



ENGINEERING REPORT

PALISADES ADMINISTRATIVE SITE LAGOON LINER AND EFFLUENT SPRINKLER SYSTEM REPLACEMENT

PIMA COUNTY
SANTA CATALINA RANGER DISTRICT
CORONADO NATIONAL FOREST

SOUTHWESTERN REGION
U.S. FOREST SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

PREPARED BY:

CARLOS TOMAS
Civil Engineer

DATE

TINA WILLIAMS
Mission Support Staff Civil Engineer

DATE

REVIEWED BY:

LEANNE MURPHY
Regional Water and Wastewater Engineer

DATE

RECOMMENDED BY:

EDWIN MONIN
Engineering and Minerals Staff Officer

DATE

DONATO DELMASTRO
District Ranger

DATE

APPROVED BY:

KERWIN DEWBERRY
Forest Supervisor

DATE

KEVIN BOURNE
Director of Engineering

DATE

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EXECUTIVE SUMMARY

The Forest Wide Water and Wastewater Project encompasses various project sites on the Santa Catalina and Douglas Ranger Districts. This includes Palisades Administrative Site, Rucker Work Center, and Sunny Flat Campground. Each site includes either a water and/or wastewater system improvement to eliminate the deferred maintenance to bring existing facilities back into compliance with local, state or other codes.

This report will look at each site and provide a recommended priority on which systems should be improved. Each system is classified differently under the State which can be considered by the Forest to select and identify which systems should be corrected. All these facilities have deficiencies and should be planned to be corrected when funds are available.

After the review of each of these sites, the Forest decided to focus on the wastewater work needed at the Palisades Administrative Site. This administrative site is open year-round and consists of a visitor center, one (1) cabin (cabin rental program), two (2) modular homes for the sheriff, one (1) apartment complex with four (4) apartments, and four (4) trailer pads. The administrative site hosts at least three (3) year-round visitor center employees, two (2) families who occupy the modular homes year-round, and at least (1) year-round facilities manager on site. There are approximately four (4) seasonal employees who reside at the apartment complex from May through October, but currently the apartment complex is vacant.

INTRODUCTION

The Palisades Administrative Site is located on the Catalina Mountains in Tucson, AZ. This report will investigate all issues when replacing a regulated wastewater treatment system. During the investigation, some of the water system deficiencies were researched to try to add any improvements but will only be documented here for future reference. The focus of this report will be information regarding the replacement of the wastewater treatment plant lagoon liner, the effluent irrigation system, and the reconditioning of the associated service access road.

This report will fulfill the requirements of FSM 7430-Wastewater to develop design criteria for the current and future users and operations. Wastewater treatment research will include revisiting the current Aquifer Protection Program rules or state engineering review and approval requirements and inquiring about any permit renewals.

Any recommendations of the planned modifications to the water system will be considered and any information will be included in this report.

LOCATION

Palisades Administrative Site is located on the Santa Catalina Ranger District on the Coronado National Forest, Pima County. The general location is located on Mount Lemmon, at 7,950 feet and is surrounded by a forest of ponderosa pine, spruce, and fir. The administrative site is a multiple use area located at milepost 19.9 on the Catalina Highway.

The coordinate of this location is latitude 32.410544°, Longitude -110.714887°.

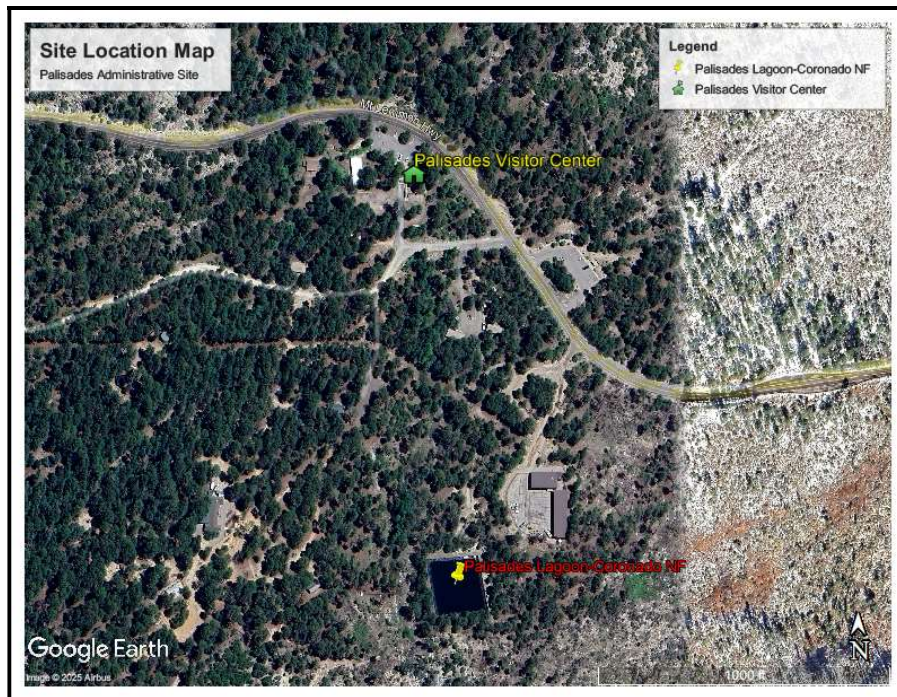


Figure 1 - Site Location Map

SITE DESCRIPTION

Facilities at the site includes a Visitor Center, bunkhouse (four 2-bedroom apartments, seasonal use), a two-bedroom rental cabin, 2 modular homes and four trailer pads (seasonal use). There is a maximum of 10 parking stalls at the visitor center, which offers visitor parking for interpretive information, popular bird watching, photography and hiking trails. The visitor center sells day use and weekly passes. The rental cabin is operated year-round and is reserved through website, Recreation.gov. Access may be impacted if weather conditions are bad during the winter season. The bunkhouse is currently not livable due to repairs necessary before its occupied. The two modular homes are occupied year-round by Sheriff and their families of Pima County.

The weather at the project site experiences low temperatures which range from average temperatures of less than 22°F in January to lows of 50° in July. High temperatures range from average of 42°F in January to over 74° in July.

The administrative site operates year-round, but has seasonal use by the public, due to its location in the higher elevation and will experience wintery conditions.

