ATTACHMENT E

Environmental Noise Assessment

DRAFT

ENVIRONMENTAL NOISE ASSESSMENT
for the
Upper and Lower SLRWRF Recycled Water Conveyance System Project
City of Oceanside, California

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ACRONYMS AND ABBREVIATIONS

APN	Assessor's Parcel Number
City	City of Oceanside
CMU	concrete masonry unit
CNEL	community noise equivalent level
dB	decibel
dBA	A-weighted decibel
gpm	gallons per minute
hp	horsepower
L_{eq}	equivalent sound level
project	Oceanside Recycled Water Pumps
SLRWRF	San Luis Rey Water Reclamation Facility

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EXECUTIVE SUMMARY

The purpose of this technical report is to assess the potential noise impact from operation of recycle water pumps in the City of Oceanside (City) in California.

The purpose of this report is to evaluate the potential noise impacts associated with implementation of the Oceanside Recycled Water Pumps (project). Specifically, the focus of this assessments will be to ensure that operational noise levels do not exceed the City's noise ordinance standards. Construction and traffic noise impacts are not evaluated in this report because they have been addressed in previous documents.

In accordance with Mitigation Measure 3.12-1c, from the Final Program EIR for the North San Diego Water Reuse Coalition Regional Recycled Water Project (State Clearinghouse No. 2014081028), as modified by an addendum adopted by the City in February 2016 (City of Oceanside 2016), operational acoustical assessments for four pump station sites (assumes two pump stations co-located at the El Corozan site) are required to be completed prior to 60% design. This assessment by Dudek has been prepared in order to fulfill the requirements specified in Mitigation Measure 3.12-c, and to ensure that operational noise levels at the property line do not exceed the City's noise ordinance standards.

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1 INTRODUCTION

1.1 Purpose

The purpose of this report is to evaluate the potential noise impacts associated with implementation of the City Oceanside's Upper and Lower SLRWRF Recycled Water Conveyance System Project (project), specifically focusing on the operational noise from four proposed pump stations.

In accordance with Mitigation Measure 3.12-1c, from the Final Program EIR for the North San Diego Water Reuse Coalition Regional Recycled Water Project (State Clearinghouse No. 2014081028), as modified by an addendum adopted by the City in February 2016 (City of Oceanside 2016), Dudek has conducted operational acoustical assessments for the four proposed pump station sites (assumes two pump stations co-located at the El Corozan site). The purpose of the assessments is to ensure that operational noise levels at the property line do not exceed the City of Oceanside's noise ordinance standards.

1.2 Regional and Local Setting

The proposed project sites are located in the City of Oceanside (City). The following is a list of sites which are analyzed in this report for operational noise:

- Morro Heights Pump Station
- Fire Mountain Pump Station
- Mesa Pump Station
- Old Grove Pump Station

Figure 1, Project Location, shows the locations of these sites within the City. Regionally, the City is situated within the northeastern portion of San Diego County, about 46 miles north of downtown San Diego via Interstate 5.

1.3 Proposed Project Description and Background

The City is expanding the production and conveyance of recycled water to reduce dependence on imported water supplies, improve water supply reliability, and allow the City to meet its strategy of developing a diverse portfolio of water resources.

The City's 2015 Recycled Water Master Plan proposes expanding tertiary recycled water treatment capacity at the San Luis Rey Water Reclamation Facility (SLRWRF) from 0.7 million

gallons per day to 3.0 million gallons per day initially, and up to 6.0 million gallons per day in the future; the Plan also envisions creating two distribution systems, referred to as the Lower SLRWRF and Upper SLRWRF systems (City of Oceanside 2015).

Expansion of the City's recycled water (RW) system as defined by the 2015 Recycled Water Master Plan is included in the North San Diego Water Reuse Coalition Regional Recycled Water Project Final Program Environmental Impact Report (PEIR) adopted by the City (North San Diego Water Reuse Coalition 2015). The City also adopted an addendum to the PEIR to address minor technical changes, a Mitigation and Monitoring Reporting Program, and CEQA Findings of Fact and Statement of Overriding Considerations for its recycled water program.

The addendum to the PEIR addresses minor changes to the locations and sizes of proposed pipelines and facilities. The changes are the result of additional planning and preliminary design efforts undertaken by the City to maximize recycled water delivery, to minimize costs and impacts during construction and operation of the systems, and to meet the goal of bringing new customers online by 2021 (City of Oceanside 2016). The analyses that form the basis of the proposed pipelines and facilities are documented in two reports: *Planning Study for the Upper and Lower SLRWRF Recycled Water Conveyance System Planning Study* (May 2018) and *Draft Preliminary Design Report for the Upper and Lower SLRWRF Recycled Water Conveyance System* (July 2018).

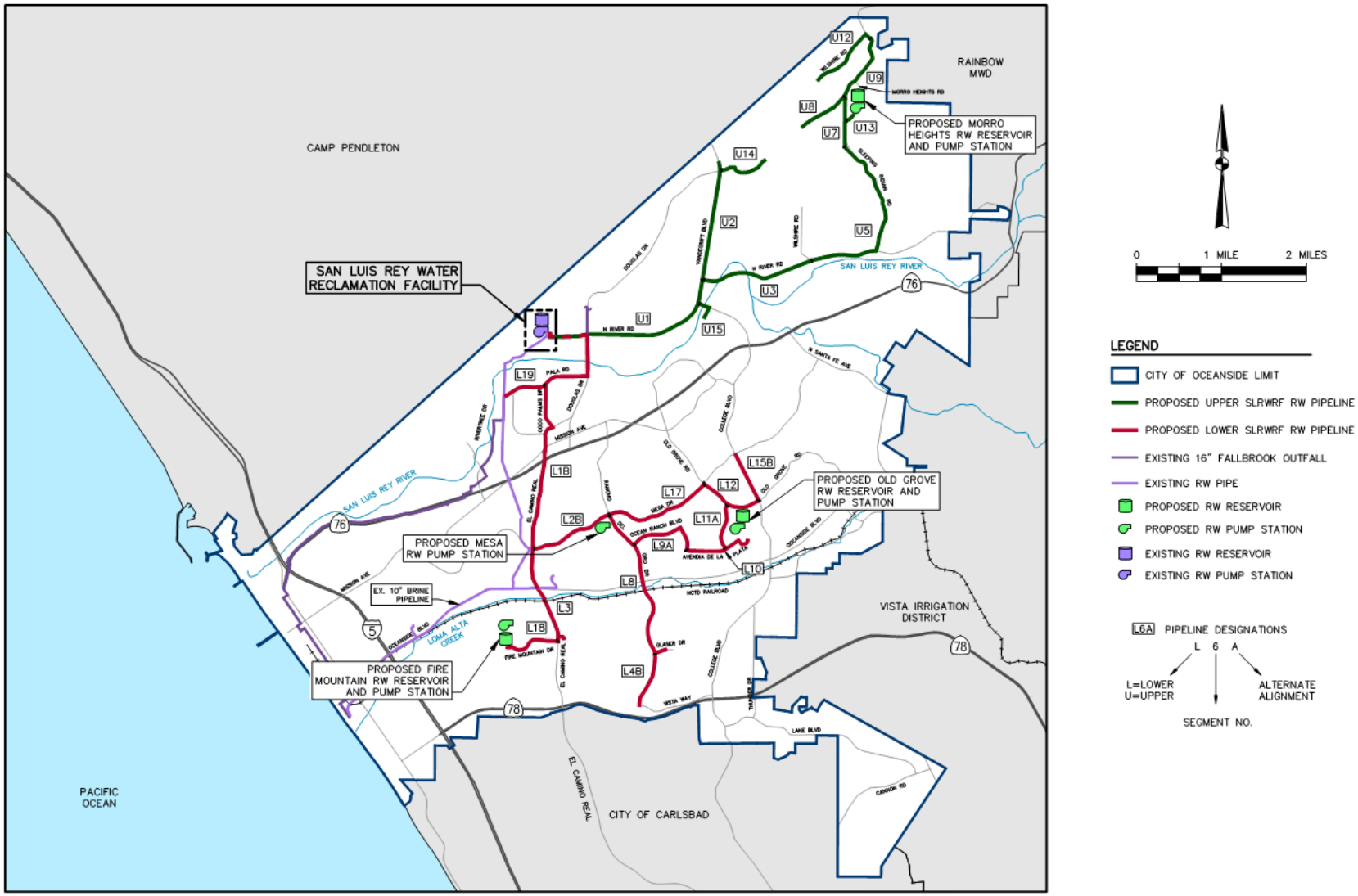

Figure 1. Project Location

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2 FUNDAMENTALS OF NOISE AND VIBRATION

The following is a brief discussion of fundamental noise concepts and basic terminology. Definitions can be found in Appendix A.

2.1 Sound, Noise, and Acoustics

Sound propagation is a process that consists of three components: the sound source, the sound path, and the sound receiver. All three components must be present for sound to propagate. Without a source to produce sound, there is no sound. Similarly, without a medium to transmit sound pressure waves, there is no sound transmitted. Finally, sound must reach a receiver; a hearing organ, sensor, or object must be present to perceive, register, or be affected by sound or noise. In most situations, there are many different sound sources, paths, and receptors. Acoustics is the field of science that deals with the production, propagation, reception, effects, and control of sound. Noise is defined as sound that is unpleasant, unexpected, or undesired.

2.2 Sound Pressure Levels and Decibels

Loudness of sound increases with increasing amplitude. Sound pressure amplitude is measured in units of micro-newton per square meter, also called a micropascal. One micropascal is approximately one-hundred billionth (0.00000000001) of normal atmospheric pressure. The pressure of a very loud sound may be 200 million micropascals, or 10 million times the pressure of the weakest audible sound. Because expressing sound levels in terms of micropascal would be very cumbersome, sound pressure level in logarithmic units is used instead to describe the ratio of actual sound pressure to a reference pressure squared. These units are called Bels. To provide a finer resolution, a Bel is subdivided into 10 decibels (dB).

2.3 A-Weighted Sound Level

Sound pressure level alone is not a reliable indicator of loudness. The frequency, or pitch, of a sound also has a substantial effect on how humans will respond. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness, or human response, is determined by the characteristics of the human ear.

Human hearing is limited not only in the range of audible frequencies, but also in the way it perceives the sound in that range. In general, the healthy human ear is most sensitive to sounds between 1,000 and 5,000 hertz, and it perceives a sound within that range as more intense than a sound of higher or lower frequency with the same magnitude. To approximate the frequency response of the human ear, a series of sound level adjustments is usually

applied to the sound measured by a sound level meter. The adjustments (referred to as a weighting network) are frequency-dependent.

