Case Nos. 24278, 24277, 24123, 23775, 23614-23617, and 24018-24027
OCD Exhibit No. 11A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 21 2014

MEMORANDUM

OFFICE OF WATER

SUBJECT: **Enhancing Coordination and Communication with States on Review and Approval of Aquifer Exemption Requests Under SDWA**

FROM: Peter Grevatt, Director
Office of Ground Water and Drinking Water (OGWDW)

TO: Water Division Directors Regions I – X

I. Introduction

More than four thousand aquifer exemptions have been approved over the history of the UIC program, and the vast majority of these have been straightforward actions that have been completed in a timely manner. There are some aquifer exemption decisions, however, where review of the aquifer exemption request has been considerably more complex, due to specific conditions associated with the proposed exemption. In some cases, these issues have led to protracted discussions between EPA and the states, without a clear path for resolution.

The purpose of this memorandum is to promote a consistent and predictable process for the review of Aquifer Exemption requests under the Safe Drinking Water Act (SDWA).[1] EPA has both a direct implementation role and a state partnership role in reviewing and approving aquifer exemption requests. Over the course of the past year, EPA has participated in discussions with a number of states through a Ground Water Protection Council (GWPC) workgroup to review issues associated with more complex aquifer exemption requests and to make recommendations on steps to improve the review process. Based on these discussions, EPA and the participating states agreed on a number of steps to enhance coordination and communication between EPA Regions and state UIC programs regarding proposed aquifer exemptions, as discussed below.

II. Roles and Responsibilities

EPA is responsible for the final review and approval of all aquifer exemption requests, based on the regulatory criteria in 40 CFR 146.4 [attached]. UIC permit applicants that need an aquifer exemption in order to conduct injection activities typically delineate the proposed exempted area and submit the delineation to the primacy agency, along with information to support a determination under 40 CFR 146.4 that the proposed exemption is appropriate. States or tribes with primacy review the application and, if the information submitted supports a determination that an aquifer exemption is warranted, make a designation, provide for public participation, and submit a request for approval of the exemption to the

[1] The substantive and procedural requirements for aquifer exemptions in connection with Class VI wells are not addressed in this memo.

appropriate EPA regional office. Primacy states and tribes are also responsible for issuing the UIC permit that goes with the aquifer exemption request and are the direct point of contact for the owners or operators requesting the permit and exemption. Where EPA directly implements the UIC program, the applicant submits the request directly to EPA, and EPA reviews the applicant's demonstrations and makes the final determination to approve or disapprove the exemption request.

If the aquifer exemption is a non-substantial program revision, the relevant EPA Region either responds by letter to the primacy state or tribe or, where EPA directly implements the program, to the applicant. If the aquifer exemption is a substantial program revision, notice of approval of the aquifer exemption is published in the *Federal Register* after EPA has provided public notice and an opportunity for public comment and a public hearing. Where EPA directly implements the UIC program, regional offices are also responsible for identifying and designating exempted aquifers or portions of aquifers at the request of a UIC permit applicant, issuing public notices, and issuing any related UIC permits following aquifer exemption approval. Regional Administrators are primarily responsible for approving/disapproving non-substantial aquifer exemption requests, and the Administrator is responsible for approving the request if the exemption is a substantial program revision.

III. Recommended Steps for Facilitating the Aquifer Exemption Review and Approval Process

As indicated above, most aquifer exemption requests have clearly met the regulatory criteria in 40 CFR 146.4, and reviews have been completed in a timely manner. There are some aquifer exemption requests, however, that have proven to be considerably more complex to review. These more complex aquifer exemption requests have not been limited to substantial program revisions; in some cases, non-substantial aquifer exemption requests have proved quite complex as well. Typically, these have involved situations where the proposed exempted area is located adjacent to an underground source of drinking water (USDW) that is currently in use, or where the potential future use of the USDW is unclear. The following steps are recommended to help facilitate the aquifer exemption review and approval process:

a. Each Region should adopt and share the attached aquifer exemption checklist with each of your states. OGWDW, in consultation with the Regions and states, developed the attached checklist to facilitate EPA's aquifer exemption review process and documentation. The checklist will help convey to states, tribes, and UIC permit applicants the typical information needed to facilitate EPA's review of an aquifer exemption request.

b. Regions should document their review and analysis of the information in the checklist in a Statement of Basis or decision memo that should be included in the Agency's record of its final action. The Statement of Basis should include explanations of the factual, technical, and legal bases for the determination. Information collected following the template of the checklist should inform the Statement of Basis.

c. In the case of aquifer exemption requests that are expected to be complex, EPA Regions are encouraged to schedule a discussion with the state UIC program managers as early in the process as possible. These discussions will serve to identify any potential technical issues that require additional attention even before the package has been submitted to EPA for review and approval.

d. Regional UIC program managers are encouraged to elevate significant disagreements on AE requests to senior primacy program managers rather than allowing them to persist at the staff level for extended periods of time. While HQ can offer assistance on specific Regional AE decisions, I anticipate that most technical issues can be resolved at the Regional level.

IV. Additional background for Approving and Documenting Aquifer Exemptions

The Safe Drinking Water Act (SDWA) directed EPA to establish an Underground Injection Control (UIC) program to prevent endangerment of Underground Sources of Drinking Water (Section 1421(b)(1)). EPA's regulatory approach to aquifer exemptions was promulgated in a 1980 rulemaking. EPA determined that without aquifer exemptions, certain types of energy production, solution mining, or waste disposal would be severely limited. Thus, the regulatory approach that EPA adopted—a broad definition of covered underground waters coupled with a discretionary exemption mechanism—allows the agency to prevent endangerment consistent with the statute while allowing some case-by-case consideration. This approach protects underground sources of drinking water while also allowing underground injection associated with industrial activities including the production of minerals, oil, or geothermal energy. EPA retains the final approval authority over aquifer exemption decisions regardless of state primacy status.

EPA must follow the regulatory criteria at 40 CFR 146.4 in making aquifer exemption determinations. For the EPA to approve an aquifer exemption, the Agency must first find that the state or, where EPA directly implements the UIC program, the applicant, has demonstrated that the aquifer or the portion of an aquifer identified by the state as exempt "does not currently serve as a source of drinking water" (40 CFR 146.4 (a)). EPA has determined that water that currently serves as a source of drinking water includes water that is being withdrawn in the present moment as well as water that will be withdrawn in the future by wells that are currently in existence. EPA's evaluation of this criterion ensures that water from the exempted area of the aquifer "does not currently serve as a source of drinking water" for nearby drinking water wells as required by 40 CFR 146.4(a).

The second exemption criterion requires EPA to determine either that the aquifer cannot now and will not in the future serve as a source of drinking water or that the total dissolved solids content of the ground water is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.[2] The regulations at 40 CFR 146.4(b) describe four (4) potential reasons for making the determination that the aquifer cannot now and will not in the future serve as a source of drinking water. One reason (146.4(b)(1)) is that the aquifer is mineral, hydrocarbon, or geothermal energy producing, or can be demonstrated as part of a permit application to contain minerals or hydrocarbons that are expected to be commercially producible. The other reasons relate to practicality of access to water. EPA is continuing discussions with the GWPC workgroup to better define and communicate the type of data and analyses used to support those determinations. EPA Regions will need to document all reasons and factors they considered in a Statement of Basis or decision memo when making the final aquifer exemption decision. As best management practice, EPA will continue to communicate to the states the importance of documenting aquifer exemption analyses and their decision making process.

Robust recordkeeping and management of decision memos and aquifer exemption data is critically important to support informed decisions related to public and private ground water uses for drinking water. Therefore, in addition to the decision memos and records underlying EPA's approval/disapproval

[2] EPA will fully address the criteria 146.4 (b) and 146.4(c) at a later time, after ongoing discussions with GWPC have concluded.

decisions, it is essential that regions maintain standardized, readily available data on all existing aquifer exemptions. Proper recordkeeping and data management at the regional level will help with mapping and geospatial analysis for greater accessibility and comprehension of the exemption data and ensure that potentially affected parties are made aware of the exempted areas. Additionally it will enhance HQ efforts to facilitate a national tracking mechanism for approved exemptions.

Conclusion

Recognizing that EPA's approval of an aquifer exemption request is typically required prior to issuance of a UIC permit, regional UIC programs should establish early communication with the primacy state to inform EPA's review. The Region should start its review with the information provided in the primacy program's designation and approval request. If questions arise or further information is needed to either supplement the request or clarify specific data points related to the proposed exempted aquifer, the Region should work with the primacy program to obtain this information at the earliest opportunity. The Region should also work expeditiously with the primacy program to resolve any disagreements arising from the aquifer exemption process.

While there are other technical and policy issues associated with aquifer exemptions that are not addressed by this memorandum, I hope that the clarity on the review and determination process for aquifer exemptions provided herein, will help the Agency's effort to achieve national consistency and clarify expectations from states and tribes (and potentially owners or operators) on aquifer exemptions. The Agency will continue to work in consultation with states and stakeholders to promote a consistent and predictable process for the review of aquifer exemption requests under the Safe Drinking Water Act (SDWA).

Attachments

40 CFR 146.4: Criteria for Exempted Aquifers

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in § 146.3 may be determined under § 144.7 of this chapter to be an "exempted aquifer" for Class I-V wells if it meets the criteria in paragraphs (a) through (c) of this section. Class VI wells must meet the criteria under paragraph (d) of this section:

(a) It does not currently serve as a source of drinking water; and

(b) It cannot now and will not in the future serve as a source of drinking water because:

(1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.

(2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

(3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

(4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or

(c) The total dissolved solids content of the ground water is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system

(d) The areal extent of an aquifer exemption for a Class II enhanced oil recovery or enhanced gas recovery well may be expanded for the exclusive purpose of Class VI injection for geologic sequestration under § 144.7(d) of this chapter if it meets the following criteria:

(1) It does not currently serve as a source of drinking water; and

(2) The total dissolved solids content of the ground water is more than 3,000 mg/l and less than 10,000 mg/l; and

(3) It is not reasonably expected to supply a public water system.

Aquifer Exemption Checklist

Reviewed by: _____ ***Date*** _____

A- Regulatory Background and Purpose

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in § 146.3 may be determined to be an "exempted aquifer". The aquifer exemption criteria at 146.4 must be met as follows:

- Class I-V wells must meet criteria **146.4(a) and 146.4(b)(1)**; or **146.4(a) and 146.4(b)(2)**; or **146.4(a) and 146.4(b)(3)**; or **146.4(a) and 146.4(b)(4)**; or **146.4(a) and 146.4(c)**.
- Class VI wells must meet the criteria **146.4(d)**[1].

Regardless of the AE request or the type of injection activity, in all cases, first and foremost a demonstration that the aquifer or portion thereof does not currently serve as a source of drinking water is the required first step in the process. **EPA must evaluate each AE request to ensure the criteria are met prior to approval. EPA should also document its rationale for approving or disapproving each AE request in its statement of basis and, in case of exemptions that are substantial program revisions, EPA must provide public notice and an opportunity for the public to comment and request a public hearing.**

The purpose of this checklist is to ensure that appropriate and adequate information is collected to facilitate review of AE requests, and documentation of AE decisions. Some information described here may not apply to all AE requests.

B- General Information

AE request received by EPA on _____

Is the aquifer exemption Substantial_____ **Non-Substantial**_____
Describe basis for substantial/non-substantial determination_____
Is the aquifer exemption Complex? (Existence of drinking water wells, populated area ...) _____
Did the state or tribe provide public notice and opportunity for public hearing on the aquifer exemption request (144.7 (b)) Y/N
Were there any public comments? Y/N If yes, identify where they may be located_____
Date(s) of notice(s) published_____, Public meeting(s) held_____, Hearing held _____, any notable findings or pending litigation _____
Describe the notice and comment process and the final decision_____
Describe the basis for the decision to exempt the aquifer or the basis for the decision to withhold or deny approval of the exemptions request_____
Any anticipated issues associated with EPA approval or disapproval of the AE request Y/N_____
Any meetings between EPA/States/Tribes/Operator to discuss issues Y/N list_____

Is the request submitted by a primacy state or tribe? Y/N If yes name the State/Tribe/Agency _____ **Contact:**_____
AE identified by the Primacy State or tribe and submitted for EPA review and final determination on _____

Name of the Owner/operator_____
Well/Project Name:_____ **Well Class** _____
Purpose of injection: _____(mineral mining/oil and gas/other)

Where is the proposed aquifer exemption located? Township, Section, Range, Quarter Section or other method used to identify the area _____ Latitude and longitude information _____County_____ City_____ State_____ Add information about distance to nearest Town, County _____

Name of aquifer or portion of aquifer to be exempted _____

[1] Additional Class VI only requirements in 40 CFR 144.7(d)(1) and (2) apply. This checklist does not address those requirements.

Areal extent of the area proposed for exemption_____
Depth and thickness of the aquifer _____
Discuss the total dissolved solid (TDS) content of the aquifer, including the TDS at the top and bottom of the exempted zone, and the locations and depths of all fluids samples taken. _____

C- Regulatory Criteria

An aquifer or a portion thereof may be determined to be an exempted aquifer for Class I-V wells if it meets the criteria in paragraphs (a) –(c) below. Other than EPA approved aquifer exemption expansions that meet the criteria set forth in 146.4(d), new aquifer exemptions for Class VI wells shall not be issued.

146.4: ( ) (a) ***Not currently used as a drinking water source*** **and:**

( ) **(b)(1)** It is mineral, hydrocarbon, or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or Class II operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible; or
( ) **(b)(2)** It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical; or
( ) **(b)(3)** It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or
( ) **(b)(4)** It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or
( ) **(c)** TDS is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.

( ) **(d)** *The areal extent of an aquifer exemption for a Class II enhanced oil recovery or enhanced gas recovery well may be expanded for the exclusive purpose of Class VI injection for geologic sequestration under § 144.7(d) if it does not currently serve as a source of drinking water; and the TDS is more than 3,000 mg/l and less than 10,000 mg/l; and it is not reasonably expected to supply a public water system.*

1- Demonstration that the aquifer or portion thereof does not currently serve as a source of drinking water per 146.4(a)

Describe the proposed exempted area and how it was determined:_____
_____

TDS:_____ **Top:**_____ **Bottom:**_____
Lithology: _____
Permeability: _____ **Porosity:** _____ **Groundwater flow direction:** _____
Upper and Lower Confining Zone(s) and description of vertical confinement from USDWs:
_____
Oil or mineral production history:_____

Are there any public or private drinking water wells within and nearby the proposed exempted area for which the proposed exempted portion of the aquifer might be a source of drinking water Y/N If yes, list all those wells
_____

- *Include*: pertinent map(s) visually showing the areal extent of exemption boundary, depth and thickness of the aquifer proposed for exemption, all known subsurface structures such as faults affecting the aquifer, and each of the inventoried water well locations by well # or owner name.
- *Include*: Table of all inventoried water wells showing: Well Name/#, Owner, (Private/Public), Contact information, Purpose of well (Domestic, Irrigation, Livestock, etc.), depth of source water, name of aquifer, well completion data, age of well (if known), and the primary source of well data (Applicant/State/Tribe/EPA).
- *Include*: Map showing the areal extent of exemption boundary, all domestic water wells considered potentially down gradient of the exemption and hydraulically connected to the exemption. If wells are deemed horizontally and/or vertically isolated from the exemption, this should be foot noted on the Table as well. Use arrow(s) to indicate the direction and speed of GW in the aquifer proposed for exemption.

- Describe the evidence presented in the application and/or methodology used to conclude GW direction and speed when relevant.
- *Include*: any source water assessment and/or protection areas and designated sole source aquifers located within the delineated area.

What is the appropriate area to examine for drinking water wells? Although guidance 34 says it should be a minimum of 1/4 mile, the determination of the appropriate area is on a case by case basis. Describe area and give a rationale.

Are there any public or private drinking water wells or springs capturing (or that will be capturing) or producing drinking water from the aquifer or portion thereof within the proposed exemption area? Y/N*

- Evaluate the capture zone of the well (s) in the area near the proposed project (i.e., the volume of the aquifer(s) or portion(s) thereof from within which groundwater is expected to be captured by that well).
- A drinking water well's current source of water is the volume (or portion) of an aquifer which contains water that will be produced by a well in its lifetime. What parameters were considered to determine the lifetime of the well?

_____

- (*) If the answer to this question is Yes, therefore the aquifer currently serves as a source of drinking water.

2- Demonstration that the aquifer or portion thereof is mineral, hydrocarbon or geothermal energy producing per 146.4(b)(1)

Did the permit applicant for a Class II or III operation demonstrate as part of the permit application that the aquifer or portion thereof contains minerals or hydrocarbons that, considering their quantity and location are expected to be commercially producible? Did the permit applicant furnish the data necessary to make the demonstration as required by 40 C.F.R. 144.7(c)(1) and (2)? Summarize this demonstration and data _____

- Include narrative statement, logs, maps, data and state issued permit.
- If the proposed exemption is to allow a Class II enhanced oil recovery well operation in a field or project containing aquifers from which hydrocarbon were previously produced, commercial producibility shall be presumed by the Director upon a demonstration of historical production having occurred in the project area or field. Many times it may be necessary to slightly expand an existing Class II operation to recover hydrocarbons and an aquifer exemption for the expanded area may be needed. If the expanded exemption for the Class II EOR well is for a well field or project area where hydrocarbons were previously produced, commercial producibility would be presumed.
- For new or existing Class II wells not located in a field or project containing aquifers from which hydrocarbons were previously produced, information such as logs, core data, formation description, formation depth, formation thickness and formation parameters such as permeability or porosity shall be considered by the Director, to the extent available.
- Many Class II injection well permit applicants may consider much information concerning production potential to be proprietary. As a matter of policy, some states/tribes do not allow any information submitted as part of a permit application to be confidential. In those cases where potential production information is not being submitted, EPA would need some record basis for concluding that the permit application demonstrates that the aquifer contains commercially producible minerals or hydrocarbons. For example, the permit application may include the results of any R & D pilot project. In this case, the applicant should state the reasons for believing that there are commercially producible quantities of minerals within the expanded area. Also, exemptions relating to new or existing Class II wells not located in a field or project containing aquifers from which hydrocarbons were previously produced should include the following types of information:
  - a- Production history of the well if it is a former production well which is being converted.
  - b- Description of any drill stem tests run on the horizon in question. This should include information on the amount of oil and water produced during the test
  - c- Production history of other wells in the vicinity which produce from the horizon in question.
  - d- Description of the project, if it is an enhanced recovery operation including the number of wells and there location.

For Class III wells, the Director must require an applicant to furnish data necessary to demonstrate that the aquifer is expected to be mineral or hydrocarbon producing and the Director must consider information contained in the mining plan for the proposed project, such as a map and general description of the mining zone, general information on the mineralogy and geochemistry of the mining zone, analysis of the amenability of the mining zone to the proposed mining

method, and a time-table of planned development of the mining zone. Information to be provided may also include: a summary of logging which indicates that commercially producible quantities of minerals or hydrocarbons are present.

3- Demonstration that the aquifer or portion thereof is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical per 146.4(b)(2)

Is the aquifer or portion thereof situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical? _____

- List evidence in the application showing how this demonstration was made.
- EPA consideration of an aquifer exemption request under this provision would include information related to: The availability of less costly and more readily available alternative supplies, the adequacy of alternatives to meet present and future needs, and costs for treatment (including cost of disposal of treatment residuals) and or development associated with the use of the aquifer.
- The economic evaluation, submitted by the applicant, should consider the above factors, and these that follow:

1. Distance from the proposed exempted aquifer to public water supplies.
2. Current sources of water supply for potential users of the proposed exempted aquifer.
3. Availability, quantity and quality of alternative water supply sources.
4. Analysis of future water supply needs within the general area.
5. Depth of proposed exempted aquifer.
6. Quality of the water in the proposed exempted aquifer.

4- Demonstration that the aquifer or portion thereof is too contaminated per 146.4(b)(3)

Is the aquifer or portion thereof proposed for exemption so contaminated that it would be economically or technologically impractical to render that water fit for human consumption _____

- List evidence in the application showing that the area to be exempted is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption.
- Economic considerations would also weigh heavily in EPA's decision on aquifer exemption requests under this section. Unlike the previous section, the economics involved are controlled by the cost of technology to render water fit for human consumption. Treatment methods can usually be found to render water potable. However, costs of that treatment may often be prohibitive either in absolute terms or compared to the cost to develop alternative water supplies.
- EPA's evaluation of aquifer exemption requests under this section will consider the following information submitted by the applicant:

(a) Concentrations, types, and source of contaminants in the aquifer.
(b) If contamination is a result of a release, whether contamination source has been abated.
(c) Extent of contaminated area.
(d) Probability that the contaminant plume will pass through the proposed exempted area.
(e) Ability of treatment to remove contaminants from ground water.
(f) Current and alternative water supplies in the area.
(g) Costs to develop current and future water supplies, cost to develop water supply from proposed exempted aquifer. This should include well construction costs, transportation costs, water treatment costs, etc.
(h) Projections on future use of the proposed aquifer.

5- Demonstration that the aquifer or portion thereof is located over a Class III well mining area subject to subsidence or catastrophic collapse per 146.4(b)(4)

Is the aquifer or portion thereof proposed for exemption located over a Class III well mining area subject to subsidence or catastrophic collapse?

- List evidence in the application showing that the area to be exempted is located over a Class III well mining area subject to subsidence or catastrophic collapse_____

- Discuss the mining method and why that method necessarily causes subsidence or catastrophic collapse. The possibility that non-exempted underground sources of drinking would be contaminated due to the collapse should also be addressed in the application.

6- Demonstration that the aquifer or portion thereof has TDS more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system per 146.4(c)

Is the TDS of the aquifer or portion thereof proposed for exemption more than 3,000 and less than 10,000 mg/l?_____

Is the aquifer proposed for exemption or portion thereof not reasonably expected to supply a public water system?____

- Identify and discuss the information on which the determination that the total dissolved solids content of the ground water in the proposed exemption is more than 3,000 and less than 10,000 mg/l and the aquifer is not reasonably expected to supply a public water system.
- Include information about the quality and availability of water from the aquifer proposed for exemption. Also, the exemption request must analyze the potential for public water supply use of the aquifer. This may include: a description of current sources of public water supply in the area, a discussion of the adequacy of current water supply sources to supply future needs, population projections, economy, future technology, and a discussion of other available water supply sources within the area.

7- Demonstration that a Class II aquifer exemption may be expanded to Class VI per 146.4(d) *(Refer to additional requirements in EPA's regulations for Class VI aquifer exemptions for this demonstration)*

May the areal extent of an aquifer exemption for a Class II enhanced oil recovery or enhanced gas recovery well be expanded for the exclusive purpose of Class VI injection for geologic sequestration under § 144.7(d)? _____

- List evidence in the application showing an existing Class II operation associated with AE that is being converted into Class VI_____

State of New Mexico
Energy, Minerals and Natural Resources Department

Susana Martinez
Governor

Tony Delfin
Acting Cabinet Secretary

David R. Catanach, Division Director
Oil Conservation Division

October 24, 2016

Mr. Philip Dellinger, Chief
Ground Water/UIC Section, Region 6
United States Environment Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: REVIEW OF UNDERGROUND INJECTION CONTROL CLASS II ACTIVITIES WITHIN THE STATE OF NEW MEXICO FOR POSSIBLE INJECTION INTO UNDERGROUND SOURCES OF DRINKING WATER

Dear Mr. Dellinger:

Reference is made to your request on behalf of the United States Environmental Protection Agency (EPA) for a review of current oil and gas injection activities occurring within New Mexico that may potentially impact Underground Sources of Drinking Water (USDWs) and their relationship to exempted aquifers associated with operations permitting injection into USDWs. This review was to specifically identify impacts due to Underground Injection Control (UIC) Class II operations potentially injecting directly in USDWs. This request was submitted to the New Mexico Oil Conservation Division (Division) in an EPA correspondence dated August 31, 2016.