The Visitor Center operates in the summer (March 1 to December) from 9:00 am to 3:30 pm daily. The winter hours from January through February are from 10:00 am to 4:00 pm from Friday through Sunday.

WATER SYSTEMS

The main water system is the USFS CNF Loma Linda Water System, PWS# AZ0410605. This is an active water system classified as Non-Community, with combination sources from a well (WL-55-506387) and spring (SP-33-1537). The coordinates of the Loma Linda Water System is latitude 34.447137, longitude -110.771103. The Arizona Department of Environmental Quality – Safe Drinking Water Information Database (SDWIS) shows an average daily production of 10,000-gallons (see excerpt below). The Loma Linda Water System provides potable water to the Palisades Administrative Site, the sheriff housing, the Pima County lot, a public hydrant at Lower Bigelow trailhead, Sollers Complex, and Rose Canyon Campground.

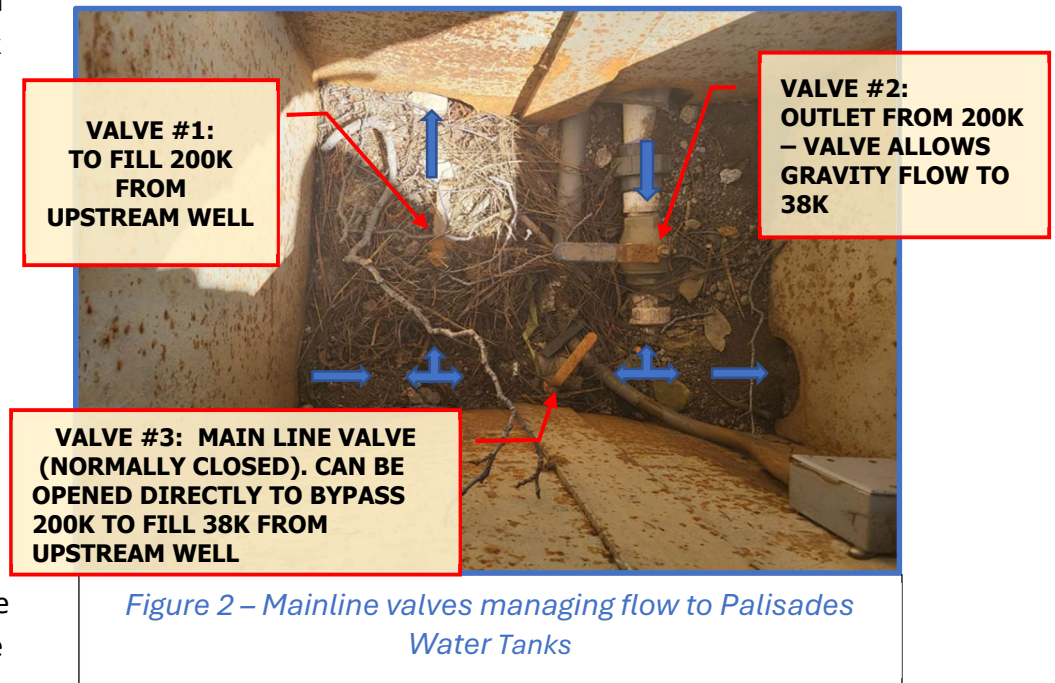
Regulating Agencies		
Name	Alias/Inspector	
AZ DEPT OF ENV QUALITY	ADEQ	
ADEQ SOUTHERN REGIONAL OFFICE	SRO	
Water System Historical Names		
Historical Name(s)		
USFS-CNF-LOMA LINDA		
WS Flow Rates		
Type	Quantity	UOM
AVPD - Average Daily Production	10000	GPD
TLDS - Total Design Capacity	20000	GPD

Figure 1 – Water System Flow Rate for Loma Linda Water System

The Palisades Administrative Site is connected to the Loma Linda Water system near the administrative site and is diverted to three other potable water storage tanks. The water system is fully manually operated from the source. The main sources of this large water distribution system is located approximately 5.9 miles from project site.

At the Palisades Administrative Site, there are three tanks: a 200,000-gallon tank, a 38,000-gallon tank, and a 16,000-gallon tank. See [Appendix E](#) to see site plan of water system.

The main 200,000 gallon above-ground steel tank requires manual operation from a set of valves to fill from the mainline upstream supply. The water from the 200k tank then provides gravity flow to the 38k tank through the same set of valves. See [Figure 2](#). The 16k tank is filled by pressure pump located at the administrative site from the 38k tank as the source. The 16k tank provides gravity flow to the entire administrative distribution system.



The 16k tank is equipped with a ladder that does not comply with current OSHA requirements. The ladder is kept locked at the bottom with a fine grated mesh to prevent any access to the top of tank. The existing exterior surface coating is slightly chalky and no past documentation of previous work on the tank. There is no standard manufacturer plate on tank to show the original thickness of shell or floor or year of construction. The operator does not have a way to monitor the water level inside this tank since there is no exterior water level gauge. The tank water level sensors are no longer automatically re-filling the tank because of needed electrical repairs. Due to the unknown construction year of the tank, it is recommended to complete a lead-based paint test. The tank appears to be structurally sound and may be able to receive improvements to the interior and exterior coatings. It is recommended to obtain a full tank assessment to measure the steel thickness for the shell, foundation evaluation, water level indicator, check for auto-fill controls, overflow pipe, access ladder, roof, roof hatch, air vents, cathodic protection, water



quality, site security, man ways, inlet/outlet, and cleaning and removing sediment and receive written recommendations for corrective actions. Market research was completed on a tank assessment and these estimates are shown in [Appendix H](#).

The water system is manually operated by an on-site certified water operator which involves continuous physical monitoring of all the tanks. The existing pumphouse is too small and the pump often overheats to fill the 16k tank. There is no chlorinator on the system and the operator manually adds the disinfectant to the 38k tank. Recommend installing controls to fully automate water system from the source and provide automated controls within the three tanks providing water for the Palisades Administrative Site. A remote telemetry system should be assessed for this site to provide communication for sensors and valves for the 200k tank. The signal for telemetry work may be difficult for dependable operation but should be evaluated. The sole operator for this site may not always be available so the system should invest in providing secondary automatic operations for maintaining full water tank levels. The water system for the on-site three tanks can be fit with sensors, electrical and any equipment to install automatic components to the 38k and 16k tanks for easier management. Recommendation to install equipment to create an automatic system for the three tanks – 200k, 38k, and 16k.

