IN THE SUPREME COURT OF THE STATE OF NEVADA

Case No. 81224

DIAMOND NATURAL RESOURCES PROTECTION & CONSERVATION ASSOCIATION; J&T FARMS, LLC; GALLAGHER FARMS LLC; JEFF LOMMORI; M&C HAY; CONLEY LAND & LIVESTOCK, LLC; JAMES ETCHEVERRY; NICK ETCHEVERRY; TIM HALPIN; SANDI HALPIN; DIAMOND VALLEY HAY COMPANY, INC.; MARK MOYLE FARMS LLC; D.F. & E.M. PALMORE FAMILY TRUST; WILLIAM H. NORTON; PATRICIA NORTON; SESTANOVICH HAY & CATTLE, LLC; JERRY ANDERSON; BILL BAUMAN; DARLA BAUMAN; TIM WILSON, P.E., NEVADA STATE ENGINEER, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES; AND EUREKA COUNTY;

Appellants,

v.

DIAMOND VALLEY RANCH, LLC; AMERICAN FIRST FEDERAL, INC.; BERG PROPERTIES CALIFORNIA, LLC; BLANCO RANCH, LLC; BETH MILLS, TRUSTEE MARSHALL FAMILY TRUST; TIMOTHY LEE BAILEY; CONSTANCE MARIE BAILEY; FRED BAILEY; CAROLYN BAILEY; SADLER RANCH, LLC; IRA R. RENNER; AND MONTIRA RENNER,

Respondents.

Appeal From Order Granting Petitions for Judicial Review
Seventh Judicial District Court of Nevada Case No. CV-1902-348

JOINT APPENDIX
VOLUME II

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AFFIRMATION

The undersigned does hereby affirm that the preceding document does not contain the social security number of any person.

Date: September 23, 2020

/s/ Debbie Leonard

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CERTIFICATE OF SERVICE

I HEREBY CERTIFY that I am an employee of Leonard Law, PC, and that on September 23, 2020, the foregoing document was electronically filed with the Clerk of the Court for the Nevada Supreme Court by using the Nevada Supreme Court's E-Filing system (E-Flex). Participants in the case who are registered with E-Flex as users will be served by the EFlex system. All others will be served by first-class mail.

/s/ Tricia Trevino
An employee of Leonard Law, PC

ORIGINAL

Case No. CV-1902-348
(Consolidated with CV-1902-349 and CV-1902-350)

Dept. No. 2

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IN THE SEVENTH JUDICIAL DISTRICT COURT OF THE STATE OF NEVADA

IN AND FOR THE COUNTY OF EUREKA

TIMOTHY LEE & CONSTANCE MARIE BAILEY; FRED & CAROLYN BAILEY; IRA R. & MONTIRA RENNER; SADLER RANCH, LLC; and DANIEL S. VENTURACCI, Petitioners, vs. TIM WILSON, P.E., Nevada State Engineer, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, Respondent.	**MOTION *IN LIMINE***

Tim Wilson, P.E., in his capacity as Acting Nevada State Engineer, Department of Conservation and Natural Resources, Division of Water Resources (hereafter "State Engineer"), by and through counsel, Nevada Attorney General Aaron D. Ford and Deputy Attorney General Tori N. Sundheim, hereby files this Motion *in Limine*. This Motion *in Limine* is based upon the attached Points and Authorities and the pleadings and papers on file herein.

POINTS AND AUTHORITIES

I. INTRODUCTION

The State Engineer respectfully requests that this Court order evidence in this matter shall be limited to the State Engineer's Record on Appeal ("Record"), and supplementation of the State Engineer's Record is improper. The underlying petitions for

judicial review brought pursuant to NRS 533.450 and 534.037 involves a challenge to Diamond Valley Groundwater Management Plan ("DVGMP") in Order No. 1302. Pursuant to NRS 533.450, judicial review is strictly limited and in the nature of an appeal. NRS 533.450 limits the evidence in appeals of the State Engineer's orders to the State Engineer's Record. Therefore, a Motion *in Limine* is appropriate to limit the scope of evidence that may be considered by this Court, in accordance with the provisions of NRS 533.450, to the State Engineer's Record.

This Motion *in Limine* is necessary because Petitioners' written requests to the State Engineer, and statements during Telephonic Status Conferences, indicate they will seek to circumvent the requirements of NRS 533.450 and seek to expand the scope of review to include evidence beyond that which was relied upon by the State Engineer in issuing Order No. 1302. Specifically, the Petitioners will seek to introduce extra-record evidence by two methods. First, Petitioners will request that this Court hold an evidentiary hearing, or allow the parties to refer to information outside of the Record. Second, the Petitioners will seek to have this Court supplement the State Engineer's Record. During the October 30, 2018, public hearing, Petitioners as well as all other interested parties were afforded the opportunity to present testimony and submit their own evidence either in support or opposition to the adoption of the DVGMP for inclusion within the Record. *See* NRS 533.450(4).

This Court's review is limited to whether the State Engineer's decision to approve the DVGMP, as articulated in Order No. 1302, is supported by substantial evidence, which is defined as "evidence that a reasonable mind might accept as adequate to support" the order. *Jackson v. Groenendyke,* 132 Nev. 296, 300, 369 P.3d 362, 365 (2016); NRS 534.037(4) (citing NRS 533.450). Therefore, the State Engineer's Record contains only the evidence the State Engineer relied upon in making his decision to accept the DVGMP as set forth in Order No. 1302. The Record also contains all of the testimony and written submissions provided to the State Engineer during the underlying proceedings, and must not be expanded or set aside on appeal.

It is ultimately the responsibility of the State Engineer to assure that the Record upon which he relied in rendering his decision is sufficient and substantial to support the decision. It is not the Petitioners who define that which was relied upon in rendering the decision and to supplement or otherwise introduce extrinsic evidence in a NRS 533.450 proceeding is improper. Accordingly, an order *in Limine* limiting the Record in this matter is appropriate.

II. FACTUAL SUMMARY

A. The Underlying Proceedings and October 30, 2018, Public Hearing

A petition signed by a majority of the affected water rights holders in Diamond Valley was submitted with the DVGMP to the State Engineer for consideration and approval on August 20, 2018. Pursuant to NRS 534.037(3), on October 30, 2018, the State Engineer held "a public hearing to take testimony on the plan." *See* SE ROA 653–742 (Transcript of Proceedings). During the October 30th public hearing, the State Engineer received testimony and comment from all interested parties. SE ROA 654–55 ("The purpose of this hearing is to provide information to the public and receive written or oral testimony from any interested person about the proposed plan provided in [NRS] 534.037"). Each of the Petitioners Bailey, Renner, Sadler, and Venturacci,[1] all provided testimony and/or written comments to the State Engineer, including attachments and expert reports, which are included within the State Engineer's Record. SE ROA 536–39; 658–59; 723–26 (Bailey); SE ROA 596–641; 660–77 (Sadler); SE ROA 593 (Renner); SE ROA 642–52; 721–23 (Venturacci). Sadler Ranch testified through the assistance of counsel and an expert witness, and submitted a comment letter with legal argument and an expert report for the State Engineer's consideration. SE ROA 596–641; 660–77.

Petitioners were aware, at the time of the public hearing, that whatever they testified to or submitted in writing would become part of the State Engineer's Record. Each of the Petitioners in this matter had the opportunity to submit any evidence that they believed was relevant for the State Engineer to consider before making a final decision.

[1] Daniel S. Venturacci's withdrawal from this lawsuit is forthcoming.

The State Engineer issued Order No. 1302 on January 11, 2019, and Petitioners filed their Petitions for Judicial Review on February 8, 2019, and February 11, 2019.

B. Petitioner's Requests to "Supplement" the State Engineer's Record

It is undisputed that Petitioners seek to expand the Court's review to material not included in Record. On April 9, 2019, the Court held a telephone status conference with the parties to discuss briefing and other procedural matters. *See* April 25, 2019, Order Following Telephone Status Hearing Held April 9, 2019. During the conference, the parties discussed the State Engineer's Record and Sadler, Venturacci, the Baileys, and the Renners requested that they be able to supplement the Record with extra-record evidence. Petitioners have also stated their belief that there should have been an *evidentiary* hearing, rather than a public hearing. The State Engineer objected to the use of extra-record evidence or to judicial supplementation of the Record, but agreed to meet and confer for the limited purpose of considering for inclusion in the Record any clerical errors or inadvertent omissions they might identify in their review. Thereafter, the Court ordered the State Engineer to file the Record on April 30, 2019. Order at 3. Further, the Court ordered that "legal counsel for the parties shall meet and confer by telephone . . . for the purpose of discussing the contents of the ROA, as filed, [and] any proposed supplemental exhibits to the ROA." *Id.* This issue was again raised during the June 4, 2019, Telephone Status Conference, where the Petitioners stated they planned to file requests to supplement the State Engineer's Record once it is filed on June 7, 2019.

The State Engineer prepared the Record for filing and shared the Draft Summary of the Record with all of the parties on April 16, 2019. *See* Ex. 1. Upon reviewing the State Engineer's Draft Summary of the Record, Petitioners did not send any "proposed supplemental exhibits" that were inadvertently omitted, in accordance with this Court's Order and the State Engineer's expectations. Instead, on April 23, 2019, Petitioners submitted a "meet and confer letter," seeking to include in the Record a list of documents, which are not only irrelevant and not part of the record relied upon in the issuance of Order

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No. 1302, but are more similar to a public records request seeking some 50 years of records relating to the Diamond Valley Hydrographic Basin. *See* Ex. 2.

In order for the State Engineer to consider the full scope of the requests listed in Ex. 2, the parties stipulated to an extension of time to file the Record on May 24, 2019. The State Engineer filed a subsequent Request for Extension of time to file the Record on June 7, 2019, which this Court granted. The April 23rd letter echoes a prior public records request and subsequent lawsuit filed by Sadler Ranch which was ultimately dismissed with prejudice on July 5, 2017. Ex. 3. Sadler Ranch already has, in its current possession, much of the information listed in Ex. 2, as part of its public records request from 2017, as the prior public records request sought much of the same information, which was in existence even at that period of time, regarding the "severe decline in the amount of water at [Sadler's] Ranch due to overpumping of groundwater and the State Engineer's mismanagement and/or lack of management of Diamond Valley." Ex. 3 at 2.

C. The State Engineer's Review of Petitioners' Requests

Despite the expansive nature of Petitioners' requests, the State Engineer reviewed the list in good faith to identify whether there was evidence that was inadvertently omitted from the Record. As a result, additional information has been included in the State Engineer's Record. The remainder of documents and records contained in Petitioners' requests, in Ex. 2., were either not considered in rendering the decision set forth in Order No. 1302, are not relevant to this Court's review of Order No. 1302, or do not exist.

III. ARGUMENT

Petitioners erroneously seek to set aside NRS 533.450 by asserting that there should have been an *evidentiary* hearing, rather than a public hearing.[2] Petitioners similarly seek to evade the strict limitations of NRS 533.450 by simply reclassifying their extra-record evidence as a "supplement" to the State Engineer's Record. Petitioners had a full

[2] It is significant to note that pursuant to NRS 534.037(3), the State Engineer is required to hold a "public hearing to take testimony on the plan . . . ." The law does not require the "evidentiary" hearing purported to be required by Petitioners. Rather, if the Legislature intended the State Engineer to hold an "evidentiary" style hearing, the statute would so direct the State Engineer to conduct a hearing, including the filing of evidence. *Cf.* NRS 533.365(4).

opportunity to introduce for the State Engineer's consideration all the information they wished to present in support of their position that the State Engineer should not adopt the DVGMP. The State Engineer's Record, as filed, contains the evidence and testimony offered by Petitioners as well as all the other evidence relied upon in the decision set forth in Order No. 1302 adopting the DVGMP. SE ROA 535–742.

The Court's review of the State Engineer's decision is "in the nature of an appeal." NRS 533.450(1). Thus the State Engineer, as the deciding body, is ultimately responsible for compiling, finalizing, and filing the Record with the evidence considered in making its decision and preparing the findings and conclusions within Order No. 1302. The Record also includes any transcripts and evidence presented by the parties during the underlying proceedings. NRS 533.450(4). The State Engineer often shares a Draft Summary of the Record with opposing counsel for the limited purpose of considering clerical errors or inadvertent omissions for inclusion within the Record. However, there is no obligation to do so pursuant to NRS 533.450, or NRCP 26, for an appellate docket.

The sole purpose of this Court's review in this case is to evaluate whether the Record contains information sufficient to conclude that substantial evidence supports the findings and conclusions within the State Engineer's Order No. 1302. *Revert v. Ray*, 95 Nev. 782, 603 P.2d 262 (1979). Petitioners' requests to set aside the provisions of NRS 533.450 by supplementing the State Engineer's Record and introduce or refer to extra-record evidence on appeal are contrary to the limited nature of this case and undercuts its very purpose. If this Court finds the State Engineer's Record, as filed, lacks substantial evidence, or that the State Engineer failed to follow the proper statutory procedures, then the appropriate relief is to remand for further proceedings, rather than allow for an evidentiary hearing on appeal, or force expansion of the Record, in contravention of NRS 533.450. *Id.*

A. Standard of Review

1. Standard of Review for Motions *in Limine*

A motion *in limine* is the appropriate vehicle to prevent the introduction of inadmissible evidence to avoid judicial error in this case. NRS 47.060(1); *Richmond v. State*,

118 Nev. 924, 59 P.3d 1249 (2002); *Revert*, 95 Nev. at 786, 603 P.2d at 264. Further, under 7JDCR 12, "[c]ounsel are encouraged to raise contested issues by motions in limine prior to trial." NRS 533.450 provides the scope of evidence the Court may consider in reviewing decisions of the State Engineer.

Motions *in limine* are designed to facilitate the management of a case by deciding evidentiary issues in advance of court proceedings. *See Richmond v. State*, 118 Nev. 924, 928–32, 59 P.3d 1249, 1252–54 (2002); *State ex rel. Dep't of Highways v. Nev. Aggregates & Asphalt Co.*, 92 Nev. 370, 376, 551 P.2d 1095, 1098 (1976). Motions *in limine* have long been recognized as an appropriate use of a District Court's authority to rule on the admissibility of evidence and narrow evidentiary issues. *Id.* An additional advantage of a motion *in limine* is to avoid the futile attempt to unring the bell, even in the event a motion to strike is granted.

Indeed, motions *in limine* determine in advance whether the District Court will admit or exclude specific items of evidence and narrow the issues to promote judicial economy. *See Finger v. State*, 117 Nev. 548, 27 P.3d 66 (2001); *see also Nev. Civ. Prac. Manual*, § 18.02[2]. The State Engineer seeks an order *in limine*, in accordance with the limitations set forth by NRS 533.450, which specifies the Court is confined to the evidence within the State Engineer's Record in reviewing Order No. 1302. Therefore, the Court must direct counsel not to seek to include or refer to extra-record evidence during court proceedings.

2. Standard of Review for NRS 533.450 Petitions for Judicial Review

NRS 534.037(4) specifies "[t]he decision of the State Engineer on a groundwater management plan may be reviewed by the district court of the county pursuant to NRS 533.450." The provisions of NRS 533.450 strictly limit judicial review to the narrow confines established under the statute and as interpreted by the Nevada Supreme Court. *See Application of Filippini*, 66 Nev. 17, 27, 202 P.2d 535, 540 (1949) ("It is also well settled in this state that the water law and all proceedings thereunder are special in character,

and the provisions of such law not only lay down the method of procedure but *strictly limits* it to that provided." (emphasis added)). NRS 533.450 explicitly provides in part that such proceedings must be "in the nature of an appeal" and are "informal and summary."

The Legislature has specified under NRS 533.450(10), "[t]he decision of the State Engineer shall be prima facie correct, and the burden of proof shall be upon the party attacking the same." *See Revert*, 95 Nev. at 786, 603 P.2d at 264. The Court reviews a challenge to the State Engineer's order for an abuse of discretion. *Office of State Eng'r v. Curtis Park Manor Water Users Ass'n,* 101 Nev. 30, 32, 692 P.2d 495, 497 (1985). When reviewing an order of the State Engineer, the Court may not "pass upon the credibility of the witness nor reweigh the evidence." *Id.*; *see also Bacher v. State Eng'r*, 122 Nev. 1110, 1121, 146 P.3d 793, 800 (2006). This means "a district court is not free to substitute its judgment for that of the Engineer in granting and extending permanent water rights" decisions. *Id.*

Rather, the Court must "review the evidence upon which the Engineer based his decision and ascertain whether that evidence supports the order." *Id.* The Court will not set aside factual findings unless they are not supported by substantial evidence or are clearly erroneous. *Jackson,* 132 Nev. at 300, 369 P.3d at 365. "Substantial evidence is evidence that a reasonable mind might accept as adequate to support a conclusion." *Id.* (internal quotations omitted).

In short, the underlying Petition for Judicial Review in this matter is for the Court to decide whether the State Engineer has the legal authority to adopt a stakeholder-developed groundwater management plan within the Record under the legislative directive given in NRS 534.037, and whether substantial evidence supports the decision to adopt the DVGMP. Extrinsic evidence is neither relevant nor proper, and Petitioners should be precluded from introducing anything beyond the State Engineer's Record, as filed.

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B. The District Court May Not Set Aside the Requirements of NRS 533.450 and Allow the Parties to Introduce Extra-Record Evidence or Judicially Supplement the State Engineer's Record

This Court may not require an evidentiary hearing, or "supplement" the State Engineer's Record, as requested by Petitioners. *See* Ex. 2. Both of these independent requests amount to the same goal—to introduce, refer to, and urge this Court to improperly consider extra-record evidence on appeal. The sole purpose of this Court's review in this case is to evaluate whether the Record contains information sufficient to conclude that substantial evidence supports the findings and conclusions within the State Engineer's Order No. 1302. *Revert*, 95 Nev. at 782, 603 P.2d at 262. Accordingly, in reviewing State Engineer decisions, *Revert* is clear that limiting the scope is the only appropriate way to proceed, otherwise there is error in the District Court's Record. *Revert*, 95 Nev. at 782, 603 P.2d at 262; *See also Kent v. Smith*, 62 Nev. 30, 32, 140 P.2d 357, 358 (1943).

In *Revert*, the District Court sought to remedy a critical deficiency in the record by allowing the appellants to introduce evidence on appeal. *Revert*, 95 Nev. at 786, 603 P.2d at 264. The District Court considered this evidence and decided for itself an issue the State Engineer had failed to address. *Id.* The Nevada Supreme Court acknowledged that substantial evidence did not support the State Engineer's decision because "resolution of this claim was essential to the full and fair determination of the instant appropriation application." *Id.* However, the Nevada Supreme Court also overturned the District Court's consideration of extra-record evidence as error:

> Contrary to appellants' suggestion, a party aggrieved by a decision of the State Engineer in an appropriation hearing is not entitled to a de novo hearing in the district court. The relevant statutes specifically provide that any such review shall be "in the nature of an appeal" and that the proceedings in the district court shall be "informal and summary." NRS 533.450(1) and (2). Moreover, while the legislature originally provided for such a de novo review, 1913 Nev. Stats., ch. 140, § 75, that provision was explicitly repealed during the next legislative session, 1915 Nev. Stats., ch. 243, § 75.

Id. The Supreme Court has since upheld *Revert* several times over.[3]

[3] *See Curtis Park 1*, 98 Nev. at 275, 646 P.2d at 549 (the district court may not substitute its judgment for that of the Engineer in granting and extending permanent water rights); *Curtis Park 2*, 101 Nev. at 30,

By allowing parties to submit evidence, or supplement the State Engineer's Record on appeal, the District Court would only compound any purported error by "supply[ing] the missing findings," or correcting the State Engineer's errors outside of the statutory process. *Revert*, 95 Nev. at 786, 603 P.2d at 264. Thus, in evaluating the present matter, the law regarding the scope of review is clear. If the Court finds the evidence within the Record, as filed, does not support the State Engineer's Order No. 1302, or that important facts are missing or lack evidentiary support, then the appropriate remedy is to "remand[] to the State Engineer for a full and fair determination" of the missing facts that must be developed. *Revert*, 95 Nev. at 788, 603 P.2d at 265. The evidence must be confined to the State Engineer's Record as filed.

1. Petitioners Already Presented Evidence Before the State Engineer During the Public Hearing Held on October 30, 2018

The State Engineer held a public hearing as expressly stated in NRS 534.037(3), on October 30, 2018. However, Petitioners will argue that this Court should set aside the requirements of NRS 533.450 because the State Engineer did not hold an "evidentiary" hearing on the adoption of the DVGMP. The plain language of NRS 534.037 and the Legislative history illustrates that the Legislature was intentional in its use of the term "public hearing." NRS 534.047(3) states "[b]efore approving or disapproving a groundwater management plan . . ., the State Engineer shall hold a *public* hearing *to take testimony* on the plan." *Compare* NRS 534.038(3), *with* NRS 533.370 (7–8) (referring only to "hearing").

When a statute is facially clear, the Court will give effect to the statute's plain meaning and not go beyond the plain language to determine the Legislature's intent.

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692 P.2d at 495 (1985) (the district court may not require the State Engineer to undertake actions that are not provided for by statute); *Town of Eureka v. Office of State Eng'r of State of Nev., Div. of Water Res.*, 108 Nev. 163, 826 P.2d 948 (1992) (remanding the matter to the State Engineer to conduct further proceedings determining whether the Town made substantial use of its water); *Morris*, 107 Nev. at 699, 819 P.2d at 203 (the State Engineer's finding that the application would recharge the Pahrump Ground Water Basin "ignored that the point of diversion sought for the appropriation is not within the Pahrump basin"); *Bacher*, 122 Nev. at 1110, 146 P.3d at 793 (The record did not support the State Engineer's findings on Vidler's need for additional importation water); *Pyramid Lake Paiute Tribe of Indians v. Ricci*, 126 Nev. 521, 245 P.3d 1145 (2010) ("Substantial evidence supports the State Engineer's conclusion that Dodge Flat Basin contains unappropriated water and that any harm to existing water rights or the public's interest is the result of the Tribe's unpermitted use").

Public Employees' Benefits Prog. v. LVMPD, 124 Nev. 138, 147, 179 P.3d 542, 548 (2008); *see also Silvers v. Sony Pictures Entm't, Inc.*, 402 F.3d 881, 885 (9th Cir. 2005) (There is a presumption that when a statute designates a procedure, all omissions should be understood as exclusions). In addition to the plain language rule, Nevada also follows the maxim "*expressio unius est exclusio alterius*," the expression of one thing is the exclusion of another. *State v. Javier C.*, 289 P.3d 1194, 1197 (Nev. 2012); *see also Public Employees' Benefits Prog.*, 124 Nev. at 147, 179 P.3d at 548 ("This Court will give effect to the statute's plain meaning and not go beyond the plain language to determine the Legislature's intent.").

Had the Legislature intended there to be an evidentiary hearing under NRS 534.037, it would have been explicit. Furthermore, in the Legislative history, the bill sponsor, Sen. Pete Goicoechea, twice stated the "bill requires the State Engineer to hold a public hearing to bring forward the water management plan that has to be approved in a public hearing process." *Hearing on AB 419 Before the Senate Committee on Government Affairs*, 2011 Leg., 76th Sess. (May 23, 2011), https://www.leg.state.nv.us/Session/76th2011/Minutes/Senate/GA/Final/1217.pdf (last visited June 6, 2019); *see also Hearing on AB 419 Before the Assembly Committee on Government Affairs*, 2011 Leg., 76th Sess. (Mar. 30, 2011), https://www.leg.state.nv.us/Session/76th2011/Minutes/Assembly/GA/Final/699.pdf (last visited June 6, 2019) ("That plan must come forward in a public hearing"). Where the Legislature has, as here, explicitly used the term "public hearing," this court will presume it deliberately excluded other types of hearings. *State v. Wyatt*, 84 Nev. 731, 734, 448 P.2d 827, 829 (1968) (Batjer, J., dissenting); *see also Matter of Estate of Prestie*, 122 Nev. 807, 814, 138 P.3d 520, 524 (2006).

In this matter, the parties already had the opportunity to create their record during the formal proceedings held before the agency. *See* SE ROA 535–742. Moreover, Petitioners, at the time of the public hearing, had the knowledge that all of the information presented and submitted to the State Engineer would become part of the Record in their impending Petition for Judicial Review. NRS 533.450(4). The State Engineer did include as part of the

Record "a true and correct" copy of the transcript of the "testimony taken" during the October 30, 2018, hearing, along with all the "evidence [that] has been filed with" the State Engineer as part of those proceedings. NRS 533.450(4); *See* SE ROA 535–742.

Petitioners Bailey, Renner, Sadler, and Venturacci all had the opportunity to present testimony during the hearing. SE ROA 658–59; 723–26 (Bailey); SE ROA 660–77 (Sadler); SE ROA 721–23 (Venturacci). Petitioners further offered comments, or written submissions, and even expert reports, as part of the proceedings. SE ROA 536–39 (Bailey); SE ROA 596–641 (Sadler); SE ROA 593 (Renner); SE ROA 642–52 (Venturacci). They were able, at that time, to introduce for the State Engineer's consideration, any information, records, or reports they deemed relevant. Furthermore, the State Engineer took the additional step of holding the Record open to allow for additional comments or information. SE ROA 656. So, even if Petitioners were ignorant that the law allowed for comments or evidence prior to the hearing, they were given extra time to submit additional materials after the hearing.

The accessibility of some State Engineer records through public records request provisions under NRS ch. 239, does not make those records relevant or appropriate for inclusion with the State Engineer's Record in this particular case. If the Petitioners felt certain records were relevant to the DVGMP Public Hearing, the appropriate administrative process to assure such documents and records were considered by the State Engineer in rendering his decision was to introduce them as attachments to written comments. None of the Petitioners sought to include that information during the underlying proceedings and the State Engineer did not include that information within the Record because it was not relevant. The Record, as filed, contains a transcript of the hearing, as well as all of Petitioners written submissions. SE ROA 535–742. Any issues not raised at the hearing or in their comments were not considered by the State Engineer and must not be included within the Record.

Therefore, as the Petitioners already had the full opportunity to present evidence and be heard, that they "failed to [introduce certain evidence] in the case at hand cannot

be attributed to any neglect of duty on the part of the State Engineer." *Bailey v. State*, 95 Nev. 378, 381, 594 P.2d 734, 736 (1979). Accordingly, the District Court is bound by the Record relied on by the State Engineer, just as an Appellate Court is bound when reviewing a decision of the District Court. This is why the rule of law, that the District Court may not consider extra-record evidence, makes sense given the posture of a Petition for Judicial Review under NRS 533.450. In comparison, when a new non-Petition for Judicial Review action is filed with the District Court, a record has not yet been created, and the court and parties must gather evidence to develop the record in support of its findings and conclusions.

2. The Court is Without the Authority to Remand the Case for an *Evidentiary* Hearing Under NRS 534.037 or NRS 533.450

The Supreme Court has held that the District Court may not require the State Engineer to hold a hearing that is not provided for under the governing water law provisions, here NRS 534.037 and NRS 533.450. As discussed above, NRS 534.037 only provides for a "public hearing to take testimony on the plan." The plain language used by the Legislature is "public hearing," not "evidentiary hearing." *Public Employees' Benefits Prog.*, 124 Nev. at 147, 179 P.3d at 548.

In *Curtis Park 2*, the Nevada Supreme Court held the District Court erred by failing to "perform a limited review" as it was bound under NRS 533.450 and *Revert. Curtis Park 2*, 101 Nev. 30 at 32, 692 P.2d 495 at 496. Instead, the District Court incorrectly "found the State Engineer abused his discretion by not holding a hearing prior to the revocation order, *even though none was required under the governing water law provisions*, NRS 534.120." *Id.* (*emphasis added*). The *Curtis Park 2* decision was based upon identical statutory authority as the present case, namely, "the agency-specific judicial review provision of NRS 533.450, and its previous decision in *Revert*." *Id.* It further held its "specific guidance was to enable the district court to review the State Engineer's order properly on remand." *Id.* "In failing to perform the limited review," by ordering the State Engineer to hold a

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hearing, the Nevada Supreme Court held, "the district court abused *its* discretion" and "usurped the Engineer's power." *Id.*

3. Judicial Expansion of the State Engineer's Record by Supplementation is Improper

Petitioners' attempts to introduce extra-record evidence for this Court's consideration by supplementing the Record is improper. Petitioners simply seek to reclassify their extra-record evidence by asking the Court to supplement the State Engineer's Record with information the State Engineer did not consider. The function of the Court on a Petition for Judicial Review is to ascertain whether the information within the State Engineer's Record supports the decision. *Curtis Park 2*, 101 Nev. at 32, 692 P.2d at 497. If it does, the court is bound to sustain the State Engineer's decision. *Id.* It is not for a third party to say what the State Engineer did or did not consider in formulating his findings and conclusions as explained in Order No. 1302.

Assuming *arguendo* that Petitioners could establish that "conflicting evidence" exists by introducing "supplemental evidence," it is irrelevant to whether Order No. 1302 is supported by substantial evidence. Importantly, the substantial evidence standard means the Court may not displace the agency's choice between two fairly conflicting views, even though the Court may justifiably arrive at a different conclusion. *Revert*, 95 Nev. at 786, 603 P.2d at 264. "[D]espite the existence of some conflicting evidence in the Record, this court will not substitute its judgment for that of the factfinder." *Id.* The Court accords "deference to the point of view of the [State Engineer] since he had the opportunity to weigh evidence and evaluate the credibility of witnesses—an opportunity foreclosed to this court." *Jackson*, 132 Nev. at 300, 369 P.3d at 365 (citing *Harris v. Zee*, 87 Nev. 309, 311, 486 P.2d 490, 491–92 (1971)).

C. Petitioners' Requests to Include Extrinsic Evidence Is Not Relevant to the Court's Legal Interpretation of NRS 534.037

Finally, Petitioners will also request the Record include all of the "legislative materials" on bills introduced to the Legislature during 2015 and 2017 and "all Records of

communications . . . related directly or indirectly to" these bills. *See* Ex. 2 at 2–3. "The starting point in statutory construction is to read and examine the text of the act and draw inferences concerning the meaning from its composition and structure . . . we do not inquire what the legislature meant; we ask only what the statute means." *In re Nev. State Eng'r Ruling No. 5823*, 128 Nev. 232, 239, 277 P.3d 449, 453 (2012). The only relevant document, outside of those already citable, is the State Engineer's legal analysis as provided within Order No. 1302. The State Engineer's legal analysis within Order No. 1302 is relevant because the Court "recognizes the State Engineer's expertise and looks to his interpretation of a Nevada water law statute as persuasive, if not mandatory, authority." *In re Ruling No. 5823*, 128 Nev. 239, 277 P.3d 453 (2012) (citing *Town of Eureka v. Office of State Eng'r of State of Nev., Div. of Water Res.*, 108 Nev. 163, 165, 826 P.2d 948, 949 (1992); *see also Sierra Pac.*, 135 Nev. Adv. Op. at 13. Therefore, outside of currently citable authority, the only document the Court would review is Order No. 1302 itself for the purpose of examining the State Engineer's legal analysis of NRS 534.037.

IV. CONCLUSION

The State Engineer respectfully requests that this Court grant this Motion *in Limine* and order that all evidence shall be limited to the State Engineer's Record in this case. The State Engineer is entitled to the relief sought because judicial review of the State Engineer's decisions is special, in "the nature of an appeal" and the proceedings before the District Court "must be informal and summary." NRS 534.050(1), (2). This unique statutory standard of review limits a reviewing court to the State Engineer's Record. *Revert*, 95 Nev. at 786, 603 P.2d at 264. The function of the District Court in this matter is first to ascertain whether the State Engineer properly interpreted the criteria set forth in NRS 534.037, and then whether the documents and evidence which were relied upon by the State Engineer, as contained in the Record, provides substantial evidence to support the State Engineer's adoption of the DVGMP through Order No. 1302. Additional evidence is not permitted on appeal; nor may Petitioners re-characterize their extra-record evidence by seeking to supplement the State Engineer's Record with information the State Engineer did not

consider. The Court should therefore preclude Petitioners from supplementing the State Engineer's Record or introducing extra-record evidence on appeal by issuing an Order *in limine.*

AFFIRMATION

The undersigned does hereby affirm that the preceding Motion *in Limine* does not contain the social security number of any person.

DATED this 7th day of June, 2019.

AARON D. FORD
Attorney General

By: _____

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Attorney for Respondent,
State Engineer

CERTIFICATE OF SERVICE

I certify that I am an employee of the State of Nevada, Office of the Attorney General, and that on this 7th day of June, 2019, I served a true and correct copy of the foregoing MOTION *IN LIMINE*, said document applies to Case Nos. CV-1902-348, -349 and -350, electronically to:

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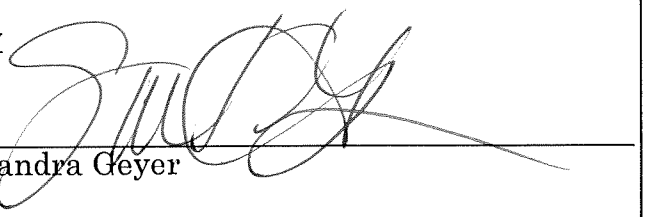

Sandra Geyer

INDEX OF EXHIBITS

EXHIBIT NO.	EXHIBIT DESCRIPTION	NUMBER OF PAGES
1.	Email re: Draft Summary of Record on Appeal and Draft Summary of Record on Appeal	6
2.	April 23, 2019, Meet and Confer Letter re: Summary of Record on Appeal	5
3.	First Judicial District Court Case No. 17 OC 00018 1B, Petition for Writ of Mandate and Notice of Voluntary Withdrawal	40

EXHIBIT 1

EXHIBIT 1

Tori N. Sundheim

From:	Tori N. Sundheim
Sent:	Tuesday, April 16, 2019 9:56 AM
To:	Paul Taggart; David H. Rigdon; 'Tim O'Connor'; Sarah Hope; 'Don Springmeyer'; Chris Mixson; Christie Rehfeld; 'Karen Peterson'; Ted Beutel
Cc:	Dorene A. Wright
Subject:	Bailey, et al. Summary of Record on Appeal
Attachments:	Bailey, Renner, et al. #348 - Draft Summary of ROA - 04.16.19.pdf

Good Morning,

Please see the attached Draft Summary of the Record on Appeal, as promised pursuant to our April 9, 2019 conference call with Judge Fairman.

Please review this ROA for clerical errors or what you believe to be omissions. I will send your requests to the State Engineer for review. If we agree that some or all of those requests were unintentionally missing from the file and should have been part of the ROA, then we will correct the ROA accordingly. Please respond back to me no later than Tuesday, April 23rd. Due to the work load at my office, we are aiming file the ROA on the 26th, rather than April 30th.

Tori

Tori Nicole Sundheim, Esq., LL.M.
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Case No. CV-1902-348
(consolidated with CV-1902-349 and CV-1902-350)

Dept. No.

IN THE SEVENTH JUDICIAL DISTRICT COURT OF THE STATE OF NEVADA

IN AND FOR THE COUNTY OF EUREKA

TIMOTHY LEE & CONSTANCE MARIE BAILEY; FRED & CAROLYN BAILEY; IRA R. & MONTIRA RENNER; SADLER RANCH, LLC; and DANIEL S. VENTURACCI, Petitioners, vs. TIM WILSON, P.E., Nevada State Engineer, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, Respondent.	**SUMMARY OF RECORD ON APPEAL**

Tim Wilson, P.E., in his capacity as Acting Nevada State Engineer, Department of Conservation and Natural Resources, Division of Water Resources (hereafter "State Engineer"), by and through counsel, Nevada Attorney General Aaron D. Ford and Deputy Attorney General Tori N. Sundheim, hereby files this Summary of Record on Appeal. The attached documents constitute the record on appeal in this matter of contested State Engineer Order #1302, Bates-stamped pages SE ROA 1–_____.

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Index to Administrative Record re: State Engineer Order #1302			
DATE	**DESCRIPTION**	**Bates Range SE ROA**	
04/05/19	Certificate of Record	1	1
	Order #1302		
01/11/19	Order #1302	2	
	Bulletin No. 35		
1968	Water Resources Bulletin No. 35 – Hydrologic Response to Irrigation Plumbing in Diamond Valley, Eureka and Elko Counties, Nevada, 1950–65		
	Order #1264		
08/25/15	Order #1264		
	Permits		
07/14/17	Amended Permit No. 82268 (Sadler Ranch)		
08/14/17	Permit No. 81825 (Daniel Venturacci)		
08/14/17	Permit No. 82572 (Daniel Venturacci)		
03/06/19	Third Amended Permit No. 81720 (Sadler Ranch)		
	List of Exhibits Submitted at Public Hearing		
10/30/18	List of Exhibits		
10/30/18	State Engineer's Exhibit 1 – Petition for Approval of the Diamond Valley Groundwater Management Plan dated 08/16/18, received by the State Engineer on 08/20/18		
10/30/18	State Engineer's Exhibit 2 – Diamond Valley Groundwater Management Plan received by the State Engineer on 08/20/18		
10/30/18	State Engineer's Exhibit 3 – Notice of Hearing with Certified Mail Receipts dated 10/01/18		
10/30/18	State Engineer's Exhibit 4 – Public Notice with Proofs of Publication dated 09/27/18		
	Diamond Valley GMP Public Comments		
10/30/18	Diamond Valley GMP Public Comments List		

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DATE	DESCRIPTION	Bates Range SE ROA	
10/30/18	Comments from Carolyn Bailey		
10/30/18	Comments from Carolyn Bailey (Revised) dated 11/02/18		
10/30/18	Comments from Timothy Lee & Constance Marie Bailey		
10/30/18	Comments from Robert Burnham		
10/30/18	Comments from Russell Conely		
10/30/18	Comments from Ari Erickson		
10/30/18	Comments from Ty Erickson		
10/30/18	Comments from Jim Etcheverry dated 11/02/18		
10/30/18	Comments from James Gallagher		
10/30/18	Comments from Andrew Goettle		
10/30/18	Comments from Great Basin Resource Watch		
10/30/18	Comments from Advocates for Community and Environment (ACE) – A Public Interest Review of the Proposed Diamond Valley Groundwater Management Plan prepared for Great Basin Resource Watch		
10/30/18	Comments from Mark Moyle Farms dated 10/29/18		
10/30/18	Comments from William Norton dated 10/25/18		
10/30/18	Comments from Donald Plamore dated 10/28/18		
10/30/18	Comments from Marty Plaskett		
10/30/18	Comments from Ira & Montira Renner dated 11/02/18		
10/30/18	Comments from Ruby Hill Mining Company dated 10/29/18		
10/30/18	Comments from Sadler Ranch dated 11/02/18		
10/30/18	Comments from Daniel Venturacci		

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Index to Administrative Record re: State Engineer Order #1302			
DATE	**DESCRIPTION**	**Bates Range SE ROA**	
	Transcript		
10/30/18	Transcript of Proceedings – Public Hearing		

AFFIRMATION

The undersigned does hereby affirm that the preceding Summary of Record on Appeal does not contain the social security number of any person.

DATED this 30th day of April, 2019.

AARON D. FORD
Attorney General

By: _____

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State Engineer

CERTIFICATE OF SERVICE

I certify that I am an employee of the State of Nevada, Office of the Attorney General, and that on this 30th day of April, 2019, I served a true and correct copy of the foregoing SUMMARY OF RECORD ON APPEAL and DOCUMENTS SE 1–____, said document applies to Case Nos. CV-1902-348, -349 and -350, electronically to:

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EXHIBIT 2

EXHIBIT 2

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April 23, 2019

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Re: *Bailey v. Wilson* (Case No. CV-1902-348) Meet and Confer re: Summary of Record on Appeal

Dear Tori:

Thank you for forwarding your draft Summary of Record on Appeal ("ROA") in the *Bailey v. Wilson* case. I have had an opportunity to review it and believe that the proposed record is significantly lacking several documents and records relevant to this case. As the Ninth Circuit has noted, an administrative record "is not necessarily [limited to] those documents that the agency has compiled and submitted as the administrative record."[1] Rather, a "whole" administrative record "consists of all documents and materials directly or *indirectly* considered by agency decision-makers and includes evidence contrary to the agency's position."[2]

Appendix C of the Diamond Valley Groundwater Management Plan ("DVGMP") contains summaries of the various community meetings that resulted in the drafting of the plan. These summaries show that senior staff members of the Division of Water Resources were intimately involved in the development and drafting of the DVGMP. Inexplicably, there are no documents or records included in the proposed ROA (other than the summaries included in Appendix C) that document this involvement. In addition, several of the summaries include references to studies and other records that are also not included in the ROA.

To ensure that the district court has a complete record to review in this matter, my clients request additional documents, as indicated below, be included in the ROA. I should emphasize that the breadth of this request is necessitated by the fact that the State Engineer failed to hold a proper evidentiary hearing that could have resolved these evidentiary questions *before* the plan was approved. In addition, these requests are based on our initial review of the proposed Summary

[1] *Thompson v. U.S. Dep't of Labor*, 885 F.2d 551, 555 (9th Cir. 1989) (emphasis in original, internal quotations omitted).
[2] *Id.* (emphasis in original).

ROA and we reserve the right to submit additional requests as we continue our review of the record.

1) The ROA should include all non-privileged emails sent or received by Jason King, Rick Felling, Adam Sullivan, Kelvin Hickenbottom, or any other employee of the Nevada Division of Water Resources, for the period between April 23, 2015, and January 11, 2019, related to the development of a groundwater management plan for Diamond Valley, reviews of outlines or draft copies of the plan, the scheduling of meetings to develop such a plan, the scheduling and format of the November 1, 2018, public comment meeting held at the Eureka Opera House, and/or the designation of Diamond Valley as a Critical Management Area. For any such document for which a claim of privilege is asserted please provide a privilege log identifying the document and stating the grounds for the claim of privilege.

2) The ROA should include all non-privileged notes, summaries, reports, presentations, or any similar documents prepared by, or provided to, Jason King, Rick Felling, Adam Sullivan, or Kelvin Hickenbottom related to any meeting attended by said individuals during which the development of the DVGMP was discussed. For any such document for which a claim of privilege is asserted please provide a privilege log identifying the document and stating the grounds for the claim of privilege.

3) P. 71 of the DVGMP indicates that on March 19, 2009, the State Engineer held a workshop wherein he outlined the history and status of Diamond Valley and asked water users to come up with a plan. Accordingly, the ROA should include copies of any presentation materials, notes, attendance logs, public comments, transcripts, or any similar documents, including any studies or reports cited in such materials.

4) P. 77 of the DVGMP indicates that the recommendations being made are based on a "Blueprint for Western Water Management" that was presented by Professor Mike Young at a meeting held on June 11, 2015. The ROA should include a copy of said "Blueprint" and any presentation materials, notes, attendance logs, public comments, transcripts, or any similar documents, including any studies or reports cited in such materials, from the June 11, 2015, meeting.

5) P. 98 of the DVGMP indicates that the State Engineer made two formal presentations (the most recent one in February 2014) to water users in Diamond Valley at which he strongly urged them to develop a plan to solve the water issues. The ROA should include copies of any presentation materials, notes, attendance logs, public comments, transcripts, or any similar documents, including any studies or reports cited in such materials, from those two meetings.

6) P. 144 of the DVGMP indicates that legislation will be needed to implement the plan and makes reference to SB 81 from the 2015 Nevada legislative session. The ROA should include all legislative materials related to the 2015 Legislature's consideration of

SB 81 including, without limitation, transcripts of all hearings on the bill. In addition, a similar bill was introduced during the 2017 Legislature (SB 73). The ROA should include all legislative materials related to SB 73 including without limitation, transcripts of all hearings on the bill. Finally, the ROA should include all records of communications between Jason King, Rick Felling, Adam Sullivan, Kelvin Hickenbottom, or any other employee of the Division of Water Resources and any employee, contractor, lobbyist, member, or employee of Eureka County or the Diamond Natural Resources Protection & Conservation Association related directly or indirectly to SB 81 or SB 73.

7) P. 147 of the DVGMP is an email, copied to Rick Felling, Jason King, and Kelvin Hickenbottom. The email indicates that it includes an attachment of the "GMP outline/working model with specific items for discussion and possible action highlighted." The referenced attachment should be included in the ROA as a separate document.

8) On p. 149 of the DVGMP reference is made to a USGS report that quantifies the amount of discharge in Diamond Valley. The ROA should include a copy of the referenced report and any and all communications by and between employees of the Division of Water Resources and either the United States Geological Survey ("USGS") or Eureka County regarding said report. In addition, the ROA should include any notes, summaries, presentations, mark-ups or comments by employees of the Division of Water Resources regarding said report and any scientific study cited within the USGS report.

9) On pp. 136-37 of the DVGMP the proposed water banking portion of the DVGMP is summarized. The DVGMP notes that "Rick Felling noted a possible depreciation to account for 'loss' by continued ET of phreatophytes of water banked." On p. 149 of the DVGMP, it states that "Rick Felling noted a possible depreciation to account for 'loss' by continued ET of phreatophytes of water banked." On p. 250 of the DVGMP it states that "[t]he rumor is that Rick Felling is saying that banked water will result in increased loss to phreatophyte and the quantity of water should be reduced if carried forward (like a negative interest rate)". On the same page it also states that "[b]anking depreciation was determined *based on guidance from the State Engineer's office* and numerical flow modeling using the best available information." This is clear evidence that senior staff of the Division of Water Resources were intimately involved in formulating the depreciation factor incorporated into the final DVGMP that is one of the points of contention in this litigation. Accordingly, the ROA should include any notes, emails, communications, research, presentations, calculations, groundwater models, groundwater model simulations, reviews of groundwater models and simulations, or any similar materials prepared by, submitted to, or reviewed by employees of the Division of Water Resources related to applying a depreciation factor to banked water. For any such document for which a claim of privilege is asserted please provide a privilege log identifying the document and stating the grounds for the claim of privilege.

10) P. 201 of the DVGMP is an email stating that Jake Tibbitts from Eureka County sent Jason King, Rick Felling, and Kelvin Hickenbottom a draft of the DVGMP for review.

Likewise, p. 222 contains an email sent to Jason King and Rick Felling indicating that a copy of a draft DVGMP is attached for their review. An email on p. 223 of the DVGMP states that "[t]he State Engineer's office completed their review of the Draft GMP" and that an "edited workup is attached." Additional emails included in the DVGMP further indicate that other drafts of the DVGMP were created and reviewed by employees of the Division of Water Resources prior to the submittal of the final DVGMP. The ROA should include all prior drafts of the DVGMP submitted to the Division of Water Resources for review as well as all comments, redlines, mark-ups, notes, or similar documents produced by employees of the Division of Water Resources related to their review of the various drafts.

11) On p. 251, the DVGMP includes a statement that "there are many reports, studies, testimony, etc. that discusses these things" (i.e., the impacts of groundwater drawdown "as it is now, *or reduced as proposed in the groundwater management plan*"). The proposed ROA appears to contain only a single study performed by Harrill in 1968. Because Petitioners have raised the issue of whether there is evidence that the DVGMP will stop the groundwater mining that is occurring in Diamond Valley, such studies are highly relevant to this litigation. Accordingly, the ROA should include each and every hydrologic study, report, groundwater model, and groundwater model simulation prepared by, submitted to, reviewed by, or commented on by employees of the Division of Water Resources related to the Diamond Valley groundwater basin including, without limitation, any reports that discuss the responsiveness of the aquifer to withdrawals from groundwater wells.