I. State Underground Injection Control (UIC) Program General Information

The Division prepared general guidelines for the protection of USDWs as part of the *Class II Demonstration* dated September 15, 1981. The demonstration was submitted to the EPA as part of the effort by the state to obtain primacy for management of Class II wells in New Mexico. The proposed program was approved by the EPA on March 7, 1982, and recorded in Code of Federal Regulations (CFR) Title 40, Part 147, Subpart GG, Section 1600.

Section j. Aquifer Protection, Aquifer Exemption of the *Class II Demonstration* presented the argument that the original concept for the use of formal aquifer designations and aquifer exemptions, as proposed in 40 CFR 104.6, was not practical based on the common occurrences of hydrocarbon reservoirs and aquifers in the same lithologic units and the expense for formal declaration of numerous exempted aquifers not supported by budget. This concept was supported by two studies included in the demonstration (Appendices I and II) and summarized in a technical paper by Wilson and Holland (1984).

The demonstration detailed, in Appendix II, the prototype approval process for each of the three Class II well categories: Enhanced Oil Recovery (ER wells), Produced Fluid Disposal (SWD wells or Class II disposal wells), and Liquid Hydrocarbon Storage (HS wells).

Following the approval of the state UIC program, a new source of produced water became prolific: coal-bed methane (CBM) wells. This new source of hydrocarbon production was not considered in the original *Class II Demonstration* and was determined to be within the regulatory authority of the Division. The produced water from CBM wells was considered to be equivalent to produced fluids from oil and gas wells and applications for disposal were assessed using the same approval process as SWD wells.

The demonstration approval process for ER wells provided the following reasoning for limited application of exempted aquifers in areas with ER projects in response to 40 CFR 146.4:

> *There seems little necessity for elaborate aquifer exemptions related to ER Projects for the following reasons:*
>
> *(1) The pressure sinks surrounding the producing wells in an ER project cause injected fluids to move inward toward producing wells rather than outward toward any other part of the formation. Such contained movement eliminates the direct potential for contamination of USWDs which may be located elsewhere in the same formation.*
>
> *(2) The Division knows of no instance in the State where drinking water is being produced and consumed by the public from an aquifer which is also an oil and/or gas reservoir at the same horizontal and vertical section. Some USDWs exist within the same vertical section but horizontally removed from the hydrocarbon zone. The San Andres formation in Eddy County provides excellent examples of both of these situations. These conditions are discussed and extensively referenced in Appendix A-1.* [Section j. Aquifer Protection, Aquifer Exemption, *Class II Demonstration,* page 51]

The demonstration approval process for SWD wells includes the following stipulation in response to 40 CFR 146.4:

> *All applications for approval of SWD wells not within an oil or gas zone or within one mile thereof will contain data on water quality in the proposed disposal interval. Any SWD well proposed for disposal into a formation or zone containing water of 10,000 mg/1 TDS* [Total Dissolved Solids] *or less which is not an exempted aquifer will be set for public hearing before a Division examiner.* [Section j. Aquifer Protection, Aquifer Exemption, *Class II Demonstration,* page 52]

This criterion is incorporated in the Division's regulation under Rule 19.15.26.8(E) New Mexico Administrative Code (NMAC). Additionally, the state UIC program included specific regulation by limiting disposal by SWD wells in Lea County to formations older than the Triassic age (Rule 19.15.26.8(E)(1) NMAC).

The demonstration also contained the following recommendation for future assessment for aquifer exemptions for portions of the Capitan Reef aquifer within Lea County:

> *Based upon this study the Division proposes that the Tansil, Yates, Seven Rivers, Queen, Grayburg, and San Andres formations of Lea County be classified as exempt aquifers. Please refer to Figures 8 and 9 of the Lea County Report, Appendix A-2* [Hiss (1980)] *and Resource Map No. 6 from "Stratigraphy and Ground-Water Hydrology of the Capitan Aquifer, Southeastern New Mexico and Western Texas" by William L. Hiss (PhD Thesis, University of Colorado 1975)* [Hiss (1976)] *for the vertical and horizontal sections to be exempted. Because of the gradational nature of the back reef facies a more precise description is not proposed.* [Section j. Aquifer Protection, Aquifer Exemption, *Class II Demonstration*, page 53]

To respond to EPA's request, the reviews of UIC Class II operations were divided and grouped based on the four major geographic areas of oil and gas activities. This separation provides the ability to discuss the corresponding Class II activities based on mutual geologic and hydrologic characteristics. These areas included the San Juan Basin, the Raton Basin, the Bravo Dome area, and the Permian Basin (see Figure 1). Of these four groups, the Permian Basin has the most Class II well activity due the significant increase in the volume of produced water associated with the recent expansion of horizontal well completions in Permian-age formations.

II. Class II Operations in the San Juan Basin

Class II activities in the San Juan Basin includes historical oil and gas operations along with recent shallow CBM production and current exploration activities of the Mancos Shale using horizontal well completions. The development of the oil potential of the Mancos Shale, as well as any new interest in further development of CBM resources, has subsided due to the decrease in commodity prices. The majority of oil and gas operations, including the recent efforts for Mancos Shale development and CBM production, is concentrated in the northern half of the San Juan Basin (see Figures 2A and 2B).

There are numerous aquifers in the San Juan Basin with the potential for classification as USDWs, but these aquifers have variable water quality characteristics relative to their location in the structural basin and the associated aquifer's recharge area (see Figure 2B). The Jurassic Morrison Formation is an example of a commonly occurring lithologic unit with potential as an USDW in the vicinity of the recharge area created by the exposure of formation outcrops along the south boundary of the basin. Groundwater occurring in this formation along the south edge of the basin contains TDS concentrations significantly below 10,000 milligrams per liter (mg/L). However, as this lithologic unit is followed to the north towards the center (axis) of the basin, the water quality degrades as the influence of recharge decreases resulting in TDS concentrations in excess of 10,000 mg/L (Kelley and others, 2014).

The volume of produced water in the San Juan Basin is relatively minor when compared to the level of production activity. This geographical area contains 99 active Class II disposal wells and

represents only 12 percent of the total amount of SWD wells operating in New Mexico. Most of the Class II disposal wells have permitted intervals within the upper Cretaceous Mesaverde Group (the Menefee Formation), the lower Cretaceous Dakota Sandstone, and the Jurassic sequence of Morrison-Bluff-Entrada Formations. The SWD wells utilizing these lithologic units for disposal are frequently located over the deepest part of the structural basin where the TDS concentrations of the formation fluids exceeds 10,000 mg/L.

The Division utilized the state UIC program's process for exempted aquifers for two applications involving disposal injection into protectable waters as defined by 40 CFR 146.4. Both applications were reviewed through Division hearings and were approved for exempted aquifer status (Division Order No. R-10168-A/Case No. 11179 and Division Order No. R-10847/Case No. 11470). Of these two orders, the exempted aquifer in the Entrada Formation provides the highest probability for future hearings for exempted aquifer determination.

ER activities are also limited with only 39 active ER wells in the San Juan Basin. Of the 39 ER wells, 20 wells are associated with a single oil field (Hospah oil field) with production from a Gallup Sandstone reservoir that initiated production in the 1930s and has been determined not to be a USDW in this portion of the basin.

III. Class II Operations in the Bravo Dome Area

The development and production of carbon dioxide (CO_2) resources southeast of the Raton Basin has required a very limited number of Class II disposal wells (see Figure 3A). The interior portion of the Bravo Dome CO_2 field (the AMOCO Unit) has gas production with little water content. Recent expansion of development along the western flank of the dome has increased produced water content, but this additional volume of water has necessitated only one additional SWD well. Disposal is permitted for the Permian Glorieta Formation which, in this area, has porosity but is void of any formation water.

IV. Class II Operations in the Raton Basin

Class II operations in the Raton Basin are limited to SWD wells in support of CBM production (see Figure 4A). The development of CBM resources in the southern portion of the Raton Basin (within New Mexico) remains stagnant and the current number of Class II disposal wells associated with production is seven. ER wells and HS wells are not employed in the Raton Basin. Disposal is permitted in the deep interval from the lower Cretaceous Dakota Sandstone to the Permian Glorieta Formation. Various analytical reports of formation fluids provided in applications for injection permits have demonstrated TDS concentrations above 10,000 mg/L for the lithologic units utilized for disposal of CBM produced waters.

V. Class II Operations in the Permian Basin

The Permian Basin represents the greatest concentration of Class II wells operating in New Mexico. Approximately 89 percent of all active SWD wells and nearly 99 percent of the

approximately 3,200 active ER wells operate within the New Mexico portion of the Permian Basin. There are two prominent occurrences in the Permian Basin where there are both hydrocarbon reservoirs and aquifers classified as USDWs following EPA definitions. These locations are the Roswell Artesian Basin aquifer system and the Capitan Reef aquifer system.

Shallower USDWs within the Permian Basin, such as the Ogallala aquifer (Ogallala and Blackwater Draw Formations) and aquifers within the Dockum Group (Santa Rosa Formation), are excluded from this review since they are protected under Rule 19.15.26.8(E)(1) NMAC and are not available for Class II activities.

The eastern extent of the Roswell Artesian Basin aquifer system parallels the Pecos River drainage from north of the city of Roswell to north of the city of Carlsbad (see Figure 6A). This aquifer system has both a shallow alluvial aquifer that is principally recharged by the Pecos River and a deeper, artesian aquifer that is recharged through exposures of the aquifer formation along the Sacramento Mountains which forms the western boundary of the basin (see Figure 6B).

The shallow alluvial aquifer is separated from the artesian aquifer by an aquitard composed of the formations known as the Artesia Group (Tansil Formation, Yates Formation, Seven Rivers Formation, Queen Formation, and Grayburg Formation). The artesian aquifer occurs within the San Andres Formation which is beneath the Artesia Group and contains both hydrocarbon resources as well as protectable waters. The artesian aquifer represents a significant USDW while the quality and quantity of groundwater from the shallow alluvial aquifer is variable due to discharges from surface uses (agriculture) and drought impacts to the Pecos River. A more extensive discussion is found in the two Appendices of the *Class II Demonstration* (Holland and others, 1979; and Holland and others, 1980).

Review of the Class II wells located in the Roswell Artesian Basin aquifer system revealed no issues for the portions of the San Andres Formation which is both an USDW and a hydrocarbon reservoir. Class II injection wells for support of hydrocarbon production are typically authorized for permitted intervals that are deeper than the San Andres Formation and contain TDS concentrations significantly above 10,000 mg/L.

There are occurrences of hydrocarbon resources in the Artesia Group located to the east of the Pecos River and the eastern boundary of the artesian aquifer. These shallow oil fields are very mature and a few are being operated using ER wells with no indication of impacts to either of the aquifer systems.

The Capitan Reef aquifer system is the lithosome that comprises the reef complex, the Goat Seep reef, and the facies transition of the backreef area (the shelf aquifers contained in the Artesia Group as described by Hiss (1980); see Figure 5B). The Capitan Reef aquifer system in New Mexico extends from the recharge area of the Guadalupe Mountains, west of the city of Carlsbad, and extends in an arc to the southeast corner to the state line with Texas (see Figure 5A).

Hiss describes the general ground-water movement as follows:

> *Water entering the Capitan aquifer in the Guadalupe Mountains moved slowly northeastward and then eastward along the northern margin of the Delaware Basin to a point southwest of present-day Hobbs. Here it joined and comingled with a relatively larger volume of ground water moving northward from the Glass Mountains along the eastern margin of the Delaware Basin. From this confluence, the ground water was discharged from the Capitan aquifer into the San Andres Limestone, where it then moved eastward across the Central Basin Platform and Midland Basin, eventually to discharge into stream draining to the Gulf of Mexico (Page 294; Hiss, 1980).*

The quality of groundwater in the Capitan Reef aquifer system is variable with location. The western segment of the Capitan Reef aquifer system is recognized as a USDW and is utilized as a source for both domestic and municipal water supply wells. The eastern portion of the aquifer contains both protectable waters, based on TDS concentrations, as well as productive oil and gas fields in formations of the Artesia Group along the facies transition in the forereef (see inset of Figure 5A). Due to this common occurrence, the *Class II Demonstration* identified this area of the aquifer in Lea County for future assessment.

In 2009, the Division identified the need for further study of the Capitan system and its relationship with Class II well activities along the eastern portion in Lea County. The EPA provided funding for the evaluation which resulted in a report that identified a list of 30 wells with a higher risk of injection into the Capitan Reef. A copy of the report (RESPEC Consulting and Services Topical Report RSI-2048) is attached.

As a result of this review, the 2009 consultant's report prepared for the Division, and the review of current injection applications, the Division has identified existing injection operations in proximity to the Capitan Reef that require supplemental assessment including the wells identified in the 2009 RESPEC report. The Division has compiled a list of 32 wells which require additional investigation to determine the potential or necessity for establishing exempted aquifers (see Table 1).

Though not reported as HS wells, there are two gas storage operations in the Permian Basin. Both operations utilize depleted oil and gas reservoirs that are below Permian-age rocks with no potential for USDW classification.

VI. Summary

The greatest potential for occurrences of USDWs containing injection operations is within the Permian Basin. Of the two areas with USDWs in the Permian Basin, the Capitan Reef aquifer system contains both ER wells and SWD wells that have injection activities in association with a USDW. Many of the Class II wells listed in Table 1 are associated with older ER projects along the backreef area of the Reef aquifer that include formations that transition into the reef complex.

Many of these ER wells and their original injection authority predate the Safe Drinking Water Act and the related UIC Program.

Equally, the older SWD wells (including the 7406 JV-S Lea 20 No. 1) were authorized through Division hearings that predate the UIC Program. Other SWD wells were approved with the best information available regarding the delineation of the aquifer and were assessed as having no hydrologic connection with the Reef system.
There is no indication in the Division's historical record of any Class II injection authority being approved for operation within a recognized USDW. Additionally, there is no evidence of acute impacts such as the degradation of a water supply system observed with the injection activities listed in Table 1; however, the potential for long-term effects of the listed activities and their possible association with any USDWs should be examined.

The operation of Class II wells within the remaining three areas, the San Juan Basin, the Bravo Dome area, and the Raton Basin, have not exhibited any indications of existing conflicts with potential USDWs and injection intervals that may require an exempted aquifer determination. Additionally, the use of the state's UIC application process has successfully addressed USDWs and exempted aquifer determinations for individual Class II SWD wells in the San Juan Basin.

VII. State UIC Program Proposed Efforts for Resolution

This review has identified potential USDW issues for management of the Capitan Reef aquifer system in Lea County. The Division finds this review as an opportunity to complete the initial effort outlined in the *Class II Demonstration* for addressing exempted aquifers, to assess the Class II wells identified in the 2009 RESPEC report, and establish a process for managing future applications for Class II activities in the proximity of the Capitan Reef.

The Division proposes to continue the effort to review the wells listed in Table 1 for determination of the necessity for exempted aquifer in each case. This would include detailed technical review of the well's operation, review of the original application for the injection authority, and assessment of the potentials for impacts to the Capitan Reef aquifer system using current hydrologic information and mapping tools.

The wells listed in Table 1 that are associated with ER activities will be assessed by reviewing the current operation of the ER project which is typically an older waterflood for this area of the Artesia Group. This would provide a greater scope on the impacts and identify any additional wells not included in the 2009 RESPEC report.

Once a determination for exempted aquifer status has been completed, then the Division would meet with the operator and discuss the findings and options. This may include a determination of no action, a requirement for the operator to apply for an exempted aquifer specific to the injection activity, or initiation a hearing by Division to have the injection authority either restricted or revoked.

The content of this response was prepared by Phillip Goetze of the Division's Engineering Bureau. If

additional information is required or if there questions about the content of this correspondence, please contact either Mr. Goetze (phillip.goetze@state.nm.us; direct: 505.476.3466) or myself at your convenience.

Sincerely,

DANIEL SANCHEZ
Field Operations Bureau Chief / UIC Program Manager

JDS/prg

References:

Hiss, W. L., 1976, Structure of the Permian Guadalupian Capitan Aquifer, Southeast New Mexico and West Texas, Resource Map 6, New Mexico Bureau of Geology and Mineral Resources, one sheet.

Hiss, W. L., 1980, *Movement of Ground Water in Permian Guadalupian Aquifer Systems, Southeastern New Mexico and Western Texas*, in New Mexico Geological Society Guidebook, 31st Field Conference, Trans-Pecos Region, 1980, p. 289-294.

Holland, Michael T., Parkhill, T., Wilson, L., Logsdon, M., and Stahl, M., 1980, *Aquifer Evaluation for UIC: Search for a Simple Procedure*, in New Mexico State Demonstration for Class II Wells, Appendix II (referenced in Demonstration as Appendix A-2). Report prepared for the Oil Conservation Division, Santa Fe, NM.

Holland, Michael T., Wilson, L., Stahl, M., and Jenkins, D., 1979, *Aquifer Designation for UIC: Prototype Study in Southeastern New Mexico*, in New Mexico State Demonstration for Class II Wells, Appendix I (referenced in Demonstration as Appendix A-1). Report prepared for the Oil Conservation Division, Santa Fe, NM.

Kelley, Shari, Engler, T., Cather, M., Pokorny, C., Yang, C., Mamer, E., Hoffman, G., Wilch, J., Johnson, P., and Zeigler, K., 2014, Hydrologic Assessment of Oil and Gas Resource Development of the Mancos Shale in the San Juan, New Mexico, New Mexico Bureau of Geology and Mineral Resources Open-file Report 566; 64 p.

Minnick, Matthew D., 2009, Capitan Reef Injection Well Study, RESPEC Consulting and Services Topical Report RSI-2048, April 2009, 14 p. Report prepared for the Oil Conservation Division, Santa Fe, NM.

Wilson, Lee, and Holland, Michael T., 1984, *Aquifer Classification for the UIC Program:*

Prototype Studies in New Mexico, in Ground Water, Volume 22, Number 6, November-December Issue, p. 706-716.

ATTACHMENTS:

Figures

Figure 1. Map Showing Locations of Major Oil and Gas Activities
Figure 2A. Geologic Map of the San Juan Structural Basin
Figure 2B. Schematic Cross Section of the San Juan Basin Showing Potential Aquifers
Figure 3A. Location Map Showing the Bravo Dome Carbon Dioxide Field
Figure 3B. General Stratigraphic Column in the Vicinity of the Bravo Dome Field
Figure 4A. Map Showing the General Geology of the Raton Basin
Figure 4B. Relevant Stratigraphic Column and Relationship to Aquifer Occurrences in the Raton Basin as Shown in the Schematic Cross Section
Figure 5A. Maps Showing the General Location of the Capitan Reef Aquifer System
Figure 5B. Relevant Stratigraphic Column and Relationship to Aquifer Occurrences in the Capitan Reef Lithosome as Shown in the Schematic and Correlation Cross Sections
Figure 6A. Map Showing the Location of the Roswell Basin Aquifer System
Figure 6B. Stratigraphic Column and Relationship to Aquifer Occurrences in the Roswell Artesian Basin as Shown in the Schematic Cross Section

Tables

Table 1. Summary Table of Active Injection Wells Requiring Further Investigation

Copy of Evaluation Report

Minnick, Matthew D., 2009, Capitan Reef Injection Well Study, RESPEC Consulting and Services Topical Report RSI-2048, April 2009, p. 14.

cc: UIC Class II Program File

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs

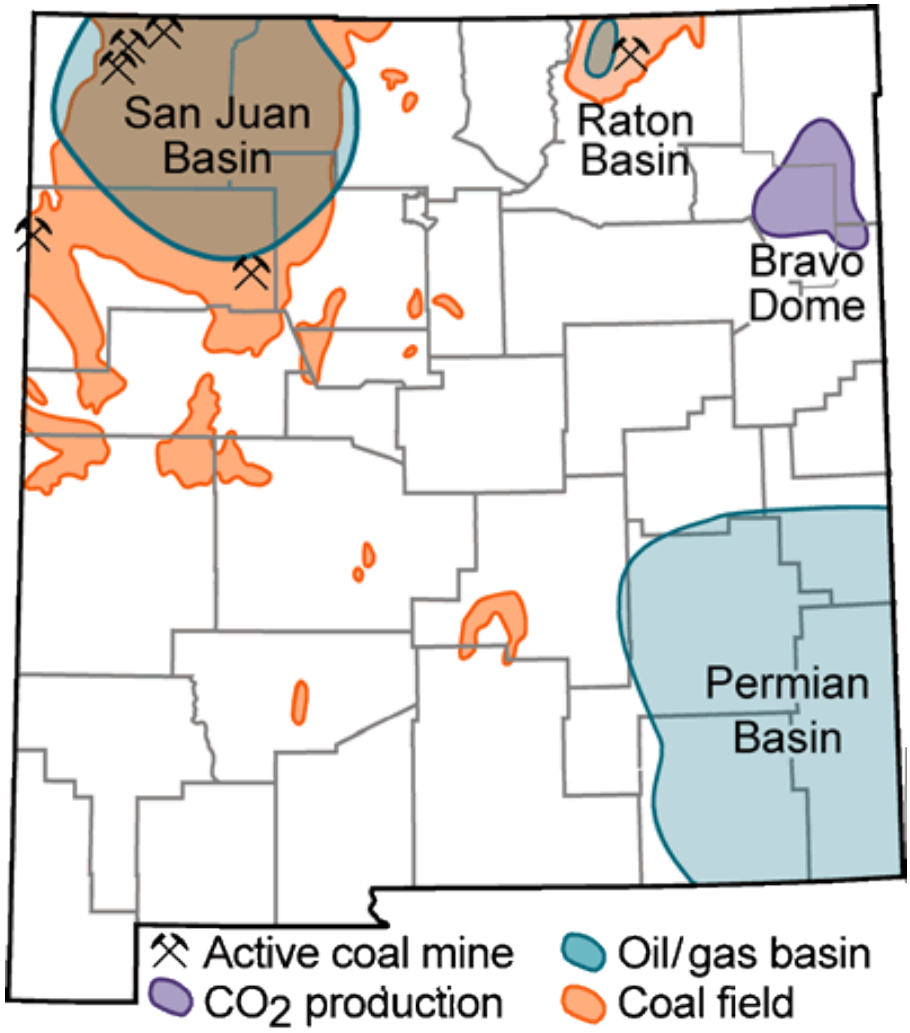

FIGURE 1. Map Showing Locations of Major Oil and Gas Activities (Including Coal-Bed Methane Production)