Arizona Department of Environmental Quality (ADEQ) requires a Drinking Water Engineering Review prior to modifying an existing system. Any improvements to this water system will require the Forest to follow the State's Engineering Review process to get an Approval to Construct. Here is a link to the ADEQ website to learn more about the process - <https://www.azdeq.gov/DWSER>.

WASTEWATER AND SEWAGE SYSTEMS

The existing wastewater system at this site is a facultative lagoon. It is not aerated. The lagoon liner and effluent sprinkler system was entirely replaced in June, 2001. The current condition of the entire wastewater system has experienced wildfire and sustained damage to the liner which is deteriorated. The dimensions of the lagoon are approximately 154' wide x 179' long and 6.5' – 7.2' deep with 3:1 slopes. The perimeter is fenced with 6' high chainlink with three rows of barbed wire at the top with locks at the entry. There are minimal signs along the fencing.



Figure 3 - Palisades Administrative Site Lagoon

The collection system receives sewer from all the buildings on the administrative site. There is an Arizona Department of Transportation (ADOT) facility near the admin site, but the ADOT facility manages their own wastewater.

a. Existing components

1. Wastewater lagoon: 28,500 sq ft area
2. Existing effluent irrigation system and drain lines
3. Existing lagoon pumphouse
4. Existing fence for lagoon and irrigation system
5. Existing 8" sewer lines

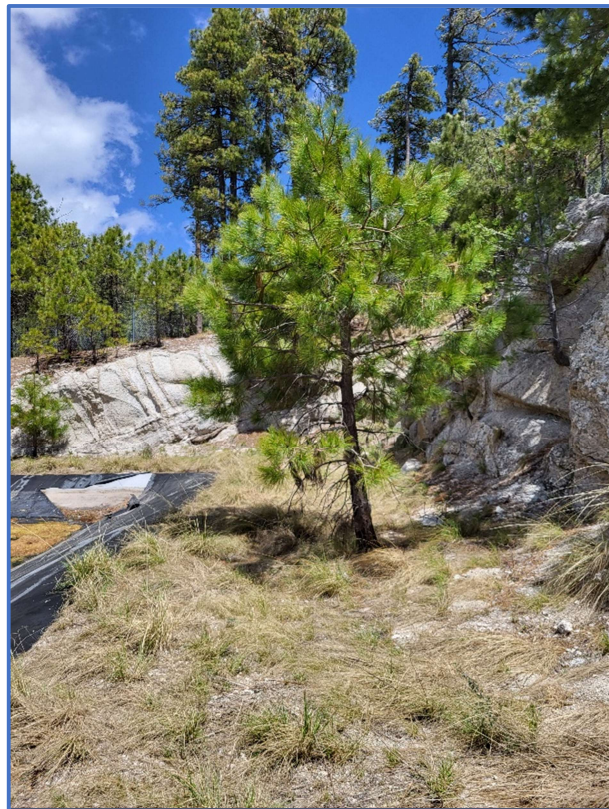
The facility holds an existing Type 1.09 general Aquifer Protection Permit (APP) which allows limited disposal quantity per day. The permit allows a total flow rate of wastewater treated in the wastewater treatment plant to not exceed 20,000 gallons per day. Copy of the general APP is attached in [Appendix I](#).

In the National Resource Manager (NRM) database, the Palisades wastewater system lists deficiencies including replacement of lagoon liner.

There have been previous improvements to the sewerline including replacement of sections of main sewer line, manhole rehabilitations, lagoon liner and effluent sprinkler system replacements dated in June 2001.



Vegetation Along Edge of Lagoon



Tree in Lagoon Fenced Perimeter

It's been 24 years and general recommendation is to de-sludge facultative lagoons at least every 20 years. ¹

The current deficiencies include repair of the existing effluent irrigation pump. The pump would not start, so it was removed for repairs and currently scheduled to be re-installed. It is unknown if the past wildfires damaged any of the sprinkler heads in the disposal area or any other wastewater system components above grade. The vegetation is overgrown and larger shrubs with roots have started to encroach along

¹ EPA Compliance Advisory: Compliance Tips for Small Wastewater Treatment Lagoons with Clean Water Act Discharge Permits. March 2022

the top edges of the liner (see photo to the left). There are trees growing near the lagoon and trees must not be allowed to grow in either the base or on the banks of the lagoon. (see photo above).

PROPANE

Not Applicable to the Lagoon or Water Improvements.

ELECTRICAL

The lagoon does have overhead electrical line to provide power to the equipment in the pump house. The pumphouse houses the pump controls and equipment for the effluent pumping system. There is a 5 HP centrifugal pump to maintain capacity of the lagoon.

There is a power pole near the lagoon pumphouse which has a meter and panel with duplex receptacle.

The overhead electrical line crosses the access road in two locations. Any equipment will have to clear the overhead lines. The approximate height clearance from existing grade to powerline was measured at 13-feet.

A temporary wastewater system is necessary to provide the administrative site sewer services during the replacement of the lagoon re-lining, unless another form of power source is used. The electrical panel in the pumphouse can be made available to extend a temporary electrical line to location for a temporary wastewater collection system. The existing electrical panel should be assessed to make necessary modifications. The utility authority for this site is Tucson Electric Power.



Existing Electrical Meter and Panel with Duplex Receptacle

TELEPHONE

Not Applicable.

ROADS AND PARKING

There is an existing access road from the end of the admin site which leads directly to the lagoon. It is a single lane road with an approximate average width of 12 to 14-feet. The lagoon is approximately 520 ft from the Catalina Highway. See [Appendix C](#) to view the site plan. The volume along this road is very minimal to none during normal operating periods, but will be used heavily during the reconstruction of the lagoon.

In preparation for the project, the road will be reconditioned to provide a minimum travelway of 14-ft width with clearing width of 22-ft to construct road ditch and slopes.

The lagoon is near the administrative compound and employees typically walk to this site when performing maintenance and/or inspections. The project includes re-conditioning the road,

constructing ditches and clearing a temporary use area to place a temporary water system. The roadway and temporary use area will generate excess material which the district will be able to utilize on other areas. District will locate a storage area on site.

The road surface will receive a minimum 3-inch aggregate along the entire roadway which is approximately 670 lineal feet.

