

Aquifer Protection Permit 105478
Place ID #21739, LTF #60870
SIGNIFICANT AMENDMENT
North Regional Wastewater Treatment Plant

The Arizona Department of Environmental Quality (ADEQ) proposes to issue an Aquifer Protection Permit for the subject facility that covers the life of the facility, including operational, closure, and post-closure periods unless suspended or revoked pursuant to A.A.C. R18-9-A213. This document gives pertinent information concerning the issuance of the permit. The requirements contained in this permit will allow the permittee to comply with the two key requirements of the Aquifer Protection Program: 1) meet Aquifer Water Quality Standards at the Point of Compliance; and 2) demonstrate Best Available Demonstrated Control Technology (BADCT). The purpose of BADCT is to employ engineering controls, processes, operating methods or other alternatives, including site-specific characteristics (i.e., local subsurface geology) to reduce discharge of pollutants to the greatest degree achievable before they reach the aquifer, or to keep pollutants from reaching the aquifer.

I. FACILITY INFORMATION

Name and Location

Name of Permittee:	Lake Havasu City
Mailing Address:	7001 Whelan Drive Lake Havasu City, Arizona 86406
Facility Name and Location:	Lake Havasu City - North Regional Wastewater Treatment Plant 1150 McCulloch Boulevard North Lake Havasu City, Arizona 86403 Mohave County

Regulatory Status

This is an existing facility. An application for this significant permit amendment was received on July 15, 2014. The purpose of this amendment is to eliminate monitoring of non-POC wells and Groundwater Conduit Wells and to Remove (Vadose Zone Injection Wells) VW-3 and replace with VW-5. At the time of permit issuance, there are no active Notices of Violation (NOVs).

Amendment Type	Effective date	Amendment Item
Individual Aquifer Protection	October 11, 2006	Individual Aquifer Protection Permit (APP) No. 105478
Other Amendment	October 10, 2008	Other Amendment No. 105478
Significant Amendment	April 22, 2011	Significant Amendment (APP) No. 105478
Other Amendment	April 28, 2014	Other Amendment No. 105478

Facility Description

The permittee is authorized to operate the North Regional Wastewater Treatment Plant (WWTP) with a design flow of 3.5 million gallons per day (mgd). The WWTP process consists of a headworks with influent screens, an equalization basin, aeration basins, membrane filtration basins, an ultraviolet (UV) disinfection system, and a sludge holding tank. The facility provides chemical feed treatment, when necessary, to meet the turbidity standards for Class A+ reclaimed water for beneficial purposes according to the Lake Havasu City Class A+ Reclaimed Water Agent Permit (Permit # R-101612) in accordance with A.A.C. R18-11-3.

Effluent from North Regional WWTP may be beneficially reused under a valid reclaimed water permit, or recharged to groundwater at one or more recharge facilities connected through the Lake Havasu City Recharge System. Permitted recharge facilities served by the Lake Havasu City Recharge System are located at the Mulberry WWTP (recharge wells permitted in APP No. P-101612), the Island WWTP (recharge basins permitted in APP No. P-101611), the North Regional WWTP (recharge wells permitted in APP No. P-105478) and the South Well Field Recharge Site (APP No. P-105653). All of the WWTPs connected to the Lake Havasu City Recharge System meet the Best Available Demonstrated Control Technology (BADCT) requirements for new facilities. All sludge, including screenings, grit and scum, shall be hauled off-site for disposal in accordance with State and Federal regulations.

Regardless of the source, recharge in the vadose zone wells at the North Regional WWTP is restricted to 3.5 mgd of effluent. Recharge through the vadose zone wells at the North Regional WWTP may also be restricted by a contingency action as per Section 2.6.1.2.

The site includes the following permitted discharging facilities:

Facility	Latitude	Longitude	ADWR Registration Number	Screened Interval (feet bgs)
North Regional WWTP	34° 33' 28" N	114° 20' 21" W	N/A ¹	N/A
Groundwater Conduit Wells²				
NP-7	34° 33' 23" N	114° 20' 22" W	55-217497	335-435
NP-8	34° 33' 21" N	114° 20' 27" W	55-217495	375-475
NP-9	34° 33' 19" N	114° 20' 21" W	55-217496	375-475
Installed Vadose Zone Injection Wells³				
VW-1	34° 33' 22.10" N	114° 20' 14.30" W	55-215758	61-179
VW-2	34° 33' 23.63" N	114° 20' 23.38" W	55-217792	79-177

¹ N/A = Not Applicable.

