This option can be implemented in phases by adding the VA lift station first and adding the equalization at the WWTP site, once the decision is made to fully adopt centralization. This phased approach will rapidly allow the City to reduce the flows handled by the Sundog WWTP and minimize the risks associated with this aging facility. This option will also allow the Airport WRF to operate within its design capacity which will enhance its performance and improve the effluent quality. This CIP will also require the installation of an 18 inch forcemain that extends from the lift station site to Watson Park area (Point B). The forcemain will discharge into a manhole at Lillian Lane. The gravity lines downstream of Lillian Lane will have to be upsized as discussed in CIP 5/Scenario 2 below.

The lift station will include a dual wetwell equipped with 4 pumps with maximum, firm pumping capacity estimated at 11mgd. The costs associated with this option are estimated at $8.1 million, in addition to partial upgrades to the Sundog trunkmain estimated at $3.2 million.

5.4.5 CIP #4 – Airport WRF Expansion Phase 2

Before the Sundog full flow can be diverted the construction of Phase II of the Airport WRF must be complete and operational. Phase II, see Figure 5-4, would increase capacity of the Airport WRF from 3.75 to 7.5 mgd, providing enough capacity to handle the current average daily flow to Sundog. Estimated cost of this project is $15 million, see Table B-3 in Appendix B.

5.4.6 CIP #5 – Sundog Flow Diversion for Centralization

Once CIP#4 construction is complete and the Airport WRF Phase 2 is operational, flow can be diverted by upgrading the Lift Station constructed under CIP#3, and constructing the force main and gravity sewer mains described below. The Point designations used on Figure 5-5 are for reference to specific stretches of the new Airport trunk main. They are described as follows:

Scenario 1

- Point A to B: This portion of the project would begin with upgrades to the lift station, Point A, constructed in CIP#3, namely piping reconfiguration and the addition of more and/or higher capacity pumps. Between Points A and B would be approximately 7570 lf of new 18-inch force main sewer from the lift station to its terminus at a high point on Hwy 89, adjacent to the Watson Lake scenic turnout.
- Point B to C: Beginning at the end of the new 18-inch force main located at the Watson Lake turnout, approximately 10,724 lf of new 30-inch gravity sewer main will be constructed within Hwy 89 right–of-way to the crossing of Willow Creek at Point C. This stretch has been identified separately due to the unknown slopes that will be necessary to maintain flow. To be conservative we have used a slope of 0.18%, resulting in a 30-inch sewer main size for this reach.
- Point C to D: Beginning at Point C the sewer main will leave Hwy 89 right-of-way and extend eastward 3,362 lf (paralleling the path of the existing trunk main). From this point forward, slopes can be estimated based on the slopes of the existing trunk main. This reach ends at Point D within the future Centerpointe South development.
- Point D to E: Beginning at the end of the 30-inch sewer at Point D, this portion will extend 4664 lf of new 33-inch gravity sewer main to the north side of Hwy 89A at Point E.
- Point E to F: Beginning at the end of the 33-inch sewer at Point E, this portion will extend 3286 lf of new 42-inch gravity sewer main to its terminus within the Hanson Materials site at Point F.
- Point F to G: Beginning at the end of the 42-inch sewer at Point F, this portion will extend 7435 lf of new 48-inch gravity sewer main to its terminus at the new Airport WRF Expansion Phase I head works at Point G.

In addition to the lift station, force and gravity sewer mains, this CIP would also include the addition of a screening and grit removal facility, associated odor control and decommissioning of the Sundog WRF and the optional conversion of the existing oxidation ditch and clarifiers to equalization contingent on their condition.

Total estimated cost of this project is $22.8 million, however it should be noted that the 2008 Wastewater Master Plan identified a portion of this project as an “Existing System CIP: Airport Trunk Main”. This project was to begin where the Airport Trunk Main deviated away from Hwy 89, Point C Figure 5-5, and continued north to its terminus at the existing Airport WRF head works. A cost of $13 million was estimated and the project construction was scheduled between 2013-2015. This would have placed this project in the City’s 5-year CIP plan, essentially making the proposed CIP#5 an additional $9.8 million ($22.8 - $13) project, see Table B-3 in Appendix B.

Scenario 2

- Point A to B: This portion of the project would be included in CIP#3B with the installation of the Primary Lift Station at the VA site. Between Points A and B would be approximately 17,800 lf of new 18-inch force main from the lift station to its terminus where it connects to the gravity sewer at the intersection of Lillian Lane and SR 89.
- Point B to C: Beginning at the end of the new 18-inch force main located at Lillian Lane, approximately 7,900 lf of new 36-inch gravity sewer main will be constructed within Hwy 89 right–of-way to the crossing of Willow Creek at Point C.
- Point C to D: Beginning at Point C the sewer main will leave Hwy 89 right-of-way and extend northeastward 17,100 lf (paralleling the path of the existing trunk main) to the Airport WRF.
- In addition to the lift station, force and gravity sewer mains, this CIP would also include the addition of the secondary Pump Station, odor control and decommissioning of the Sundog WRF and the optional conversion of the existing oxidation ditch and clarifiers to equalization contingent on their condition.

Total cost this CIP are estimated at $17.4 million.

5.4.7 CIP #6 – Reverse Flow of Sundog Effluent Main & Installation of New Sundog Effluent Tank

With the completion of CIP#5 it will be necessary to reverse the flow through the Sundog effluent mains to continue delivery to the Prescott Lakes effluent pump station. CIP#2 converted the existing Airport water tank and booster station to an effluent storage and delivery facility capable of delivering 2000 gpm to an elevation higher than the existing Sundog effluent ponds. CIP#6 would include the installation of a new 1 million gallon tank adjacent to the existing effluent ponds and Prescott Lakes Parkway. This tank would serve several purposes:

- It would keep the Class A+ effluent from the new Airport WRF Expansion from degrading due to sun exposure.
- It would maintain its volume of stored effluent since it won’t be as susceptible to evaporation as the existing ponds are.
- It would allow the City of Prescott to reclaim the land currently used by the effluent ponds for future uses or possible sale.
- It would provide a buffer of effluent volume available to Prescott Lakes & Antelope Hills Golf Courses, and the new users identified in SECTION 4.
- It would maintain a constant pressure at the Prescott Lakes Effluent Pump Station. It should be noted that CIP#6 does not include consideration of the existing Sundog effluent pipe condition or potential rehabilitation. The estimated cost of this CIP is $1.25 million, see Table B-3 in Appendix B.

5.4.8 Summary of Capital Improvement Projects for Centralization

The following tables summarize the CIP’s necessary, preliminary cost estimates of the CIP’s, and the timeframe for their completion to the Roadmap to Centralization Table 5-1 contains a total cost summary for both Scenarios based on the preliminary cost estimates shown in Table B-3 in Appendix B. These costs assume that each CIP is done in the order shown.