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: San Juan Basin

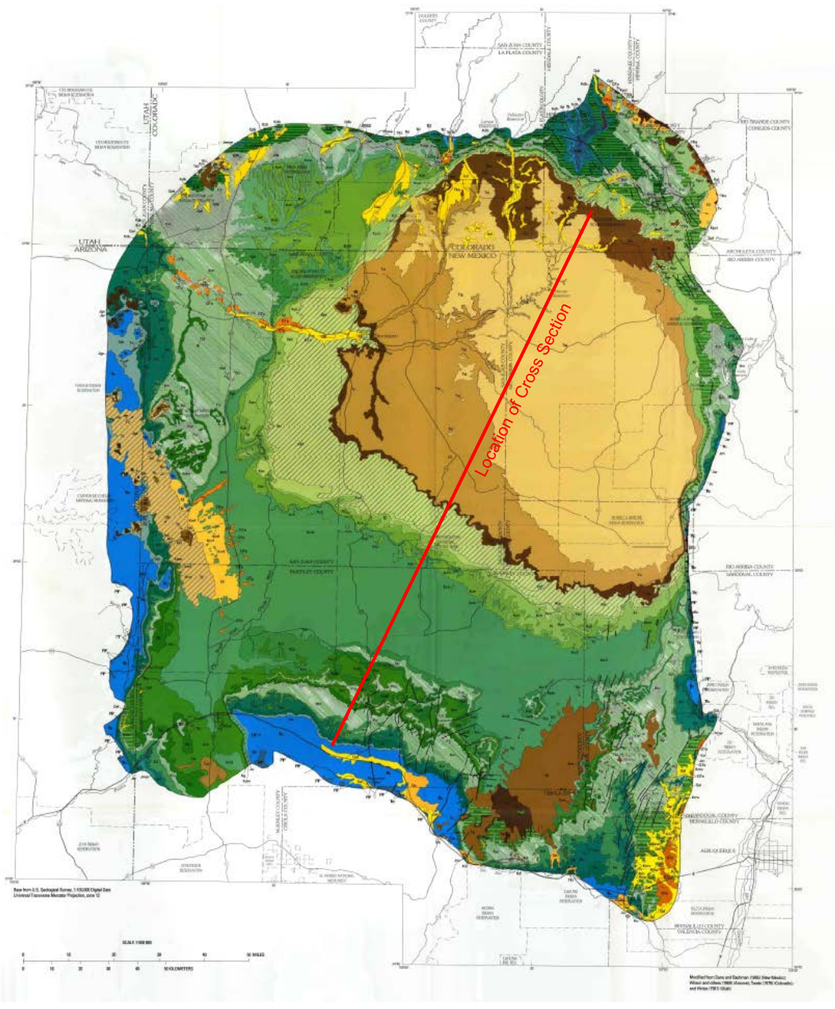

FIGURE 2A. Geologic Map of the San Juan Structural Basin

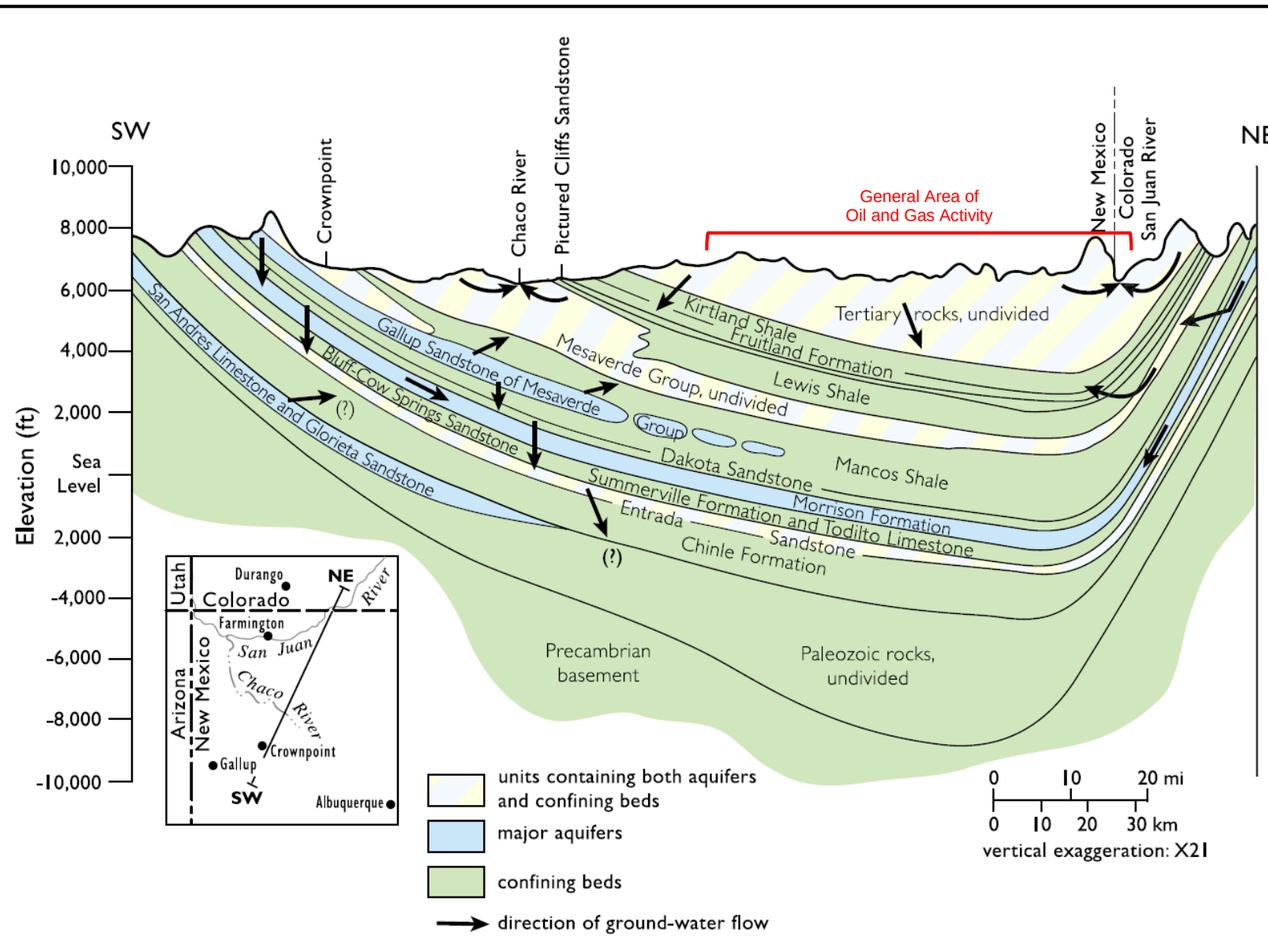

FIGURE 2B. Schematic Cross Section of the San Juan Basin Showing Potential Aquifers

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State of New Mexico

Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: Bravo Dome Area

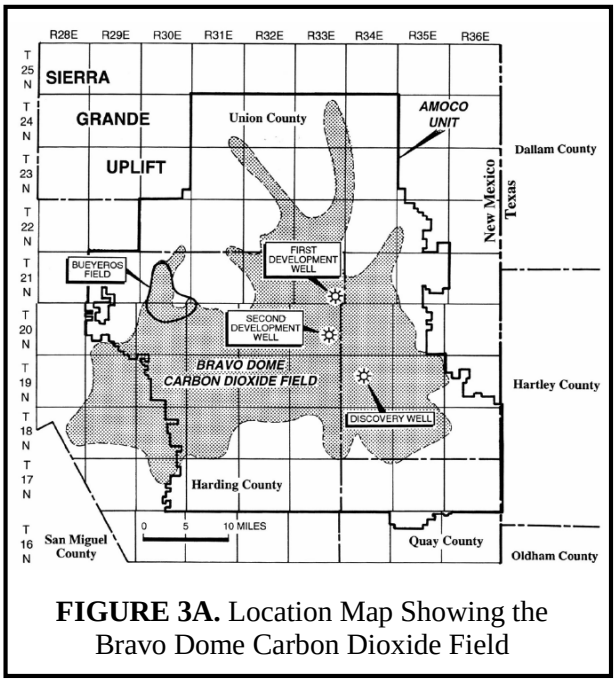


FIGURE 3A. Location Map Showing the Bravo Dome Carbon Dioxide Field

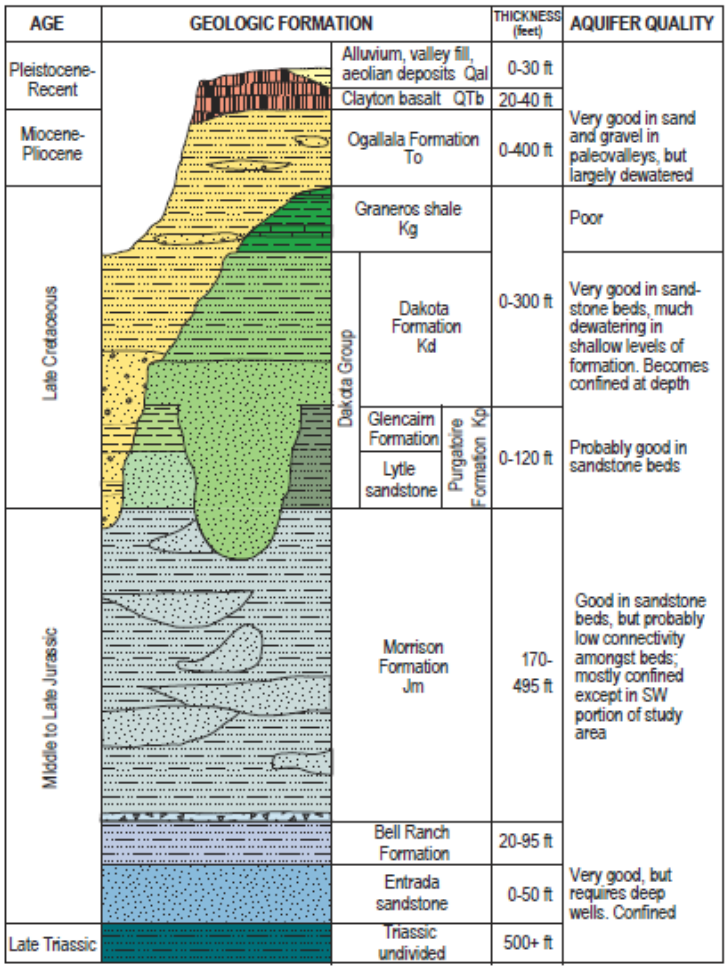


FIGURE 3B. General Stratigraphic Column in the Vicinity of the Bravo Dome Field

Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: Raton Basin

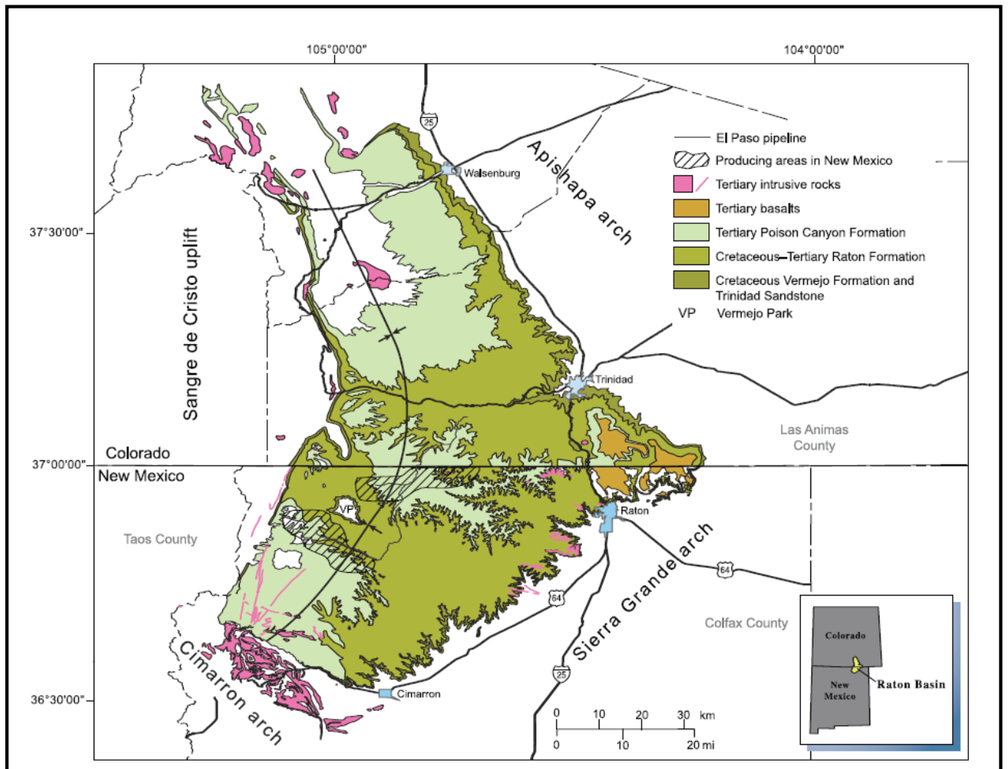
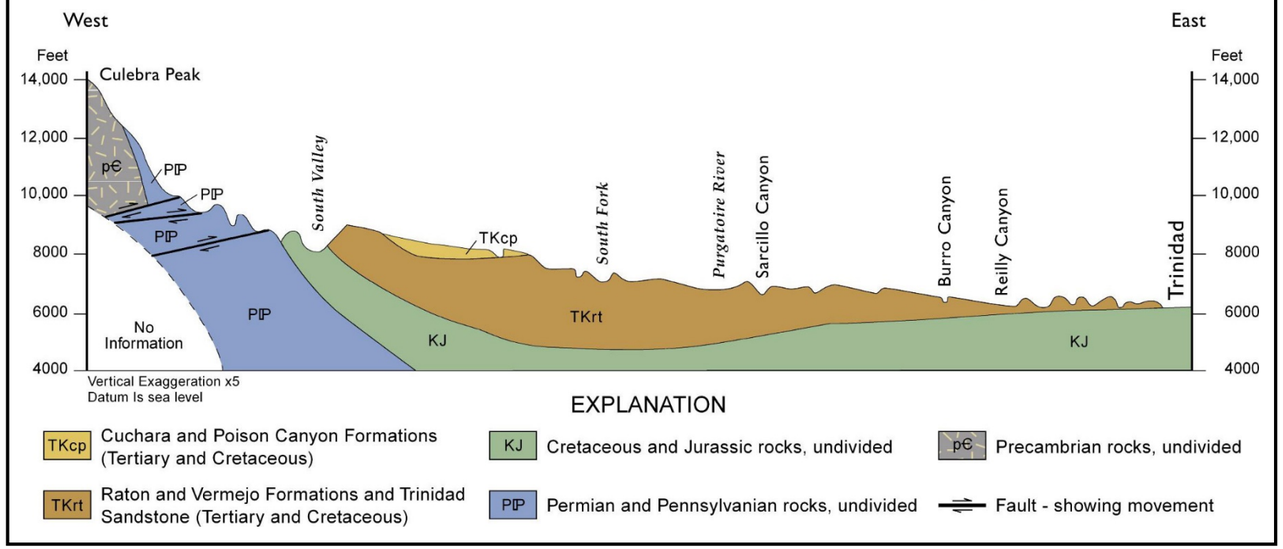


FIGURE 4A. Map Showing the General Geology of the Raton Basin

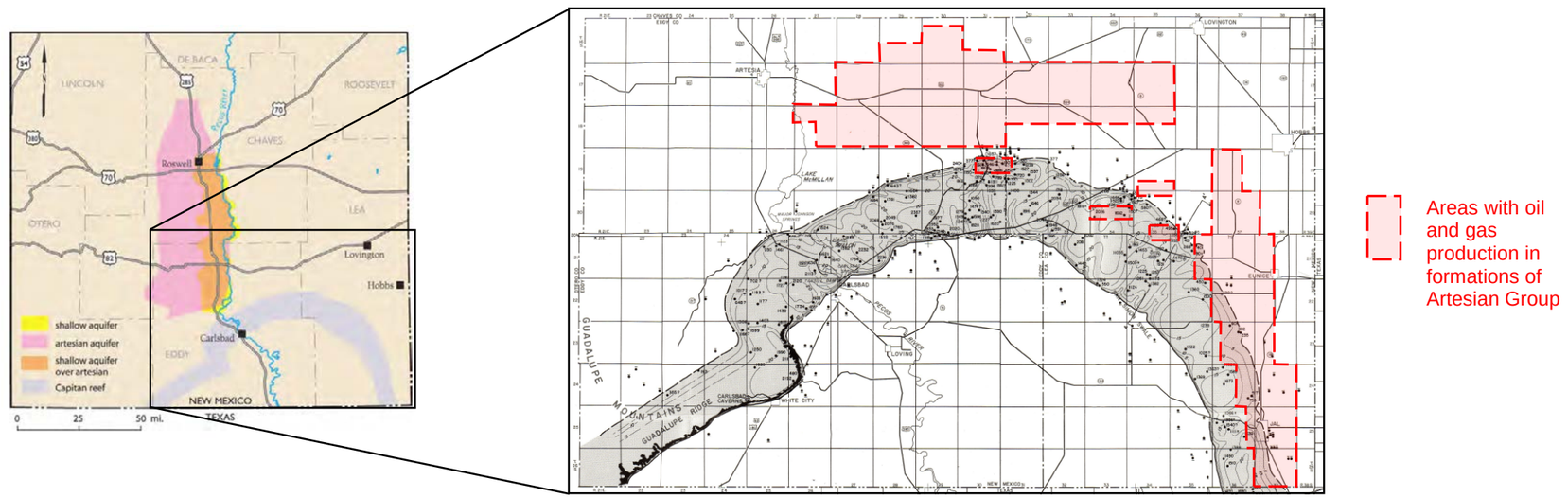
FIGURE 4B. Relevant Stratigraphic Column and Relationship to Aquifer Occurrences in the Raton Basin as Shown in the Schematic Cross Section

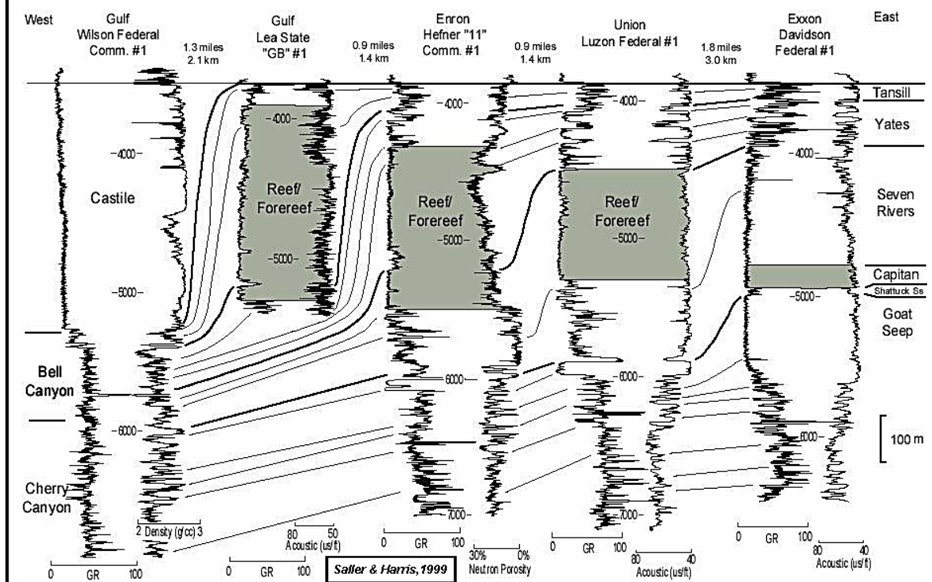
Era	System	Series	Strati-graphic Unit	Unit Thickness (feet)	Physical Characteristics	Hydrogeologic Unit	Hydrologic Characteristics
Cenozoic	Quaternary	Holocene	Alluvium		Silt, sand, and gravels	Alluvial aquifer	Water-table aquifer of limited extent
		Pleistocene					
	Tertiary	Oligocene	Devil's Hole Formation				
			Farisita Conglomerate				
			Intrusive igneous rocks		Granitic to gabbroic stocks, dikes, and sills		
		Eocene	Huerfano Formation	2,000	Variegated shale and limestone		
			Cuchara Formation	5,000	Pink and white sand-stone with shale	Cuchara-Poison Canyon aquifer	Transmissivities of 0.20–575 ft²/day; yields 0.07–33 gpm
		Paleocene	Poison Canyon Formation	2,500	Tan, gray and olive sandstone, conglomerate and shale		
Mesozoic	Cretaceous	Upper Cretaceous	Raton Formation	1,000–1,600	Gray, green, and black shale, siltstone with sandstone, coal	Raton-Vermejo-Trinidad aquifer	Target formation for coalbed methane; trans-missivities of 0.02–79 ft²/day; yields 0.04–16 gpm
			Vermejo Formation	80–550	Gray, green, and black shale, siltstone with sandstone, coal		
			Trinidad Sandstone	45–310	Tan and gray sandstone with shale partings		
			Pierre Shale	1,600–2,300	Shale, with interbedded sandstone in the upper 100–300 feet	Confining layer	Sandstone layers might yield limited water
			Niobrara Formation	450–570	Chalky and sandy shale with limestone in lower 50–70 feet	Ft. Hayes Limestone Member	Ft. Hayes Limestone Member supplies wells in adjacent areas
			Carlile Shale	225–290	Sandstone in upper 5–30 feet, shale below	Codell Sandstone Member	Codell Sandstone Member supplies wells in adjacent areas
			Greenhorn Limestone	25–35	Thin gray limestone interbedded with shale		Yields small quantities of water to wells in adjacent areas
			Graneros Shale	185–235	Shale and limestone	Confining layer	Not an aquifer in Raton Basin
		Lower Cretaceous	Dakota Sandstone	50–200	White and tan sandstone	Dakota aquifer	Average porosity range 10–20%; average hydraulic conductivity 0.2 ft/day



Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: Permian Basin and the Capitan Reef Aquifer System

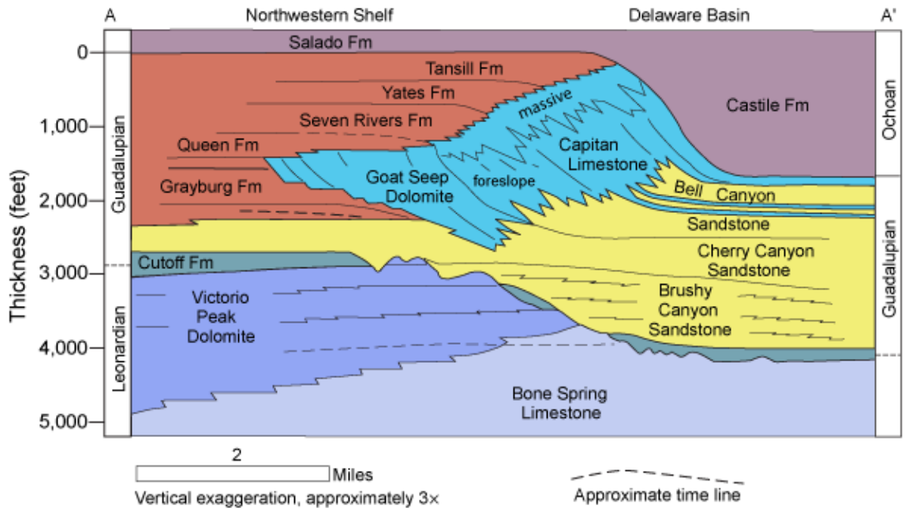
FIGURE 5A. Maps Showing the General Location of the Capitan Reef Aquifer System





Era	Period	Northwest Shelf	Delaware Basin
Cenozoic	Quaternary	Pecos Valley alluvial fill	
	Tertiary	Gatuna Formation	
		Ogallala Formation	
		Sierra Blanca volcanics	
Mesozoic	Cretaceous		
	Jurassic		
	Triassic	Santa Rosa Fm./Dockum Grp.	
Paleozoic	Permian	Rustler Fm.	Rustler Fm.
		Salado Fm.	Salado Fm.
			Castile Fm.
		Artesia Group: Tansill, Yates, Seven Rivers, Queen, Grayburg; Capitan Reef*	Delaware Mountain Group
		San Andres Formation	Bone Spring Formation
		Yeso, Victorio Peak	
		Abo Formation	Hueco Group
		Older Paleozoic strata	

* lower portion of reef section includes the Goat Seep reef



Modified from King, 1948; Hayes, 1964; Tyrrell, 1969; Pray, 1988

FIGURE 5B. Relevant Stratigraphic Column and Relationship to Aquifer Occurrences in the Capitan Reef Lithosome as Shown in the Schematic and Correlation Cross Sections

Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs: Permian Basin and Roswell Basin Aquifer System

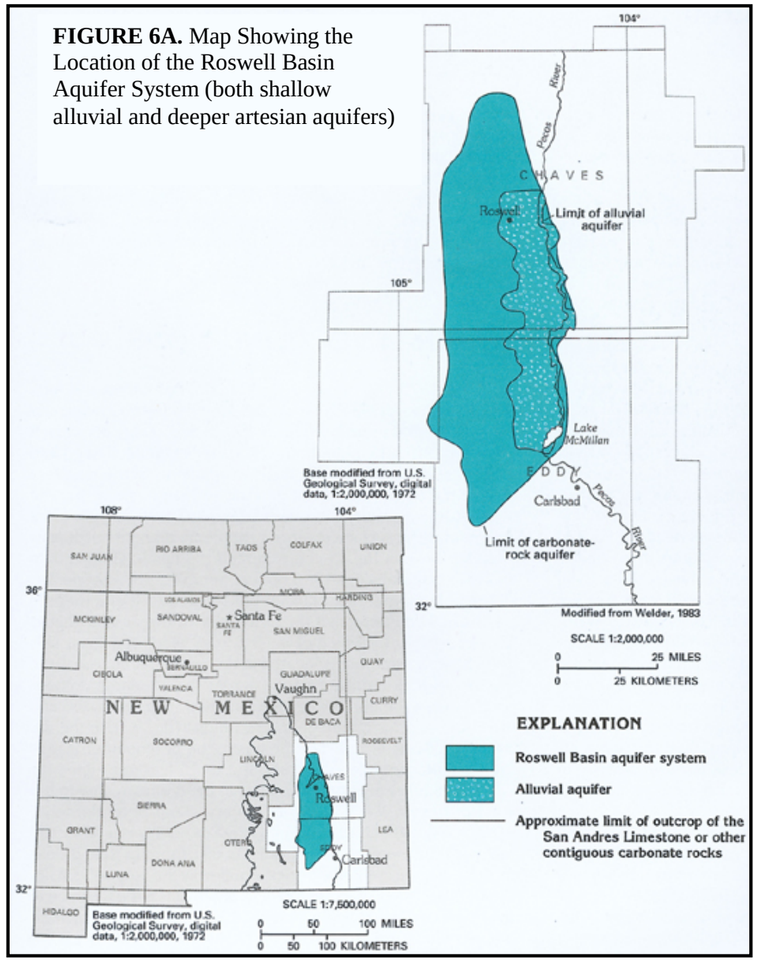
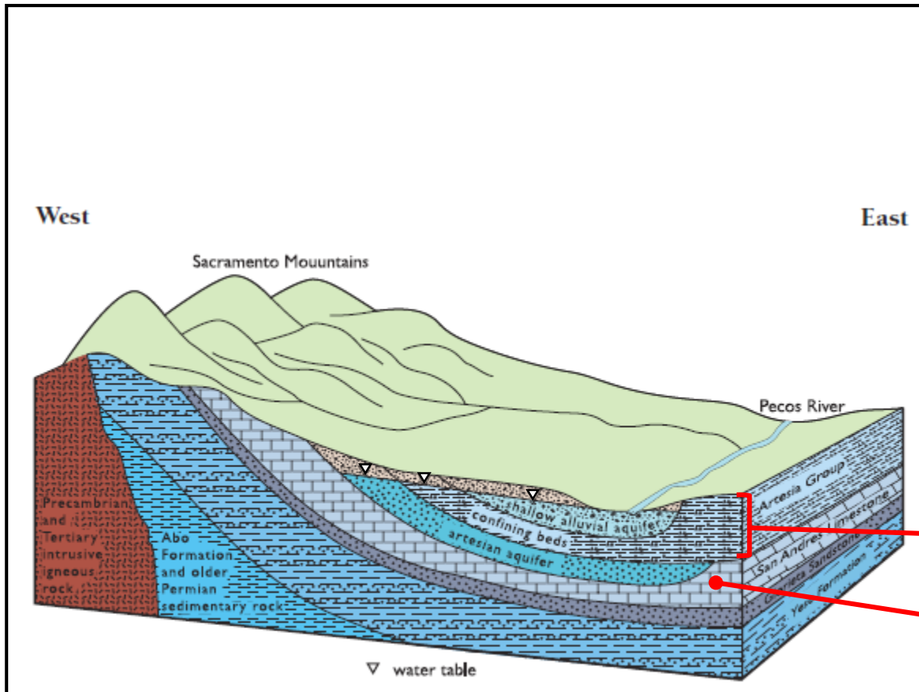


FIGURE 6A. Map Showing the Location of the Roswell Basin Aquifer System (both shallow alluvial and deeper artesian aquifers)



Era	Period	Northwest Shelf	Delaware Basin
Cenozoic	Quaternary	Pecos Valley alluvial fill	
	Tertiary	Gatuna Formation	
		Ogallala Formation	
		Sierra Blanca volcanics	
Mesozoic	Cretaceous		
	Jurassic		
	Triassic	Santa Rosa Fm./Dockum Grp.	
Paleozoic	Permian	Rustler Fm.	Rustler Fm.
		Salado Fm.	Salado Fm.
			Castile Fm.
		Artesia Group: Tansill, Yates, Seven Rivers, Queen, Grayburg; Capitan Reef*	Delaware Mountain Group
		San Andres Formation	Bone Spring Formation
		Yeso / Victorio Peak	
		Abo Formation	Hueco Group
		Older Paleozoic strata	

* lower portion of reef section includes the Goat Seep reef

FIGURE 6B. Stratigraphic Column and Relationship to Aquifer Occurrences in the Roswell Artesian Basin as Shown in the Schematic Cross Section

Oil Conservation Division
Energy, Minerals and Natural Resources Department
State of New Mexico

Review of UIC Class II Activities Within the State of New Mexico for Possible Injection into USDWs

Table 1. Summary Table of Active Injection Wells Requiring Further Investigation

Report ID Number	Well Identification No.	Well Name	Current Operator	Location (UL-Sec-Twn-Rge)	OCD Designated Pool	Well Type	Injection Authority	Source Identifying Potential
1*	30-015-02446	SALADAR FEDERAL NO. 4	MNA ENTERPRISES LTD CO	K (NE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869	RESPEC Report RSI-2048
2*	30-015-02448	SALADAR FEDERAL NO. 6	MNA ENTERPRISES LTD CO	K (NE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869	RESPEC Report RSI-2048
3*	30-015-02449	SALADAR FEDERAL NO. 8	MNA ENTERPRISES LTD CO	N (SE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869	RESPEC Report RSI-2048
4*	30-015-02450	SALADAR B NO. 2	MNA ENTERPRISES LTD CO	L (NW¼SW¼)-33-20S-28E	SALADAR;YATES	ER	**Shut-in** (expired authority)	RESPEC Report RSI-2048
5*	30-015-24179	SALADAR FEDERAL NO. 12	MNA ENTERPRISES LTD CO	K (NE¼SW¼)-33-20S-28E	SALADAR;YATES	ER	WFX-869	RESPEC Report RSI-2048
6*	30-025-08606	CONE JALMAT YATES POOL UNIT NO. 105	BREITBURN OPERATING LP	L (NW¼SW¼)-13-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	**R-2495^**	RESPEC Report RSI-2048
7*	30-025-08640	CONE JALMAT YATES POOL UNIT NO. 502	BREITBURN OPERATING LP	L (NW¼SW¼)-24-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	WFX-206	RESPEC Report RSI-2048
8*	30-025-08648	CONE JALMAT YATES POOL UNIT NO. 107	BREITBURN OPERATING LP	D (NW¼NW¼)-24-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	**R-2495^**	RESPEC Report RSI-2048
9*	30-025-08579	JALMAT FIELD YATES SAND UNIT NO. 123	BREITBURN OPERATING LP	P (SE¼SE¼)-10-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	**R-2243^**	RESPEC Report RSI-2048
10*	30-025-08588	JALMAT FIELD YATES SAND UNIT NO. 121	BREITBURN OPERATING LP	N (SE¼SW¼)-11-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	**R-2243^**	RESPEC Report RSI-2048
11*	30-025-08590	JALMAT FIELD YATES SAND UNIT NO. 114	BREITBURN OPERATING LP	J (NW¼SE¼)-11-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	**R-2243^**	RESPEC Report RSI-2048
12*	30-025-08601	JALMAT FIELD YATES SAND UNIT NO. 116	BREITBURN OPERATING LP	L (NW¼SW¼)-12-22S-35E	JALMAT;TAN-YATES-7 RVRS (OIL)	ER	**Currently producer** (R-2243)	RESPEC Report RSI-2048
13	30-015-26524	HADSON FEDERAL NO. 1	VANGUARD OPERATING, LLC	O (SW¼SE¼)-11-19S-31E	SWD;YATES-SEVEN RIVERS	SWD	SWD-700	RESPEC Report RSI-2048
14	30-015-26730	HADSON FEDERAL NO. 3	VANGUARD OPERATING, LLC	G (SW¼NE¼)-11-19S-31E	SWD;YATES-SEVEN RIVERS	SWD	SWD-479	RESPEC Report RSI-2048
15	30-025-32735	PRONGHORN SWD NO. 1	COG OPERATING LLC	B (NW¼NE¼)-24-19S-32E	SWD;YATES-SEVEN RIVERS	SWD	SWD-536	RESPEC Report RSI-2048
16	30-025-02431	LEA UNIT NO. 8	LEGACY RESERVES OPERATING, LP	B (NW¼NE¼)-12-20S-34E	SWD;SEVEN RIVERS	SWD	**SWD-189^**	RESPEC Report RSI-2048
17	30-025-02459	CRUCES FEDERAL NO. 3	BURK ROYALTY CO., LTD.	N (SE¼SW¼)-26-20S-34E	LYNCH;YATES-SEVEN RIVERS	SWD	R-9000	RESPEC Report RSI-2048
18	30-025-02507	W H MILNER FEDERAL NO. 4	BURK ROYALTY CO., LTD.	C (NE¼NW¼)-35-20S-34E	SWD;YATES	SWD	**R-3779^**	RESPEC Report RSI-2048
19	30-025-02501	NEAL NO. 3	BURK ROYALTY CO., LTD.	A (NE¼NE¼)-35-20S-34E	LYNCH;YATES-SEVEN RIVERS	ER	R-4283-A	RESPEC Report RSI-2048
20	30-025-02476	SILVER FEDERAL NO. 4	STEVEN D RUPPERT	O (SW¼SE¼)-28-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	**R-3724^**	RESPEC Report RSI-2048
21	30-025-02466	BALLARD DE FEDERAL NO. 3	BLACK MOUNTAIN OPERATING LLC	D (NW¼NW¼)-27-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-354	RESPEC Report RSI-2048
22	30-025-02494	B V LYNCH A FEDERAL NO. 2	MAS OPERATING CO.	P (SE¼SE¼)-34-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	R-7971	RESPEC Report RSI-2048
23	30-025-12580	B V LYNCH A FEDERAL NO. 10	MAS OPERATING CO.	C (NE¼NW¼)-34-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	R-4612	RESPEC Report RSI-2048
24	30-025-02448	D AND E FEDERAL NO. 1	CHESTNUT EXPLORATION AND PRODUCTION, INC.	N (SE¼SW¼)-22-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-326	RESPEC Report RSI-2048
25	30-025-20386	WHITTEN NO. 1	NEW MEXICO SALT WATER DISPOSAL COMPANY	I (NE¼SE¼)-14-20S-34E	SWD;SEVEN RIVERS	SWD	SWD-525	RESPEC Report RSI-2048
26	30-025-23985	WALLEN FEDERAL NO. 2	DAKOTA RESOURCES INC (I)	C (NE¼NW¼)-20-20S-34E	SWD;YATES-SEVEN RIVERS	SWD	SWD-249	RESPEC Report RSI-2048
27	30-015-26710	WELCH FEDERAL NO. 7	BILL G TAYLOR AND HARVEY R TAYLOR	P (SE¼SE¼)-5-21S-27E	CEDAR HILLS;YATES	SWD	SWD-425	RESPEC Report RSI-2048
28	30-015-22055	EXXON STATE NO. 8	PYOTE WELL SERVICE, LLC	O (SW¼SE¼)-15-21S27E	SWD;YATES	SWD	R-13043	RESPEC Report RSI-2048
29	30-025-25957	7406 JV-S LEA 20 NO. 1	CHANCES PROPERTIES COMPANY	P (SE¼SE¼)-20-26S-36E	SWD; CAPITAN REEF	SWD	**SWD-210^**	Identified as result of EPA 2016 review request
30	30-025-01671	FEDERAL 18 B NO. 4	COG OPERATING LLC	H (SE¼NW¼)-18-19S-33E	SWD; SEVEN RIVERS	SWD	SWD-589	Identified as result of EPA 2016 review request
31	30-025-09807	MARALO SHALES B NO. 2	OWL SWD OPERATING, LLC	P (SE¼SE¼)-25-25S-36E	SWD;YATES-SEVEN RIVERS	SWD	SWD-1127	Identified as result of disposal application in vicinity
32	30-025-09807	BROWN NO. 5	OWL SWD OPERATING, LLC	E (SW¼NW¼)-25-25S-36E	SWD;YATES-SEVEN RIVERS	SWD	**R-5196^**	Identified as result of disposal application in vicinity

*****Colors represent grouping of individual injection wells that are part of active waterflood units.

^Indicates injection authority predates primacy approval date of March 7, 1982.

CAPITAN REEF INJECTION WELL IMPACT STUDY

Topical Report RSI-2048

prepared for

New Mexico Oil Conservation Division
1220 South Saint Francis Drive
Santa Fe, New Mexico 87505

April 2009

RESPEC
CONSULTING & SERVICES

CAPITAN REEF INJECTION WELL IMPACT STUDY

Topical Report RSI-2048

by

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Rapid City, South Dakota 57709

prepared for

New Mexico Oil Conservation Division
1220 South Saint Francis Drive
Santa Fe, New Mexico 87505

April 2009

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1.0 OBJECTIVES

The objective of this preliminary study was to increase the New Mexico Energy, Minerals, and Natural Resources Department (NMERD), Oil Conservation Division's ability to protect the water quality in and around the Capitan Reef and to protect the Carlsbad area's drinking water source. This aquifer vulnerability study focused primarily on identifying brine injection wells that have the potential to contaminate the freshwater resource of the Capitan Reef aquifer.

2.0 TASKS

The primary task and deliverable of this study was to identify wells currently permitted to inject into or near the upper or lower portions of the Capitan Reef boundary. The wells considered consist of those within 1 mile of Capitan Reef that are injecting and/or have injected within the past 2 years. Well completion reports and electronic log (elogs) data were obtained to determine the perforation depths and subsequent formation of injection to identify wells that have potential for contaminating groundwater in the area. A Geographic Information System (GIS) layer of the wells was generated and delivered in a format compatible with the Oil Conservation Division's risk-based data management system (RBDMS).

A list of wells found to meet the criteria was generated with the following attributes:

- American Petroleum Institute (API) numbers
- Injection location (above, into, or adjacent to Capitan Reef)
- Injection formation
- Well data source.

A new table, WELLSINJECT_SENAREA, was created in the RDBMS_BASE_GIS SQL database. The table includes wells that meet the criteria and the associated attributes.

3.0 METHODS

The primary source of data used for this project was the procuring agency's wells database and catalog of electronic completion reports and elogs. The New Mexico Environmental Department was also contacted as a data source, but no wells were found to fit the criteria stipulated under the project task from this agency. Using the task criteria, wells were identified that had been injecting in the last 2 years within 1 mile of the Capitan Reef. Oil Conservation Division's wells database was queried by well type and water injected per year to narrow down the spatial search. A 1-mile buffer was created around the surface boundaries for the Capitan Reef. The boundaries used were from the Phase 1 study that was digitized from open file reports developed by the U.S. Geological Survey in the mid-1970s [Hiss, 1975]. The buffered surface boundaries of Capitan Reef were used to perform a spatial selection of the wells in **ArcGIS**.

For the list of wells found to match the criteria, electronic documents, including well completion reports, status changes, perforation permits, and elogs, were downloaded. Many wells did not have elogs and some had only a few supporting documents where available. The perforated or open hole injection interval was determined from the supporting documents. This was done with careful attention to the evolution of the well outlined in the documentation to pinpoint the most recent injection interval. The injection formation and other formation tops were also recorded from the completion reports and elogs where available. Subsequently, the injection location attribute was populated based on the understanding of the injection interval and formation relative to the depth and thickness of the Capitan Reef. A second interpretation of the injection location was also done comparing the injection interval from the documentation with the structure contour and isopach data of the Capitan Reef developed by Hiss [1975]. The structure interval and isopach maps were used to develop interpolated surfaces to define the subsurface structure of the Capitan Reef. Wells and associated injection intervals were visually inspected and compared with the interpolated structure to further refine injection intervals.

4.0 RESULTS

A total of 298 wells were found to fit the criteria outlined in the project task. A table of the selected wells is contained in Appendix A (included on CD). The full datatable was uploaded into the RDBMS_BASE_GIS SQL database as specified by the Oil Conservation Division. From the preliminary findings based solely on well completion data, 139 wells are injecting above, 84 wells adjacent, and 75 below the Capitan Reef. The spatial distribution of the well injection locations from the initial findings are presented in Figure 4-1.

The injection intervals were reanalyzed using the 1975 Hiss interpolation of the subsurface structure of the Capitan Reef. A three-dimensional (3D) model of the Capitan Reef was built in ESRI's **ArcScene** using Hiss' interpolation and the 298 wells and injection intervals were added to the 3D structure model in Figure 4-2. The spatial distribution of the 3D interpolated injection well locations is presented in Figure 4-3. According to Hiss' structural interpolation, a set of 30 wells was found to be injecting close to, if not into, Capitan Reef. These 30 higher risk wells are presented in Table 4-1 and Figure 4-4. From the 3D interpolation, Exxon State 08 was found to be injecting approximately 70 feet above Capitan Reef (Figure 4-5). It is therefore difficult to identify the impact of the wells identified here in this subset.

The Hiss structural interpolation is an approximation based on limited data that may not reflect exact spatial relations between Capitan Reef and well injection intervals. The close spatial proximity to the Capitan Reef of these wells does not prove these wells are impacting Capitan Reef, just that they are a potential source of vulnerability. A modern structural interpolation using all available data would help to better define the subsurface structure of Capitan Reef and the proximity to the well injection intervals. To verify whether injection either below or above the Capitan Reef is safe under various aquifer stress conditions, additional work must be done to characterize the vertical hydraulic gradients.

A plot of the chloride concentration [Hiss, 1975] reveals a trend of lower chloride concentrations on Capitan Reef with concentrations increasing basinward (Figure 4-6). Recent water-quality data was not compared to historic data or injection well locations.

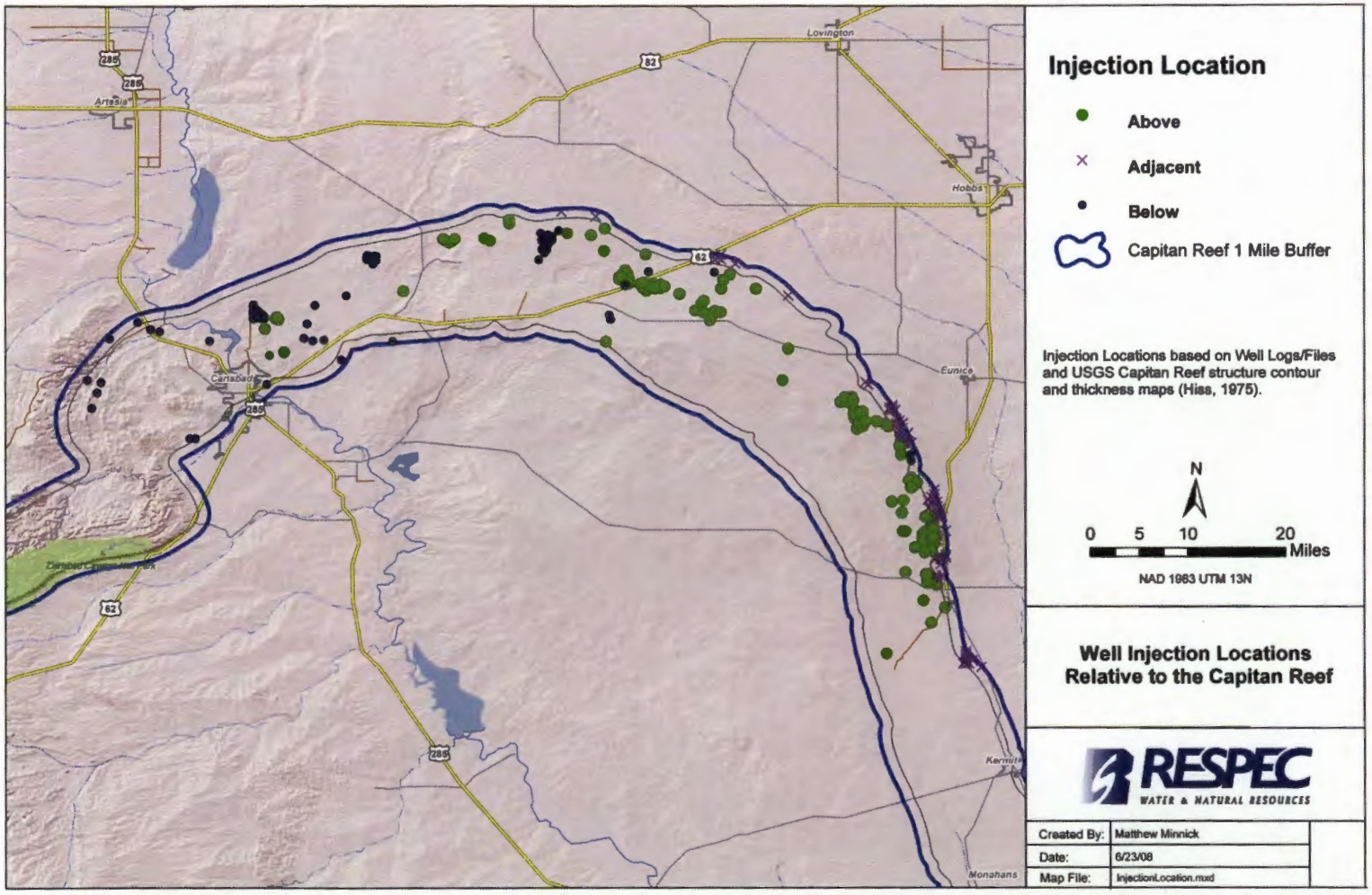

Figure 4-1. Locations of All Active Injection Wells Within 1 Mile of the Capitan Reef. Injection intervals derived from supporting well documents.