12) P. 254 of the DVGMP indicates that "based on monitoring data in DV, small reductions in pumping have created substantial reductions in drawdown." On the same page it also states that "[b]ased on past monitoring in DV, the pumping reductions in the GMP will result in [groundwater stabilization]." Again, this is an issue of direct consequence in the instant litigation. Accordingly, the ROA should include any and all monitoring reports, monitoring data, analysis of such reports and data, notes, communications, or similar documents regarding groundwater levels in Diamond Valley that were submitted to, prepared by, reviewed by, or commented on by employees of the Division of Water Resources.

13) The record should also include all past orders of the State Engineer regarding the management of the Diamond Valley aquifer, as well as transcripts of previous meetings and hearings held by the State Engineer to discuss such orders including, without limitation, the transcript of the public hearing held by State Engineer Morros in 1982 to discuss a request for curtailment submitted by Milton Thompson.

14) In the 1970s the State Engineer cancelled a large number of water rights permits in Diamond Valley because the owners of the permits had failed to apply the water to beneficial use. However, the State Engineer allowed such individuals to apply for replacement permits with the understanding that these permits would be the first to be

restricted in the event that pumping was regulated. Because the DVGMP imposes a basin-wide regulation of pumping, the record in this case should include copies of the cancellation notices for these water rights, applications for new water rights to replace the cancelled ones, any public documents related to the State Engineer's consideration of those new applications, and the approved permits and certificates associated with those applications.

Finally, the Summary of the ROA include copies of mitigation water rights issued to Sadler Ranch and Daniel Venturacci. My clients do not necessarily object to this, but do wonder why their permits are the only ones included. Either copies of all the water rights permits issued by the Division of Water Resources in Diamond Valley should be included in the ROA, or none should (except those identified in request # 14 above). Our clients' mitigation rights permits should not be singled out.

My clients eagerly await your response. Should you have any questions or concerns, please feel free to contact me by phone or email. I am also happy to meet with you and your client in person to discuss these issues further.

Sincerely,

David H. Rigdon, Esq.
TAGGART & TAGGART, LTD.

EXHIBIT 3

EXHIBIT 3

Luke Andrew Busby, Ltd.
Nevada State Bar No. 10319
216 East Liberty St.
Reno, NV 89501
775-453-0112
luke@lukeandrewbusbyltd.com
Attorney for the the Plaintiff

IN THE FIRST JUDICIAL DISTRICT COURT OF THE STATE OF NEVADA IN AND FOR CARSON CITY

SADLER RANCH, LLC, a Nevada Limited Liability Company,

Petitioner,

vs.

JASON KING, P.E. Nevada State Engineer, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES,

Defendant(s).

Case No. 17OC00018 1B

Dept. No. I

PETITION FOR WRIT OF MANDATE

COMES NOW, Petitioner, SADLER RANCH, LLC, a Nevada Limited Liability Company (the "Petitioner" or "Sadler") by and through the undersigned counsel, and submits herein the following Petition for Writ of Mandate against Respondent JASON KING, P.E. Nevada State Engineer, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES ("Respondent" or "State Engineer"), seeking an order from the Court compelling compliance with the public

records disclosure requirements of Nevada's Public Records Act ("NPRA") codified in Nevada Revised Statutes ("NRS") Chapter 239.001 *et seq.*

PARTIES

1. Sadler owns and operates the Sadler Ranch, located in Diamond Valley, Eureka County, Nevada. Sadler Ranch has one of the oldest water rights in Diamond Valley. Due to the issuance of groundwater permits by the State Engineer, for many years and far in excess of the perennial yield of water available in Diamond Valley, Sadler has suffered a severe decline in the amount of water at its ranch due to overpumping of groundwater and the State Engineer's mismanagement and/or lack of management of Diamond Valley.

2. The State Engineer is a "government entity" as the term is defined by NRS 239.005(5), and is subject to the requirements of the NRPA.

VENUE AND JURISDICTION

3. Jurisdiction and Venue in the matter is vested in this District Court per NRS 239.011(1), as to the best of the Petitioner's knowledge and belief the State Engineer's offices and records are in Carson City, Nevada.

ALLEGATIONS OF FACT

4. On June 9, 2016, Sadler made a public records request pursuant to the NPRA to the State Engineer. The request is attached hereto as Exhibit 1.

5. On June 14, 2016, the State Engineer responded with a letter, attached hereto as Exhibit 2, essentially objecting to Sadler's request and stating that Sadler's request was vague, overly-broad, and unduly burdensome.

6. On July 29, 2016, Sadler made a second public records request pursuant to the NPRA, attached hereto as Exhibit 3, narrowing the scope of the records sought in response to and accommodating the State Engineer's objections to Sadler's first request.

7. Around this same time period described above, Sadler also made public records requests to Eureka County seeking similar information.

8. On or around September 27, 2016, the State Engineer responded to Sadler's public records request by providing a DVD, which included emails responsive to Sadler's requests. Along with the contents of the DVD, the State Engineer disclosed to Sadler the documents attached hereto as Exhibit 4, which appears to be correspondence between the State Engineer and the State of Nevada Department of Administration, Enterprise I.T. Services Division, who presumably stores emails on behalf of the State Engineer.

9. On January 27, 2017, Eureka County provided a response to Sadler's public records request to Eureka County.

10. In comparing the responses to Sadler's records requests from Eureka County and the State Engineer, it is clear that the State Engineer did not disclose emails sought in Sadler's public records requests, as there are emails from the State Engineer's staff included in Eureka County's response that were not included in the State Engineer's response. Attached hereto as Exhibit 5 is a list of emails compiled by Sadler, from Jason King, the State Engineer, and Rick Felling, an employee of the State Engineer, that were disclosed by Eureka County but not by the State Engineer in its response to Sadler's NPRA request. Because the overlap between the records requested from Eureka County and the State Engineer is not total,

Sadler believes that there may be many more undisclosed emails that should have properly been disclosed in the State Engineer's response.

11. Further, in so far as the State Engineer's response to Sadler's records requests included email "chains", for most of these email chains, only the first email within that chain was provided while the rest of the correspondence in the email chain was missing. In other words, in cases where a staff member at the State Engineer sent or received an email to/from a person in Diamond Valley and other State Engineer staff had been "cc'ed" in that message, rarely were emails from that "cc" list provided by the State Engineer in response to Sadler's records request. For example, attached hereto as Exhibit 6 is an email chain entitled "Application 85651." This Chain started with a message from Jake Tibbitts, Natural Resource Manager from Eureka County, to DWR employees. The initial email that began this chain was not disclosed in the State Engineer's response. Further, the State Engineer's response did not include emails that were provided in Eureka County's response where the State Engineer or his staff were "cc'd" on emails from Eureka County.

12. Sadler has retained an expert in the field of data recovery, Mr. Ira Victor, whose CV and fee schedule are attached hereto as Exhibit 7, and is informed and believes that an inspection of the devices on which the State Engineer's emails are stored may yield further information responsive to Sadler's requests.

13. Subsequent to Sadler receiving the public records request response from the State Engineer, Sadler has attempted to resolve this dispute with the State Engineer informally, by requesting that the State Engineer do further searches for records and that Sadler's expert be

permitted to inspect the devices on which the State Engineer's emails are stored, to no avail.

CAUSE OF ACTION

Violation of the NPRA

14. Petitioners re-allege and incorporate by reference the facts alleged in this Petition, as if fully set forth below.

15. The Petitioner is informed and believes that the substantive response of the State Engineer to the Petitioners NPRA request is inadequate and/or incomplete for the reasons stated above.

16. The Petitioner is informed and believes that the State Engineer has violated the NPRA by not producing all public records responsive to Petitioners' NPRA request.

17. Based on information and belief, the State Engineer has withheld or failed to disclose public records in violation of the NPRA and has failed to provide Petitioners with a any lawful basis for withholding public records.

18. Per NRS 239.011, the NPRA authorizes members of the public to bring an action to compel the production of public records where a governmental entity has refused to comply with NPRA requirements.

REQUEST FOR RELIEF

WHEREFORE, Petitioners request judgment in their favor as follows:

19. That the Court declare that the State Engineer violated the NPRA by failing to produce all public records responsive to the Petitioner's request;

20. That the Court order the State Engineer to disclose to Sadler where, by whom, and in

which devices its email records are stored.

21. That the Court issue a Writ of Mandate directing the State Engineer to produce all public records requested;

22. That the Court issue a Writ of Mandate directing the State Engineer, or any organization that stores information on behalf of the State Engineer including the State of Nevada Department of Administration, Enterprise I.T. Services Division, to permit inspection and search by Sadler Ranch's expert of the devices on which the State Engineer's emails are stored;

23. For Petitioners costs and reasonable attorney's fees incurred as a result of this per NRS 239.011(2); and,

24. For such other and further relief as the Court may deem just and proper.

NRS 239B.030(4) AFFIRMATION

Pursuant to NRS 239B.030, the undersigned hereby affirms that this document does not contain the social security number of any person.

Respectfully submitted this February 14, 2017

By: _____

Luke Busby, Esq.
Nevada State Bar No. 10319
216 East Liberty St.
Reno, NV 89501
775-453-0112
luke@lukeandrewbusbyltd.com
Attorney for the Petitioner

Exhibit List

1. Sadler June 6, 2016 NPRA Request
2. June 14, 2016 Response to NPRA Request
3. July 29, 2016 Modified NPRA Request
4. Documents provided in response to NPRA Request
5. Index of emails not disclosed by DWR
6. "Application 85651" email chain
7. Irs Victor CV and fee Schedule

Exhibit 1

Exhibit 1

Sadler Ranch, LLC
HC62 Box 62175
2401 Sadler Brown Road
Eureka, NV 89316

June 9, 2016

Division of Water Resources
State of Nevada
901 S. Stewart St., Suite 2002
Carson City, NV 89701

Re: NRS 239 Public Records Request

Dear DWR:

Pursuant to NRS 239.010, I hereby request copies of all written communications (including, without limitation, emails, letters, memos, or other correspondence) by and between any employee or contractor of the Division of Water Resources, and any member of the Board of County Commissioners of Eureka County, any employee or contractor of Eureka County, and or any agent representing or acting on behalf of Eureka County, for the time period beginning on January 1, 2013 and ending on June 9, 2016. Additionally, I request copies of any telephone logs, calendars, journals, notes, diaries, message slips or other documents which record or memorialize any meetings and/or any telephonic or other verbal communications between the above described parties during the same period of time.

I would prefer that any documents related to this request be provide in an electronic PDF format on a compact disc or USB thumb drive unless it is impractical or impossible to do so.

Please let me know as soon as possible when such documents will be available for pickup and if there is any charge associated with this request. I can be reached at 415-609-8077 or dofr@comcast.net.

Sincerely,

Doug Frazer

Exhibit 2

Exhibit 2

BRIAN SANDOVAL
Governor

STATE OF NEVADA

LEO DROZDOFF
Director

JASON KING, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
901 South Stewart Street, Suite 2002
Carson City, Nevada 89701-5250
(775) 684-2800 • Fax (775) 684-2811
http://water.nv.gov

June 14, 2016

Doug Frazer
Sadler Ranch, LLC
HC 62, Box 62175
Eureka, Nevada 89316
Via E-mail and Regular Mail

Re: § NRS 239 Public Records Request

Dear Mr. Frazer:

I am in receipt of your request filed on June 13, 2016, for "copies of all written communications (including, without limitation, emails, letters, memos, or other correspondence) by and between any employee or contractor of the Division of Water Resources, and any member of the Board of County Commissioners of Eureka County, any employee or contractor of Eureka County, and or any agent representing or acting on behalf of Eureka County, for the time period beginning on January 1, 2013 and ending on June 9, 2016." Additionally, you requested copies of any telephone logs, calendars, journals, notes, diaries, message slips or other documents which record or memorialize any meetings and/or any telephonic or other verbal communications between the above described parties during the same time period.

This letter shall confirm that I spoke with you by telephone on June 13, 2016, in response to this request. I informed you that the records of the Nevada Division of Water Resources' (Division) are public and that I would be glad to assist you in finding what you are looking for in the Division's public records. The public records of the Division are subject to the Nevada Public Records Act (NPRA), and those records are open to public and inspection, subject to the Act. However, I indicated that because your request asks for every record identified above, without limitation, for any employee of the Division over the last 3 ½ years, that I believe your request to be vague, overly-broad and unduly burdensome, without a specific matter identified to which the public record(s) may relate.

In my discussion with you, I requested clarification as to what you are really looking for in order to determine if there is any record of the Division that can be produced subject to the record request. You indicated that your belief was that it appeared there had been improper *ex parte* communications with Eureka County prior to the status conference on remand held on May 10, 2016, concerning the Sadler Ranch mitigation water rights in Diamond Valley. I indicated to you that this office does not have *ex parte* communications with a party to any protested application on matters of substance. We strictly adhere to that policy. If a party has a question of process and non-substantive procedure, we will provide information, but we do not discuss matters of substance *ex parte*. Therefore, I do not believe any such document exists that you seem to be seeking. Nevertheless, your request is addressed below.

In order to demonstrate the over-breadth of your request, I will provide the following non-exhaustive list of examples. Eureka County was a principle party in the hearing on Kobeh Valley Ranch, LLC's water right applications in Kobeh and Diamond Valleys and two hearings were held regarding those water right applications and all that documentation would have to be reviewed in order to research your request. Eureka County has its own water right applications/permits and every file would have to be researched to see if there is anything that meets your request. Eureka County files protests to water right applications filed by others and all those files would have to be researched. Eureka County has participated in the 3M Plan (monitoring, management and mitigation) for the Kobeh Valley Ranch/General Moly Mine and all those files would have to be researched in order to determine if anything meets your request. Eureka County may have participated in legislative workshops in 2015 and those records would have to be researched. The point being that the Division interacts with Eureka County on many topics not related to Sadler Ranch's water rights in Diamond Valley. I hope by these examples you can appreciate the over-breadth of your request and the extraordinary amount of time and resources required of the Division, and the cost to you, which would be required and not produce any records responsive to the interest of your search.

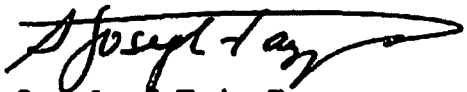
Nevada Revised Statute § 239.0107 requires that the agency respond within five (5) business days to a public records request and that, if the agency is unable to comply within that timeframe, the agency provide the requester with notice of that fact and a date and time after which the record will be made available for the person to inspect or obtain a copy.

Please be advised that the Division cannot accommodate your request within five (5) business days due to the fact the request is so vague and overly-broad. I believe your request will require extraordinary use of personnel and resources of this agency to research and produce the wide-range of information requested, which allows this agency to not only charge copy costs, but also the cost of the manpower to retrieve and reproduce the records. A deposit on the estimated charges must be placed before the work of preparing a response will begin, and in my opinion, it would take weeks of research to review the records of this agency before the Division could even estimate the copy and personnel costs. Be advised that the estimated staff time to accomplish your request will be charged at $30-50/hour, depending on the staff member assigned to the request.

We would ask that you please refine your request and specifically identify a topic or matter to which the records relate before the Division commits to the enormous undertaking of responding to your public records request. You stated that you would confer with your counsel, Paul Taggart, Esq., regarding the request and get back to me.

Thank you for your attention in this matter and I await your response before proceeding any further with your request.

Respectfully,



Susan Joseph-Taylor, Esq.
Deputy Administrator

SJT/js

Exhibit 3

Exhibit 3

STATE OF NEVADA

Public Records Request

Email to:
jkittrell@denr.nv.gov

Attention: Public Records Officer, Joanne Kittrell

Date of Request	July 29, 2016
Requestor Contact Information	
Name:	Doug Frazer
Organization:	Sadler Ranch
Address:	PO Box 831
City, State, Zip:	Forest Knolls, CA 94933
Phone:	415-609-8077
E-mail:	dofr@comcast.net

Records Requested:

Check one: ☐ Paper copies ☒ Electronic copies ☐ Certified copies ☐ Inspection (in person)

Please be specific and include as much detail as possible regarding the records you are requesting.

Electronic copies of email communication (including attachments) that has occurred between staff within the Nevada Department of Conservation and Natural Resources and one or more of the email addresses attached to this request, since January 1, 2013. If possible, this would also include email communication that have been deleted by staff within the last 60 days, but are still present on a server. This request includes communication either to or from the address in the attached list.

I prefer to obtain the records in an electronic format. Once the size of the files are known, please inform me and I can provide the appropriate storage device to be used for the records transfer.

Please call or email me if there are any questions about the scope of the request.

To complete an estimate, the agency will need the following information:

☐ I will pick up	☐ Please FedEx *Fed Ex billing number:*	☐ Please send USPS	☒ E-mail (if format allows)

Statement

☒ I understand there is a charge for copies of public records. I understand I will receive a written estimate for production of the records indicated above if the estimated cost is expected to be over $25.00, which I will be required to pay in full prior to inspection or reproduction. Materials will be held for 30 days.

Requester Signature [signature] 7/29/16
Signature

Office Use Only

Request status:		Estimate:	
Date			
_____	Request received	Estimate:	$ _____
_____	Receipt acknowledgement issued	Date deposit received	_____
_____	Request filled	Actual (if different):	$ _____
_____	Estimated completion	Date final payment received	_____
_____	Estimate provided	Completed by	_____
_____	Request denied in whole		
_____	Other:	*Retain request form for 90 days following completing of request. RDA 2009047*	

natresmgr@eurekanv.org
jjgoicoechea@eurekanv.org
natres@eurekanv.org
jberg@eurekanv.org
dnrpca@gmail.com
lionsunlimited@gmail.com
nortoncritters@yahoo.com
burnhamhayfarm@msn.com
lazygbaraqhas@gmail.com
haystax@icloud.com
dmarkmick@firstcommercellc.com
eurekah2o.bugenig@gmail.com
leorabetschart@gmail.com
deniselmoyle@gmail.com
dustymoyle1@gmail.com
fred.etchegaray@yahoo.com
gmccuin549@gmail.com
kpeterson@allisonmackenzie.com
halpin40@hotmail.com
dirtandpots@gmail.com
jerrytrina@sbcglobal.net
csestanovich@gmail.com
simpsoncreekranch@gmail.com
JGEU45@gmail.com
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martin@eresheepcompany.com
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nicketcheverry@yahoo.com
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Pete.Goicoechea@sen.state.nv.us
rbecknet@gmail.com
lewisst@unce.unr.edu
stevewalker@gbis.com
tshalpin@gmail.com
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conleyag@gmail.com,
huntnboy@gmail.com,
lamarmoyle@gmail.com,
jsestanovich@gmail.com,
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Ari@gullsil.com
ropin4fun2@yahoo.com,
Jaime.Jasmine@nv.usda.gov
kkinsella@generalmoly.com,
grothhay@gmail.com,
cdubray@frontier.com,
bryan562185@gmail.com,
sandygreen01@gmail.com
corbinknowles@cableone.net,
jeffbulkley@gmail.com,
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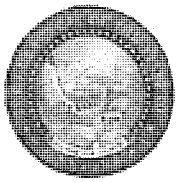
dvfarmgirl@aol.com,
ropp91@gmail.com,
randye@mwpower.org,
debbie.lassiter@elkomininggroup.com
minonancy@hotmail.com

Exhibit 4

Exhibit 4

Brian Sandoval
Governor



Patrick Cates
Director

Shannon Rahming
Chief Information Officer

STATE OF NEVADA
DEPARTMENT OF ADMINISTRATION
Enterprise I.T. Services Division

100 N. Stewart Street, Suite 100 | Carson City, NV 89701
Phone: (775) 684-5800

September 15, 2016

To: Ms. Kay Scherer
Deputy DCNR
Nevada Department of Public Safety
Investigation Division

Through: Shannon Rahming
Chief Information Officer
Department of Administration, Enterprise IT Services

From: Sean Montierth
IT Manager II
Department of Administration, Server support group

Subject: Email Search Request

Ms. Scherer,

The Department of Administration, EITS Server group has completed email searches related to the request dated August 9, 2016. A summary of the search conducted and the results found is attached.

The EITS server group extends its gratitude for the opportunity to serve DCNR and the citizens of the State.

As your primary contact for the EITS Server support Group, I would like you to know that I am always available to discuss any portion of this email search request. You may contact me directly at (775) 684-4313.

Best regards.

Executive Summary

At the request of the DCNR,the EITS Server Group conducted an independent email search using criteria specified in the request dated August 9, 2016. The EITS Server Group:

1. Searched the State email system via the Barracuda Message Archiver using the following criteria:
    a) Requests all emails between anyone with the Nevada Division of Water Resources Domain (water.nv.gov) and the list of email addresses in the attached spreadsheet. January 1, 2013 through July 209, 2016

Using search criteria identified for the email search request, the results were:

1. 158 emails that matched search criteria and are contained in two archive folders "Results From" and "Results To".

At all phases, the EITS Server group has been mindful of the sensitivity and privacy of email contained in this request and has used every measure available to us to ensure that the contents of the search remain protected.

Included in the enclosed package are:

1. One CD/DVD containing two archives of the results as mentioned above. All documents given to EITS representing the search request.
2. An electronic copy of this memorandum

BRIAN SANDOVAL
Governor

LEO M. DROZDOFF, P.E.
Director

KAY SCHERER
Deputy Director

JAMES R. LAWRENCE
Deputy Director

State of Nevada
Department of Conservation and Natural Resources
Office of the Director
901 S. Stewart Street, Suite 1003
Carson City, Nevada 89701-5244
Telephone (775) 684-2700
Facsimile (775) 684-2715
www.dcnr.nv.gov

Division of Environmental Protection
Division of Water Resources
Division of Forestry
Division of State Parks
Division of State Lands
State Historic Preservation Office
Nevada Natural Heritage
Conservation Districts Program
Sagebrush Ecosystem Program

STATE OF NEVADA
Department of Conservation and Natural Resources

Date: August 1, 2016

To: Shannon Rahming
Chief Information Officer
Department of Administration
Enterprise IT Services

From: Kay Scherer
Deputy Director

Re: Public Records Request – Division of Water Resources' Emails

The Department of Conservation and Natural Resources includes as one of its agencies/programs the Division of Water Resources (also known as the Office of the State Engineer.)

The Division is in receipt of the attached public records request. You will see that it requests all emails between anyone with the Nevada Division of Water Resources and the list of email addresses in the attached spreadsheet.

The email addresses for the employees of the Nevada Division of Water Resources are found in the Outlook Address Book under Water Resources Groups – Everyone.

With this email I formally request EITS to provide the information needed to answer this request and I thank you in advance for your and EITS staff's assistance. We stand ready to answer any questions you may have.

Exhibit 5

Exhibit 5

Subject	Body	FromName	FromAddress	ToName	ToAddress	CCName	CCAddress	Categories
	Good Morning Jason, The proposed language is not a John, Sent from my tablet Jason Walker www.nevadaengineer.com							
Re: SB 133	Good morning Jason - attached	Jason King	jkingdwr@water.nv.gov			[illegible]	[illegible]	1 Longfact in DWR submission
	Ok, sounds good. See you then. From: John Tabbitt [mailto:jtabbitt@water Sent: Tuesday, July 22, 2014 8:54 To: Jason King; Steve Walker Subject: RE: Meeting Within the Cour							
RE: Meet to discuss Diamond Valley GMP scoping	It looks like we're good to go on	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
	I will be out of the office beginning							
[SULT] Out of Office: Roberts Meeting		Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
	Thanks John. From: John Tabbitt [mailto:jtabbitt@water Sent: Tuesday, September 16, 20 To: Jason King Subject: RE: DMA							
	Jason, The lawsuit was delayed going out	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
RE: DMA	Thanks John! From: John Tabbitt [mailto:jtabbitt@water Sent: Friday, January 31, 2014 4:12 To: Mason Wilmarth Cc: Jason King; Bob Fleming Subject: Eureka water management Mason,							
RE: Eureka water management plan and Page	The Diamond Complement, upstream	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
	Good Morning John, Sorry I haven't gotten back to yo	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
RE: Groundwater Management Plan	Thanks John. I don't have to be Jason							
RE: SB 133	From: John Tabbitt [mailto:jtabbitt@water Hi John, I hope you're having a good wee	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
	FYI Thanks John. I'm somewhat surp	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
Thanks for a Meeting	Who's Steve Lewis? Steve Walke Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 6							
RE: GMP Facilitated Session - April 23	Hi John, Any updates on the letter sent to	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
	Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 684-2 E: jkingdwr@water.nv.gov | W: water	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
DMA	FYI - Susanna Kelley Ruling: Water Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 684-2 E: jkingdwr@water.nv.gov | W: water							
FYI: Ruling signed and mailed	Thanks John. I had forwarded on to Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 684-2 E: jkingdwr@water.nv.gov | W: water	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
RE: GMP	From: John Tabbitt [mailto:jtabbitt@water I don't notice it. ---Original Message--- From: Steve Walker [mailto:swalker@ne Sent: Tuesday, February 11, 201 To: Jason King; John Tabbitt; Tim Cc: [illegible] Subject: Re: [illegible]	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
RE: Meg on SB 133	Good Morning John, Any news on a GMP stakeholder Jason Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 684-2 E: jkingdwr@water.nv.gov | W: water	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
Groundwater Management Plan	Thanks John. I've forwarded it on From: John Tabbitt [mailto:jtabbitt@water Sent: Tuesday, August 26, 2014 1 To: Jason King Cc: [illegible] Subject: Appleyard [illegible]	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
RE: Appleyard [illegible]	Hi Jason, Bobby Mike, Bob Fleming and I will attend how Jason Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 684-2	Jason King	jkingdwr@water.nv.gov			[illegible]	[illegible]	1 Longfact in DWR submission
RE: Invitation to and Proposed Dates for NDWRA	E: jkingdwr@water.nv.gov | W: water Are proposed. Either day (morning)	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
	From: John Tabbitt [mailto:jtabbitt@water Sent: Monday, January 27, 2014 4 To: Jason King Subject: Meet to GPI's							
RE: Meet to talk about SB 133 amendments tomorrow	Thought you might find it interesting Jason King, P.E. | State Engineer Nevada Division of Water Resour P: (775) 684-2941 | F: (775) 684-2	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
Large Courtesy Reach Arrows	E Good Morning John,	Jason King	jkingdwr@water.nv.gov	[illegible]	[illegible]			1 Longfact in DWR submission
RE: Will you be in town or else on Thursday 25th	I imagine you'll be driving in from	Jason King	jkingdwr@water.nv.gov			[illegible]	[illegible]	1 Longfact in DWR submission

	Yes, I know we are going. This would							
	From: Jake Tibbitts [mailto:mailto							
	Sent: Friday, December 05, 2014							
	To: Jason King							
	Subject: RE: Diamond Valley Chi							
	Jason							
RE: Diamond Valley CMA survey	Are you going to the CMAWA mee	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	I will do my best but am on a possib							
	Jason King, P.E. | State Engineer							
RE: SR 81	Nevada Division of Water Resou	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Hi Jake,							
	I just got back from vacation and							
RE: Subject: Meeting	Jason	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	FYI - Pleasant Valley Parking - Hum							
	Jason King, P.E. | State Engineer							
	Nevada Division of Water Resou							
	P: (775) 684-2800 | F: (775) 684-							
	E: jkingfhwa@dot.gov | W: water							
FW: Parking original and revised	Hi Jake,	Jason King	jkingfhwa@dot.gov	jgoodwin@washoecounty.us	jgoodwin@washoecounty.us			Langfitt in DWR submission
	I don't remember if I responded							
RE: Diamond Valley CMA survey	Not much new here, as I said it too	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Thanks Jake. I've forwarded it on							
	From: Jake Tibbitts [mailto:mailto							
	Sent: Tuesday, August 26, 2014							
	To: Jason King							
	Cc: Sommerfeld, Chris							
	Subject: Assessment CMA							
RE: Assessment CMA	Hi Jason, Bishop	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Hi Jake,							
	I'd'd Thursday are the second half and							
	Jason							
RE: Meet to discuss Diamond Valley CMA meeting	From: Jake Tibbitts [mailto:	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Sounds good.							
	From: Jake Tibbitts [mailto:mailto							
	Sent: Friday, December 05, 2014							
	To: Jason King							
	Subject: RE: Diamond Valley CMA							
	Sorry, agenda for the meeting							
RE: Diamond Valley CMA survey	Yes	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Hi Rene,							
	Yes, we are interested. Jake is the one							
	Jason							
	Jason King, P.E. | State Engineer							
	Nevada Division of Water Resou							
RE: Notice of Meeting on Drought Management Plan	P: (775) 684-2800 | F: (775)	Jason King	jkingfhwa@dot.gov			nathanking@dot.state.nv.us	nathanking@dot.state.nv.us	Langfitt in DWR submission
	Thanks Jake.							
	From: Jake Tibbitts [mailto:mailto							
	Sent: Monday, September 08, 20							
	To: Tom Harvey; Jason King							
	Subject: Letter regarding BLM pr							
	Jason and Tom,							
RE: Letter regarding BLM proposal of Bailey Meadow	Attached is a letter to	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Mike,							
	Sorry, Parking and I will discuss							
	Jason							
	Jason King, P.E. | State Engineer							
	Nevada Division of Water Resou							
	P: (775) 684-2800 | F: (775) 684-							
RE: Invitation to and Proposed Dates for HMMP	E: jkingfhwa@dot.gov | W: water	Jason King	jkingfhwa@dot.gov			jgoodwin@washoecounty.us	jgoodwin@washoecounty.us	Langfitt in DWR submission
	Hi Jake,							
	I hope you're having a great week							
Thursday's Meeting	FYI -	Jason King	jkingfhwa@dot.gov			jgoodwin@washoecounty.us	jgoodwin@washoecounty.us	Langfitt in DWR submission
	Sorry Jake, we'll take care of that							
	Jason King, P.E. | State Engineer							
	Nevada Division of Water Resou							
	P: (775) 684-2800 | F: (775) 684-							
	E: jkingfhwa@dot.gov | W: water							
	From: Jake Tibbitts [mailto:mailto							
RE: Phone hookup on the meter for Bowman Yr	Sure, Tom	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	FYI - have a great weekend!		jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
FW: Dam and Tailing Administration - Bowman meeting		Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Morning Jake,							
RE: Bowman with grazing permit exp	You would be happy to attend |	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Hi Joe wrote, Thanks							
	----Original Message----							
	From: Jake Tibbitts [mailto:mailto							
	Sent: Wednesday, April 16, 2014							
	To: Jason King							
	Subject: RE: Workshop with grazi							
RE: Workshop with grazing permit exp	Hi Jason, I'm in a meeting here with	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission
	Hi Mike,							
RE: Creek present stress in Dyer	Good to hear from you. I will be	Jason King	jkingfhwa@dot.gov	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Langfitt in DWR submission, Carrolton and Hayes
	I am scared to be at Hayes | Tree of							
	Do you have his phone number?							
RE: Mt. Hay Jr. Project TAC meeting	From: Jake Tibbitts [mailto:mailto	Eric Fielding	fielding@dot.state.nv.us	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Eric, Not in DWR submission
	Hi Jake,							
	We had a few new faces at yester							
	Thanks,							
	Eric							
	From: Jake Tibbitts [mailto:mailto							
	Sent: Saturday, July 12, 2014 1:11							
[SELL2] RE: Groundwater Management Plan (GMP)	Yes I am Country!	Eric Fielding	fielding@dot.state.nv.us	nathanking@dot.state.nv.us	nathanking@dot.state.nv.us			Eric, Not in DWR submission

Re: Letter to groundwater rights holders and non	Hi John, Michael Young [redacted] me th Rich Rich Poling Deputy Administrator Nevada Division of Water Resou 901 S. Stewart St., Suite 5001 Carson City, NV, 89701 (775)684-2 Rich does work for me. Rich Poling Deputy Administrator Nevada Division of Water Resou 901 S. Stewart St., Suite 5001 Carson City, NV, 89701 (775)684-2 On Nov 15, 2013, at 3:59 PM, Jo	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
Re: December 12 Ruby Diamond Valley Groundwa		Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
Fw: Dialing in January - Ruby Diamond Valley Gro	I meet Andie [illegible] on the 12th of Jan Rich From: John Tibbitts [jmt@water.com] Sent: Friday, December 06, 2013 To: rdoling@water.nv.gov; Tyler I can make the meeting on wed. Rich Angela Martin [amartin@gmail.com]	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
Re: Mr. Hope TAC - Power Supply and Pug Mounts	Right Order D Hi John, We are putting the order that for yo Rich From: John Tibbitts [jmt@water.com] Sent: Wednesday, February 12, 2 To: Rich Poling Subject: Waiting for OV Rich, Im working on Pat,	Rich Poling	rdoling@water.nv.gov			rainsong@earthlink.net	rainsong@earthlink.net	Rich Also in DWR submission
RE: Waiting for OV		Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
RE: Comment Step & Cover Chosen	I received your comments above John, I would like to scoop a WAC mee 1. Can we hold the meeting a	Rich Poling	rdoling@water.nv.gov			rainsong@earthlink.net	rainsong@earthlink.net	Rich Also in DWR submission
WAC meeting	2. If not at the noon, then WAC Representatives	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
RE: Hope WAC Meeting	I got a response to my request to WAC Representatives,	Rich Poling	rdoling@water.nv.gov			rainsong@earthlink.net	rainsong@earthlink.net	Rich Also in DWR submission
RE: Hope WAC Meeting	I got a response to my request to WAC Members	Rich Poling	rdoling@water.nv.gov	gravesbarnes@yahoo.com	gravesbarnes@yahoo.com			Rich Also in DWR submission
RE: Hope Project WAC meeting	We are due for a WAC meeting. Hi John, If he attending the meeting she	Rich Poling	rdoling@water.nv.gov	jgravesbar@earthlink.net	jgravesbar@earthlink.net			Rich Also in DWR submission
RE: Ruby Diamond Valley Groundwater Managem	From: John Tibbitts [jmt@water.com] Sent: Friday, September 13, 2013 To: Tyler Co John, Attached is Mike Young's check fo Rich	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Tony Also in DWR submission
CIP/GMP check comments	John and Rich, FYI Jenson just received this very che Rich ---------- Forwarded message ---------- From: Rich Poling Deputy Administrator Nevada Division of Water Resou 901 S. Stewart St., Suite 5001 Carson City, N	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
RE: Ruby Diamond Valley CIP/FYI		Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Tony Also in DWR submission
RE: KCSW DCIS PROPOSED - RE: Rich Also Meet	Attachment: John Tibbitts [jmt@water.com] Sent: Thursday, November 12, 2 To: rdoling@water.nv.gov; Tyler December 16 work for us. Rich Attachment: John Tibbitts [jmt@water.com] Sent: Monday, November 04, 20 To: rdoling@water.nv.gov; Tyler	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Tony Also in DWR submission
RE: December 14 Ruby Diamond Valley Groundw	I will be out of the office until Ap	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Tony Also in DWR submission
[EXT] RE: Out of Office: CIP Facilitated Session - Ap	Hi John, Can you forward me the 3-page Thanks, Rich From: John Tibbitts [jmt@water.com] Sent: Friday, March 28, 2014 10: To: Tyler Cowley; Rich Poling; Rich We have the NDWR meeting over See you then. Rich ---- Original Appointment ---- From: Tyler, Cliff [cliff@water.com] Sent: Monday, September 04, 20 To: Hayes, Rich; Steve Hedegaard; Rich Thanks John. Just a reminder, we will be the of Rich From: John Tibbitts [jmt@water.com] Sent: Wednesday, February 26, 2 To: Tyler Cowley; Rich Poling; Rich	Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
RE: Meeting - Monday, March 27 at 9 am		Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
RE: Re: Rich Poling Model Report Review Meet		Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Rich Also in DWR submission
RE: Letter to groundwater rights holders and non		Rich Poling	rdoling@water.nv.gov	rainsong@earthlink.net	rainsong@earthlink.net			Tony Also in DWR submission

	[redacted] From: John Tikkanen [redacted] Sent: Thursday, October 31, 2019 To: Bob Felling Subject: Kit: Hot Diamond Valley				
Kit: Hot Diamond Valley Groundwater Management	Bob, Please, going to change item 1	Bob Felling	[redacted]	[redacted]	[redacted]
Diamond Valley CMP Amendment	Hi John, As we Chatted at the DMCMP , Please replace with Groundwater Management Plan Bob Felling PS, these are [redacted]		[redacted]	[redacted]	[redacted]
	Bob.				
Fw: Kit, Hope Project WAC meeting	From: Bob Felling Sent: Monday, June 03, 2019 9:32 To: [redacted] Subject: Kit, Hope Project WAC m WAC meeting,	Bob Felling	[redacted]	[redacted]	[redacted]
Re: Kit Fwd: [redacted] & TAC instructions	Please see the attached [redacted] Bob Felling thanks for [redacted] Bob		[redacted]	[redacted]	[redacted]
Kit: [redacted] Hot Diamond Valley Groundwater	From: John Tikkanen [redacted] Sent: Thursday, November 07, 20 To: [redacted] Bob Felling John, Have you moved this [redacted] Bob		[redacted]	[redacted]	[redacted]
Kit: Hot Diamond Valley Groundwater Managem	From: John Tikkanen [redacted] Sent: Wednesday, September 03 To: Lynn Cawley; Trudy Morse; Bob F filing		[redacted]	[redacted]	[redacted]
Diamond Valley water rights spreadsheet	John, The attached spreadsheet was a Bob Felling [redacted] Lynn [redacted] but we'll get it! Thanks, Bob		[redacted]	[redacted]	[redacted]
[redacted]	---------- Forwarded A. Felling Good Morning Bob Nevada Division of Water Resou [redacted] Bob Felling That does works Bob		[redacted]	[redacted]	[redacted]
Kit: Overview of Hot Diamond Valley Groundwa	From: John Tikkanen [redacted] Sent: Tuesday, November 19, 201 To: [redacted] Bob Felling		[redacted]	[redacted]	[redacted]

Exhibit 6

Exhibit 6

From: Jason King
To: "Jake Tibbitts"; Kelvin Hickenbottom; Rick Felling
Cc: "Ty B. Erickson, M.D."; "Ari Erickson"; "jjgoicoechea"
Subject: RE: Application 85651
Date: Wednesday, March 16, 2016 9:25:00 AM

Thanks Jake.

Jason King, P.E. | State Engineer
Nevada Division of Water Resources
P: (775) 684-2861 | **F:** (775) 684-2811
E: jking@water.nv.gov | **W:** water.nv.gov

From: Jake Tibbitts [mailto:natresmgr@eurekanv.org]
Sent: Wednesday, March 16, 2016 8:25 AM
To: Jason King; Kelvin Hickenbottom; Rick Felling
Cc: Ty B. Erickson, M.D.; 'Ari Erickson'; 'jjgoicoechea'
Subject: Application 85651

Good morning Jason, Kelvin, and Rick. Please find attached a letter from Solarijos LLC and Eureka County regarding application 85651. The original has been placed in regular US Mail.

Regards,

Jake Tibbitts
Natural Resources Manager
Eureka County, NV
PO Box 682
Eureka, NV 89316

Phone: 775-237-6010
Fax: 775-237-6012

Exhibit 7

Exhibit 7

Curriculum Vitae

IRA VICTOR

SUMMARY

Ira Victor is a digital forensics and information security analyst with Data Clone Labs. Ira Victor has a passion for digital technologies, privacy and the law.

WORK HISTORY

2004-CURRENT

Data Clone Labs, Co-Founder

Involved in three primary activities:

1. Preserving digital evidence and preparing for litigation
2. Responding to cybercrime and other security incidents, which includes tracking down lost assets, and perpetrators when possible
3. Preventive information security efforts, to mitigate risk and reduce cybercrime

2002-2003

Engate Technologies, Co-Founder

Co-inventor of patented email security systems

US Patent Nos. 7,310,660 and 8,423,618

2000-2002

Information Security Consulting

Project-based consulting

Provided services to healthcare providers, retailers, and technology firms

1992-2000

452 Degrees, Founder

eCommerce and Web Development Company to retailers, broadcasters, fitness companies, engineering companies, and technology firms

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PROFESSIONAL AFFILIATIONS AND LEADERSHIP

- American Bar Association, Science and Technology Law section
- Sierra Nevada InfraGard Chapter, a Program of the FBI, Co-Founder and past President
- High Tech Crime Investigators Association (membership by invitation)
- SANS Advisory Board. SANS and GIAC are affiliated
- Previously a member of The Office of Attorney General, State of Nevada, Technological Crime Advisory Board, Technical Privacy Subcommittee

EDUCATION AND PROFESSIONAL CERTIFICATIONS	**BACHELORS OF ARTS DEGREE, POLITICAL SCIENCE DEGREE, CUM LAUDE** **TEMPLE UNIVERSITY, PHILADELPHIA PENNSYLVANIA** Graduated with honors at age 20. Prior to graduation, received special permission to undertake credited independent software development course of study **GLOBAL INFORMATION ASSURANCE CERTIFICATION BODY (GIAC)** • G2700: GIAC Certified in the International Standards Organization, ISO 27001 Standard for Information Security Management Systems • GCFA: GIAC Certified in Digital Forensics and Incident Response • GPCI: GIAC Certified in Information Security Management Systems for the protection of Credit Card Data • GSEC: GIAC Certification in Information Security and Controls **ISACA, FORMERLY KNOWN AS INFORMATION SYSTEMS AUDIT AND CONTROL ASSOCIATION** • CGEIT: ISACA Certified in the Governance of Enterprise Information Technologies • CRISC: ISACA Certification in Risk and Information System Control
TEACHING, MEDIA, WRITINGS	**CONTINUING LEGAL EDUCATION INSTRUCTOR** Topics: Digital Forensics and Information Security For the Clark County Bar Association, Las Vegas, NV; co-instructed on occasion with Discovery Commissioner Ayers, Beacroft and Buelia For the Washoe County Bar Association, Reno, NV; co-instructed on occasion with Discovery Commissioner Ayers For the Nevada Justice Association, Las Vegas, NV; co-instructed on occasion with Discovery Commissioner Ayers and Beacroft **CONTINUING PROFESSIONAL EDUCATION INSTRUCTOR** InfraGard G-Guard Con, Carson City, NV, 2010-Present Risk Management Society, Reno, NV, 2015 Paraben Forensic Innovators Conference, Salt Lake City, UT, 2013 Health Information Management Systems Society National Conference, Las Vegas, NV 2012

PUBLISHED: COMMUNIQUE, CLARK COUNTY BAR ASSOCIATION, JANUARY 2016

Five Things Nevada Attorneys Should Know About Electronic Discovery. Co-authored with Sean Brohawn, Esq.

PUBLISHED: THE WRIT, WASHOE COUNTY BAR ASSOCIATION, JULY 2016

The $500 Million Dollar Question: Why Do Doctors Say "No Thanks" to Liability-limiting Technology?

PUBLISHER: HABEAS HARD DRIVE, NEWSLETTER

Digital Crime and Litigation Briefings for legal professionals

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NOTEWORTHY

ONE OF THREE EXPERTS THAT ADVISED THE NEVADA ATTORNEY GENERAL'S OFFICE AND THE NEVADA LEGISLATURE ON GROUND-BREAKING DATA ENCRYPTION LEGISLATION

Provided expertise on Nevada's Data Encryption Law, NRS 603A

RENO COMPUTERS FOR KIDS, A RENO LION'S CLUB PROGRAM

Co-Founder of a Linux computer educational program for children in the Reno area

Rate Sheet

IRA VICTOR, DIGITAL FORENSIC ANALYST

Digital Forensics and eDiscovery	$240/hour
Expert Witness, Deposition, In-Court Time	$340/hour
Software Licensing, Hardware, Travel Expenses	Additional

Name: Luke Andrew Busby, Ltd.
Mailing Address: 216 East Liberty St.
City, State, Zip: Reno, NV 89501
Telephone: 775-453-0112

In The First Judicial District Court of the State of Nevada
In and for Carson City

Sadler Ranch, LLC Plaintiff, vs. Jason King, P.E. Nevada State Engineer, Defendant.	Case No.: 17OC00018 1B Dept. No.: I **SUMMONS**

THE STATE OF NEVADA SENDS GREETINGS TO THE ABOVE-NAMED DEFENDANT:

NOTICE! YOU HAVE BEEN SUED. THE COURT MAY DECIDE AGAINST YOU WITHOUT YOUR BEING HEARD UNLESS YOU RESPOND WITHIN 20 DAYS.

READ THE INFORMATION BELOW.

TO THE DEFENDANT: A civil Complaint has been filed by the plaintiff against you.

1. If you wish to defend this lawsuit, you must, within 20 days after this Summons is served on you, exclusive of the day of service, file with this Court a written pleading* in response to this Complaint.
2. Unless you respond, your default will be entered upon application of the plaintiff, and this Court may enter a judgment against you for the relief demanded in the Complaint**, which could result in the taking of money or property or the relief requested in the Complaint.
3. If you wish to seek the advice of an attorney in this matter, you should do so promptly so that your response may be filed on time.
4. You are required to serve your response upon plaintiff's attorney, whose address is:

SUSAN MERRIWETHER, Clerk of the Court

By: V. Alonris, Deputy Clerk

Date: February 14, 2017.

*There is a fee associated with filing a responsive pleading. Please refer to fee schedule.
**Note – When service by publication, insert a brief statement of the object of the action. See Rule 4.

RETURN OF SERVICE ON REVERSE SIDE

AFFIDAVIT OF SERVICE (For General Use)

STATE OF _____)
) **ss.**
COUNTY OF _____)

_____, declares under penalty of perjury:
That affiant is, and was on the day when (s)he served the within Summons, over 18 years of age, and not a party to, nor interested in, the within action; that the affiant received the Summons on the _____ day of _____, 20_____, and personally served the same upon _____ the within named defendant, on the _____ day of _____, 20_____, by delivering to the said defendant, personally, in _____, County of _____, State of _____, a copy of the Summons attached to a copy of the Complaint.
I declare under penalty of perjury under the law of the state of Nevada that the foregoing is true and correct.
Executed this _____ day of _____, 20___. _____
Signature of person making service

NEVADA SHERIFF'S RETURN
(for use of Sheriff of Carson City)

STATE OF NEVADA)
) **ss.**
CARSON CITY)

I hereby certify and return that I received the within Summons on the _____ day of _____, 20_____, and personally served the same upon _____, the within named defendant, on the _____ day of _____, 20_____, by delivering to the said defendant, personally, in Carson City, State of Nevada, a copy of the Summons attached to a copy of the Complaint.

KENNY FURLONG, Sheriff of Carson City, Nevada
Date: _____, 20_____. By:_____, Deputy

AFFIDAVIT OF MAILING
(For use when service is by publication and mailing)

STATE OF _____)
) **ss.**
COUNTY OF _____)

_____, declares under penalty of perjury:
That affiant is, and was when the herein described mailing took place, over 18 years of age, and not a party to, nor interested in, the within action; that on the _____ day of _____, 20____, affiant deposited in the Post Office at _____, Nevada, a copy of the within Summons attached to a copy of the Complaint, enclosed in a sealed envelope upon which first class postage was fully prepaid, addressed to _____ the within named defendant, at _____ _____; that there is a regular communication by mail between the place of mailing and the place so addressed.
I declare under penalty of perjury under the law of the State of Nevada that the foregoing is true and correct.
Executed this _____ day of _____, 20___. _____

NOTE - If service is made in any manner permitted by Rule 4 other than personally upon the defendant, or is made outside the United States, a special affidavit or return must be made.