Table 5-1 CIP Preliminary Cost Estimates

CIP Projects/Capital Costs ($M)	Scenario 1	Scenario 2
CIP#1: New Zone 12 Water Tank	Completed	Completed
CIP#2: Airport Tank & Booster Station Conversion	Completed	Completed
CIP#3A: Sundog Equalization Basin and Lift Station	$5.3	$2.7
Sundog WWTP Trunkmain Upgrades	$7.0	$3.2
CIP#3B: VA Lift Station and Forcemain	$0	$8.1
CIP#4: Airport WRF Expansion Phase 2	$15.0	$15.0
CIP#5: Sundog Flow Diversion for Centralization*	$22.8	$17.4

CIP#6: Reverse Flow of Sundog Effluent Main and Installation of Sundog Effluent Tank	$1.25	$1.25
Total Cost of CIP's=	**$51.35**	**$47.65**

*$13.0 previously planned CIP funds

Table 5-2 CIP Priority Table is a chart that was originally shown to City Council on Jan. 24, 2012 and has been modified to include Scenario 2. The chart identifies the CIP priority and what project(s) will commit the City to the centralization concept. Per this chart, full commitment to centralization would not be required until CIP#5. CIP#3 is not required at this time but would greatly improve the operation of the Sundog WTP especially after large rainfall events. CIP#3 will also improve the performance of the Airport WRF. CIP#4 would be necessary for centralization or future population growth. CIP#5 and CIP#6 would be built as a result of the City committing to the centralization concept.

Table 5-2 CIP Priority Table

CIP Projects	Will it commit City to Centralization?
CIP#1: New Zone 12 Water Tank	No
CIP#2: Airport Tank & Booster Station Conversion	No
CIP#3A: Sundog Equalization Basin and Lift Station	No
CIp#3B: VA Lift Station	No
CIP#4: Airport WRF Expansion Phase 2	No
CIP#5: Sundog Flow Diversion for Centralization	Yes
CIP#6: Reverse Flow of Sundog Effluent Main	Yes

Table 5-3 is a slide shown to City Council on Jan. 24, 2012. This graph represents the preliminary time frames for each CIP along with the anticipated duration. The estimated durations shown include the engineering, bid, construction, and final approval stages of each CIP.

Table 5-3 CIP Preliminary Schedule

CIP - Scenario 1	2014	2015	2016	2017	2018	2019	2020	2021
CIP#1: New Zone 12 Water Tank *	Completed							
CIP#2: Airport Tank & Booster Station Conversion *								
CIP#3: Sundog Equalization Basin and Lift Station		1.3	2	2				
Sundog WWTP Trunkmain Upgrades		2	2.5	2.5				
CIP#4: Airport WRF Expansion Phase 2					3	6	6	
CIP#5: Sundog Flow Diversion for Centralization					4	9.4	9.4	
CIP#6: Reverse Flow of Sundog Effluent Main						0.35	0.9	
Scenario 1 - CIP Cost Breakdown, Per Year ($51.35 M)	*	3.3	4.5	4.5	7	15.75	16.3	
CIP - Scenario 2	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
CIP#1: New Zone 12 Water Tank *	Completed							
CIP#2: Airport Tank & Booster Station Conversion *								
CIP#3B: VA Lift Station and Forcemain		1.1	3.5	3.5				
Sundog WWTP Trunkmain Upgrades		1	1	1.2				
CIP#3A: Sundog Equalization Basin and Pump Station					0.7	1	1	
CIP#4: Airport WRF Expansion Phase 2					3	6	6	
CIP#5: Sundog Flow Diversion for Centralization						1	8.2	8.2
CIP#6: Reverse Flow of Sundog Effluent Main							.25	1
Scenario 2 - CIP Cost Breakdown Per Year ($47.65 M)	*	2.1	4.5	4.7	3.7	8	15.45	9.2

*Note: CIP#1 & CIP#2 are not included in the Cost Breakdown since they are completed.