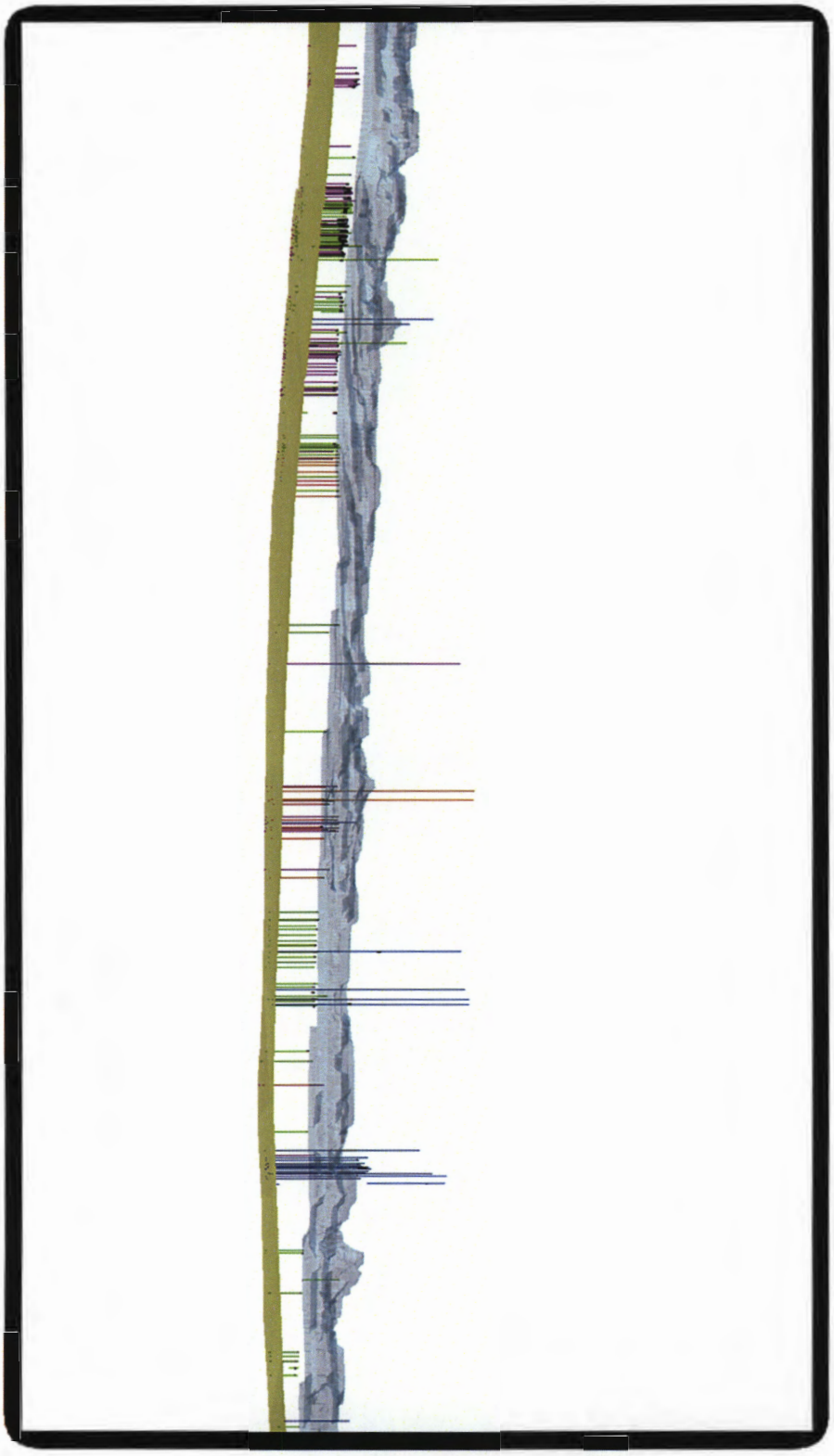

Figure 4-2. Three-Dimensional Interpolation of the Capitan Reef Created From Structure and Isopach Contours (From Hiss [1975]). Wells are colored according to injection location, green–above, blue–above, purple–adjacent, red–into. Injection intervals are colored black.

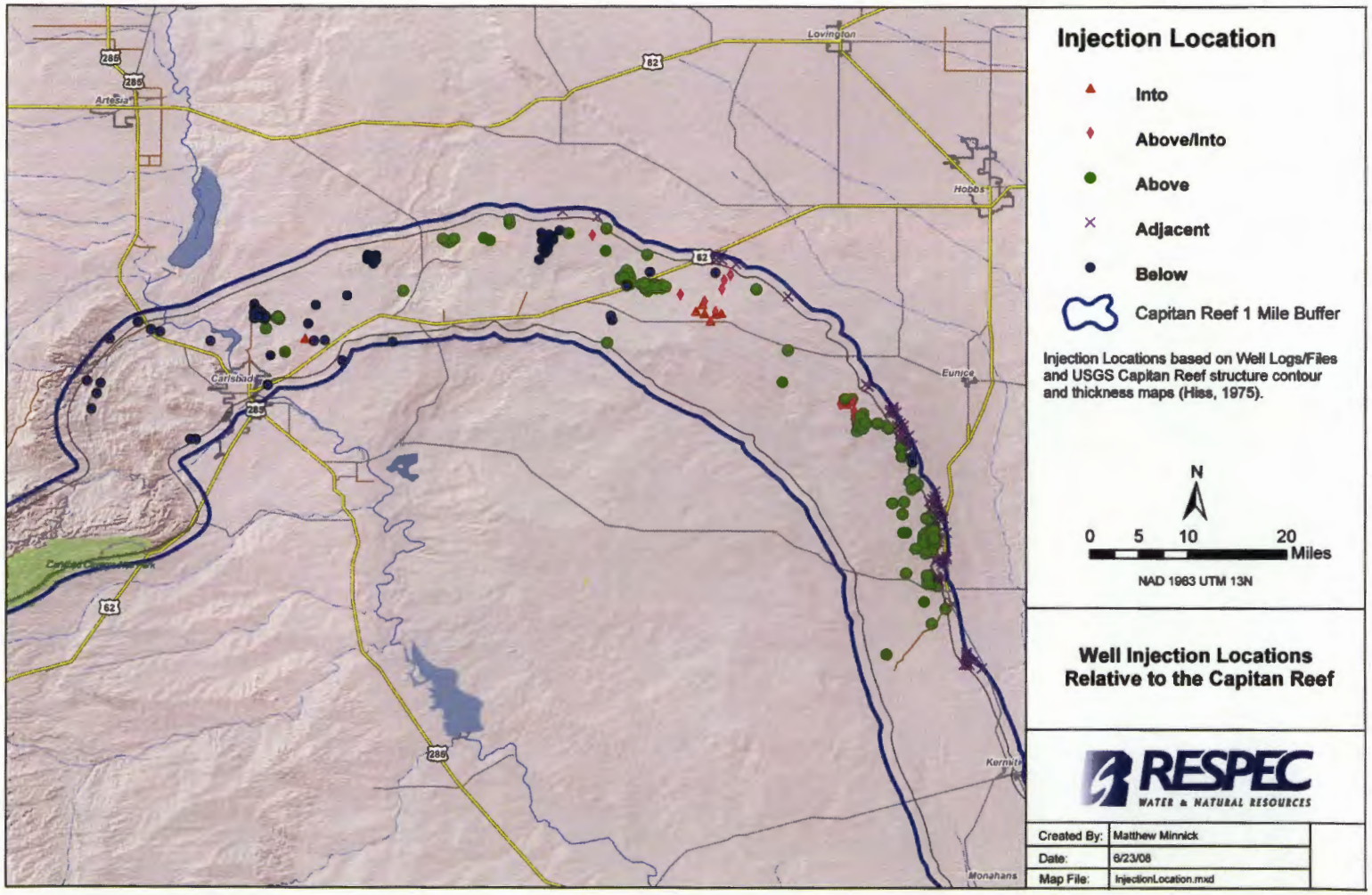

Figure 4-3. Revised Well Injection Intervals Derived From the Three-Dimensional Interpolation of the Capitan Reef.

Table 4-1. List of Higher Risk Wells Identified Using the Three-Dimensional Interpolation of the Capitan Reef (Page 1 of 2)

API No.	Well Name	Injection Location	Interpolated Injection Location	Injection Formation
3001502449	SALADAR UNIT 008	Above	Above	Yates
3001502446	SALADAR UNIT 004	Above	Above	Yates
3001502448	SALADAR UNIT 006	Above	Above	Yates
3001502450	SALADAR UNIT 002	Above	Above	Yates
3001524179	SALADAR UNIT 012	Above	Above	Yates
3002502459	CRUCES FEDERAL 003	Above	Above/Into	Yates
3002508640	CONE JALMAT YATES POOL UNIT 502	Above	Above/Into	Yates
3002508590	JALMAT FIELD YATES SAND UNIT 114	Above	Into	Yates
3002508579	JALMAT FIELD YATES SAND UNIT 123	Above	Above/Into	Yates
3002508606	CONE JALMAT YATES POOL UNIT 105	Above	Above/Into	Yates
3002508588	JALMAT FIELD YATES SAND UNIT 121	Above	Into	Yates
3002508601	JALMAT FIELD YATES SAND UNIT 116	Above	Above/Into	Yates
3002508648	CONE JALMAT YATES POOL UNIT 107	Above	Above/Into	Yates
3001526524	HADSON FEDERAL 001	Above	Above	Yates
3001526710	WELCH FEDERAL 007	Above	Above	Yates
3002502476	SILVER FEDERAL 004	Above	Into	Seven Rivers
3002502466	BALLARD DE FEDERAL 003	Above	Into	Seven Rivers
3001526730	HADSON FEDERAL 003	Above	Above	Yates/Seven Rivers
3002502507	W H MILNER FEDERAL 004	Above	Into	Seven Rivers
3002502431	LEA UNIT 008	Above	Above/Into	Yates
3002502494	B V LYNCH A FEDERAL 002	Above	Into	Yates/Seven Rivers
3002502448	D AND E FEDERAL 001	Above	Above/Into	Yates
3002502501	NEAL 003	Above	Into	Yates
3002520386	WHITTEN 001	Above	Above/Into	Seven Rivers/Queen

Table 4-1. List of Higher Risk Wells Identified Using the Three-Dimensional Interpolation of the Capitan Reef (Page 2 of 2)

API No.	Well Name	Injection Location	Interpolated Injection Location	Injection Formation
3002512580	B V LYNCH A FEDERAL 010	Above	Into	Yates
3002528528	LEA UNIT SWD 002	Above	Above/Into	Seven Rivers
3002523985	WALLEN FEDERAL 002	Above	Above/Into	Seven Rivers
3002532735	PRONGHORN SWD 001	Above	Above/Into	Yates/Seven Rivers
3001520387	GOVERNMENT D 001	Below	Into	Delaware
3001522055	EXXON STATE 008	Above	Above	Yates

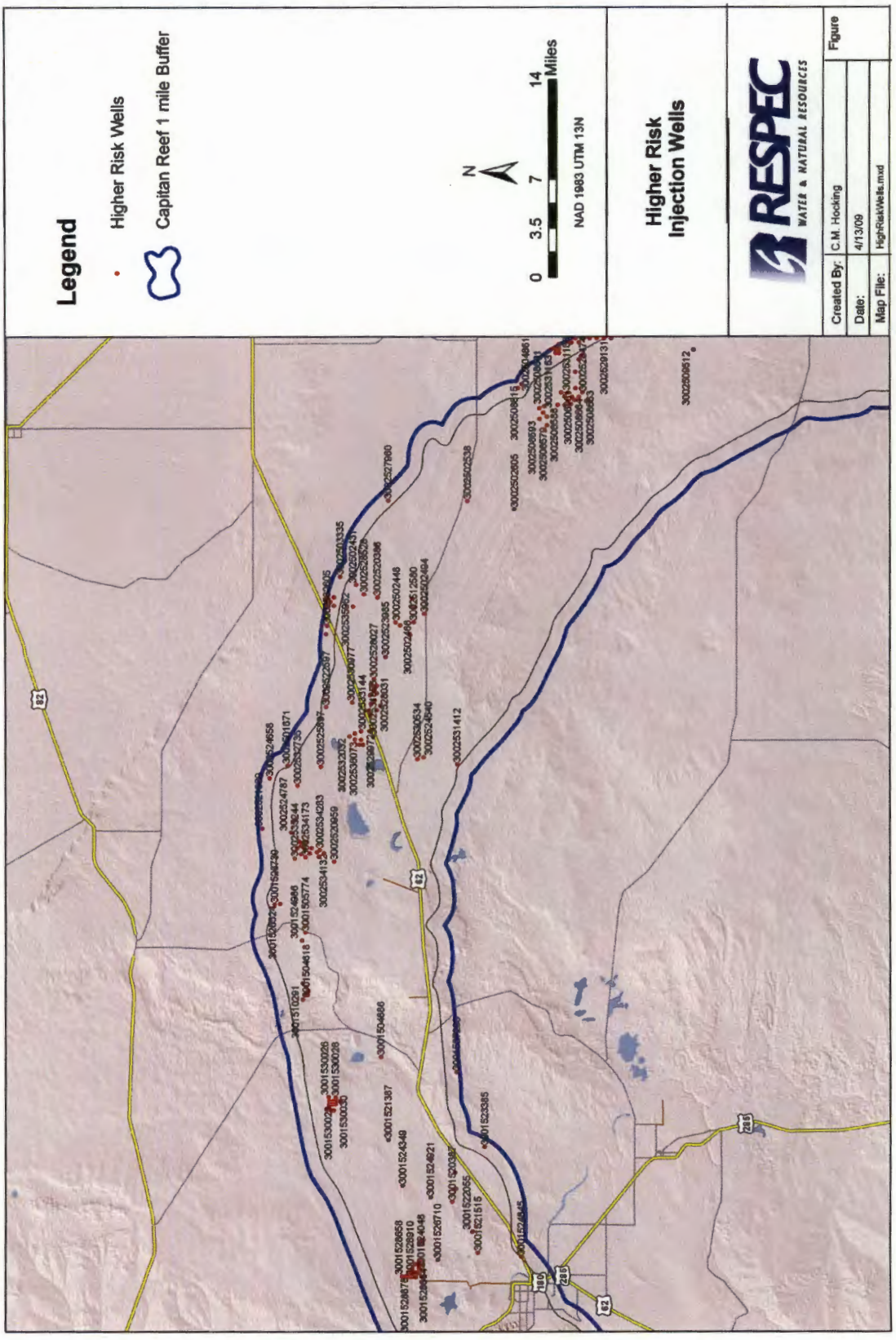

Figure 4-4. Injection Location Map of the 30 Wells Representing Higher Risk.

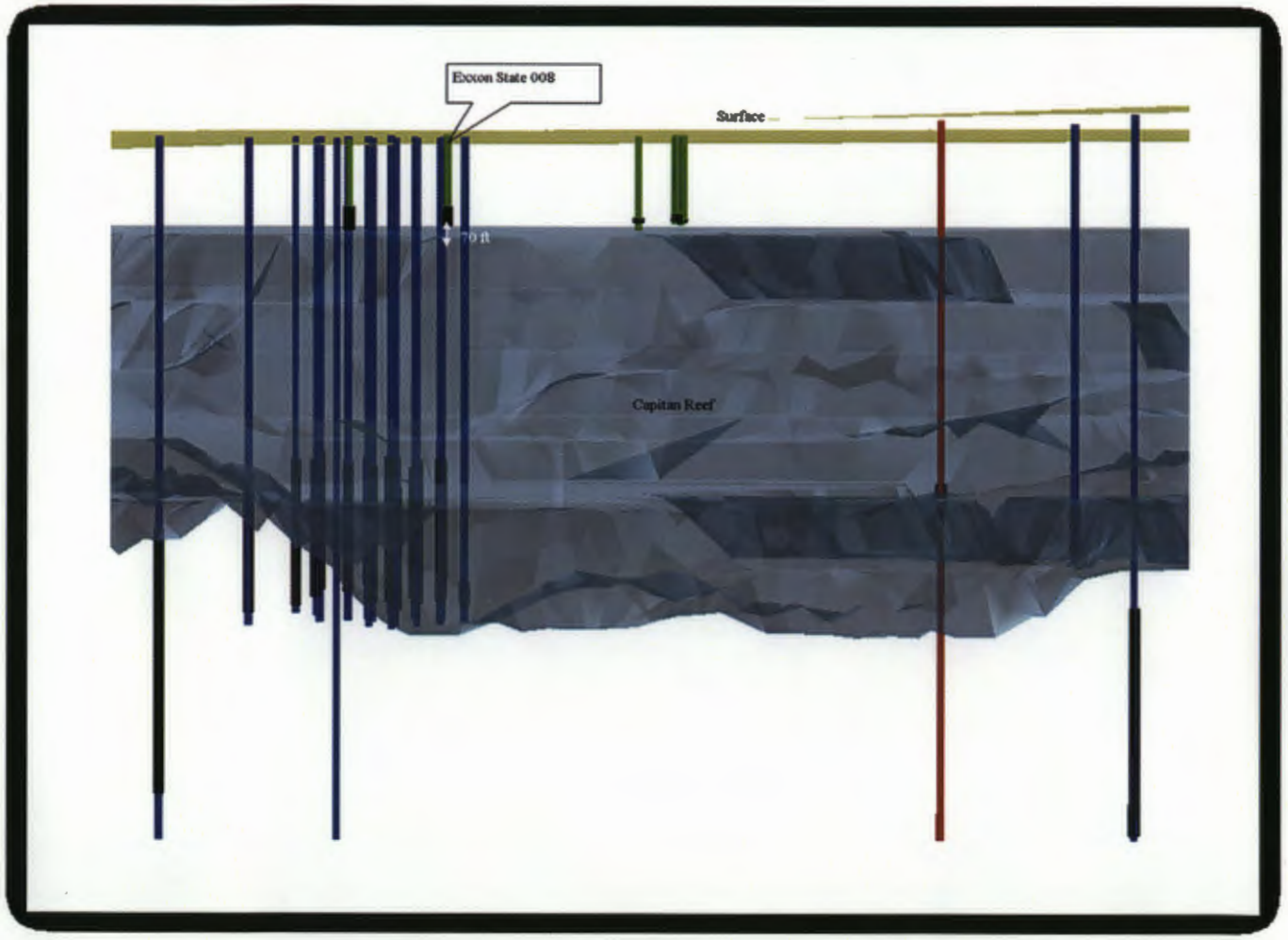

Figure 4-5. View of the Exxon State 008 Well Injection Interval in Relation to the Capitan Reef. Three-dimensional interpolation of the Capitan Reef created from structure and isopach contours (from Hiss [1975]). Wells are colored according to injection location, green–above, blue–below, purple–adjacent, and red–into. Injection intervals are colored black. In this figure, Exxon State 008 is injecting approximately 70 feet above the reef.

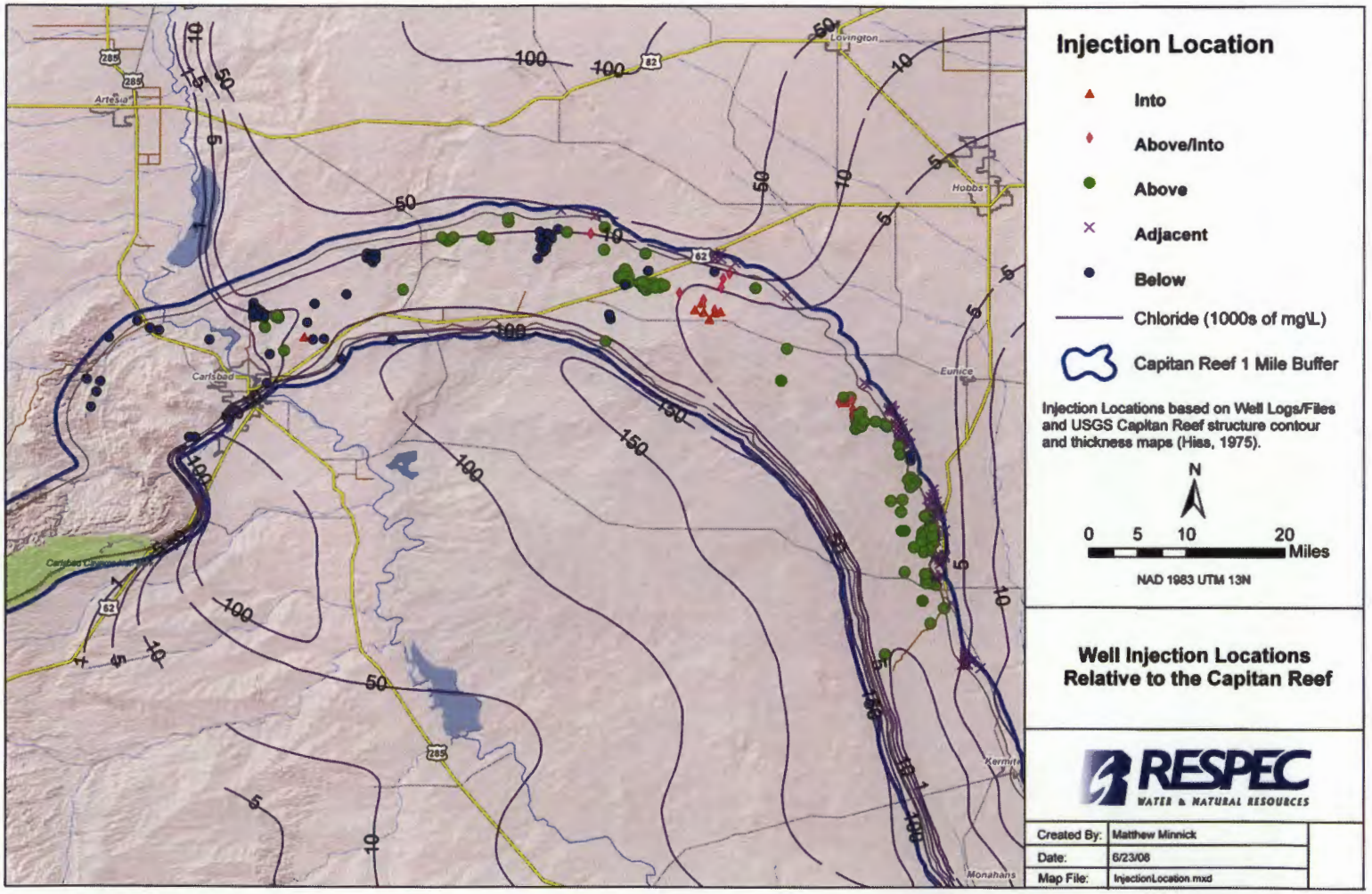

Figure 4-6. Injection Location Map Coupled With Chloride Concentrations Interpolated by Hiss [1975]. Injection locations represented here are derived from the three-dimensional interpolation of the reef.

5.0 RECOMMENDATIONS

Out of the 298 wells identified that match the task criteria, 30 wells were found to be of higher risk for potential to impact the Capitan Reef aquifer. Out of the 30 higher risk wells, 29 wells are injecting above the Capitan Reef in the Yates and Seven Rivers Formations and possibly into Capitan Reef. One well, GOVERMENT D 001, is injecting just below or possibly into the Capitan Reef. This study is a regional survey of risk potential and does not attempt to understand the local scale structural features, faults, and lithology that control interformational flow and potential impact of brine injection. Understanding these features on a local scale is important to further assessing the potential impact of these wells. Using the results from this regional study, areas of focused research may be identified around suspect wells and areas of high vulnerability, including the fresh water, saline groundwater interface and the Pecos River. A more detailed and accurate subsurface visualization using data from all available resources should be built to provide a framework for assessing the potential impact of the higher risk wells and defining vulnerable areas of the Capitan Reef. Structural features, including faults that may provide preferential flow paths for injected brine to reach the Capitan Reef, need to be identified. Highly porous lithologic units or evaporites susceptible to dissolution also need to be identified in the subsurface framework. Other data, including groundwater flow and geochemistry, can also be visualized to further support the understanding of the aquifer.

ESRI's GIS can provide the platform to store, analyze, visualize, and disseminate the geology and groundwater data. Detailed geostatistical subsurface interpolations can be built using C-Tech's **Mining Visualization Systems** (**MVS**) and imported into an **ArcHydro** groundwater geodatabase schema for analysis with groundwater flow and geochemistry data. Coupling of this data with analytical and numerical models can provide a powerful decision support tool. Products developed from this system, including visualizations and animations, provide powerful and defendable litigation support material. This system would increase the NMERD Oil Conservation Division's ability to protect the water quality in and around the Capitan Reef and protect the Carlsbad area's drinking water source.