Your name or firm: Luke Andre Busby, Ltd.
Mailing Address: 216 East Liberty St.
City, State, Zip: Reno, NV 89501
Telephone: 775-453-0112

In The First Judicial District Court of the State of Nevada
In and for Carson City

Sadler Ranch, LLC Plaintiff, vs. Jason King P.E. et al. Defendant.	Case No. _____ Dept. No. _____

AFFIRMATION
Pursuant to NRS 239B.030/603A.040
(Initial Appearance)

The undersigned does hereby affirm that upon the filing of additional documents in the above matter, an Affirmation will be provided **ONLY** if the document contains a social security number (NRS 239B.030) or "personal information" (NRS 603A.040), which means a natural person's first name or first initial and last name in combination with any one or more of the following data elements:

1. Social Security number.
2. Driver's license number or identification card number.
3. Account number, credit card number or debit card number, in combination with any required security code, access code or password that would permit access to the person's financial account.

The term does not include publicly available information that is lawfully made available to the general public.

(Your signature) Luke A Busby (Date) 2-14-17

The purpose of this initial affirmation is to ensure that each person who initiates a case, or upon first appearing in a case, acknowledges their understanding that no further affirmations are necessary unless a pleading which is filed contains personal information.

DISTRICT COURT CIVIL COVER SHEET

Carson City County, Nevada

Case No. .....

(Assigned by Clerk's Office)

I. Party Information *(provide both home and mailing addresses if different)*

Plaintiff(s) (name/address/phone):	Defendant(s) (name/address/phone):
Sadler Ranch, LLC	Jason King, P.E. Nevada State Engineer
	DIVISION OF WATER RESOURCES
	DEPARTMENT OF CONSERVATION
	And NATURAL RESOURCES
Attorney (name/address/phone):	Attorney (name/address/phone):
c/o Luke Andrew Busby, Ltd	Susan Joseph-Taylor, Esq.
216 East Liberty St.	901 S Stewart St #2002
Reno, NV 89501	Carson City, NV 89701
775-453-0112	

II. Nature of Controversy *(please select the one most applicable filing type below)*

Civil Case Filing Types

Real Property	Torts	
Landlord/Tenant	**Negligence**	**Other Torts**
☐ Unlawful Detainer	☐ Auto	☐ Product Liability
☐ Other Landlord/Tenant	☐ Premises Liability	☐ Intentional Misconduct
Title to Property	☐ Other Negligence	☐ Employment Tort
☐ Judicial Foreclosure	**Malpractice**	☐ Insurance Tort
☐ Other Title to Property	☐ Medical/Dental	☐ Other Tort
Other Real Property	☐ Legal	
☐ Condemnation/Eminent Domain	☐ Accounting	
☐ Other Real Property	☐ Other Malpractice	

Probate	Construction Defect & Contract	Judicial Review/Appeal
Probate *(select case type and estate value)*	**Construction Defect**	**Judicial Review**
☐ Summary Administration	☐ Chapter 40	☐ Foreclosure Mediation Case
☐ General Administration	☐ Other Construction Defect	☐ Petition to Seal Records
☐ Special Administration	**Contract Case**	☐ Mental Competency
☐ Set Aside	☐ Uniform Commercial Code	**Nevada State Agency Appeal**
☐ Trust/Conservatorship	☐ Building and Construction	☐ Department of Motor Vehicle
☐ Other Probate	☐ Insurance Carrier	☐ Worker's Compensation
Estate Value	☐ Commercial Instrument	☐ Other Nevada State Agency
☐ Over $200,000	☐ Collection of Accounts	**Appeal Other**
☐ Between $100,000 and $200,000	☐ Employment Contract	☐ Appeal from Lower Court
☐ Under $100,000 or Unknown	☐ Other Contract	☐ Other Judicial Review/Appeal
☐ Under $2,500		

Civil Writ		Other Civil Filing
Civil Writ		**Other Civil Filing**
☐ Writ of Habeas Corpus	☐ Writ of Prohibition	☐ Compromise of Minor's Claim
☑ Writ of Mandamus	☐ Other Civil Writ	☐ Foreign Judgment
☐ Writ of Quo Warrant		☐ Other Civil Matters

Business Court filings should be filed using the Business Court civil coversheet.

2-14-17
Date

Signature of initiating party or representative

See other side for family-related case filings.

FIRST JUDICIAL DISTRICT COURT
885 EAST MUSSER ST SUITE 3031

Receipt Number 48260 Receipt Date 02/14/2017

Case Number 17 OC 00018 1B

Description SADLER RANCH, LLC VS. KING, JASON et al

Received From LUKE ANDREW BUSBY, LTD

Total Received	265.00
Net Received	265.00
Change	0.00

Receipt Payments	Amount	Reference	Description
CHECK	265.00	6089	

Receipt Applications	Amount
COST	265.00

Balance Due 0.00

Comments:

Deputy Clerk: 1BVANESSA Transaction Date 02/14/2017 11:09:54.67

ORIGINAL

Case No. 17OC-000181B

Dept. No. 1

IN THE FIRST JUDICIAL DISTRICT COURT OF THE STATE OF NEVADA

IN AND FOR CARSON CITY

SADLER RANCH, LLC, a Nevada Limited Liability Company,

Petitioner,

vs.

JASON KING, P.E. Nevada State Engineer, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES,

Respondent(s).

_____/

NOTICE OF VOLUNTARY DISMISSAL

COMES NOW, Petitioner Sadler Ranch, LLC, by and through the undersigned counsel, and hereby files the following Notice of Voluntary Dismissal of above captioned matter. Pursuant to Nevada Rule of Civil Procedure 41(a)(1), as no answer or motion for summary judgment has been filed by the Respondent(s), this matter may be dismissed without further action from the Court.

///

NRS 239B.030(4) AFFIRMATION

I certify that the attached filing includes no social security numbers or other personal information.

Respectfully submitted this July 5, 2017:

By: _____

Luke Andrew Busby, Ltd.
Nevada State Bar No. 10319
216 East Liberty St.
Reno, NV 89501
775-453-0112
luke@lukeandrewbusbyltd.com

CERTIFICATE OF SERVICE

I certify that on July 5, 2017, I served the foregoing document on the following parties via US Mail and/or electronic service.

Nevada Division of Water Resources
Susan Joseph-Taylor
901 S Stewart St #2002
Carson City, NV 89701

Office of the Attorney General
Micheline Fairbank, Esq.
100 North Carson Street
Carson City, NV 89701

By: _____

Luke Busby

ORIGINAL

Case No. CV-1902-348
(consolidated with CV-1902-349 and CV-1902-350)

Dept. No. 2

NO. _____
FILED

JUN 11 2019

By _____ Eureka County Clerk

IN THE SEVENTH JUDICIAL DISTRICT COURT OF THE STATE OF NEVADA

IN AND FOR THE COUNTY OF EUREKA

TIMOTHY LEE & CONSTANCE MARIE BAILEY; FRED & CAROLYN BAILEY; IRA R. & MONTIRA RENNER; SADLER RANCH, LLC; and DANIEL S. VENTURACCI,

Petitioners,

vs.

TIM WILSON, P.E., Nevada State Engineer, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES,

Respondent.

SUMMARY OF RECORD ON APPEAL

Tim Wilson, P.E., in his capacity as Acting Nevada State Engineer, Department of Conservation and Natural Resources, Division of Water Resources (hereafter "State Engineer"), by and through counsel, Nevada Attorney General Aaron D. Ford and Deputy Attorney General Tori N. Sundheim, hereby files this Summary of Record on Appeal. The attached documents constitute the record on appeal in this matter of contested State Engineer Order #1302, Bates-stamped pages SE ROA 1–952.

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RECEIVED
JUN 11 2019
Eureka County Clerk

Index to Administrative Record re: State Engineer Order #1302			
DATE	**DESCRIPTION**	**Bates Range SE ROA**	
04/05/19	Certificate of Record	1	1
Order #1302			
01/11/19	Order #1302	2	19
Bulletin No. 35			
1968	Water Resources Bulletin No. 35 – Hydrologic Response to Irrigation Plumbing in Diamond Valley, Eureka and Elko Counties, Nevada, 1950–65	20	133
Order #1264			
08/25/15	Order #1264	134	138
Permits			
07/14/17	Amended Permit No. 82268 (Sadler Ranch)	139	140
08/14/17	Permit No. 81825 (Daniel Venturacci)	141	142
08/14/17	Permit No. 82572 (Daniel Venturacci)	143	144
03/06/19	Third Amended Permit No. 81720 (Sadler Ranch)	145	146
Exhibits Submitted at Public Hearing on October 30, 2018			
10/30/18	List of Exhibits	147	147
10/30/18	State Engineer's Exhibit 1 – Petition for Approval of the Diamond Valley Groundwater Management Plan dated 08/16/18, received by the State Engineer on 08/20/18	148	216
10/30/18	State Engineer's Exhibit 2 – Diamond Valley Groundwater Management Plan received by the State Engineer on 08/20/18	217	527
10/30/18	State Engineer's Exhibit 3 – Notice of Hearing with Certified Mail Receipts dated 10/01/18	528	529
10/30/18	State Engineer's Exhibit 4 – Public Notice with Proofs of Publication dated 09/27/18	530	534
Diamond Valley GMP Public Comments Submitted at Public Hearing on October 30, 2018			
10/30/18	Diamond Valley GMP Public Comments List	535	535

Index to Administrative Record re: State Engineer Order #1302			
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10/30/18	Comments from Carolyn Bailey	536	536
10/30/18	Comments from Carolyn Bailey (Revised) dated 11/02/18	537	538
10/30/18	Comments from Timothy Lee and Constance Marie Bailey	539	539
10/30/18	Comments from Robert Burnham	540	540
10/30/18	Comments from Russell Conely	541	541
10/30/18	Comments from Ari Erickson	542	544
10/30/18	Comments from Ty Erickson	545	545
10/30/18	Comments from Jim Etcheverry dated 11/02/18	546	546
10/30/18	Comments from James Gallagher	547	547
10/30/18	Comments from Andrew Goettle	548	548
10/30/18	Comments from Great Basin Resource Watch	549	553
10/30/18	Comments from Advocates for Community and Environment (ACE) – A Public Interest Review of the Proposed Diamond Valley Groundwater Management Plan prepared for Great Basin Resource Watch	554	587
10/30/18	Comments from Mark Moyle Farms dated 10/29/18	588	589
10/30/18	Comments from William Norton dated 10/25/18	590	590
10/30/18	Comments from Donald Plamore dated 10/28/18	591	591
10/30/18	Comments from Marty Plaskett	592	592
10/30/18	Comments from Ira and Montira Renner dated 11/02/18	593	593
10/30/18	Comments from Ruby Hill Mining Company dated 10/29/18	594	595
10/30/18	Comments from Sadler Ranch dated 11/02/18	596	641
10/30/18	Comments from Daniel Venturacci	642	652

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Index to Administrative Record re: State Engineer Order #1302			
DATE	**DESCRIPTION**	**Bates Range SE ROA**	
	Transcript		
10/30/18	Transcript of Proceedings – Public Hearing	653	742
	Data and Documents Reviewed and Evidence Relied Upon		
	USGS Budgets and Chemical Characterization of Groundwater for the Diamond Valley Flow System, Central Nevada, 2011–12, Scientific Investigations Report 2016–5055	743	839
	Determination of Year-to-Year Losses to Banked Water: Northern & Southern Diamond Valley	840	841
	Crop Inventory, Calendar Year 2013, Diamond Valley Hydrographic Basin 10-153,	842	861
	Crop Inventory, Calendar Year 2014, Diamond Valley Hydrographic Basin 10-153,	862	883
	Crop Inventory, Calendar Year 2015, Diamond Valley Hydrographic Basin 10-153,	884	905
	Crop Inventory, Calendar Year 2016, Diamond Valley Hydrographic Basin 10-153,	906	926
	Crop Inventory, Calendar Year 2017, Diamond Valley Hydrographic Basin 10-153,	927	948
	SIR2016-5055 WL Contours Map	949	949
	Surfer WT Elevations SIR20016-5055 Contours Map	950	950
	Gravel Surface Elevation Map	951	951
	Saturated Thickness Map	952	952

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AFFIRMATION

The undersigned does hereby affirm that the preceding Summary of Record on Appeal does not contain the social security number of any person.

DATED this 7th day of June, 2019.

AARON D. FORD
Attorney General

By: _____

TORI N. SUNDHEIM (Bar No. 14156)
Deputy Attorney General
State of Nevada
Office of the Attorney General
100 North Carson Street
Carson City, Nevada 89701-4717
T: (775) 684-1219
E: tsundheim@ag.nv.gov
Attorney for Respondent,
State Engineer

CERTIFICATE OF SERVICE

I certify that I am an employee of the State of Nevada, Office of the Attorney General, and that on this 7th day of June, 2019, I served a true and correct copy of the foregoing SUMMARY OF RECORD ON APPEAL and a DVD CONTAINING DOCUMENTS SE ROA 1–952, said documents apply to Case Nos. CV-1902-348, -349 and -350, via U.S. Mail and electronically to:

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Timothy O'Connor, Esq.
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Courtesy Copy to Chambers:
The Honorable Gary D. Fairman
Post Office Box 151629
Ely, Nevada 89315
E: wlopez@whitepinecountynv.gov

Dorene A. Wright

CERTIFICATE OF RECORD

STATE OF NEVADA)
) ss
CARSON CITY)

I, Kristen Geddes, Chief Hearing Officer of the Division of Water Resources, State of Nevada, duly appointed and qualified, having full charge of the records and files of the Office of the State Engineer, do hereby certify that any copies of originals provided herein are true copies as appear in the records and files of the Office of the State Engineer of Nevada.

Kristen Geddes
Chief, Hearings Section

4/5/19
Date

SUBSCRIBED AND SWORN to before me
by Kristen Geddes this

5th day of April, 2019.

Brenda Albertson
Notary Public

BRENDA ALBERTSON
NOTARY PUBLIC
STATE OF NEVADA
No. 18-2298-3 My Appt. Exp. April 30, 2022

Record on Review
In the matter of the Order 1302

IN THE OFFICE OF THE STATE ENGINEER
OF THE STATE OF NEVADA

#1302

ORDER

GRANTING PETITION TO ADOPT A GROUNDWATER MANAGEMENT PLAN FOR THE DIAMOND VALLEY HYDROGRAPHIC BASIN (07-153), EUREKA COUNTY, STATE OF NEVADA.

WHEREAS, decades of declining water levels in the Diamond Valley Hydrographic Basin is due to the simple fact that groundwater pumping has consistently exceeded the perennial yield of the basin. An obvious solution to the problem caused by *over* pumping is to *reduce* groundwater pumping. Designating Diamond Valley a Critical Management Area (CMA) (the first and only basin thus far in Nevada), provided water right users within the Diamond Valley basin the opportunity to develop a customized groundwater management plan (GMP) that does in fact reduce groundwater pumping to a level that satisfies the State Engineer that the water levels will reach an equilibrium. The CMA and GMP process became law in 2011 specifically to allow those that truly have skin-in-the-game (the water right holders in the basin), to create a means to the same end as curtailment by priority, but without the dire and sudden impacts.

Years before the State Engineer declared the basin a CMA in 2015, the GMP process was initiated by the local community and stakeholders. Work on the GMP continued for an additional three years after the CMA designation with numerous meetings of the community and stakeholders, ultimately arriving at the version presented to the State Engineer in 2018. The testimony, written public comment and background of Appendix C of the GMP demonstrate that this process was emotional and difficult for the participants—yet they persisted in forging a plan in an effort to avoid curtailment by priority to save their community and the established agricultural way of life in Diamond Valley. It is significant that the participants are not professional water right managers, but are ordinary citizens who made a Herculean effort to craft their own plan in response to a complex problem.

WHEREAS, this matter came before the State Engineer on a Petition to Adopt a Groundwater Management Plan (Petition), pursuant to Nevada Revised Statute (NRS) § 534.037 filed on August 20, 2018.

WHEREAS, the history leading up to the subject Petition is as follows:

Diamond Valley is a major groundwater farming area in the Diamond Valley Hydrographic Basin, Basin 153.[1] There are approximately 26,000 acres of irrigated land, which primarily produce premium quality alfalfa and grass hay. In 2013, it was estimated that approximately 110,000 tons of hay were produced annually for a total farming income of approximately $22.4

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[1] GMP, p. 8.

million.[2] Approximately 126,000 acre-feet annually (afa) of irrigation groundwater rights are appropriated in Diamond Valley, and as of 2016, groundwater pumping for irrigation was estimated to be 76,000 afa. The perennial yield of Diamond Valley is 30,000 acre-feet (af).[3]

For over 40 years, annual groundwater pumping has exceeded the perennial yield of Diamond Valley.[4] In the years that groundwater pumping has exceeded the perennial yield, groundwater levels in Diamond Valley have consistently declined at a rate of up to 2 feet per year. Prior to declaring Diamond Valley a CMA pursuant to NRS § 534.110(7), the State Engineer held public meetings on numerous occasions in Diamond Valley to discuss over-appropriation of the basin and to encourage water rights holders to formulate solutions or a plan at the local level to address declining water levels.

Because withdrawals have consistently exceeded the perennial yield of the basin, on August 25, 2015, the State Engineer declared Diamond Valley a CMA pursuant to NRS § 534.110(7).[5] Once declared a CMA, holders of water rights within the basin have 10 years to create and present to the State Engineer a groundwater management plan; otherwise, the State Engineer is required to curtail the basin by priority.[6]

WHEREAS, the process for approval of a GMP by the State Engineer is as follows:

Nevada Revised Statute § 534.037(1) requires that a petition for the approval of a GMP that is submitted to the State Engineer must be signed by a majority of the holders of permits or certificates to appropriate water in the basin that are on file in the Office of the State Engineer.

At the time of filing the petition, there were 419 water right permits or certificates in the Diamond Valley Hydrographic Basin. Of these, 257 are represented by at least one signature in the petition. Comparing the signatories with the confirmed owner of record in the files of the Office of the State Engineer demonstrates that 223 water right permits or certificates are represented by the owner of record. If accepting the affirmation made on each page of the signed petition, then 257 rights of 419 rights is 61%. If limiting only to those signatures by a confirmed owner of record, then 223 of 419 is 53.2%. In either case, a majority of permits and certificates in the Diamond Valley Hydrographic Basin are represented in the petition; therefore, the State Engineer finds that the petition satisfies the requirement of NRS § 534.037(1).[7]

The total duty of groundwater rights in Diamond Valley is 130,625 afa. Of these, 126,188 afa are subject to the plan and 4,437 afa are not subject to the plan. The estimated amount of

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[2] GMP, p. 8.
[3] GMP, p. 8.; J.R. Harrill, *Hydrologic Response to Irrigation Pumping in Diamond Valley, Eureka and Elko* Counties, *Nevada, 1950-65,* Water Resources Bulletin No. 35, (Department of Conservation and Natural Resources, Division of Water Resources and U.S. Department of the Interior, Geological Survey), 1968.
[4] GMP, p. 8.
[5] Order 1264, official records in the Office of the State Engineer; GMP, p. 8.
[6] NRS § 534.110(7).
[7] Exhibit 1, public administrative hearing before the State Engineer October 30, 2018, official records in the Office of the State Engineer. Hereinafter the exhibits and transcript will be referred to solely by the exhibit number or transcript page.

groundwater committed to domestic wells at the statutory maximum of 2 afa per domestic well is 234 afa. By duty, over 96% of the total groundwater commitments are subject to the plan. It is reasonable that the focus of the plan to reduce the groundwater pumping be focused on those manners of use that have the greatest potential effect on the pumping in the groundwater basin.

The GMP assumes that the dividing line between senior and junior water rights holders is where the consumptive use of the water rights is estimated at 30,000 af, which is equal to the perennial yield of Diamond Valley; therefore, those rights with a priority date of May 12, 1960, or earlier are referred to in this Order as the senior rights (with a duty totaling 29,325 afa) and those rights with a priority date after May 12, 1960, are referred to as the junior rights. At the time of filing the petition, there were 77 senior water right permits or certificates, and 36, or 46.8%, of these were represented by at least one signature on the petition. The remaining 342 water right permits or certificate were junior, and 221, or 64.6%, of these were represented by at least one signature on the petition. Of the 29,325 afa of senior water rights, 18,700 afa, or about 64%, is represented by signatories of the petition. The State Engineer finds that significant portions of both senior and junior rights are represented in the petition.

Nevada Revised Statute § 534.037(3) requires that before approving or disapproving a groundwater management plan the State Engineer shall hold a public hearing to take testimony on the plan in the county where the basin lies or, if the basin lies in more than one county, within the county where the major portion of the basin lies. The State Engineer shall cause notice of the hearing to be:

a. Given once each week for two consecutive weeks before the hearing in a newspaper of general circulation in the county or counties in which the basin lies.
b. Posted on the Internet website of the State Engineer for at least two consecutive weeks immediately preceding the date of the hearing.

Notice of a public hearing to be held on October 30, 2018, was published in the *Eureka County Sentinel*, the *Elko Daily Free Press*, and the *Ely Times* during the weeks of the 15th and 22nd of October.[8] Also, notice of the hearing was posted on the Internet website of the Nevada Division of Water Resources commencing on October 1, 2018.[9] Additional notice was also sent by certified mail directly to the boards of county commissioners for the counties of Eureka, Elko, and White Pine.[10] The GMP was made available through the Internet website of the Nevada Division of Water Resources commencing on October 1, 2018, and was also available by request.[11]

A public hearing to take testimony on the proposed GMP was held in Eureka, Nevada, on October 30, 2018, during which testimony in favor of and in opposition to the GMP was received. In addition, the State Engineer held open the period for written public comment for an additional three working days following the hearing, during which time additional public comments were

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[8] Exhibit 4.
[9] http://water.nv.gov/documents/Hearing_Notice-Diamond_Valley_GMP.pdf
[10] Exhibit 3.
[11] http://water.nv.gov/documents/Final%20DV%20GMP%20for%20Petition.pdf

received. This Order evaluates the testimony and written comments and other elements required for approval of the Petition.

Nevada Revised Statute § 534.037(1) requires that in a determination whether to approve a groundwater management plan, the State Engineer shall consider, without limitation:

a. The hydrology of the basin;
b. The physical characteristics of the basin;
c. The geographic spacing and location of the withdrawals of groundwater in the basin;
d. The quality of the water in the basin;
e. The wells located in the basin, including, without limitation, domestic wells;
f. Whether a groundwater management plan already exists for the basin; and
g. Any other factor deemed relevant by the State Engineer.

WHEREAS, the Diamond Valley Groundwater Management Plan is summarized as follows:[12]

The predominant manner of use of existing rights in Diamond Valley is irrigation, where groundwater is pumped and used to produce primarily alfalfa and grass hay. Consequently, the GMP applies to irrigation rights and mining and milling rights with an irrigation base right, while vested rights, other manners of use and domestic wells are excluded from the plan. The GMP requires annual reductions in pumping with a goal of stabilizing groundwater levels and reducing consumptive use to the perennial yield. The GMP applies a formula to calculate the annual duty a rights holder can pump after required reductions, where the formula is based upon the original water right duty and priority of the right to arrive at a number of shares. The formula is defined as:

WR * PF = SA

Where:

WR = Total groundwater right volume as recognized by DWR, accounting for total combined duty (i.e., overlapping places of use) (measured in acre feet)

PF = Priority Factor based on seniority

SA = Total groundwater Shares

An annual amount of water that can be pumped per share is allocated to a rights holder (*i.e.*, the annual allocation), and the reductions in pumping are accomplished by annually reducing the amount of water each share is allocated. In the initial year of the GMP, the total amount of water that can be pumped is equal to the amount of water currently in use. Unused allocations

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[12] Specific components of the GMP are discussed in greater detail below with reference to the public comments received; accordingly, an overview of the major GMP structure is introduced here.

may be banked, traded, leased or sold; thus, the GMP employs a market-based approach. The GMP also contains penalty provisions for pumping in excess of allocations. The GMP is governed by an Advisory Board of elected representatives that are charged with making recommendations to the State Engineer, who ultimately oversees and administers the Plan. The GMP is funded through annual assessments, which, in part, will be used to also fund a water manager employed by the Nevada Division of Water Resources, whose role is expected to involve implementation and management of the GMP.

WHEREAS, the comments made at the October 30, 2018, hearing on the Diamond Valley Groundwater Management Plan and the State Engineer's response are as follows[13]:

I. COMMENTS RELATED TO LEGAL SUFFICIENCY

Several comments were received challenging the legal sufficiency of the GMP as being in violation of established Nevada water law or that the GMP waives existing mandatory provisions required by the NRS including the prior appropriation doctrine, movement of allocations, well abandonment and a banking component without adequate permitting.[14]

Prior Appropriation

First, several commenters asserted that the GMP violates the doctrine of prior appropriation by eliminating the bedrock principle of "first in time, first in right." The violation, they allege, occurs because all water rights—both senior and junior—have their allocations reduced annually, rather than reductions being imposed solely on junior rights.[15]

While it is acknowledged that the GMP does deviate from the strict application of the prior appropriation doctrine with respect to "first in time, first in right," the following analysis demonstrates that the legislature's enactment of NRS § 534.037 demonstrates legislative intent to permit action in the alternative to strict priority regulation. Nevada Revised Statute § 534.037(1) provides that a groundwater management plan "must set forth the necessary steps for removal from the basin's designation as a [CMA]." Other prior appropriation states have addressed whether a

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[13] The following analysis is intended to address written and public comments received concerning the GMP. In large part, all of the comments made in opposition to the GMP in writing or at the hearing raised issues that were considered during the GMP drafting process. These issues, and many more, are succinctly summarized in a "comment and answer format" in Appendix C at pp. 241-255, entitled *GMP Issues and Concerns Identified Through the Process.*

[14] Written comments of Ira and Montira Renner, Timothy and Constance Marie Bailey, Sadler Ranch, LLC, and Great Basin Resource Watch.

[15] Appendix F to the GMP contains the preliminary table of all rights subject to the GMP and the share calculation for each right. The relative priority dates of all rights subject to the Plan are shown in the table. Notwithstanding the share calculations shown in Appendix F, one commenter acknowledged that if a GMP is not adopted and curtailment is ordered on all rights, that rights junior to about May 1960 would be curtailed. This would include a significant number of irrigation rights, all mining rights, and some municipal rights. *See* Written Comment of Great Basin Resource Watch, p. 5. In addition, the majority of domestic wells in the basin are junior and would also be completely curtailed. *See* NRS § 534.110(6) (the State Engineer may order that withdrawals, including withdrawals from domestic wells, be restricted to conform to priority rights).

shortage sharing plan violates the prior appropriation doctrine. For example, in *State Engineer v. Lewis*, 150 P.3d 375 (N.M. 2006), the New Mexico Supreme Court examined whether a settlement agreement entered into by the Interstate Stream Commission, the United States and three irrigation districts, upon which a partial final decree was entered in an adjudication proceeding, violated the New Mexico Constitution, which codified the prior appropriation doctrine.

The appellants, senior rights holders, contended that the settlement agreement violated the New Mexico Constitution, and that due to chronic water shortages for senior rights, the negotiating parties were duty-bound to adhere to the prior appropriation doctrine as it was traditionally understood and enforced, through a priority call. *Id.*

The court's examination focused on a statute that was enacted for the express purpose of achieving compliance with New Mexico's obligations under the Pecos River Compact (the compliance statute). *See id.* at 150 P.3d at 379. In the words of the court, the parties to the settlement agreement sought to cut the water shortage "Gordian knot" through a process more flexible than strict priority enforcement, yet still comply with the prior appropriation doctrine.

In interpreting the legislative intent of the compliance statute, the *Lewis* court found that the intent and purpose of the legislation was beyond dispute—to take charge of resolving a critical situation created by an amended decree, while complying with the obligation of protecting existing rights. In determining that the statute was constitutional, the court assumed that the legislature was aware of the prior appropriation doctrine when it enacted the statute, and that the statute was to be read as a clear signal that the legislature and governmental players wanted to create a solution other than a priority call as the first and only response. *Id.* at 150 P.3d 385.[16] Notwithstanding that the court found the statute constitutional and not violative of prior appropriation, the court found it important that the settlement agreement did not rule out a priority call if needed. *Id.* at 150 P.3d 386.

Nevada Revised Statute § 534.037(1) was enacted in 2011 by A.B. 419. Aside from the six specific and one general consideration codified in the statute, the State Engineer finds that the legislative history contains scarce direction concerning how a plan must be created or what the confines of any plan must be.

Like *Lewis*, in enacting NRS § 537.037, the Nevada legislature expressly authorized a procedure to resolve a shortage problem. And, like *Lewis*, the State Engineer assumes that the Legislature was aware of prior appropriation when it enacted NRS § 534.037,[17] and the State Engineer interprets the statute as intending to create a solution other than a priority call as the first and only response. Nothing in the legislative history of A.B. 419 or the text of NRS § 534.037 suggests that reductions in pumping have to be borne by junior rights holders alone—if that were

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[16] Although the prior appropriation doctrine is not codified in the Nevada Constitution, a similar analysis to *Lewis* is appropriate as prior appropriation is the law in Nevada.

[17] The fact that NRS § 534.110(7) requires the State Engineer to regulate by priority after 10 years if no GMP is adopted makes clear that the Legislature was aware of prior appropriation. Also, the remarks of Assemblyman Goicoechea, the bill sponsor, reinforces the Legislature's awareness of prior appropriation when the Assemblyman described regulation by priority (*e.g.*, pumping is curtailed and the basin is brought back into balance with only senior water rights being held). *See* Minutes on the Assembly Committee on Government Affairs, 76th Session, p. 66 (March 30, 2011).

the case, the State Engineer could simply curtail junior rights—a power already granted by pre-existing water law in NRS § 534.110(6). Thus, the State Engineer concludes that NRS § 534.037 provides flexibility outside regulation by priority, and the manner in which the GMP proposes to reduce pumping is authorized by Nevada law.

Notwithstanding, even though NRS § 534.037(1) does not require a GMP to impose reductions solely against junior rights, the most senior rights in the GMP have a higher priority factor than junior rights when the share calculation is made. Thus, the State Engineer finds that the GMP still honors prior appropriation by allocating senior rights a higher priority factor than junior rights.[18]

Well Use Approvals

Second, commenters opposed to the GMP challenged the GMP's provision to allow temporary movement (less than 1 year) of allocations, alleging the GMP contravenes existing law by automatically granting such changes, that the temporary approval process diminishes State Engineer and public review and encourages trading on annual bases, rather than filing for a permanent change.[19] On the other hand, other comments were received that supported the flexibility offered by the expedient temporary movement process.[20]

Existing water law has provisions that deal with temporary changes to water rights[21] and permanent changes to existing rights.[22] Because the GMP unbundles allocations from the place of use where existing water rights are appurtenant, movement of allocations is controlled by a new or existing well serving as the point of diversion.[23] Thus, the GMP was (1) modeled after existing law regarding temporary changes[24] and (2) still requires application of NRS § 533.370 to new wells or increased withdrawals exceeding 1 year.[25]

Section 14.8 of the GMP provides that any new wells or wells having withdrawals in excess of what was approved under the base right be submitted to the State Engineer. Such changes are approved after 14 days if not denied as impairing other rights or contrary to the public interest. The State Engineer finds that the existing law concerning temporary changes (NRS § 533.345(2))

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[18] The public comments during the hearing reiterated that the 20% spread of the priority factor likely received the greatest consideration and debate during the GMP process. Ultimately, a spread of priority factor between 0.9997 and 0.80 was what a majority of the plan proponents could agree to.
[19] Written comments of Sadler Ranch, LLC and Great Basin Resource Watch.
[20] Written comment of Marty Plaskett; *and see* Transcript, pp. 80-81 (Matt Morrison) (providing an example that when annual reductions are implemented, an irrigator may not have enough water for one pivot, but would have flexibility to combine allocations to water a full crop, while also allowing some irrigation on former irrigation lands to keep them viable until farming on that pivot could resume).
[21] NRS § 533.345(2).
[22] NRS § 533.370.
[23] *See* GMP §§ 14.8 and 14.9.
[24] GMP, p. 20 at fn. 20.
[25] GMP § 14.9.

expresses a command to grant temporary changes (*e.g.*, "shall approve") unless the State Engineer determined it impairs existing rights or is contrary to the public interest. Thus, the State Engineer finds that § 14.8 and § 533.345(2) to be entirely consistent. Further, the State Engineers agrees that allowing changes expediently up to the original duty at that well is permissible because the State Engineer already made such an affirmative analysis when the water right was granted. Additionally, the State Engineer finds that § 14.8 of the GMP is not a significant departure from existing law because temporary change applications do not undergo publication or hearing unless required by the State Engineer.[26] Thus, it is unpersuasive that § 14.8 diminishes State Engineer and public review. Finally, the potential of a rights holder to serially move allocations for less than 1 year to escape being subject to the procedures of NRS § 533.370, exists under current law, as there is no limitation in statute to the number of temporary applications to change. The State Engineer is mindful that when annual notices are given, to examine such notices to determine there is a motivation to avoid the statutory change process.

With respect to new wells, additional withdrawals exceeding 1 year, or where the State Engineer determined within the 14 calendar days may be not be in the public interest or may impair rights of other persons, the existing procedures under NRS chapters 533 and 534, including publication and protest provisions, still apply.[27]

Well Plugging Provisions

One commenter asserted that the GMP waived existing law regarding exempting wells from NRS Chapters 533 and 534.[28]

GMP §§ 14.2 and 14.3 direct when active, unused or inactive wells must be plugged and abandoned, or that a waiver of abandonment can be obtained. The State Engineer finds that these provisions are consistent with existing regulations found in NAC §§ 534.300 and 534.427. Additionally, GMP §§ 14.4 and 14.5 expressly require that well construction and maintenance must comply with the requirements of NRS and NAC Chapter 534. The State Engineer finds that the GMP does not waive or exempt wells from existing laws or regulations.

Banking and Aquifer Storage and Recovery

Lastly, one commenter stated that the banking component of the plan was an aquifer storage and recovery (ASR) project, which lacks a necessary permit required by NRS § 534.250, *et. seq.*[29]

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[26] NRS § 533.345(3).
[27] GMP § 14.9.
[28] Transcript, p. 19 (David Rigdon).
[29] Written comment of Sadler Ranch, LLC; Transcript, p. 14 (David Rigdon). The statement at the hearing was that this comment was based upon the report of the hydrogeologist in Appendix I that water banking is a type of aquifer storage and recovery project regulated by the State Engineer. As indicated by further findings, the State Engineer does not agree that the banking component of the GMP is an aquifer storage and recovery project.

Section 13.9 of the GMP allows unused allocations to be carried over and banked for use in a subsequent year to increase the amount of water the rights holder can use in the next year. The banked allocation is subject to depreciation in the amount that is carried over to account for natural losses over time.[30] In contrast to banking in the GMP, a typical aquifer storage and recovery project is operated by injecting or infiltrating water from a surface source into the aquifer for the purpose of accumulating storage for future use.[31] These elements of project operation are not part of the GMP. The State Engineer finds that banking of unused allocations in the GMP is a mechanism to allow flexibility by users to determine when to use their limited allocation and to encourage water conservation practices. Consequently, the State Engineer finds that the banking allocations in the GMP is a reasonable means to facilitate conservation and water planning by water users, as provided for under NRS § 534.037, and that the GMP is not required to fulfill the statutory obligations of NRS §§ 534.250–340.

II. COMMENTS RELATED TO ABANDONMENT, FORFEITURE, AND PROVING BENEFICIAL USE

Some commenters stated that water rights that are currently unused should be abandoned or forfeited prior to reductions in pumping being imposed against existing water rights.[32] The State Engineer finds that pursuing forfeiture or abandonment prior to implementing any GMP is ill-advised for several reasons.

First, time is of the essence for rights holders to get a GMP approved prior to August 25, 2025, or curtailment by priority will be ordered for all rights in Diamond Valley. Because forfeiture and abandonment must be shown by clear and convincing evidence, it is doubtful whether there is sufficient time to investigate and assemble evidence concerning abandoned rights, to conduct administrative hearings and engage in any appellate proceedings with time left to secure a final table of water rights to support the GMP. Pursing abandonment at this moment would likely lead to lengthy administrative and/or appeal proceedings, delaying action on a GMP until a final listing of active groundwater rights would be known.[33]

Second, a different problem is presented by forfeiture proceedings. Because the State Engineer conducts an annual inventory in Diamond Valley, information is available concerning those rights that may be subject to forfeiture. However, in 2017, NRS § 534.090 was amended to require that a notice of non-use be served prior to forfeiting unused water rights to provide one year to cure a forfeiture.[34] Serving notices of non-use at this stage would require that owners of water rights that are currently unused make efforts to resume beneficial use (*i.e.*, pumping). The

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[30] Section 13.9 describes that Diamond Valley is divided between the main farming area (generally located in the southern half of the basin) and the groundwater discharge area (the northern half of the basin). Banked water north of the dividing line in the discharge area depreciates at 17% and banked water south of the line at 1%. The depreciation factors are based on numerical flowing modeling analysis to justify and support these amounts. *See* GMP, Appendix I.
[31] *See, e.g*, NRS §§ 534.250- 340.
[32] Written comments of Sadler Ranch, LLC and Carolyn Bailey.
[33] *See, e.g.*, GMP, Appendix F.
[34] *See* NRS § 534.090(2).

consequence of resuming pumping is contrary to the intent of the GMP to *reduce* pumping. Thus, the State Engineer finds that in addition to similar timing problems discussed above, initiating forfeiture proceedings could exacerbate conditions in the basin by increasing pumping, prior to reducing pumping pursuant to the GMP, thereby lessening the effectiveness of the plan.[35]

Third, assuming *arguendo*, there are water rights existing only on paper (*e.g.*, that could be abandoned or forfeited), reductions in pumping by the GMP start at the ceiling of *actual pumping* (76,000 afa), not at the ceiling of existing rights (126,000 afa). Stated otherwise, even if the State Engineer assumed that the difference between existing rights and actual pumping (50,000 afa) was paper water, the elimination of paper water rights to match active rights will not change that the reductions in *pumping* begin at the component of active rights. The issue of paper water was raised and considered during the GMP drafting process, and it was determined that the GMP contemplated that any valid right in good standing was to be issued shares.[36] The State Engineer believes there is a low probability of success for abandonment, and the preceding paragraph describes the likely unanticipated effect of pursuing forfeiture. Therefore, the State Engineer finds that requests to eliminate paper water does not warrant halting this process in order to initiate abandonment or forfeiture proceedings.

Additionally, one commenter stated that existing permitted rights should prove beneficial use and become certificated prior to implementing a GMP. For reasons discussed above, including timing and discouraging increases in pumping, the State Engineer finds that requiring proof of beneficial use prior to implementing a GMP is not in the best interest of taking immediate action to adopt and implement a basin-wide GMP. Further, the GMP petition process expressly applies to the holders of *permits* and *certificates*. Therefore, the GMP statute implicitly recognizes that permitted rights which have not fully proven beneficial use will participate in the GMP process.

III. COMMENTS RELATED TO APPLICABILITY OF PLAN TO ONLY CERTAIN WATER RIGHTS

Some comments were directed to the scope of GMP applying only to irrigation rights and mining and milling rights with a base irrigation right. Some expressed concern that it created a preference for certain manners of use, that there was no environmental component to the plan and it would result in water barons.[37] Many comments in favor of the plan described how they believed the plan would allow more irrigators or mines to stay in business, ultimately benefitting the greatest number of operators by providing more favorable conditions such as weed and rodent control.[38] The comments favored adoption of a GMP in lieu of curtailment, which many recognized would

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[35] The issue of forfeiture in Diamond Valley, particularly of pivot corners, pre-dates the 2017 amendments to NRS § 534.090. In the 1980s, the State Engineer pursued forfeiture of unused pivot corners in Diamond Valley, which lead to the enactment of NRS § 534.090(3) (pre-2017 version). *See* Nev. Stat. ch 559 (1983); *and see*, A.B. 597 (1983).
[36] *See* GMP, Appendix C, p. 244.
[37] Written comments of Great Basin Resources Watch, and Ari Erickson.
[38] Written comments of James Gallagher, Mark Moyle and Donald Palmore; Transcript, p. 68 (Jim Gallagher); pp. 80-81 (Matt Morrison).

likely force many junior irrigators into bankruptcy, and as a result, the community would suffer.[39] In addition, many comments in favor of the GMP spoke positively about methods for increasing efficiency to continue operations while reducing pumping.[40]

As discussed in the introductory paragraphs section, *supra*, over 96% of committed rights are represented in the plan; therefore, the State Engineer finds that given the overwhelming majority of irrigation rights and mining and milling rights having irrigation base rights, the application of the plan to those rights that will have the most impact and be most impacted, is appropriate. While one commenter opined that the GMP does not address environmental concerns, the State Engineer does not agree. The GMP may not contain express provisions for the environment, but allowing the greatest number of irrigators to remain in business and keep cultivated lands active, will prevent the incursion of weeds, and will provide dust and rodent control. And ultimately, the State Engineer finds that the objective to reduce the pumping of groundwater to stabilize groundwater levels is a benefit of the groundwater basin, the irrigators and other members of the community that rely upon it and live within it, and that it is not necessary to explicitly identify certain areas of environmental concern within the scope of the plan for the plan to have a generalized benefit to the environment.

Finally, the State Engineer finds that comments that the GMP will result in "water barons" or that it will create a preference for certain manners of use, are speculative. Existing water law provides that water rights are a form of real property that are freely alienable and transferrable independent of land where the water was formerly appurtenant. In that way, the ownership of water rights and the manners of use are currently determined by a market of real property transactions.

IV. COMMENTS RELATED TO PRACTICALITY OR REASONABLENESS OF THE PLAN IMPLEMENTATION

Mitigation Rights

Some commenters challenged the fact that the GMP does not provide for mitigation of senior surface water rights that have been negatively impacted by junior groundwater pumping.[41]

The requirement for the approval of a GMP is that it "must set forth the necessary steps for removal of the basin's designation as a critical management area." NRS § 534.037(1). Neither the plain language nor the legislative history indicate that mitigation of senior surface water rights that have allegedly been adversely affected by groundwater pumping must be mitigated by a GMP.[42]

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[39] Written comments of William Norton and Donald Palmore; Transcript, pp. 80-81 (Matt Morrison).
[40] Written comment of William Norton, Marty Plaskett, Robert Burnham and James Gallagher; Transcript, p. 81 (Matt Morrison).
[41] Written comments of Sadler Ranch, LLC and Daniel Venturacci.
[42] In fact the opposite appears to be true from the legislative history. As proposed, A.B. 419 would have required the State Engineer "to consider the relationship between surface water and groundwater in the basin," but this consideration was amended out of the bill after the First Reprint.

Of note is that the State Engineer entered Order 1226, entered on March 26, 2013, which provided a mechanism for mitigation of senior surface water rights allegedly impacted by junior groundwater pumping. Two of the commenters at the hearing who raised this issue have taken advantage of the provisions of Order 1226, by filing for mitigation groundwater rights, which were granted by the State Engineer. Consequently, the State Engineer finds that mitigation is not a required element of the GMP; and in any event, the commenters who raised this issue have already taken advantage of Order 1226.[43]

Out-of-Basin Transfers

One commenter was concerned that unbundling water rights appurtenant to their place of use creates an incentive for out-of-basin transfers.[44] The commenter acknowledged that the current GMP prohibits out-of-basin transfers, but suggested the plan proponents may consider amending the plan to strengthen provisions to avoid incentivizing out-of-basin transfers. The State Engineer finds that NRS § 534.037 provides that once adopted, the GMP can be amended by the same procedure which allows for adoption of a plan.[45] Because the GMP currently prohibits out-of-basin transfers, there is currently no necessity to mandate changes to the GMP to strengthen provisions to disincentivize out-of-basin transfers. Some commenters involved the creation of the plan who spoke in favor of it acknowledged the plan may not be "perfect." Short of finding the current GMP cannot be approved as a matter of law, the State Engineer finds that denial of the Petition to require years of possible additional negotiations to merely better state existing plan provisions, to be unnecessary.[46]

See A.B. 419 (First Reprint), Senate Committee on Government Affairs, 76th Sess. (May 25, 2011).

[43] *See, e.g.*, Permits 81720, 82268, 81825 and 82572, official records in the Office of the State Engineer.

[44] Written comment of Great Basin Resource Watch.

[45] NRS § 534.037(5).

[46] The State Engineer values all comments and testimony received concerning the GMP. While it is clear the *Public Interest Review of the Proposed Diamond Valley Groundwater Management Plan* prepared for Great Basin Resource Watch was thorough in its analysis, the State Engineer gives great weight to comments and testimony from water rights holders in Diamond Valley, senior or junior whom are for or against approval of the GMP. Great Basin Resource Watch does not own water rights in Diamond Valley and it does not appear it was involved in the years of public meetings held in Eureka to negotiate the details of the GMP. *See, e.g.*, GMP Appendix C at pp. 121-240. Indeed, its own written comment appears to recognize it is appropriate to afford great weight to those that created and are affected by the plan. *See* Written comment of Great Basin Resource Watch at p. 8 (a groundwater management plan should address the varied objectives or goals of water users and residents in the basin, and a worthwhile consideration is whether the GMP promotes bottom-up collaboration to promote broad buy-in from affected individuals and to provide flexibility in decision-making); *and see also*, Transcript, p. 65 (Mark Moyle) (responding to comments at the hearing, stating that the GMP was developed by the people who live in Diamond Valley and will be most affected and that everyone was making sacrifices).

Public and Local Community Interest

The same commenter stated that the public interest component was not adequately represented and that the description of local community interests could be strengthened.[47]

The State Engineer disagrees that the public interest is not adequately represented. As already discussed under well use approvals, new wells, additional withdrawals exceeding one year, or where the State Engineer rejected a request under § 14.8, is subject to the procedures of NRS § 533.370—including the public interest review for change applications.

Many comments in support of the GMP reflect the reality that it took years for the participants to negotiate an agreement that was able to attain majority support required to petition the State Engineer for approval. Years before the State Engineer declared the basin a CMA in 2015, the GMP process was initiated by the local community and stakeholders.[48] Work on the GMP continued for an additional three years after the CMA designation with numerous meetings of the community and stakeholders, ultimately arriving at the version presented to the State Engineer in 2018.[49] Appendix C of the GMP demonstrates that this process was emotional and difficult for the participants—yet they persisted in forging a plan in an effort to avoid curtailment. The written comments overwhelmingly demonstrate the public and local community interests to be preserved by the approval of the plan, which are best stated by the following irrigator:[50]

> The irrigators that support this plan understand that we all need to sacrifice for the long-term benefit of the community and the long-term continued success of the farming industry. Diamond Valley is the heart of southern Eureka County's economy. . . . Strong, willing, and giving people who understand that it takes community effort to sustain and survive built Diamond Valley. . . . The purpose of the DVGMP is to continue the ongoing success of the entire southern Eureka County area and the enterprises that exists [sic] there.

This sentiment was repeated in all written comments submitted in support of the plan.[51] In addition, many stirring accounts were given at the public hearing about living and growing up in Diamond Valley, the desire to preserve the established way of life, the hardscrabble efforts made over decades to create the farms that exist in the valley today, and the determination of the community to work together to solve issues, both past and present, which challenged their continued existence.[52] The State Engineer finds that the GMP materials, written comments and testimony at the public hearing overwhelmingly describe and support the public and local

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[47] Written comment of Great Basin Resource Watch.
[48] GMP, Appendix B.
[49] *See* GMP, Appendices A, C.
[50] Written comment of Mark Moyle.
[51] *See* written comments of Robert Burnham, Russell Conley, Jim Etcheverry, James Gallagher, Andrew Goettle, William Norton, Donald Palmore, Marty Plaskett and Ruby Hill Mining Company; *and see* Transcript, pp. 52-53 (D'Mark Mick).
[52] Transcript, pp. 57-59 (James Moyle); pp. 75-77 (Vickie Buchanan); pp. 79-82 (Matt Morrison); pp. 84-85 (Lloyd Morrison); pp. 85-88 (Alberta "Birdie" Morrison).

community interests, which weigh heavily in the determination at hand. While many comments in the *Public Interest Review*[53] reflect aspirational components of what a plan *may* contain or how it could be best stated, the State Engineer finds that the GMP is acceptable in these areas.