² Groundwater Conduit Wells listed in this permit consist of wells constructed with gravel packing from 25 feet bgs to the bottom of each well (no monitoring required under this permit).

³ Installed Vadose Zone Injection Wells consist of the existing vadose zone wells at this site, which inject effluent under pressure into the vadose zone.

Facility	Latitude	Longitude	ADWR Registration Number	Screened Interval (feet bgs)
VW-4	34° 33' 22.59" N	114° 20' 24.52" W	55-217791	79-177
VW-5	34° 33' 21" N	114° 20' 20" W	55-222579	79-179
VW-7	34° 33' 23" N	114° 20' 18" W	55-224756	79-179
Approved Vadose Zone Injection Wells⁴				
VW-6	34° 33' 23" N	114° 20' 21" W	N/A	N/A
VW-8	34° 33' 21" N	114° 20' 21" W	N/A	N/A
VW-9	34° 33' 22" N	114° 20' 21" W	N/A	N/A
VW-10	34° 33' 24" N	114° 20' 20" W	N/A	N/A
VW-11	34° 33' 24" N	114° 20' 24" W	N/A	N/A
VW-12	34° 33' 23" N	114° 20' 16" W	N/A	N/A
VW-13	34° 33' 24" N	114° 20' 26" W	N/A	N/A
VW-14	34° 33' 20" N	114° 20' 20" W	N/A	N/A
VW-15	34° 33' 20" N	114° 20' 22" W	N/A	N/A
VW-16	34° 33' 20" N	114° 20' 27" W	N/A	N/A
Contingency Vadose Zone Injection Wells⁵				
VW-17	34° 33' 24" N	114° 20' 22" W	N/A	N/A
VW-18	34° 33' 25" N	114° 20' 26" W	N/A	N/A
VW-19	34° 33' 22" N	114° 20' 22" W	N/A	N/A
VW-20	34° 33' 20" N	114° 20' 23" W	N/A	N/A
VW-21	34° 33' 24" N	114° 20' 16" W	N/A	N/A
VW-22	34° 33' 20" N	114° 20' 18" W	N/A	N/A
VW-23	34° 33' 20" N	114° 20' 20" W	N/A	N/A
VW-24	34° 33' 22" N	114° 20' 22" W	N/A	N/A
VW-25	34° 33' 24" N	114° 20' 18" W	N/A	N/A
VW-26	34° 33' 26" N	114° 20' 27" W	N/A	N/A
VW-27	34° 33' 27" N	114° 20' 29" W	N/A	N/A
VW-28	34° 33' 29" N	114° 20' 30" W	N/A	N/A
VW-29	34° 33' 30" N	114° 20' 30" W	N/A	N/A
VW-30	34° 33' 31" N	114° 20' 31" W	N/A	N/A
VW-31	34° 33' 31" N	114° 20' 29" W	N/A	N/A
VW-32	34° 33' 30" N	114° 20' 28" W	N/A	N/A

Injection Well Design

The Approved and Contingency vadose zone injection wells shall be constructed as 48 inch diameter wells, with 12 inch diameter casings. Each well shall extend no deeper than 180 feet bgs, and the screened interval shall extend from approximately 80 feet bgs to the bottom of the well.

Amendment Description

⁴ Approved Vadose Zone Injection Wells consist of vadose zone wells approved for installation. The total recharge volume of these wells is restricted to 3.5 mgd. These wells are part of the Lake Havasu City Recharge System.

⁵ Contingency Vadose Zone Injection Wells consist of wells approved for installation as replacement wells and/or to increase recharge in this well field up to 3.5 mgd.

The purpose of this significant amendment is to:

- Eliminate monitoring of non-POC wells and Groundwater Conduit Wells.
- Remove (Vadose Zone Injection Well) VW-3 and replace with VW-5.