GEOLOGY

The Santa Catalina Mountains, located North of Tucson consist mainly of granite, schist, gneiss, limestone, and sandstone. Their formation is due to tectonic activity and subsequent erosion. The Palisades visitors center is located on rocky steep topography and surrounded by various species of pine.

TOPOGRAPHY

Not applicable.

HYDROLOGY

Not Applicable.

HYDROLOGICAL FEATURES

The photo below shows a steep section of the service road which eroded cover over the existing culvert. This portion of road was analyzed for improvement, reducing the existing slope from 22% to 12% which would require lowering the existing grade between 3 to 4 feet. At this depth, there is an existing section of sewerline that crosses the road and would encroach the required minimum cover. If this section of road is lowered, the existing sewerline will not have the required minimum of cover and would need a costly alignment change making this work impractical. Therefore, regrading and surfacing the road will be adequate for project completion. The existing culvert will be removed and re-installed at the same elevation and protected with rip rap to minimize erosion.



Service Access Road to Lagoon

VEGETATION

Within the lagoon, there is vegetation including brush, shrubs, and small diameter ponderosa pine trees. These should be cut and removed from the edges of the lagoon cell.

PROPOSED IMPROVEMENTS

In the beginning, it was necessary to have a discussion with ADEQ, to inquire about a permit requirement and/or engineering review to incorporate the additional work and fees for the proposed improvements. Based on not increasing the capacity or changing any existing treatment of the wastewater treatment system, it was determined the proposed improvements would not require the Forest Service to apply for a new permit. The proposed work was considered to be maintenance. The following maintenance improvements will be made to the Palisades Lagoon:

1. Propose to replace the lagoon liner with geosynthetic liner in combination with non-woven geotextile. Recommended geomembrane liners include either a 45-mil polypropylene or 60-mil High-density Polyethylene with a heavy 8-oz non-woven geotextile.
2. The 8-inch supply pipe has several existing concrete supports which will all be replaced and double padded to protect the geomembrane liner. The double padding consists of two layers of the geomembrane and geotextile.
3. The leak detection pipe system will be entirely replaced.
4. The pump and plumbing system which is used to pump effluent from the lagoon and discharge to the disposal area will be entirely replaced. A new effluent sprinkler system will be replaced while the existing system will be abandoned to minimize the damage to resources.
5. The service access road will be reconstructed to support the construction traffic for this project, but mainly to improve for continued maintenance. The current road template will remain as 12-ft wide with majority of road to receive 3-inches of compacted surface aggregate.
6. The drainage will also be improved along the service road. The road receives surface flow from the upper sloped hill so road ditches will be constructed. There is a section of the road with steep slopes and creating severe erosion so this section will be corrected by lowering the elevation of the existing road and culvert and adding riprap to minimize the erosion.

REFERENCES

Include:

List of references used.

EPA Compliance Advisory: Compliance Tips for Small Wastewater Treatment Lagoons with Clean Water Act Discharge Permits. March 2022

EPA 509/19: Wastewater Lagoon Construction

U.S. EPA, 2002, Wastewater Technology Factsheet: Facultative Lagoons (EPA/832/F-02/104), Office of Water, Washing, DC. (<https://www3.epa.gov/npdes/pubs/faclagon.pdf>)

ATTACHMENTS

Include:

1. Location/Vicinity Maps
2. Existing Site Plan (with utilities)
3. Proposed/Conceptual Site Plan
4. GIS Shape Files of areas of concern (T&E/Heritage/Private Property/etc.)
5. Photos (to show existing condition of structures, pavement, etc.)

[Appendix A](#) – Forest Location Map

[Appendix B](#) – Project Location Map

[Appendix C](#) – Existing Site Plan

[Appendix D](#) – Proposed Site Plan – Lagoon System

[Appendix E](#) – Palisades Water System

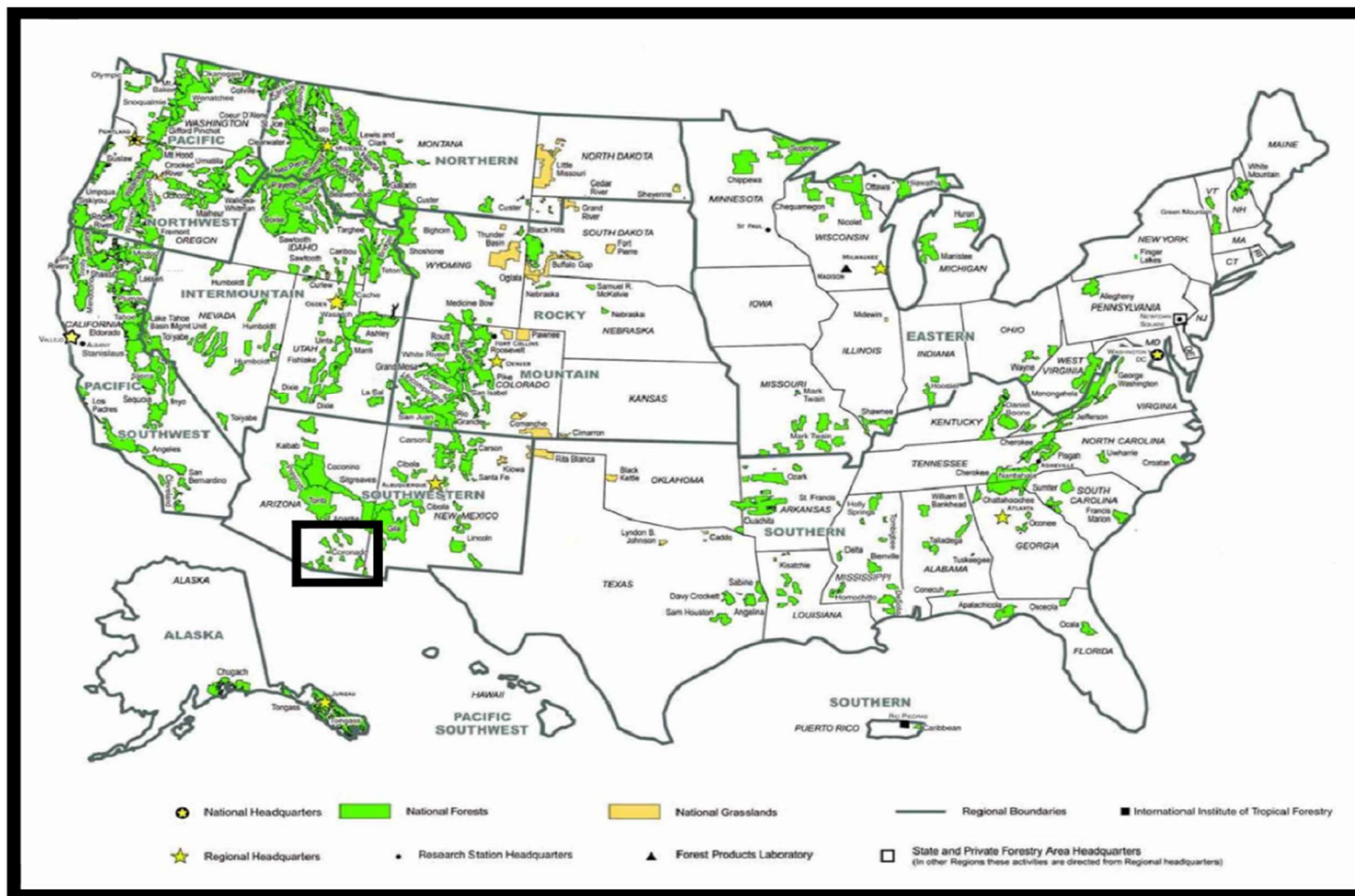
[Appendix F](#) – Average Daily Design Flow, Calculation