The A-scale weighting network approximates the frequency response of the average young ear when listening to ordinary sounds. When people make judgments about the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Noise levels are typically reported in terms of A-weighted sound levels. All sound levels discussed in this report are A-weighted decibels (dBA), unless otherwise stated. Examples of typical noise levels for common indoor and outdoor activities are depicted in Table 1.

Table 1
Typical Sound Levels in the Environment and Industry

Common Outdoor Activities	Noise Level (dB)	Common Indoor Activities
—	110	Rock band
Jet fly over at 300 meters (1,000 feet)	100	—
Gas lawn mower at 1 meter (3 feet)	90	—
Diesel truck at 15 meters (50 feet), at 80 kilometers per hour (50 miles per hour)	80	Food blender at 1 meter (3 feet); garbage disposal at 1 meter (3 feet)
Noisy urban area, daytime; gas lawn mower at 30 meters (100 feet)	70	Vacuum cleaner at 3 meters (10 feet)
Commercial area; heavy traffic at 90 meters (300 feet)	60	Normal speech at 1 meter (3 feet)
Quite urban, daytime	50	Large business office; dishwasher next room
Quite urban, nighttime	40	Theater; large conference room (background)
Quite suburban, nighttime	30	Library
Quite rural, nighttime	20	Bedroom at night; concert hall (background)
—	10	Broadcast/recording studio
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Source: Caltrans 2013

2.4 Human Response to Changes in Noise Levels

It is generally accepted that the average healthy ear can barely perceive a noise level change of 3 dB (Caltrans 2013) in an outdoor environment. A change of 5 dB is readily perceptible to an average person, while a change of 10 dB is perceived as twice or half as loud. A doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (i.e., for traffic noise, doubling the average daily numbers of traffic on a road) would result in a barely perceptible change in sound level.

2.5 Noise Descriptors

Additional units of measure have been developed to evaluate the long-term characteristics of sound. The equivalent sound level (L_{eq}) is also referred to as the time-average sound level. It is the equivalent steady-state sound level that in a stated period of time would contain the same acoustical energy as the time-varying sound level during the same time period. The 1-hour A-weighted equivalent sound level, $L_{eq}(h)$, is the energy average of the A-weighted sound levels occurring during a 1-hour period.

People are generally more sensitive and annoyed by noise occurring during the evening and nighttime hours. Thus, another noise descriptor used in community noise assessments—the community noise equivalent level (CNEL)—was introduced. The CNEL scale represents a time-weighted, 24-hour average noise level based on the A-weighted sound level. The CNEL accounts for the increased noise sensitivity during the evening hours (7 p.m. to 10 p.m.) and nighttime hours (10 p.m. to 7 a.m.) by adding 5 dB and 10 dB, respectively, to the average sound levels occurring during the evening and nighttime hours.

2.6 Sound Propagation

Sound propagation (i.e., the passage of sound from a noise source to a receiver) is influenced by geometric spreading, ground absorption, atmospheric effects, and shielding by natural and/or built features. Sound levels attenuate (or diminish) at a rate of approximately 6 dB per doubling of distance from an outdoor point source due to the geometric spreading of the sound waves. For a line source, such as vehicle traffic along a roadway, sound levels attenuate at a rate of approximately 3 dB per doubling of distance. Atmospheric conditions such as humidity, temperature, and wind gradients can also temporarily alter sound levels. In general, the greater the distance the receiver is from the source, the greater the potential for variation in sound levels due to atmospheric effects. Additional sound attenuation can result from built features such as intervening walls and buildings, and by natural features such as hills and dense woods.

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3 REGULATORY SETTING

City of Oceanside Noise Level Compatibility Standards

The Noise Element of the City's General Plan (City of Oceanside 1974) establishes target maximum noise levels in the City. The Noise Element provides the following limitations on construction noise:

1. It should be unlawful for any person within any residential zone of 500 feet there from to operate any pile driver, power shovel, pneumatic, power hoist, or other construction equipment between 8:00 p.m. and 7:00 a.m. generating an ambient noise levels of 50 dBA at any property line unless an emergency exists.
2. It should be unlawful for any person to operate any construction equipment at a level in excess of 85 dBA at 100 feet from the source.
3. It should be unlawful for any person to engage in construction activities between 6:00 p.m. and 7:00 a.m. when such activities exceed the ambient noise level by 5 dBA. A special permit may be granted by the Director of Public Works if extenuating circumstances exist.

In addition, the Noise Element addresses nuisance noise and states that it should be unlawful for any person to make or continue any loud, unnecessary noise that causes annoyance to any reasonable person of normal sensitivity (City of Oceanside 1974).

City of Oceanside Noise Ordinance

Chapter 38 of the Oceanside Municipal Code governs operational noise and contains the maximum 1-hour average sound levels for various land uses for operational noise (Table 2). The Noise Ordinance sets an allowed level for single-family and medium-density residential areas to 50 dBA L_{eq} from 7:00 a.m. to 9:59 p.m., and 45 dBA L_{eq} from 10:00 p.m. to 6:59 a.m. High-density residential areas are limited to 55 dBA L_{eq} from 7:00 a.m. to 9:59 p.m. and 50 dBA L_{eq} from 10:00 p.m. to 6:59 a.m.

Table 2
City of Oceanside Exterior Noise Standards

Zone	Applicable Limit (decibels)*	Time Period
Residential Estate, Single-Family	50	7:00 a.m. to 9:59 p.m.
Residential, Medium Density	45	10:00 p.m. to 6:59 a.m.
Residential, Agricultural, Open Space		

Table 2
City of Oceanside Exterior Noise Standards

Zone	Applicable Limit (decibels)*	Time Period
High Density, Residential Tourist	55 50	7:00 a.m. to 9:59 p.m. 10:00 p.m. to 6:59 a.m.
Commercial	65 60	7:00 a.m. to 9:59 p.m. 10:00 p.m. to 6:59 a.m.
Industrial	70 65	7:00 a.m. to 9:59 p.m. 10:00 p.m. to 6:59 a.m.
Downtown	65 55	7:00 a.m. to 9:59 p.m. 10:00 p.m. to 6:59 a.m.

Source: Oceanside Municipal Code, Section 38.12
* 1-hour average sound level.

Section 38.16 of the Oceanside Municipal Code prohibits nuisance noise as recommended in the General Plan Noise Element. It is unlawful for any person to make, continue, or cause to be made or continued, within the limits of the City of Oceanside, any disturbing, excessive, or offensive noise that causes discomfort or annoyance to reasonable persons of normal sensitivity.

4 SIGNIFICANCE CRITERIA

This analysis has been conducted in order to satisfy compliance with Mitigation Measure 3.12-1c: Noise and Vibration Minimization during Operation from the Final Program EIR for the North San Diego Water Reuse Coalition Regional Recycled Water Project (State Clearinghouse No. 2014081028), as modified by an addendum adopted by the City in February 2016 (City of Oceanside 2016.

MM 3.12-1c: Noise and Vibration Minimization during Operation. The City of Oceanside shall design the proposed pumps and mechanic, noise-generating equipment at treatment plants to ensure that operational noise levels at property line do not exceed the affected jurisdictions' noise ordinance standards. The City of Oceanside shall implement the following noise minimization measures to the extent they are feasible and necessary to meet the City of Oceanside's noise ordinance standards:

- Noise-generating facilities shall be located as far away from sensitive receptors as practical.
- Shielding and other specified measures as deemed appropriate and effective by the design engineer would be incorporated into the design to comply with performance standards.
- Project equipment shall be outfitted and maintained with noise-reduction devices such as equipment closures, fan silencers, mufflers, acoustical louvers, vents, noise barriers, and acoustical panels to minimize operational noise.
- The orientation of any necessary acoustical exists shall always be facing away from nearby sensitive receptors.
- Berms or noise walls shall be incorporated, where appropriate, to absorb and/or redirect noise away from nearby sensitive receptors. Contractors shall test each pump and its drive system and any other mechanical devices that generate vibration after installation to confirm that the equipment has been properly installed, aligned and connected, is free of defects and excessive noise and vibration. If the testing indicates noncompliance with affected jurisdictions' noise ordinances, additional measures (e.g., installation of sound proofing material inside the wall; installation of sound dampening materials around the valves) shall be taken until compliance can be demonstrated.

Residential zones are noise sensitive and are the main concern and focus relative to noise generating characteristics of the project. As established in the Oceanside Noise Ordinance, the applicable limit for noise affecting a residential zone during daytime is 50 dBA and 45 dBA during nighttime. A

significant impact could therefore occur if proposed uses were to generate noise levels in excess of 50 dBA during the day or 45 dBA overnight within or at residential zone boundaries.

All of the pump stations except the Old Grove Pump Station are located within or immediately adjacent to a residential zone district, and therefore the 50 dBA during the day or 45 dBA overnight limits apply to these pump stations. The Old Grove Pump Station is adjacent to a the fire station, which is deemed a light industrial zone. Thus, the industrial zone limits of 70 dBA daytime and 65 dBA nighttime are the thresholds of significance for the Old Grove Pump Station site.

5 METHODOLOGY

In order to predict operational noise levels that would be associated with the proposed pump stations, sound level measurements were conducted to quantify sound levels for an operating pump facility similar to the proposed pump facilities.

Site plans for each of the proposed pump station sites are included in the analysis section, below. The site plans and regional aerial images were used to determine distances from the pump shelters to the nearest property lines of noise-sensitive receptors. The distances measured from the site plans and maps were used to calculate attenuation (reduction) in operational noise levels for the pumps, from the location of pumps to the noise-sensitive receiver property lines. Additional attenuation of pump operations noise would also be provided by the pump shelter, which is expected to be constructed of concrete cinder blocks.

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6 EXISTING SITE MEASUREMENTS

Sound levels in the vicinity of an operating pump station were measured to establish a representative operational noise level for this source, to be used in our analysis (see Figure 2). The pump station selected for sound level measurements is of similar design to the proposed pump stations, but is located at the City's Morro Hills No. 1 and No.2 potable water reservoirs and pump station site. The measurements were taken at different locations around the pump shelter to assess the variations in noise levels that occur with respect to characteristics of each façade (i.e., umber and size of wall openings, vent louvers, etc.) of the shelter. Details and results of those measurements are discussed in the following section.

6.1 Operating Pump Noise Measurement Results

General noise measurements were conducted at a representative pump site to determine typical operating noise levels for a pump station facility. The measurements were conducted using a Rion NL-52 sound level meter. This sound level meter meets the current American National Standards Institute standard for a Type 1 Precision sound level meter. The sound level meter was positioned on a tripod at a height of approximately 5 feet above the ground and fitted with a windscreen during measurements. The instrument was calibrated prior to and following the measurement set.