Protections for Domestic Wells

One commenter suggested that domestic wells were not protected because pumping will continue to exceed the perennial yield while the GMP is carried out. The State Engineer finds that NRS § 534.110(7), states that unless at GMP has been approved for a basin pursuant to NRS § 534.037, "withdrawals, including, without limitation, withdrawals from domestic wells, be restricted in that basin to conform to priority rights." And that pursuant to NRS § 534.080, domestic wells are assigned the date of priority of the date the well was drilled. Thus, the GMP is protective of domestic wells because it specifically excludes the domestic wells from pro-rata reductions in use and allows for their continued use to the full statutory permitted amount, compared to the alternative that (a) the domestic wells in Diamond Valley are junior in priority to the 30,000 af PY, and (b) since, absent an approved GMP, domestic wells are subject to curtailment based upon their priority.

Advisory Board Makeup

Commenters had differing issues with the makeup of the Advisory Board.[54] One commenter stated that the GMP favors junior appropriators on the Advisory Board. Alternatively, another commenter posited that after a period of years, the makeup of the Advisory Board could favor non-irrigators over irrigators. The State Engineer finds that the plan was created by the individuals that will be subject to the plan, and the State Engineer accepts that a majority of the rights holders agreed that the makeup and voting structure of the participants agreed this to be a fair manner of representation on the Board.

V. COMMENTS RELATED TO SCIENTIFIC SOUNDNESS

Some commenters challenged the GMP, asserting that the GMP is not supported by science and hydrologic analysis, with the following observations:[55]

a. The scheduled reduction in pumping would exceed the perennial yield for the life of the GMP and in the process it would deplete aquifer storage in excess of the transitional storage volume.

b. The GMP is not supported by a hydrogeologic analysis or a groundwater model to provide information on the effects of the plan.

c. Some commenters had questions about the accuracy of the ET depreciation rate, and whether this rate may change over time because

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[53] Written comment of Great Basin Resource Watch.
[54] Written comments of Sadler Ranch, LLC and Great Basin Resource Watch.
[55] Written comments of Ira and Montira Renner and Sadler Ranch, LLC; Transcript, p. 19 (David Rigdon); pp. 23-24 (David Hillis).

of groundwater recovery and corresponding changes in groundwater ET.

d. One commenter raised the lack of thresholds or triggers in the GMP.

The GMP is based on the simple fact that groundwater pumping is the cause of declining water levels, and therefore pumping must be reduced to solve the problem. The reduction in pumping is set at 3% per year for the first 10 years, and may be adjusted up or down thereafter as informed by groundwater level monitoring data. The goal of this approach is to progressively reduce groundwater pumping until the perennial yield is not consistently exceeded, and the measure of that ultimate outcome is a stabilization of water levels.

Perennial yield is based on the principle of conservation of mass, which dictates that water levels will stabilize when recharge equals discharge. Before any groundwater development occurs, an undeveloped basin is considered to be in equilibrium between natural groundwater recharge and discharge. When wells are developed, groundwater is initially drawn from aquifer storage in the vicinity of the well, but over time that groundwater removal is replaced by a decrease in natural discharge or increase in recharge until a new equilibrium is reached and the discharge by pumping is part of the basin water balance. Water drawn from storage in the period of time between the pre-development equilibrium and the post-developed equilibrium is defined as the transitional storage. The amount of transitional storage consumed before a new equilibrium state is reached may affect the depth to water at a new equilibrium condition, but as long as recharge and discharge are ultimately balanced then an equilibrium condition can be reached and the goal of the GMP to stabilize water levels can be achieved. The amount of storage consumed in the transitional period will not prevent equilibrium from being reached.

Groundwater modeling and hydrogeologic analysis are not the basis for the GMP's determination of pumping reduction rates and target pumping totals at the end of the plan. Instead, the pumping reduction rate was selected by agreement of the GMP authors, and the target for total pumping at the end of the GMP was selected from existing published values. Upon implementation, the real effects of the plan will be monitored and observed by measuring the change in groundwater levels throughout the basin. Those measurements will be the basis for plan review and any modifications of pumping reduction rates that the GMP requires after an observation period of 10 years.

Groundwater modeling is a helpful and informative tool for projecting the effects of pumping reduction and planning accordingly, but modeling is not necessary to conclude that reductions in pumping will lead to reductions in water level drawdown. Groundwater modeling and hydrogeologic analysis beyond what is publicly available in existing published reports would not change the fact that the cause of groundwater decline is due to pumping groundwater and that the stakeholder-authored plan seeks to reduce pumping. Modeling could be a useful tool for future evaluation of the plan and modifications to pumping reduction rates, but it is not required.

One commenter questioned whether the reductions in pumping under the plan combined with rights not subject to plan would bring withdrawals to the perennial yield based on his calculation of rights able to be pumped being excess of 42,000 afa.[56] As explained, the goal of the

[56] *See* written comment of Ari Erickson.

GMP is to reduce consumptive use to the current perennial yield; and, as indicated in the introductory paragraphs, there are 4,437 af of groundwater rights in the basin not subject to the plan. Thus, the State Engineer does not find that there could be total pumping in excess of 42,000 afa in the basin at the end of 35 years under the GMP. Assuming, *arguendo*, that rights subject to the plan and those not subject to the plan were estimated to be 34,437 af, existing evidence used by the State Engineer to designate the basin a CMA demonstrates that there are wide variations in annual pumping—in some years, by several thousand acre-feet more or less than the prior year.[57] Because the designation of a CMA is based on withdrawals *consistently* exceeding the perennial yield, the State Engineer finds that existing law suggests some tolerance of variations on the annual amount of pumping. In addition, the State Engineer is mindful that perennial yield is an *estimate* of water availability and is only one-half of the equation of GMP success.[58] Actual observations of water levels are the most direct and reliable means of determining GMP success. The plan to reduce pumping, monitor the effects on water levels, and then adjust pumping reductions is a sound approach to achieving the goal of stabilizing water levels. The lack of a groundwater model or detailed hydrogeologic analysis does not preclude approval of the GMP as written.

One commenter raised the lack of thresholds or triggers in the GMP. The State Engineer finds that there is no express requirement in NRS § 534.037 for thresholds or triggers, and that a reference to thresholds or triggers is commonly in reference to a "Monitoring, Management and Mitigation (3M)" Plan. The State Engineer has historically utilized 3M Plans as a tool in approving new appropriations when impacts to existing rights are unknown. Consequently, the State Engineer finds that a 3M Plan having thresholds and triggers is different than the GMP now pending before the State Engineer, and that the two types of plans serve different functions. Nevertheless, the State Engineer finds that there has been robust monitoring of irrigation groundwater use in Diamond Valley by the State Engineer's office for many decades and that monitoring groundwater use and groundwater levels is ongoing. Moreover, the GMP requires irrigators to install a smart meter, which will provide increased accuracy and nearly real-time knowledge of groundwater use.[59] Finally, the GMP incorporates the State Engineer's enforcement authority concerning over-pumping of a user's allocation, and contains penalties to be paid in water for over-pumping and stiff administrative fines for meter tampering.[60]

Finally, some commenters had questions about the accuracy of the ET depreciation rate, and whether this rate may change over time because of groundwater recovery and corresponding

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[57] *See* Order 1264, official records in the Office of the State Engineer.

[58] Both the GMP and the commenter acknowledged the release of a 2016 report by the U.S. Geological Survey, which estimated the perennial yield may be 35,000 af. GMP, p. 8 at fn. 2; Transcript, p. 37 (Ari Erickson). As part of a different administrative hearing proceeding, the State Engineer was requested to accept the USGS Report as the perennial yield in Diamond Valley. That matter is currently under submission, and no determination has been made by the State Engineer whether to accept this number. Consequently, the GMP was based on the current estimate of perennial yield of 30,000 af.

[59] *See* GMP § 15. The most recent groundwater inventory conducted by the State Engineer in 2018 revealed that there was nearly 100% compliance with smart meter installation already. This further affirms that rights holders have already made financial commitments of purchasing and installing smart meters to ensure success of the GMP.

[60] GMP §§ 16, 17.

changes in groundwater ET. The selection of these rates was the only component of the GMP expressly based on groundwater model simulations. The accuracy of the model and appropriateness of assigning ET depreciation rates based on model interpretation was discussed at GMP planning meetings. The ET depreciation rates in the final GMP were a compromise and there was never a consensus. Adjustments to these rates is provided for under the provisions to amend the GMP, as warranted by the data.

VI. COMMENTS RELATED TO PRECEDENCE

Several commenters were concerned that any GMP adopted in Diamond Valley creates a precedent for other areas in the state that may be designated Critical Management Areas. The proposed GMP under consideration is the first plan in the state adopted through the process required by NRS § 534.037. As with most decisions involving water, the conditions and issues facing Diamond Valley are unique to Diamond Valley, and therefore the requirements of this plan may not be suitable for any other area in the state. Many individuals speaking in support of the plan made this observation, and the State Engineer concurs that the Diamond Valley GMP does not limit the possible solutions that may be employed by other groundwater management plans.

WHEREAS, based upon the foregoing, the State Engineer makes the following findings of fact, conclusions of law and order:

The State Engineer finds that Appendix D to the GMP sufficiently describes (a) the hydrology of the basin; (b) the physical characteristics of the basin; (c) the geographic spacing and location of the withdrawals of groundwater in the basin; (d) the quality of the water in the basin; and (e) the wells located in the basin, including, without limitation, domestic wells.

The State Engineer finds that there is currently no groundwater management plan in existence for Diamond Valley.

The State Engineer finds that the GMP is analogous to the settlement agreement at the center of the *Lewis* case, *i.e.*, an agreement supported by at least a majority of the permit and certificate holders in Diamond Valley to protect existing rights while cutting the Gordian knot of basin over-appropriation. Thus, the State Engineer concludes that adoption of the GMP is expressly authorized by statute and does not violate the prior appropriation doctrine because the statute provides flexibility outside strict regulation by priority.

The State Engineer finds that the GMP is not legally deficient nor waives any authority of the State Engineer to enforce Nevada water law.

The State Engineer finds that due to the length of time required, initiating abandonment or forfeiture proceedings or requiring proof of beneficial use prior to implementing a GMP is not in the best interest of reducing pumping and would only serve to delay such reductions.

As discussed in the introductory paragraphs, over 96% of committed rights are represented in the plan; therefore, the State Engineer finds that given the overwhelming majority of irrigation rights and mining and milling rights having irrigation base rights, and that the application of the plan to those rights that will have the most impact, and that will be the most impacted, is appropriate.

The State Engineer finds that public and local community interests have been considered, and that such interests are a cornerstone of the plan by retaining the greatest number of farms or mines as economically viable, which will provide social, economic, and environmental benefits.

The State Engineer finds that the standard for determining success of the plan by stabilizing water levels is sound.

The State Engineer finds that groundwater modeling is an informative tool for projecting the effects of pumping reduction, and that future model results could add confidence to decisions on any changes to pumping reductions, but that the lack of a groundwater model or hydrogeologic analysis does not preclude approval of the GMP as written.

The State Engineer finds that the GMP's annual reductions in pumping will lead to the entire basin's groundwater pumping approaching the perennial yield and stabilization of groundwater levels.

The State Engineer finds that the GMP is a groundwater management plan and is not a monitoring, management and mitigation plan; therefore, not only is there no requirement that there be a mitigation component or thresholds and triggers for activation of mitigation actions, but also such components would cloud the plan's goal and objectives.

The State Engineer finds that 1 acre-foot is equal to 325,851 gallons pursuant to practice and policy of the Office of the State Engineer, and that this conversion rate will be used.

In light of the foregoing findings, having considered the comments for and against the GMP, the State Engineer concludes that the petitioning parties have met the requirements for the adoption of the Diamond Valley Groundwater Management Plan, and the Petition is accordingly granted.

ORDER

NOW THEREFORE, it is ordered that the Petition to Adopt the Groundwater Management Plan for the Diamond Valley Hydrographic Basin is hereby GRANTED.

P.E.

JASON KING, P.E.
State Engineer

Dated at Carson City, Nevada this
11TH day of JANUARY, 2019.

STATE OF NEVADA

DEPARTMENT OF CONSERVATION AND

NATURAL RESOURCES

WATER RESOURCES BULLETIN NO. 35

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN DIAMOND VALLEY, EUREKA AND ELKO COUNTIES, NEVADA, 1950-65

By

J. R. Harrill

With section on

Surface Water

By

R. D. Lamke

Prepared in cooperation with the

United States Department of the Interior

Geological Survey

1968

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HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN DIAMOND VALLEY, EUREKA AND ELKO COUNTIES, NEVADA, 1950-65

By
J. R. Harrill

ABSTRACT

This second appraisal on the water supply of Diamond Valley was made 4 years after the first cooperative study. The first report described the hydrology of the valley under nearly natural conditions and indicated that the recharge from precipitation within the basin was insufficient to account for the observed discharge. Estimates derived during the present study indicate that, of the 30,000 acre-feet of natural discharge each year, about 21,000 acre-feet is from precipitation within the basin and about 9,000 acre-feet is by interbasin flow from the adjacent Garden Valley area.

Nearly all ground-water development has been in the southern half of the valley, herein called the South Diamond subarea. In 1965, the total net pumpage was 12,000 acre-feet, which is less than half the estimated perennial yield of 30,000 acre-feet for Diamond Valley. Permits to pump about 150,000 acre-feet per year have been granted, mostly in the South Diamond subarea. Because most of the pumping occurs about 10 miles south of the nearest area of natural discharge, local overdraft is certain to occur long before an appreciable amount of natural discharge can be salvaged.

Pumping during the 16-year period 1950-65 has resulted in an estimated ground-water storage depletion of 60,000 acre-feet, which is roughly equal to the total net pumpage for the period. This is only 3 percent of the 2 million acre-feet of water estimated to be in storage in the upper 100 feet of saturated alluvium in the South Diamond subarea. If future pumping continues to be concentrated in the same general areas as in 1965, the amount of storage depletion necessary before a new equilibrium can be achieved is about 3 million acre-feet for a sustained net pumpage of only 12,000 acre-feet per year; the ultimate maximum drawdown would be about 200 feet below 1965 levels. Pumpage increased at a rate of about 2,000 acre-feet per year between 1960 and 1965; if the same rate of increase prevails, a new equilibrium may not be achieved in the future until increased pumping costs result in a decrease or relocation of pumping.

The first approximation of transmissibility distribution in the South Diamond subarea suggests that the values range from less than 50,000 gpd per foot in the northern part of the subarea to more than 100,000 gpd per foot locally in the southern part. The long-term storage coefficient may average about 0.14 for the entire subarea but locally may be as high as 0.20.

The chemical quality of the water in 1965 was satisfactory for irrigation, domestic, and stock use. However, over the long term, recycling of pumped water and the possibility of migration of poor quality water from beneath the playa could result in a gradual deterioration in water quality in the areas of use.

INTRODUCTION

Purpose and Scope

This is the second report on the hydrology of the Diamond Valley area prepared by the U. S. Geological Survey in cooperation with the Nevada Department of Conservation and Natural Resources. The first report, (Eakin, 1962) was a reconnaissance and provided preliminary estimates of recharge to and discharge from the valley.

The need for the present study was expressed by the State because of the extensive development of ground water for irrigation since 1962. Development has been concentrated in the south-central part of the valley. By 1964 permits to pump more that 150,000 acre-feet per year had been issued which greatly exceeded the preliminary estimates of recharge for the entire valley. A local overdraft in the area of concentrated pumping and a potential overdraft for the entire valley was suspected. Furthermore, continued lowering of the water level by depletion of water from storage might induce underflow of poor quality from beneath the playa into the area of development. Therefore, the principal purposes of this report are: (1) to reappraise the hydrology of the valley with special emphasis upon the initial effects of the present (1965) development; (2) to predict the possible future effects of this development; (3) to appraise the chemical quality of the water to provide a basis for comparison in the future; and (4) to evaluate the structural basin and associated carbonate-rock aquifers to determine the outer hydraulic boundaries of the valley.

To accomplish these objectives, this report includes: (1) a reappraisal of the main elements of the natural hydrologic system, including precipitation, recharge, interbasin flow, and natural discharge; (2) an estimate of the average annual surface-water inflow to the valley and its distribution within the valley; (3) a description of the ground-water reservoir; (4) an estimate of the magnitude of depletion of ground water in storage; (5) estimates of pumpage, ground-water yield, possible overdraft, and effects of future development; and (6) an analysis of the chemical quality of the ground water to establish a base for comparing changes in salt balance that probably will occur in the future.

Field work began in April 1964 when 14 small-diameter test wells were drilled in undeveloped parts of the valley. Water-level measurements of selected wells were made in October 1964 and in April 1965. Intensive field work began in August 1965 and was completed by July 1966. This work consisted of canvassing all wells in the area, measuring the water levels in wells after the 1965 irrigation season and before the 1966 season, making pumping tests on wells, estimating the annual pumpage, measuring discharges of major springs

and flowing wells, and inventorying the chemical quality of the water. Surface-water inflow to the valley was estimated from periodic streamflow measurements made during the course of this study.

This reevaluation is consistent with the objectives of the long-range cooperative program (Shamberger, 1962, p. 14) for the orderly study of the water resources of Nevada which provides for additional detailed studies in areas where moderate to substantial development has occurred and where records are available through a continuing inventory over a prolonged period of time.

Location and General Features

Location and Areal Extent

Diamond Valley is an intermountain valley in east-central Nevada. It lies within an area bounded by lat 39°27' and 40°15' N. and long 115°47' and 116°12' W. Most of the valley is in Eureka County; however, the north end extends about 8 miles into the southwestern part of Elko County (fig. 1). It is roughly elliptical in shape, the long axis extending about 56 miles from Prospect Peak at the southern end to Bailey Mountain at the northern end. The maximum width is approximately 20 miles at the latitude of T. 22 N. and the average width is about 12 miles. The total area of the drainage basin is about 735 square miles.

The area is bounded on the east by the Diamond Mountains and on the west by the Sulphur Spring Range, Whistler Mountain, and the Mountain Boy Range (pl. 1). The southern boundary is formed by the Fish Creek Range and the northern boundary by the Diamond Hills. These surface boundaries form a closed basin except for Devils Gate, which is a topographic low between Whistler Mountain and the Mountain Boy Range and which permits surface and subsurface inflow from Antelope, Kobeh, and Monitor Valleys.

Garden Valley is about 22 miles long, 5 to 6 miles wide, and is on the west flank of the Sulphur Spring Range at the southeast end of Pine Valley. It is separated from Pine Valley by the Roberts Mountains and Table Mountain and surficially drains into Pine Valley through two topographic lows at the southern end of Table Mountain.

The lowest part of Diamond Valley, altitude about 5,770 feet, is the playa which covers most of the northern part of the valley floor. Southward from the playa the valley floor rises at a gradient of about 9 feet per mile. Areas at altitudes above 9,000 feet are found only in the Fish Creek Range and Diamond Mountains. The highest point is South Diamond Peak, in the Diamond Mountains, at an altitude of 10,614 feet.

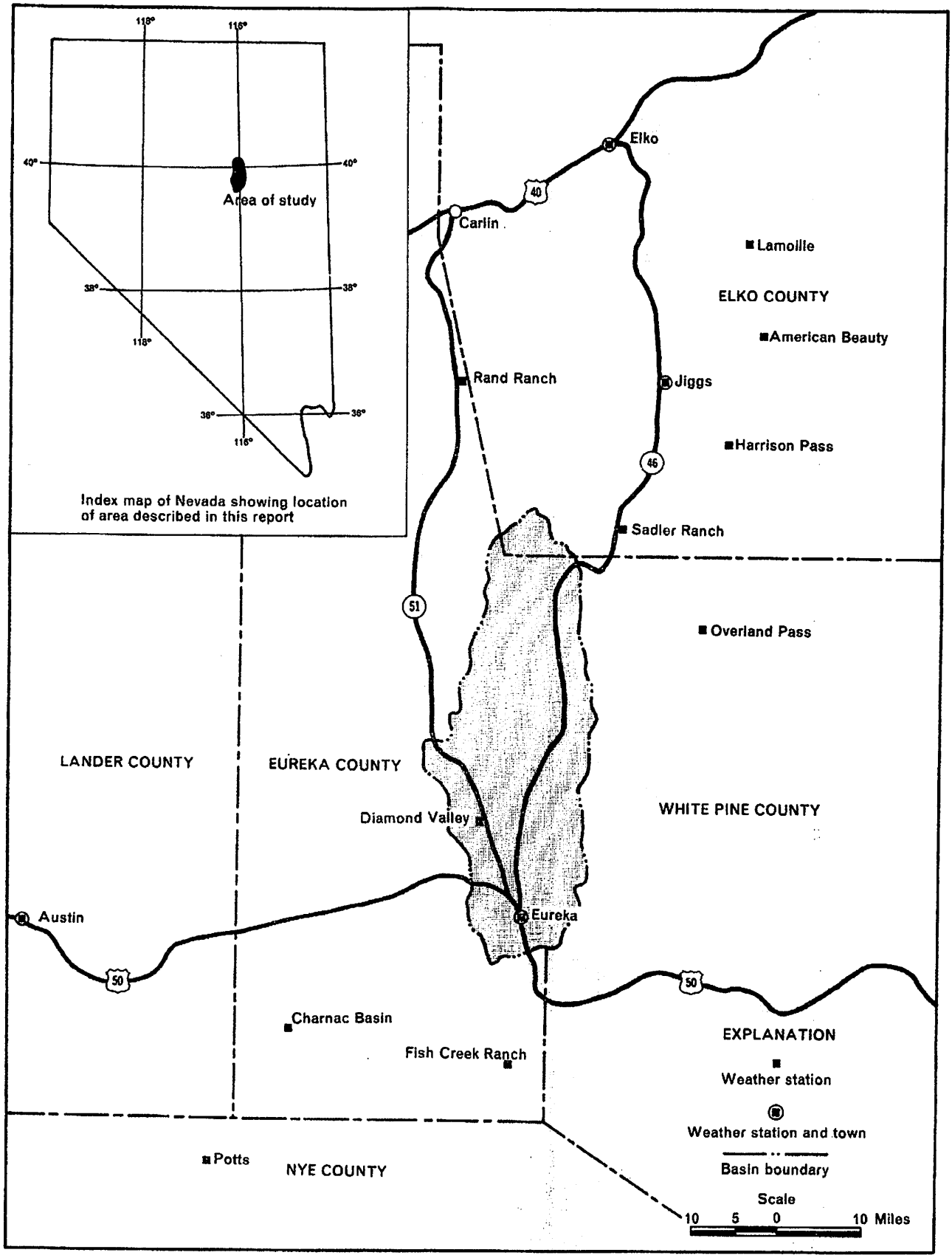


Figure 1.—Location of area, principal communities and weather stations

Eureka, population 605 (Nevada Dept. of Economic Development, 1965 estimate), is the only town in the area and is the county seat of Eureka County. It is in the southern end of the valley on the lower slopes of the Fish Creek Range. U. S. Highway 50 crosses the southern part of the valley and passes through Eureka. State Highway 51 joins U. S. Highway 50 about 3 miles northwest of Eureka and traverses part of the west side of the valley. It leaves the area at Garden Pass and extends northward to U. S. Highway 40 at Carlin (fig. 1). State Highway 46, a graded and gravel road, originates in Eureka, traverses the east side of the valley, and leaves the area at Railroad Pass; from there it extends northward through Huntington Valley and connects with U. S. Highway 40 at Elko. The remainder of the valley floor is traversed by graded and gravel roads. Graded roads have been constructed along most section lines in developed areas and permit access in all but the most severe weather. The nearest rail connections are at Ely, about 76 miles east of Eureka, and at Carlin and Elko, about 100 miles north of Eureka.

Subareas

For the purpose of this report, the valley has been divided into the South Diamond and the North Diamond subareas. The subareas are shown on plate 1. The South Diamond subarea lies south of the cross-valley road from Sulphur Springs to Thompson Ranch in T. 23 N., R. 54 E. It has a total area of about 276,000 acres and contains the area of major ground-water development. The North Diamond subarea lies north of the above described cross-valley road. It has a total area of about 194,000 acres and contains all but a small part of the area of natural discharge. The west side of this subarea is characterized by a large volume of spring discharge.

Economic Development

Diamond Valley has developed into a major agricultural area; however, the area was developed initially to exploit the mineral resources of the Eureka district. The first ore was discovered in 1864, a few miles southwest of the present town of Eureka. In 1869 rich ore bodies were discovered in Ruby Hill, and Eureka developed into a prosperous mining district. Mining activity continued to increase steadily, and by 1880 the Eureka district, according to Hague (1892, p. 6), was the most successful in the State at that time. During the period 1871-80, the town of Eureka had a population in excess of 9,000 (Myrick, 1962, p. 91). The total value of lead and silver produced up to 1959 was approximately 122 million dollars (Nolan, 1962, p. 57), most of which was produced in the period 1871-80. In 1880 the major ore bodies in Ruby Hill were apparently bottomed. Production continued on a reduced scale and no new discoveries were made until 1940, when ore was found in the hanging-wall side of the Ruby Hill fault.

A new shaft, the Fad, was started in 1941 to exploit the newly discovered ore. Development was interrupted by the war, but in 1948 when the shaft had reached a depth of 2,465 feet, a large flow of water was encountered in the 2,250-foot level drift. This resulted in a flooding problem which was not economically solved for many years. About 5,000 acre-feet of water was pumped from the shaft during the period from March 1948 to December 1948 (Stuart, 1955, p. 2), in an unsuccessful attempt to dewater the shaft. Most of the pumped water recharged the valley-fill reservoir by infiltration through relatively permeable alluvial deposits. Until the water problem was solved, exploratory work was concentrated in the region north of the Fad shaft. The T. L. shaft, approximately 1.1 miles northwest of the Fad shaft, was constructed in 1954. It was sunk to a depth of 1,034 feet and was operated until 1958 when it closed for economic reasons. At the present time, grouting the major water-bearing formations has permitted the Fad shaft to be dewatered with relatively small pumping rates. Pumped water currently is run either into the Locan or T. L. shafts. At the end of 1965 a sampling and exploration program was terminated and operations weretemporarily suspended, pending the completion of metallurgical tests.

The first agricultural development in the valley was associated with the raising of livestock. Initial development consisted of no more than systems of ditches to distribute the available water. Meadows of native grasses were sustained by surface-water runoff in the lower parts of some canyons and by spring discharge along the sides of the valley. Ranching operations consequently were established in those areas.

Spring discharge along the west side of the valley was supplemented by the drilling of flowing wells on the Romano Ranch in 1948 and the Flynn Ranch in 1949.

The first ground-water development in the South Diamond subarea was attempted in 1949, when two wells were drilled on the east side of the valley. From 1950 to 1958 a few wells were drilled each year, then in 1958 renewed effort was made to develop land for irrigation. In 1961 an estimated 85 wells were completed (Eakin, 1962, p. 29). By 1965 more than 200 irrigation wells had been drilled; however, probably not more than 80 have been pumped during any single growing season. The maximum use of land probably will not occur for several more years.

Previous Studies

The geology of the Eureka Mining District has been the subject of much detailed study. Early investigators, King (1878), Hague (1883, 1892), and Walcott (1884), described a stratigraphic section from locations in the vicinity of the Eureka district which was long used as a

standard for the central Great Basin. The economic aspects of the area were described by Curtis (1884) and Emmons (1910).

Detailed studies and subsequent revisions of small parts of the section were made by Walcott (1908a, b, 1923), Wheeler and Lemmon (1939), Gianella (1946), Sharp (1947), and Easton and others (1953). However, the most comprehensive and detailed study of the stratigraphic section in the vicinity of Eureka has been reported by Nolan, Merriam, and Williams (1956). A detailed study, which summarizes the geology of the Eureka Mining District, was made by Nolan (1962). Merriam (1963) described the Paleozoic rocks of Antelope Valley.

A preliminary geologic map of Eureka County, scale 1:200,000, was compiled by Lehner, Tagg, Bell, and Roberts (1961), and a preliminary geologic map of the Diamond Springs Quadrangle, scale 1:62,500, was made by Larsen and Riva (1963). A geologic map, scale 1:12,000, is included in Nolan's study of the Eureka Mining District (1962). Mabey (1964) made a gravity survey of Eureka County and adjoining areas.

Interest in possible oil development has led to the drilling of two exploratory wells in Diamond Valley. In 1954, a 1,072-foot well was drilled by the Diamond Oil Corp. in sec. 15, T. 26 N., R. 54 E., and in 1956 the Shell Oil Company drilled an exploratory well to a depth of 8,042 feet in sec. 30, T. 23 N., R. 54 E.

The first hydrologic studies made in the area were concerned with mine drainage. A general description of the drainage problem was given by Mitchell (1953). Stuart (1955) described the results of a pumping test of the Fad shaft which was made in 1952; at that time Stuart and Metzger also made a general study of the region to assist in evaluating the problem.

A reconnaissance of the ground-water resources of Diamond Valley was made by Eakin (1962); it is the only study which gives a preliminary evaluation of the hydrology of the entire valley. The hydrology of areas adjacent to Diamond Valley has been studied at reconnaissance level by Eakin (1960, 1961) and by Rush and Everett (1964, 1966a, b).

Climate

The climate in Diamond Valley is similar to that of most valleys in east-central Nevada. Air masses which move eastward across Nevada are generally deficient in moisture. Areas at low elevations commonly receive less moisture than areas at higher elevations. This results in semiarid conditions in the valleys and subhumid conditions in the surrounding mountains. Winter precipitation generally falls as snow from

regional storms, whereas summer precipitation is localized as thunderstorms of short duration and high intensity.

Table 1 lists the average monthly and annual precipitation, in inches, at 14 stations in central Nevada. Eureka and Diamond Valley are the only stations within the area of study. At Eureka, the maximum annual precipitation, 20.64 inches, occurred in 1907; the minimum, 6.13 inches, occurred in 1928. The record at Diamond Valley is too short and incomplete to provide a valid average. Data available suggests that the average annual precipitation on the valley floor is several inches less than at Eureka, possibly about 8 inches.

Temperature is subject to large daily and seasonal variations. Summer days generally are hot and nights cold. Freezing temperatures have been recorded at Eureka in every month of the year. Winters normally are severe. The average annual temperature at Eureka for the period 1953 to 1959 is 46°F. Short-term records at Diamond Valley suggest that the average temperature there throughout most of the year is several degrees lower than at Eureka. Additional information on precipitation is given in the section on recharge. The effects of thermal inversion on the growing season in the South Diamond subarea are discussed in the section on growing season.

Acknowledgments

Acknowledgment is made of the cooperation of the local residents of the valley in supplying data and permitting use of their wells for pumping tests and water-level observations during the course of this investigation. The writer is grateful for the wholehearted assistance received from Federal, State, and local governmental agencies. Most of the drillers' logs and other pertinent data on well construction used in this investigation were furnished by the Nevada State Engineer.

Mr. Ivan B. Jones, assistant County Agent, of Eureka and White Pine Counties, furnished records of crop acreages. Data on the status of privately owned lands were made available by the U. S. Bureau of Land Management. Lithologic and electric logs of Shell Oil Company tests, Diamond Valley No. 1, were provided by Mr. Robert Horton formerly of the Nevada Bureau of Mines.

Table 1.--Average monthly and annual precipitation, in inches, at 14 stations in central Nevada

[From published records of the U.S. Weather Bureau]

Location[1]	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1 Elko	1.23	0.96	0.92	0.70	0.86	0.68	0.35	0.28	0.33	0.66	0.76	1.06	8.7
2 Lamoille	1.42	1.60	1.94	2.40	2.29	1.42	.66	.57	.77	1.44	1.37	1.50	17.3
3 American Beauty	--	--	--	--	--	--	--	--	--	--	--	--	21.5
4 Rand Ranch	.75	.96	.98	1.02	1.30	1.11	.28	.47	.48	.68	.94	.94	9.9
5 Jiggs	1.01	.89	1.14	1.27	1.60	.90	.41	.50	.53	.82	.90	1.14	11.1
6 Harrison Pass	1.95	1.73	1.84	2.12	2.13	1.26	.63	.65	.68	.91	1.36	2.11	17.3
7 Sadler Ranch	--	--	--	--	--	--	--	--	--	--	--	--	7.9
8 Overland Pass	--	--	--	--	--	--	--	--	--	--	--	--	10.2
9 Diamond Valley	--	--	--	--	--	--	--	--	--	--	--	--	7.4
10 Eureka	.87	.86	.90	1.60	1.14	1.29	.74	1.57	.76	.56	1.15	1.34	12.7
11 Austin	1.13	1.05	1.47	1.57	1.46	.79	.55	.53	.49	.84	.80	.90	11.5
12 Charnac Basin	.92	1.46	1.12	1.24	2.02	.66	.41	.66	.63	.62	1.04	.83	11.6
13 Fish Creek Ranch	.44	.32	.53	.51	.62	.34	.55	.48	.53	.33	.59	.50	5.7
14 Potts	.56	.66	.74	.72	.95	.36	.51	.44	.27	.33	.37	.42	6.33

1. Stations listed according to geographic location, from north to south, and locations shown on figure 1.

	Altitude	Location: Section	Township	Range	Period of record	Remarks
1	5,047	16	34 N.	55 E.	95 years, 1870-1964	
2	6,260	6	32 N.	58 E.	54 years, 1911-64	
3	8,000	33	31 N.	58 E.	4 years, 1959-62	Storage gage
4	5,047	33	30 N.	52 E.	9 years, 1957-65	
5	5,465	34	30 N.	56 E.	21 years, 1945-65	
6	7,300	2	28 N.	57 E.	14 years, 1951-64	Storage gage, records prorated monthly
7	5,690	26	27 N.	55 E.	16 years, 1950-65	Storage gage
8	6,789	29	25 N.	57 E.	16 years, 1950-65	Storage gage
9	5,850	18	21 N.	53 E.	3 years, 1963-65	Poor record, best available values within the area
10	6,540	13	19 N.	53 E.	20 years, 1922-30, 1939-42, 1953-59, 1965	
11	6,594	19	19 N.	44 E.	73 years, 1890-98, 1900-1908, 1911-64	
12	8,500	20	17 N.	49 E.	7 years, 1955-61	Storage gage, records prorated monthly
13	6,050	10	16 N.	53 E.	19 years, 1944-62	
14	6,635	35	15 N.	47 E.	28 years, 1892-1919	

GENERALIZED GEOLOGY

Physiography

The landforms in Diamond Valley are typical of those which occur in the Great Basin. The valley is a structural depression which is partly filled by unconsolidated and semiconsolidated lacustrine and subareal deposits. Physiographically, the valley may be divided into three parts, the mountains, the alluvial apron, and the playa. The alluvial apron and playa together form the valley floor. Pleistocene lake features have been developed largely on the alluvial apron.

Mountains

The mountains that border Diamond Valley are composed principally of complexly faulted and folded Paleozoic sedimentary rocks (pl. 1). The overall size and shape of the mountains is the result of regional uplift and warping associated with normal faulting. The complex internal structures have had little control over the gross topographic features; however, the effects of internal structures may be pronounced in certain areas, and fault scarps and ridges formed by relatively resistant beds are locally prominent. The mountains are areas of active erosion and are generally deeply dissected. This dissection is prominent in the Diamond Mountains. Areas underlain by volcanic rocks typically have smooth convex upper surfaces and steep talus-covered slopes.

Alluvial Apron

The alluvial apron is the area of intermediate slope between the mountains and the comparatively flat playa. The apron generally is composed of coalescing alluvial fans but may also contain pediments, or areas in which the bedrock is covered by a thin sheet of alluvium.

The slopes on the alluvial apron decrease from about 100 feet per mile near the mountain fronts to only a few feet per mile near the playa. Local relief may be as much as 25 feet, due principally to stream entrenchment on the higher slopes and bars, spits, and beach deposits on intermediate and lower slopes.

Lake Features

During Pleistocene and possibly earlier time, a large lake occupied Diamond Valley. In Pleistocene time the level of the lake fluctuated between the present level of the playa (altitude 5,770 feet) and the outlet level at Railroad Pass (altitude approximately 6,040 feet). The material near the shore was reworked by the action of waves and nearshore currents. In places where the shoreline extended

onto the alluvial apron, terraces, cliffs, bars, spits, and beaches were formed upon the then-existing alluvial fans and pediments.

At the north end of the valley a series of beaches, terraces, cliffs, and spits are prominent between altitudes of 5,860 and 6,040 feet. The altitude of the highest terrace is the same as that of the outlet altitude in Railroad Pass, approximately 6,040 feet. Subsequent erosion has lowered the altitude of the pass to 5,895 feet.

Lake features are best preserved along the west side and at the north end of the valley; however, shoreline features may be observed along the east side. Many lacustrine features have been destroyed by the action of recent intermittent streams.

Playa

The playa occupies the northern part of the valley floor. Its surface is nearly flat, and it covers an area of about 50,000 acres (pl. 1). Fine-grained wind-blown material from the playa and lower slopes of the alluvial apron form low dunes locally along the margins of the playa.

Principal Lithologic Units

For the purposes of this report, the lithologic units in Diamond Valley are divided into two major groups on the basis of their hydrologic properties: (1) unconsolidated deposits which form the valley fill, are highly porous, and commonly transmit water readily; and (2) consolidated rocks which occur in the mountains and at depth beneath the valley fill, commonly have low porosities and permeabilities and, except for certain carbonate rocks, do not readily transmit appreciable quantities of water.

Six principal lithologic units used in this report are presented in table 2, which was compiled largely from the work of Nolan (1962); Nolan, Merriam, and Williams (1956); Merriam (1963); Lehner, Tagg, Bell, and Roberts (1961); Larson and Riva (1963); Merriam and Anderson (1942); and Stuart and Metzger (written commun., 1961). The six units are carbonate sedimentary rocks, clastic sedimentary rocks, granitic rocks, volcanic rocks, older alluvium, younger alluvium, and playa deposits. Distribution of the units, listed in table 2, is shown on plate 1.

Table 2.--Principal lithologic units in Diamond Valley

Age		Unit designation		Thickness	Lithology and geologic formations	Occurrence	General hydrologic properties
QUATERNARY	Pleistocene and Recent	VALLEY FILL	Playa deposits	0 to 100±[a]	Silt, clay, and evaporites. Includes some dune sand.	Occurs beneath playa in north-central Diamond Valley.	High interstitial porosity and low permeability.
			Younger alluvium	0 to 200±	Unconsolidated alluvial and colluvial deposits of interbedded sand, gravel, silt, and clay. Materials generally moderately to well sorted and form lenticular bodies.	Occurs primarily as Lake Diamond and associated deposits. Includes some slope wash, flood-plain, and channel deposits formed during and after the lake receded. Fine-grained, lake-bottom deposits predominate near the center of the valley; coarse-grained beach-gravel and bar deposits predominate along edges and southern end of valley.	Sand and gravel deposits highly permeable and capable of yielding large quantities of water to wells. Buried beach gravels are the highest yielding deposits of the valley fill. Lake-bottom deposits of fine-grained sand, silt, and clay are less capable of yielding water to wells.
	Pleistocene		Older alluvium	0 to 1500±[b]	Alluvial and colluvial deposits of sand, gravel, silt, and clay. Materials range from well sorted to poorly sorted. Partially consolidated (cemented) in localized areas and at depth. Deposits at depth in the center of the valley generally moderately to well sorted.	Occurs principally as alluvial-fan deposits, also slope wash, talus deposits, upland alluvial surfaces, and high-level shore-line deposits. Locally includes some surficial recent alluvial-fan deposits and channel deposits. Fan deposits locally have been uplifted, faulted, dissected by erosion, and marked by shore-line features of various lake stages. Occurs at depth in the center of the valley as lake deposits which overlie valley-fill deposits of Tertiary age.	Permeability ranges from low to high. Zone of high permeability generally associated with buried channel deposits.
TERTIARY and QUATERNARY		CONSOLIDATED ROCKS	Volcanic rocks undivided	0 to 700+ exposed	Flows, dikes, sills, and small plugs of andesite, basalt, rhyolite, and rhyolitic tuff.	Northeast end of Fish Creek Range, northeast flank Sulphur Spring Range, Table Mountain.	Commonly have little or no interstitial porosity; may transmit small amounts of water through joints and zones between flows.
CRETACEOUS and TERTIARY			Granitic rocks	--	Alaskite stock, quartz diorite plugs, quartz porphyry sills and dikes.	Stock forms Whistler Mountain, plugs at north end of Ruby Hill and in northern Diamond Mountains.	Virtually no interstitial porosity and permeability; may transmit small amounts of water through near-surface fractures and weathered zones.
CAMBRIAN TO CRETACEOUS			Clastic sedimentary rocks	9,000±[c]	Primarily sandstone, quartzite, shale, or conglomerate. Includes: Prospect Mountain quartzite; Pioche Shale; Secret Canyon Shale; Dunderberg Shale; Vinini Formation; Eureka Quartzite; Pilot Shale; Chainman Shale; Diamond Peak Formation; Carbon Ridge Formation; Garden Valley Formation; and Newark Canyon Formation.	Exposed in parts of the Diamond Mountains, Fish Creek Range, Mountain Boy Range, Sulphur Springs Range, and Roberts Mountains.	Do not readily transmit water, except in areas of intense structural deformation where some water may be transmitted along fractures.
CAMBRIAN TO PENNSYLVANIAN			Carbonate sedimentary rocks	14,000±[c]	Primarily limestone or dolomite with some interbedded sand and shale. Includes: Eldorado Dolomite; Geddes Limestone; Hamburg Dolomite; Windfall Formation; Pogonip Group; Hanson Creek Formation; Roberts Mountains Formation; Lone Mountain Dolomite; Nevada Formation; Devils Gate Limestone; Joana Limestone, and Ely Limestone.	Principal exposures in Sulphur Springs Range, Fish Creek Range, Mountain Boy Range, and west flank Diamond Mountains in Tps. 21 and 22 N.	Some carbonate rocks readily transmit water through fractures and solution openings.

a. May overlie older playa deposits of indeterminate thickness.
b. 1500 feet in total thickness of unconsolidated or poorly indurated material logged in the upper portion of the valley fill in the Shell Oil test hole (sec. 30, T. 23 N., R. 54 E.).
c. Aggregate thickness

VALLEY-FILL RESERVOIR

The valley-fill ground-water reservoir is formed by the older and younger alluvium and the playa deposits which fill the structural depression underlying Diamond Valley (pl. 1). This reservoir is the most feasible source for the extensive development of ground-water supplies. Therefore, the hydrology of the basin is discussed in terms of its relationship to the valley-fill reservoir.

Extent and Boundaries

The valley-fill reservoir is approximately 45 miles long, 6 to 12 miles wide, and has a surface area of about 410 square miles. The bedrock surfaces of the adjacent mountain blocks and their subsurface extensions form the lateral and bottom boundaries of the valley-fill reservoir.

The exact configuration of the reservoir is not known. However, several generalizations as to the overall size and shape of the reservoir may be made on the basis of gravity data (Mabey, 1964) and information from an oil-test hole (Shell Diamond Valley No. 1, drilled in 1956).

A large gravity low underlies Diamond Valley. It is measured by the differences between the densities of the valley-fill material (2.2 to 2.5 g per cm^3) and those of the consolidated rocks of the mountain blocks (2.6 to 2.7 g per cm^3). The magnitude of the low is a rough indication of the thickness of fill. The low generally conforms with the elliptical shape of the valley; however, the largest values (maximum residual relief of about 40 mgals) are east of the center of the valley, suggesting that the fill is thickest there. Approximately 7,485 feet of the valley fill was logged in the Shell Oil test hole (sec. 30, T. 23N., R. 54 E.), and Mabey (1964) stated that the maximum thickness of fill probably is not much greater than this. Relatively permeable Pleistocene and Recent deposits form only the upper part (1,500± feet) of the valley fill. The remaining part is composed of Tertiary or older deposits.

The gravity gradient along the southwest margin of the valley from Devils Gate to Garden Pass is markedly less than it is along the margin of the valley in other areas. Merriam and Anderson (1942) reported that a pediment extends eastward from Whistler Mountain and the ridge to the north. In sec. 5, T. 20N., R. 53 E., small knolls of bedrock protrude through the valley fill. To the north, wells 21/53-18cc (depth 134 feet), 21/53-20cc (depth 150 feet), and 21/53-20db (depth 183 feet) were bottomed in "hard rock," presumed to be bedrock. Merriam and Anderson (1942, p. 1715) indicated that a small scarp, about a mile east of Whistler Mountain, may mark the east edge of the pediment. Thus, much of the valley fill between Whistler Mountain and Garden Pass, west of State Highway 20, is underlain by bedrock at fairly shallow depths; locally bedrock may extend east to the edge of the developed area.

Subsurface Distribution of Sand and Gravel in the South Diamond Subarea

Examination of drillers' logs of wells in the South Diamond subarea revealed that thick accumulations of sand and gravel are present in localized areas and that these deposits yield most of the water to wells. A knowledge of the overall distribution of sand and gravel therefore would provide generalized information about variations in the water-bearing properties of the valley fill.

Any information derived from well logs is subject to certain limitations. The major difficulty is the amount of interpretation involved. An initial interpretation is made when the driller logs the material which he has drilled. Most drillers are consistent in their descriptions and interpretations but when reports made by several drillers are compared some differences are apparent. An interpretation must then be made of the drillers' lithologic descriptions to reduce them to terms suitable for comparison and analysis. The interpretation used in this report is similar to that used by Bredehoeft (1963, p. 32) and is summarized in table 3. This interpretation necessarily is highly subjective, and although the results obtained from any one log may be slightly in error, the sum of all interpretations probably represents overall conditions with a reasonable degree of accuracy. This contention is supported by the fact that results obtained from logs of adjacent wells were in good agreement.

An analysis was made of the distribution of sand and gravel in the upper 100 feet of saturated valley fill (1965 data). The logs of 117 wells were used, selected on the basis of their location and clarity. For each well the percentage of sand and gravel within the upper 100 feet of saturation was determined and this value plotted on a map. Areas showing the percentage distribution of sand and gravel were then drawn, and the results are shown in figure 2. The same procedures were followed to ascertain the distribution for the upper 150 feet of valley fill, and nearly identical results were obtained for this partly saturated interval.