Listed below are the changes to the permit as a result of this amendment:

1. Section 2.1, Facility/Site Description: Removed VW-3 and replaced with VW-5 as installed Vadose Zone Injection Wells. Move VW-7 from Approved to installed Vadose Zone Injection Wells
2. Section 3.0, Compliance Schedule: Undated the number sequence from 1 to 5 to 3.1 to 3.5.
3. Section 4.0, Tables of Monitoring Requirements: Under 4.2, Table IA-1, removed the requirement to monitor for Indicator Parameters/Major Cations and Anions from the Table.
4. Section 4.0, Tables of Monitoring Requirements: Under 4.2, Table II-A, removed the requirement to monitor for Indicator Parameters/Major Cations and Anions from the Table.
5. Section 4.0, Tables of Monitoring Requirements: Under 4.2, Table II-B, removed the requirement to monitor for Indicator Parameters/Major Cations and Anions from the Table.
6. Section 4.0, Tables of Monitoring Requirements: Under 4.2, Table II-C, removed the requirement to monitor for Indicator Parameters/Major Cations and Anions from the Table.
7. Other changes include updating the permit language to conform to the most current permit format.

II. BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT)

North Regional WWTP is designed to meet the treatment performance criteria for new facilities as specified in A.A.C. R18-9-B204. The facility will meet the requirements for pretreatment by conducting monitoring as per A.A.C. R18-9-B204 (A)(6)(b)(iii).

All industrial hookups and other non-residential hookups to the treatment system will be authorized according to the applicable federal, state or local regulations.

III. HYDROGEOLOGIC SETTING

Lake Havasu City is located adjacent to Lake Havasu on the Colorado River, in the Chemehuevi Valley, located within the Basin and Range Physiographic Province. Most of Lake Havasu City is located above alluvium, both alluvial fan and Colorado River deposits, along the east bank of the Colorado River and Lake Havasu

Most of the groundwater within the basin flows west-southwest towards the Colorado River, where it then begins to parallel the river. Flows near the river can be strongly influenced by surface water flows and groundwater pumping. Local groundwater flows near the river may be eastward or northward due to the influence of surface water migrating into the groundwater and groundwater pumping. Depths to groundwater vary from less than 10 feet below ground surface (feet bgs) near

the lake boundary (with a connection to surface water flow) to nearly 500 feet bgs toward the mountain front.

Based on the ADWR database, there are approximately 49 wells located within one mile of the North Regional WWTP. The wells have been constructed for domestic, irrigation, industrial, commercial, drinking, and monitoring uses. The closest wells to the North Regional WWTP are four vadose zone recharge wells and thirteen monitoring wells.

Five groundwater monitoring wells (NP-1, NP-2, NP-3, NP-12, and NP-13) were installed as point of compliance (POC) wells to monitor potential groundwater impacts by operations at the North Regional WWTP.

Eight additional wells (NP-4, NP-5, NP-6, NP-7, NP-8, NP-9, NP-10 and NP-11) were installed to monitor aquifer conditions during recharge operations. However, monitor wells NP-7, NP-8, and NP-9 may be acting as conduit wells. These wells are called conduit wells because effluent injected at the vadose zone injection wells, and moving laterally within the vadose zone, can intersect the gravel pack of these three monitoring wells, which extends upward to within 25 feet of the ground surface, then migrate down through the gravel pack as a conduit to the aquifer.

Due to the unexpected complexity observed in the subsurface geology and the presence of the conduit wells, groundwater levels have risen much faster than originally expected. The suspected lateral movement of injected water within the vadose zone has not yet impacted NP-4, NP-5, NP-6, NP-10, NP-12, and NP-13.

Based on continued investigations at the North Regional WWTP, a volcanic unit has been found that limits the suitable locations for additional vadose zone injection wells. The location of the volcanic unit is primarily in the northeast portion of the facility. The proposed locations for additional vadose zone injection wells are primarily located on the south, southeast and west portions of the property.