The short-term noise measurements were conducted on Tuesday, June 12, 2018. The measured noise levels are presented in Table 3.

Table 3
Measured Noise Levels (dBA)

Site	Description/Noise Sources Observed	Date/Time	L_{eq}*	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}
ST1 front entrance	Pump	02:07 PM to 02:08 PM	69.2	70	68.3	68.6	69.2	70
ST2 west side	Pump	02:10 PM to 02:10 PM	54.7	55.6	53.8	53.8	54.8	55.4
ST3 north side	Pump	02:12 PM to 02:13 PM	45.5	47.9	44.2	44.7	45.4	46.8
ST4 east side	Pump	02:15 PM to 02:16 PM	53.1	53.6	52.4	52.6	53.2	53.6
ST5 inside building	Pump	02:20 PM to 02:20 PM	79.8	80.4	79.2	79.4	79.9	80.2

* Equivalent Continuous Sound Level (Time-Average Sound Level)

The highest recorded sound level occurred at ST1, located at least 3 feet from the Morro Hills No. 1 reservoir structure and facing the pump shelter entrance. The entrance includes a large roll-up door, which does not attenuate sound as well as the cinder block wall construction. Even though the roll-up door was closed during the measurement, the recorded sound level was 69 dBA L_{eq} (approximately 11 dBA lower than noise levels within the interior of the structure).

The measurement location with the most shielding from the structure is the north side (ST3) measurement; this façade of the structure contains no openings. At this location,the measured sound level was 46 dBA L_{eq} (approximately 24 dBA lower than noise levels within the interior of the structure).. Sound levels recorded at the remaining two sides of the structure, which contain ventilation louvers or personnel access door, were 53 and 55 dBA L_{eq} (approximately 25 to 27 dBA lower than noise levels within the interior of the structure)..

SOURCE: SANGIS 2014

DUDEK

0 50 100 Feet

FIGURE 2

Noise Measurement Locations for Existing Pump Station

Environmental Noise Assement

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7 PUMP OPERATIONAL IMPACT ANALYSIS

This section reviews and analyzes project sites, layouts, and pump noise data. The number of active pumps and the orientation of the pump shelters are considered.

Results of calculations and modeling are presented for the nearest receivers. Those results are compared with the City's noise regulations.

Table 4 provides a summary of the pumps planned for the different sites. All pumps have rated speeds of approximately 3,600 rpm.

Table 4
Pump Station Data Summary

Pump Station	No. of Duty Pumps	No. of Standby Pumps	Total Maximum Flow (gpm)	Total Design Head (feet)	Pump Model	Max Individual Pump Flow (gpm)	Individual Pump Horsepower
Morro Heights Main Pumps	7	1	3,500	440	Grundfos CR 125-4-2	525	75
Morro Heights Jockey Pumps	4	0	600	440	Grundfos CR 32-8-2	150	30
Fire Mountain	3	1	1,150	160	Grundfos CR 90-2-2	425	25
Mesa	3	1	1,500	167	Grundfos CR 90-2	550	40
Old Grove	5	1	2,200	173	Grundfos CR 90-2-1	475	30

gpm = gallons per minute

The number of pumps was used to adjust the source sound levels to account for multiple pumps operating at the same time.

A sound level data sheet for the motors of the pumps can be found in Appendix B.

7.1 Morro Heights Pump Station

Figure 3 shows the Morro Heights project site location.

Figure 3. Morro Heights Recycled Water Reservoir and Pump Station Location

A 3.0-million-gallon reservoir would be located on a vacant 3-acre City-owned parcel (APN 122-170-42) (see Figure 3). The reservoir would be pre-stressed concrete construction with an approximate diameter of 144 feet and a height of 30 feet. It is proposed to be buried to a depth of 15 feet to 28 feet, leaving the upper 2 feet to 15 feet of the structure above ground. Construction of the reservoir would require temporary excavations up to 32 feet deep. The reservoir would be accessed by a driveway off Morro Heights Road and would have a crushed-rock perimeter road and parking pad for operations and maintenance. The pump station would be accessed by a separate asphalt concrete paved driveway off Morro Heights Road and surrounded by a crushed rock area for parking and operations. The facility would also include appurtenant buried recycled water and drainage piping and vaults. The site would be enclosed by a perimeter fence with exterior lighting at the entrance gate. See Figure 4 for a preliminary site plan.

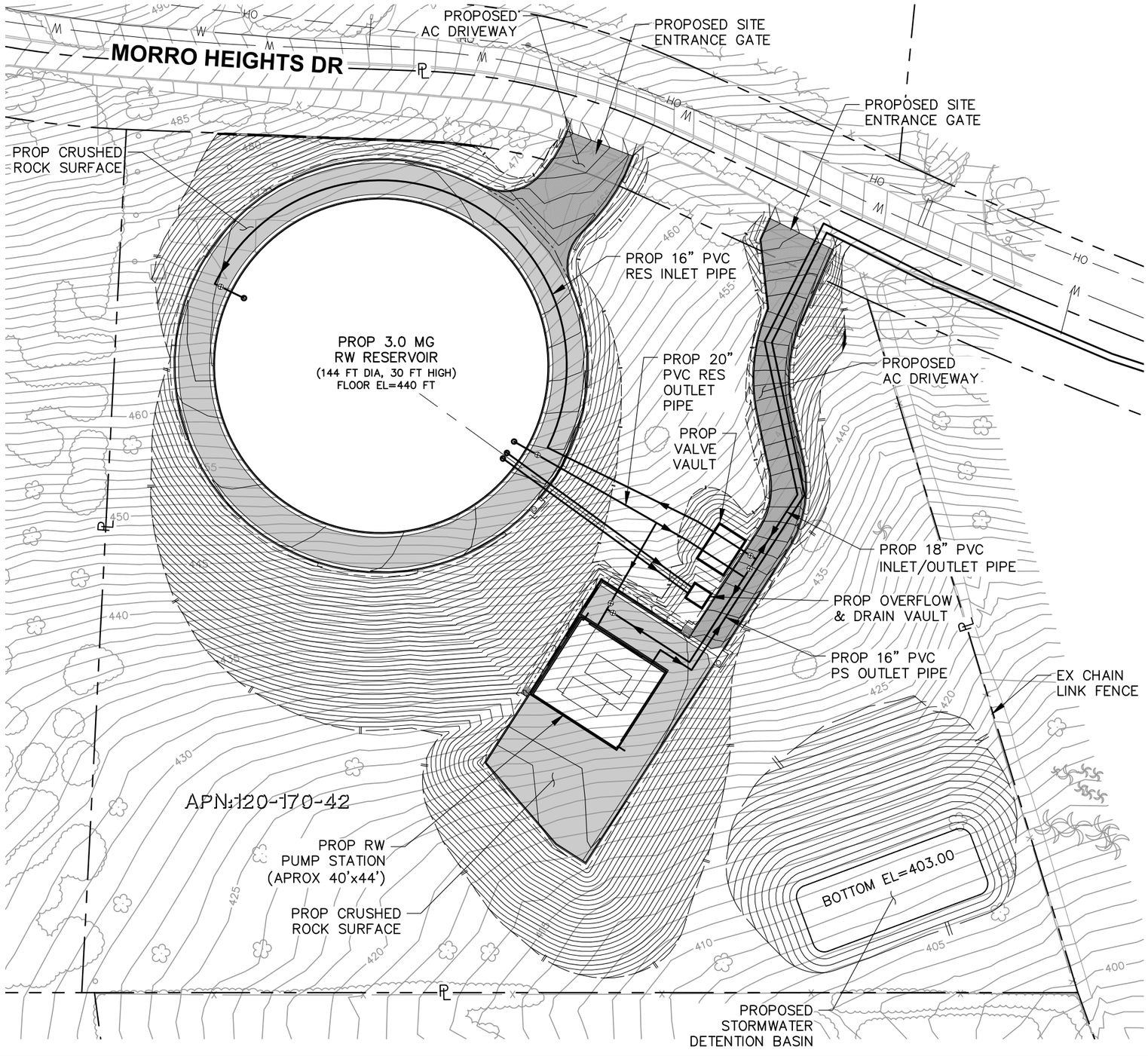

FIGURE 4

Morro Heights Site Plan

Environmental Noise Assement

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A 3,000-gallons per minute (gpm) pump station (expandable up to 3,750-gpm) would be located on the same parcel as the Morro Heights Reservoir. The facility would include of up to seven 100-horse power (hp) and four 30-hp inline multi-stage vertical pump units The facility would be housed in a grade-level, single story, concrete masonry unit (CMU) block building with approximate dimensions of 44 feet by 40 feet, and a height of 14 feet. See Figure 5 for a preliminary building plan.

7.1.1 Morro Heights Sound Level Analysis

Commercial and agricultural operations are located on the parcel to the west of the project site, while residences exist on the property to the south, west, and north of the project site; both agriculture and residential uses are considered noise-sensitive. The distance from the pump installation to the residential property line is about 90 feet; the distance to the commercial/agricultural property line from the pump location is over 180 feet. Noise limitations for agricultural and residential land use zones are similar, and therefore noise levels were calculated for the closer residential property line. Noise levels would be less at the other property lines, due to greater distance separation.

Based on the data sheet provided in Appendix B, the specified pump has a sound power level of 78 dBA. The data sheet also provides sound pressure levels at various distances from the pump equipment. At 3 feet, the sound pressure level of the specified pump is 68 dBA Leq. At 5 feet, the reported sound pressure level for the pump is 64 dBA Leq.

At the Morro Heights site, seven (7) 100-hp pumps and four (4) 30-hp pumps are expected to be operating simultaneously. Other pumps shown in the figure would be on standby. When there are multiple incoherent sound sources, the sound levels from each source must be added together to determine the total sound level. Sound levels are expressed in decibels, which are a logarithmic function. The formula to add one dB level to another is:

$$LA + LB = 10\log (10^{(LA/10)} + 10^{(LB/10)}) \text{ [dB]}$$

Using the above equation, eleven of the pumps would correspond to a 10.4 dB increase over the sound pressure level for a single pump. Thus the eleven total pumps all operating simultaneously would produce a sound level of approximately 78.4 dBA at 3 feet. The distance from the pumps to the closest noise-sensitive land use property line is approximately 90 feet.