The areas in which a high percentage of sand and gravel is indicated roughly coincide with areas where well yields are large. A possible exception to this is at the extreme southwestern end of the valley where the yields of several wells are not as high as those of wells which have penetrated comparable thicknesses of sand and gravel in other parts of the valley. The sand and gravel deposits there are partly indurated (cemented) and are not as productive as the unconsolidated sand and gravel deposits to the north. A linear zone deficient in sand and gravel is near the east side of the valley (fig. 2). In most cases, suitable irrigation wells have been developed there; however, to obtain

Table 3.--Classes of material described in drillers' logs

Drillers' description	Geologic interpretation	Estimated composition	Percentage of sand, gravel or both
Gravel	Gravel	100% gravel	100
Sand and gravel	Interbedded layers of medium to coarse-grained sand and gravel	50% sand 50% gravel	100
Sand, gravel, and clay Gravel and clay, cemented gravel	(1) Pebbles in a matrix of sand, silt, and clay, matrix is indurated in the case of cemented gravel (2) Interbedded layers of sand, gravel, and clay	20% gravel 20% sand 60% silt and clay	40
Sand	Fine, medium, or coarse-grained sand	100% sand	100
Sand and clay, sandy clay	Interbedded layers of medium-grained sand, silt, and clay	30% sand 70% silt and clay	30
Clay, silt, mud, muck	Interbedded silt and clay in varying proportions	0 to 100% clay 0 to 100% silt	0

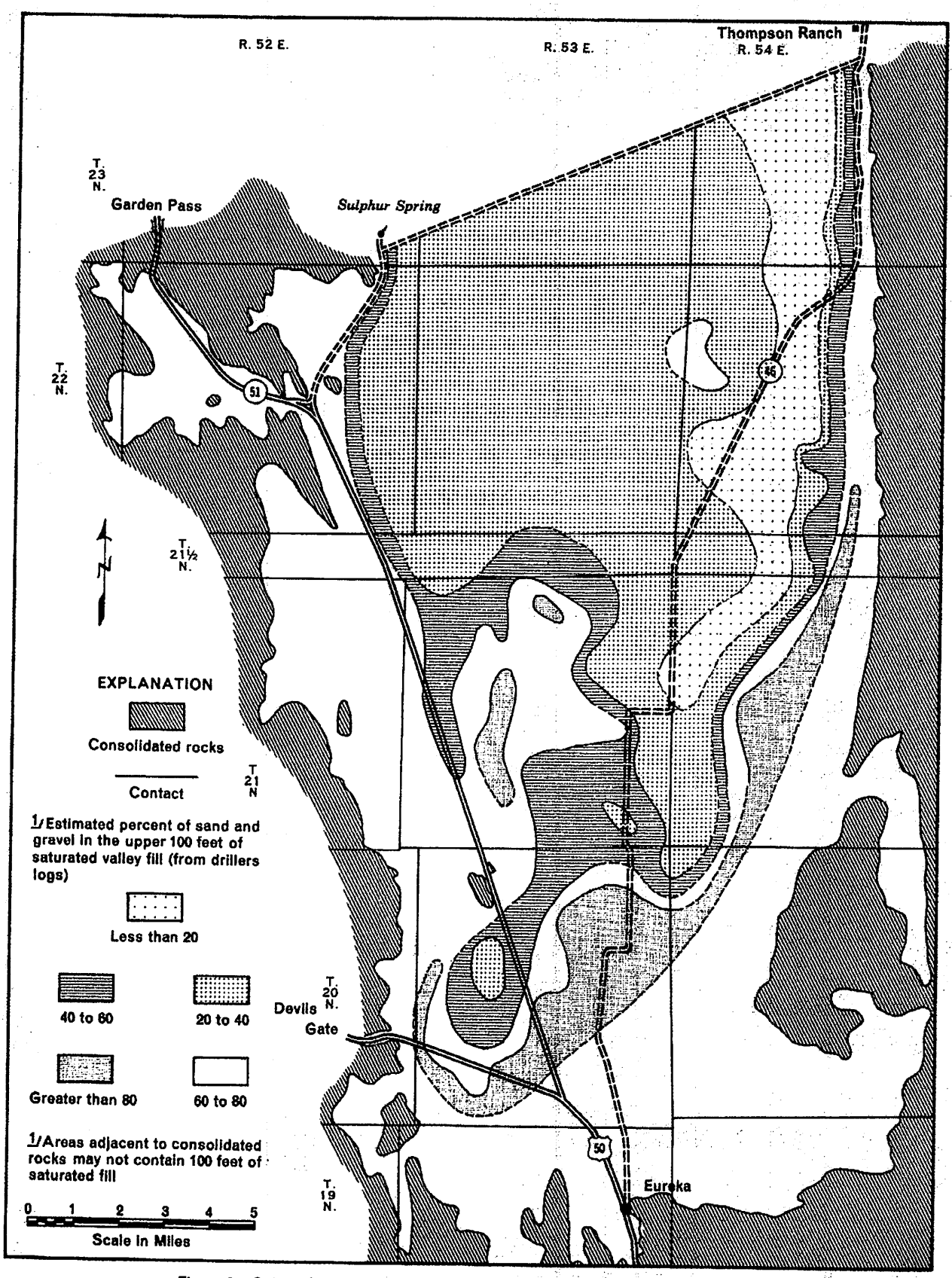


Figure 2.—Sub surface distribution of sand and gravel, South Diamond subarea

comparable yields they have had to penetrate a thicker section of saturated deposits than wells in adjacent areas.

Coefficients of Transmissibility and Storage

The coefficients of transmissibility, T, and storage, S, express the water-bearing properties of the valley fill. Transmissibility is a measure of the capability of an aquifer or reservoir system to transmit water. It is dependent upon the permeability of the material involved and the thickness of the aquifer. The coefficient of storage is a measure of the amount of water that will be released from storage, within a unit area, as water levels are lowered. These coefficients may be used in the construction of analog models, in the computation of drawdowns and storage changes caused by pumping, or in the determination of subsurface flow.

Coefficients of transmissibility may be estimated from specific capacities of wells, which are usually expressed as yield in gallons per minute per foot of drawdown. Properly designed wells in deposits with high transmissibilities have higher specific capacities than wells in deposits with low transmissibilities.

Six pumping tests of 40 to 90 minutes duration were made to determine representative values and ranges of transmissibility. The values of transmissibility determined ranged from 27,000 to 250,000 gpd (gallons per day) per foot. Transmissibilities were also estimated from about 84 commercially determined specific capacities. These values provide the basis for the approximate distribution of transmissibility in the South Diamond subarea shown in figure 3. The values shown are representative only of that thickness of the valley fill affected by pumping. As might be expected, the agreement between the distribution of sand and gravel (fig. 2) and transmissibility (fig. 3) is reasonably good; that is, the areas underlain by high percentages of sand and gravel generally are the areas of high transmissibility. In cases where deep circulation occurs, such as underflow toward the playa, the transmissibility may be greater than that shown in figure 3, because of the greater thickness of material involved.

Only one coefficient of storage was calculated. A value of .0002 was determined from observations made in well 21/53-15ac while well 21/53-15db was pumping. This artesian coefficient (value of less than .001) indicates that the horizontal permeability of the valley fill is much greater than the vertical permeability and that the flow system for short-term periods responds to pumping stress much like an artesian system. Over the long term, however, all deposits will drain slowly in response to pumping, and the coefficient of storage will be nearly equal to the specific yield. Thus, in analyzing long-term cause and effect relations, the valley-fill reservoir must be considered as a

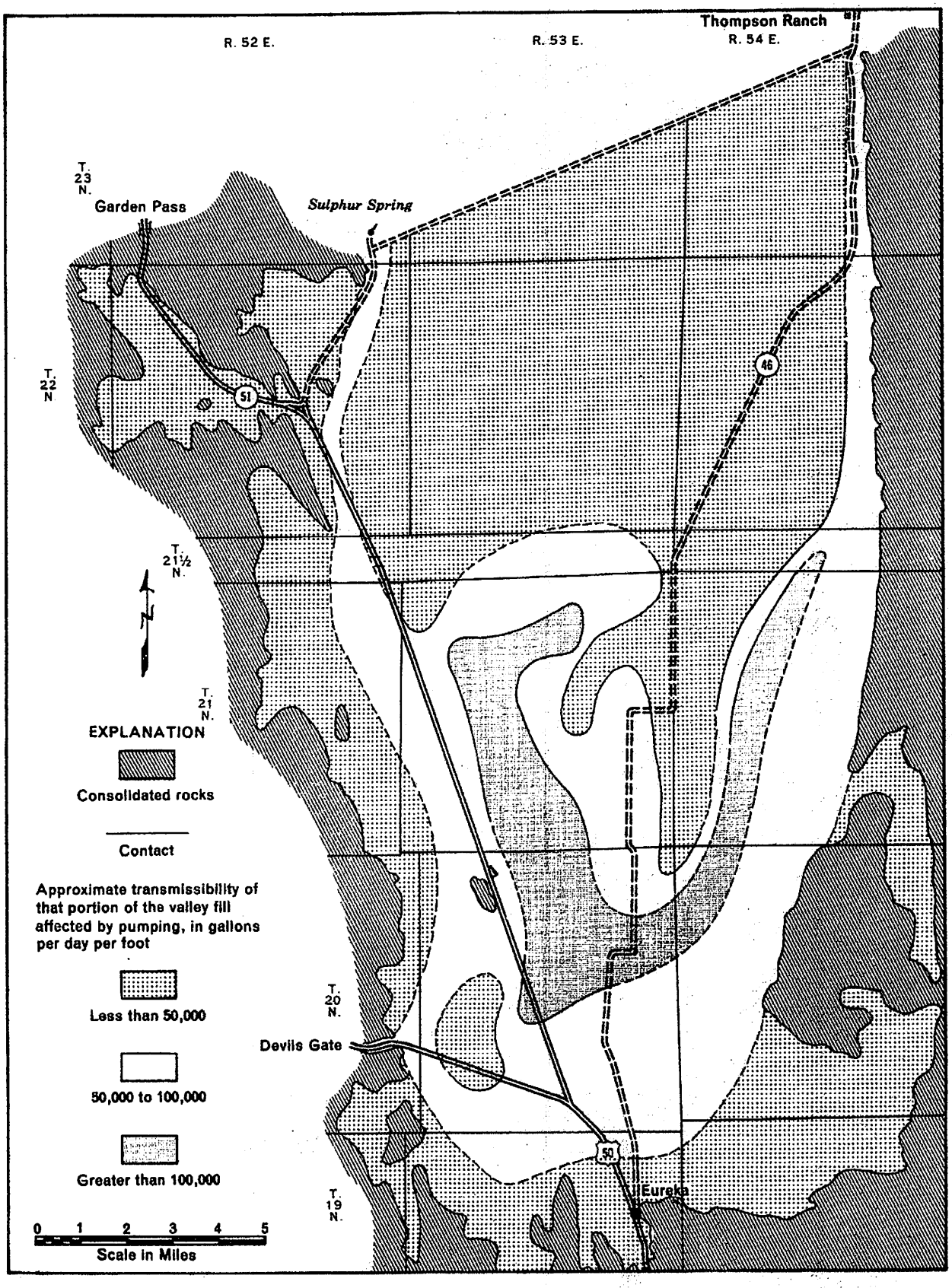


Figure 3.—Preliminary transmissibility map, South Diamond subarea

water-table system. Storage coefficients may be approximated from the specific yield values, as discussed later in the section on ground-water storage. (See fig. 7 and table 11.)

Source, Occurrence, and Movement of Ground Water

Ground water in the valley-fill reservoir is derived principally from the infiltration of precipitation that falls within the drainage basin. Other sources are: infiltration of surface-water inflow at Devils Gate, subsurface inflow at Devils Gate, and subsurface inflow of deep circulating ground water from the adjacent Garden Valley area.

Ground water occurs in the saturated part of the valley fill where it occupies the interstices or voids in the granular clastic deposits and chemical precipitates. It is present under both water-table and artesian conditions. Artesian conditions occur where the saturated permeable deposits are overlain by relatively impermeable strata and where the water at the top of the acquifer is under greater than atmospheric pressure. Water-table conditions exist where the saturated deposits are not confined by impermeable strata and where the water at the top of the zone of saturation, the water table, is under atmospheric pressure.

Artesian conditions were encountered in most of the irrigation wells drilled north of T. 22 N. In that area, the water level is noticeably higher in deeper wells. Springs and flowing wells are common along the west side of the North Diamond subarea where artesian conditions predominate. In T. 22 N. and to the south, artesian conditions exist where lenses of silt and clay confine the water in underlying deposits. The clay lenses are most extensive along the east side of the valley but locally are present in other parts of the area.

Ground water moves along the path of least resistance from areas of high hydraulic head to areas of lower hydraulic head. The rate of movement depends upon the hydraulic gradient and the permeability and porosity of the material through which water is moving. Typical rates range from several feet per year to several hundred feet per year.

The horizontal movement of ground water in the valley fill is parallel to the slope of the water surface. The slope of the water surface is indicated on plate 2, which shows contours of the altitude of the water levels in wells for the spring of 1950, prior to any extensive withdrawal of ground water by pumping. Therefore, the contours indicate the general direction of ground-water movement under natural conditions. The direction of movement is perpendicular to the contours. Ground water moves from areas of recharge in the mountains and borders of the valley floor toward the playa and surrounding phreatophyte-covered discharge areas in the north-central part of the valley where the altitudes are 5,770 feet or lower.

Water-level contours downgradient from Devils Gate suggest that recharge there is no greater than from adjacent areas (pl. 2).

Ground-water movement in the southern end of the valley-fill reservoir may have been affected locally by the large withdrawals from the Fad shaft. A localized trough or depression in water levels may have developed during initial periods of heavy pumping. Subsequent pumping in which water withdrawn from the Fad shaft was put down either the Locan or T. L. shafts probably has had little or no effect on ground-water movement in the developed area.

Figure 4 shows the approximate depth to water in the South Diamond subarea in the spring of 1966. In the heavily pumped area, nonpumping levels are between 35 and 120 feet below land surface. Most pumping levels in 1966 were 30 to 75 feet more than the "static" spring levels of 1966.

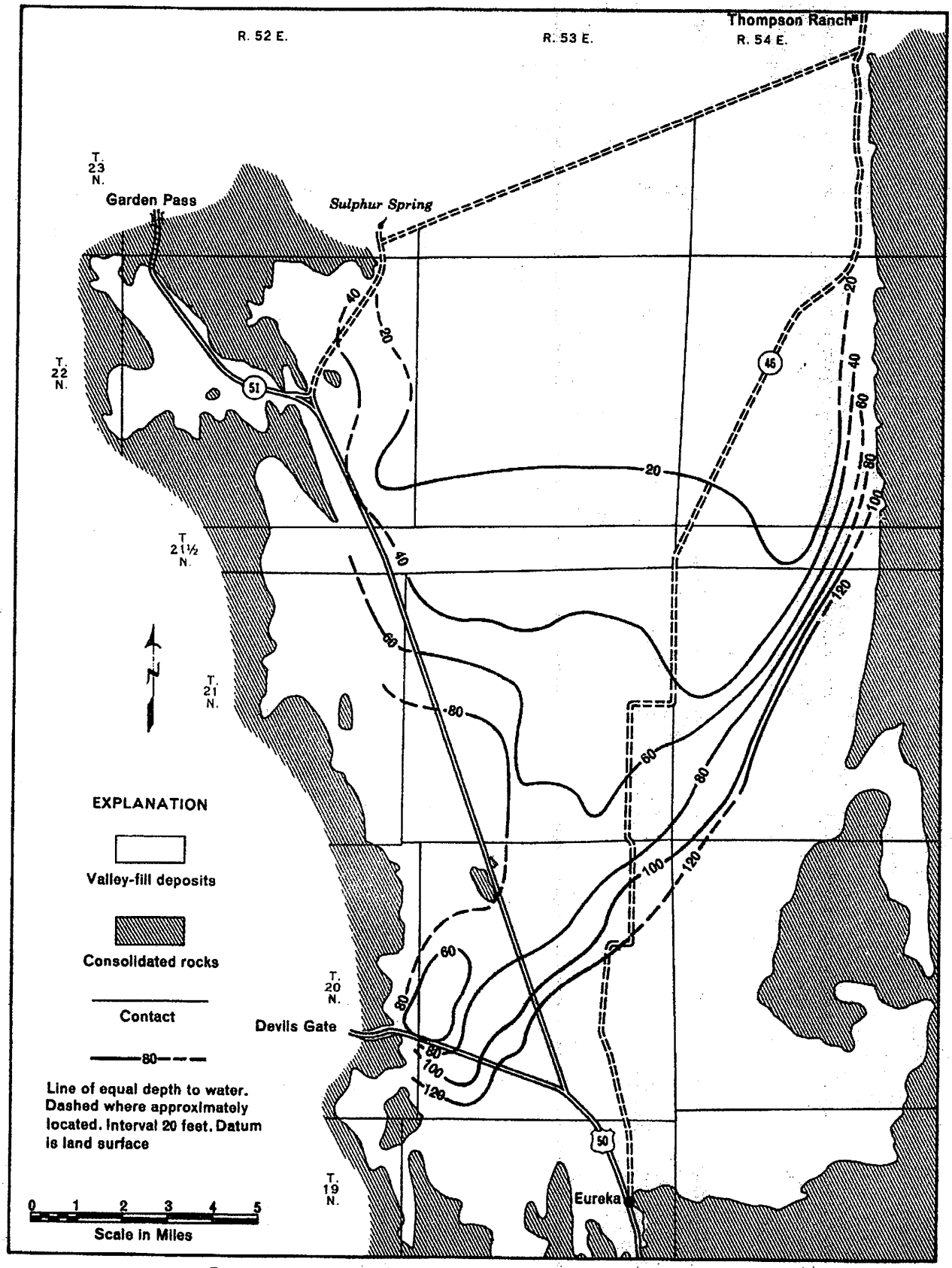


Figure 4.—Approximate depths to water April 1966, South Diamond subarea

INFLOW TO THE VALLEY-FILL RESERVOIR

Runoff

By

R. D. Lamke

The estimated average annual runoff within Diamond Valley is only 5,800 acre-feet. The methods and data used to calculate this value are briefly described below, and a general description of the streams in the valley is presented.

Only a few perennial streams occur in the valley, all of which are on the east side on the slopes of the Diamond Mountains. Cottonwood and Simpson Creeks are the two most prominent streams, and the only ones that support ranching operations. The only other streams with a seasonal snowmelt runoff of any significant volume are also in the Diamond Mountains. The remainder of the streams in Diamond Valley are ephemeral and have minor seasonal snowmelt runoff.

Most of the streams flow radially inward from the mountains toward the playa in the north-central part of the valley. Streams in the mountains are short, have well-formed channels, and generally have drainage areas of less than 10 square miles. The point of maximum streamflow occurs near the base of the mountains. Streamflow diminishes downslope on the alluvial apron because of increased infiltration, irrigation diversions, and evapotranspiration. Consequently, stream channels become poorly defined with increasing distance from the mountain front.

Measurements of streamflow and channel dimensions were obtained at 13 representative points, near the base of the mountains. Table 4 lists these points, shows the date and discharge of streamflow measurements, and estimated average annual streamflow; figure 5 shows the location of these points. Average annual flow for the ephemeral channels was estimated by a method developed by W. B. Langbein (oral commun., 1964) which is based on an empirical relation between average annual flow and channel geometry. Average annual flow for the perennial or seasonal snowmelt streams was determined by a method described by D. O. Moore (oral commun., 1965). Generally, the method relates a streamflow measurement or measurements at a miscellaneous-measurement site to long-term average flow for gaged sites on other comparable streams to obtain an estimate of average annual flow at the miscellaneous-measurement site. The measurements at the miscellaneous sites were adjusted to an average annual discharge value using three nearby long-term gaging station records: Cleve Creek near Ely (average discharge for 8 water years 1915, 1916, and 1960-65), Lamoille Creek near Lamoille (average discharge for 29 water years 1916-22, 1944-65), and Huntington

Table 4.--Selected streamflow data and estimated average annual streamflow at representative points

(Measuring points shown in fig. 5)

Map no.	Name	Location	Date	Discharge (cfs)	Average annual streamflow 1/ (acre-feet per year) (1)	(2)	(3)
1	Four-Mile Canyon	25/54-10ba	4- 1-66	dry	73	--	50
			10-19-66	dry			
2	Davis Canyon	25/54-28a	4- 1-66	dry	136	--	172
			10-19-66	dry			
3	Telegraph Canyon	23/54-2aa	5-13-65	0.24	--	75	113
			4- 1-66	dry			
			10-19-66	dry			
4	Homestead Canyon	22/54-12bd	5-13-65	0.39	84	121	98
			4- 1-66	0.06			
			5-17-66	0.02			
			6-27-66	0.02			
			10-19-66	0.01			
5	Green Canyon	21/54-11ba	5-13-65	dry	93	--	69
			3-31-66	dry			
			6-27-66	dry			
6	Pedrioli Creek	21/54-23cb	5-13-65	0.63	222	196	186
			9-21-65	dry			
			3-31-66	dry			
			6-27-66	dry			
7	Cottonwood Creek	20/54-10bd	5-13-65	1.75	--	439	433
			9-21-65	0.24			
			3-31-66	0.38			
			5-17-66	0.15			
			6-27-66	0.02			
			10-20-66	dry			
8	Hildebrand Canyon	20/54-9cc	5-13-65	0.41	--	150	237
			9-21-65	0.10			
			3-31-66	0.06			
			5-17-66	0.04			
			6-27-66	dry			
9	Torre Creek	20/54-21db	5-13-65	0.34	--	177	128
			9-21-65	0.16			
			3-31-66	0.16			
			5-17-66	0.08			
			6-27-66	0.05			
			10-20-66	0.01			

Table 4.--Continued

Map no.	Name	Location	Date	Discharge (cfs)	Average annual streamflow 1/ (acre-feet per year) (1)	(2)	(3)
10	Simpson Creek	19/54-16ba	5-13-65	0.47	--	267	267
			9-21-65	0.37			
			3-31-66	0.39			
			5-17-66	0.34			
			6-27-66	0.27			
			10-20-66	0.37			
11	Spring Valley Canyon	19/53-33ab	4- 1-66	dry	90	--	a 90
			6-25-66	dry			
12	Garden Pass Creek	22/52-22bb	3-31-66	dry	123	--	b108
			6-26-66	dry			
13	Unnamed	26/53-5ba	4- 1-66	dry	18	--	b 28
			10-19-66	dry			

1. Column notes:
   (1) Calculated from channel geometry.
   (2) Calculated from streamflow measurements.
   (3) Computed, using altitude-runoff relation (fig. 5).
      (a) Computed, using 25 percent of runoff values (see fig. 5).
      (b) Computed, using 75 percent of runoff values (see fig. 5).

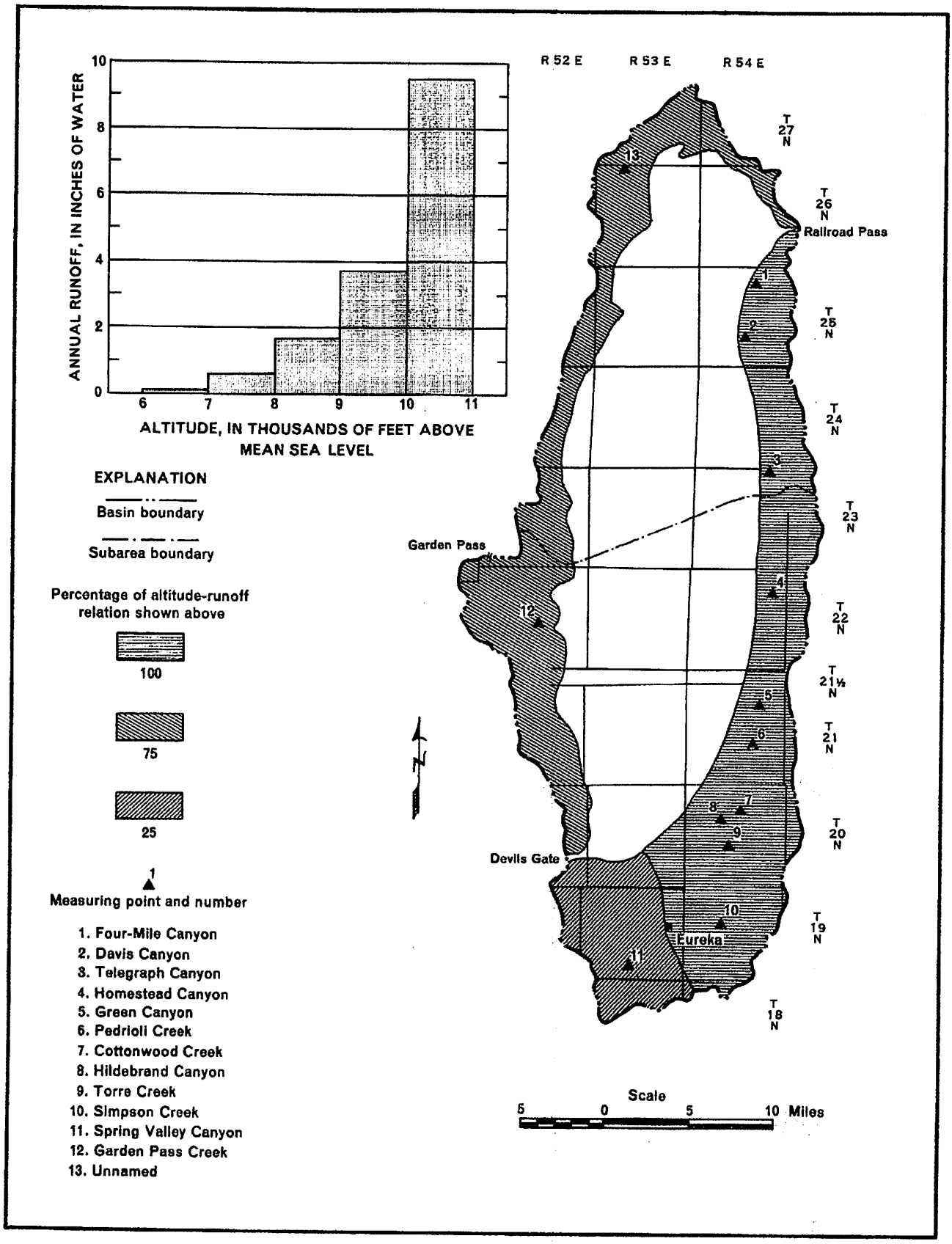


Figure 5.—Relation between runoff and altitude and map showing areas having similar runoff characteristics

Creek near Lee (average discharge for 17 water years 1949-65).

Streamflow data (numbers 1-10 in table 4 and fig. 5) were used to develop the relation between average annual runoff and altitude, shown in figure 5, applicable to the Diamond Mountains. The procedure used is described in detail by Riggs and Moore (1965, p. D199-D202). This runoff-altitude relationship for the Diamond Mountains was adjusted for other mountains around the valley on the basis of field observations of the physical and hydrologic characteristics of the mountains and average annual discharge figures obtained at three sites (numbers 11-13 in table 4 and fig. 5). From these data three areas having different runoff characteristics were identified and are shown in figure 5.

Table 5 shows the estimated average annual runoff for the North and South Diamond subareas, which totals 5,800 acre-feet, calculated from altitude-runoff relations. Average annual runoff of about 5,000 acre-feet occurs from the Diamond Mountains and about 800 acre-feet from the rest of the valley margins.

Inflow at Devils Gate

Water from Monitor, Antelope, and Kobeh Valleys enters Diamond Valley as surface and subsurface flow at Devils Gate. Surface flow is intermittent, most occurring in the early spring and usually diminishing to near zero by summer. The channel is dry during most summers, except for short periods of flow after summer storms. In very wet years, a small amount of flow may be maintained throughout the year. Recharge to the valley-fill reservoir from the infiltration of surface water occurs mainly during the spring runoff, because this is the only time during the year when an appreciable flow is maintained.

The estimated average annual surface-water inflow is 100 acre-feet per year, on the basis of channel-geometry measurements made by R. D. Lamke. Inflow during the spring of 1964, a high runoff year, is estimated to have been about 1,000 acre-feet, on the basis of measurements of 15 cfs (cubic feet per second) on April 14 and 21, an estimated flow of 2.5 cfs on May 19, and an estimated peak of 50 cfs on April 17 or 18. Inflow in the spring of 1965 and 1966 was negligible. These observations suggest that the long-term average inflow is on the same order of magnitude as the estimate obtained from channel geometry.

The alluvial deposits in the vicinity of Devils Gate are relatively permeable. Most of the inflow probably infiltrates to recharge the valley-fill reservoir.

Subsurface inflow is probably small. The canyon at Devils Gate is about 100 feet wide at its narrowest point on the surface, and probably less wide at depth. The fill in the canyon is estimated to be no greater

Table 5.--Estimated average annual runoff

Altitude zone (feet)	Area (acres)[1/]	Percentage of altitude-runoff relation (fig. 5)	Depth of runoff (feet) (fig. 5)	Average annual runoff (acre-feet per year) Subtotal[1/]	Total[1/]
		North Diamond Subarea			
9,000 to 10,000	110	100	.305		30
8,000 to 9,000	3,800	100	.136	520	
	190	75	.102	20	540
7,000 to 8,000	8,900	100	.045	400	
	5,600	75	.034	190	590
6,000 to 7,000	12,200	100	.006	70	
	35,500	75	.004	140	210
Subarea total (rounded)					1,400
		South Diamond Subarea			
Above 10,000	170	100	.792		130
9,000 to 10,000	1,900	100	.305	580	
	300	25	.076	20	600
8,000 to 9,000	10,400	100	.136	1,400	
	40	75	.102	trace	
	2,100	25	.034	70	1,500
7,000 to 8,000	31,700	100	.045	1,400	
	3,700	75	.034	130	
	10,600	25	.011	120	1,700
6,000 to 7,000	44,900	100	.006	270	
	33,600	75	.004	130	
	17,500	25	.001	20	420
Subarea total (rounded)					4,400

1. Units rounded to nearest ten below 1,000 units and to nearest hundred above 1,000 units.

than 100 feet thick. Assuming a hydraulic gradient of 10 feet per mile, the same as the land-surface gradient through Devils Gate, and a permeability of 2,000 gpd per square foot for the fill material in the canyon, the calculated subsurface inflow is less than 40 acre-feet per year.

Precipitation Within the Basin

Precipitation is the source of virtually all the water entering the hydrologic system in Diamond Valley. Of the precipitation that falls on the valley, part runs off, part is evaporated or transpired sometime after it enters the ground, and part ultimately recharges the ground-water system.

The average annual recharge to the valley-fill reservoir may be estimated as a percentage of the average annual precipitation within the basin (Eakin and others, 1951, p. 79-81). Hardman (1936) demonstrated that in gross aspect, the average annual precipitation in Nevada is related closely to the altitude of the land surface and that it can be estimated with a reasonable degree of accuracy by assigning precipitation rates to altitude zones. Thus, the recharge may be estimated as a percentage of the precipitation within each zone.

In Diamond Valley, for any specified altitude zone, precipitation is generally greater at the northern end of the valley than at the southern end. This statement is supported in part by data presented in table 1 and figure 6, which suggest a regional trend in the precipitation-altitude relationship, by field observations of vegetation, by the results of investigations in adjacent areas (Eakin, 1960, 1961; Rush and Everett, 1964, 1966a, b), and by the distribution of precipitation zones as shown on a Nevada precipitation map (Hardman, 1965).

The north-south division of precipitation zones shown in figure 6 affords only a rough approximation of the overall differences that exist in the precipitation-altitude relationship within the study area. It does no more than to equate the probable precipitation conditions at the north end of the valley with those believed to exist in the adjacent Pine and Huntington Valley areas and conditions at the southern end of the valley with those believed to exist in the adjacent Kobeh and Newark Valley areas. Significant differences also exist in the precipitation-altitude relationships for the east and west sides of the valley and those parts of the valley that are affected by a rain shadow from the Roberts Mountains; however, further refinement is not justified at this time because of the lack of precipitation data within the basin.

Estimates of recharge for Diamond Valley are summarized in table 6. Recharge from precipitation within the basin is approximately 21,000 acre-feet per year, or about 5 percent of the total estimated precipitation. This value is higher than the 16,000 acre-feet estimated by Eakin (1962) because of the north-south division of precipitation zones

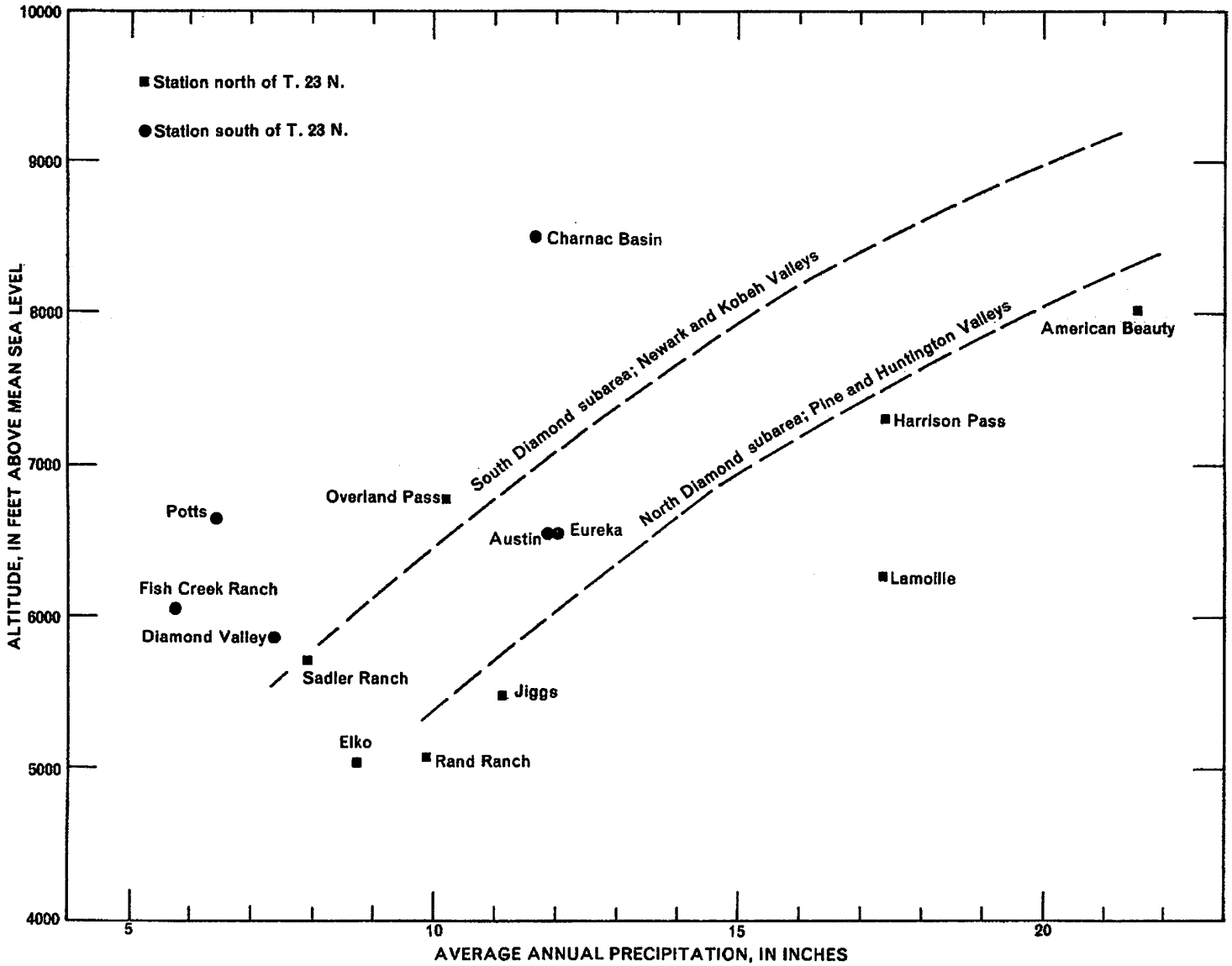


Figure 6.—Relation between precipitation and altitude

Table 6.--Estimated average annual precipitation and ground-water recharge from precipitation

Precipitation zone (feet)	Area (acres)	Estimated annual precipitation: Range (inches)	Average (feet)	Average (acre-feet)	Estimated recharge from precipitation: Percent of precipitation	Acre-feet per year
North Diamond Subarea						
Above 8,000	4,100	> 20	1.8	7,200	25	1,800
7,000 to 8,000	14,500	15 to 20	1.5	22,000	15	3,300
6,000 to 7,000	47,700	12 to 15	1.1	53,000	7	3,700
5,840 to 6,000 1/	9,200	8 to 12	.8	7,400	3	200
Below 6,000 or 5,840 2/	119,300	< 8	.6	71,000	0	--
Subtotal (rounded)	194,800			160,000		9,000
South Diamond Subarea						
Above 9,000	2,400	> 20	1.8	4,300	25	1,100
8,000 to 9,000	12,500	15 to 20	1.5	19,000	15	2,900
7,000 to 8,000	46,000	12 to 15	1.1	51,000	7	3,600
6,000 to 7,000 3/	197,500	8 to 12	.8	160,000	3	4,800
Below 6,000 4/	17,400	< 8	.6	10,000	0	--
Subtotal (rounded)	275,800			240,000		12,000
Total (rounded)	470,000			400,000		21,000

1. North of T. 25 N.
2. Below 5,840 north of T. 25 N.
   Below 6,000 south of T. 26 N.
3. Below 7,000 south of T. 23 N.
   6,000 to 7,000 in T. 23 N.
4. In T. 23 N.

used in this report. The estimated recharge appears high, however, when compared to the estimated runoff of only 5,800 acre-feet per year. If both estimates are reliable, they suggest that about one-fourth the recharge is derived from runoff and that most recharge from precipitation in the mountains moves to the valley-fill reservoir as underflow through carbonate rocks across the bedrock-alluvial contact.

Subsurface Inflow from Garden Valley

The valley-fill reservoir in the North Diamond subarea probably is recharged in part by interbasin flow from the adjacent Garden Valley (pl. 1). This was suggested by Eakin (1962, p. 21).

Moreover, in the Pine Valley study, which included Garden Valley, Eakin (1961) estimated that recharge exceeded the discharge by a substantial amount. The subsurface inflow may be substantiated only by indirect evidence, because no data are available concerning the eastward movement of ground water beneath the Sulphur Spring Range. In general, interbasin flow is possible only if a hydraulic gradient exists between basins and if the bedrock separating them is capable of transmitting water.

The altitude of the major springs along the west side of the North Diamond subarea is approximately 5,800 feet, whereas in Garden Valley, some 5 to 6 miles west, the altitude of the water table ranges from a low of 5,960 feet, where Garden Valley drains into Pine Valley, to more than 6,400 feet along the flood plain of Henderson Creek (pl. 2). Therefore, the potential hydraulic gradient from Garden Valley to Diamond Valley ranges from 25 to 120 feet per mile.

The Sulphur Spring Range is composed primarily of Paleozoic carbonate rocks (pl. 1). In Garden Valley these rocks are overthrust by shale and chert of the Ordovician Vinini Formation, but locally are exposed through windows in the nearly horizontal and presumably thin thrust plate. The Garden Valley Formation unconformably overlies parts of the thrust plate and forms a prominent ridge along the southeast margin of Garden Valley. Structures in the area are complex, and features formed during the thrusting and subsequent deposition of the Garden Valley Formation have been modified by periods of later normal faulting. Consequently, the rocks of all formations, depending upon local conditions, are fractured and brecciated to varying degrees.

The general hydrologic properties of the rocks are given in table 2 and are mentioned here only with respect to local conditions. Sequences of carbonate rocks are considered capable of transporting appreciable quantities of water through solution-enlarged fractures. The shale and chert of the Vinini Formation normally would present effective barriers to the movement of ground water. In the Sulphur Spring Range, however,

they are present in a relatively thin plate near the surface and have undergone a high degree of deformation. Therefore, they are considered capable locally of transmitting moderate quantities of water to underlying carbonate rocks. The sandstone and conglomerate beds of the Garden Valley Formation probably do not transmit water readily, except in areas where they have been highly fractured or brecciated.

In gross aspect, the bedrock separating the two basins is considered to be capable of transmitting appreciable subsurface flow. Movement would be complex, and local barriers, due to either structure or lithology, would be common. Deep circulation is suggested by the fact that most of the spring discharge in Diamond Valley is warm.

To estimate the quantity of water available for interbasin flow, a ground-water budget of the Garden Valley area was developed. Recharge was estimated in the same manner as for Diamond Valley. The precipitation zones used are the same as those used for the North Diamond subarea and those used by Eakin (1961) in his reconnaissance study of Pine Valley.

Ground water is discharged by phreatophytes growing along the flood plain of Henderson Creek and by springs and seeps near the points where Garden Valley drains into Pine Valley. Nearly all the spring discharge and ground-water seepage flows out of the area before it is evaporated or transpired by plants. The volcanic rocks of Table Mountain are a barrier to ground-water movement and probably transmit only a small amount of water to Pine Valley.

Estimates of recharge to and discharge from the ground-water reservoir in Garden Valley are summarized in table 7. The estimated recharge exceeds the estimated discharge by 9,000 acre-feet per year, which is an estimate of the subsurface inflow from Garden Valley to Diamond Valley. This quantity is adequate to account for the observed spring discharge along the west side of the North Diamond subarea. However, the hydrologic boundaries in the Roberts Creek Mountains probably do not coincide exactly with topographic boundaries and some ground water derived from adjacent Kobeh Valley (Rush and Everett, 1964, p. 24) may enter Diamond Valley.

Table 7.--Estimated ground-water budget for Garden Valley

RECHARGE (1):

Precipipation zone (feet)	Area (acres)	Estimated annual precipitation: Range (inches)	Average (feet)	Average (acre-feet)	Estimated recharge from precipitation: Percentage of recharge	Acre-feet per year
Above 8,000	3,300	> 20	1.8	5,900	25	1,500
7,000 to 8,000	18,900	15 to 20	1.5	28,000	15	4,200
6,000 to 7,000	57,500	12 to 15	1.1	63,000	7	4,400
Below 6,000	400	8 to 12	.8	320	3	Tr.
Total (rounded)	80,100			97,000		10,000

DISCHARGE (2):

Discharge by phreatophytes

Type	Area (acres)	Average annual consumption of ground water: (feet)	(acre-feet)
Rabbitbrush and greasewood, some sparse saltgrass	700	.3	210
Meadow grass	300	1.2	360
Subtotal (rounded)			600
Portion of average annual outflow to Pine Valley which is maintained by spring discharge near Table Mountain		acre-feet per year 300 to 400	
Water transitted to Pine Valley through volcanic rocks of Table Mountain		Tr.	
Total		900 to 1,000	

DIFFERENCE (1) - (2): 9,000

NATURAL OUTFLOW FROM THE VALLEY-FILL RESERVOIR

Evapotranspiration

Natural discharge of ground water occurs where the water table in the valley fill is near the surface. Discharge takes place principally in three ways: (1) by evapotranspiration in areas of phreatophytes; (2) by direct evaporation where the capillary fringe extends to within a short distance of the land surface; and (3) by spring discharge where the water table intersects the land surface, or where artesian conditions cause ground water to rise to the surface. In Diamond Valley, the water discharged by springs then is consumed by evapotranspiration.

The principal phreatophytes are rabbitbrush, greasewood, saltgrass, and meadowgrass. As shown on plate 2, the grasses are most abundant in areas supported by spring discharge, whereas the rabbitbrush and greasewood are mainly in a band 1 to 3 miles wide around the margin of the playa. Evaporation from bare soil occurs mainly on the playa. Some of the vegetation shown in the North Diamond subarea (pl. 2) is supported in part by discharge from flowing wells. The flow from the wells is included with natural discharge, because most of the wells have flowed for 10 to 15 years with no control and are in the areas of natural discharge. The discharge by flowing wells probably is partly compensated for by local reductions in seepage and spring discharge.

Estimates of the natural discharge of ground water in each of the subareas are summarized in table 8. These estimates are based upon annual rates of consumption of ground water by phreatophytes in other areas, as described by Lee (1912), White (1932), Young and Blaney (1942), Houston (1950), and Robinson (1965). The rates are about the same as those used by Eakin (1962). Little information is available concerning the rate at which ground water is evaporated from the surface of the playa. Descriptions of a salt marsh at the north end of the playa by Vanderburg (1938, p. 65-66) indicate that there the water level is within 4 feet of the surface and that salt incrustations are readily formed by the evaporation of ground water that is brought to the surface by capillary action. At the south end of the playa the depth to water in well 23/53-4cc is 3.5 feet. The depth may be greater in the central part of the playa. The estimated average rate of evaporation of 0.1 foot per year for the entire playa is based on rates used in hydrologically similar areas of the State.

The estimated annual discharge of ground water is about 30,000 acre-feet, of which 5,000 acre-feet is evaporation from the playa and 25,000 acre-feet is evapotranspiration by phreatophytes and spring-supported vegetation. These figures are in reasonable agreement with the annual discharge of 23,000 acre-feet, which does not include evaporation from the playa, estimated by Eakin(1962) in his reconnaissance study

Table 8.--Estimated evapotranspiration of ground water

Dominant process of ground-water discharge	Phreatophyte	Areal density	Depth to water (feet)	Area (acres)	Annual Evapotranspiration: Acre-feet per acre	Annual Evapotranspiration: Acre-feet (rounded)
		North Diamond subarea				
Evapotranspiration	Rabbitbrush, greasewood, sparse saltgrass	Moderate to low	5 to 20	46,000	0.3	14,000
Evapotranspiration in areas supported by spring discharge	Meadowgrass, hay, some saltgrass	--	<5	4,500	1.2	5,400
Do.	Wet meadow, marsh, normally flooded; includes some acreage of alfalfa	--	< .5	1,500	3.0	4,500
Evaporation from bare soil (playa)	--	--	<5	50,000	.1	5,000
Subtotal (rounded)				102,000		29,000
		South Diamond subarea				
Evapotranspiration	Rabbitbrush, greasewood, sparse saltgrass	Moderate to low	5 to 20	4,000	.3	1,200
Evapotranspiration in areas supported by spring discharge (seepage)	Meadowgrass, saltgrass	--	<5	150	1.2	180
Subtotal (rounded)				4,200		1,400
Total (rounded)				106,000		30,000

of the area.

Spring Discharge

In South Diamond subarea small springs occur along the east side of the valley mostly as seepage areas near the bases of alluvial fans. The discharge in these areas is about 180 acre-feet per year, and most of the water is consumed by vegetation.

In the North Diamond subarea there is one fairly large spring on the east side of the valley at Thompson Ranch, sec. 3, T. 23 N., R. 54 E. There, water flows from bedrock outcrops mapped as klippe of western facies rocks of Ordovician(?) age by Larsen and Riva (1963). The water is warm, and the spring is considered to be in a fault-controlled area of discharge of moderately deeply circulating ground water. Other small seepage areas are common along the east side of the subarea. The western margin of the subarea is characterized by a number of pond springs at altitudes of approximately 5,800 feet. All the springs discharge warm water and all are in alluvial material near the bases of alluvial fans or pediments.

Drillers' logs of wells and field observations indicate that the alluvial fill in the vicinity of the springs along the west side of the North Diamond subarea is composed predominantly of interbedded sand, gravel, and clay, and is capable of transmitting appreciable quantities of water. This coarse-grained valley fill is underlain by bedrock at shallow depth. Logs of wells drilled nearer the center of the valley indicate that there the valley fill is predominantly silt, clay, and fine sand, and is less capable of transmitting water. These springs probably are fault controlled and supplied principally by deeply circulating ground water that passes from bedrock into a narrow band of coarser material and then is discharged at the surface.

Table 9 lists the locations, names, discharges, and dates of measurements of the major springs. Slight decreases in discharge have occurred in both Shipley Hot Spring and Thompson Ranch spring. These changes are interpreted as adjustments to local development or as natural fluctuations, which may represent below-average precipitation in the 1950's, as indicated by Eakin and Lamke (1966, p. 19) for stations in the adjacent Humboldt River basin, rather than to pumping in the South Diamond subarea. Eventually, a gradual decrease of spring discharge in the North Diamond subarea should occur in response to pumping in the South Diamond subarea as sufficient water is removed from storage to induce subsurface flow from the spring areas toward the well field.