Figure 5-1 CIP#1 New Zone 12 Water Tank

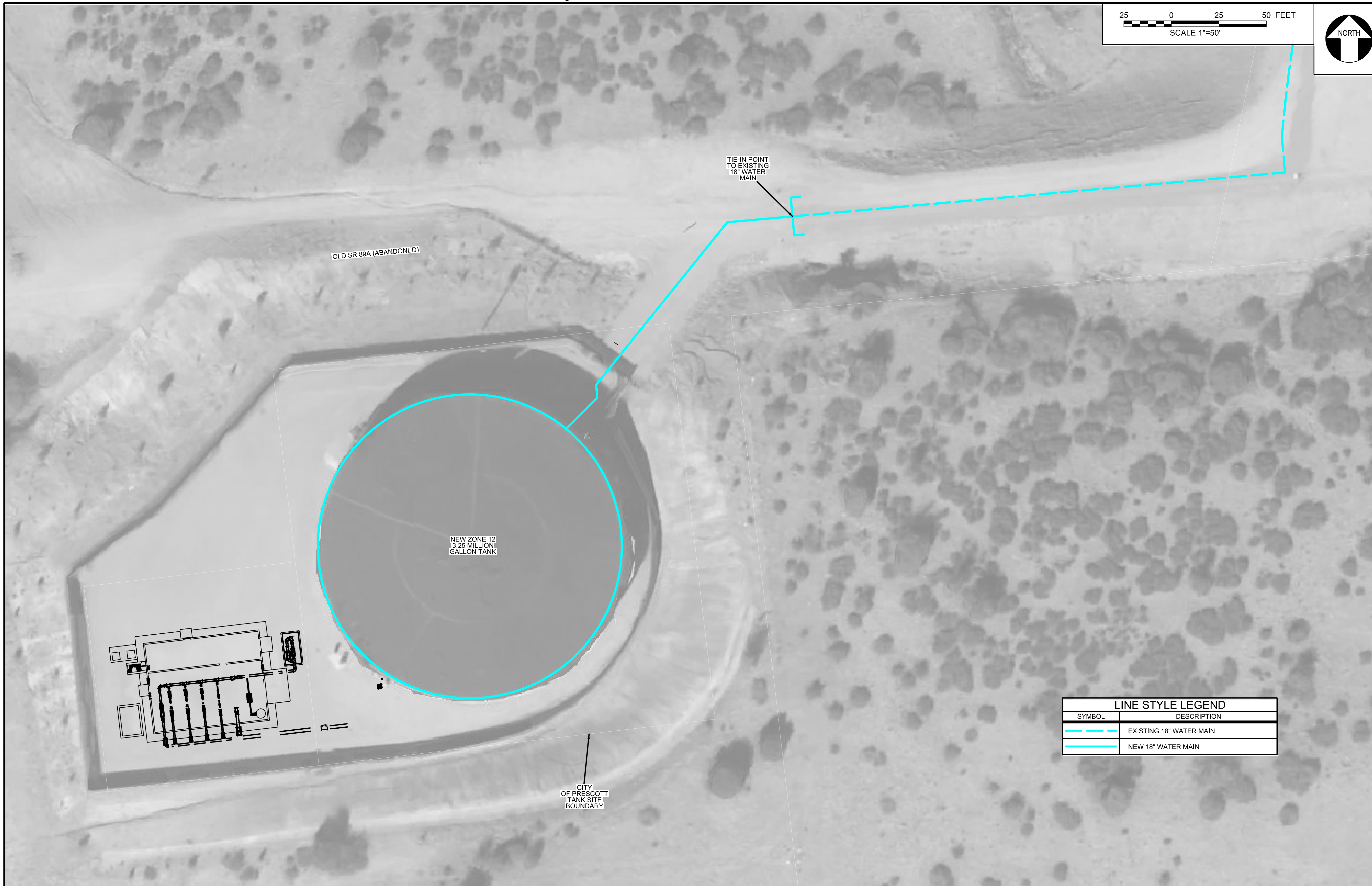


Figure 5-2 CIP#2 Airport Water Tank & Booster Station Conversion