Sound attenuation due to distance, for a point source (which is applicable to the group of pumps) is calculated with the equation:

$$SPL1 = SPL2 - B - 20 \log(D1/D2)$$

Where: SPL1 is the calculated sound pressure level (in dB) at specified distance [D1]

SPL2 is a known (measured) sound pressure level at a known distance [D2]

D1 is distance from source to measured sound pressure level

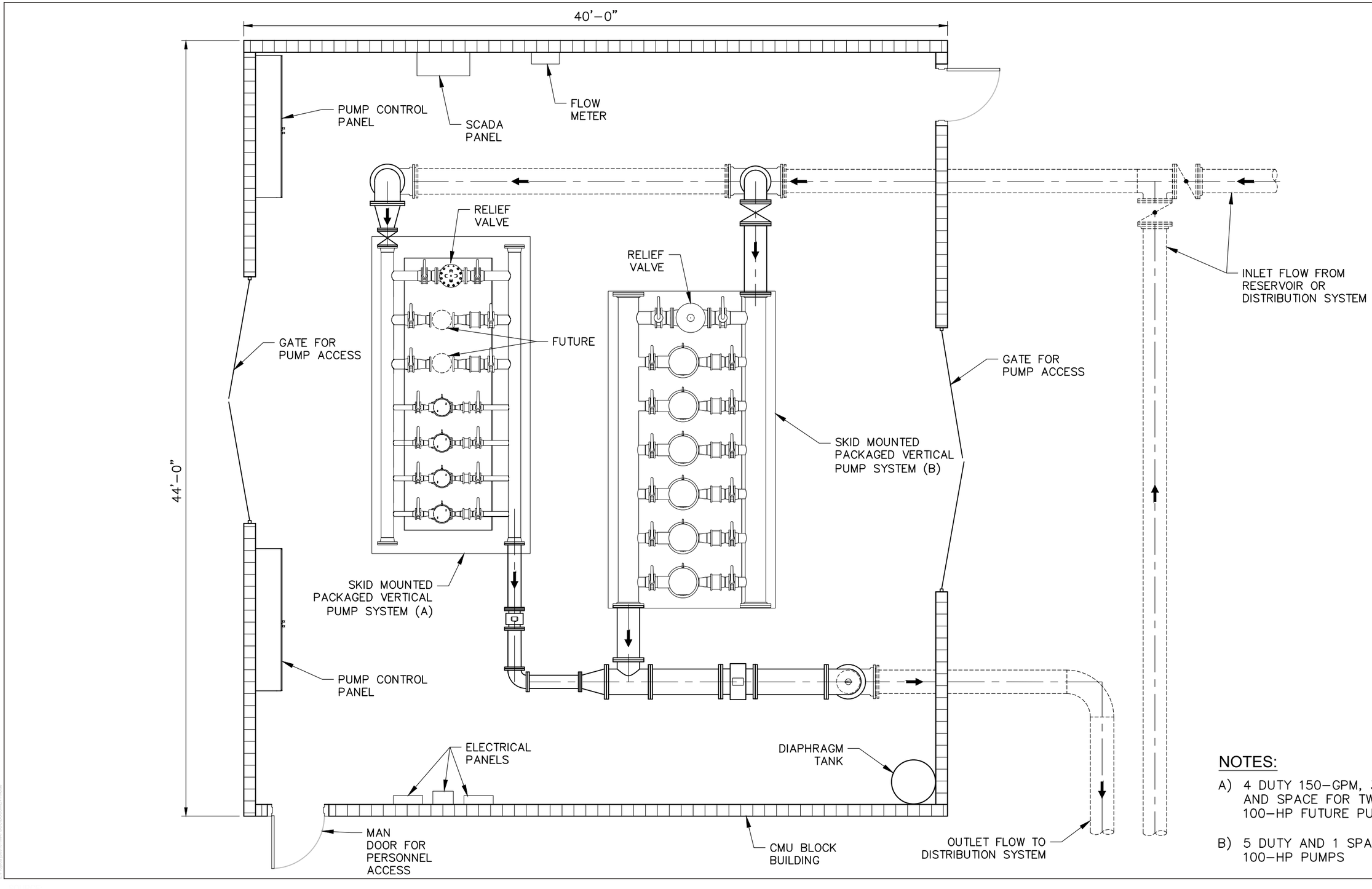
D2 is distance from source to location of calculated sound pressure level

B is attenuation (reduction) in noise level due to the barrier or enclosure (dB)

The property lines for noise-sensitive land uses closest to the proposed pump installation location are south of the shelter where the greatest attenuation (shielding) would be realized, due to the presence of solid wall elements (no openings). The center of the pumps are assumed to be mounted at approximately 3-4 feet above the ground. Since the structure has 14 foot walls, we conservatively estimate that 8 dB of attenuation would be provided by the structure in the direction of the closest noise-sensitive land use property line (this is conservative, as the sound level measurements at the Morro Hills 1&2 Pump Station evidence a minimum 11 dBA sound attenuation for all facades of the structure).

Using the above equation, the combined sound level from the simultaneous operation of all 11 pumps is calculated to be approximately 40 dBA L_{eq} at the closest residential property line. These uses fall within the most restrictive applicable limit of 50 dBA between 7:00 a.m. and 9:59 p.m., and 45 dBA between 10:00 p.m. and 6:59 a.m. Calculated pump noise levels at the nearest property line would be 40 dBA L_{eq}, compared to the most restrictive threshold for nighttime residential land uses of 45 dBA $L_{eq.}$ Thus, the noise level calculated for the pump station would comply with the local City noise ordinance, resulting in a less than significant impact on the surrounding land uses. No mitigation is required.

Additionally, for the existing agricultural and residential land uses in other directions around the project site that are located at greater distances, the pump noise levels would expected to be lower.



NOTES:

A) 4 DUTY 150–GPM, 30–HP PUMPS AND SPACE FOR TWO 525–GPM, 100–HP FUTURE PUMPS

B) 5 DUTY AND 1 SPARE 525–GPM 100–HP PUMPS

FIGURE 5

Morro Heights Pump Station Layout

Environmental Noise Assement

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7.2 Fire Mountain Pump Station

Figure 6 shows the Fire Mountain project site location.

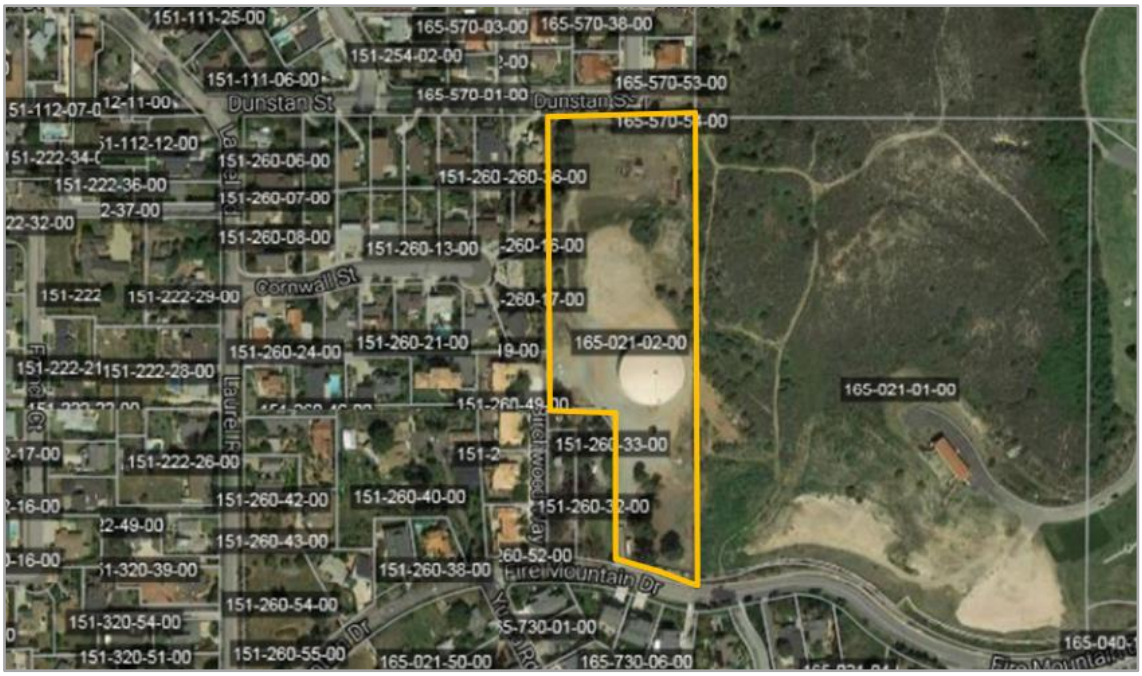

Figure 6. Fire Mountain Recycled Water Reservoir and Pump Station Location

A 2.2-million-gallon reservoir would be located on a portion of 5.7-acre City-owned parcel (APN 165-021-02) (see Figure 6) at the Fire Mountain site. The reservoir would be prestressed concrete or steel construction with an approximate diameter of 124 feet and a height of 30 feet. It is proposed to be buried to a depth of approximately 2 feet, leaving the upper 28 feet of the structure above ground. Construction of the reservoir would require temporary excavations up to 5 feet deep. The proposed reservoir would be located adjacent to the City's 3-million-gallon prestressed concrete potable Fire Mountain Reservoir, and would have a crushed-rock perimeter road and parking pad for operations and maintenance. It would be accessed by the existing site drive off of Fire Mountain Drive. The proposed reservoir would include appurtenant recycled water and drainage buried piping and vaults. All new facilities would be located within the existing perimeter fence. The reservoir would include a roof-mounted light. See Figure 7 for a preliminary site plan.

A 1,150-gpm pump station would be located on same parcel as Fire Mountain Reservoir (APN 165-021-02). This facility would include three 25-hp inline multi-stage vertical pump units in duty service. The facility would be housed in a grade-level, single-story CMU block building with approximate dimensions of 27 feet by 18 feet and a height of 14 feet.. See Figure 8 for a preliminary building plan.

7.2.1 Fire Mountain Sound Level Analysis

The property lines for noise-sensitive land uses closest to the proposed pump installation location are in the directions where the shelter will provide the greatest attenuation (shielding), due to the presence of solid wall elements (no openings). The center of the pumps are assumed to be mounted at approximately 3-4 feet above the ground. Since the structure has 14 foot walls, we conservatively estimate that 8 dB of attenuation would be provided by the structure in the direction of the closest noise-sensitive land use property line (this is conservative, as the sound level measurements at the Morro Hills 1&2 Pump Station evidence a minimum 11 dBA sound attenuation for all facades of the structure).