When vadose zone injection began in December 2008, the water level in NP-7, located in immediate proximity to three of the four vadose zone injection wells, immediately rose approximately 200 ft. In total, the water level in NP-7 has risen approximately 230 feet. In NP-8 and NP-9, located approximately 398 feet and 334 feet, respectively, from NP-7, water levels have also risen, but after a longer period of time. Water levels have risen approximately 140 feet in NP-8, and approximately 200 feet in NP-9. Water levels have also risen in monitoring well NP-5 (approximately 45 feet) and in the POC well NP-2 (approximately 25 feet).

Due to the water level rises that have been observed during injection activities, two additional POC wells have been installed (NP-12 and NP-13). Once water levels rise 100 feet in the POC wells, additional down-gradient non-hazardous POC well locations will be evaluated to monitor the potential impacts of the injection to the uppermost aquifer. Water level rises that propagate away from the site could potentially create adverse impacts on the aquifer. Potential impacts include increases of nitrate concentration when water levels rise into vadose zone soils containing elevated levels of nitrate.

In addition to the information obtained from the groundwater elevation data, chemical data, including nitrate concentrations and changes in cation and anion data, show changes in

concentration that indicate that the groundwater mound has expanded beyond the boundaries of the wastewater treatment plant site. Cation and anion data presented in a Piper Tri-linear Diagram show a change in cation chemistry between samples collected in POC Well NP-3 before recharge began and samples collected in the same well after recharge began. Nitrate concentrations in groundwater wells also rose after recharge began.

The data that is to be collected from the POC wells, non-POC monitoring wells, conduit wells and vadose zone recharge wells will help to determine the potential impact of recharge to the aquifer, and help to protect current and future uses of the aquifer.

Up to 32 vadose zone recharge wells may be installed at North Regional WWTP to recharge effluent. Vadose zone injection wells were chosen as a recharge method based on sub-surface hydrogeology. The vadose zone injection wells are to be perforated in a zone located above the water table that is believed to have sufficient permeability to recharge 3.5 mgd of effluent.

The pollutant management area (PMA) incorporates the North Regional WWTP, the five vadose zone injection wells currently installed, and 27 additional proposed and contingency vadose zone injection well sites.

The extent of the discharge impact area (DIA) was determined by numerical groundwater modeling and particle tracking. It was assumed that effluent recharged to the vadose zone would immediately impact groundwater. The model determined the extent of a theoretical particle of pollution's movement over twenty years. The groundwater model also predicted a large, regional groundwater mound, rising approximately 50 feet in an area extending approximately 2 miles from the North Regional WWTP.

IV. STORM WATER/SURFACE WATER CONSIDERATIONS

Stormwater/surface water considerations for North Regional WWTP included whether the facility was located within the 100-year floodplain, and whether the discharge had the potential to impact surface water drainages located downstream of the WWTP and the vadose zone injection wells.

Lake Havasu City is located within the Colorado River surface water basin. The North Regional WWTP site is located immediately upstream of the confluence of the ephemeral Wing Mine Wash and the ephemeral Desert Wash. These washes convey storm water westward from the Mohave Mountains located on the east side of the Chemehuevi Valley to Lake Havasu Reservoir on the Colorado River. Flows are only observed during significant rainfall events.

The Flood Hazard Boundary Map for Lake Havasu City was rescinded by the Federal Emergency Management Agency (FEMA) in 1981, because water levels within Lake Havasu were brought under control through the operation of Parker Dam. However, site specific data has been used to determine that a portion of the North Regional WWTP site is located in Zone C, and the rest of the site is located in Zone A1. Based on this information, the portion of the site mapped as Zone A1 has the potential to be adversely impacted by a 100-year storm event.

V. COMPLIANCE WITH AQUIFER WATER QUALITY STANDARDS

Monitoring and Reporting Requirements

To ensure that site operations do not violate Aquifer Water Quality Standards at the point of compliance, representative samples of the effluent shall be collected downstream of the UV channel. The permittee will monitor the effluent daily for *E. coli*, monthly for total nitrogen, quarterly for metals, and semi-annually for VOCs (see Section 4.2, Tables IA, in the permit).

To ensure that site operations do not violate the Reclaimed Water Quality Standards for the beneficial use of Class A+ reclaimed water, the permittee will monitor the reclaimed water at the same effluent sampling point as indicated above. The permittee will monitor the reclaimed water daily for *E. coli* and turbidity, monthly for total nitrogen, and on a suspended/monthly basis for enteric virus (see Section 4.2, Table IB, in the permit). The permittee will monitor the Groundwater at the POC wells monthly for total nitrogen, quarterly for metals, and semi-annually for VOCs (see Section 4.2, Tables IIA, in the permit).