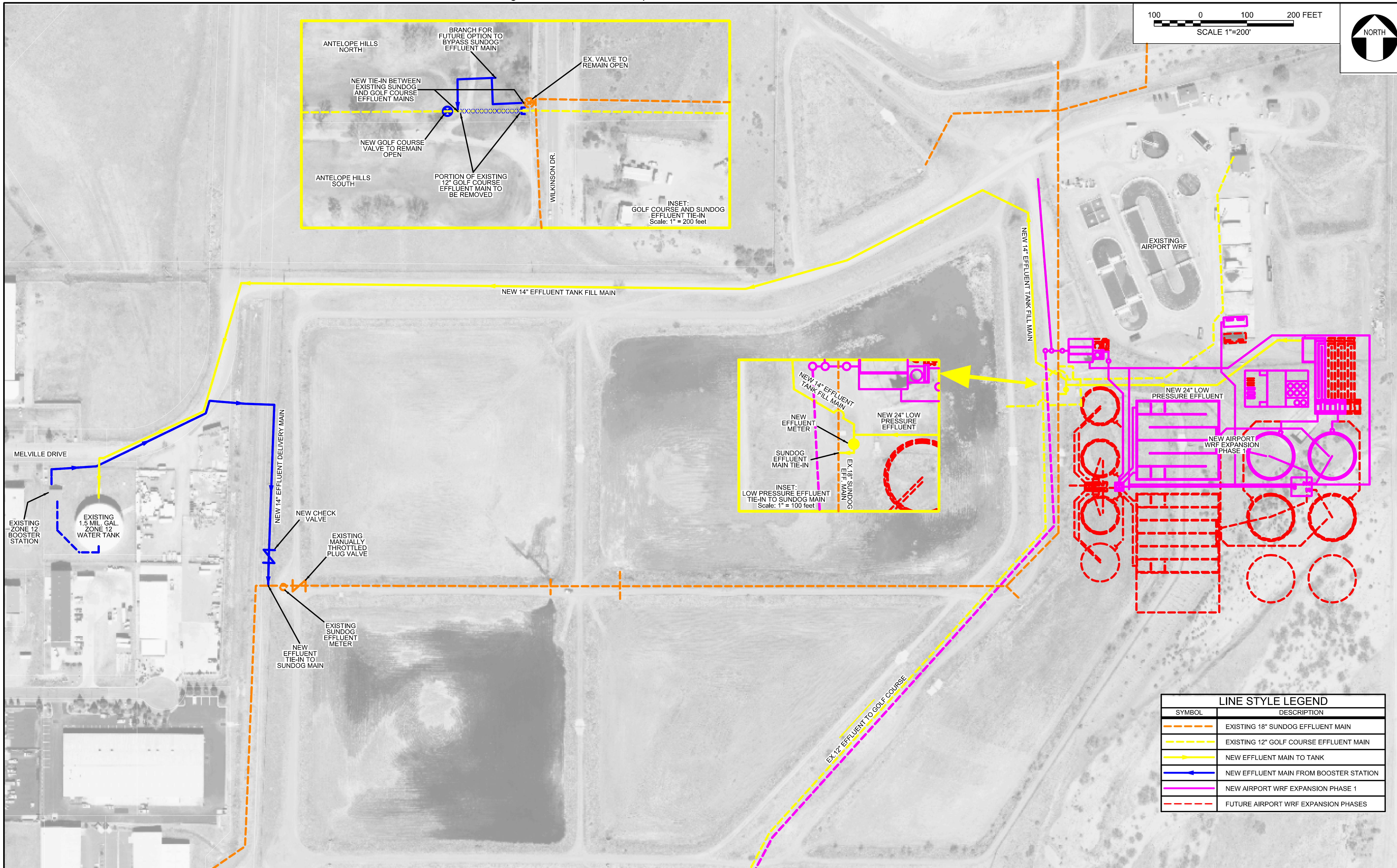


Figure 5-3A CIP#3 Sundog Equalization Basin and Lift Station - Scenario 1

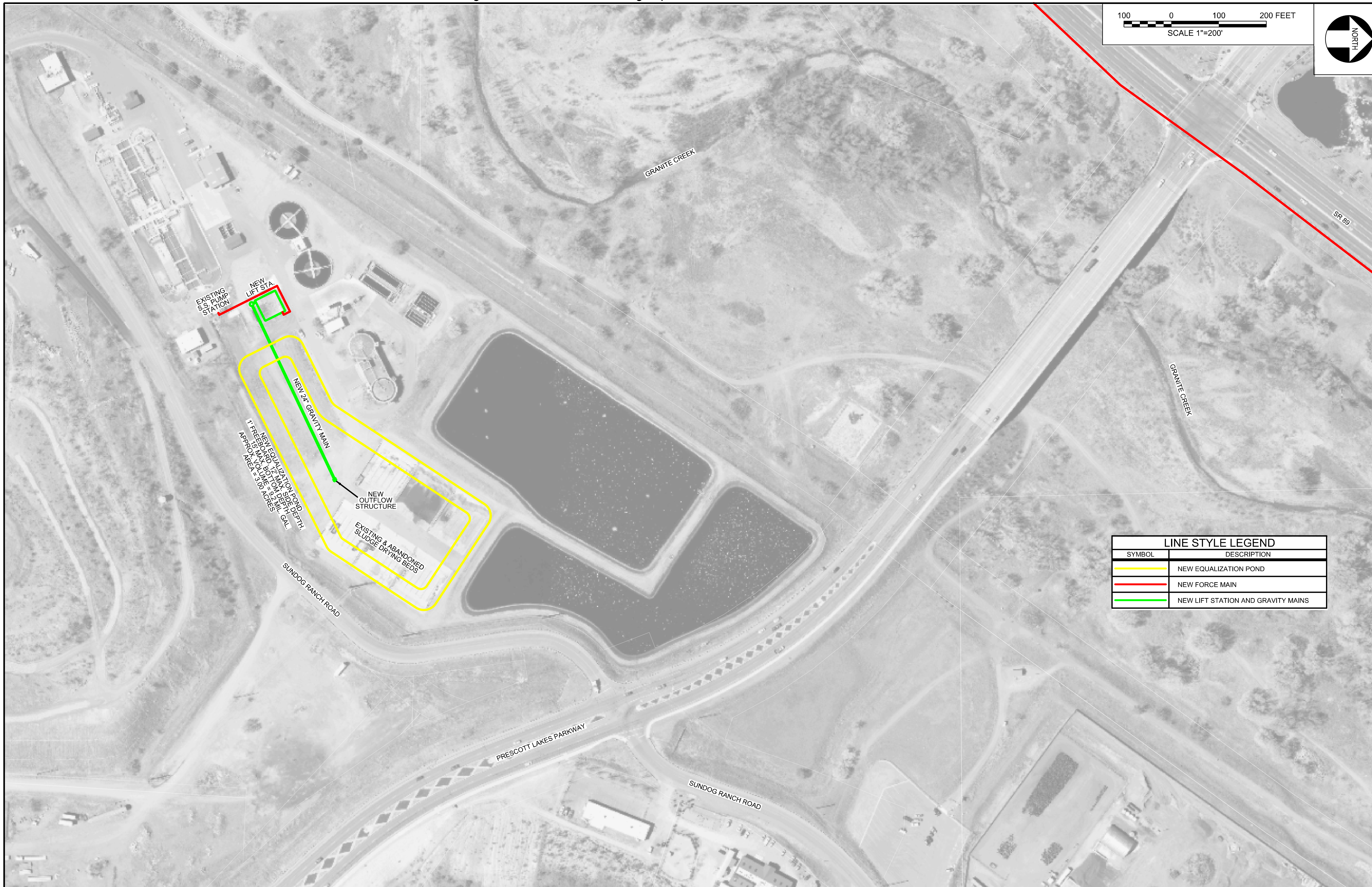


Figure 5-3B CIP#3b VA Lift