Based on the data sheet provided in Appendix B, the specified pump has a sound power level of 78 dBA. The data sheet also provides sound pressure levels at various distances from the pump equipment. At 3 feet, the sound pressure level of the specified pump is 68 dBA Leq. At 5 feet, the reported sound pressure level for the pump is 64 dBA Leq.

At the Fire Mountain site, three 25 hp pumps are expected to be operating simultaneously. Other pumps shown in the figure would be on standby. When there are multiple incoherent sound sources, the sound levels from each source must be added together to determine the total sound level. Sound levels are expressed in decibels, which are a logarithmic function. The formula to add one dB level to another is:

$$LA + LB = 10\log (10^{(LA/10)} + 10^{(LB/10)}) \text{ [dB]}$$

Using the above equation, three of the pumps would correspond to a 4.8 dB increase over the sound pressure level for a single pump. Thus, the series of pumps all operating would produce sound levels of approximately 72.8 dBA at 3 feet.

Sound attenuation due to distance, for a point source (which is applicable to the group of pumps) is calculated with the equation:

$$SPL1 = SPL2 - B - 20 \log(D1/D2)$$

Where: SPL1 is the calculated sound pressure level (in dB) at specified distance [D1]

SPL2 is a known (measured) sound pressure level at a known distance [D2]

D1 is distance from source to measured sound pressure level

D2 is distance from source to location of calculated sound pressure level

B is attenuation (reduction) in noise level due to the barrier or enclosure (dB)

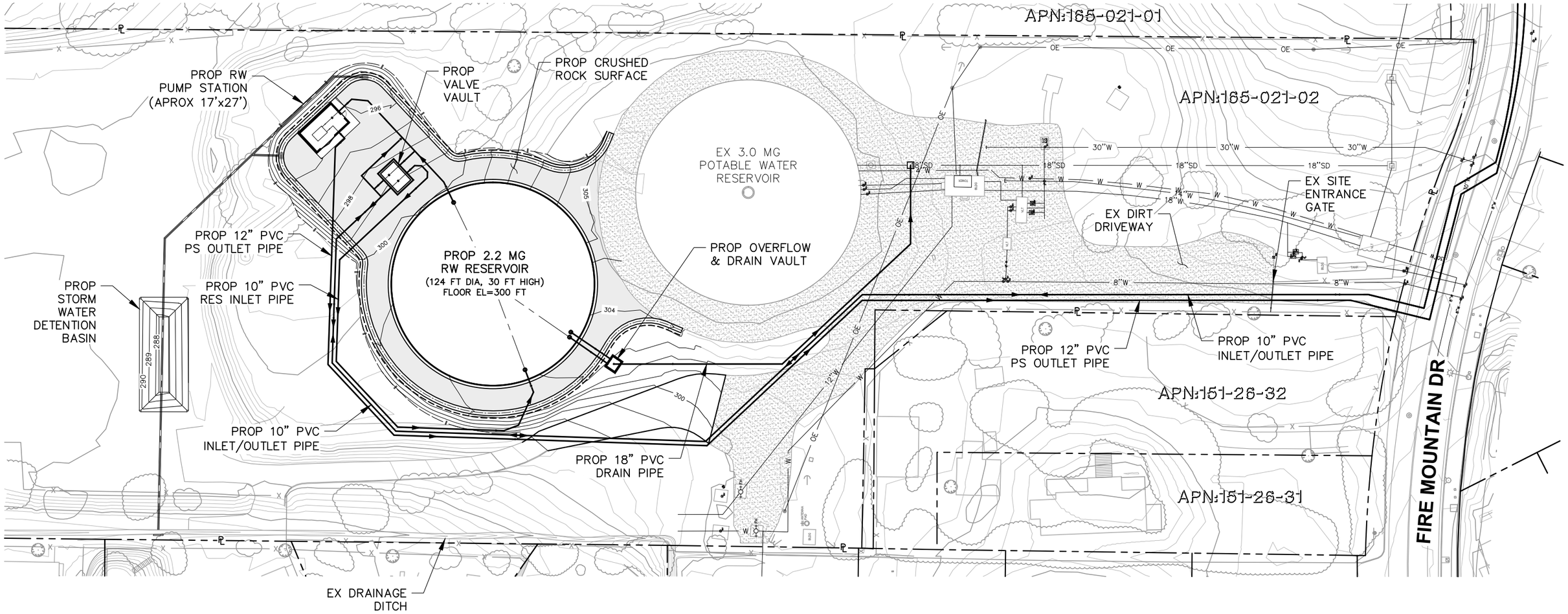

FIGURE 3

Fire Mountain Site Plan

Environmental Noise Assement

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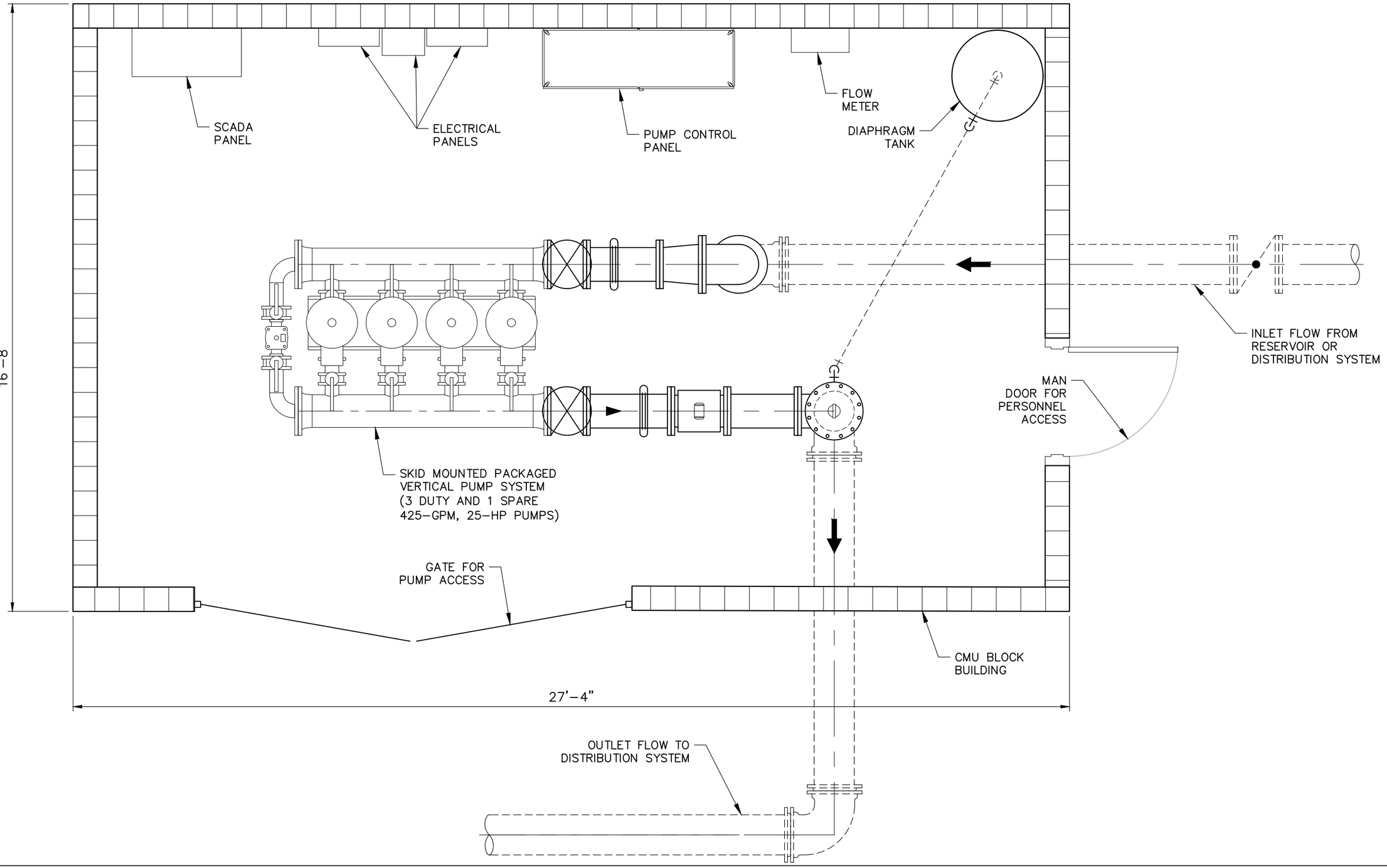

FIGURE 8

Fire Mountain Pump Station Layout

Environmental Noise Assement

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The property boundary closest to the pump structure is located approximately 120 feet from the rear of the structure. Using the above equation, the combined sound level from the simultaneous operation of all 3 pumps is calculated to be approximately 33 dBA L_{eq}. This calculated operational sound level at the closest residential property boundary to the pump station would be less than the most restrictive limit (i.e., 45 dBA nighttime) for residential zones. Thus, the noise level calculated for the pump station would comply with the local City noise ordinance, resulting in a less than significant impact. Additionally, for the existing residential land uses east of the project site (located at greater distances), the pump noise levels would expected to be lower.

7.3 Mesa Pump Station

Figure 9 shows the Mesa project site location.