[Appendix G](#) – Photographs

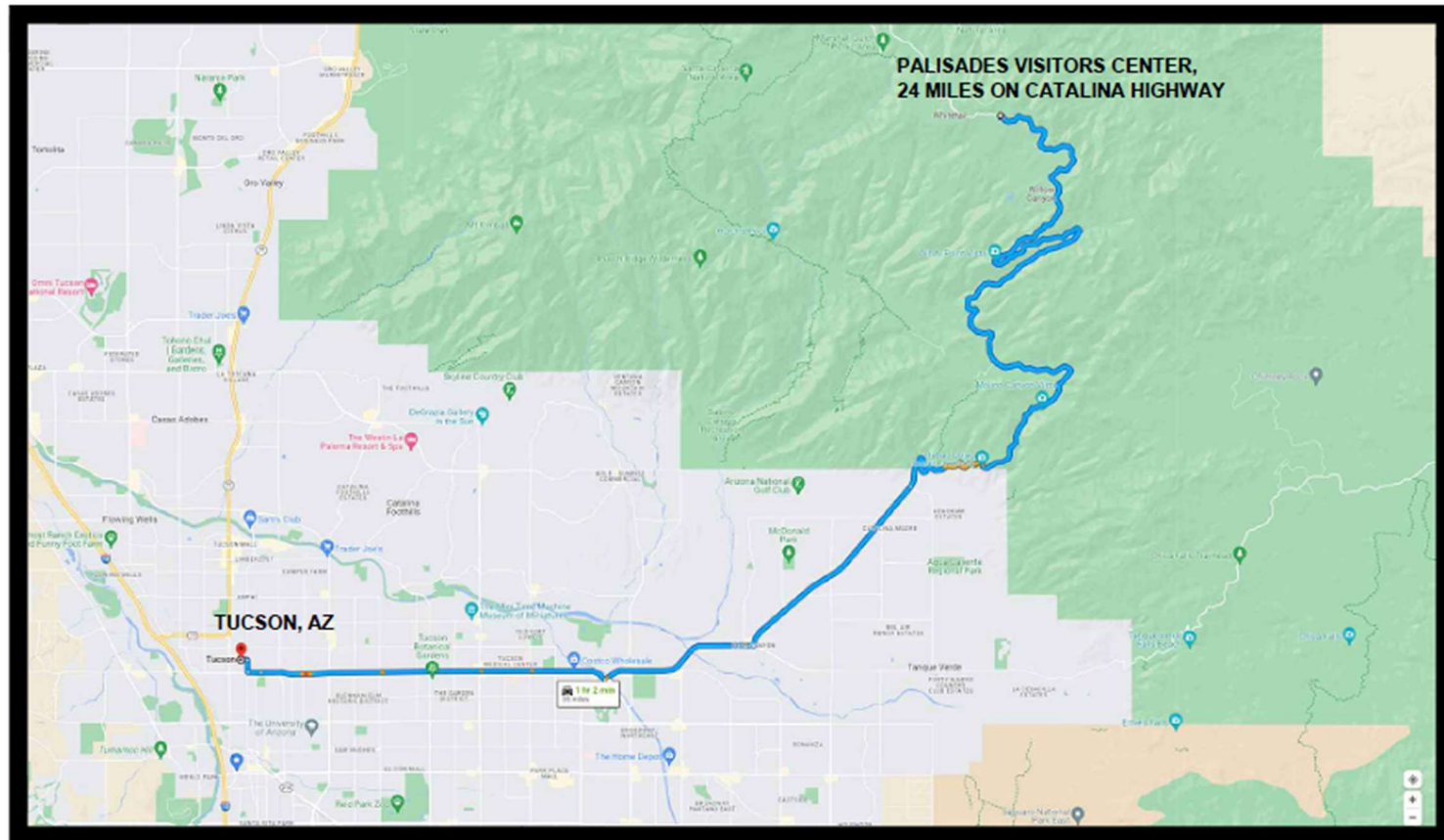
[Appendix H](#) – Market Research – Potable Water Tank Assessment Cost Estimates

[Appendix I](#) – Type 1.09 General Aquifer Protection Permit (APP)