Station and Force Main - Scenario 2

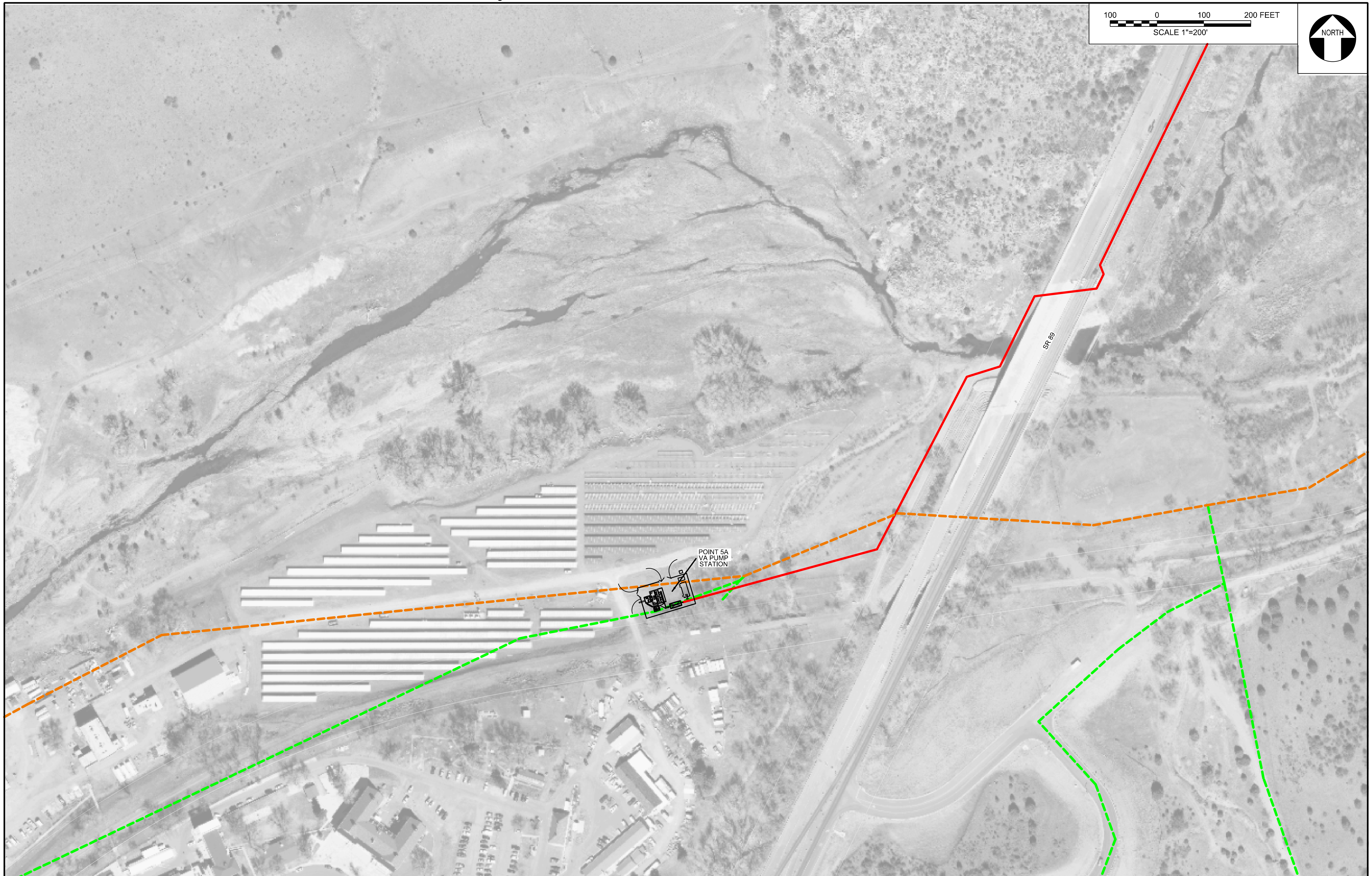


Figure 5-3C
CIP#3b VA Lift Station

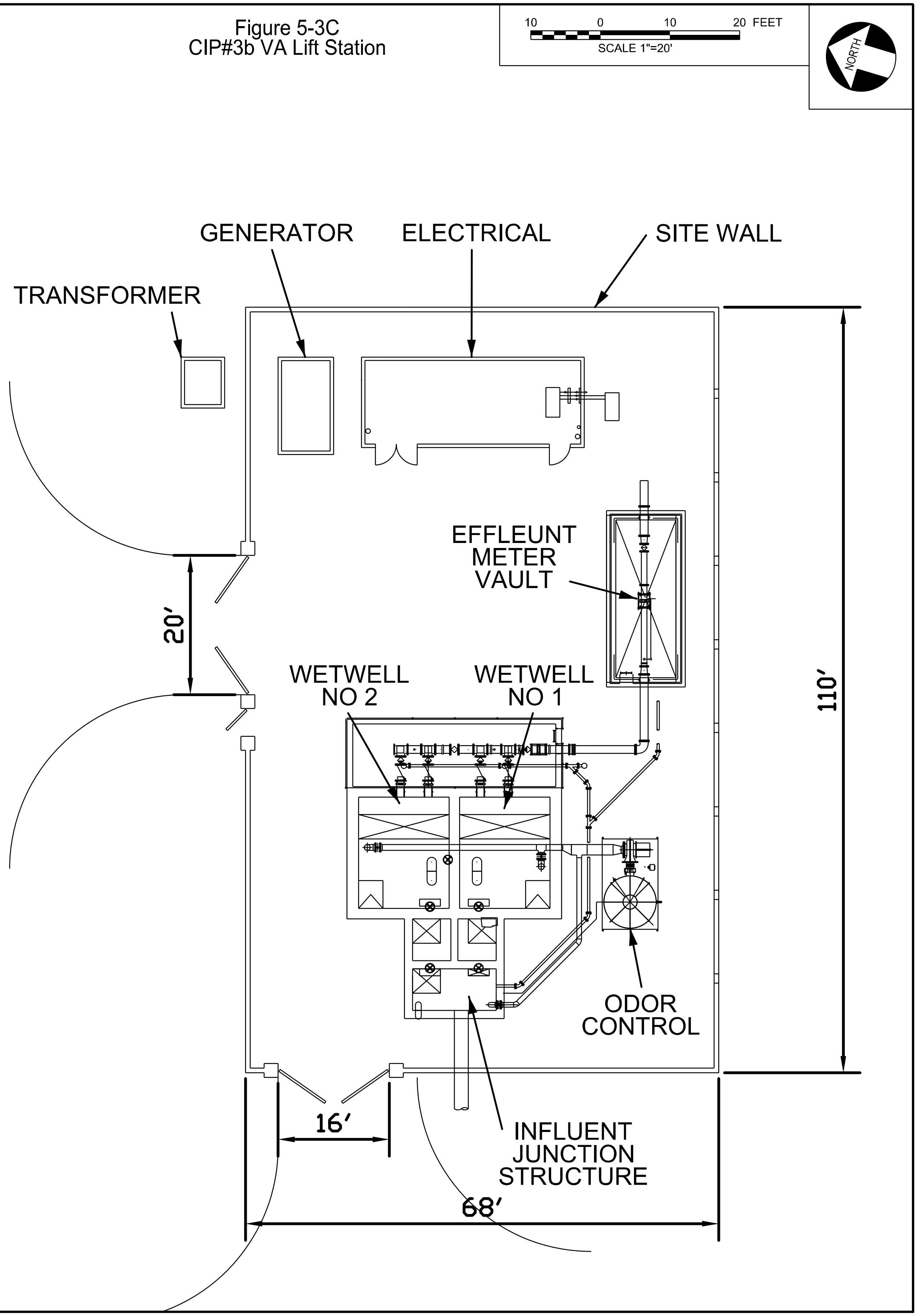