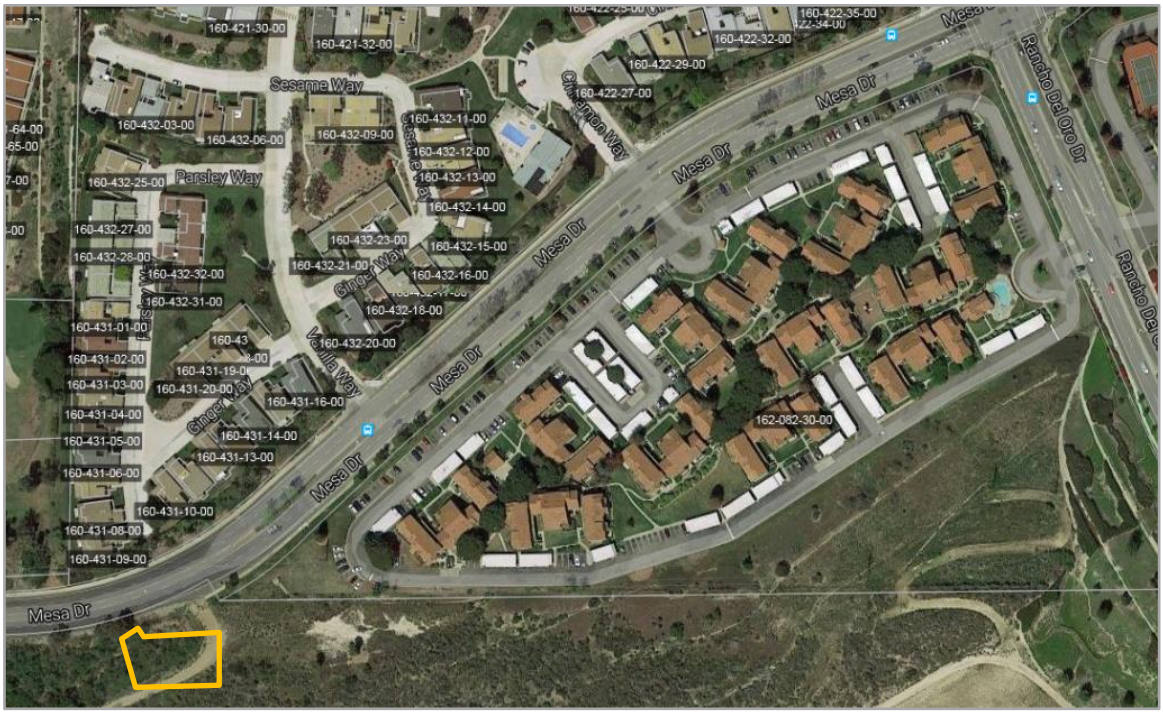

Figure 9. Mesa Recycled Water Pump Station Location

A 1,500 gpm pump station would be located on a small portion of City-owned parcel APN 162-082-51, which is the El Corazon site (see Figure 9). This facility would include three 40-hp inline multi-stage vertical pump units in duty service. This facility would be housed in a grade-level, single story CMU block building with approximate dimensions of 25 feet by 16 feet and a height of 14 feet. The proposed pump station would be accessed by an existing dirt road into El Corazon off of on Mesa Drive and would include a small crushed rock parking area for operations and maintenance. The site would be enclosed by a perimeter fence with screening. See Figures 10 and 11 for a preliminary site plan and building plan.

7.3.1 Mesa Sound Level Analysis

Residential and open space are located on the parcels surrounding the project site. Residences exist to the north (about 200 feet away) and east (about 120 feet away) of the property. Open space exists south and west of the site.

Based on the data sheet provided in Appendix B, the specified pump has a sound power level of 78 dBA. The data sheet also provides sound pressure levels at various distances from the pump equipment. At 3 feet, the sound pressure level of the specified pump is 68 dBA Leq. At 5 feet, the reported sound pressure level for the pump is 64 dBA Leq.

At the Mesa site, three 25 hp pumps are expected to be operating simultaneously. Other pumps shown in the figure would be on standby. When there are multiple incoherent sound sources, the sound levels from each source must be added together to determine the total sound level. Sound levels are expressed in decibels, which are a logarithmic function. The formula to add one dB level to another is:

$$LA + LB = 10\log (10^{(LA/10)} + 10^{(LB/10)}) \text{ [dB]}$$

Using the above equation, three of the pumps would correspond to a 4.8 dB increase over the sound pressure level for a single pump. Thus, the series of pumps all operating would produce sound levels of approximately 72.8 dBA at 3 feet.

The property lines for noise-sensitive land uses closest to the proposed pump installation location are in the directions where the shelter will provide the greatest attenuation (shielding), due to the presence of solid wall elements (no openings). The center of the pumps are assumed to be mounted at approximately 3-4 feet above the ground. Since the structure has 14 foot walls, we conservatively estimate that 8 dB of attenuation would be provided by the structure in the direction of the closest noise-sensitive land use property line (this is conservative, as the sound level measurements at the Morro Hills 1&2 Pump Station evidence a minimum 11 dBA sound attenuation for all facades of the structure).

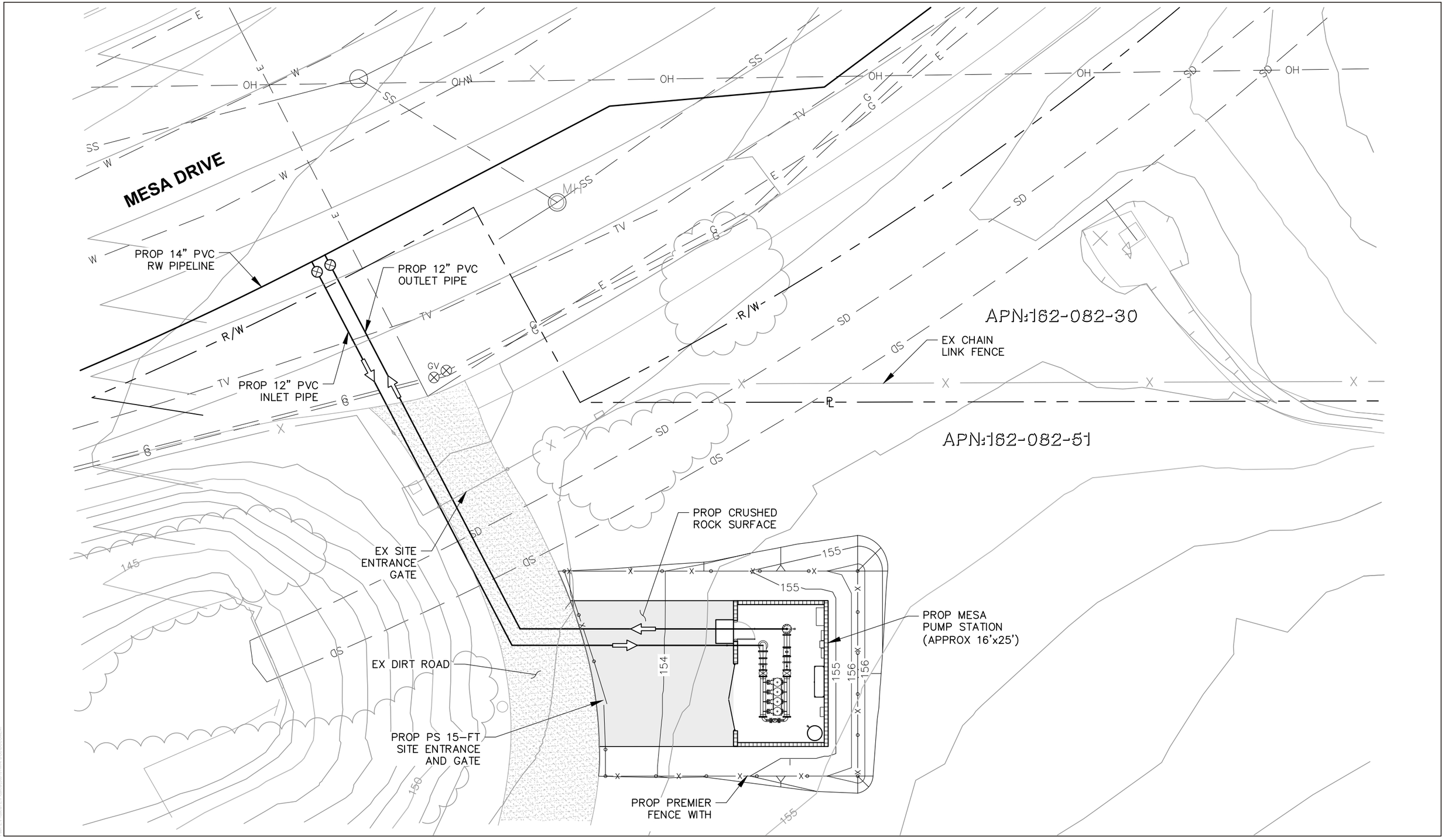

FIGURE 4
Mesa Site Plan
Environmental Noise Assement

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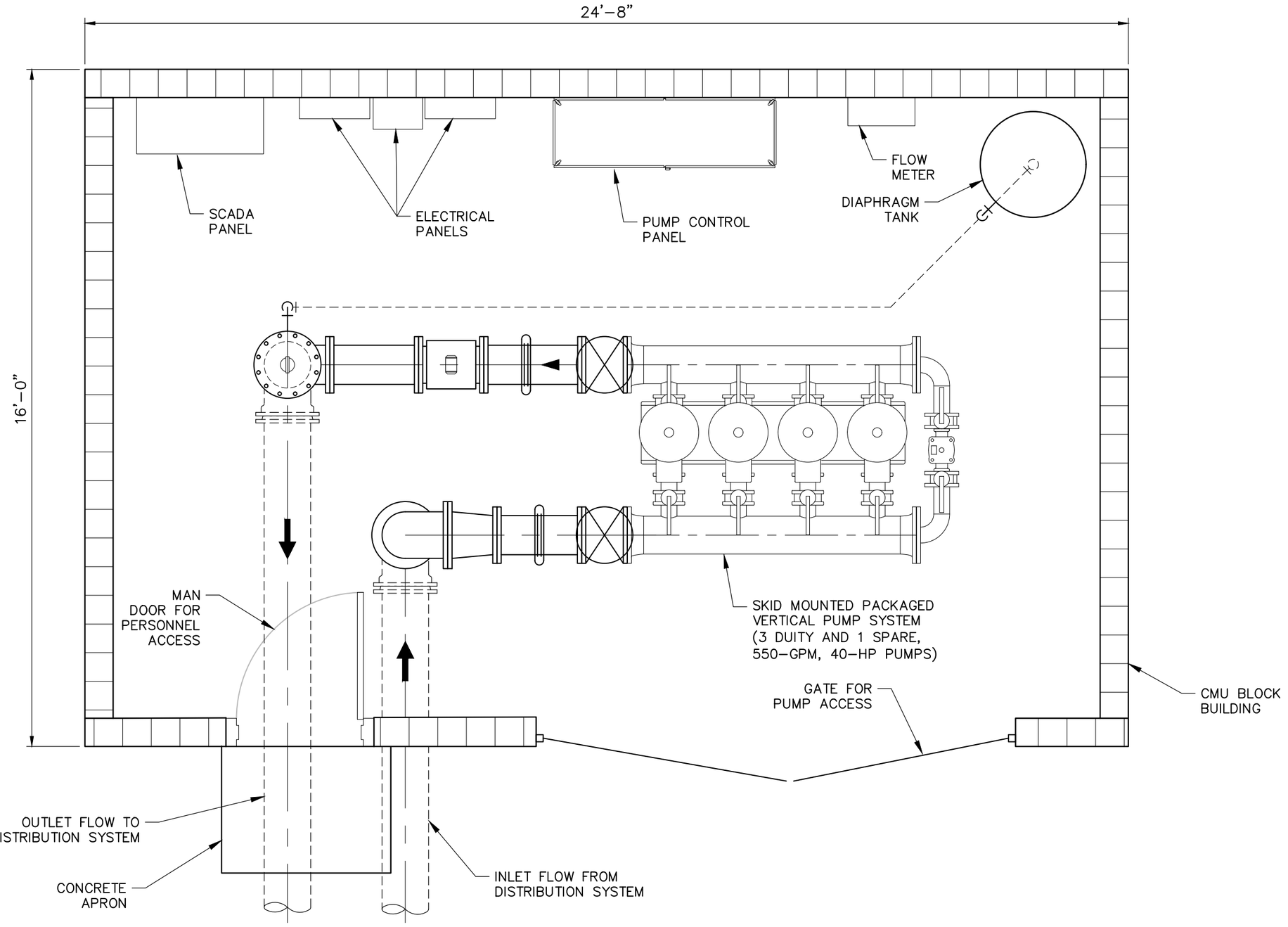