Facility inspection and operational monitoring will be performed on a routine basis (see Section 4.2, Table III, in the permit).

Vadose Zone Injection Well Monitoring

The permittee will monitor the Vadose Injection Wells for depth to groundwater monthly, recharge flow monitored daily, calculated monthly and reported quarterly.

Point of Compliance (POC)

The Points of Compliance (POC) is designated at the following location:

POC No.	Well Name	POC Location	Latitude	Longitude	Well Purpose
1	NP-1	Approximately 1,016 feet northwest of Vadose Zone Injection Well VW-2	34° 33' 32.4" N	114° 20' 30.2" N	Hazardous/Non-Hazardous POC
2	NP-2a	Approximately 1,066 feet west-southwest of Vadose Zone Injection Well VW-4	34° 33' 21.1" N	114° 20' 37.2" N	Hazardous/Non-Hazardous POC
3	NP-3	Approximately 601 feet northwest of Vadose Zone Injection Well VW-2	34° 33' 27.9" N	114° 20' 9.7" N	Hazardous/Non-Hazardous POC
4	NP-12	Approximately 814 feet south-southeast of POC Well NP-2	34° 33' 13.9" N	114° 20' 32.6" N	Non-Hazardous POC

POC No.	Well Name	POC Location	Latitude	Longitude	Well Purpose
5	NP-13	Approximately 955 feet southwest of POC Well NP-2	34° 33' 13.7" N	114° 20' 43.6" N	Non-Hazardous POC

Groundwater monitoring is required at the POC wells as per Section 4.2, Table IIA. The Director may amend this permit to designate additional points of compliance if information on groundwater gradients or groundwater usage indicates the need.

Non-Point of Compliance (POC)

The five (5) non-POC monitoring wells shown below provided a better understanding of the hydrogeology of the area, and the operational performance of the North Regional WWTP vadose zone injection wells. The non-POC monitoring wells are located as follows:

Well Name	Descriptive Location	Latitude	Longitude
NP-4	Approximately 1,320 feet west of the west site boundary	34° 33' 29.42" N	114° 20' 39.64" W
NP-5	Approximately 924 feet south of the south site boundary	34° 33' 15.90" N	114° 20' 21.74" W
NP-6	Approximately 2,772 feet west of the southwest corner of the site	34° 33' 21.07" N	114° 20' 54.54" W
NP-10	Approximately 879 feet east-northeast of Groundwater Conduit Well NP-9	34° 33' 17.2" N	114° 20' 19.7" W
NP-11	Approximately 418 feet east of Groundwater Conduit Well NP-9	34° 33' 22.5" N	114° 20' 14.3" W

Groundwater monitoring is not required at the non-POC monitoring wells.

VI. COMPLIANCE SCHEDULE

No.	Description	Due by:	Permit Amendment Required?
Vadose Zone Injection Well Installation			
3.1	The permittee shall construct the Approved Vadose Zone Wells as needed. After construction of each well, the permittee shall submit a report that includes latitude and longitude, ADWR 55-Series registration number, well construction details, and initial depth to water. If multiple wells are installed, then a single construction report may be submitted containing information on multiple wells.	Each construction report shall be submitted within 90 days after completion of well construction.	No
Annual Groundwater Monitoring Report			