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Figure 5-4 CIP#4 Airport WRF Expansion Phase 2

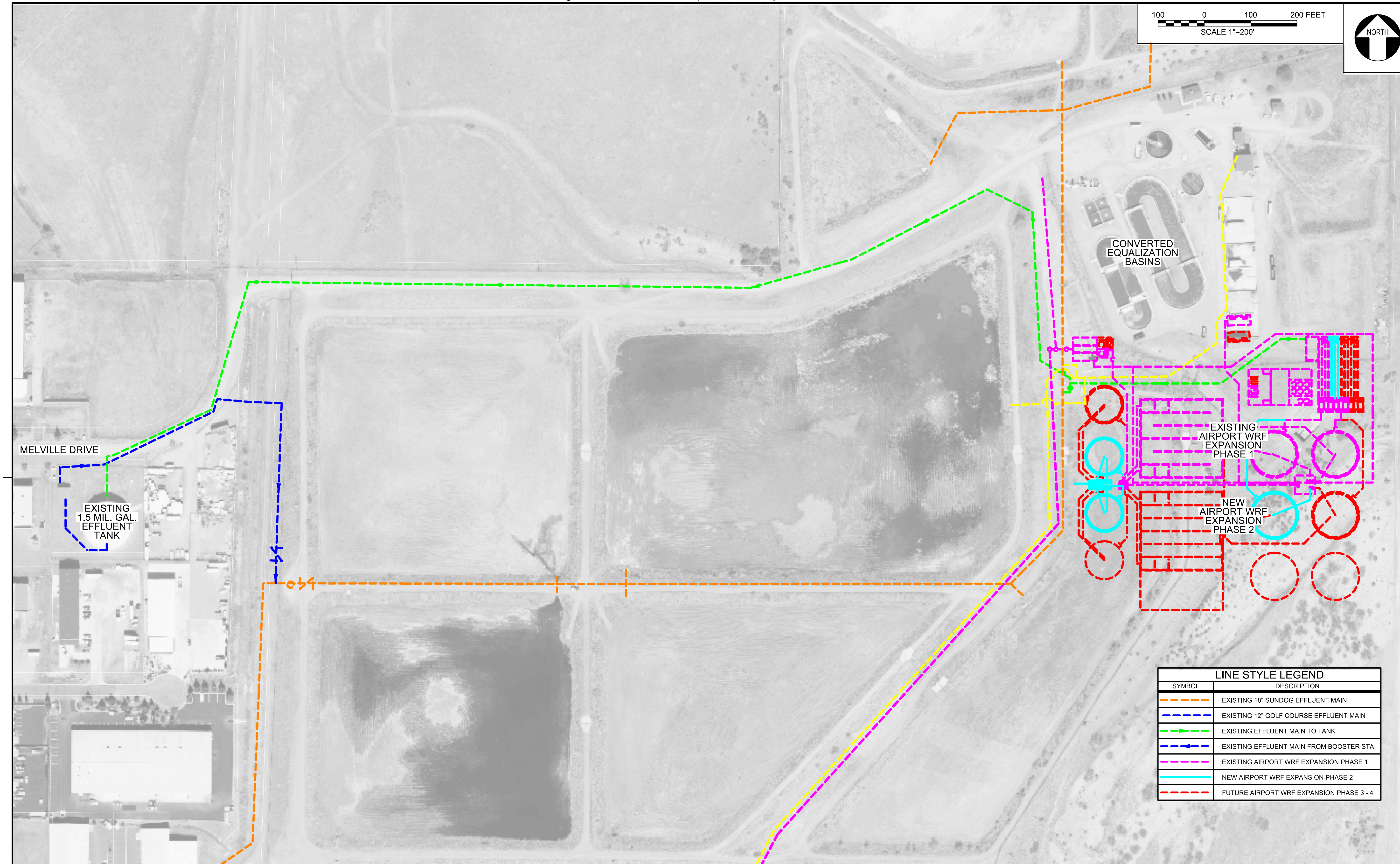
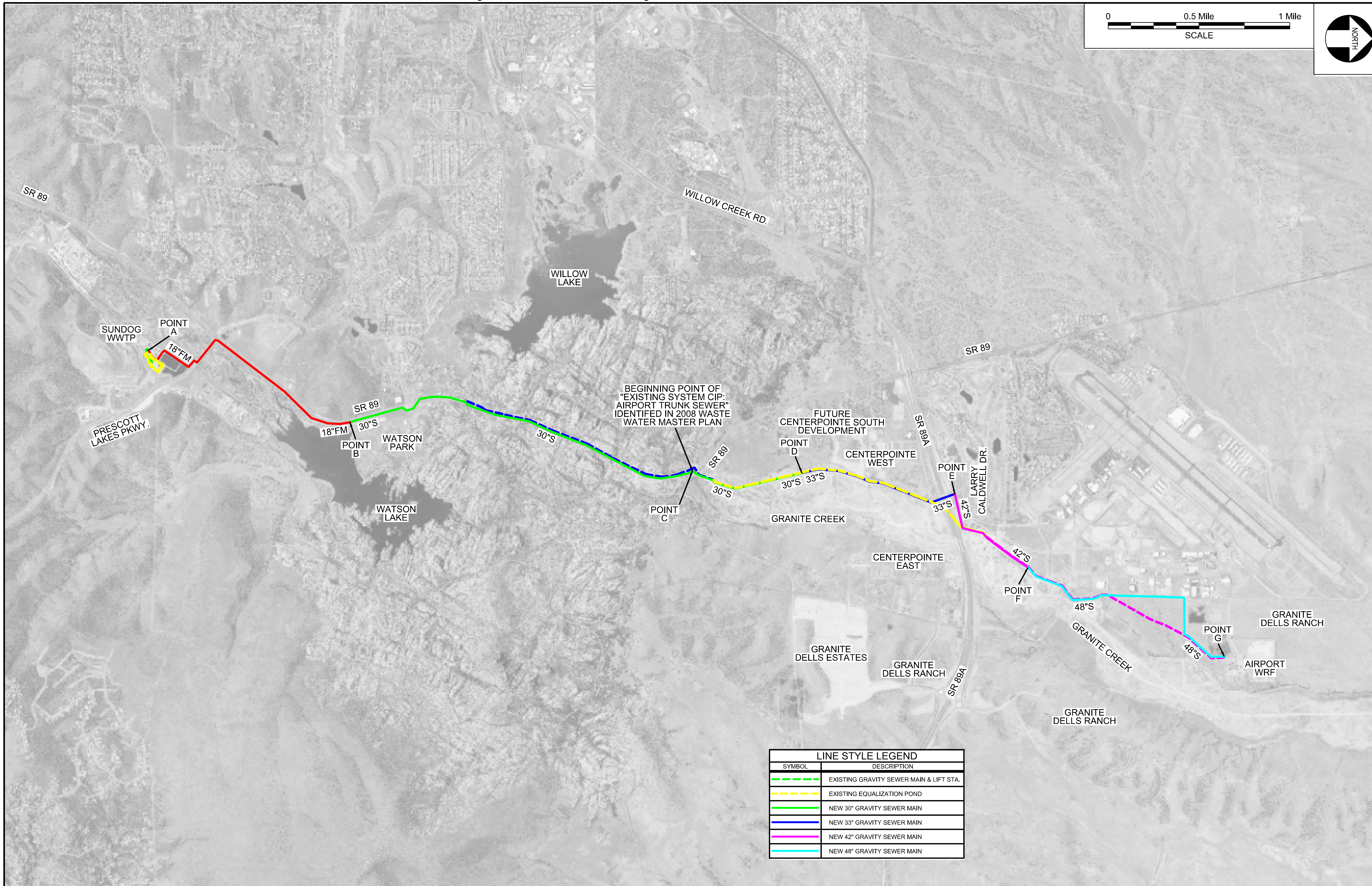