Table 9.--Discharge of major springs in the North Diamond subarea

Location	Name or owner	Date	Discharge (cfs)	Discharge (acre-feet per year)
West side:				
23/52-25b	Tule Dam Spring	11-16-65	.12	90
23/52-36b	Sulphur Spring	11-18-65	.09	60
24/52-23d	Shipley Hot Spring	9-22-65	7.19	
		4- 1-66	7.01	4,900
		10-19-66	6.20	
24/52-26d	Unnamed	12- 7-65	.66	540
		4- 1-66	.82	
24/52-36c	Unnamed spring at Bailey Ranch	11-19-65	1.14	820
24/53-6cab	Siri Ranch spring	12- 7-65	.58	420
Subtotal			9.47	6,800
East side:				
23/54-3db	Thompson Ranch spring	9-21-65	2.33	
		4- 1-66	2.11	1,600
		10-19-66	2.06	
Subtotal			2.17	1,600
Total			11.64	8,400

Discharge Supported by Interbasin Flow

The quantity of interbasin flow from Garden Valley to Diamond Valley may be estimated from the measured discharge of springs and flowing wells in the western part of the North Diamond subarea. Warm water is discharged by at least half of these wells, which suggests a source similar to that which supplies the springs. The combined discharge from the major springs along the west side of the valley is approximately 6,800 acre-feet per year (table 9); that from flowing wells is about 1,300 acre-feet per year (table 20). The amount of discharge supported by interbasin flow is estimated at between 7,000 and 8,000 acre-feet per year. This estimate probably is low because it was not possible to measure effluent seepage downgradient from many of the springs; however, the quantity of water measured is on the same order of magnitude as the quantity estimated by indirect methods.

EQUILIBRIUM CONDITIONS OF THE NATURAL SYSTEM

Prior to the development of ground-water supplies, the hydrologic system of the valley-fill reservoir was in a state of dynamic equilibrium. Over the long term, recharge equaled discharge and no net change occurred in the quantity of ground water stored in the system.

Water Budget

Table 10 is a ground-water budget which lists the several estimates of recharge to and discharge from the valley-fill reservoir under natural conditions. The estimated total average annual recharge to the valley-fill reservoir of 30,000 acre-feet per year is the same as the estimated discharge.

The table also shows a substantial imbalance between recharge and discharge for both subareas--the difference for one being about equal to and offsetting the difference for the other. These differences are reasonable in view of the fact that about 95 percent of the total discharge occurs in the North Diamond subarea (pl. 2).

Ground Water in Storage

The potentially recoverable ground water in storage is the amount of water that will drain by gravity from the valley-fill reservoir in response to pumping. It is the product of the area, the selected depth of dewatering, and the specific yield of the deposits composing the valley-fill reservoir. Figure 7 shows that the area used in this computation is somewhat less than that of the valley-fill reservoir. The selected depth for this study is the uppermost 100 feet of saturation.

The specific yield of a deposit with respect to water is the ratio of (1) the volume of water which, after being saturated, the deposit will yield by gravity to (2) its own volume, usually expressed as a percentage (Meinzer, 1923, p. 28). Estimates of the specific yield of the upper 100 feet of saturated material were made by methods similar to those used to show subsurface distribution of sand and gravel in the South Diamond subarea. Lithologic descriptions from drillers' logs were grouped into five general categories and a specific-yield value was assigned to each category (table 11).

The average specific yield for the upper 100 feet of saturated valley fill below prepumping water levels in each of 70 selected wells was calculated, using the above categories and drillers' descriptions of the lithologies. From these values a map showing specific-yield distribution was prepared (fig. 7). The area of highest specific yield is in the South Diamond subarea, and the lowest is beneath the playa in the North Diamond subarea. The area of pumping in 1966 roughly

Table 10.--Ground-water budget, in acre-feet per year, for equilibrium conditions in Diamond Valley

(All values estimated, as described in text)

Budget item	North Diamond subarea	South Diamond subarea	Total
RECHARGE:			
Precipitation (table 6)	9,000	12,000	21,000
Inflow at Devils Gate (p. 21)	--	150	150
Subsurface inflow from Garden Valley (table 7)	9,000	--	9,000
Total (rounded): (1)	18,000	12,000	30,000
DISCHARGE:			
Evapotranspiration (table 8)			
In areas of shallow ground water	14,000	1,200	15,000
In areas of spring discharge	9,900	180	10,000
From the playa	5,000	--	5,000
Total (rounded): (2)	28,900	1,400	30,000
IMBALANCE: (1) - (2)	-10,900	+10,600	0

Table 11.--Specific yields of materials described in drillers' logs

Lithologic category (based on drillers' descriptions)	Assigned specific-yield value 1/ (percent)
Medium and coarse sand	30
Gravel, sand and gravel	25
Sand, gravel, and clay Gravel and clay	15
Fine sand, sand and clay Sandy clay, cemented gravel	10
Clay, silt, mud, muck	5±

1. Assigned specific-yield values based on Morris and Johnson (1966).

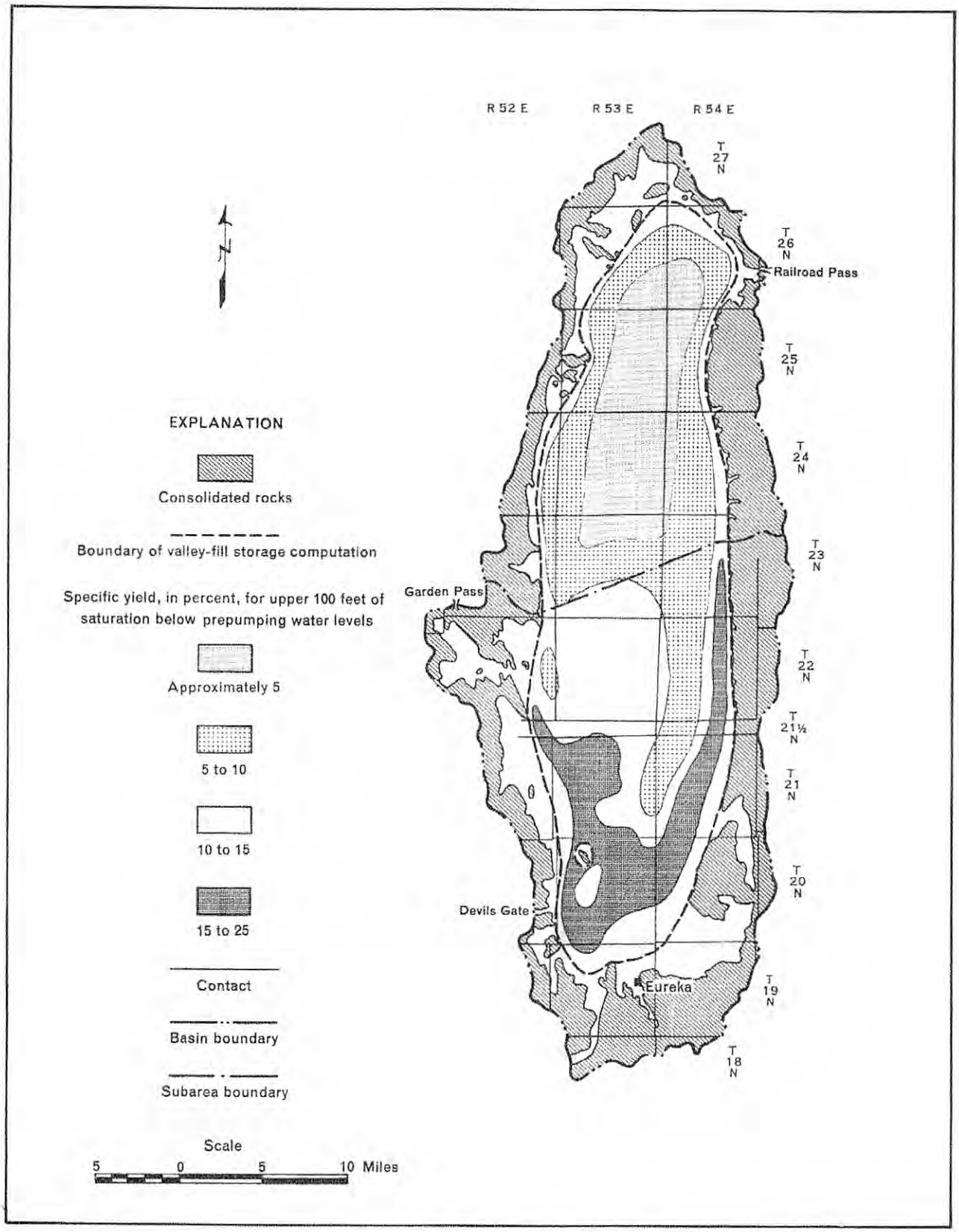


Figure 7.—Estimated specific-yield distribution

corresponds to the area of highest specific yield, which means that more water will be supplied from storage per foot of drawdown in that area than in any other area of similar size in the valley.

Table 12 summarizes the recoverable ground water stored in the upper 100 feet of saturation in the valley-fill reservoir. The estimated total storage is 2,800,000 acre-feet, about 70 percent of which is in the South Diamond subarea. The difference in total storage between subareas is attributed largely to the predominance of playa deposits in the North Diamond subarea, which have an estimated specific yield of only 5 percent and underlie about 40 percent of the subarea.

To assist in estimating the probable effects of future water-level decline on storage, the valley was divided into east-trending subdivisions, or strips, bordered on the north and south by township lines. The estimated amount of water that must be withdrawn from each subdivision to drop water levels 1 foot was computed (table 13) from the distribution of specific yield shown in figure 7.

Table 12.--Estimated recoverable water stored in the upper 100 feet of saturation in the valley-fill reservoir

Specific yield (percent) Range[1]	Average value	Area[1] (acres)	Storage[2] (acre-feet)
	South Diamond subarea		
5 to 10	7.5	24,600	180,000
10 to 15	12.5	77,400	970,000
15 to 25	20	41,400	830,000
Subtotal	a 14	143,400	2,000,000
	North Diamond subarea		
Approximately 5	5	47,700	240,000
5 to 10	7.5	51,700	390,000
10 to 15	12.5	18,000	220,000
Subtotal	a 7	117,400	850,000
Total (rounded)	a 11	260,800	2,800,000

1. As shown on figure 7.
2. Storage = 100 x average specific yield x area.
a. Weighted areal average specific yield.

Table 13.--Estimated recoverable water per foot of storage in the upper 100 feet of saturation

Subdivision[1/]	Necessary withdrawal (acre-feet)
T. 19 N., R. 53, 54 E.	600
T. 20 N., Do.	5,000
T. 21, 21½ N., R. 52, 53, 54 E.	7,000
T. 22N., Do.	5,300
T. 23 N., Do.	3,700
T. 24 N., Do.	2,700
T. 25 N., R. 53, 54 E.	2,000
T. 26 N., Do.	1,900
T. 27 N., Do.	<100
Total (rounded)	28,000

1. Townships and ranges shown in figure 7.

CHEMICAL QUALITY OF WATER

Analyses of 45 ground-water samples were made during this study to determine the quality of the water as of 1966, to relate variations in water quality to the ground-water flow system, and to determine the suitability of ground water for use. The results of these analyses are listed in table 14 along with the results of 4 additional analyses that had been made prior to this study.

Types of Water

For the purpose of this report, waters are classified on the basis of their predominate cations and anions. The method used has been described by Piper (1944) and is shown in figure 8. Points plotted in the diamond-shaped field indicate the character of the water as represented by the relationships among groups of ions, namely, the Na + K, Ca + Mg, CO_3 + HCO_3, and Cl + SO_4. The size of the circle is proportional to the dissolved-solids content of the water. Assignment of a water sample to a chemical type is based on determination of the group or groups that comprise more than 50 percent of the total anions or cations, respectively.

Variations in Quality

As ground water moves from areas of recharge to areas of discharge, the quality of the water changes in response to changing conditions in its environment. The dissolved-solids content generally is low in areas of natural recharge near the mountains and increases as water moves toward areas of natural discharge in the valley lowlands. In areas of natural discharge, the dissolved-solids content usually increases as water moves upward toward the surface.

There is a systematic variation in the occurrence of the three main types of water. In general, ground water near the recharge areas is a calcium magnesium bicarbonate type. This type changes downgradient into a sodium potassium bicarbonate type, which in turn changes to a sodium potassium chloride sulfate type in the central part of the valley. These changes are effected principally by the combined processes of ion exchange and leaching. Concentration by evapotranspiration increases dissolved-solids concentrations in discharge areas.

The relationship of water quality to ground-water flow is shown in figure 9. The approximate direction of the flow is indicated by arrows, the dissolved-solids content is indicated by the distribution of specific conductance at selected points, and the type of water is represented by generalized areas where quality is similar. Part of the data used was obtained from shallow observation wells and may not be representative of the quality of water that would be obtained by a deep well at the same location. This is evident on the east side of the valley where water

Table 14.--Chemical analysis of water from Diamond Valley

Part I.--Detailed analyses by the U.S. Geological Survey

Location	Source	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Dissolved solids (calculated, mg/l)	Hardness as $CaCO_3$ (mg/l) Calcium magnesium	Hardness as $CaCO_3$ (mg/l) Noncarbonate	pH	Specific conductance (micromhos at 25°C)	SAR	RSC (me/l)
						Milligrams per liter (upper number) and milliequivalents per liter (lower number) for indicated cations and anions																	
19/53-15bd	Fad shaft	1-21-53	56	11	0.02	52	26	8.3	1.4	0	238	38	10	2.6	0	0.06	267	236	42	7.8	467	.2	0
						2.59	2.14	0.36	0.04	0	3.90	0.79	0.28	0.04	0								
19/53-25d	Springs	5- 7-58	48	39	0	69	10	15	1.2	0	242	41	6.7	1.5	.4	.10	303	213	14	7.6	476	.4	0
						3.44	0.82	0.65	0.03	0	3.97	0.85	0.19	0.02	0.02								
20/52-26	Slough Creek	4-10-54	46	21	.06	41	94	1,020	98	35	834	918	800	.08	1.0	1.8	3,440	489	0	8.3	5,370	20	5.05
						2.05	7.73	44.37	2.51	1.16	13.67	19.11	22.56	0.01	0.05								
20/53-17cc	Well	5- 5-66	65	28	.01	72	25	62	8.2	0	398	52	31	.5	.5	.1	475	282	0	7.8	760	1.6	.88
						3.59	2.05	2.70	0.21	0	6.52	1.08	0.87	0.01	0.03								
20/53-21ad	Well	5- 9-66	58	39	0	51	20	17	5.1	0	220	45	14	2.7	.3	0	302	208	28	7.6	467	.5	0
						2.54	1.62	0.74	0.13	0	3.61	.94	0.39	0.04	0.02								
21/53- 3ab	Well	7-11-66	54	44	0	63	13	85	8.8	0	302	76	60	.8	.3	.2	500	212	0	7.8	788	2.6	.71
						3.14	1.10	3.70	0.23	0	4.95	1.58	1.69	0.01	0.02								
21/53- 5cb	Well	5-18-66	54	42	.01	66	25	60	8.8	0	312	71	50	1.0	.5	.1	478	268	12	7.8	758	1.6	0
						3.29	2.07	2.61	0.23	0	5.11	1.48	1.41	0.02	0.03								
21/53-13da	Well	5-17-66	54	28	0	46	16	17	2.2	0	207	39	6.0	.4	.1	0	257	179	9	7.5	406	.6	0
						2.30	1.28	0.74	0.06	0	3.39	.81	0.17	0.01	0.01								
21/53-28cc	Well	5-17-66	60	38	0	74	25	43	6.8	0	368	45	30	.2	.4	.1	444	288	0	7.8	709	1.1	.27
						3.69	2.07	1.87	0.17	0	6.03	.94	0.85	0.00	0.02								
21/53-33da	Well	7-11-66	58	37	0	78	26	73	12	0	406	68	54	.6	.6	.1	549	300	0	7.8	878	1.9	.65
						3.89	2.11	3.18	0.31	0	6.65	1.42	1.52	0.01	0.03								
21/53-36ac	Well	5-20-66	53	16	.01	57	10	13	1.2	0	204	34	8	2.8	.1	0	242	185	18	7.7	400	.4	0
						2.84	0.86	0.57	0.03	0	3.34	.71	0.23	0.05	0.01								
22/53-27aa	Well[1/]	5-17-66	56	11	.18	46	21	224	22	0	354	173	180	1.9	.7	.6	854	200	0	8.1	1,430	.5	1.80
						2.30	1.70	9.74	0.56	0	5.80	3.60	5.08	0.03	0.04								
22/53-30cc	Well[1/]	5-17-66	56	8.4	.01	21	17	88	16	8	262	34	48	.6	.3	.3	371	124	0	8.6	635	3.4	2.08
						1.05	1.43	3.83	0.41	.27	4.29	.71	1.35	0.01	0.02								
22/54-34ab	Well	3-10-54	54	37	.13	78	36	27	5.5	0	356	77	16	5.5	.6	.12	458	342	51	7.4	709	.6	0
						3.89	2.96	1.17	0.14	0	5.83	1.60	0.45	0.09	0.03								
23/52-13ca	Well	5- 5-66	62	26	.01	41	27	39	8.2	4	264	45	25	.6	.4	.1	346	212	0	8.3	560	1.2	.09
						2.05	2.19	1.70	0.21	.13	4.33	.94	0.71	0.01	0.02								
23/53-34dd	Well	5-17-66	52	15	.02	26	22	216	26	0	374	5	220	2.5	.6	.5	718	154	0	7.9	1,300	7.6	3.05
						1.30	1.78	9.40	0.66	0	6.13	.1	6.21	0.04	0.03								
23/54- 3db	Spring	5-17-66	69	19	.01	73	22	23	5.1	0	318	51	6.5	1.1	.4	0	358	274	13	7.8	583	.6	0
						3.64	1.84	1.00	0.13	0	5.21	1.06	0.18	0.02	0.02								
24/52-23ca	Spring	4-16-63	94	30	0	55	21	30	6	0	288	33	17	.6	.5	.1	330	224	0	7.6	529	.8	.25
						2.74	1.73	1.31	0.15	0	4.72	.69	0.48	0.01	0.03								
24/53-6ac	Well	5- 5-66	95	25	0	51	20	15	3.4	0	255	25	10	.5	.4	0	276	210	1	8.0	449	.4	0
						2.54	1.66	0.65	0.09	0	4.18	.52	0.28	0.01	0.02								

1. Shallow test well augered by U.S. Geological Survey.

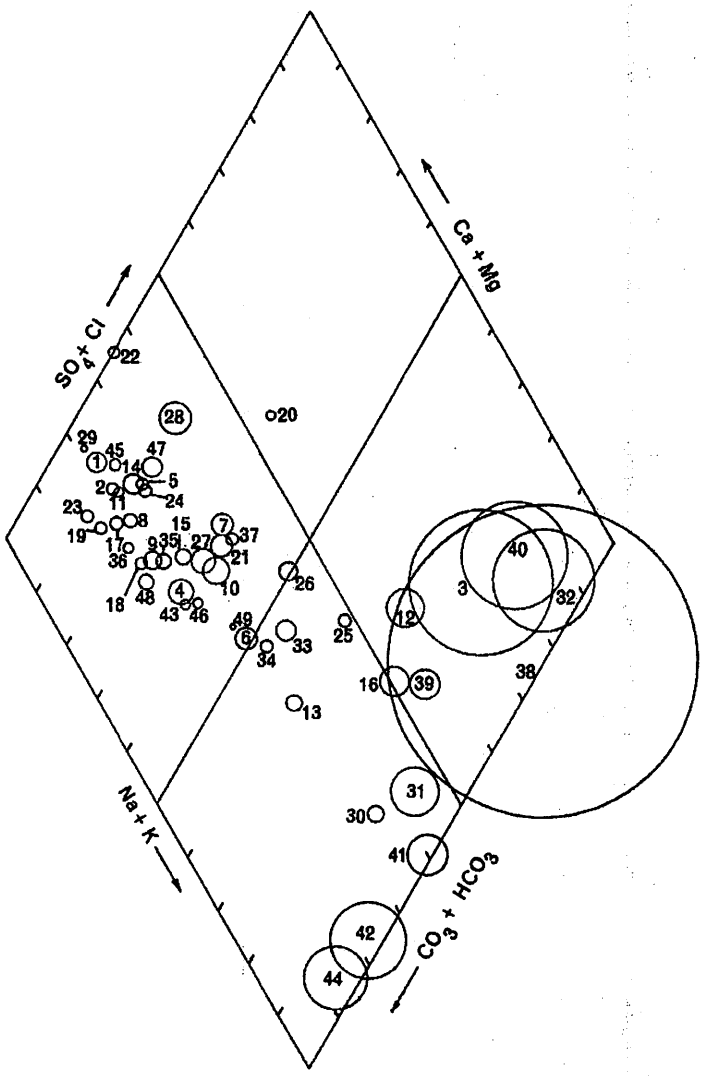
Note: Chemical constituents reported in metric units of milligrams per liter and milliequivalents per liter. The metric values are respectively equal to parts per million and equivalents per million for samples with specific conductances up to about 10,000 micromhos, and are slightly more than parts per million and equivalents per million for samples with specific conductances greater than 10,000 micromhos.

Table 14.--Continued

Part II.--Field analyses by the U.S. Geological Survey

Location	Source	Date of collection	Temperature (°F)	Milligrams per liter (upper number) and milliequivalents per liter (lower number) for indicated cations and anions: Calcium (Ca)	Magnesium (Mg)	Sodium (Na) and potassium (K)[1]	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Hardness as $CaCO_3$ (mg/l): Calcium magnesium	Noncarbonate	pH	Specific conductance (micromhos at 25°C)	SAR	RSC (me/l)
20/53- 1ac	Well	8-17-65	52	21	22	31	0	116	100	9.0	144	49	7.8	335	1.1	0
				1.05	1.83	1.35	0	1.90	2.08	0.25						
20/53- 4dd	Well	8-19-65	54	77	28	79	0	382	80	59	308	0	7.6	806	2.0	.11
				3.84	2.31	3.44	0	6.26	1.67	1.66						
20/53-23ac	Well	5-19-66	56	84	22	0	0	234	16	64	300	108	7.6	655	0.0	0
				4.19	1.80	0	0	3.84	0.33	1.81						
20/53-30db	Well	8-19-65	-	37	27	12	0	237	25	7.4	204	10	7.5	389	.4	0
				1.85	2.23	0.53	0	3.88	0.52	.21						
21/53- 2ac	Well	7-12-66	60	45	20	20	0	210	40	17	195	23	8.0	411	.6	0
				2.25	1.65	0.85	0	3.44	0.83	0.48						
21/53- 3cd	Well	7-11-66	55	26	22	121	0	264	83	80	154	0	8.2	749	4.2	1.25
				1.30	1.78	5.24	0	4.33	1.73	2.26						
21/53- 3db	Well	8-17-65	52	16	30	69	0	216	67	47	162	0	7.8	569	2.4	.30
				0.80	2.44	3.02	0	3.54	1.39	1.33						
21/53-21ad	Well	8-18-65	62	60	40	75	0	406	68	54	316	0	7.3	806	1.8	.34
				2.99	3.32	3.28	0	6.65	1.42	1.52						
21/54- 4ad	Well	8-20-65	53	66	69	41	0	400	156	34	450	122	7.3	907	.8	0
				3.29	5.70	1.78	0	6.56	3.25	0.96						
21/54-16cd	Well	7-12-66	53	28	9.2	2.1	0	109	13	6.8	108	19	7.8	198	.9	0
				1.40	0.76	0.09	0	1.79	0.27	0.19						
22/52-13ca	Well[2]	9- 2-65	56	7.5	5.5	122	0	244	42	45	41	0	8.0	558	8.3	3.18
				0.37	0.45	5.32	0	4.00	0.87	1.27						
22/53- 1aa	Well[2]	9- 2-65	53	11	13	382	20	600	15	264	82	0	8.5	1,740	18.0	8.86
				0.55	1.09	16.62	0.67	9.83	0.31	7.45						
22/53-17aa	Well[2]	9- 2-65	54	24	27	873	0	396	480	883	172	0	8.2	4,110	29.0	3.05
				1.20	2.24	37.95	0	6.49	9.99	24.91						
22/53-32cd	Well[2]	9- 2-65	54	9.5	37	98	0	300	65	55	177	0	8.1	680	3.2	1.38
				0.47	3.07	4.28	0	4.92	1.35	1.55						
22/53-36cc	Well[2]	12- 8-65	53	32	15	72	0	244	39	40	140	0	7.8	506	2.7	1.20
				1.60	1.20	3.14	0	4.00	0.81	1.13						
22/54- 8dd	Well	8-18-65	60	18	33	32	0	231	42	11	179	0	8.0	427	1.0	.21
				0.90	2.68	1.39	0	3.79	.87	0.31						
22/54-18db	Well	8-18-65	57	32	18	18	0	190	25	7.4	152	0	8.1	325	.7	.07
				1.60	1.44	.80	0	3.11	0.52	0.21						
22/54-22bd	Well	8-18-65	55	16	29	43	0	195	73	12	160	0	7.9	444	1.5	0
				0.80	2.40	1.86	0	3.20	1.52	0.34						
23/53- 4cc	Well[2]	5-17-66	52	1.6	1.0	5,320	964	1,880	2,300	4,280	8	0	9.1	16,400	818.0	62.78
				0.08	0.08	231.41	32.13	30.81	47.89	120.74						
23/53-27bb	Well[2]	9- 2-65	55	23	13	244	0	352	26	231	111	0	8.0	1,230	10.0	3.55
				1.15	1.07	10.61	0	5.77	0.54	6.52						
23/53-30dd	Well[2]	9- 2-65	55	15	61	768	0	427	308	912	288	0	8.2	3,890	20.0	1.25
				0.75	5.00	33.39	0	7.00	6.41	25.73						
23/53-33cc	Well[2]	9- 2-65	55	3	0.6	321	245	27	50	160	10	0	10.3	1,430	44.0	8.41
				0.15	.05	13.96	8.17	0.44	1.04	4.51						
23/54-29aa	Well[2]	9- 2-65	55	8	4.9	613	103	1,100	39	184	40	0	8.8	2,310	42.0	20.66
				0.40	0.40	26.66	3.43	18.03	0.81	5.19						
23/54-29dd	Well	9- 2-65	58	12	27	36	0	204	35	10	140	0	8.0	382	1.3	.54
				.6	2.2	1.55	0	3.34	0.73	0.28						
23/54-33bb	Well[2]	5-16-66	50	3.4	11	489	142	904	12	89	52	0	8.7	1,680	30.0	18.51
				0.17	0.87	21.27	4.73	14.82	0.25	2.51						
25/53- 5cb2	Well	5- 5-66	80	33	36	13	0	267	23	10	229	10	7.7	419	.4	0
				1.65	2.93	0.56	0	4.38	0.48	0.28						
25/54-28bc	Well	8-18-65	-	5.1	42	50	0	268	52	15	185	0	8.1	506	1.6	.69
				0.25	3.45	2.19	0	4.39	1.08	0.42						
26/53- 8a	N. T. Spring	9- 3-65	49	8.8	78	33	0	345	106	14	342	59	8.2	631	.8	0
				0.44	6.39	1.42	0	5.65	2.21	0.39						
26/54-15cd	Well	9- 3-65	52	35	25	34	0	263	20	21	192	0	8.1	588	1.1	.47
				1.75	2.09	1.48	0	4.31	0.42	0.59						
28/54-23c[3]	Bailey Sp.	9- 3-65	60	24	6.6	32	0	136	24	15	87	0	7.3	296	1.5	.49
				1.20	0.54	1.41	0	2.23	0.50	0.42						

1. Determined by difference
2. Shallow test well augered by U.S. Geological Survey.
3. Sample taken at stock tank
   Spring is at 27/54-14a



EXPLANATION

0 50 100

Total dissolved solids in milliequivalents per liter

Detailed analyses

1. 19/53—15bd
2. 19/53—25d
3. 20/52—26a
4. 20/53—17cc
5. 20/53—21ad
6. 21/53—3ab
7. 21/53—5cb
8. 21/53—13da
9. 21/53—28cc
10. 21/53—33da
11. 21/53—36aa
12. 22/53—27aa
13. 22/53—30cc
14. 22/54—34ab
15. 23/52—13ca
16. 23/53—34dd
17. 23/54—3db
18. 24/52—23ca
19. 24/53—6ac

Field analyses

20. 20/53—1ac
21. 20/53—4dd
22. 20/53—23ac
23. 20/53—30db
24. 21/53—2ac
25. 21/53—3cd
26. 21/53—3db
27. 21/53—21ad
28. 21/54—4ad
29. 21/54—16cd
30. 22/52—13ca
31. 22/53—1aa
32. 22/53—17aa
33. 22/53—32cd
34. 22/53—36cc
35. 22/54—8dd
36. 22/54—18db
37. 22/54—22bd
38. 23/53—4cc
39. 23/53—27bb
40. 23/53—30dd
41. 23/53—33cc
42. 23/54—29aa
43. 23/54—29dd
44. 23/54—33bb
45. 25/53—5cb2
46. 25/54—28bc
47. 26/53—8a
48. 26/54—16cd
49. 26/54—23c

Figure 8.—Chemical character and dissolved solids content of water samples

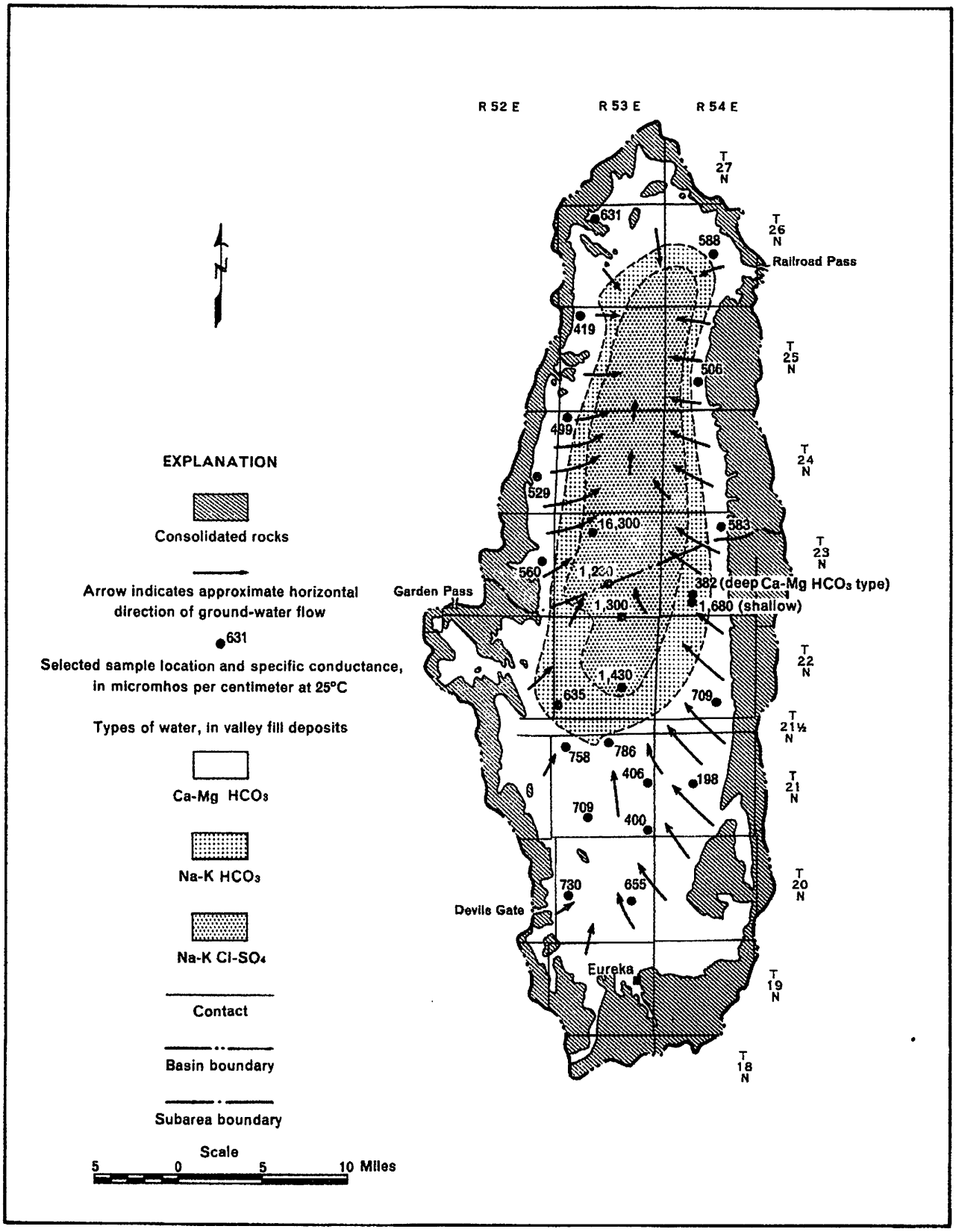


Figure 9.—Generalized relation between water quality and ground-water flow

obtained from well 23/54-33bb (22 feet deep), is a sodium potassium bicarbonate type with a very high salinity, whereas water from well 23/54-29dd (50 feet from well 23/54-33bb, is 320 feet deep, and has no perforations above 144 feet) is a calcium magnesium bicarbonate type with a moderate salinity.

The highly saline sodium potassium chloride sulfate type water in the north-central part of the South Diamond subarea probably forms a fairly thin layer beneath the water table. The high concentration may result from current leaching both of saline soils and of residual salts accumulated at a time when a small lake occupied Diamond Valley and the area of natural discharge extended much farther south than it does at present. The dissolved-solids content of the water in the North Diamond subarea may decrease with depth as it does in some other areas of Nevada. Near the edges of the playa and downgradient from the major springs (table 9), water of good quality may overlie accumulations of saline water.

Water in wells along the west side of the developed part of the South Diamond subarea has a higher dissolved-solids content and slightly higher proportion of sodium than water in wells in the center and along the southern side of the valley. The reason for this was not determined but may be associated with moderately deep circulation along faults, as is suggested by slightly higher water temperatures on the west side of the valley.

Suitability for Agricultural Use

The dissolved-solids content, the percentage of sodium in the water compared to the total cation content, and the concentration of elements and compounds that may be toxic to plants and animals are the most significant factors regarding the suitability of water for agricultural use (U. S. Department of Agriculture, 1954).

Dissolved-solids content as it is related to the suitability of water for agricultural use commonly is referred to as "salinity hazard." Salinity hazard usually is defined in terms of specific conductance, which is a measure of the ease with which an electric current will pass through the water. The U. S. Department of Agriculture (1954) defines salinity hazard and its relation to specific conductance as follows:

Salinity hazard	Specific conductance (micromhos per centimeter at 25°C)	Classification
Low	0 to 250	C1
Medium	251 to 750	C2
High	751 to 2,250	C3
Very high	greater than 2,250	C4

The sodium adsorption ratio (SAR) of irrigation water, is related to the experimentally determined adsorption of sodium by soil, and is defined by the following equation in which all the constituents are expressed in milliequivalents per liter (milliequivalents per liter are given in table 14):

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

Waters from springs and irrigation wells are classified according to their salinity hazard and sodium hazard on the basis of a diagram prepared by the U. S. Department of Agriculture (fig. 10). Salinity hazard is directly related to specific conductance. Sodium hazard is defined in terms of SAR values; however, as shown on the diagram, fixed values of SAR cannot be assigned to the various sodium-hazard classes because the sodium hazard increases as the specific conductance increases.

All samples of water from irrigation wells and springs in Diamond Valley had a low sodium hazard; approximately 75 percent had a medium salinity hazard, and 25 percent had a high salinity hazard. In places where the salinity hazard is high, some treatment of the soil or the water may be necessary in the future to alleviate accumulation of excessive amounts of salt in the soil.

Residual sodium carbonate (RSC) is another factor that affects the chemical suitability of water for irrigation. It was defined by Eaton (1950) as:

$$RSC = (CO^{--} + HCO_3^{-}) - (Ca^{++} + Mg^{++}),$$

where the values are expressed in milliequivalents per liter (see table 14). According to Eaton, water having an RSC value larger than 2.5 me/l (milliequivalents per liter) generally is unsuitable for irrigation because calcium and magnesium will be precipitated from the water, causing the sodium hazard of the water to increase. Water having an RSC value of 1.25 me/l to 2.5 me/l is considered marginal, and water having an RSC value of less than 1.25 me/l probably is safe. All samples of irrigation water had RSC values of less than 1.25 me/l and are therefore safe for irrigation in this regard.

Boron is one of the most critical constituents in irrigation water. It is essential for proper plant nutrition in small quantities but is toxic to many plants in amounts only slightly more than the needed amounts. Most of the crops raised in the area are classified by the U. S. Department of Agriculture (1954) as semitolerant and tolerant with respect to boron. The semitolerant crops include most small grains, potatoes, and some other vegetables. Alfalfa is listed as a tolerant crop. Scofield (1936) showed permissible boron concentrations for semitolerant and

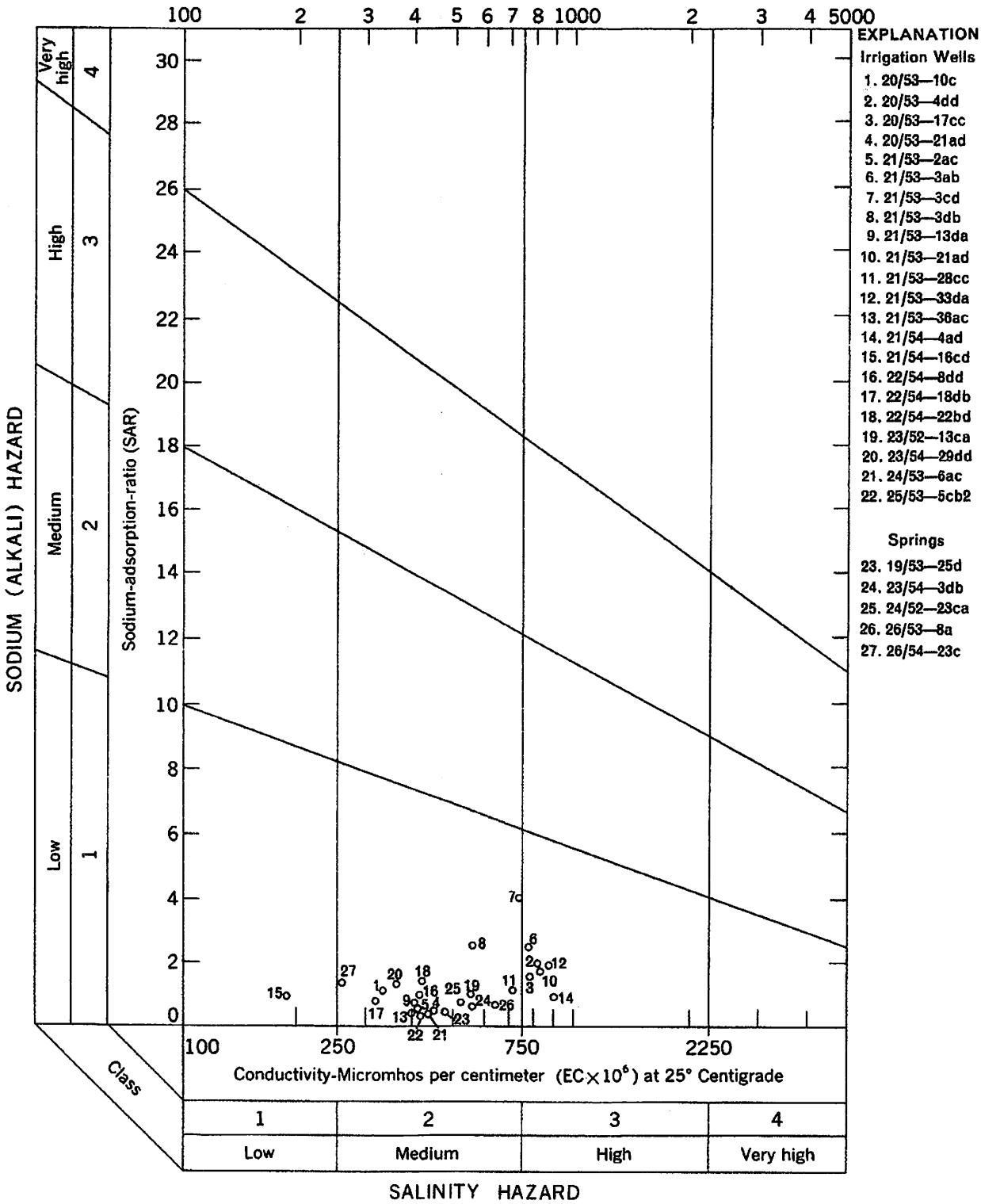


Figure 10.—Classification of water from springs and irrigation wells based on conductivity and sodium adsorption ratio (After U.S. Department of Agriculture 1954)

tolerant crops as follows:

Classes of water		Boron content	
Rating	Grade	Semitolerant crops (mg/l)	Tolerant crops (mg/l)
1	Excellent	less than 0.67	less than 1.00
2	Good	.67 to 1.33	1.00 to 2.00
3	Permissible	1.33 to 2.00	2.00 to 3.00
4	Doubtful	2.00 to 2.50	3.00 to 3.75
5	Unsuitable	more than 2.50	more than 3.75

The boron content of all samples of irrigation water from Diamond Valley was less than the amount that might be harmful to semitolerant crops.

Water from shallow wells in the north-central part of the South Diamond subarea is poorly suited for agricultural use. However, these samples may not be representative of the quality of water that would be obtained from deeper wells in the same locations. The limited data available suggest that quality improves with depth; however, samples must be obtained from deeper wells before meaningful conclusions can be made concerning the suitability of water for use in this area.

Suitability for Domestic Use

The limits recommended by the U.S. Public Health Service (1962) for water used on interstate carriers for drinking purposes commonly are cited as standards for domestic use. Listed below are some of the chemical substances which should not be present in water in excess of the listed concentration where more suitable supplies are available.

Constituents	Concentration (milligrams per liter)
Chloride (Cl)	250
Iron (Fe)	0.3
Nitrate (NO_3)	45
Sulfate (SO_4)	250
Fluoride (F)	a 1.7
Total dissolved solids	500 (1,000 permitted)

a. Varies inversely with mean temperature; for example, higher temperature results in more water intake and permissible concentration is lower.

At the present time, 1965, less than 25 families use water obtained from the valley-fill reservoir. However, as the area becomes more fully developed, domestic use is expected to increase. The chemical constituents of all samples obtained from irrigation and stock wells during the course of this study are within the permitted limits for domestic use (table 14). This is also true of the water obtained from the Fad shaft.

GROUND-WATER DEVELOPMENT

Initial Development

The earliest development in the valley was in the North Diamond subarea where settlers constructed ditches and shallow pits to utilize the discharge of springs. As ranching became established along the east and west sides of the valley, additional improvements were made to utilize all readily available discharge from springs. No attempts were made to develop additional supplies until the 1940's when flowing wells were drilled on the Romano and Flynn Ranches. These wells were successful, and subsequently flowing wells were also drilled on the Siri and Saddler Ranches.

In 1966, 15 wells in the North Diamond subarea were flowing (table 20), but at rates substantially less than the reported initial discharge; two wells were pumped during the irrigation season; and irrigation water was pumped from the pond at Thompson's spring. The hydrologic system in this area was considered to be adjusting to a new set of equilibrium conditions, because these ground-water developments were either in or adjacent to areas of natural discharge and were being compensated for by local reductions in natural discharge.

Development in the South Diamond Subarea

The extensive well development in the South Diamond subarea began in 1949 when wells 22/54-27ca and 22/54-33dd were drilled along the east side of the valley. Development continued at the rate of a few wells each year until 1958, when extensive efforts were begun to develop land for irrigation. By 1964, when the area was closed to additional development, permits to pump more than 150,000 acre-feet per year had been granted, more than 200 irrigation wells had been drilled, and approximately 35,000 acres of land was to be irrigated by pumping ground water. Due to problems inherent in developing new land, production has lagged behind acquisitions, and in 1965 only 7,600 acres of cropland was harvested. The acreage is increasing each year, and maximum production probably will occur within the next decade.

Irrigation Practices

Sprinkling has been the most widely used method of applying irrigation water during the initial phases of land acquisition and development. In the summer of 1965 sprinkler systems were used with about two-thirds of the 70 to 75 wells pumped. In July 1966 sprinkler systems were being used with 51 of the 74 pumping wells. Lateral and main-line and self-propelled rotary systems are the principal types used. The lateral and main-line systems consist basically of sprinkler lines that are connected to a main line from the well. These lateral lines may

be almost a quarter of a mile long and are commonly mounted on wheels so that the entire lateral may be moved to different positions along the main line. Laterals not mounted on wheels must be broken down into individual sections to be moved. Self-propelled rotary systems, also called "Valley sprinklers," consist of one sprinkler line, as much as a quarter of a mile long, mounted on hydraulically driven wheels. The entire system rotates about a pivot at one end of the line which is connected to a well in the center of a 160-acre field. Other methods use ditches or gated pipes to distribute water.

In Diamond Valley, sprinkling generally requires less water than other irrigation methods, because infiltration is reduced in areas of sandy soil. However, wells that discharge through sprinklers must pump against a 70- to 170-foot head in the sprinkler system, in addition to lifting the water to the land surface. The cost of pumping and sprinkling water per acre-foot is higher than with other methods, but the cost of labor and land preparation is generally less.

Sprinkling probably will remain the most commonly employed method of applying water for some time in the future, largely because of the current success, because of the high infiltration rates in local areas, and because of present investment in equipment. For the long term, increased lifts may raise pumping costs sufficiently for some owners to consider reducing pumping costs by using gravity distribution from the well head.

Growing Season

The growing season is determined largely by temperature, and varies with the type of crop grown. Temperature data have been recorded at Diamond Valley, Eureka, Fish Creek Ranch, Jiggs, and Rand Ranch. Table 15 shows the daily minimum temperatures, published by the U.S. Weather Bureau, used in determining the longest period of consecutive days during each year in which the temperature did not go below 32°F, 28°F, and 24°F, respectively, at four of these stations. For example, at Eureka a crop which experienced a killing frost at 28°F would have an average growing season of 118 days.

The effects of topographic position and exposure on the growing season are illustrated by the data in table 15. Both Fish Creek Ranch and Rand Ranch, which have the shortest growing seasons, are in the lower parts of the valleys. Jiggs, on the alluvial apron, has a slightly longer growing season. Eureka, on the lower slopes of the Fish Creek Range, has the longest growing season. These variations may be due in part to differences in station exposure but probably also reflect conditions of thermal inversion which are common in valleys of Nevada.