Appendix A – Forest Location Map

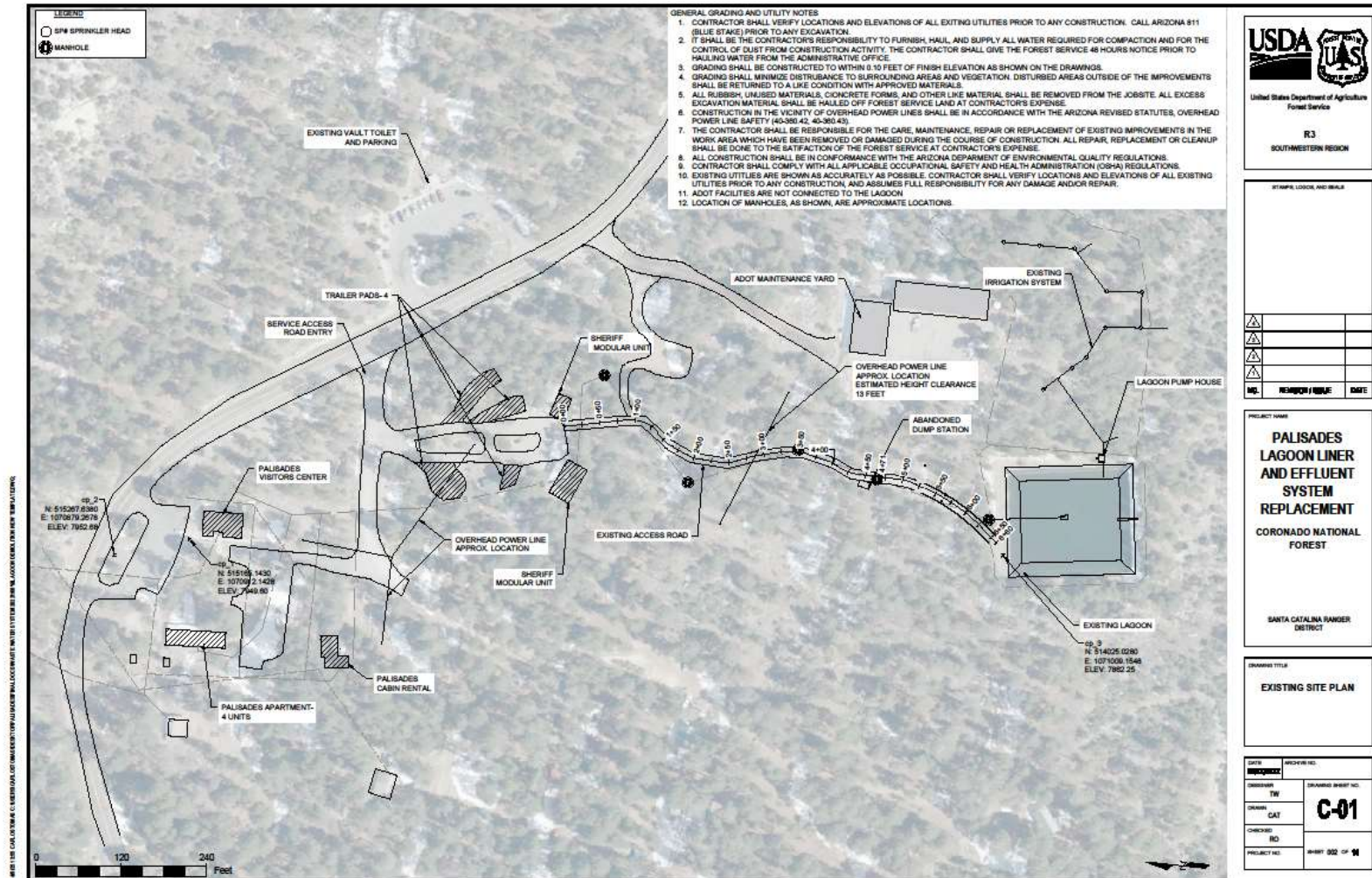


Appendix B – Project Location Map



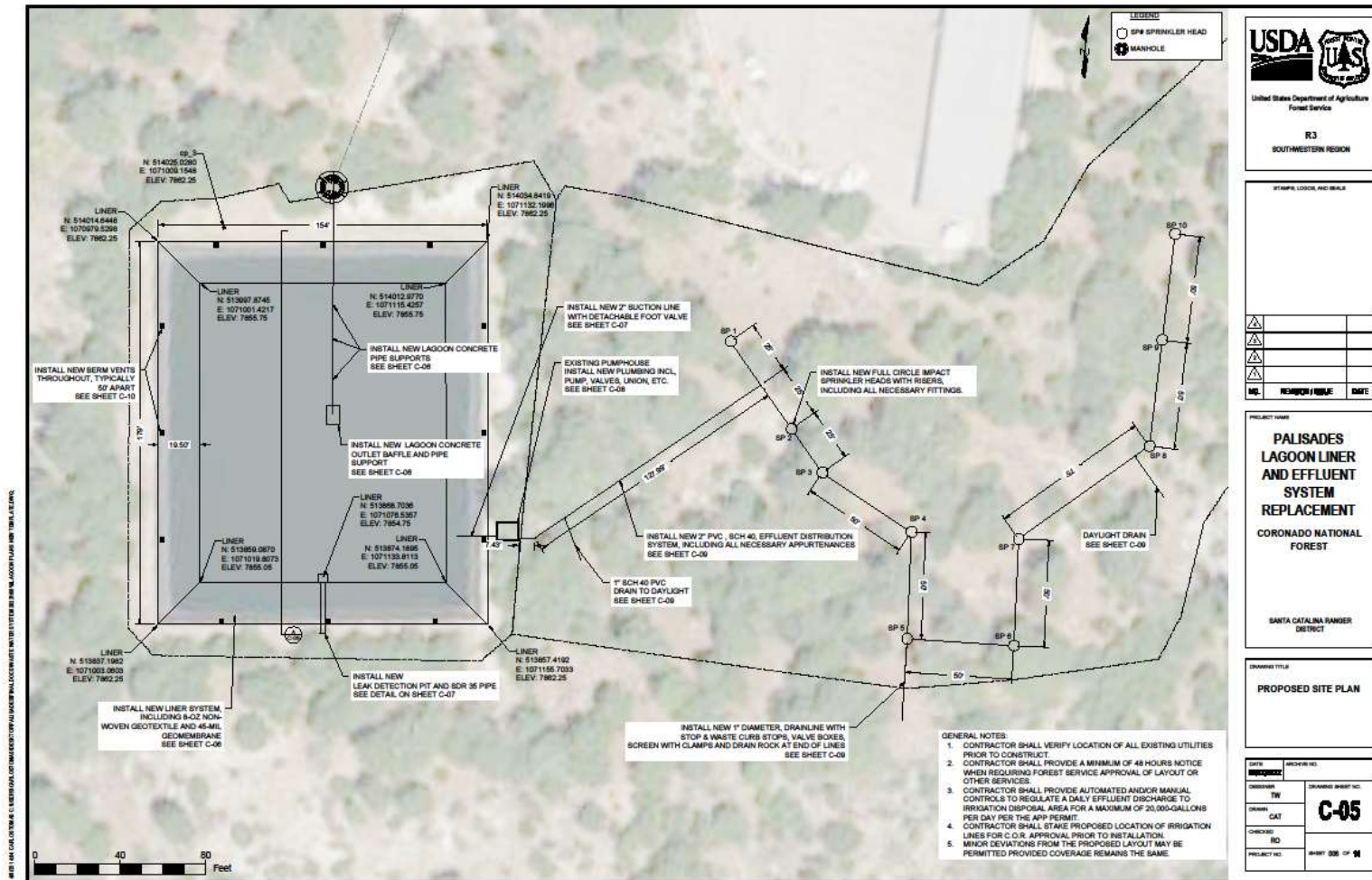
PROJECT LOCATION MAP

Appendix C – Existing Site Plan



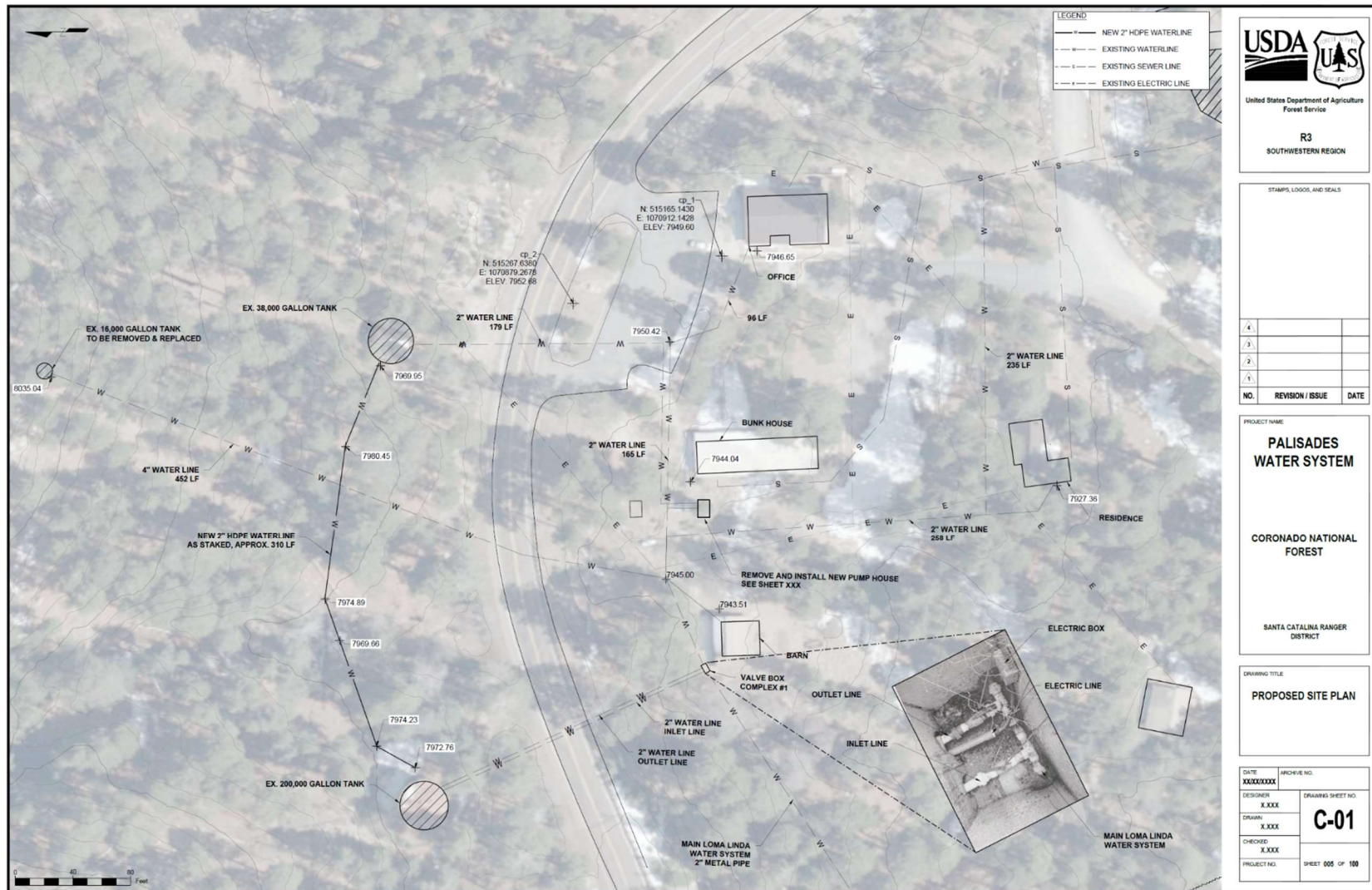
Existing Site Plan

Appendix D – Proposed Site Plan – Lagoon System



Proposed Site Plan – Lagoon System

Appendix E – Palisades Water System



Palisades Water System

Appendix F: FSH 7409.11, Chapter 40, Average Daily Design Flow

The Average Daily Design Flow:

- a) 10 parking spaces = $3.5 \times 10 = 35$ PAOT
 - a. Assuming 5 gpd/person (day use)
 $35 \text{ persons} \times 5 \text{ gpd/person} = \underline{175 \text{ gpd}}$
- b) 1 Visitor Center (office) = 15-25 gpd/person
 - a. Assume 4 permanent employees (office) + 4 seasonal employees (office)
= 8 persons-at-one-time (PAOT)
= 8 persons $\times$ 25 gpd/person = 200 gpd