6.0 REFERENCES

Hiss, W. L. 1975. *Map Showing Thickness of the Permian (Guadalupian) Capitan Aquifer, Southeast New Mexico and West Texas,* prepared by the U.S. Geological Survey in cooperation with the New Mexico State Engineer.

APPENDIX A

TABLE OF WELLS MEETING THE TASK CRITERIA

(CD ROM)

Capitan Reef Injection Well Impact Study

Topical Report RSI-2048

April 2009

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Carlsbad, New Mexico 88221-2261
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RESPEC
CONSULTING & SERVICES

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API	WELL NAME	InjectLoc	InjectLoc3D	InjectFm	WellDataSrc	Elev	TD	Perf_T	Perf_B	T_Rustler	T_T_Salt	T_B_Salt	T_Yates	T_Seven	T_Queen	T_Penrose	T_Grayburg	T_Cap	T_Del	T_Cherry_C	T_49sand	T_BrushyCa	T_Bone_Spr	T_Wolfcamp	T_CiscoReef	T_Strawn	T_Atoka	T_Morrow	T_Dev	T_Ellenburger	water_inj_2008	water_inj_2007	water_inj_2006	LATITUDE	LONGITUDE
3001502449	SALADAR UNIT 008	Above	Above	Yates	OCD	3,199	664	628	664				604																		0	4,375	9,007	32.5254	-104.1840
3001502446	SALADAR UNIT 004	Above	Above	Yates	OCD	3,200	700	667	677				634																		0	1,337	31	32.5290	-104.1862
3001502448	SALADAR UNIT 006	Above	Above	Yates	OCD	3,200	682	666	677				636																		0	73	37	32.5272	-104.1844
3001502450	SALADAR UNIT 002	Above	Above	Yates	OCD	3,201	748	650	689				636																		0	1,312	1,174	32.5272	-104.1883
3001524179	SALADAR UNIT 012	Above	Above	Yates	OCD	3,198	711	631	696				631																		0	829	764	32.5281	-104.1851
3001504622	NORTH HACKBERRY YATES UNIT 108	Above	Above	Yates	OCD	3,257	2,000	1,749	1,851	545			1,684																		3	4	5	32.6440	-103.9331
3001504627	NORTH HACKBERRY YATES UNIT 113	Above	Above	Yates	OCD	3,268	2,000	1,789	1,901	562		1,560	1,712																		1,266	5,842	2,309	32.6412	-103.9286
3001504626	NORTH HACKBERRY YATES UNIT 110	Above	Above	Yates	OCD	3,350	2,075	1,896	1,927	600		1,664	1,823																		1,963	7,738	3,034	32.6431	-103.9246
3001504618	NORTH HACKBERRY YATES UNIT 105	Above	Above	Yates	OCD	3,285	1,993	1,762	1,820			1,510	1,716	1,947																	307	625	72	32.6467	-103.9374
3001510291	NORTH HACKBERRY YATES UNIT 101	Above	Above	Yates	OCD	3,436	2,125	2,022	2,050			1,500	1,928																		1,968	7,745	4,371	32.6467	-103.9203
3001526006	PARKWAY DELAWARE UNIT 302	Below	Below	Delaware	OCD	3,312	5,000	4,241	4,310	403	502	1,130	1,335						3,345												90	36,178	70,360	32.6182	-104.0516
3001526029	PARKWAY DELAWARE UNIT 505	Below	Below	Delaware	OCD	3,319	5,000	4,221	4,300	392	480	1,130	1,325						3,362												0	70,192	0	32.6153	-104.0517
3001526143	PARKWAY DELAWARE UNIT 204	Below	Below	Delaware	OCD	3,310	4,550	4,210	4,246			1,122	1,480	1,619					3,680												10,092	107,930	36,432	32.6216	-104.0510
3001526433	PARKWAY DELAWARE UNIT 601	Below	Below	Delaware	OCD	3,320	4,500	4,266	4,350				1,355	1,548	2,510				3,862												9,110	3,261	8,568	32.6089	-104.0425
3001527445	PARKWAY DELAWARE UNIT 303	Below	Below	Delaware	OCD	3,311	4,800	4,138	4,247	390		1,175	1,470	1,620					3,365												32,452	384,258	307,962	32.6204	-104.0459
3001527464	PARKWAY DELAWARE UNIT 506	Below	Below	Delaware	OCD	3,311	4,750	4,127	4,203	394		1,162	1,468	1,624					3,366												22,117	239,670	212,151	32.6170	-104.0456
3001527283	GOLDEN 8 FEDERAL 003	Below	Below	Delaware	OCD	3,391	4,575	4,238	4,310	902								2,064	3,044	3,854											0	99,666	60,764	32.4921	-104.0122
3001528668	AVALON DELAWARE UNIT 571	Below	Below	Delaware	OCD	3,212	3,880	2,520	3,736										2,486												0	25,220	25,433	32.5263	-104.2090
3001528667	AVALON DELAWARE UNIT 533	Below	Below	Delaware	OCD	3,216	3,880	2,546	3,706										2,500												0	28,790	30,000	32.5295	-104.2090
3001528659	AVALON DELAWARE UNIT 238	Below	Below	Delaware	OCD	3,295	3,926	3,632	3,470										2,510												0	180,619	175,681	32.5434	-104.2213
3001528683	AVALON DELAWARE UNIT 537	Below	Below	Delaware	OCD	3,236	3,800	2,544	3,656										2,508												0	82,298	91,474	32.5298	-104.2179
3001528658	AVALON DELAWARE UNIT 222	Below	Below	Delaware	OCD	3,299	3,950	2,706	3,753										2,530												0	9,768	12,354	32.5471	-104.2214
3001528665	AVALON DELAWARE UNIT 516	Below	Below	Delaware	OCD	3,232	3,850	2,576	3,670										2,484												0	127,532	131,771	32.5335	-104.2091
3001528666	AVALON DELAWARE UNIT 570	Below	Below	Delaware	OCD	3,233	3,850	2,600	3,692										2,485												0	58,939	59,887	32.5301	-104.2132
3001528660	AVALON DELAWARE UNIT 254	Below	Below	Delaware	OCD	3,291	3,870	2,584	3,632										2,480												0	41,102	40,390	32.5403	-104.2213
3001528684	AVALON DELAWARE UNIT 542	Below	Below	Delaware	OCD	3,279	3,875	2,644	3,774										2,480												0	52,312	53,742	32.5263	-104.2219
3001528661	AVALON DELAWARE UNIT 253	Below	Below	Delaware	OCD	3,297	3,820	2,552	3,728										2,480												0	54,465	56,825	32.5400	-104.2174
3001528664	AVALON DELAWARE UNIT 520	Below	Below	Delaware	OCD	3,240	3,782	2,590	3,628										2,505												0	67,789	69,119	32.5333	-104.2172
3001528662	AVALON DELAWARE UNIT 626W	Below	Below	Delaware	OCD	3,208	3,849	3,532	3,711										2,480												0	50,876	50,247	32.5299	-104.2051
3001528594	AVALON DELAWARE UNIT 503	Below	Below	Delaware	OCD	3,265	3,850	2,628	3,680										2,548												0	231,384	279,103	32.5370	-104.2136
3001528678	AVALON DELAWARE UNIT 507	Below	Below	Delaware	OCD	3,260	3,870	2,498	3,614										2,480												0	61,444	81,933	32.5368	-104.2217
3001528677	AVALON DELAWARE UNIT 505	Below	Below	Delaware	OCD	3,257	3,850	2,546	3,576										2,476												0	99,503	95,766	32.5368	-104.2175
3001528663	AVALON DELAWARE UNIT 642	Below	Below	Delaware	OCD	3,205	3,850	2,534	3,678										2,495												0	76,520	81,150	32.5263	-104.2051
3001528910	AVALON DELAWARE UNIT 523	Below	Below	Delaware	OCD	3,283	3,800	2,556	3,738										2,514												0	64,823	65,836	32.5334	-104.2219
3001529504	PARKWAY DELAWARE UNIT 507	Below	Below	Delaware	OCD	3,334	4,400	4,164	4,280																						12,997	151,877	134,179	32.6170	-104.0419
3001529503	PARKWAY DELAWARE UNIT 304	Below	Below	Delaware	OCD	3,321	4,430	4,154	4,261																						12,032	99,428	124,966	32.6202	-104.0419
3001530026	PARKWAY DELAWARE UNIT 205	Below	Below	Delaware	OCD	3,338	4,400	4,260	4,364																						22,563	259,172	192,700	32.6206	-104.0376
3001530030	PARKWAY DELAWARE UNIT 509	Below	Below	Delaware	OCD	3,333	4,400	4,204	4,324																						0	90,207	140,949	32.6131	-104.0410
3001530029	PARKWAY DELAWARE UNIT 508	Below	Below	Delaware	OCD	3,328	4,400	4,160	4,278																						26,169	242,627	256,822	32.6135	-104.0453
3001530028	PARKWAY DELAWARE UNIT 704	Below	Below	Delaware	OCD	3,327	4,400	4,219	4,344																						32,266	273,133	213,182	32.6137	-104.0381
3002501724	TEAS YATES UNIT 034	Above	Above	Yates	OCD	3,608	3,536	3,308	3,484				3,120																		0	299	1,389	32.5777	-103.6136
3002501739	TEAS YATES UNIT 121	Above	Above	Yates	OCD	3,540	3,355	3,304	3,355				3,115																		0	598	713	32.5786	-103.6447
3002501725	TEAS YATES UNIT 022	Above	Above	Yates	OCD	3,599	3,359	3,335	3,359				3,015																		0	429	826	32.5786	-103.6243
3002501722	TEAS YATES UNIT 032	Above	Above	Yates	OCD	3,611	3,540	3,335	3,366				3,130																		0	401	310	32.5722	-103.6147
3002501727	TEAS YATES UNIT 111	Above	Above	Yates	OCD	3,592	3,319	3,204	3,329																						0	406	756	32.5777	-103.6329
3002501720	TEAS YATES UNIT 021	Above	Above	Yates	OCD	3,606	3,309	3,290	3,305		1,585	3,080	3,249																		0	440	888	32.5749	-103.6189
3002501734	TEAS YATES UNIT 091	Above	Above	Yates	OCD	3,596	3,338	3,204	3,330				3,215																		0	524	533	32.5686	-103.6350
3002502459	CRUCES FEDERAL 003	Above	Above/Into	Yates	OCD	3,725	3,730	3,509	3,629	1,620			3,494	3,692																	3,100	37,500	41,030	32.5377	-103.5340
3002508640	CONE JALMAT YATES POOL UNIT 502	Above	Above/Into	Yates	OCD	3,602	3,950	3,802	3,914		1,820	3,570	3,753																		0	27,029	0	32.3763	-103.3264
3002508641	CONE JALMAT YATES POOL UNIT 503	Above	Above	Yates	OCD	3,592	3,840	3,794	3,824		1,725	3,514	3,696																		0	46,884	0	32.3727	-103.3222
3002508649	CONE JALMAT YATES POOL UNIT 110	Above	Above	Yates	OCD	3,583	4,010	3,754	3,876		1,867	3,526	3,706																		0	54,712	9,227	32.3791	-103.3232
3002508587	JALMAT FIELD YATES SAND UNIT 108	Above	Above	Yates	OCD	3,606	4,062	3,866	3,878				3,741																		0	5,708	6,644	32.4081	-103.3307
3002508590	JALMAT FIELD YATES SAND UNIT 114	Above	Into	Yates	OCD	3,612	4,076	3,868	4,004				3,868																		0	107,532	57,179	32.4045	-103.3350
3002508579	JALMAT FIELD YATES SAND UNIT 123	Above	Above/Into	Yates	OCD	3,602	4,132	3,718	3,986		2,010	3,730	3,936																		0	97,298	100,060	32.4008	-103.3478
3002508606	CONE JALMAT YATES POOL UNIT 105	Above	Above/Into	Yates	OCD	3,585	4,000	3,766	3,906		1,902	3,576	3,766																		0	31,289	20,764	32.3900	-103.3275
3002508588	JALMAT FIELD YATES SAND UNIT 121	Above	Into	Yates	OCD	3,613	4,052	3,876	4,013				3,780																		0	115,896	100,565	32.4008	-103.3393
3002508610	CONE JALMAT YATES POOL UNIT 111	Above	Above	Yates	OCD	3,587	3,921	3,647	3,862		1,790	3,461	3,628																		0	49,593	23,071	32.3864	-103.3147
3002508651	CONE JALMAT YATES POOL UNIT 602	Above	Above	Yates	OCD	3,582	3,900	3,784	3,812		2,200	3,020	3,618																		0	56,282	0	32.3755	-103.3190
3002508593	JALMAT FIELD YATES SAND UNIT 110	Above	Above	Yates	OCD	3,626	4,065	3,890	4,000				3,711																		0	66,231	28,588	32.4081	-103.3414
3002508658	CONE JALMAT YATES POOL UNIT 804	Above	Above	Yates	OCD	3,571	3,960	3,812	3,832				3,714																		0	45,941	0	32.3609	-103.3232
3002508601	JALMAT FIELD YATES SAND UNIT 116	Above	Above/Into	Yates	OCD	3,596	4,030	3,828	3,966																						0	1,094	6,643	32.4036	-103.3286
3002508648	CONE JALMAT YATES POOL UNIT 107	Above	Above/Into	Yates	OCD	3,583	4,003	3,773	3,900		1,915	3,582	3,773																		0	52,014	25,379	32.3827	-103.3275
3002508664	CONE JALMAT YATES POOL UNIT 702	Above	Above	Yates	OCD	3,536	3,900	3,696	3,815				3,647																		0	32,481	50,604	32.3682	-103.3190
3002508663	CONE JALMAT YATES POOL UNIT 701	Above	Above	Yates	OCD	3,536	3,830	3,726	3,750				3,588																		0	1,869	1,832	32.3646	-103.3147
3002508646	CONE JALMAT YATES POOL UNIT 304	Above	Above	Yates	OCD	3,563	3,824	3,593	3,722		1,759	3,351	3,598																		0	62,198	50,748	32.3791	-103.3147
3002509187	SOUTH EUNICE UNIT 033	Above	Above	Seven Rivers/Qu	OCD	3,542	3,815	3,644	3,810	1,365	1,465	3,020	3,156	3,377	3,785																0	76,735	49,739	32.3682	-103.2808
3002509142	SEVEN RIVERS QUEEN UNIT 035	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,490	3,910	3,667	3,857	1,364	1,454	3,026	3,186	3,375	3,758																0	37,417	1,085	32.3429	-103.2594
3002508986	SOUTH EUNICE UNIT 020	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,515	3,810	3,672	3,807		1,605	2,995	3,178	3,383	3,755																0	100,456	100,375	32.3755	-103.2638
3002509073	SOUTH EUNICE UNIT 041	Above	Above	Seven Rivers/Qu	OCD	3,519	3,820	3,660	3,800	1,345	1,452	2,990	3,128	3,354	3,745																0	12,123	12,107	32.3646	-103.2765
3002509070	SEVEN RIVERS QUEEN UNIT 003	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,502	3,790	3,714	3,778	1,490	1,570	3,050	3,204	3,422	3,772																0	57,970	67,851	32.3682	-103.2548
3002509076	SOUTH EUNICE UNIT 037	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,517	3,815	3,682	3,770		1,496	3,002	3,154	3,390	3,764																0	14,681	12,677	32.3682	-103.2637
3002509151	SEVEN RIVERS QUEEN UNIT 023	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,474	3,755	3,706	3,754	1,358	1,435	2,895	3,171	3,363	3,744																0	57,078	60,053	32.3501	-103.2595
3002508644	CONE JALMAT YATES POOL UNIT 202	Above	Above	Seven Rivers/Qu	OCD	3,573	3,850	3,698	3,762		1,821	3,123	3,646																		0	23,197	36,124	32.3827	-103.3190
3002508992	SOUTH EUNICE UNIT 028	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,514	3,830	3,704	3,796	1,460	1,553	3,030	3,184	3,422	3,788																0	37,574	54,127	32.3719	-103.2595
3002509137	SEVEN RIVERS QUEEN UNIT 038	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,494	3,785	3,660	3,810	1,410	1,525	2,925	3,090	3,275	3,642																0	64,312	39,953	32.3429	-103.2477
3002509068	SEVEN RIVERS QUEEN UNIT 005	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,503	3,768	3,692	3,768	1,430	1,522	2,990	3,181	3,394	3,751																0	64,600	55,035	32.3646	-103.2595
3002509064	SEVEN RIVERS QUEEN UNIT 013	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,479	3,785	3,684	3,785	1,365	1,468	3,015	3,187	3,392																	0	54,632	33,454	32.3573	-103.2595
3002509560	COOPER JAL UNIT 146	Above	Above	Seven Rivers/Qu	OCD	3,326	3,642	3,088	3,628	1,175	1,275	2,865	2,996																		14,356	159,960	35,025	32.2146	-103.2135
3002509145	SEVEN RIVERS QUEEN UNIT 021	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,476	3,750	3,664	3,745	1,385	1,495	2,985	3,158	3,360	3,736																0	62,560	36,434	32.3537	-103.2552
3002509239	SEVEN RIVERS QUEEN UNIT 052	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,476	3,866	3,654	3,772	1,349	1,509	2,878	3,026	3,230	3,664																0	17,556	945	32.3356	-103.2466
3002509063	SEVEN RIVERS QUEEN UNIT 011	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,510	3,885	3,733	3,822	1,456	1,562	3,030	3,198	3,416	3,776																0	81,944	66,396	32.3610	-103.2552
3002509150	SEVEN RIVERS QUEEN UNIT 025	Adjacent	Adjacent	Queen	OCD	3,489	3,780	3,680	3,780	1,426	1,501	2,957	3,120	3,318	3,680																0	61,283	25,197	32.3501	-103.2510
3002509489	MYERS LANGLIE MATTIX UNIT 138	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,312	3,609	3,449	3,609	1,170			2,910	3,140	3,496																0	72,697	63,383	32.2517	-103.2124
3002509245	SEVEN RIVERS QUEEN UNIT 047	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,510	3,817	3,698	3,782	1,350	1,450	3,070	3,170	3,362	3,737																0	46,274	5,022	32.3392	-103.2541
3002509136	SEVEN RIVERS QUEEN UNIT 037	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,486	3,782	3,678	3,782	1,380	1,480	2,930	3,100	3,370	3,684																0	54,136	13,506	32.3438	-103.2520
3002509620	COOPER JAL UNIT 205	Above	Above	Yates/Seven Riv	OCD	3,316	3,600	2,988	3,600	1,150	1,260	2,850	3,010																		13,908	139,836	84,609	32.2046	-103.2156
3002509148	SEVEN RIVERS QUEEN UNIT 019	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,513	3,800	3,660	3,800		1,590	2,973	3,142	3,352	3,704																0	75,288	55,640	32.3537	-103.2467
3002509389	LANGLIE LYNN QUEEN UNIT 005	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,371	3,734	3,494	3,631	1,221	1,358	2,770	2,918	3,150	3,514																0	92,146	62,934	32.2881	-103.2338
3002509554	MYERS LANGLIE MATTIX UNIT 239	Above	Above	Seven Rivers/Qu	OCD	3,318	3,570	3,400	3,570																						0	125,430	143,152	32.2300	-103.2124
3002509139	SEVEN RIVERS QUEEN UNIT 033	Adjacent	Adjacent	Queen	OCD	3,481	3,894	3,772	3,806	1,372	1,470	2,990	3,144	3,337	3,710																0	61,582	18,632	32.3465	-103.2552
3002509212	SEVEN RIVERS QUEEN UNIT 044	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,497	3,800	3,552	3,757	1,394			3,040	3,232	3,597																0	74,282	33,931	32.3392	-103.2423
3002509388	LANGLIE LYNN QUEEN UNIT 003	Above	Above	Seven Rivers/Qu	OCD	3,371	3,791	3,556	3,691	1,182	1,322	2,760	2,990	3,210	3,580																0	81,937	64,001	32.2881	-103.2423
3002509561	COOPER JAL UNIT 234	Above	Above	Yates/Seven Riv	OCD	3,315	3,228	2,985	3,228	1,165	1,270	2,860	3,002																		15,170	159,300	66,065	32.2110	-103.2156
3002509644	COOPER JAL UNIT 134	Above	Above	Yates/Seven Riv	OCD	3,310	3,570	3,031	3,570	1,170	1,280	2,840	3,030	3,250	3,416																13,521	134,483	78,477	32.1965	-103.2220
3002509646	COOPER JAL UNIT 224	Above	Above	Yates/Seven Riv	OCD	3,309	3,230	2,970	3,230	1,180	1,270	2,860	3,010																		8,398	85,568	42,525	32.1946	-103.2198
3002509482	MYERS LANGLIE MATTIX UNIT 099	Adjacent	Adjacent	Queen	OCD	3,324	3,690	3,458	3,642	1,170		2,860	2,968																		0	22,628	40,366	32.2590	-103.2124
3002509636	COOPER JAL UNIT 126	Above	Above	Seven Rivers/Qu	OCD	3,311	3,560	3,022	3,560	1,150	1,250	2,850	2,995	3,240	3,430																3,284	43,226	25,183	32.2055	-103.2178
3002509391	LANGLIE LYNN QUEEN UNIT 007	Above	Above	Seven Rivers/Qu	OCD	3,384	3,800	3,510	3,682	1,232	1,392	2,798	2,908	3,180	3,650																0	87,166	68,611	32.2845	-103.2380
3002509631	COOPER JAL UNIT 120	Above	Above	Yates/Seven Riv	OCD	3,317	3,604	3,011	3,516	1,140	1,255	2,800	3,000		3,407																10,145	122,292	76,264	32.2082	-103.2209
3002509624	COOPER JAL UNIT 218	Above	Above	Yates/Seven Riv	OCD	3,310	3,250	2,991	3,250				3,095																		7,207	86,826	43,784	32.1964	-103.2156
3002509630	COOPER JAL UNIT 203	Above	Above	Yates/Seven Riv	OCD	3,324	3,195	3,031	3,195	1,180	1,300	2,790	3,030																		2,870	47,148	29,083	32.2046	-103.2249
3002509639	COOPER JAL UNIT 132	Above	Above	Yates/Seven Riv	OCD	3,307	3,640	3,024	3,640				3,016		3,474																16,677	197,600	86,305	32.2019	-103.2135
3002509641	COOPER JAL UNIT 135	Above	Above	Yates/Seven Riv	OCD	3,312	3,650	3,019	3,650	1,120	1,260	2,850	2,995	3,300	3,419																11,798	150,386	84,086	32.1983	-103.2167
3002509653	COOPER JAL UNIT 241	Above	Above	Yates/Seven Riv	OCD	3,288	3,580	3,033	3,580	1,090	1,220	2,800	2,965	3,180																	7,245	56,551	29,831	32.1910	-103.2156
3002509634	COOPER JAL UNIT 216	Above	Above	Yates/Seven Riv	OCD	3,325	3,210	3,035	3,210				3,035																		20,542	240,522	101,822	32.1974	-103.2252
3002509628	COOPER JAL UNIT 201	Above	Above	Yates	OCD	3,308	3,237	2,994	3,160	1,190	1,290	2,850	3,005	3,235																	14,134	130,904	75,547	32.2082	-103.2114
3002509486	MYERS LANGLIE MATTIX UNIT 103	Adjacent	Adjacent	Yates/Seven Riv	OCD	3,325	3,648	3,385	3,648			2,650	2,870	3,070																	0	477,328	85,945	32.2554	-103.2167
3002509787	COOPER JAL UNIT 211	Above	Above	Seven Rivers/Qu	OCD	3,313	3,600	3,255	3,600	1,160	1,270	2,860	3,005																		10,536	127,512	66,352	32.2019	-103.2198
3002509659	COOPER JAL UNIT 238	Above	Above	Yates/Seven Riv	OCD	3,304	3,589	3,032	3,589	1,190	1,310	2,870	3,030	3,255	3,436																18,426	187,689	72,035	32.1901	-103.2263
3002509551	MYERS LANGLIE MATTIX UNIT 241	Above	Above	Seven Rivers/Qu	OCD	3,334	3,607	3,436	3,607																						0	187,761	173,572	32.2300	-103.2209
3002509748	JALMAT YATES UNIT 002	Above	Above	Yates/Seven Riv	OCD	3,162	3,064	2,885	3,049	1,117	1,292	2,778	2,940																		0	6,103	25,606	32.1439	-103.2157
3002509597	MYERS C SWD 002	Above	Above	Seven Rivers/Qu	OCD	3,340	3,510	3,344	3,510	1,408	1,640	3,140	3,260		3,452																0	1,161,462	1,310,862	32.2083	-103.2550
3002509651	COOPER JAL UNIT 226	Above	Above	Yates/Seven Riv	OCD	3,287	3,600	2,989	3,600	1,100	1,200	2,800	2,995																		9,191	102,115	42,016	32.1946	-103.2114
3002509638	COOPER JAL UNIT 122	Above	Above	Yates/Seven Riv	OCD	3,309	3,552	3,020	3,552	1,180	1,280	2,880	2,996	3,250	3,430																14,663	172,359	55,084	32.2091	-103.2135
3002510908	MYERS LANGLIE MATTIX UNIT 105	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,313	3,608	3,470	3,608	1,180	1,250	2,770	2,920		3,570																0	13,642	57,543	32.2554	-103.2081
3002511049	MYERS LANGLIE MATTIX UNIT 246	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,313	3,595	3,407	3,595	1,200	1,298	2,734	2,920		3,518																0	18,159	88,588	32.2264	-103.1999
3002511161	COOPER JAL UNIT 133	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,286	3,680	2,982	3,680	1,160	1,268	2,815	2,976		3,582																13,826	178,032	88,343	32.2010	-103.2041
3002511297	LANGLIE JAL UNIT 027	Adjacent	Adjacent	Queen	OCD	3,242	3,540	3,493	3,540	1,160	1,350		2,898																		908	10,103	9,510	32.1683	-103.1956