Figure 5-5A CIP#5 Sundog Flow Diversion for Centralization - Scenario 1



LINE STYLE LEGEND	
SYMBOL	DESCRIPTION
(green dashed)	EXISTING GRAVITY SEWER MAIN & LIFT STA.
(yellow dashed)	EXISTING EQUALIZATION POND
(green)	NEW 30" GRAVITY SEWER MAIN
(blue)	NEW 33" GRAVITY SEWER MAIN
(magenta)	NEW 42" GRAVITY SEWER MAIN
(cyan)	NEW 48" GRAVITY SEWER MAIN

City of Prescott, AZ
ROADMAP TO WRF CENTRALIZATION
Phase 1: CIP11-009

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Figure 5-5B CIP#5B Sundog Flow Diversion for Centralization - Scenario 2

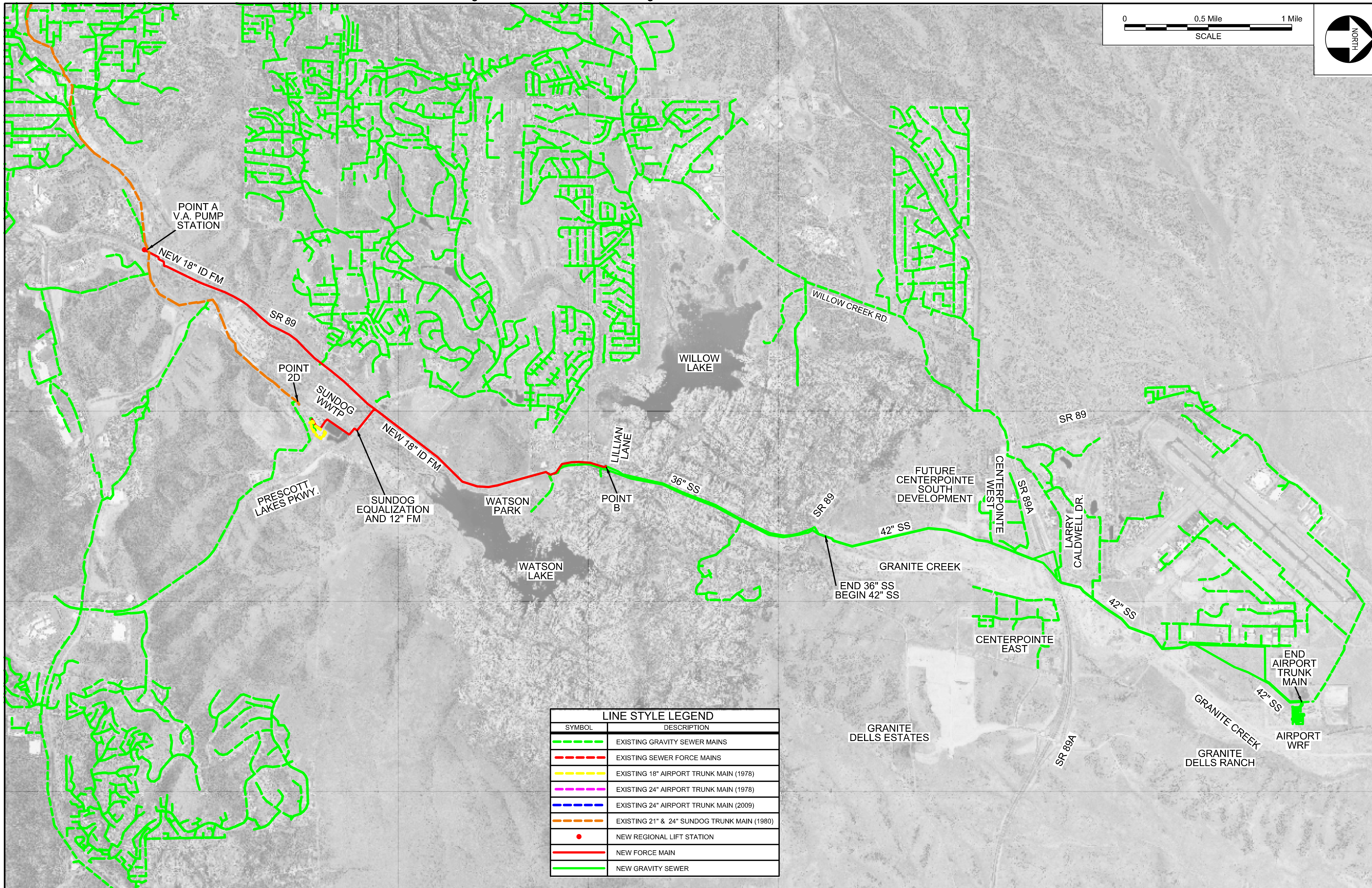
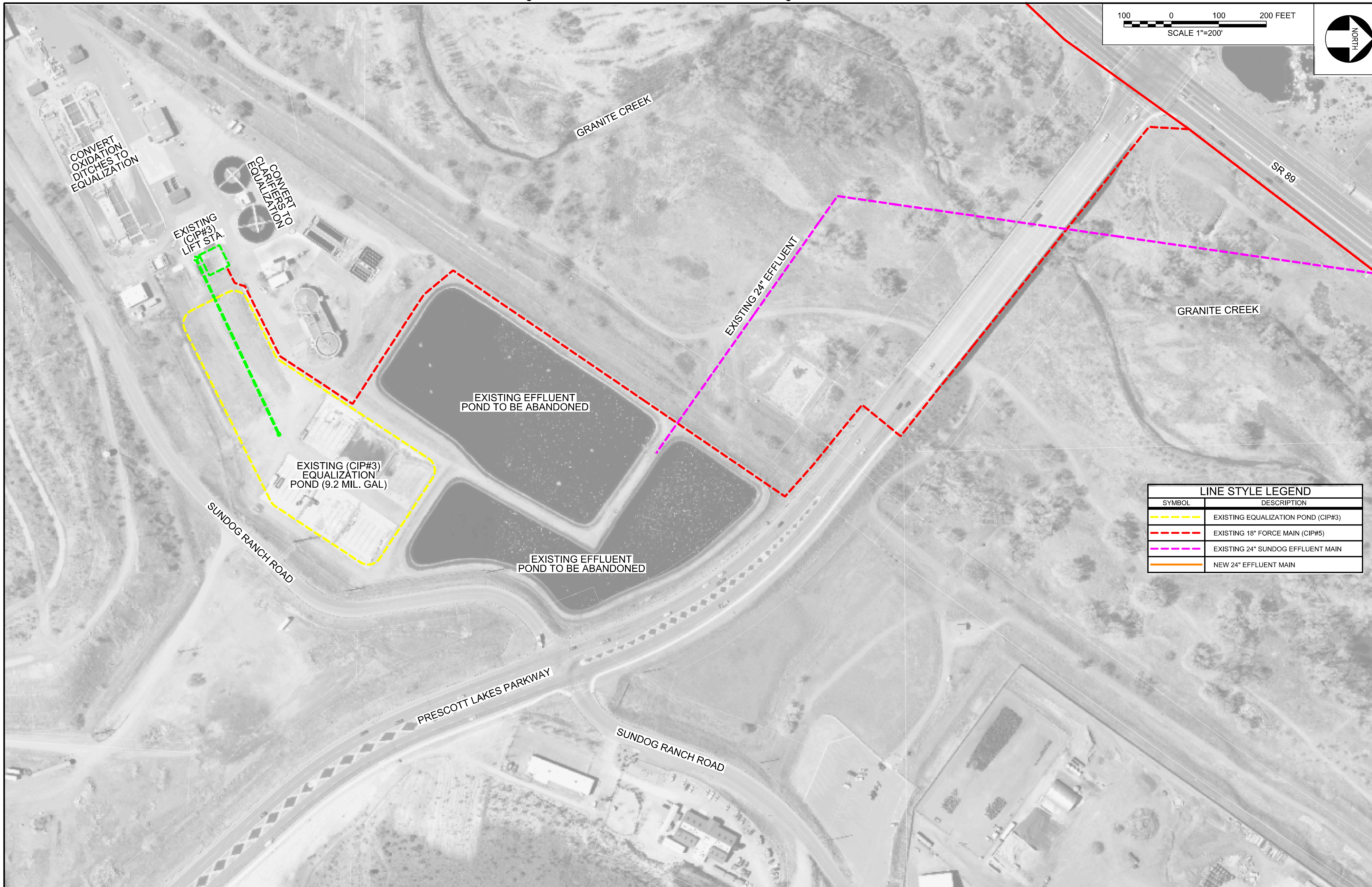


Figure 5-6 CIP#6 Reverse Flow of Sundog Effluent Main



SECTION 6. Conclusion Summary

6.1 Sundog WWTP Modifications

The Sundog WWTP will be partially decommissioned and flows diverted to the Airport WRF. This will require the abandonment of the existing process units and the addition of the following facilities as shown in Table 6-1.

Table 6-1 Additional Facilities - Scenarios 1 and 2

Scenario 1	Scenario 2
▪ Upsizing the Sundog WWTP influent sewer trunk main	▪ Primary Lift Station (Hwy 89 and Hwy 69) with Odor Control
▪ Lift station	▪ Forcemain serving the primary lift station
▪ Screening	▪ Secondary Pump Station (Sundog WWTP site)
▪ Grit removal	▪ Primary Equalization
▪ Primary Equalization	▪ Secondary Equalization
▪ Secondary Equalization	▪ Odor Control for the Primary Equalization Facilities and Pump Station
▪ Odor Control for the Headworks Facilities, Lift Station and Primary Equalization	▪ Upsizing the receiving sewer line
▪ Upsizing the receiving sewer line	

6.2 Collection System

Scenario 1 - The best alternative route for the new trunk sewer main, facilitating centralization, would include a force main along Hwy 89 to a point where Hwy 89 crossed Willow Creek, and from this point a new trunk main paralleling the existing Airport Trunk Main. Flows in the force main would vary based on inflow into the Sundog lift station with a maximum flow of 8.4 mgd. Flows in the gravity sewer system would be the sum of the 8.4 mgd maximum flow from the lift station plus the flows identified in the 2013 Wastewater Master Plan.

Scenario 2 - This option proposes intercepting the Sundog Trunk Main with a new regional lift station at a point just west of Hwy 89 on Veteran Administration (VA) land. This lift station would then convey flow through a new 18-inch force main to a tie-in point, with a new 30-inch gravity sewer main at the intersection of Lillian Lane and Hwy 89,which will then convey flow to the existing 24-inch Hobas trunk sewer main.