 - b. Seasonal Use: Assume 4 permanent employees (office)
= 4 persons-at-one-time (PAOT)
= 4 persons $\times$ 25 gpd/person = 100 gpd
- c) House Trailers (Modulars) = 50-75 gpd/person $\times$ 2 = 100 to 150 gpd/person
 - a. Assuming 4 Persons (PAOT) per modular
 $2 \text{ modulars} \times 4 \text{ PAOT/modular} = 8 \text{ PAOT}$
 $8 \text{ persons} \times 150 \text{ gpd/person} = \underline{1,200 \text{ gpd}}$
- d) Bunkhouse, Barracks (with kitchen) = 65 gpd/person
 - a. Assume 2 persons per apartment = 65 gpd/person $\times$ 4 apartments $\times$ 2 persons/apartment = $65 \times 4 \times 2 = \underline{520 \text{ gpd}}$ OR
 - b. Assume 2 PAOT/apartment
 $4 \text{ apartments} \times 2 \text{ PAOT/apartment} = 8 \text{ PAOT}$
 - c. Seasonal – not occupied → no water usage
- e) Trailer pads (w/ water and sewer connection) = 50 gpd/person
 - a. 4 persons $\times$ 50 gpd/person = 200 gpd
 - b. 0 persons during seasonal period.