3002510887	MYERS LANGLIE MATTIX UNIT 039	Adjacent	Adjacent	Queen	OCD	3,333	3,650	3,541	3,650	1,205			2,940		3,540														0	27,717	9,509	32.2699	-103.2081
3002511048	MYERS LANGLIE MATTIX UNIT 244	Adjacent	Adjacent	Queen	OCD	3,314	3,666	3,472	3,617	1,185			2,960																0	44,377	43,766	32.2264	-103.2081
3002511323	LANGLIE JAL UNIT 019	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,250	3,620	3,354	3,609	1,120	1,220	2,692	2,918	3,149	3,454														2,917	34,319	40,290	32.1720	-103.1913
3002511149	COOPER JAL UNIT 242	Adjacent	Adjacent	Yates/Seven Riv	OCD	3,303	3,190	2,962	3,190	1,150			2,855	2,985															17,334	193,121	106,867	32.2073	-103.2051
3002511036	MYERS LANGLIE MATTIX UNIT 137	Adjacent	Adjacent	Queen	OCD	3,321	3,588	3,454	3,588	1,158			2,940	3,193															0	12,966	65,970	32.2517	-103.2083
3002511019	MYERS LANGLIE MATTIX UNIT 136	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,327	3,615	3,460	3,615	1,170	1,270	2,740	2,950	3,230	3,590														0	26,764	81,753	32.2517	-103.2039
3002511322	LANGLIE JAL UNIT 026	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,239	3,560	3,397	3,560	1,175			3,000	3,220	3,481														9,245	117,335	103,124	32.1683	-103.1913
3002511301	LANGLIE JAL UNIT 017	Adjacent	Adjacent	Queen/Grayburg	OCD	3,233	4,006	3,504	3,700	1,100	1,200	2,680	2,879	3,100	3,515		3,700												6,707	74,665	106,892	32.1720	-103.1997
3002511022	MYERS LANGLIE MATTIX UNIT 173	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,328	3,620	3,464	3,620	1,165			2,922	3,215															0	6,362	45,762	32.2445	-103.2041
3002510901	MYERS LANGLIE MATTIX UNIT 071	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,325	3,650	3,459	3,647	1,165	1,255	2,740	3,090		3,495														0	41,391	48,542	32.2626	-103.2081
3002511480	LANGLIE JAL UNIT 033	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,228	3,577	3,375	3,521	1,110	1,434	2,650	2,829	3,043	3,395														8,346	102,447	97,320	32.1656	-103.1988
3002511290	COOPER JAL UNIT 228	Adjacent	Adjacent	Yates	OCD	3,267	3,134	3,040	3,120	1,105			2,957																9,070	116,297	68,500	32.1937	-103.2041
3002511029	MYERS LANGLIE MATTIX UNIT 175	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,311	3,620	3,477	3,620	1,170			2,921	3,272	3,538														0	1,710	91,869	32.2418	-103.1988
3002511039	MYERS LANGLIE MATTIX UNIT 235	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,306	3,570	3,410	3,570																				0	49,402	48,292	32.2300	-103.1959
3002511488	SOUTH LANGLIE JAL UNIT 004	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,125	3,353	3,127	3,353	1,080	1,185	2,610	2,760	2,965	3,205														0	113,400	113,400	32.1421	-103.1965
3002511162	COOPER JAL UNIT 220	Above	Above	Seven Rivers/Qu	OCD	3,276	3,600	2,986	3,600	1,109	1,224	2,820	2,979	3,210															6,750	106,774	57,453	32.1973	-103.2082
3002511288	COOPER JAL UNIT 239	Above	Above	Yates/Seven Riv	OCD	3,268	3,180	2,828	3,180	1,089			2,869																8,808	116,643	66,967	32.1901	-103.2081
3002511141	COOPER JAL UNIT 116	Above	Above	Yates/Seven Riv	OCD	3,326	3,641	2,980	3,641	1,100			2,980	3,215	3,598														12,286	114,459	65,712	32.2119	-103.2081
3002511476	LANGLIE JAL UNIT 055	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,241	3,511	3,370	3,511		1,251	2,650	2,846	3,070	3,460														3,605	41,221	51,669	32.1584	-103.1988
3002511173	LANGLIE JACK UNIT 006	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,287	3,641	3,334	3,641				2,830		3,467														0	350	0	32.2082	-103.1913
3002511475	LANGLIE JAL UNIT 031	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,245	3,470	3,157	3,470			2,640	2,770	2,930	3,380														7,535	94,469	196,316	32.1656	-103.2073
3002511654	JALMAT YATES UNIT 030	Adjacent	Adjacent	Yates	OCD	3,126	3,062	2,822	3,040				2,819																0	20,770	25,546	32.1294	-103.2028
3002512075	W H RHODES B FEDERAL NCT 2 003	Adjacent	Adjacent	Seven Rivers	OCD	2,983	3,330	3,018	3,330	1,180			2,860	3,030															0	1,200	300	32.0124	-103.1614
3002512033	RHODES YATES UNIT 001	Adjacent	Adjacent	Seven Rivers	OCD	2,977	3,253	3,054	3,253	1,087			2,774																0	600	600	32.0269	-103.1614
3002512066	RHODES YATES UNIT 011	Adjacent	Adjacent	Seven Rivers	OCD	2,988	3,327	3,130	3,327																				0	48,600	48,086	32.0133	-103.1518
3002512059	RHODES YATES UNIT 009	Adjacent	Adjacent	Seven Rivers	OCD	2,981	3,323	3,139	3,275	1,087			2,898																0	600	0	32.0160	-103.1614
3002520052	LANGLIE LYNN QUEEN UNIT 012	Above	Above	Seven Rivers/Qu	OCD	3,368	3,750	3,446	3,682	1,203	1,295	2,796	2,926	3,193	3,596														0	76,173	55,623	32.2809	-103.2423
3002512776	MARY E WILLS A FEDERAL 008	Adjacent	Adjacent	Seven Rivers	OCD	2,973	3,324	3,256	3,297	1,130		2,805	2,956	3,247															0	720	0	32.0035	-103.1386
3002520049	LANGLIE LYNN QUEEN UNIT 009	Above	Above	Seven Rivers/Qu	OCD	3,371	3,800	3,512	3,714	1,188			2,998	3,211	3,603														0	81,771	60,132	32.2845	-103.2455
3002520191	LANGLIE LYNN QUEEN UNIT 014	Above	Above	Seven Rivers/Qu	OCD	3,373	3,720	3,408	3,586	1,188	1,289	2,731	2,893	3,148	3,490														0	81,126	57,077	32.2808	-103.2338
3002520302	MESCALERO RIDGE UNIT 351	Adjacent	Adjacent	Queen/Penrose	OCD	3,703	5,152	4,580	5,086	1,778	1,908	3,365	3,572		4,543	4,886													0	95,854	121,086	32.6150	-103.5243
3002520695	MESCALERO RIDGE UNIT 358	Adjacent	Adjacent	Queen/Penrose	OCD	3,705	5,232	4,580	5,102	1,751	1,894	3,376	3,613		4,557	4,920													0	45,714	14,023	32.6150	-103.5331
3002520693	MESCALERO RIDGE UNIT 356	Adjacent	Adjacent	Queen/Penrose	OCD	3,719	5,250	4,591	4,996	1,797	1,923	3,352	3,573		4,560	4,912													0	61,564	52,261	32.6223	-103.5331
3002520692	MESCALERO RIDGE UNIT 354	Adjacent	Adjacent	Queen/Penrose	OCD	3,715	5,200	4,562	5,190	1,792	1,918	3,356	3,564		4,543	4,885													0	19,606	24,894	32.6187	-103.5289
3002521229	LANGLIE LYNN QUEEN UNIT 016	Above	Above	Seven Rivers/Qu	OCD	3,355	3,700	3,468	3,653	1,178	1,310	2,793	2,951	3,166	3,571														0	86,654	68,819	32.2772	-103.2380
3002521244	TEAS YATES UNIT 061	Above	Above	Yates	OCD	3,579	3,429	3,180	3,310	1,370	1,510	2,990	3,166																0	497	3,429	32.5722	-103.6393
3002521458	LANGLIE LYNN QUEEN UNIT 018	Above	Above	Seven Rivers/Qu	OCD	3,360	3,710	3,540	3,681	1,176		2,850	3,007	3,220	3,624														0	87,957	62,877	32.2736	-103.2423
3002521639	LUSK SEVEN RIVERS UNIT 004	Adjacent	Adjacent	Seven Rivers	OCD	3,662	3,860	3,816	3,820	1,265		2,752	2,932	3,812															310	1,986	217	32.6876	-103.7605
3002521683	MESCALERO RIDGE UNIT 015	Adjacent	Adjacent	Queen/Penrose	OCD	3,722	5,135	4,585	4,971	1,808	1,932	3,349	3,565		4,571	4,900													0	74,985	117,878	32.6223	-103.5246
3002523867	LANGLIE JAL UNIT 029	Adjacent	Adjacent	Queen	OCD	3,234	3,600	3,185	3,547	1,090	1,408	2,623	2,775	2,988	3,170														8,549	111,787	116,839	32.1683	-103.2038
3002524869	LUSK WEST DELAWARE UNIT 007	Below	Below	Delaware	OCD	3,581	12,814	6,446	6,467	770	1,083	2,395	2,583					2,885	4,676										0	27,453	160,011	32.6486	-103.7873
3002524575	RHODES YATES UNIT 002	Adjacent	Adjacent	Yates/Seven Riv	OCD	2,966	3,350	3,128	3,194	1,120			2,912	3,154															0	600	600	32.0233	-103.1614
3002524889	LANGLIE JAL UNIT 034	Adjacent	Adjacent	Queen	OCD	3,231	3,750	3,134	3,556	1,126			2,864	3,092	3,428														4,081	46,136	65,837	32.1647	-103.1956
3002525691	W H RHODES B FEDERAL NCT 2 004	Adjacent	Adjacent	Yates/Seven Riv	OCD	2,965	3,460	3,114	3,318	1,050	1,410	2,650	2,940	3,180															0	150	0	32.0088	-103.1614
3002525217	RHODES YATES UNIT 004	Adjacent	Adjacent	Yates/Seven Riv	OCD	2,973	3,350	3,080	3,325	1,050	1,410	2,650	2,940	3,180															0	600	0	32.0199	-103.1614
3002525682	COOPER JAL UNIT 151	Above	Above	Yates	OCD	3,304	3,650	3,296	3,608	1,188	1,298	2,860	3,020	3,294															8,565	88,488	40,585	32.1983	-103.2108
3002525897	TONTO 007	Above	Above	Yates	OCD	3,589	3,119	2,900	3,113				2,960																0	16,391	22,579	32.6285	-103.6972
3002525693	RHODES YATES UNIT 013	Adjacent	Adjacent	Yates	OCD	2,975	3,450	3,175	3,349	1,198			3,045	3,362															0	107,643	71,872	32.0088	-103.1572
3002526405	JALMAT YATES UNIT 015	Above	Above	Yates	OCD	3,187	3,570	2,954	3,178				2,954	3,191	3,410														0	36,315	76,177	32.1346	-103.2139
3002526407	JALMAT YATES UNIT 020	Above	Above	Yates/Seven Riv	OCD	3,156	3,500	2,920	3,447				2,906	3,148	3,363														0	82,029	102,394	32.1341	-103.2101
3002526128	COOPER JAL UNIT 153	Above	Above	Yates/Seven Riv	OCD	3,291	3,700	3,003	3,696	1,128	1,240	2,834	3,003	3,276	3,616														14,288	160,000	92,936	32.1994	-103.2094
3002526403	JALMAT YATES UNIT 004	Above	Above	Yates	OCD	3,153	3,500	2,917	3,002				2,917	3,141	3,359														0	14,062	51,529	32.1415	-103.2140
3002526406	JALMAT YATES UNIT 019	Adjacent	Adjacent	Yates	OCD	3,148	3,540	2,902	3,130			2,740	2,895	3,141	3,357														0	129,046	151,846	32.1340	-103.2059
3002526408	JALMAT YATES UNIT 025	Adjacent	Adjacent	Yates	OCD	3,125	3,510	2,858	3,031			2,700	2,856	3,085	3,310														0	29,367	39,680	32.1307	-103.2053
3002526409	JALMAT YATES UNIT 031	Above	Above	Yates/Seven Riv	OCD	3,113	3,500	2,833	3,210				2,824	3,052	3,476														0	77,672	132,948	32.1276	-103.2048
3002526897	JALMAT YATES UNIT 018	Adjacent	Adjacent	Yates	OCD	3,113	3,500	2,836	3,055				2,834	3,074															0	80,830	105,956	32.1340	-103.2021
3002526404	JALMAT YATES UNIT 009	Above	Above	Yates	OCD	3,183	3,557	2,971	3,184			2,802	2,954	3,192	3,409														0	71,884	66,409	32.1386	-103.2136
3002526871	JALMAT YATES UNIT 027	Above	Above	Yates	OCD	3,152	3,501	2,885	3,127				2,883	3,129															0	25,937	43,879	32.1305	-103.2139
3002526896	JALMAT YATES UNIT 011	Adjacent	Adjacent	Yates	OCD	3,133	3,497	2,876	3,107				2,876	3,126															0	184,862	228,557	32.1372	-103.2059
3002526869	JALMAT YATES UNIT 014	Above	Above	Yates	OCD	3,133	3,525	2,916	3,186				2,916	3,186															0	238,116	147,739	32.1345	-103.2185
3002526971	MYERS LANGLIE MATTIX UNIT 204	Adjacent	Adjacent	Queen	OCD	3,311	3,750	3,355	3,503	1,178		2,798	2,858	3,110	3,446	3,574													0	109,254	108,494	32.2372	-103.2039
3002527020	JALMAT YATES UNIT 008	Above	Above	Yates	OCD	3,150	3,550	2,904	3,157				2,904																0	144,747	101,057	32.1385	-103.2184
3002527019	JALMAT YATES UNIT 003	Above	Above	Yates	OCD	3,165	3,496	2,915	3,163				2,912	3,164															0	190,652	84,877	32.1418	-103.2184
3002527089	MYERS LANGLIE MATTIX UNIT 212	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,306	3,711	3,404	3,652	1,193		2,690	2,902	3,115	3,496														0	4,037	35,644	32.2336	-103.1992
3002527073	JALMAT YATES UNIT 010	Adjacent	Adjacent	Yates	OCD	3,135	3,497	2,873	3,106				2,871	3,116															0	121,105	0	32.1410	-103.2062
3002526872	JALMAT YATES UNIT 028	Above	Above	Yates	OCD	3,133	3,498	2,901	3,020				2,899	3,166															0	184,482	148,354	32.1306	-103.2185
3002527635	TEAS YATES UNIT 103	Above	Above	Yates/Seven Riv	OCD	3,604	3,420	3,210	3,310	950			3,100																0	520	324	32.5742	-103.6300
3002528033	TEAS YATES UNIT 132	Above	Above	Yates	OCD	3,583	3,380	3,206	3,330	970	1,380		3,200																0	526	281	32.5804	-103.6404
3002528031	TEAS YATES UNIT 084	Above	Above	Yates	OCD	3,610	3,433	3,280	3,420		1,400		3,200																0	449	705	32.5721	-103.6222
3002528027	TEAS YATES UNIT 012	Above	Above	Yates	OCD	3,614	3,512	3,354	3,392	1,392	1,500		3,228																0	706	1,283	32.5749	-103.6082
3002528911	W H RHODES B FEDERAL NCT 2 006	Adjacent	Adjacent	Yates/Seven Riv	OCD	2,966	3,450	3,168	3,324	1,195	1,230		3,020																0	150	0	32.0088	-103.1654
3002529131	SEVEN RIVERS QUEEN UNIT 065	Above	Above	Seven Rivers/Qu	OCD	3,479	3,920	3,691	3,831	1,284	1,470	3,008	3,180	3,355	3,772														0	23,854	205	32.3353	-103.2597
3002529971	WEST TEAS YATES SEVEN RIVERS UNIT 91	Above	Above	Yates	OCD	3,555	3,400	3,138	3,270				3,025	3,275															0	6,165	4,438	32.5895	-103.6747
3002530439	LUSK WEST DELAWARE UNIT 105	Below	Below	Delaware	OCD	3,589	6,700	4,984	5,040	830		2,481	2,613	2,817					4,715										0	24,063	44,575	32.6486	-103.7787
3002529972	WEST TEAS YATES SEVEN RIVERS UNIT 91	Above	Above	Yates	OCD	3,543	3,400	3,114	3,172				3,101																0	11,933	11,328	32.5858	-103.6747
3002530165	LUSK WEST DELAWARE UNIT 911	Below	Below	Delaware	OCD	3,553	6,850	6,431	6,446	890	1,075	2,345	2,532	2,765				2,875	4,485										0	32,847	95,441	32.6305	-103.7899
3002530572	LUSK WEST DELAWARE UNIT 103	Below	Below	Delaware	OCD	3,596	6,650	6,489	6,503			2,513	2,657	2,878					4,817										0	26,351	101,628	32.6504	-103.7744
3002530490	LUSK WEST DELAWARE UNIT 015	Below	Below	Delaware	OCD	3,564	7,200	5,025	5,394	784			2,522					2,740	4,552		5,591								0	2,167	13,123	32.6396	-103.7862
3002530524	LUSK WEST DELAWARE UNIT 009	Below	Below	Delaware	OCD	3,582	7,230	6,469	7,154	782			2,552					2,800	4,648		5,640								0	11,477	76,842	32.6450	-103.7819
3002530518	LUSK WEST DELAWARE UNIT 001	Below	Below	Brushy Canyon	OCD	3,592	7,500	6,476	6,484	823			2,688					2,870	4,590		5,610	7,174							0	51,284	139,012	32.6523	-103.7809
3002531157	MCDONALD STATE AC 1 031	Adjacent	Adjacent	Queen	OCD	3,543	4,000	3,656	3,748						3,656		3,830												0	60,196	82,446	32.3882	-103.2702
3002531158	MCDONALD STATE AC 1 032	Adjacent	Adjacent	Queen	OCD	3,545	4,000	3,691	3,790						3,689		3,854												0	93,907	132,157	32.3882	-103.2657
3002531166	MCDONALD STATE AC 1 042	Adjacent	Adjacent	Queen	OCD	3,563	4,000	3,699	3,780						3,678		3,868												0	11,685	2,213	32.3954	-103.2702
3002531162	MCDONALD STATE AC 1 036	Adjacent	Adjacent	Queen	OCD	3,553	4,000	3,699	3,780						3,678		3,868												0	2,694	236	32.3917	-103.2702
3002531156	MCDONALD STATE AC 1 030	Adjacent	Adjacent	Queen	OCD	3,538	4,000	3,606	3,690						3,606		3,771												0	79,853	24,734	32.3884	-103.2746
3002530791	LUSK WEST DELAWARE UNIT 111	Below	Below	Delaware	OCD	3,585	7,230	6,735	6,744	832		2,487	2,612	2,810					4,794										0	87,809	146,088	32.6450	-103.7744
3002531163	MCDONALD STATE AC 1 037	Adjacent	Adjacent	Queen	OCD	3,549	4,000	3,661	3,755						3,662		3,840												0	1,234,509	77,008	32.3917	-103.2744
3002531896	WEST TEAS YATES SEVEN RIVERS UNIT 92	Above	Above	Yates	OCD	3,557	3,320	3,161	3,252			2,970	3,161																0	50,794	147,098	32.5940	-103.6694
3002532032	WEST TEAS YATES SEVEN RIVERS UNIT 43	Above	Above	Yates	OCD	3,556	3,550	3,230	3,292	1,403	1,495	3,029	3,126	3,319															0	176,595	82,433	32.5994	-103.6662
3002532217	WEST TEAS YATES SEVEN RIVERS UNIT 94	Above	Above	Yates	OCD	3,555	3,390	3,076	3,306	1,400			3,060	3,350															0	216,868	231,657	32.5940	-103.6630
3002534131	LUSK WEST DELAWARE UNIT 901	Below	Below	Brushy Canyon	OCD	3,573	6,927	6,425	6,478	810	1,130		2,620					2,765	4,590		6,472								0	16,288	29,343	32.6378	-103.7808
3002534269	LUSK WEST DELAWARE UNIT 915Y	Below	Below	Brushy Canyon	OCD	3,551	6,630	6,434	6,456	898			2,570					2,793	4,315		6,434								0	62,342	42,733	32.6254	-103.7864
3002534132	LUSK WEST DELAWARE UNIT 907	Below	Below	Brushy Canyon	OCD	2,559	6,630	6,434	6,451	898			2,570					2,793	4,315		6,434								0	8,184	67,068	32.6326	-103.7851
3002534283	LUSK WEST DELAWARE UNIT 909	Below	Below	Brushy Canyon	OCD	2,559	6,630	6,444	6,456	898			2,570					2,793	4,315		6,444								0	98,673	93,184	32.6296	-103.7828
3002534173	LUSK WEST DELAWARE UNIT 011	Below	Below	Brushy Canyon	OCD	3,574	6,630	6,443	6,451	922	1,090		2,545					2,787	4,660		6,443								0	14,132	12,322	32.6441	-103.7905
3002535962	MOBIL LEA STATE 008	Below	Below	Cherry Canyon	OCD	3,664	6,275	5,930	5,992	1,595	1,710	3,431	3,612	3,835	4,655		5,050		5,596	5,930									0	180,418	185,403	32.5959	-103.5342
3002536079	WEST TEAS YATES SEVEN RIVERS UNIT 94	Above	Above	Yates/Seven Riv	OCD	3,553	3,350	3,096	3,322	1,289	1,412	2,920	3,082	3,295															0	110,265	131,455	32.5877	-103.6608
3002536073	WEST TEAS YATES SEVEN RIVERS UNIT 92	Above	Above	Yates/Seven Riv	OCD	3,540	3,350	3,038	3,286	1,275	1,420	2,870	3,035	3,230															0	48,574	57,490	32.5879	-103.6697
3001526524	HADSON FEDERAL 001	Above	Above	Yates	OCD	3,564	2,740	2,648	2,656	644		2,194	2,388	2,603															0	115,518	121,023	32.6699	-103.8386
3001524349	LEE FEDERAL 002	Below	Below	Delaware	OCD	3,240	11,660	3,123	3,226				1,169	1,438					3,090			5,518	8,994	10,234	10,670	11,241			0	26,301	24,501	32.5464	-104.1291
3002502605	STATE AA 001	Above	Above	Yates/Seven Riv	OCD	3,620	4,250	3,822	4,150	1,662		3,547	3,851	4,223															0	66,730	54,187	32.4336	-103.4341
3001526710	WELCH FEDERAL 007	Above	Above	Yates	OCD	3,231	698	515	698				407																0	158,896	193,236	32.5113	-104.2043
3002502476	SILVER FEDERAL 004	Above	Into	Seven Rivers	OCD	3,732	3,733	3,718	3,725			3,302	3,480	3,718															0	6,000	6,000	32.5386	-103.5631
3001524986	AMOCO FEDERAL 003	Above	Above	Yates	OCD	3,493	2,400	2,215	2,327	856		2,004	2,162																0	43,232	13,617	32.6478	-103.8764
3002503352	APPLESEED SWD FEDERAL 002	Above	Above	Seven Rivers	OCD	3,698	4,130	3,932	4,038	1,942	2,050	3,500	3,675	3,848															0	10,581	13,846	32.5714	-103.4730
3001534833	TWO MARKS 36 STATE 004	Below	Below	Devonian	OCD	3,719	12,500	11,099	12,500												2,126	3,255	7,344		9,473	9,702	11,052	12,156	0	1,521,255	158,534	32.4301	-104.4495
3001524921	GOVERNMENT D 004	Below	Below	Delaware/Bone S	OCD	3,196	5,712	3,849	5,632									1,493	2,865			5,516							0	28,274	138,946	32.5184	-104.1409
3002502466	BALLARD DE FEDERAL 003	Above	Into	Seven Rivers	OCD	3,677	4,026	3,615	4,026	1,557	2,120	3,225	3,450	3,610															0	26,070	16,510	32.5486	-103.5534
3001533458	DRY LAND SWD 001	Below	Below	Devonian	OCD	3,272	8,875	8,400	8,620										1,762			2,822	7,600		8,184				0	1,520,840	2,653,849	32.5098	-104.3755
3001526730	HADSON FEDERAL 003	Above	Above	Yates/Seven Riv	OCD	3,586	2,744	2,613	2,717	681	900	2,238	2,448	2,664															0	10,107	10,587	32.6753	-103.8390
3001527558	BARBADOS STATE 001	Below	Below	Delaware	OCD	3,334	5,040	4,402	4,783										1,675			4,934							0	181,864	218,859	32.3465	-104.3088
3001525006	TRIGG FEDERAL 001	Below	Below	Delaware	OCD	3,155	3,366	2,926	3,315										2,712										0	34,982	41,410	32.4931	-104.1323
3002502507	W H MILNER FEDERAL 004	Above	Into	Seven Rivers	OCD	3,735	3,850	3,786	3,806				3,480	3,665															10,450	153,700	161,738	32.5341	-103.5340
3002502431	LEA UNIT 008	Above	Above/Into	Yates	OCD	3,674	14,693	3,986	4,180	1,726	1,849	3,133	3,544		4,724							8,225	11,136	12,002			14,295		0	434,723	400,397	32.5927	-103.5117
3001523385	BIG EDDY UNIT 079Y	Below	Below	Delaware	OCD	3,221	12,370	3,869	4,150										2,514			5,974	9,602	10,740	11,120	11,866			0	10,805	16,311	32.4640	-104.0895
3002502494	B V LYNCH A FEDERAL 002	Above	Into	Yates/Seven Riv	OCD	3,783	4,003	3,633	4,003																				0	576,202	488,486	32.5241	-103.5415
3002502448	D AND E FEDERAL 001	Above	Above/Into	Yates	OCD	3,675	3,693	3,478	3,693	1,563	1,695	3,230	3,428																1,664	17,485	17,496	32.5532	-103.5502
3002503335	CACTUS FEDERAL 003	Adjacent	Adjacent	Queen	OCD	3,694	5,030	4,650	4,970	1,890	1,985	3,383	3,580		4,610	4,938													3,258	33,971	37,959	32.6087	-103.5031
3001524845	WERSELL FEDERAL 002	Below	Below	Delaware	OCD	3,172	4,650	2,832	3,794																				0	251,711	311,701	32.4273	-104.2013