Wastewater flow diversion alternatives were analyzed to determine their validity. Options 1, 3 & 4 were not feasible due to the lack of capacity in existing gravity sewer mains. Upgrades to the existing sewer mains are feasible for Options 1, 3, & 4, but are already included in the proposed CIP#5, see Section 5.4.6. Option 2 is a feasible project but the costs associated with it, $11.6 million, would be better spent on CIP#3 (See Section 5.4.4) which provides the entire peak flow mitigation on-site at the Sundog WWTP at a cost of $5.3 million, a savings of $6.3 million. The diversion alternatives analyzed are considered temporary measures until the Sundog WWTP is replaced, or the CIP's necessary for centralization have been constructed. Therefore the entire peak mitigation, 8.8 mgd, was not included in any of the alternative analysis since CIP#3 in Section 5.4.4 details a project that will accomplish that purpose, but will not commit the City to centralization.

6.3 Effluent Water System

With the centralization scenario there will be the option to extend the existing City effluent system to new users. These users currently use 46.9 million gallons (144 acre-feet) per year, of City potable water for irrigation. These users are Embry-Riddle Aeronautical University, and the City facilities of Pioneer Park, Kuebler Field, Heritage Park, Willow Creek Park, and Watson Park. Total cost to extend effluent to these systems is $2.37 million. These same users could be serviced with Class A+ effluent after the Airport WRF Phase I and before centralization with an additional effluent bypass project that would cost $1.48 million. It should be noted that Watson Park can be served with A+ effluent without the extension of the system since its potential effluent service was incorporated into the design of the Prescott Lakes Effluent Pump Station, adjacent to the park. However, Watson Park can only be served after centralization has taken place or if the Sundog WWTP modifications detailed in 0 improve the Sundog effluent to Class A+ or better.

6.4 Centralized Concept Roadmap

There are a total of six CIP projects that will be necessary to achieve the centralization scenario with a cost ranging between $45.1 and $52 million, depending on the scenario selected. Of this total, $16.1 million is already budgeted in the City 5-year capital improvement program. . Figure 6-1A and Figure 6-1B is an overall project map showing the location of the proposed CIPs.

- CIP #1 and #2 were necessary for the Airport WRF Expansion Phase 1, and were completed in 2014.
- CIP #3 is will greatly help the Sundog WWTP and Airport WRF capacities issues during large wet weather events that typically occur during the monsoon season or after heavy snowfall. It is anticipated that this CIP will need to be in place by 2017 or 2020, depending on the scenario selected.
- CIP #4 and #5 implementation time frame will need to be re-evaluated on a yearly basis.
- CIP #5 would fully commit the City to centralization and City staff will need to closely monitor flows, capacities and process equipment at the Sundog WWTP to determine when these projects will be necessary.
- CIP #6 is the final step for centralization and would coincide closely with the time frame for CIP #4 and CIP #5.

Figure 6-1A Overall Capital Improvements Projects Location Map - Scenario 1

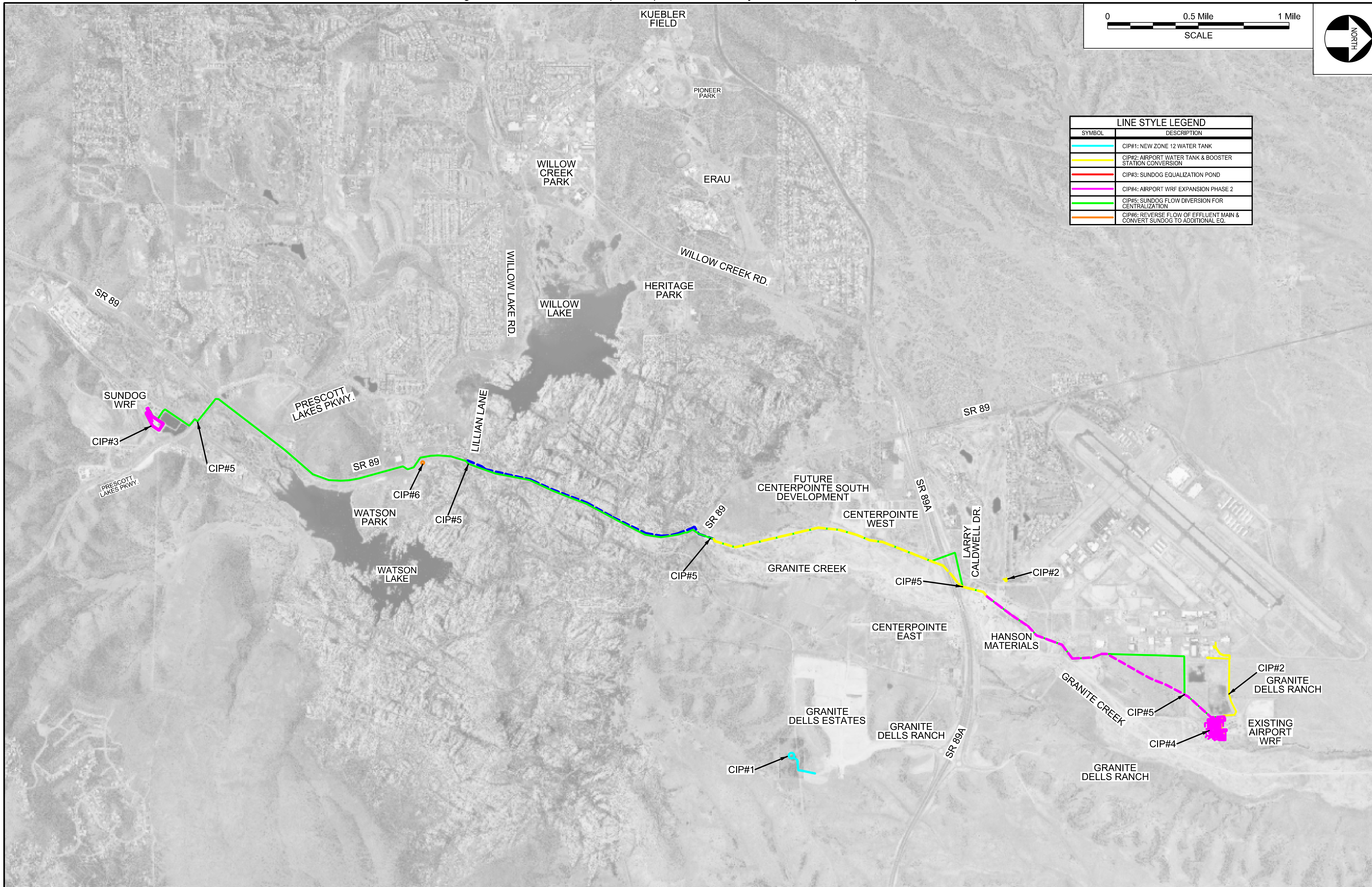


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Figure 6-1B Overall Capital Improvements Projects Location Map - Scenario 2