Table 15.--Longest period, in days, in which temperatures did not go below the indicated values at four stations in east-central Nevada

[From published records of the U.S. Weather Bureau]

Year	Eureka[1]			Fish Creek Ranch[2]			Jiggs[3]			Rand Ranch[4]		
	24°F	28°F	32°F	24°F	28°F	32°F	24°F	28°F	32°F	24°F	28°F	32°F
1948	--	--	--	125	50	29	--	--	--	--	--	--
1949	--	--	--	119	80	40	--	--	--	--	--	--
1950	--	--	--	88	40	33	--	--	--	--	--	--
1951	--	--	--	94	81	9	--	--	--	--	--	--
1952	--	--	--	142	87	44	--	--	--	--	--	--
1953	129	128	111	89	69	3	--	--	--	--	--	--
1954	150	115	96	98	70	48	--	--	--	--	--	--
1955	143	117	108	88	82	63	--	--	--	--	--	--
1956	133	109	109	135	58	28	--	--	--	--	--	--
1957	96	96	95	121	35	28	--	--	--	--	51	27
1958	140	134	93	139	98	73	--	--	--	128	100	60
1959	131	112	27	121	79	44	131	91	52	60	43	24
1960	--	--	--	141	87	87	63	63	56	--	--	--
1961	--	--	--	110	91	65	118	110	93	110	99	47
1962	--	--	--	122	77	27	132	78	76	114	76	22
1963	--	--	--	146	142	48	124	98	49	58	22	11
1964	--	--	--	117	80	46	117	103	59	91	47	25
1965	130	129	73	--	--	--	112	108	60	79	49	28
Average	131	118	89	117	77	42	114	93	64	91	61	30

1. Altitude 6,500 feet.
2. Altitude 6,050 feet.
3. Altitude 5,450 feet.
4. Altitude 5,047 feet.

Temperature records available from the Diamond Valley station, which is closest to the agricultural area in Diamond Valley (fig. 1), are too short and incomplete to provide valid averages, but suggest that conditions of thermal inversion exist throughout much of the year. The growing season in the developed part of the South Diamond subarea probably is longer than at Jiggs and shorter than at Eureka.

Limited attempts were made to prevent frost damage to alfalfa by sprinkling in the fall of 1965. Should this practice prove feasible, the effective growing season might be extended as much as several weeks.

Crop Types, Acreages, and Consumptive Use

The principal crops grown commercially are wheat, oats, and barley, alfalfa, and potatoes. Sorghum, onions, and some grass-legume mixes have been tried on a small scale. According to Mr. Ivan B. Jones of the White Pine-Eureka Counties Branch of the Cooperative Extension Service, University of Nevada (written commun., 1966) other crops that might be grown in the area with proper care are peas, beans, clover, safflower, sugar beets, and cool-season grasses. The major types of irrigated crops, computed seasonal consumptive use of water, and approximate acreages for the summers of 1961-65 are listed in table 16. Because the area has not yet reached its full potential production, new crops and varieties are still being tried, and a permanent pattern of land usage may not become established for several more years. As of the summers of 1965-66, small grains were the predominate crops; however, the acreage and relative proportion of alfalfa has increased each year. Potatoes have met with only limited success, and no large-scale attempts to raise them have been made since 1962.

Estimated Pumpage 1950-65

Estimates of pumpage for the 16-year period 1950-65 were made from pumpage inventories, crop acreages, and the number of wells considered to have been operated during a given year. For the purposes of computation, 75 percent of the total amount of water pumped is assumed to be consumed by crops (65 percent) or lost by spray and surface evaporation (10 percent). The remaining 25 percent is assumed to be recirculated (returns to ground water). A moderately low percentage of recirculated water is used, because most crops are irrigated by sprinkling.

Inventories of pumpage furnished by the State Engineer are available for 1958 and 1959, and a pumpage canvass was made in 1965 as a part of this study. Crop acreages are available for 1961-65. Eakin (1962, p. 29) estimated that the pumpage for 1961 was between 4,000 and 7,000 acre-feet, probably about 5,000 acre-feet. Estimates for the remaining years are based on the number of wells considered to be in operation during that year and on partial reports of pumpage. Table 17

Table 16.--Approximate acreages and computed seasonal consumptive use for major irrigated crops

Crop	Approximate growing season	Computed seasonal consumptive use[1] (acre-feet per acre)	Crop acreages[2] 1961	1962	1963	1964	1965
Alfalfa[3]	5 to 5½ months[4]	1.9	70	300	400	985	2,132
Small grains	3 months	1.2	2,900	3,000	3,740	4,710	5,453
Potatoes	4 months	1.4	220	2,200	700	41	19
Onions	4 months	1.4	--	100	--	--	--
Total acreage			3,200	5,600	4,800	5,736	7,604

1. Consumptive use was estimated, using the general method outlined by Houston (1950). The percentage of daylight hours used is for a latitude of 39°40', the average monthly temperatures are those for Eureka, and a consumptive-use coefficient of 0.5 for alfalfa is used for periods of relatively slow growth before and after the frost-free period (Blaney and Hansen, 1965, p. 25).

2. Acreages from information furnished by Cooperative Extension Service, University of Nevada, White Pine and Eureka Counties Branch.

3. Includes mixtures of alfalfa and grain.

4. Includes periods of slower growth before and after the frost-free period.

Table 17.--Estimated pumpage, 1950-65

(All estimates rounded to two significant figures)

Year	Gross pumpage	Net pumpage 1/	Cumulative net pumpage
1950	300	220	220
1951	600	450	670
1952	800	600	1,300
1953	800	600	1,900
1954	800	600	2,500
1955	1,000	750	3,200
1956	1,000	750	4,000
1957	1,200	900	4,900
1958	a 1,200	900	5,800
1959	a 1,800	1,400	7,200
1960	2,400	1,800	9,000
1961	b 6,100	4,600	14,000
1962	b11,000	8,200	22,000
1963	b 9,700	7,300	29,000
1964	b12,000	9,000	38,000
1965	c16,000	12,000	50,000
Totals (rounded)	67,000	50,000	50,000

1. Net pumpage is assumed to be 75 percent of gross pumpage.

a. Inventory by office of Nevada State Engineer.

b. Based principally on crop inventories (table 16).

c. Based principally on pumpage inventory by the author.

lists the gross pumpage, net pumpage, and cumulative net pumpage for the period 1950-65.

Effects of Pumping on the Ground-Water System

Effects on Natural Conditions

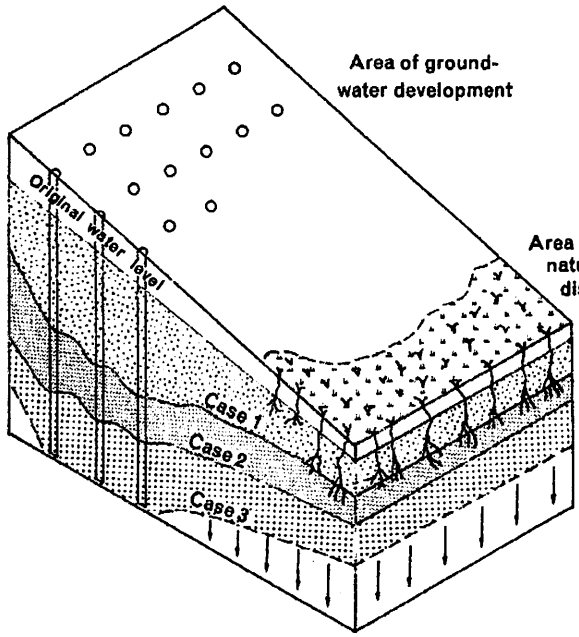
Prior to any development the ground-water system over the long term was in a state of dynamic equilibrium, where recharge equaled discharge and the quantity of water in storage remained constant. Pumping creates an imbalance in the system, where total discharge (natural discharge plus net pumpage) exceeds the recharge. Consequently, water is pumped from storage and water levels decline until natural discharge is reduced sufficiently to bring the system to a new equilibrium, where recharge equals a reduced natural discharge (sometimes to zero) plus net pumpage. However, if net pumpage exceeds the predevelopment natural discharge, water levels will decline indefinitely and a new equilibrium will never be reached.

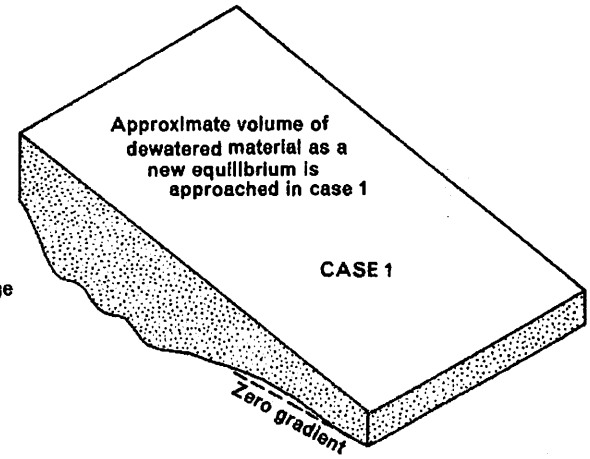
Effects of Specific Developments

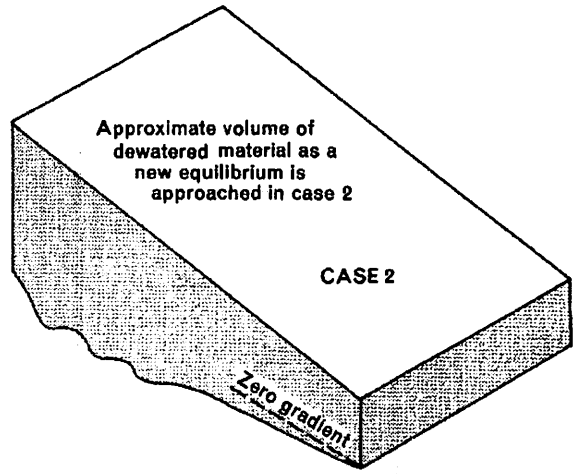
The amount by which water levels will decline in any given place is dependent on the quantity of water pumped in relation to the quantity of natural discharge, the distance from the area of pumping to areas of natural discharge, the degree to which pumping is localized, and the coefficients of transmissibility and storage. Development in the South Diamond subarea is: (1) distributed asymmetrically with respect to the area of natural discharge, (2) concentrated in a localized area, and (3) at least 10 miles away from any area where an appreciable quantity of natural discharge may be salvaged (the distance is based on the area with the highest concentration of pumping, T. 21 N., R. 53 E.).

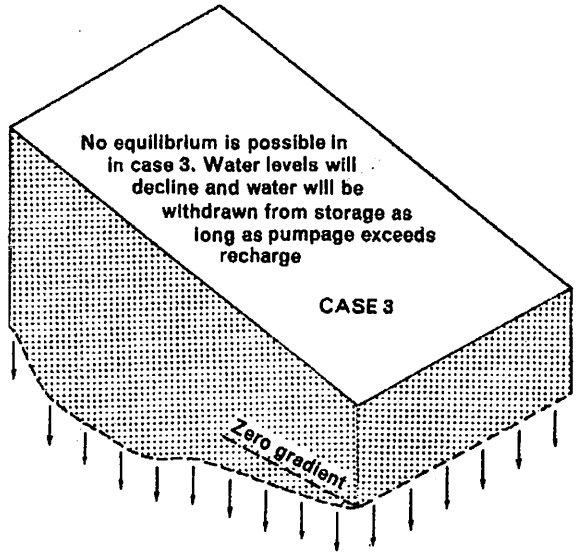
These three conditions indicate that, regardless of the pumping rate, a great deal of water must be withdrawn from storage and water levels lowered appreciably before any new equilibrium is possible. Figure 11 shows the long-term effects of three rates of pumping on the natural system. The distribution of pumping in relation to the area of natural discharge, as shown, is similar to that which exists in the South Diamond subarea.

The extent to which various pumping rates in the South Diamond subarea will eventually affect conditions in the North Diamond subarea may be estimated approximately from figure 12, which shows the area of ground-water development and the cumulative natural discharge from the vicinity of the pumping area to the northern end of the valley. In estimating the areal extent of pumping effects, it must be realized that the natural discharge in the southern area would not be completely eliminated before the area to the north is affected. For example, if equilibrium conditions were approached for a net pumping rate of









CASE 1—Annual pumpage is less than average annual recharge and natural discharge

Water is pumped from storage and water levels decline until natural discharge is reduced by an amount equal to the rate of pumping. A local depression develops in the pumping area. A slight reversed gradient from parts of the area of natural discharge toward the pumping area may develop; however, natural discharge continues at a reduced rate

CASE 2—Annual pumpage equals average annual recharge and natural discharge

Water is pumped from storage and water levels decline until natural discharge is eliminated. Water levels continue to drop at a reduced rate until a slight reversed gradient is established toward the pumping area allowing all recharge to flow toward and ultimately be discharged by pumping

CASE 3—Annual pumpage exceeds average annual recharge and natural discharge

Water is pumped from storage and water levels decline throughout the area. When natural discharge is eliminated, the rate at which water is pumped from storage about equals the amount by which pumpage exceeds recharge to the area. Water levels will continue to decline until pumpage is decreased or terminated because of (1) increased lifts and costs or (2) a deterioration in water quality

Figure 11.—Long-term effects of three rates of pumping on the ground-water system

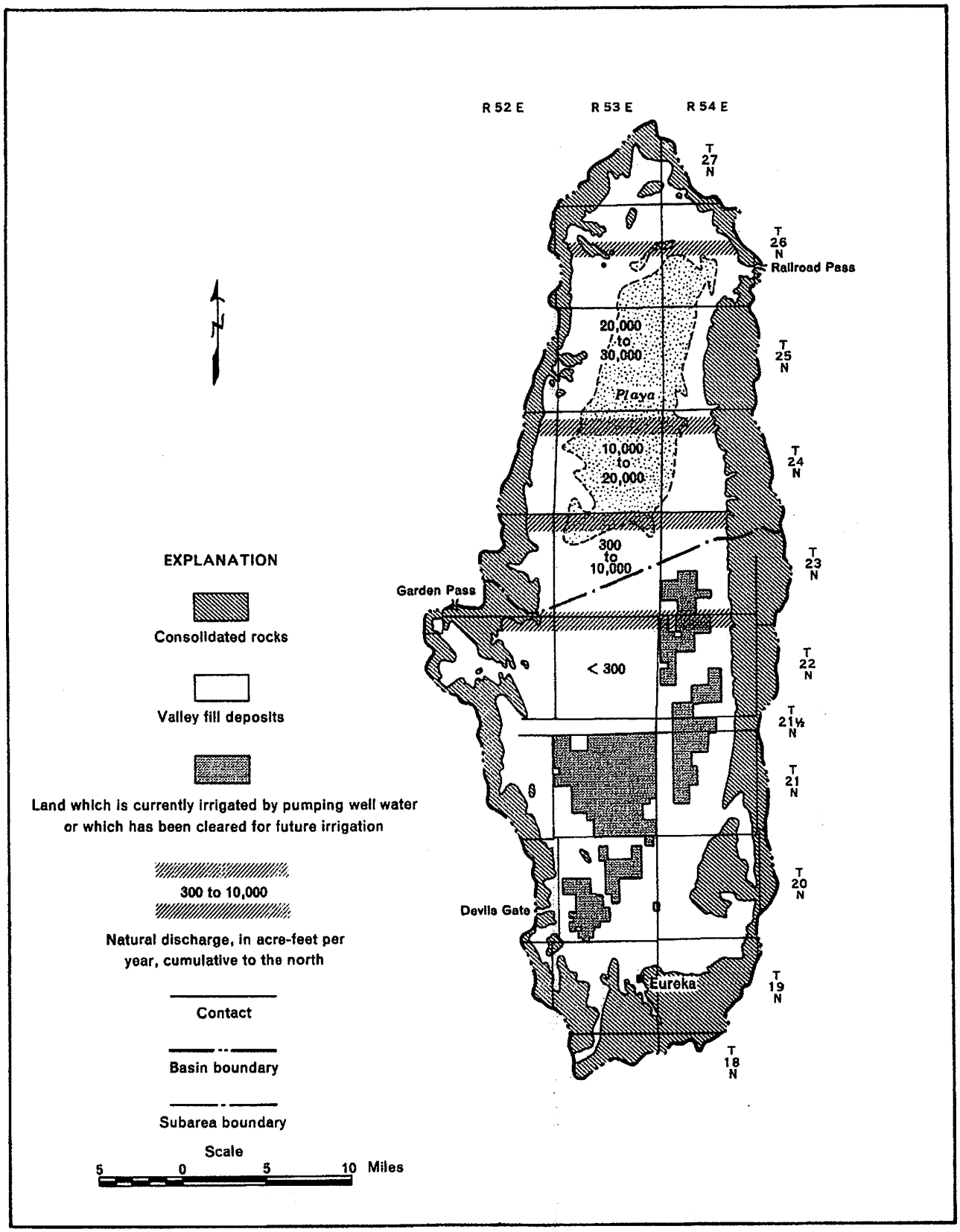


Figure 12.—Location of major ground-water development with respect to the distribution of natural discharge in 1965

12,000 acre-feet per year in the South Diamond subarea (estimated 1965 rate, table 17), then the natural discharge in Tps. 22 and 23 N. would be greatly reduced while discharge in T. 24 N. and possible parts of T. 25 N. would be reduced progressively, but to a lesser extent. The total reduction in natural discharge eventually would equal 12,000 acre-feet per year, and the conditions of Case I in figure 11 would be achieved.

Changes in Water Quality

In hydrologically closed basins, the chemical quality of pumped water generally deteriorates with time. This change is attributed to (1) the reversal of natural gradients which may cause water of poor quality to flow into the pumping area from beneath the playa, and (2) an unfavorable salt balance caused by the recycling of irrigation water in the area of pumping. The effects of both of these processes are lessened by mixing with locally derived water of good quality so considerable pumping may be required before changes in water quality will cause significant reductions.

The problem of an unfavorable salt balance in time may pose a threat to the future of the existing ground-water development. As pointed out by Hem (Halpenny and others, 1952, p. 149):

> "It has long been recognized that if an irrigation project is to be permanently successful it must be so designed and operated that the drainage leaving the area of irrigation carries off the accumulating soluble salt from the whole area. Ideally, the amount of mineral matter that must be removed should at least be equivalent to the amount entering the area in the irrigation water supply and from other sources. This is essentially the principal of salt balance."

Drainage from the South Diamond subarea under natural conditions was by subsurface flow toward the playa. As natural gradients are reversed by pumping, drainage from the area will be eliminated and salts which are not removed by crops or wind action will remain either in the soil or in that part of the irrigation water which returns to the zone of saturation. Soluble salts are continually being brought into the area, either in ground water or in fertilizers. This results in an unfavorable salt balance and, over the long term, an insidious but cumulative deterioration in the quality of the pumped water.

The Nonequilibrium Condition

Water-Level Decline

Rate.--Development along the east side of the valley in Tps. 21 and 22 N. has existed since the early 1950's; however, the area of

heaviest pumping, T. 21 N., R. 53 E., was not developed to any degree until 1958. The hydrographs in figure 13 show the effects of the duration and extent of development on the magnitude and rate of water-level decline in three wells over periods of 16 to 18 years. Hydrographs of wells 22/54-10ac and 22/54-33dd, on the east side of the valley, show a nearly constant decline since 1950. In well 21/53-22cd, near the center of the most heavily pumped area, water levels did not begin to drop appreciably until 1958, but since then have declined more rapidly than in the wells on the east side of the valley. The pronounced annual fluctuations shown since 1960 are the result of seasonal pumping.

Well 22/54-10ac is in the extreme southeastern part of the natural-discharge area. The lowering of water levels in that area indicates that small local reduction in natural discharge is occurring; however, no large-scale reduction will occur until water levels begin to decline in the main area of natural discharge some 5 to 6 miles farther north.

Figure 14 is a diagrammatic cross section showing the overall water-level decline for one year in the most heavily pumped part of the developed area. It was constructed by projecting the net changes for one year, spring 1965 to spring 1966, in some 16 selected wells onto a north-south section through the approximate center of the most heavily pumped area. Additional pumping occurred some 4 to 6 miles east of the line of section, in T. 22 N., R. 54 E., but the effect on observation wells in the center of the valley was negligible.

The rate of water-level decline in the central part of the pumped area is somewhat irregular, but averages 1.5 to 2 feet per year, whereas the rate of decline in wells outside of the pumped area decreases with distance from the pumped area. The net change-distance relationship suggested is similar to the drawdown-distance relationship obtained from the cone of depression of a single pumped well. On the basis of this similarity, increases in the rate of pumping may produce moderately large increases in the rate of water-level decline beneath the pumped area with progressively smaller increases in the rate of water-level decline with increasing distance from the pumping area.

Net change, 1950-66.--Contours drawn for the high water levels in the spring 1966 in the South Diamond subarea are shown in figure 15. In the developed area, water levels are substantially lower than those shown for the spring of 1950 on plate 2. The area in which water levels have declined and the amount of the decline were determined from these two maps and extrapolated from changes observed in individual wells having shorter records. Figure 16 shows the net decline in water levels from spring 1950 to spring 1966.

The maximum change noted was 12.2 feet in well 21/53-36dc. The area of maximum change does not coincide exactly with the area of

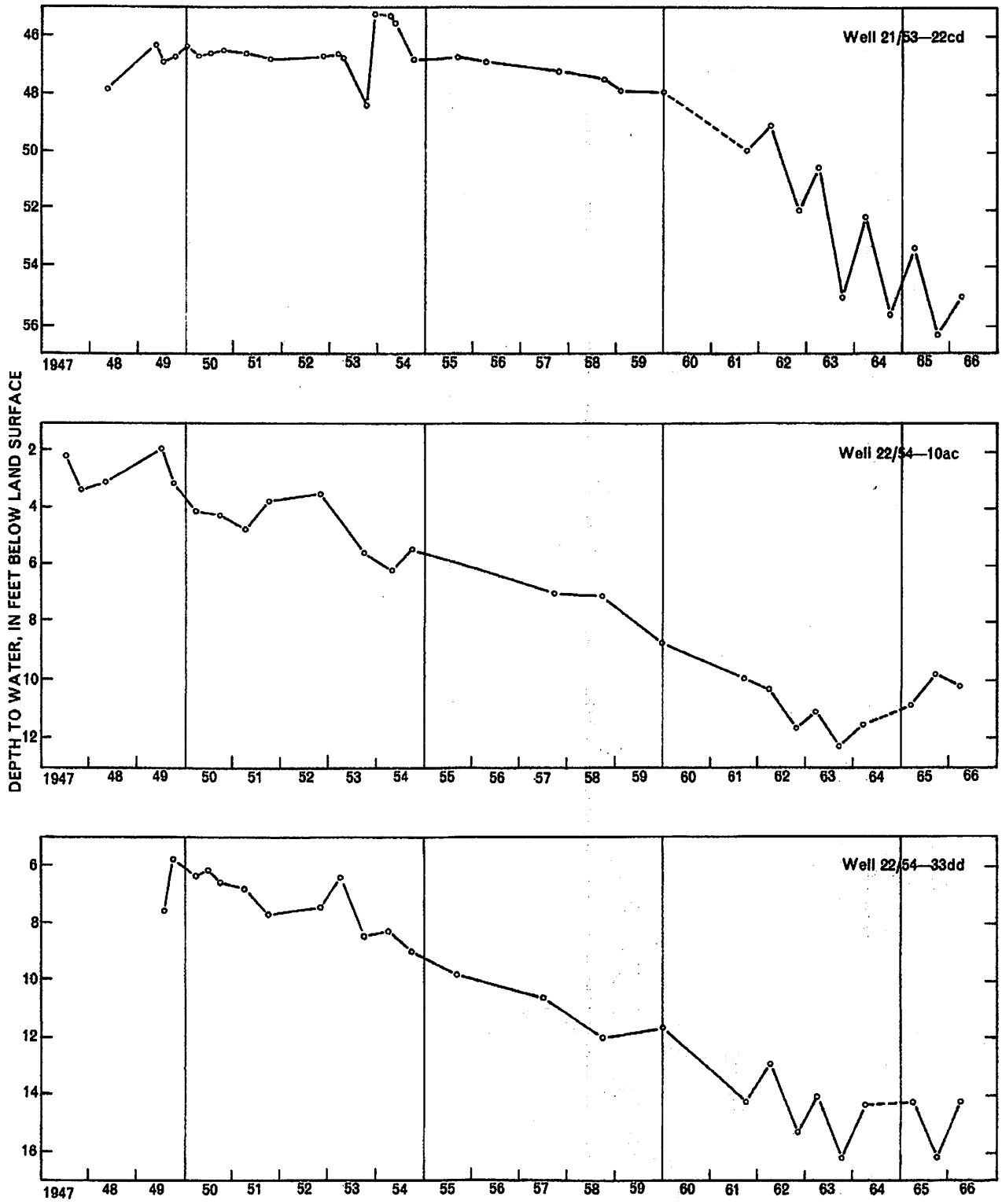


Figure 13.—Hydrographs of three wells

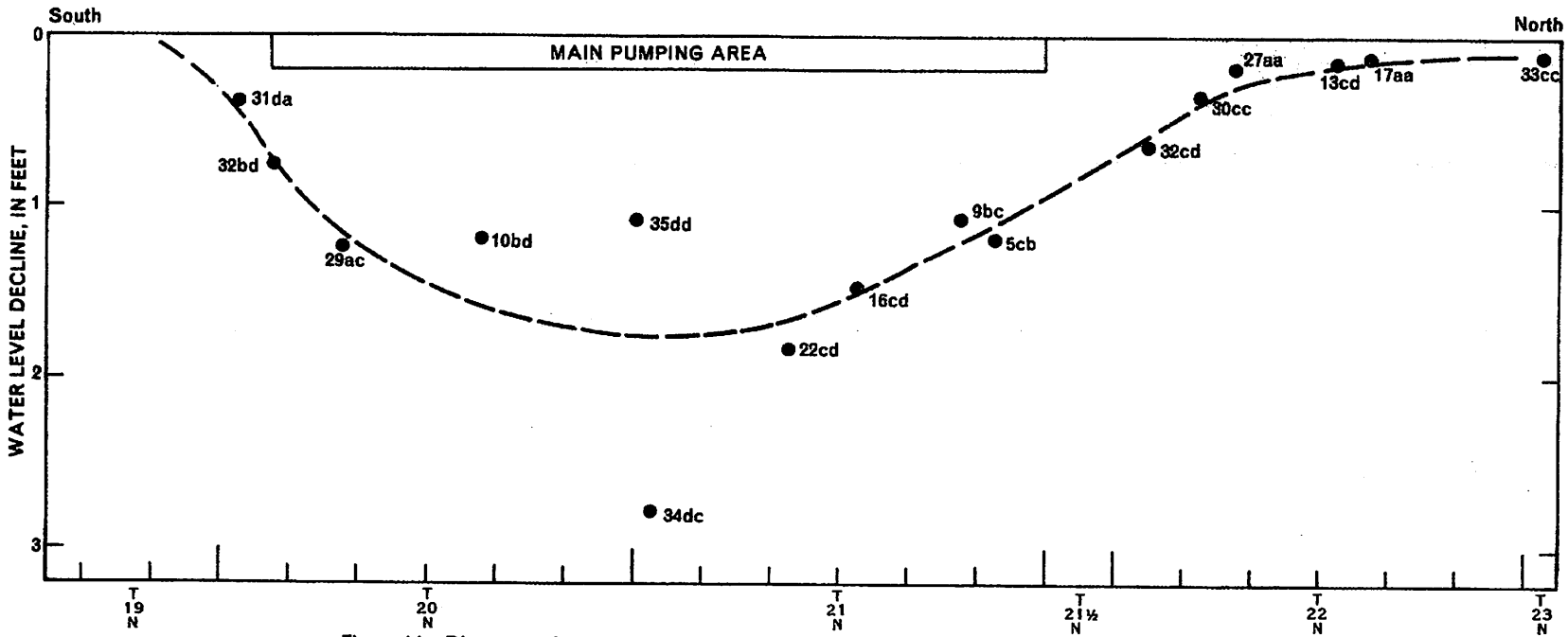


Figure 14.—Diagrammatic cross section showing net decline in water levels, spring 1965 to spring 1966

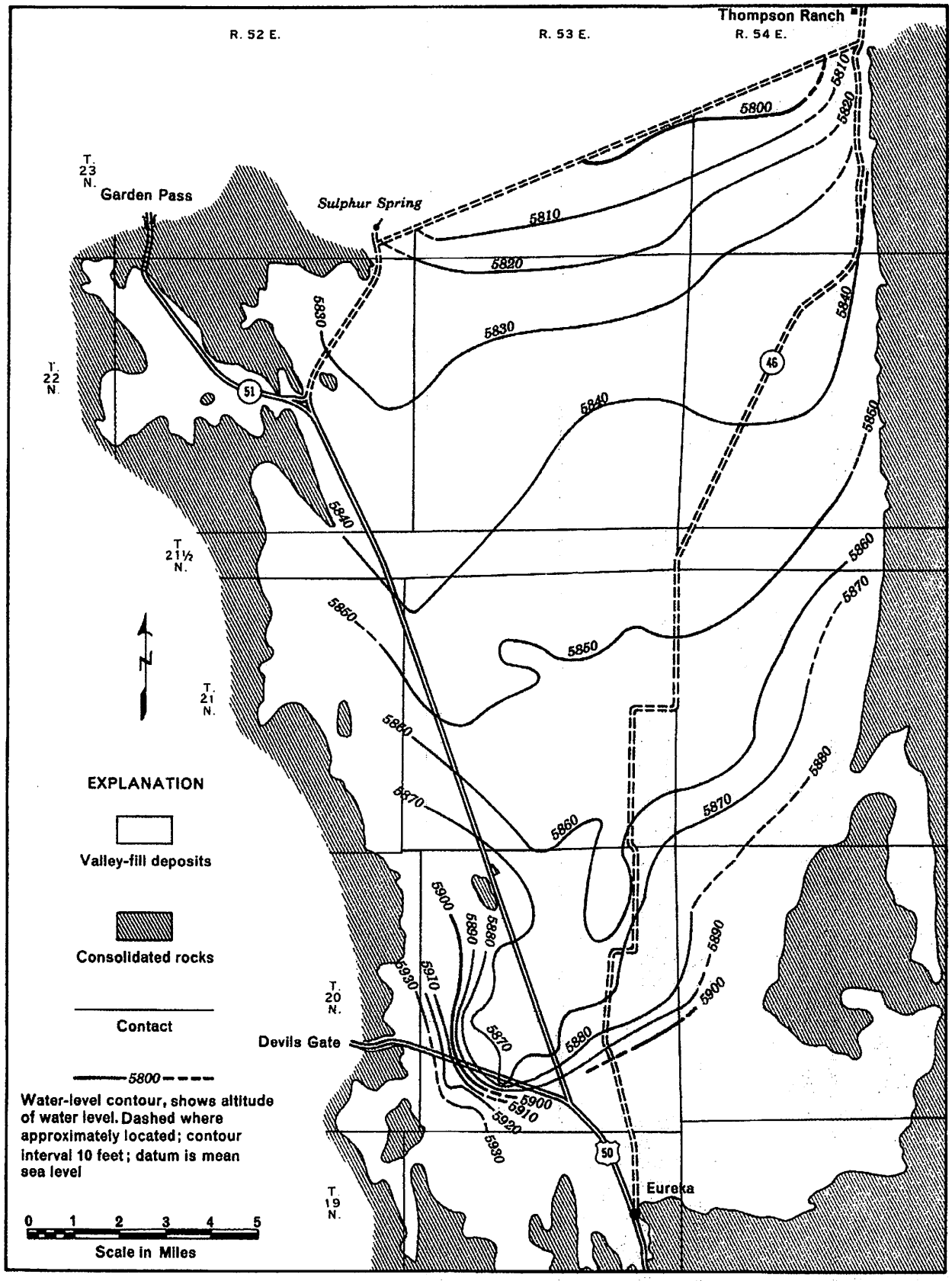


Figure 15.—Water-level contours for April 1966, South Diamond subarea

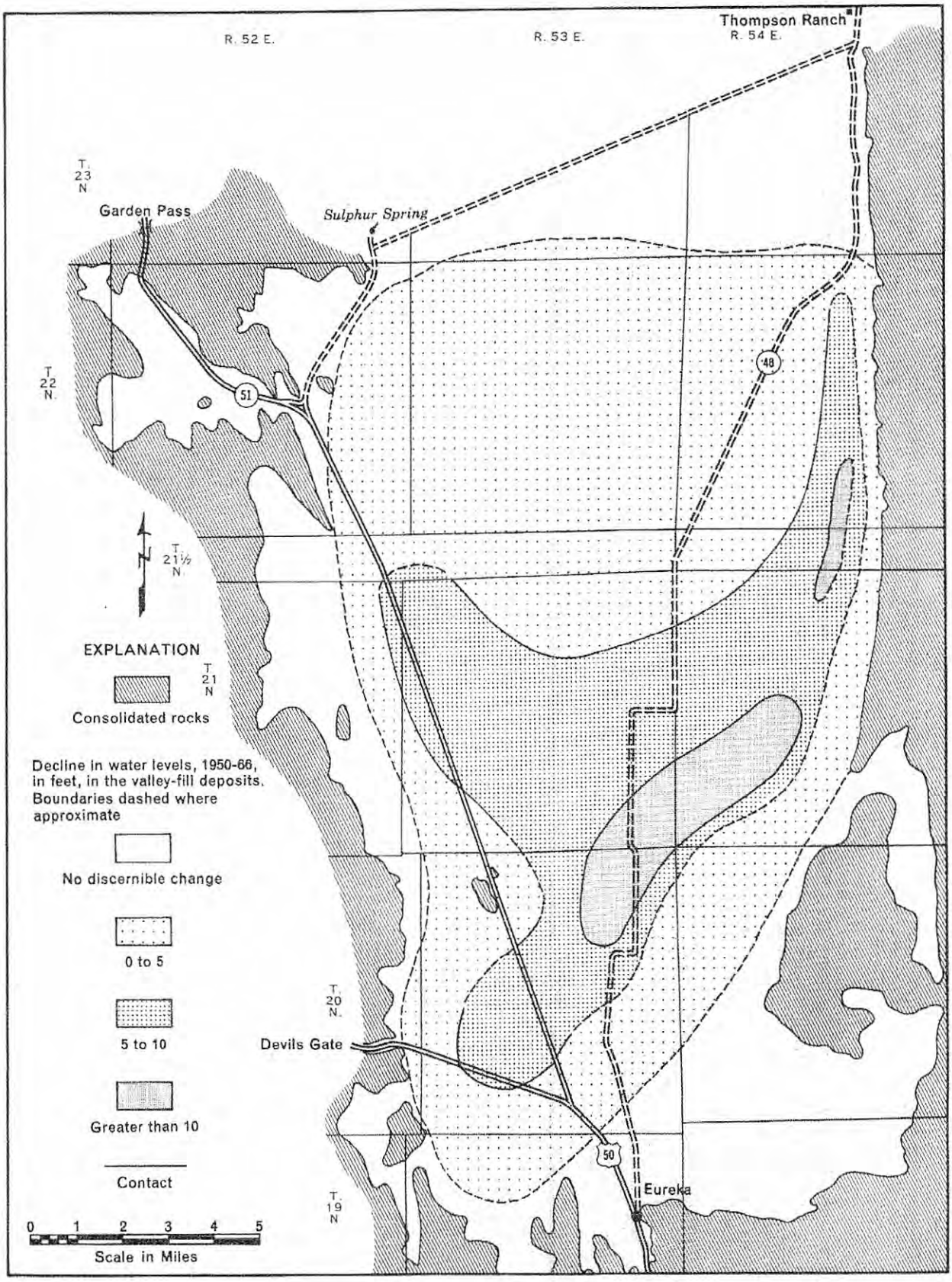


Figure 16.—Approximate net decline of water levels in the south Diamond subarea, 1950-66

heaviest pumping. It is offset slightly toward the Diamond Mountains and is attributed in part to fine-grained lenses in the valley fill which cause semiconfined conditions under the southeast part of the developed area. In most of the developed area the net change is between 5 and 10 feet. At the extreme northeastern end of the developed area, in T. 23 N., R. 54 E. (fig. 16), no substantial pumping has occurred and no measurable change in water levels was noticed.

Storage Depletion as of Spring 1966

Water that has been removed from storage by pumping during the 16-year period, spring 1950-spring 1966, was estimated by the same method used to determine the recoverable storage in the upper 100 feet of saturated valley fill. For purposes of estimating the depletion the specific yields for the upper 100 feet of saturated valley fill shown on figure 7 are considered to be roughly equivalent to those of the thinner interval dewatered during the 16-year period. The volume of the dewatered interval was determined from the net water-level declines shown in figure 16.

Table 18 shows an estimated storage depletion of 60,000 acre-feet. That value is larger than, but on the same order of magnitude as, the estimated total net pumpage of 50,000 acre-feet for the 16 years, 1950-65 (table 17). Under ideal conditions, these quantities should be equal, because the area of net change (fig. 16) has not yet salvaged any appreciable quantity of natural discharge, which indicates that virtually all pumpage has been from storage. The difference of 10,000 acre-feet, or about 18 percent, in these two estimates is attributed to inaccuracies in the assumptions made, to a time lag in the draining of finer grained deposits, to a time lag in the return of recirculated water to the zone of saturation, and to water-level declines in some wells that may represent changes in pressure head rather than actual storage depletion.

Ground-Water Budget, 1950-66

Table 19 summarizes the effects of 16 years of pumping on the hydrologic system, a period of nonequilibrium conditions. Virtually all the change has occurred in the South Diamond subarea. When all the recharge to the valley-fill reservoir during the 16-year period is compared to all the discharge, a net loss of approximately 48,000 acre-feet, or 3,000 acre-feet per year, is noted. If all estimates are correct, the net loss of 48,000 acre-feet (budget item 3) should equal the estimated net storage depletion of 60,000 acre-feet (budget item 4), which was computed independently. The imbalance between methods of 12,000 acre-feet, which is only a little more than 2 percent of the recharge or discharge, is attributed largely to errors in estimates of net pumpage and storage depletion. In the event that the larger estimates of recharge from precipitation, inter-basin flow, and natural discharge, which were computed for the long-term average, are not representative of or imposed some change on the system for the period 1950-60, the budget may be even more in error.

Table 18.--Estimated net storage depletion for the 16-year period 1950-66

Net change (feet) Range	Average	Area (acres)	Volume dewatered (acre-feet)	Average specific yield (percent)	Storage depletion (acre-feet)
0 to 5	1	14,000	14,000	20	2,800
	1	51,000	51,000	12.5	6,400
	1	11,000	11,000	7.5	820
5 to 10	7	19,000	130,000	20	26,000
	7	9,600	67,000	12.5	8,400
	7	4,600	32,000	7.5	2,400
Greater than 10	11	4,600	51,000	20	10,000
	11	1,900	21,000	12.5	2,600
	11	200	2,200	7.5	160
Totals (rounded)	a 3.3	116,000	380,000		60,000

a. Average weighted water-level decline.

Table 19.--Ground-water budget, in acre-feet, for nonequilibrium conditions in Diamond Valley, 1950-66

(All values estimated, as described in text)

Budget item[1/]	16-year period	Average annual
RECHARGE:		
Precipitation (table 6)	336,000	21,000
Inflow at Devils Gate (p. 21)	2,400	150
Subsurface inflow from Garden Valley (table 7)	144,000	9,000
Total (rounded) (1):	482,000	30,000
DISCHARGE:		
Evapotranspiration (table 8)	480,000	30,000
Net pumpage (table 17)	50,000	3,100
Total (rounded) (2):	530,000	33,000
IMBALANCE (3): (1) - (2)	-48,000	-3,000
STORAGE DEPLETION (table 19) (4):	-60,000	-3,800
DIFFERENCE BETWEEN METHODS: (3) - (4)	12,000	800

1. All items, except pumpage and storage depletion, based on long-term average rather than for period 1950-66.

THE AVAILABLE GROUND-WATER SUPPLY

The available ground-water supply in Diamond Valley can be expressed in several ways: (1) the natural yield, which is provided by the springs, principally in the North Diamond subarea; (2) the perennial yield, or the maximum amount of salvable natural discharge; (3) storage depletion, which is sometimes referred to as the "one-time reserve"; and (4) the possible future development and its relation to the available supply. These are discussed in the following sections.

Natural Ground-Water Yield

The large springs, principally in the North Diamond subarea (pl. 2), provide a natural ground-water supply of about 8,400 acre-feet per year (table 9). For many years most of the discharge has been used to irrigate hay, natural pasture, alfalfa, and native grasses. Because of the relatively uniform flow throughout the year and because of the short growing season, only about a third of the total spring discharge is put to beneficial use. The bulk of the flow is consumed largely by nonbeneficial evapotranspiration in areas of phreatophytes downstream from the spring outlets.

In time, as the effects of ground-water development begin to reduce natural discharge, the spring flow probably will begin to decrease. If ranchers eventually drill wells and pump in this area, the spring flow can be expected to decrease more rapidly.

Perennial Yield

The perennial yield of a ground-water reservoir may be defined as the maximum amount of water of usable chemical quality that can be withdrawn and consumed economically each year for an indefinite period of time. If the perennial yield is continually exceeded, water levels will decline until the ground-water reservoir is depleted of water of usable quality or until pumping lifts become uneconomical to maintain. Perennial yield cannot exceed the natural recharge to or discharge from the reservoir. Moreover, the perennial yield ultimately is limited to the maximum amount of natural discharge that can be economically salvaged for beneficial use.

Table 6 shows that the estimated average annual recharge to the ground-water reservoir is 30,000 acre-feet, and table 8 shows that the average annual discharge is the same. Thus, with an ideal distribution of pumping so as to salvage all natural discharge and with no deterioration in water quality, the perennial yield of the valley-fill reservoir also is approximately 30,000 acre-feet.

The estimated net pumpage in 1965 was 12,000 acre-feet (table 17), which is considerably less than the estimated yield. However, from 1960 to 1965, net pumpage increased from 1,800 to 12,000 acre-feet, or at an average rate of about 2,000 acre-feet per year. If this rate should continue, net pumpage would equal the perennial yield by about 1975. Moreover, because permits to pump nearly 150,000 acre-feet per year have been granted in this same area, the rate of increase might be accelerated and the yield equaled even sooner. Eventually it could be greatly exceeded.

The maximum amount of natural discharge that can be salvaged by pumping in the general area of development in 1966 in the South Diamond subarea (fig. 12) will be governed by the rate at which pumping lifts become uneconomical to maintain or at which a significant influx of poor-quality water from the playa area might occur. Because of the unfavorable distribution of pumping with respect to salvage of natural discharge, lifts in much of the developed area would have to increase substantially over those in 1966 to salvage even an amount of natural discharge equal to the estimated net pumpage of 12,000 acre-feet in 1965. Figure 12 shows that all natural discharge in Tps. 22 and 23 N., Rs. 52, 53, and 54 E., and about 10 percent of that in T. 24 N., Rs. 52, 53, and 54 E. would have to be salvaged to equal this pumpage. The northernmost salvage would be some 15 miles north of the area of concentrated pumping in T. 21 N., R. 53 E.

Sustained annual pumping much in excess of 12,000 acre-feet per year would produce accelerated rates of water-level decline in the pumped area, and any new equilibrium (fig. 11, Case I) probably could not be attained before lifts would become uneconomical to maintain. Thus, pumpage much in excess of 12,000 acre-feet per year in the area of development in 1966 probably will lead to a paradox, common in Nevada valleys; a condition of local overdraft in the South Diamond subarea, while more than 15,000 acre-feet per year goes to waste in the North Diamond subarea.

Storage Depletion

The quantity of storage depletion necessary before the hydrologic system can attain a new equilibrium at a rate of pumpage equal to or less than the perennial yield is dependent primarily upon the distribution of pumping with respect to natural discharge. With properly spaced wells in or near the area of natural discharge, the necessary storage depletion becomes minimal. Conversely, the necessary storage depletion increases as pumping is moved away from the natural-discharge area or is asymmetrically distributed with respect to it.

In Diamond Valley the necessary storage depletion required to reach a new equilibrium is difficult to predict, because of the many unknown and variable hydrologic factors. Moreover, as previously mentioned, the unfavorable distribution of pumping with respect to natural

discharge, as of 1965, probably will result in a local overdraft in the South Diamond subarea long before a new equilibrium could be approached with a net pumpage equal to the perennial yield. Therefore, an example is considered in terms of that storage depletion necessary before the system can approach a new equilibrium where net pumpage equals 12,000 acre-feet per year (the 1965 rate) from the general area of development shown in figure 12. Although this rate represents only 40 percent of the perennial yield, it may approximate the maximum amount of natural discharge that can be economically salvaged by pumping in the South Diamond subarea. The following assumptions are utilized to obtain an estimate: (1) Pumping in the future would continue to be concentrated in the same general areas as in 1965 (fig. 12); (2) Net pumpage would continue at the 1965 rate of 12,000 acre-feet per year; (3) A hydraulic gradient from the playa toward the area of pumping would develop as equilibrium is approached (fig. 11, Case I); (4) The area affected would include most of the valley fill south of T. 24 N., Rs. 52, 53, and 54 E. and some valley fill in the southern part of T. 24 N., Rs. 52, 53, and 54 E. (fig. 12)--a total of roughly 200,000 acres; (5) The water-level decline would range from about 10 feet in the playa area in T. 24 N., R. 53 E. to 200 feet at the south edge of the pumped area in Tps. 19 and 20 N., R. 53 E., and the weighted areal decline would be roughly 125 feet; and (6) The estimated specific-yield distribution shown on figure 7 also would apply at depths greater than the uppermost 100 feet of saturation, and is computed to average about 12 percent.

Utilizing these assumptions together with the distribution of transmissibility (fig. 3), the storage depletion is computed to be about 3 million acre-feet, most of which would occur in the South Diamond subarea. Figure 17 shows diagrammatically the effect on water levels of a storage depletion of this magnitude in the South Diamond subarea. The economic significance of this large quantity is that locally water levels in the area of development may be expected to decline as much as 200 feet below the 1965 levels (as much as 300 feet below land surface), if net pumpage were held at about the 1965 rate of 12,000 acre-feet. Pumping at greater rates would result in more rapid storage depletion in the developed area, causing larger increases in the rate of water-level decline in the vicinity of the pumping and smaller increases in the rate of decline near the area of natural discharge. Moreover, if net pumpage were held to 12,000 acre-feet per year, the estimated 3 million acre-feet of storage would not be exhausted for 300 to 400 years, depending on the rate at which natural discharge would be salvaged. At that time water levels would stabilize, and all the net pumpage of 12,000 acre-feet per year would be supplied by recharge moving directly to the pumping wells.