FIGURE 11

Mesa Pump Station Layout

Environmental Noise Assement

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Sound attenuation due to distance, for a point source (which is applicable to the group of pumps) is calculated with the equation:

$$SPL1 = SPL2 - B - 20 \log(D1/D2)$$

Where: SPL1 is the calculated sound pressure level (in dB) at specified distance [D1]

SPL2 is a known (measured) sound pressure level at a known distance [D2]

D1 is distance from source to measured sound pressure level

D2 is distance from source to location of calculated sound pressure level

B is attenuation (reduction) in noise level due to the barrier or enclosure (dB)

The property boundary closest to the pump structure is located approximately 120 feet from the rear of the structure. Using the above equation, the combined sound level from the simultaneous operation of all 3 pumps is calculated to be approximately 34 dBA L_{eq}. This calculated operational sound level at the closest residential property boundary to the pump station would be less than the most restrictive limit (i.e., 45 dBA nighttime) for residential zones. Thus, the noise level calculated for the pump station would comply with the local City noise ordinance, resulting in a less than significant impact.

Additionally, for the existing residential land uses north of the project site (located about 170 feet away), the pump noise levels would expected to be about 32 dBA Leq.

7.4 Old Grove Pump Station

Figure 12 shows the Old Grove project site location.

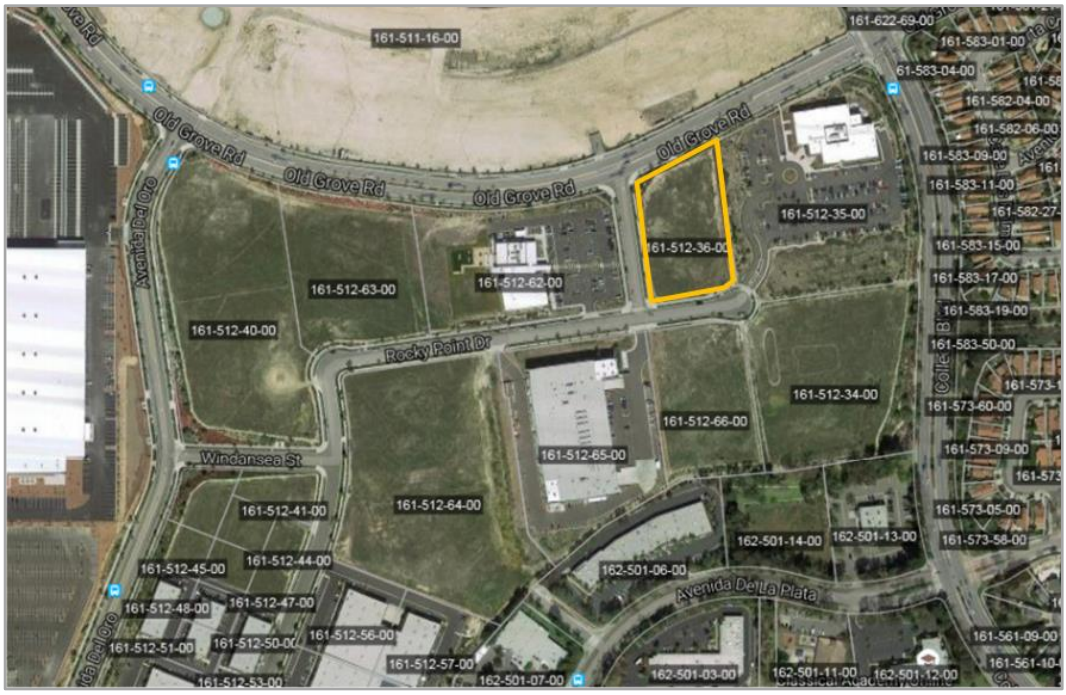

Figure 12. Old Grove Recycled Water Pump Station Location

A 2.2-million-gallon reservoir would be located on a vacant 2.14-acre City-owned parcel (Assessor's Parcel Number [APN] 161-512-36) (see Figure 12). The reservoir would be pre-stressed concrete or steel construction with an approximate diameter of 124 feet and a height of 30 feet. The proposed reservoir would be accessed by a new driveway off of Trestle Street and would have a crushed-rock perimeter road and parking pad for operations and maintenance. The proposed reservoir would include appurtenant recycled water and drainage buried piping and vaults. The site would be enclosed by a perimeter fence with exterior lighting at the entrance gate. See Figure 13 for a preliminary site plan.

A 2,200-gpm pump station would be located on same parcel as Old Grove Reservoir (APN 161-512-36). This facility would consist of four 30-hp inline multi-state vertical pump units in duty service and appurtenant above and below ground piping and electrical equipment. The facility would be housed in a grade-level, single-story CMU block building with approximate dimensions of 30 feet by 17 feet and a height of 14 feet. The structure would include one exterior light. See Figure 14 for a preliminary pump station plan.

7.4.1 Old Grove Sound Level Analysis

Commercial and open space are located on the parcels surrounding the project site. Residences exist over 650 feet to the east of the property. Future residences may exist across Old Grove Road about 340 feet from the pump station. A fire station would also be constructed on the parcel adjacent to the pump station parcel.

Based on the data sheet provided in Appendix B, the specified pump has a sound power level of 78 dBA. The data sheet also provides sound pressure levels at various distances from the pump equipment. At 3 feet, the sound pressure level of the specified pump is 68 dBA Leq. At 5 feet, the reported sound pressure level for the pump is 64 dBA Leq.

At the Old Grove site, four (4) pumps are expected to be operating simultaneously. Other pumps shown in the figure would be on standby. When there are multiple incoherent sound sources, the sound levels from each source must be added together to determine the total sound level. Sound levels are expressed in decibels, which are a logarithmic function. The formula to add one dB level to another is:

$$LA + LB = 10\log (10^{(LA/10)} + 10^{(LB/10)}) \text{ [dB]}$$

Using the above equation, three of the pumps would correspond to a 6 dB increase over the sound pressure level for a single pump. Thus, the four total pumps all operating simultaneously would produce a sound level of approximately 74 dBA at 3 feet.

The property lines for noise-sensitive land uses closest to the proposed pump installation location are in the directions where the shelter will provide the greatest attenuation (shielding), due to the presence of solid wall elements (no openings). The center of the pumps are assumed to be mounted at approximately 3-4 feet above the ground. Since the structure has 14 foot walls, we conservatively estimate that 8 dB of attenuation would be provided by the structure in the direction of the closest noise-sensitive land use property line (this is conservative, as the sound level measurements at the Morro Hills 1&2 Pump Station evidence a minimum 11 dBA sound attenuation for all facades of the structure).

The distance from the pumps to the closest noise-sensitive land use property line is approximately 340 feet.

Sound attenuation due to distance, for a point source (which is applicable to the group of pumps) is calculated with the equation:

$$SPL1 = SPL2 – B – 20 \log(D1/D2)$$

Where: SPL1 is the calculated sound pressure level (in dB) at specified distance [D1]

SPL2 is a known (measured) sound pressure level at a known distance [D2]

D1 is distance from source to measured sound pressure level

D2 is distance from source to location of calculated sound pressure level

B is attenuation (reduction) in noise level due to the barrier or enclosure (dB)

The property adjacent to the structure would include a fire station, which would fall within the industrial zone land use. For industrial zones, 70 dBA is the highest acceptable hourly average sound level between 7:00 a.m. and 9:59 p.m., and 65 dBA is the highest acceptable level between 10:00 p.m. and 6:59 a.m.

Using the above equation, the combined sound level from the simultaneous operation of all 4 pump is calculated to be approximately 43 dBA L_{eq} at the property line for the adjacent fire station parcel. This calculated pump noise at the proposed fire station parcel is less than the most restrictive limit (i.e., 65 dBA Leq nighttime).

The land uses north of Old Grove Road may include single-family homes. The most restrictive limit for residences is 45 dBA (between 10:00 p.m. and 6:59 a.m). The calculated noise level at the closest residential property line (using the above equations and a separation distance of 340 feet) is less than 30 dBA Leq.

Consequently, calculated noise levels at the adjacent fire station property and at the closest residential property line would fall well below allowable limits specified in the noise ordinance. Thus compliance with the noise ordinance would be achieved, and noise impacts would be less than significant.

Additionally, for the existing residential land uses east of the project site (located over 600 feet away), the pump noise levels would expected to be lower.