Calculation of Avg Daily Design Flow during **normal** operating period (non-seasonal):

1. Visitors = 175 gpd
2. Visitor Center = 200 gpd
3. Modulars = 1,200 gpd
4. Apartments (Barracks) = 520 gpd
5. Trailer Pads = 200 gpd

Total = 2,295 gallons per day

Calculation of Avg Daily Design Flow during **seasonal** operating period:

1. Visitors = 175 gpd
2. Visitor Center = 100 gpd
3. Modulares = 1,200 gpd
4. Apartments (Barracks) = 0 gpd (no use)
5. Trailer Pads = 0 gpd (no use)

Total = 1,475 gallons per day

The average daily design flow during seasonal operating period shows lower flows and would be recommended to schedule the work to be done during this time. This would provide lower costs and impact fewer employees.

Appendix G - Photographs



Palisades Administrative Site Lagoon (taken 9/12/2024)



Eroded Service Access Road with Exposed Culvert & Erosion
(taken 9/12/2024)

Appendix G – Photographs (Continued)



Palisades Lagoon Pumphouse



Vegetation along banks of Lagoon

Appendix H: Market Research – Potable Water Tank Assessment Estimates

NAMP folder will have the details of the cost estimates.

Company Name	Date of Quote	Quote Estimate
Arizona Commercial Diving Services, Inc	1/16/2025	Dive Team, daily rate = \$6800 (cleaning & inspection) <u>Lead Paint Testing = \$Cost + 10%</u> Total = \$7,500
Mountain West Tank Resources	12/9/2024	*ROV inspection will not be able to provide thickness of steel tank. Cleaning & inspection/lead paint Total Estimate Fee = \$3,000
Rubicon Applied Divers	1/13/2025	Cleaning & Inspection = \$3,850 12 UT Readings = \$ 750 <u>Lead Paint Sample = \$ 150</u> Total = \$4,750



Janet Napolitano
Governor

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

1110 West Washington Street Phoenix, Arizona 85007
(602) 721-2300 www.azdeq.gov



Stephen A. Owens
Director

September 26, 2007

Steve Hensel, Water Systems Supervisor
Santa Catalina Ranger District
5700 N. Sabino Canyon Road
Tucson, Arizona 85750

**Re: Coronado National Forest - Palisades Ranger Station
Reclaimed Wastewater Reuse Permit #R101682 Closure
General Aquifer Protection Permit coverage for spray disposal of effluent**

Dear Mr. Hensel:

The Arizona Department of Environmental Quality issued a reclaimed wastewater reuse permit to the USDA Forest Service, Coronado National Forest for the Palisades Ranger Station on April 6, 1998. As per Arizona Administrative Code (AAC) Title 18, Chapter 9, Article 7, reuse permits expire five years after permit signature. The Department has not received an application to renew the reuse permit. The official closure date of the reuse permit is considered to be April 6, 2003.

However, the new rules which were promulgated in January, 2001, have a more narrow definition of reuse than the previous rules. Reuse must now be considered "beneficial", as in landscape irrigation, agricultural irrigation, or some other use which has the effect of saving potable water resources. The spraying of effluent over the enclosed naturally-vegetated area which occurs at the Palisades Ranger Station during wet years when the pond is at risk of overtopping, is now considered disposal, and not beneficial reuse. Therefore, it falls within the regulatory purview of AAC R18-9-B301.1 for a Type 1.09 general Aquifer Protection Permit (APP) as long as you continue to comply with the following:

1. The total flow rate of wastewater treated in the wastewater treatment plant does not exceed 20,000 gallons per day;
2. The disposal area continues to remain fenced to preclude access by the public;
3. Operation of this facility does not cause or contribute to a violation of an aquifer water quality standard;
4. The wastewater treatment facility only treats typical sewage;
5. The wastewater treatment facility may not treat flows from commercial operations using hazardous substances or creating hazardous wastes, as defined in A.R.S. § 49-921(S);
6. The discharge from the facility does not create any environmental nuisance condition listed in A.R.S. § 141; or

Northern Regional Office
1801 W. Route 66, Suite 117 Flagstaff, AZ 86001
(928) 779-0313

Southern Regional Office
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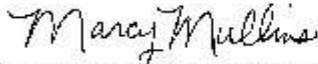
Steve Heusel
September 26, 2007
Page 2

7. The treatment or disposal characteristics of the original facility are not altered, except as allowed under AAC R18-9-A309(A)(9)(a).

The determination for this facility to operate under the terms of the wastewater general APP does not affect or modify in any way the obligations or liability of any person for any damages, injury, or loss resulting from a discharge. The Department may modify or withdraw its determination if the information relied upon is inaccurate or new information becomes available. If, at any time, the Department determines that the terms and conditions of the general permit have been violated or discharge from the wastewater treatment facility or disposal site have caused or contributed to the violation of an aquifer water quality standard, the Director may revoke the general permit authorization. This letter is not intended to waive any other federal, state, or local laws, codes, or ordinances.

The ADEQ Water Quality Compliance Section and the ADEQ Southern Regional Office will be notified of this determination. Please keep this letter on file for reference purposes. If you have any questions pertaining to this general permit authorization or otherwise need assistance, please feel free to contact me at (602) 771-4464.

Sincerely,



Marcy Mullins, APP and Reuse Project Manager
APP and Reuse Unit

cc: Asif Mejeed, Supervisor, APP and Reuse Unit, ADEQ
Lynne Dekarske, Environmental Program Specialist, Groundwater Section, ADEQ
Robert Casey, Manager - Water Quality Compliance Section, Enforcement Unit, ADEQ
Matthew Hodge, Manager - Water Quality Compliance Section, Data Unit, ADEQ
Martin McCarthy, P.E., Regional Compliance Manager - Southern Regional Office, ADEQ
Bob Wallin, Field Inspector - Southern Regional Office, ADEQ
Pima Association of Governments
Pima County Department of Environmental Quality

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