3001524824	BIG EDDY FEDERAL 100	Below	Below	Delaware	OCD	3,178	9,200	3,197	3,450													5,720	8,994		10,039	10,366	10,736		30,687	360,926	312,143	32.4938	-104.1158
3001524048	AVALON DELAWARE UNIT 546	Below	Below	Wolfcamp	OCD	3,229	11,901	9,004	9,130													4,876	8,994		10,039	10,366			0	5,731	688	32.5280	-104.2152
3002504861	ATHA 001	Adjacent	Adjacent	Yates	OCD	3,615	3,872	3,715	3,872	1,755	1,935	3,335	3,487																12,879	72,666	46,590	32.4299	-103.3104
3001534529	RIGHTHAND CANYON 35 FEDERAL 007	Below	Below	Devonian	OCD	3,917	12,000	11,000	12,000													3,750	7,440			9,472	9,811	11,048	0	15,690,281	1,216,506	32.4337	-104.4697
3002502501	NEAL 003	Above	Into	Yates	OCD	3,729	3,805	3,705	3,714	1,650	1,775		3,576																1,800	6,250	35,320	32.5359	-103.5255
3001532056	ZEBRA FF FEDERAL 001	Below	Below	Atoka/Morrow	OCD	3,490	10,390	9,564	10,214					457			1,523					2,735	7,240		9,018	9,528	9,999		0	14,017	8,344	32.4960	-104.4366
3001525352	NEW MEXICO EV STATE 001	Below	Below	Delaware	OCD	3,346	11,788	2,658	4,680													4,828	8,462		9,936		11,036		0	55,831	53,713	32.3465	-104.3174
3002501671	FEDERAL 18 004	Above	Above	Yates	OCD	3,642	3,750	3,350	3,450	1,350	1,480	2,830	3,010																0	785,653	568,697	32.6621	-103.6960
3002502538	KAISER STATE 009	Above	Above	Yates	OCD	3,660	3,781	3,590	3,668	1,614	2,155		3,571																49,155	785,754	704,260	32.4809	-103.4256
3002530977	GEM 8705 JV-P 003	Below	Below	Delaware	OCD	3,579	13,700	7,743	8,022									5,486				7,898	11,174		12,234		13,050		0	127,590	108,160	32.5968	-103.6319
3002528396	STATE A A/C 1 116	Above	Above	Seven Rivers/Qu	OCD	3,480	8,400	3,740	3,842	1,230		2,968	3,117	3,323	3,740		3,937												0	1,068,485	1,773,243	32.3228	-103.2572
3002524540	CLEARY STATE 001	Below	Below	Delaware	OCD	3,626	13,860	5,413	5,682	1,345	1,485	3,115	3,185					4,750				8,315	11,500		12,287	12,635			0	230,498	216,244	32.5251	-103.6876
3002525957	LEA 20 001	Above	Above	Queen	OCD	2,920	3,420	3,323	3,420	1,932	1,988	2,416	3,210																0	9,378	6,919	32.0242	-103.2796
3002520463	STATE A A/C 1 101	Below	Below	Delaware	OCD	3,418	10,241	3,950	5,100	1,240	1,490	2,800	2,945	3,160	3,559												10,200		0	1,063,163	514,868	32.3135	-103.2423
3002509807	BROWN 005	Above	Above	Seven Rivers	OCD	3,066	3,350	3,289	3,350	1,085	1,210	2,860	3,030																0	51,640	47,133	32.1040	-103.2242
3002509839	C W SHEPHERD B FEDERAL 005	Above	Above	Seven Rivers	OCD	2,992	2,964	2,964	3,088	1,027	1,140	2,580	2,762																0	118,488	178,304	32.0705	-103.2125
3002508815	J H DAY 001	Adjacent	Adjacent	Seven Rivers	OCD	3,591	3,851	3,706	3,851	1,720	1,750		3,260																12,879	72,666	46,590	32.4263	-103.3061
3002528474	CITIES FEDERAL 002	Above	Above	Seven Rivers/Qu	OCD	3,539	3,800	3,492	3,800	1,430	1,650	3,148	3,296	3,518															4,522	19,260	79,450	32.3718	-103.2937
3002530386	WHITTEN 001	Above	Above/Into	Seven Rivers/Qu	OCD	3,649	14,495	4,040	4,165	1,700	2,130	3,360	3,550									8,268	11,282		12,128	12,252	12,766	14,394	72,434	749,944	822,116	32.5713	-103.5245
3002524787	LUSK 16 STATE 004	Below	Below	Delaware	OCD	3,616	11,000	4,918	6,535			2,379	2,790	3,133	3,925		4,375	5,510				7,280	10,478						0	135,965	98,133	32.6587	-103.7648
3002509709	MCKINNEY 001	Above	Above	Seven Rivers	OCD	3,269	3,490	3,066	3,490	1,900	2,150		2,855	3,150															0	46,545	49,560	32.1792	-103.2124
3002509753	W F HANAGAN 004	Above	Above	Yates	OCD	3,179	3,164	2,892	2,955		1,200	2,740	2,885	3,080															0	94,700	116,900	32.1435	-103.2203
3002526106	ARNOTT RAMSAY NCT-B 004	Above	Above	Seven Rivers/Qu	OCD	2,999	3,600	3,338	3,448		1,200	2,582	2,727	3,025	3,390														0	54,669	79,507	32.0931	-103.1923
3002512580	B V LYNCH A FEDERAL 010	Above	Into	Yates	OCD	3,716	3,734	3,712	3,734																				0	576,206	488,484	32.5350	-103.5502
3002509512	H WHITTEN 001	Above	Above	Seven Rivers	OCD	3,422	3,761	3,645	3,761	745																			372	4,390	4,368	32.2527	-103.2711
3002520959	NEW MEXICO CR STATE 003	Below	Below	Delaware	OCD	3,533	11,500	4,578	4,624	857	987	2,354	2,530									7,254	10,558		11,290				0	40,328	44,818	32.6150	-103.7948
3002530534	HAT MESA STATE 010	Below	Below	Delaware	OCD	3,619	13,900	5,310	5,574	1,327	1,552	3,135	3,318						3,516	4,908		8,314	11,292		12,312	12,480	13,154		0	63,041	82,805	32.5314	-103.6894
3002524658	LUSK FEDERAL DISPOSAL 001	Adjacent	Adjacent	Yates/Seven Riv	OCD	3,665	4,675	3,481	4,427				3,208	3,575	4,145	4,375													0	101,810	104,273	32.6802	-103.7090
3002526676	WEST JAL DISPOSAL 001	Above	Above	Yates	OCD	3,166	9,550	3,690	3,700	1,305		3,190	3,376	3,627					3,743	5,300		7,647							0	161,456	132,942	32.1466	-103.2509
3002528210	DOUBLE SS 001	Above	Above	Yates/Seven Riv	OCD	3,302	3,275	3,207	3,238	990	1,140	2,260	2,990	3,220															0	124,898	136,194	32.1838	-103.2369
3002509531	J L COATES 004	Above	Above	Yates/Seven Riv	OCD	3,379	3,670	3,492	3,496																				18,750	231,600	216,600	32.2364	-103.2561
3002531412	UNION AJS FEDERAL 001	Above	Above	Queen	OCD	3,557	3,700	3,445	3,502			2,588	2,762	2,968	3,432														0	1,120,405	1,316,821	32.4914	-103.6947
3002528528	LEA UNIT SWD 002	Above	Above/Into	Seven Rivers	OCD	3,659	4,611	3,800	4,611					3,800															0	446,438	429,949	32.5849	-103.5213
3002523985	WALLEN FEDERAL 002	Above	Above/Into	Seven Rivers	OCD	3,637	3,847	3,660	3,847	1,480	1,580	3,200	3,403																0	9,541	9,236	32.5632	-103.5857
3002524334	ARCO CRUMP 002	Adjacent	Adjacent	Seven Rivers/Qu	OCD	3,333	3,730	3,454	3,638	1,179	1,455	2,730	2,896	3,106	3,510														3,275	35,995	38,973	32.2436	-103.2157
3002529544	STIVASON FEDERAL 003	Adjacent	Adjacent	Queen	OCD	3,692	4,630	4,527	4,556	106	1,860	3,322	3,605	3,958	4,490														0	20,805	13,237	32.6231	-103.5621
3002526965	POSSH 002	Above	Above	Queen	OCD	3,268	3,750	3,553	3,627	1,170	1,300	2,600	2,767	2,995	3,394														0	179,001	139,394	32.1765	-103.2220
3002508961	CLOSSON B FEDERAL 018	Above	Above	Seven Rivers	OCD	3,580	3,909	3,790	3,834	1,602		3,405	3,582																0	22,586	100,806	32.3718	-103.3104
3002527960	BYERS, B605 JV-P 002	Adjacent	Adjacent	Queen/Delaware	OCD	3,676	13,570	4,842	9,840					4,440	4,855			5,738				8,239					12,877		0	95,146	81,488	32.5605	-103.4251
3002509463	B DAVIS 002	Above	Above	Seven Rivers	OCD	3,382	3,607	3,278	3,418				3,034	3,246	3,516														0	173,600	179,637	32.2545	-103.2540
3002522597	BATE FEDERAL 003	Above	Above	Seven Rivers	OCD	3,600	3,514	3,484	3,514	1,304		2,918	3,118	3,402															0	120,114	255,334	32.6230	-103.6361
3002509603	A H MEYERS A 005	Above	Above	Seven Rivers	OCD	3,340	3,800	3,590	3,645																				0	7,281	7,538	32.2083	-103.2508
3002527188	JENNINGS B FEDERAL 002	Above	Above	Yates	OCD	3,621	3,100	2,986	3,060	1,003		2,606	2,824																0	168,103	179,771	32.6549	-103.7519
3002511830	GUTMAN SWD 002	Adjacent	Adjacent	Seven Rivers	OCD	3,028	3,297	2,960	3,068	950			2,565																0	16,931	48,182	32.1004	-103.1817
3002533144	WEST TEAS YATES SEVEN RIVERS UNIT 64	Above	Above	Yates	OCD	3,552	3,470	3,160	3,294				3,160	3,424															0	662	95	32.5795	-103.6608
3002535244	LUSK DEEP UNIT A 019	Below	Below	Strawn	OCD	3,584	12,754	11,358	11,410	778			2,584					4,476				10,346			11,220	11,615	12,228		0	211,211	91,527	32.6550	-103.7816
3002531856	WEST TEAS YATES SEVEN RIVERS UNIT 60	Below	Below	Delaware	OCD	3,539	13,858	5,554	5,653									5,468				8,241	11,600		12,300	12,860			0	501	2,300	32.5756	-103.6662
3002532605	MALLON 34 FEDERAL 001	Below	Below	Delaware	OCD	3,699	6,306	6,180	6,260	1,730		3,348	3,541	3,843	4,578	4,858	5,092	5,702											0	43,993	105,082	32.6222	-103.5535
3002532735	PRONGHORN SWD 001	Above	Above/Into	Yates/Seven Riv	OCD	3,620	3,500	3,300	3,500			2,835	3,068	3,348															0	912,366	1,090,577	32.6521	-103.7166
3002536098	SAPPHIRE STATE 003	Below	Below	San Andres	OCD	3,456	8,647	4,692	5,319																				0	635	978	32.3217	-103.2434
3001520387	GOVERNMENT D 001	Below	Into	Delaware	OCD	3,208	11,800	2,802	2,950													5,414	9,048		10,281	10,760	11,242		0	90,660	92,938	32.4966	-104.1454
3001521387	BURTON FLATS SWD 001	Below	Below	Queen/Delaware	OCD	3,271	12,000	3,410	5,385	720			2,083		3,150			4,300					9,383						0	116,166	197,705	32.5608	-104.0822
3001522055	EXXON STATE 008	Above	Above	Yates	OCD	3,270	700	550	700	70			338																223,342	2,470,011	1,090,105	32.4763	-104.1757
3001520963	LEVERS FEDERAL SWD 002	Below	Below	Cisco Reef	OCD	3,258	10,560	8,144	8,160													7,260		8,124	8,805		10,104		0	1,767,789	1,546,567	32.5066	-104.3624
3001521824	STATE L 001	Below	Below	Delaware	OCD	3,236	11,100	3,980	4,130													7,950	8,280		9,642	10,043	10,412		0	134,334	132,397	32.4928	-104.2872
3001522782	M H FEDERAL COM SWD 001	Below	Below	Cisco Reef	OCD	3,854	8,381	8,004	8,381									1,592				3,551	7,502	7,932					0	4,035,239	4,990,041	32.4145	-104.4552
3001505774	TENNESSEE FEDERAL 001	Above	Above	Yates	OCD	3,467	5,010	2,418	2,470																				0	129,966	99,889	32.6441	-103.8679
3001521515	MYRTLE MYRA SWD 001	Below	Below	Delaware	OCD	3,236	11,750	3,002	5,050														8,800	9,930	10,185	10,788	11,008		0	98,295	107,789	32.4709	-104.1971
3001504686	STATE 002	Above	Above	Yates	OCD	3,210	1,520	1,443	1,520				1,181																0	55,368	921,287	32.5679	-103.9965
3001500129	SPRING SWD 001	Below	Below	Cisco Reef	OCD	3,304	10,784	8,300	8,400													2,300	7,558	8,155	10,430	10,748			0	1,244,902	900,037	32.5207	-104.3944
3001521010	MCKITTRICK 14 FEDERAL SWD 001	Below	Below	Morrow	OCD	4,025	12,366	11,500	12,366													7,145	8,110	8,925	9,320	10,180			0	8,117,303	9,601,167	32.3916	-104.4633

Case Nos. 24278, 24277, 24123, 23775, 23614-23617, and 24018-24027
OCD Exhibit No. 11C

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

April 23, 1992

Mr. Eluid L. Martinez
State Engineer
P.O. Box 25102
Santa Fe, New Mexico 87504-5102

Dear Mr. Martinez:

As you may know, the Oil Conservation Division of the Energy, Minerals and Natural Resources Department, has primacy in administering the Federal Underground Injection Control Program for the State of New Mexico. This program mandates that the Division, in reviewing applications for salt water disposal and secondary recovery injection wells, make a determination that such injection shall not pose a danger of contaminating underground sources of drinking water containing less that 10,000 parts per million total dissolved solids.

Recently, an application was filed by Anadarko Petroleum Company to utilize the Exxon Federal Well No. 3 located 660 feet from the North line and 1980 feet from the West line (Unit C) of Section 19, Township 19 South, Range 33 East, NMPM, Lea County, New Mexico, as a salt water disposal well, injection to occur into the Capitan Reef at a depth of approximately 3500 feet to 4300 feet. The produced water to be injected into this well originates from the Delaware formation at a depth of approximately 5492 feet to 6020 feet, and contains total dissolved solids of approximately 219,389 parts per million. Injection is proposed to average 1000 barrels of water per day.

Anadarko presented geologic and engineering evidence and testimony at a public hearing held in Santa Fe on February 6, 1992, which indicates that in the area of concern, the Capitan Reef contains water with total dissolved solids of 105,532 parts per million, as evidenced by a water analysis from Anadarko's Teas Yates Water Supply Well No. 1 located 1330 feet from the North and West lines (Unit F) of Section 14, Township 20 South, Range 33 East, NMPM, which is currently completed in the Capitan Reef at a depth of approximately 3660 feet to 3762 feet. Based upon the evidence presented, the Division can approve the proposed injection into the Capitan Reef.

The Division's concerns regarding the proposed injection are as follows:

1) The Division has historically not allowed injection into the Capitan Reef as per an agreement supposedly reached between Mr. Pete Porter, previous director of the Division and Mr. Steve Reynolds;

2) Allowing the proposed injection at the present time would set a precedent, and as a result, the Division would expect to see numerous similar applications filed due to the unique ability of the Capitan Reef to easily accept injected fluids;

3) The Division lacks reservoir modeling capability and hydrologic expertise to adequately predict whether or not injection into the Capitan Reef on a large scale will ultimately have a detrimental affect on those portions of the Capitan Reef containing good quality water such as that currently being used by the City of Carlsbad.

Members of my staff have been in preliminary contact with Mr. Paul Saavedra of your office. Thus far, they have been unable to locate any documentation regarding the agreement between Mr. Porter and Mr. Reynolds.

I feel that this is a very important issue because once injection into the Capitan Reef is allowed and the injection occurs, it would be very difficult to perform remediation should contamination occur. We are therefore seeking your assistance in making a hydrologic determination that large scale injection of produced salt water into the Capitan Reef will not have a detrimental affect, at some future time, on those portions of the Reef containing fresh water. A hydrologic study of this nature will provide the Division scientific data and evidence needed to make informed decisions on the effects of salt water injection into the Capitan Reef.

Any assistance you can provide the Division in this matter will be greatly appreciated. If my engineering or geologic staff can be of any assistance, please feel free to request such assistance.

Sincerely,

William J. LeMay

William J. LeMay
Division Director

Case Nos. 24278, 24277, 24123, 23775, 23614-23617, and 24018-24027
OCD Exhibit No. 11D

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

March 25, 1993

Eluid Martinez
State Engineer
Bataan Memorial Building
Santa Fe, NM 87501

RE: Proposed Injection into Capitan Reef

Dear Mr. Martinez:

The Oil Conservation Division has recently received another application to inject produced salt water into a portion of the Capitan Reef, this one being from Pronghorn SWD System of Hobbs, New Mexico. We are informed that the applicant has or is submitting information to your office and soliciting your support or approval for the project.

As you may remember, there has been a previous application for the same type of operation, which the Division denied. At that time we consulted with your staff regarding a long-standing agreement between Steve Reynolds and Pete Porter under which no injection would be allowed in the Reef.

As the agency responsible for protecting fresh water as designated by your office, we are very concerned about permitting injection into the Capitan Reef. We know that there are portions of the Reef which are major sources of fresh water in the area. Our concern is that injection of produced water could at some point contaminate the fresh water.

We would very much appreciate input from the experts in your office on questions within their expertise, specifically questions about the locations of fresh water and the potential alterations of water movement within the Reef which could cause contamination. We may ask that someone from your staff provide testimony at the hearing on this application.

That hearing is currently set for April 8, 1993, in the OCD conference room in the State Land Office Building, but we plan to continue that hearing to a later docket. We would like to hear from you prior to April 8 to help us determine what input your office can provide.

Thank you for your assistance.

Sincerely,

Lawrence O. Van Ryan,
Chief Engineer

LOVR/RGS

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Case Nos. 24278, 24277, 24123, 23775, 23614-23617, and 24018-24027
OCD Exhibit No. 11E