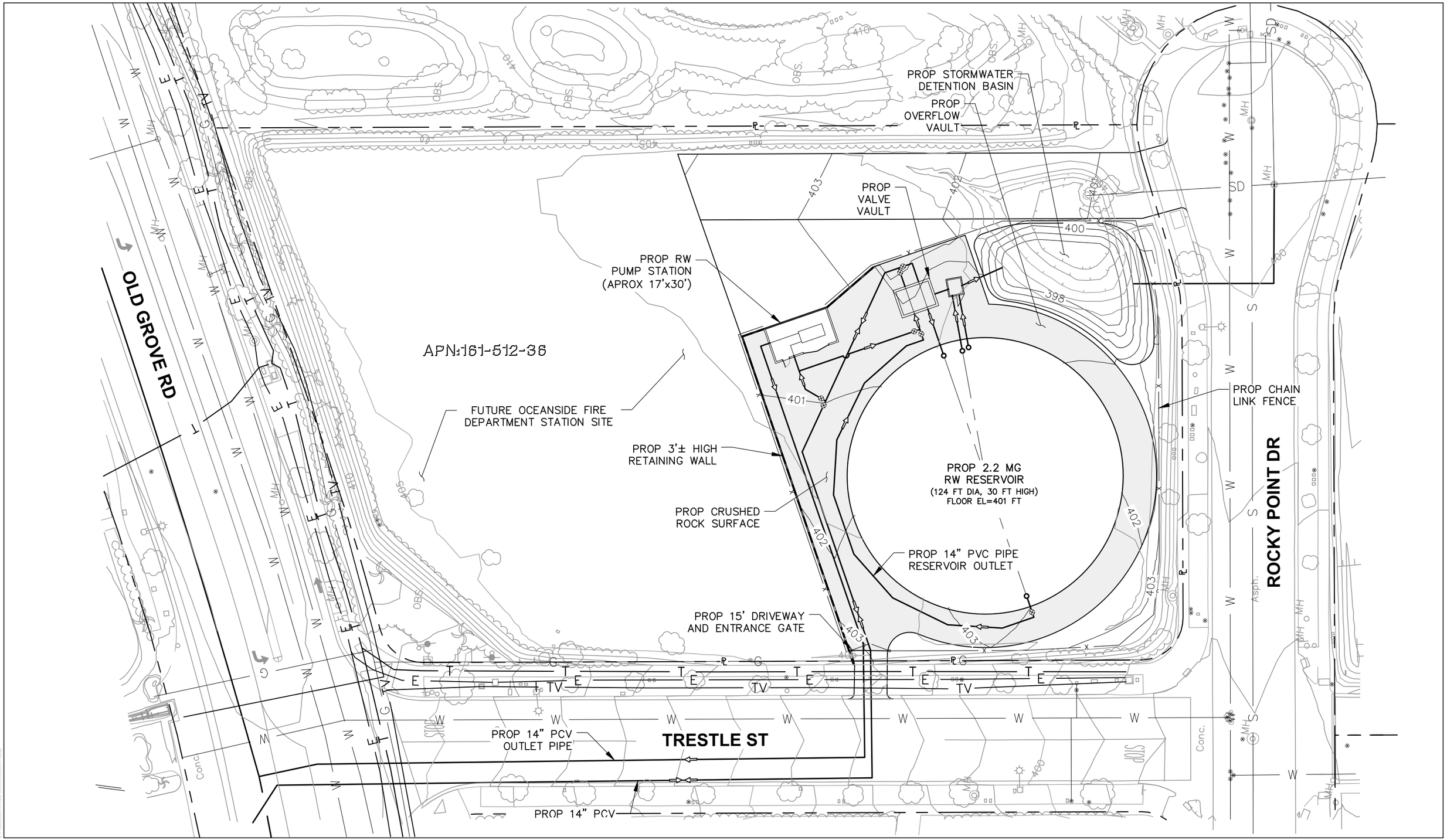

FIGURE 13

Old Grove Site Plan

Environmental Noise Assement

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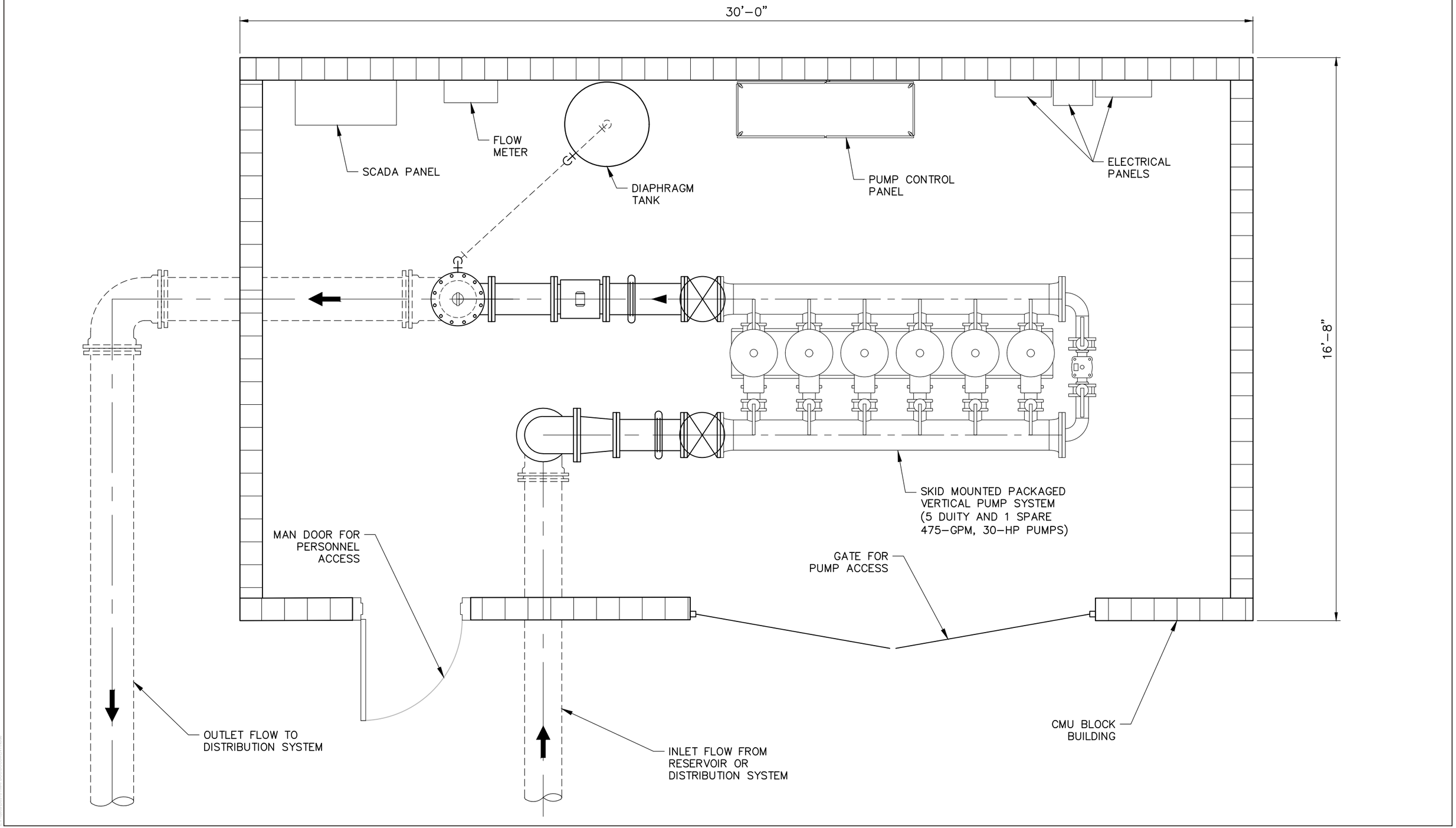

FIGURE 14

Old Grove Pump Station Layout

Environmental Noise Assement

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8 MITIGATION MEASURES

The potential operational noise impacts at the pump stations would be less than significant. No mitigation is required.

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9 REFERENCES

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Typical Acoustic Performance of TEFC/EPACT Motors. Data Sheet. Provided by Martin Trim. Barrett Engineered Pump. 1695 National Avenue San Diego, CA 92113. Office: (619) 232-7867. Email to Amanda Combs April 21, 2018.

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APPENDIX A

Definitions

APPENDIX A
Definitions

Term	Definition
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
A-Weighted Sound Level (dBA)	The sound pressure level in decibels as measured on a sound-level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Community Noise Equivalent Level (CNEL)	CNEL is the A-weighted equivalent continuous sound exposure level for a 24-hour period with a 10 dB adjustment added to sound levels occurring during nighttime hours (10 p.m. to 7 a.m.) and a 5 dB adjustment added to the sound levels occurring during the evening hours (7 p.m. to 10 p.m.).
Decibel (dB)	A unit for measuring sound pressure level, equal to 10 times the logarithm to the base 10 of the ratio of the measured sound pressure squared to a reference pressure, which is 20 micropascals.
Equivalent Sound Level (L_{eq})	The sound level corresponding to a steady-state sound level and containing the same total energy as a time varying signal over a given sample period. L_{eq} is designed to average all of the loud and quiet sound levels occurring over a specific time period.

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APPENDIX B

Pump Motor Data Sheet

TABLE II -- TYPICAL ACOUSTIC PERFORMANCE OF TEFC/EPACT MOTORS

ALL VALUES LISTED ARE dBA

FRAME SIZE		PWL NOM SOUND [NEMA SOUND] (FAN OD)				SPL @ 3'				SPL @ 5'			
BALDOR	NEMA	3600 RPM	1800 RPM	1200 RPM	900 RPM	3600 RPM	1800 RPM	1200 RPM	900 RPM	3600 RPM	1800 RPM	1200 RPM	900 RPM
33	42												
34	48												
35, 305	56	76 [85] (5.00)	70 [70] (6.38)	55 [70] (6.38)		68	62	47		64	58	43	
35, 306	140	76 [85] (5.00)	70 [70] (6.38)	55 [70] (6.38)		68	62	47		64	58	43	
36, 306	180	78 [88] (5.25)	74 [74] (6.38)	58 [67] (6.38)		68	66	50		64	62	46	
37, 307	210	79 [91] (6.00)	79 [79] (7.00)	60 [71]		71	71	52		67	67	48	
39, 309	250	81 [94] (6.00)	82 [84] (8.50)	66 [78](9.00)		72	73	57		68	69	54	
40, 310	280	84 [94] (7.75)	83 [88] (8.50)	70 [84] (9.00)		75	74	61		71	71	58	
42, 312	320	88 [100] (8.50)	85 [89] (10.75)	71 [83] (10.75)		79	76	62		75	73	59	
44, 314	360	91 [101] (8.50)	87 [95] (12.00)	74 [86] (13.75)		81	77	64		78	74	61	
316	400	94 [102] (8.50)	88 [98] (12.00)	79 [90] (13.75)		84	78	69		81	75	66	
318	440	99 [104] (7.75)	91 [103] (10.00)	82 [98] (15.75)		89	81	72		86	78	69	
318	449	103 [107] (9.62)	92 [105] (12.00)	89 [100] (17.50)		93	82	79		90	79	76	
318	449	113 [110] (12.00)	94 [105] (17.50)	99 [100] (17.50)		103	84	89		100	81	86	
5000	500	(12.00)	(17.50)	99 (19.50)				89				86	
5800	580												

NOTES: PWL (SOUND POWER LEVEL) REF. 10^{-12}watts
SPL (SOUND PRESSURE LEVEL) REF .0002 μ bar or 20 x 10^{-6} Pa or 20 x 10^{-6} N/m^2
REF DOCUMENTS: MG1-1998, Rev 1, 9.4.1, 9.4.2
Baldor Sound Level [Nema Sound Level] (Fan Dia.)

1/3 - 3hp
3-5 hp 3 phase
5 single 10 hp
15-20 hp
20-30 hp
50 hp
60 & 75 hp
100 hp