3.2	The permittee shall submit an annual groundwater monitoring report that will provide monthly groundwater contour maps, all analytical data, evaluation of anions and cations via Piper tri-linear diagrams and Stiff diagrams, hydrographs, a well survey based on ADWR records to discover any new wells that have been installed within the DIA, an evaluation of the appropriateness of the POC locations and whether new POCs are needed, and an evaluation of the actual water levels versus modeled water levels to determine the accuracy of the groundwater flow model and its predictions. The annual groundwater report shall evaluate the amount of water level rise during the year.	Within 360 days after the date of permit issuance, and annually thereafter.	No
3.3	If water levels rise 100 feet in the POC wells, and the elevated water levels persist for 90 days after the end of the typical recharge season (October 1 to April 30), then as per Section 2.6.1.3, the permittee shall submit an APP amendment application with a work plan that proposes locations and construction details for one or more new POCs further downgradient of the injection site.	If high water levels persist during a given year, then the APP amendment application shall be submitted by September 1 of that year.	Yes
Rehabilitation of Vadose Zone Wells			
3.4	Vadose zone wells may be rehabilitated prior to being placed back into service. As per Section 2.6.1.2, the permittee shall provide a rehabilitation report to the ADEQ Water Quality Compliance Section, Data Unit, and the ADEQ Water Permits Section each time a well is rehabilitated, including flow data, methods of rehabilitation, the quantity and quality of any chemicals involved in rehabilitation, a description of the actions and repeat actions taken, and the period of time required to complete the rehabilitation. ADEQ approval of the rehabilitation report is not required before the well is placed back in service.	Within 30 days after completion of well rehabilitation.	No
3.5	As per Section 2.6.1.2, the permittee shall submit a report describing the percolation capacity of a rehabilitated well, the new water levels involved, and an estimation of the remaining lifespan of the well.	Within 60 days after completion of well rehabilitation.	No

VII. OTHER REQUIREMENTS FOR ISSUING THIS PERMIT

Technical Capability

Lake Havasu City has demonstrated the technical competence necessary to carry out the terms and conditions of the permit in accordance with A.R.S. § 49-243(N) and A.A.C. R18-9-A202 (B).

The permit requires that appropriate documents be sealed by an Arizona-registered geologist or professional engineer. This requirement is a part of an on-going demonstration of technical capability. The permittee is expected to maintain technical capability throughout the life of the facility.

Financial Capability

Lake Havasu City has demonstrated the financial responsibility necessary to carry out the terms and conditions of the permit in accordance with A.R.S. § 49-243(N) and A.A.C. R18-9-A203(C)(1). The estimated dollar amount demonstrated for financial capability is \$925,000.00. The financial capability was demonstrated through a letter from the chief financial officer and a statement specifying the details of the financial arrangements used to meet the estimated closure and post-closure costs as per A.A.C. R18-9-A203 (B)(1)and(2). The permittee is expected to maintain financial capability throughout the life of the facility.

Zoning Requirements

North Regional WWTP has been properly zoned for the permitted use, and the permittee has complied with applicable zoning ordinances in accordance with A.R.S. § 49-243(O) and A.A.C. R18-9-A201(B)(3).

VIII. ADMINISTRATIVE INFORMATION

Public Notice (A.A.C. R18-9-108(A))

The public notice is the vehicle for informing all interested parties and members of the general public of the contents of a draft permit or other significant action with respect to a permit or application. The aquifer protection program rules require that permits be public noticed in a newspaper of general circulation within the area affected by the facility or activity and provide a minimum of 30 calendar days for interested parties to respond in writing to ADEQ. The basic intent of this requirement is to ensure that all interested parties have an opportunity to comment on significant actions of the permitting agency with respect to a permit application or permit.

The public notice was published in the XXXXXXXX on XXXXXXXXXX, under public notice No. 15-.

Public Comment Period (A.A.C. R18-9-109(A))

The Department shall accept written comments from the public before a significant permit amendment is made. The written public comment period begins on the publication date of the public notice and extends for 30 calendar days. After the closing of the public comment period, ADEQ is required to respond to all significant comments at the time a final permit decision is reached or at the same time a final permit is actually issued.

Public Hearing (A.A.C R18-9-109(B))

A public hearing may be requested in writing by any interested party. The request should state the nature of the issues proposed to be raised during the hearing. A public hearing will be held if the Director determines there is a significant amount of interest expressed during the 30-day public comment period, or if significant new issues arise that were not considered during the permitting process.

IX. ADDITIONAL INFORMATION

Additional information relating to this permit may be obtained from:

Arizona Department of Environmental Quality
Water Quality Division – Water Permits Section – APP Unit
Attn: Monica Phillips
1110 West Washington Street, Mail Code 5500E-3
Phoenix, Arizona 85007
Phone: (602) 771-2253

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