Future Pumpage

The foregoing sections on yield indicate that large drawdowns will result if pumping is restricted to the areas of development shown on

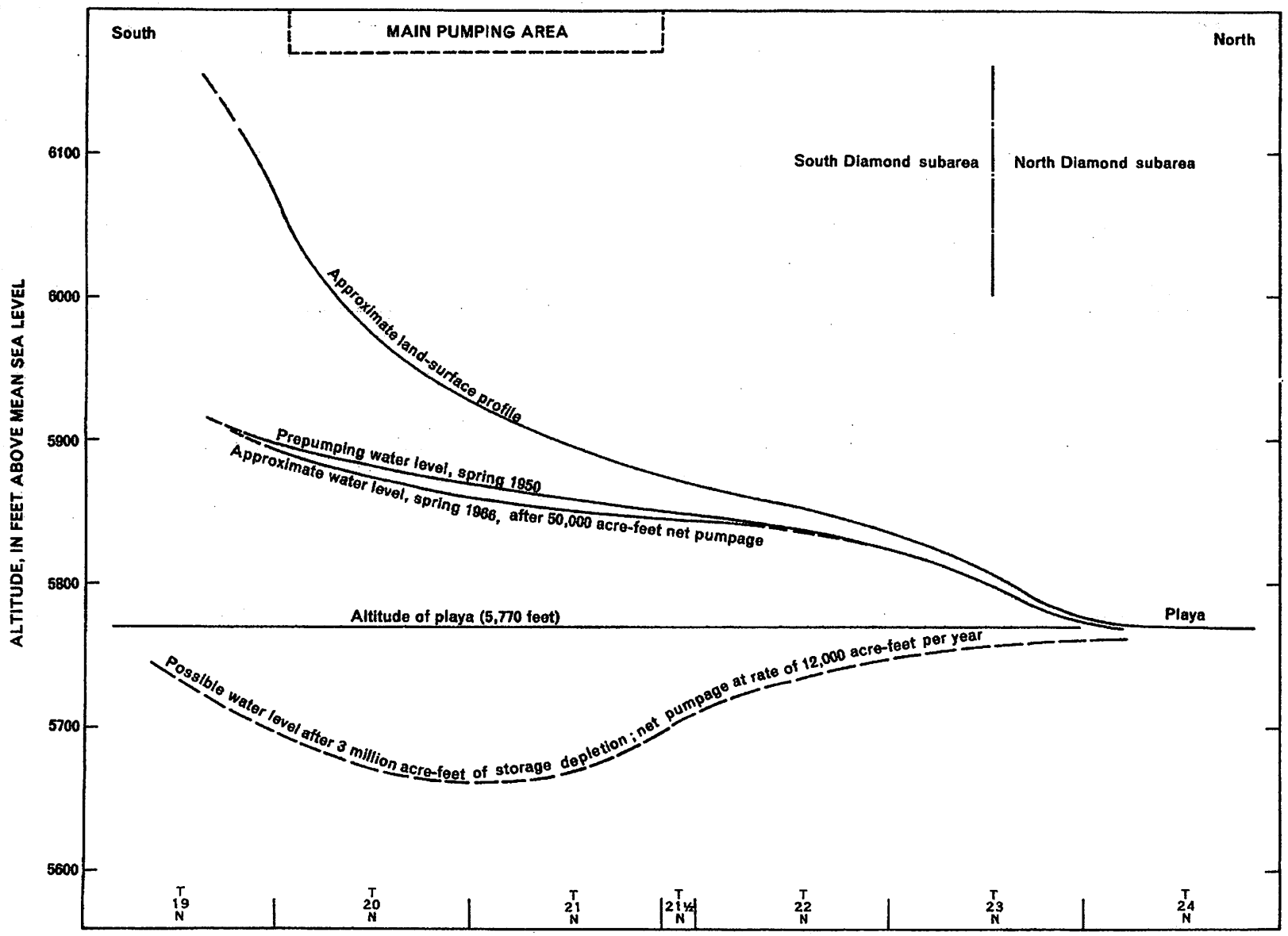


Figure 17.—Diagrammatic water-level profiles in South Diamond subarea

figure 12. A local overdraft will occur in the South Diamond subarea long before any new equilibrium is reached. Moreover, even without any increase in net pumpage rate, pumping lifts locally could become uneconomical to maintain within the next 10 to 20 years.

As previously mentioned, permits to pump approximately 150,000 acre-feet per year in Diamond Valley have been granted by the State. Thus, future utilization of existing permits will result in a massive local overdraft and accelerated rates of water-level decline.

CONCLUSIONS

This second appraisal of the water resources of Diamond Valley has led to the following conclusions regarding the adequacy of supply, effects of development, and types of data needed to refine the flow system and response characteristics of the valley-fill reservoir:

1. All development to date and all applications for future development are in the South Diamond subarea--total permits to pump about 150,000 acre-feet per year have been granted. This is considerably in excess of the estimated perennial yield of 30,000 acre-feet for Diamond Valley.

2. The estimated net pumpage in 1965 was 12,000 acre-feet, or less than half the estimated yield. Virtually all net pumpage of record (1950-65), which totals an estimated 50,000 acre-feet, has been supplied from ground water in storage in the South Diamond subarea.

3. Because the area of pumping is remote from areas of natural discharge, storage depletion will continue for many years in the future. An example demonstrated that if net pumpage were held to only 12,000 acre-feet per year, about 3 million acre-feet of storage depletion would be required before 12,000 acre-feet per year of natural discharge could be salvaged. Water levels in the area of concentrated pumpage (T. 21 N., R. 53 E.) would be drawn down as much as 200 feet below 1965 levels. The time required to reach the new equilibrium would be from 300 to 400 years.

4. The rate of increase in estimated net pumpage from 1,800 acre-feet in 1960 to 12,000 acre-feet in 1965 suggests that net pumpage may equal the perennial yield by 1975. Even if the perennial yield is not exceeded, local overdraft is likely to occur in the South Diamond subarea and water levels locally may be drawn down below economic pumping lifts.

5. Pumping in the South Diamond subarea eventually should decrease the natural discharge from springs in the North Diamond subarea, which during the summer 1965 was largely being used beneficially. In time, the discharge from springs may have to be supplemented or replaced by pumping from wells. Although more costly, this procedure would salvage the large amount of water (about 6,000 acre-feet per year) now running to waste during the nongrowing season.

6. The cost of pumping will increase in about direct proportion to the increase in pumping lift, provided that other fixed

costs remain constant. To the extent possible, new or replacement pumping should be situated farther north near the playa, where the cost of pumping would be less and where salvage of natural discharge would tend to reduce the rate of water-level decline. This in turn would reduce the rate of pumping-cost increase.

7. The cause-and-effect relations (pumpage versus the distribution and amount of water-level decline and associated factors) for the 16-year period 1950-66 are first approximations developed from an estimated gross pumpage of 67,000 acre-feet (estimated 50,000 net pumpage). Future refinements of these relations will require reasonably accurate records of the annual pumpage, periodic water-level measurements in most wells, preferably in the spring before pumping begins, periodic discharge measurements of the major streams and springs, and monitoring the chemical quality of pumped water. Additional precipitation stations on the valley floor and in the surrounding mountains also would provide valuable data for refining runoff and recharge estimates.

8. A reappraisal of Diamond Valley about in 1975, or sooner if pumpage increases substantially, would be desirable to evaluate the effects of pumping on the flow system, the magnitude of the storage depletion, and the extent of any overdraft that might then exist. Those findings would provide the basis for timely decisions for the administration and management of the water resources of Diamond Valley.

Numbering System for Wells and Springs

The numbering system for wells and springs in this report is based on the rectangular subdivisions of the public lands, referenced to the Mount Diablo base line and meridian. It consists of three units: the first is the township north of the base line; the second unit, separated from the first by a slant, is the range east of the meridian; and the third unit, separated from the second by a dash, lists the section number followed by two letters that designate the quarter section, and the quarter-quarter section, respectively. The northeast quarter of a subdivision is designated by the letter a, the northwest quarter by the letter b, the southwest quarter by the letter c, and the southeast quarter by the letter d. Following the letters, a number indicates the order in which the well or spring was recorded within the 10-acre subdivision. For example, well 21/53-1acl is the first well recorded in the southwest quarter of the northeast quarter of sec. 1, T. 21 N., R. 53 E., Mount Diablo meridian.

Because of the limitation of space, wells and springs are identified on plates only by that part of the number which designates the subdivision of the section and, if two or more wells are in one subdivision, the order in which the well or spring was recorded in that section.

Table 20.--Records of selected wells and testholes

Owner: BLM, U.S. Bureau of Land Management
Use: D, domestic; I, irrigation; O, observation; S, stock; U, unused; Des, destroyed
Specific capacity: In gallons per minute (gpm) per foot of drawdown
Altitude: Determined from topographic maps
Water-level measurements: Depth, in feet, below land-surface datum
State log number: Log number in the files of the State Engineer
Remarks: Dis, discharge

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
19/53-8ab	"Old Holly Well"	--	--	6	Des	--	6,110	3-16-50	179.82	--	
-14ad	--	--	--	--	I,S	--	6,360	4-26-66	19.86	--	
-14da	Eureka County School District	1962	265	8	I	--	6,465	4- 5-66	44.37	8329	
20/53-1ac	Lavern Machacek	1960	173	17	I	14	5,960	do.	86.38	5542	
-2ac	--	1966	220+	16	I	--	5,937	5-17-66	67.08	--	
-2dd	L. W. Wilbanks	1963	250	16	I	--	5,966	4- 6-66	105.69	8114	
-4ad	M. C. Kelly	1961	131	13	I	103	5,928	4- 4-66	60.63	6313	
-4dd	do.	1961	177	13	I	66	5,931	4- 5-66	60.71	6152	
-10ad	R. Wilson	1961	180	16	I	64	5,942	do.	83.05	6117	
-10bd	do.	1963	220	16	I,S	--	5,935	do.	67.44	7401	
-10cd	do.	1963	220	16	I	--	5,943	do.	73.06	7402	
-10dd	do.	1961	200	16	I	60	5,952	do.	91.65	6118	
-11ad	Harvey Rife	1965	110	6	D	--	5,972	do.	100.04	--	
-11bd	do.	1962	182	16	I	--	5,958	do.	103.01	6889	
-11cc	Coleman Wade	1962	300	16	I	--	5,955	do.	91.36	8124	
-11dd	do.	1962	275	16	I	--	5,970	do.	97.84	8125	
-15bc	BLM	--	--	--	Des	--	5,952	3-17-50	75.21	--	
-15cd	W. S. Agnew	1964	398	16	I	--	5,984	4- 5-66	121.54	8231	
-17aa	G. S. Wiggins	1965	225	16	I	--	5,942	4- 4-66	72.09	8721	
-17cc	W. E. Baker	1964	175	16	I	--	5,948	do.	46.32	7625	

Table 20.—continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
20/53-17dc	G. S. Wiggins	1963	214	16	I	—	5,950	4- 4-66	71.63	7586	
-18dc	W. E. Baker	1962	165	16	I	—	5,957	do.	48.19	6454	
-20ac	Verlea Vogelsmeier	1965	275	16	I	—	5,962	do.	97.06	8497	
-20bd	Clarence Allamong	1964	260	16	I	—	5,952	do.	81.63	8132	
-20ca	do.	1961	200	16	I	16	5,960	do.	91.83	7641	
-20dd	Gladys Allamong	1961	200	16	I	30	5,960	do.	91.64	7640	
-21ad	E. B. Johnson	1961	213	16	I	60	5,975	4- 5-66	106.98	6116	
-21bd	E. C. Bishop	1962	200	16	I	72	5,960	4- 4-66	98.29	6523	
-21dc	do.	1964	248	16	I	—	5,972	do.	124.29	7993	
-22bd	E. B. Johnson	1964	320	16	I	22	6,010	4- 5-66	137.33	8017	
-23ac	BLM	1961	—	6	S	—	6,012	do.	140.94	—	
-24dd	Ed. Melka	1956	155	8	I	—	6,110	do.	125.00	3566	
-28ad	Mrs. L. B. Bishop	1962	225	16	I	—	6,024	4- 4-66	154.14	6522	
-28bd	do.	1965	230	16	I	—	5,995	do.	118.73	8589	
-29ac	B. A. Peters	1963	302	16	I,S	11	5,980	do.	105.97	7465	
-29bc	—	—	—	—	—	—	5,974	do.	95.88	—	
-29bd	Lions Club of Eureka	1949	141	6	Des	—	5,988	8-16-49	111	1063	
-29dd	A. H. Peters	1965	320	16	I	—	6,005	4- 4-66	136.00	8618	
-30ab	James Ithirriude	1960	150	16	I	16	5,978	do.	59.23	6644	
-30db	do.	—	—	—	S	—	6,000	—	—	—	
-30dc	do.	1963	210	16	I	—	6,012	4-26-66	94.19	7352	
-31da	Pastorino Well	—	—	6	S,O	—	6,099	3-16-50	165.25	—	
-32bb	Rex Collingwood	1965	—	16	I		6,030	4- 4-66	87.98	—	
-32bd	Fred Minoletti	1961	218	12	I	—	6,038	do.	112.98	6312	
-32ca	D. Collingwood	1962	255	14½	I	35	6,059	do.	123.99	7301	
20/54-19bb	BLM	1961	189	8	S	—	6,055	4-23-65	172.19	—	
21/53-1bd	Robert Wilson	1961	210	16	I	—	5,885	4- 6-66	36.57	6721	

Table 20.—continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
21/53-1cd1	Robert Wilson	1961	182	16	I	31	5,887	4- 6-66	37.98	6155	
-1cd2	do.	1961	210	16	I	--	5,887	do.	36.98	6058	
-1db	Valley Grain	1961	184	16	I	--	5,884	do.	37.73	6722	
-1dd	do.	1961	184	16	I	--	5,885	do.	41.64	6376	
-2bd	Everett Veatch	1961	182	16	I	38	5,884	do.	37.74	6146	
-2cd	Katherine Veatch	1961	182	16	I	38	5,886	--	--	6061	
-2db	Ed Knowles	--	--	16	I	38	5,885	4- 6-66	36.84	--	
-3ab	George Knowles	1961	182	16	I	43	5,882	do.	37.72	6060	
-3cd	Dr. J. S. Gaynor	1964	182	16	I	--	5,885	do.	40.00	8149	
-3db	do.	1961	182	16	I	72	5,884	do.	39.12	6166	
-4ad	C. C. Cooper	1961	182	16	I	--	5,883	do.	40.38	6709	
-4bd	do.	1963	188	16	I	--	5,880	do.	34.34	7426	
-4cd	do.	1960	182	16	I	--	5,884	do.	38.03	--	
-4dd	E. R. Cooper	1963	188	16	I	--	5,884	do.	40.35	7425	
-5cb	--	--	--	--	S,O	--	5,879	do.	34.71	--	
-6ad	Elaine Burnham	1963	210	15	I	--	5,875	4-26-66	28.20	7445	
-6cc	Steimley Bailey	1962	120	16	I	--	5,883	4- 6-66	43.22	6670	
-6dc	Robert Burnham	1962	175	14	I	--	5,881	do.	39.22	6640	
-7aa	--	1965	--	16	I	--	5,890	10-18-65	45.85	--	
-7bd	--	1964	182	16	I	--	5,885	4- 6-66	52.31	7874	
-7dd1	--	1962	164	18½	I	--	5,899	do.	51.75	7328	
-7dd2	--	1962	--	18½	I	--	5,899	do.	51.42	--	
-8aa	M. A. Farley	1962	184	13	I	41	5,885	do.	40.72	6669	
-8ca	Alfred Farley	1961	164	13	I	88	5,894	do.	48.04	6062	
-8dd	M. A. Farley	1961	192	13	I	--	5,895	do.	46.18	6063	
-9ad	Jean Stearns	1964	183	16	I	50	5,887	do.	41.02	8144	
-9bc	H. E. Stearns	1964	183	16	I	36	5,886	do.	37.53	8143	
-9cc	do.	1961	182	16	I	66	5,894	do.	43.79	6148	
-9db	E. J. Conaway	1961	182	17½	I	58	5,894	do.	43.70	6149	

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
21/53-10ac	L. W. Dillon	1962	176	17	I	60	5,887	4- 6-66	42.74	7364	
-10bc	D. E. Morrison	1962	176	17	I	70	5,886	--	--	7363	
-10cc	do.	1961	182	13	I	44	5,894	4- 6-66	49.80	6161	
-10dc	L. W. Dillon	1961	182	13	I	53	5,894	do.	43.83	6150	
-11aa	J. D. Carr	1962	192	16	I	--	5,885	do.	43.73	8692	
-11ba	Denver Kelly	1960	192	16	I	31	5,886	--	--	5578	
-11ca	do.	1960	186	17	I	20	5,890	4- 6-66	42.65	5551	
-11da	J. D. Carr	1962	183	16	I	--	5,894	do.	42.65	8693	
-12aa	Jackie Cooper	1963	230	16	I	--	5,887	do.	37.99	7429	
-12bc	Grannell Tolliver	1961	200	16	I,D	--	5,892	do.	41.39	6689	
-12cc	do.	1961	200	16	I	--	5,894	do.	44.28	6688	
-12dd	Neil Cooper	1961	192	16	I	25	5,889	do.	38.69	6162	
-13aa	B. A. DuBose	1962	250	16	I	--	5,895	do.	42.50	6631	
-13ba	Ruthel DuBose	1961	182	16	I	--	5,896	do.	43.99	--	
-13ca	Bruce DuBose	1960	171	17	I	33	5,898	do.	43.98	5545	
-13da	do.	1962	250	16	I	--	5,897	do.	44.05	6630	
-14aa	B. S. Murphy	1961	182	16	I	41	5,896	do.	45.63	6154	
-14ba	do.	1963	182	16	I	--	5,896	do.	45.18	6979	
-14ca	M. S. Murphy	1962	180	16	I	--	5,899	do.	48.25	6754	
-14da	do.	1960	182	16	I	--	5,900	do.	46.97	--	
-15ac	J. W. Cooper	1961	180	16	I	--	5,899	do.	48.39	6724	
-15bc	Vida Cooper	1960	182	16	I	32	5,898	do.	46.10	5548	
-15cd	do.	1962	182	16	I	--	5,900	do.	47.83	7419	
-15db	J. W. Cooper	1962	180	16	I	--	5,900	do.	47.88	7420	
-16aa	T. M. Tynes	1962	182	16	I	--	5,899	--	--	6638	
-16bc	Max Allen	1962	182	16	I	--	5,900	4- 6-66	50.80	7447	
-16cd	do.	1960	183	16	I	108	5,910	do.	61.37	5550	
-16dc	T. M. Tynes	1962	182	16	I	--	5,911	do.	60.88	6888	

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
21/53-17bb	--	1964	165	16	I	--	5,910	4- 6-66	60.01	7854	
-17cc	--	1964	200	16	I	--	5,922	do.	74.52	7888	
-18cc	--	1964	134	16	I	--	5,921	do.	74.15	7873	
-18dd	--	1964	165	16	I	--	5,922	do.	76.22	7646	
-20ac	James Kahle	1961	196	16	I	72	5,926	do.	74.73	6169	
-20ba	E. K. Nunneley	1961	172	16	I	33	5,929	do.	80.51	6168	
-20ca	do.	1962	150	16	I	38	5,938	do.	85.42	6509	
-20cc	do.	--	--	--	-	--	5,941	do.	85.72	--	
-20db	V. E. Nelson	1962	183	16	I	120	5,935	do.	82.92	6769	
-21ad	F. C. Cannedy	1961	182	16	I	45	5,906	do.	53.12	6153	
-21bc	M. A. Allen	1961	190	16	I,D	--	5,918	do.	63.55	6725	
-21cd	do.	1962	186	16	I	--	5,930	do.	79.82	7448	
-21db	F. C. Cannedy	1963	180	16	I	--	5,913	do.	57.59	7872	
-22ad	J. B. Bonds	1962	260	16	I	24	5,903	do.	50.12	6978	
-22ba	B. A. Cooper	1963	180	16	I	--	5,904	do.	53.06	7430	
-22ca	do.	1962	222	16	I	--	5,910	do.	54.47	6964	
-22cd	--	--	--	6	S,O	--	5,911	3-17-50	46.70	--	
								4- 6-66	55.34		
-22dc	Louis Heller	1960	117	16	I	62	5,910	do.	55.15	5546	
-23aa	K. M. Murphy	1960	172	17	I	66	5,903	do.	47.30	5547	
-23ba	do.	1962	216	16	I	--	5,902	do.	50.29	6632	
-23ca	Dewey Murphy	1961	177	16	I	47	5,904	do.	53.91	6147	
-23da	do.	1960	166	17	I	75	5,904	do.	52.62	5544	
-24aa	A. W. Machacek	1961	186	17	I	5	5,902	do.	46.92	6287	
-24ba	do.	1962	400	16	I	--	5,902	do.	45.17	7115	
-24dc	--	--	--	--	-	--	5,918	do.	62.40	--	
-26aa	J. D. Knupps	1961	181	13	I	74	5,907	do.	58.40	6167	
-26ba	Dale Mackibe	1960	176	16	I	37	5,907	do.	53.12	5581	
-26ca	do.	1962	162	--	I	--	5,908	do.	58.44	6720	

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
21/53-26da	J. D. Knupps	1964	218	16	I	--	5,909	4- 6-66	55.09	7954	
-27aa	--	--	--	--	-	--	5,906	do.	55.18	--	
-27bb	Dr. Clifford Fisher	1962	232	17	I	43	5,912	do.	56.96	6770	
-27cc	do.	1960	151	16	I	51	5,914	do.	60.25	5597	
-27da	K. E. Griffith	1961	184	13	I	6	5,910	--	--	6673	
-28ac	W. D. Anderson	1964	210	16	I	--	5,916	4- 6-66	57.54	7953	
-28bc	Dorothy Gallagher	1964	185	16	I	--	5,938	do.	86.13	8151	
-28cc	do.	1964	186	16	I	31	5,944	do.	85.60	7652	
-28da	W. D. Anderson	1961	209	16	I	40	5,916	do.	60.22	6437	
-29ab	J. O. Meyers	1961	188	16	I	--	5,941	do.	86.61	6751	
-29ba	do.	1964	170	16	I	--	5,940	do.	88.47	8251	
-29bd	do.	1960	250	16	I	18	5,941	do.	85.74	5270	
-33ad	R. D. Nichols	1961	112	17	I	86	5,920	do.	61.67	6157	
-33da	L. C. Enzminger	1961	112	17	I	62	5,927	4- 5-66	72.20	6156	
-34ac	L. W. Kelly	1962	126	17	I	52	5,916	do.	66.08	6863	
-34bb	do.	1961	128	13	I	88	5,920	do.	62.34	6674	
-34cb	--	--	--	--	-	--	5,920	do.	62.07	--	
-34dc	H. M. Nichols	1961	157	13	I	67	5,922	do.	57.82	6675	
-35ab	O. G. Gullett	1963	300	16	I	--	5,923	do.	65.76	7434	
-35bd	--	--	--	--	-	--	5,919	do.	59.47	--	
-35ca	--	--	--	--	-	--	5,923	do.	70.08	--	
-35cd	O. G. Gullett	1961	195	18¼	I	--	5,927	--	--	5969	
-35dd	C. F. Gullett	1961	187	16¼	I	40	5,932	4- 5-66	69.72	5968	
-36ab	E. M. Machacek	1960	152	17	I	12	5,935	do.	69.10	5543	
-36ac	do.	1963	300	16	I	30	5,938	do.	71.17	7286	
-36ad	do.	1962	300	16	I	29	5,942	do.	78.75	6550	
-36cd	do.	--	--	16	I	--	5,941	do.	78.77	--	
-36dc	--	--	108.5	6	U	--	5,952	6-15-48	67.57	--	
								5- 4-66	79.80		

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
21/54-4ad1	C. E. Pollard	1949	73	12	I,O	--	5,900	3-17-50	37.50	981	
								4- 7-66	47.22		
-4ad2	do.	1950	120	12	I	--	5,893	do.	39.14	1478	
-4dd	do.	--	182	14	I	--	5,910	do.	47.80	--	
-5aa	T. I. Loiter	1964	244	16	I	--	5,869	4- 6-66	22.18	7974	
-5ba	Roy Ruthford	1962	150	--	I	--	5,869	4- 7-66	23.43	7700	
-5cd	C. E. Pollard	1962	190	14	I	--	5,875	do.	27.95	6641	
-5dc	T. I. Loiter	--	--	--	--	--	5,875	do.	24.14	--	
-8cd	P. H. Burnham	1964	203	16	I	--	5,893	do.	33.44	8061	
-8dd	M. A. Burnham	1964	245	16	I	--	5,902	do.	46.47	8081	
-9bc	--	--	--	6	U	--	5,881	do.	24.81	--	
-16cd	Bill Palmer	1960	240	16	I	28	5,930	do.	119.02	7324	
-17ab	Gordon Woods	1963	210	16	I	--	5,902	do.	45.59	7101	
-17bb	J. T. Woods	1962	225	16	I	--	5,887	do.	38.14	7124	
-17cd	do.	1962	240	16	I	--	5,920	do.	62.33	6637	
-17dd	Gordon Woods	1962	200	16	I	--	5,940	do.	89.50	6635	
-20aa	--	--	--	--	I	--	5,947	do.	84.43	--	
-20ba	--	--	--	--	I	--	5,921	do.	57.93	--	
-20cc	F. D. Glass, Jr.	1962	230	16	I	--	5,933	do.	83.05	6633	
-20dd	Josephine Glass	1962	240	16	I	--	6,000	do.	145.85	6634	
-29cb	Raymond LaBarry	1953	130	8	S	--	5,958	do.	92.49	2216	
-32db	--	--	--	--	S	--	6,040	do.	162.43	--	
21½/52-1bc	--	--	--	--	S	--	5,888	4- 8-66	43.78	--	
21½/54-3cc	--	--	--	16	I	--	5,897	4- 7-66	44.16	--	
-3cd	V. L. Politiski	1963	200	16	I	--	5,930	do.	82.01	7480	
-4bc	--	--	--	13	I	--	5,865	do.	18.06	--	
-4cc	Grace Krueger	1962	148	13	I	9	5,868	do.	19.70	6563	
-4dc	--	--	195	12	I	--	5,873	do.	18.87	--	
-4dd	A. W. Krueger	1962	102	18	I	55	5,880	4-26-66	32.08	6436	

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
22/54-18ab	--	--	--	14½	I	--	5,844	4- 7-66	11.90	--	
-18da	Edward Siudmak	1961	200	12	I,D	--	5,850	do.	12.35	5866	
-18db	--	1958	222	12	I	4	5,848	do.	11.90	5885	
-19ab	Charles Poorbaugh	1962	192	15	I	--	5,854	do.	16.51	6596	
-19bb	H. H. Schmoll	1962	192	16	I	--	5,856	do.	13.91	6599	
-19cb	Dr. Jones	--	--	16	I	--	5,856	do.	16.09	--	
-19dc	Charles Poorbaugh	1960	182	14	I	15	5,856	do.	16.01	5552	
-22bd	Raymond LaBarry	1961	200	16	I	9	5,860	4- 6-66	20.42	6726	
-22cc	Willie Dixon	1962	120	19½	I,S	9	5,858	4- 7-66	12.58	7157	
-27ca	Robert Stucki	1949	94	12	I,D	17	5,859	3-17-50	7.64	982	
								4- 7-66	15.52		
-27cc	Willie Dixon	1962	148	19½	I,S	6	5,859	do.	14.46	7156	
-28ad	Oscar Carrol	1958	184	12	I,D	36	5,856	--	--	4389	
-28bd	do.	1961	232	14	I	32	5,857	4- 7-66	14.53	5919	
-28dc	D. F. Palmore	1961	220	12	I	20	5,862	do.	14.62	5920	
-32cc1	R. Burnam	1963	208	15	I	--	5,866	do.	22.02	7424	
-32cc2	do.	--	--	--	I	--	--	--	--	--	
-32dd1	do.	1963	250	16	I	--	5,865	4- 7-66	19.58	7423	
-32dd2	do.	--	--	--	--	--	--	--	--	--	
-33bb	Bailey Bros.	1961	300	14	I	--	5,865	4- 7-66	15.68	7291	
-33dd	A. L. Jones	1949	191	12	I,D	5	5,864	3-17-50	6.24	983	
						--		4- 7-66	14.28		
-34ab	BLM	--	50	6	S	--	5,885	3-17-50	30.31	--	
								4- 7-66	38.27		
23/52-11ad1	J. Bachelor	--	98	6	S	--	5,810	11-19-65	flows	--	Wells ad1 and
-11ad2	do.	--	--	--	--	--	5,810	do.	do.		ad2 dis. 41 gpm
-13ba	do.	--	--	--	D	--	5,815	do.	do.	--	Dis. 9 gpm
-13bb1	do.	--	80	10	I,D	--	5,805	do.	do.	--	Dis. 13 gpm
-13bb2	do.	1957	157	14	I	50	5,815	9-15-61	4.89	3708	

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
23/52-13bc1	J. Bachelor	1948	--	--	I	--	5,800	11-18-65	flows	--	Dis. 13 gpm
-13bc2	do.	1948	--	6	I,S	--	5,810	do.	do.	--	Dis. 33 gpm
-13bc3	do.	1948	--	6	I	--	5,820	do.	do.	--	Wells bc3 and
-13bc4	do.	1948	--	--	I	--	--	--	do.	--	bc4 dis. 16 gpm
-13ca1	do.	--	--	--	I	--	5,810	11-18-65	do.	--	Dis. 102 gpm
-13ca2	do.	--	--	8	I	--	5,810	11-19-65	do.	--	Dis. 137 gpm
-13ca3	do.	--	--	6	I,S	--	5,810	do.	do.	--	Dis. 30 gpm
-13cd	do.	--	--	--	I	--	5,810	do.	do.	--	Dis. 46 gpm
-24ab	do.	--	--	--	I	--	5,805	do.	do.	--	Dis. 81 gpm
23/53-9bb	U.S.G.S. no. 16	1966	8	1½	O	--	5,775	4- 8-66	3.35	--	
-27bb	U.S.G.S. no. 4	1964	22	1½	O	--	5,819	do.	12.97	--	
-30dd	U.S.G.S. no. 9	1964	22	1½	O	--	5,821	do.	14.52	--	
-33cc	U.S.G.S. no. 6	1964	22	1½	O	--	5,831	do.	13.25	--	
-34dd	U.S.G.S. no. 7	1964	22	1½	O	--	5,832	do.	12.77	--	
23/54-18db	U.S.G.S. no. 3	1964	32	1½	O	--	5,800	do.	16.69	--	
-20dd	C. M. Russell	1964	245	16	I	--	5,820	4- 7-66	0.40	7834	
-27ac	L. Maggini	1963	339	6	S	--	5,850	do.	12.86	--	
-28cc	B. A. Russell	1962	262	16	I,D	--	5,825	do.	0.63	7835	
-29aa	U.S.G.S. no. 2	1964	22	1½	O	--	5,821	do.	15.30	--	
-29cd	U. J. Doty	1964	189	16	I	--	5,829	do.	1.62	7861	
-29dd	Richard Doty	1964	320	16	I	--	5,830	do.	3.54	7862	
-30ba	U.S.G.S. no. 1	1964	22	1½	O	--	5,824	do.	16.83	--	
-30cd	Blake Briscoe	1964	220	16	I	--	5,828	do.	1.21	7868	
-30dd	L. D. Williamson	1965	220	16	I	--	5,829	do.	2.31	8629	
-32aa	U.S.G.S. no. 8	1964	22	1½	O	--	5,830	do.	11.43	--	
-32cd	Melvin Bailey	1964	280	16	I	--	5,835	do.	2.21	7937	
-32dd	Alleen Bailey	1964	232	16	I	--	5,835	do.	4.04	7902	
24/52-13bd	Sadler Ranch	1960	135	16	I	--	5,782	8-15-65	flows	5526	Dis. 100 gpm

Table 20.--continued

Well number	Owner	Year drilled	Depth (feet)	Diameter (inches)	Use	Specific capacity	Altitude (feet)	Water-level measurement Date	Water-level measurement Depth	State log number	Remarks
24/53-6bd	George Brown	--	190	14	I,S	--	5,788	12- 7-65	flows	--	Dis. 200 gpm pumped 800 gpm
24/54-4ba	Ted Thompson	1950	130	10	D	--	5,830	4- 8-66	9.74	1350	
25/53-5bc	Joe Flynn	1949	100	6	I	--	5,830	--	--	1009	
-5cb1	do.	1949	131	6	I	--	5,835	5- 5-66	1.78	1008	
-5cb2	do.	1949	91	6	I	--	5,835	do.	flows	943	Dis. 10-15 gpm
-5cc1	do.	1949	176	6	I	--	5,855	do.	2.58	944	
-5cc2	do.	1949	70	6	I	--	5,840	do.	flows	1038	Dis. 2-3 gpm
25/54-9db1	Ted Thompson	--	35	60	S	--	5,855	--	--	--	
-9db2	do.	1952	80	8	S	--	5,843	4- 8-66	35.61	1910	
-28bc	--	--	--	6	S	--	5,810	do.	8.79	--	
26/53-12db	FERA no. 16	--	13	60	S	--	5,783	do.	8.50	--	
26/54-15cd	BLM	--	9.5	60	S	--	5,779	do.	6.03	--	

Table 21.--Selected drillers' logs of wells

Material	Thickness (feet)	Depth (feet)
20/53-2dd L. W. Wilbanks		
Topsoil	2	2
Gravel, large	23	25
Clay	5	30
Sand and clay	20	50
Gravel	4	54
Clay	6	60
Gravel	1	61
Clay	20	81
Gravel	5	86
Clay and gravel	4	90
Clay	6	96
Gravel	148	244
Clay	6	250
20/53-4dd M. C. Kelly		
Soil	5	5
Sand and gravel, dry	39	44
Clay, sand, and gravel layers	48	92
Gravel	11	103
Clay	19	122
Sand and gravel	17	139
Clay and cemented gravel	38	177
20/53-10cd Robert Wilson		
Topsoil	10	10
Sand	10	20
Clay, blue	15	35
Gravel	1	36
Clay, blue	42	78
Gravel	20	98
Clay	16	114
Gravel	14	128
Clay	2	130
Gravel	24	154
Clay	2	156
Gravel	30	186
Sand rock	8	194
Gravel	11	205
Clay	15	220
20/53-11dd B. C. Wade		
Topsoil	20	20
Sand	23	43
Gravel	22	65
Clay and gravel	7	72
Gravel, coarse	58	130
Gravel, pea	14	144
Clay	1	145
Gravel	41	186
Clay	14	200
Gravel	15	215
Clay	6	221
Gravel	25	246
Clay, hard	29	275
20/53-15cd W. S. Agnew		
Topsoil	1	1
Gravel and clay, mixed	24	25
Sand	21	46
Gravel, pea	8	54
Gravel	46	100
Gravel, pea	20	120
Gravel, coarse	9	129
Sand and rock	1	130
Gravel, coarse	56	186
Clay	19	205
Gravel, pea	2	207
Gravel, cemented	33	240
Gravel	10	250
Clay	1	251
Gravel	3	254
Gravel, cemented, in layers, and free gravel	129	383
Rock, hard, white	15	398
20/53-18dc W. E. Baker		
Clay	5	5
Sand	6	11
Clay, sandy	17	28
Clay and gravel	16	44
Conglomerate	2	46
Gravel	31	77
Silty sand	13	90
Gravel	12	102
Sand, coarse	23	125
Clay, sandy	15	140
Granite, decomposed	3	143
Gravel	5	148
Sand, clay, gravel	14	162
Shell, hard	3	165

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)
20/53-20ca C. H. Allamong		
Soil	5	5
Gravel and sand, fine	11	16
Silt and clay	7	23
Gravel, fine, sandy	45	68
Gravel, cemented, large	51	119
Clay, tight, white	18	137
Clay	14	151
Clay and sand lenses, cemented	14	165
Sand, gravel, loose, water-bearing	35	200
20/53-22bd E. B. Johnson		
Topsoil	3	3
Gravel	37	40
Gravel and hard clay	100	140
Boulders and gravel	35	175
Gravel, cemented	5	180
Gravel, layers of free and cemented	30	210
Gravel and boulders in layers	15	225
Gravel and boulders	5	230
Gravel, loose	15	245
Gravel, cemented	13	258
Gravel, hard, cemented	62	320
20/53-24dd Ed Melka		
Topsoil	26	26
Boulders and gravel	14	40
Gravel, coarse, and clay	80	120
Clay and gravel	15	135
Gravel and clay	20	155
20/53-32bd Fred Minoletti		
Soil	8	8
Clay	82	90
Gravel, cemented	30	120
Gravel	5	125
Gravel, cemented	5	130
Gravel	20	150
Gravel, cemented	5	155
Sand and gravel	40	195
Gravel, cemented	20	215
Gravel	3	218
21/53-1bd Robert Wilson		
Topsoil	3	3
Gravel	27	30
Sand and gravel	28	58
Clay and gravel	6	64
Sand and gravel	4	68
Clay	7	75
Gravel	2	77
Clay	59	136
Gravel, fine	7	143
Clay	2	145
Gravel	3	148
Clay	1	149
Gravel	4	153
Clay	10	163
Gravel	10	173
Clay and gravel	2	175
Gravel	8	183
Clay	2	185
Gravel	11	210
Clay	14	210
21/53-4ad C.C. Cooper		
Topsoil	5	5
Gravel and sand, fine	20	25
Sand, coarse, and fine gravel	7	32
Sand and gravel, coarse	36	68
Clay and sand mixture	2	70
Sand and gravel, coarse	10	80
Clay and gravel mixture	2	82
Gravel and sand, coarse, good	28	110
Clay, tough, white	7	117
Clay and gravel mixture	2	119
Gravel and sand, good	2	121
Clay streak, white	1	122
Gravel and sand, clean, water-bearing	26	148
Clay, white	3	151
Gravel and sand, clean	16	167
Clay	2	169
Gravel and sand, clean	10	179
Clay	3	182

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)
21/53-6cc Steimley Bailey		
Topsoil	3	3
Sand and gravel	27	30
Clay and gravel	10	40
Gravel	10	50
Sand, coarse	28	78
Clay	2	80
Gravel, good	17	97
Clay and gravel	5	102
Gravel, good	3	105
Clay and gravel	1	106
Clay	4	110
Gravel, good	8	118
Gravel, hard	2	120
21/53-8aa M. A. Farley		
Topsoil	3	3
Hardpan	3	6
Gravel	24	30
Clay and gravel	5	35
Clay	5	40
Gravel	10	50
Clay and sand	5	55
Sand	5	60
Gravel	5	65
Clay and gravel	3	68
Gravel	25	93
Sand and clay	5	98
Clay	9	107
Gravel	8	115
Clay	5	120
Gravel, good	8	128
Gravel and clay	2	130
Gravel, good	14	144
Clay	5	149
Gravel, good	16	165
Clay	5	170
Gravel	4	174
Clay	6	180
Clay and sand	4	184
21/53-11ba Denver Kelly		
Topsoil and overburden	4	4
Sand and gravel	44	48
Clay, gray	20	68
Clay, black	28	96
Sand and gravel, black	52	148
Clay, soft	2	150
Sand, medium	6	156
Clay, soft	2	158
Sand and gravel, good	34	192
Bottomed in soft clay at 192 feet		
21/53-13da Bruce DuBose		
Topsoil	3	3
Sand, coarse, and gravel	27	30
Gravel, coarse	12	42
Clay, colored	50	92
Sand, fine	4	96
Clay	9	105
Gravel, black	4	109
Clay	1	110
Clay and coarse sand	4	114
Sand, fine	2	116
Clay	4	120
Gravel, coarse	7	127
Clay	12	139
Gravel, coarse	2	141
Gravel with clay streamers	2	143
Gravel, coarse	7	150
Clay, brown	5	155
Gravel, coarse	3	158
Sandstone and clay	2	160
Sand, fine	2	162
Clay	18	180
Gravel, coarse	7	187
Clay and gravel	2	189
Gravel, coarse and some rocks	8	197
Clay and gravel	2	199
Clay and coarse gravel	11	210
Gravel, coarse	7	217
Gravel, coarse and clay	17	234
Gravel, coarse	9	243
Clay and gravel	7	250

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)
21/53-16aa T. M. Tynes		
Topsoil	3	3
Sand and gravel	32	35
Clay and gravel	3	38
Gravel	27	65
Clay	3	68
Gravel, coarse	32	100
Clay and coarse gravel	8	108
Gravel, coarse	36	144
Clay	8	152
Gravel	28	180
Clay	2	182
21/53-18cc Unknown		
Topsoil	2	2
Gravel	26	28
Sand	4	32
Clay	10	42
Sand	3	45
Gravel	20	65
Sand	1	66
Sandstone	3	69
Clay	5	74
Sand, fine	3	77
Gravel	8	85
Clay	3	88
Sandstone	1	89
Shale	3	92
Gravel, coarse	13	105
Sand	6	111
Clay, white	1	112
Gravel, cemented	4	116
Gravel and stone	9	125
Clay, cemented gravel, and coarse sand	9	134
21/53-20db V. E. Nelson		
Surface soil	2	2
Sand and gravel	22	24
Clay	6	30
Sand and gravel	60	90
Clay	11	101
Sand and gravel	39	140
Clay	10	150
Sand and gravel	32	182
Rock, hard	1	183
21/53-23ba K. M. Murphy		
Topsoil	3	3
Sand and gravel	17	20
Clay	5	25
Sand and gravel	5	30
Gravel, coarse	4	34
Clay, colored	61	95
Clay and black gravel	5	100
Clay	4	104
Clay and black gravel	3	107
Clay	8	115
Gravel, coarse	7	122
Clay and gravel	1	123
Clay, light	3	126
Clay and coarse gravel	3	129
Gravel, coarse	6	135
Clay and coarse gravel	1	136
Clay	6	142
Gravel, coarse	11	153
Sandstone	1	154
Clay	3	157
Clay and gravel	1	158
Gravel, coarse	4	162
Clay	9	171
Clay and coarse gravel	1	172
Gravel, coarse	3	175
Clay	12	187
Sand, fine	5	192
Clay	13	205
Clay and coarse gravel layers	4	209
Clay	7	216
21/53-27bb Dr. Clifford Fisher		
Surface soil	2	2
Sand and gravel	21	23
Sand, fine, and clay	33	56
Sand, gravel, and clay stringers	14	70
Sand, fine, gravel, and clay	26	96
Sand, coarse, and gravel	24	120
Clay	75	195
Sand and gravel	5	200
Clay	4	204
Sand and gravel	12	216
Clay	4	220
Sand and gravel	11	231
Clay	1	232

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)
21/53-33da L. C. Enzminger		
Soil	5	5
Sand and gravel	19	24
Clay, gray	14	38
Sand, clay, and gravel	11	49
Clay	9	58
Sand and gravel	14	72
Clay and sand	8	80
Sand and gravel	31	111
Clay	1	112
21/53-36ad E. M. Machacek		
Soil	4	4
Sand, coarse, and fine gravel	32	36
Clay, brown	33	69
Gravel, medium to coarse, and sand	23	92
Gravel, partly cemented, and clay	68	160
Clay with occasional thin sand streaks	32	192
Clay, solid tan	63	255
Clay with occasional sand streaks	45	300
21/54-16cd Bill Palmer		
Topsoil	4	4
Gravely clay	11	15
Cobblestones, gravel, clay	58	73
Gravel, fine	7	80
Boulders	50	130
Rock, solid	8	138
Rocks and free gravel	5	143
Clay	1	144
Boulders	12	156
Gravel, coarse	17	173
Clay	1	174
Gravel	38	212
Clay	2	214
Boulders	21	235
Clay and boulders	5	240
21/54-20cc F. D. Glass, Jr.		
Topsoil	3	3
Clay and gravel	17	20
Sand	5	25
Clay	3	28
Sand	2	30
Clay	1	31
Sand	8	39
Clay	21	60
Clay and gravel	2	62
Gravel	13	75
Shale and gravel	55	130
Gravel	41	171
Clay	3	174
Gravel	36	210
Clay	20	230
21½/54-3cd V. H. Politiski		
Topsoil	2	2
Clay and rock	78	80
Gravel	70	150
Rock	4	154
Gravel, loose	16	170
Rock	4	174
Gravel, loose	11	185
Rock	8	193
Clay and gravel	7	200

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)
21½/54-5cc R. F. Krueger		
Soil	3	3
Sand and fine gravel	9	12
Clay, brown	8	20
Sand, fine	12	32
Sand, fine, and small gravel	4	36
Ooze, soft, black	12	48
Sand, fine, black	11	59
Gravel streak	3	62
Clay, white	48	110
Clay, blue	12	122
Clay, white	15	137
Gravel streak with fine sand	4	141
Clay, solid, blue	71	212
Ooze, black	5	217
Ooze, black, with very fine sand	13	230
Clay, white	5	235
Ooze, black, and fine sand	7	242
Gravel, fine, with sand, water	10	252
Gravel, coarse, and sand	5	257
22/54-4cc M. H. Moshier		
Topsoil	4	4
Sand and gravel	12	16
Clay, black	24	40
Mud, black	22	62
Clay, different collored	76	138
Clay and sand	12	150
Clay	12	162
Sand	11	173
Clay	47	220
Sand and clay	10	230
Clay	40	270
Clay and gravel	5	275
Clay	10	285
Sand and fine gravel	10	295
Gravel	5	300
Clay and gravel	15	315
22/54-6cc Paul Camer		
Topsoil	3	3
Gravel	17	20
Sand and clay	10	30
Clay	25	55
Clay and black gravel	2	57
Gravel, black	4	61
Clay	14	75
Sand, coarse	4	79
Clay and gravel layers	7	86
Gravel, black	1	87
Clay	1	88
Sand, coarse	4	92
Clay	4	96
Clay and gravel	7	103
Sand, coarse	7	110
Clay and gravel	5	115
Clay	24	139
Sand, coarse	6	145
Clay	1	146
Gravel	2	148
Clay and gravel	4	152
Clay and sand	1	153
Sand	8	161
Clay	2	163
Gravel	7	170
Clay	2	172
Sand and gravel	3	175
Clay and gravel	2	177
Clay	1	178
Sand	5	183
Clay and sand	3	186
Clay	2	188
Sand and gravel	4	192
Clay	40	232
Sand	6	238
Clay	2	240
Sand	4	244
Clay	2	246
Sand	4	250

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)
22/54-8cc L. L. Pollard		
Sand and gravel	28	28
Shale or sandy clay	22	50
Clay, blue, and sand	30	80
Shale	18	98
Clay, blue	10	108
Sand and gravel; water	12	120
Shale, sandy	7	127
Shale and gravel	16	143
Gravel, water-bearing	9	152
Shale, blue	2	154
22/54-19dc Charles Poorbaugh		
Topsoil	6	6
Sand	17	23
Clay, soft	70	93
Sand	9	102
Clay, soft	13	115
Sand, medium	6	121
Clay, soft	17	138
Sand, medium	8	146
Clay, soft	16	162
Sand, medium	3	165
Sand and clay layers, loose and soft	17	182
22/54-22bd Raymond LaBarry		
Topsoil	9	9
Sand and gravel	10	19
Clay, yellow	4	23
Sand and gravel	7	30
Clay, black	8	38
Clay, yellow, large rock	11	49
Sand, gravel, and large rock	6	55
Clay, yellow, rocky	7	62
Sand and gravel	8	70
Clay, yellow, rocky	7	77
Sand, loose, and gravel	13	90
Clay, yellow, rocky	15	105
Sand and gravel	10	115
Clay, yellow, rocky	35	150
Sand and gravel	11	161
Clay, yellow, rocky	14	175
Sand and gravel	4	179
Clay, rocky	6	185
Sand and gravel	15	200
22/54-28dc D. F. Palmore		
Soil	4	4
Gravel, fine, sandy	17	21
Clay ooze, black	39	60
Clay, gray	10	70
Clay, brownish	32	102
Clay, tough, white	10	112
Clay, white, semi-sandstone	5	117
Clay, brown	10	127
Clay mixed with gravel	5	132
Gravel, good	8	140
Clay lense, white	3	143
Clay, dense green	9	152
Clay, dark green	6	158
Clay, dense green	37	195
Gravel with thin cemented lenses	15	210
Gravel with some cementation and large loose boulders	10	220
23/52-13bb2 J. Bachelor		
Gravel	14	14
Clay	8	22
Gravel	14	36
Clay	28	64
Gravel	2	66
Clay	12	78
Sandstone	2	80
Clay	8	88
Gravel	34	122
Clay	16	138
Gravel	6	144
Conglomerate	8	152
Limestone	5	157

Table 21.--Continued

Material	Thickness (feet)	Depth (feet)	Material	Thickness (feet)	Depth (feet)
23/54-20dd C. M. Russell			23/54-30cd Blake Briscoe		
Topsoil	2	2	Silt	2	2
Hardpan	2	4	Clay	6	8
Sand and gravel	13	17	Gravel	18	26
Clay, black	33	50	Clay, black	46	72
Clay	25	75	Gravel	3	75
Sand, coarse	1	76	Clay, blue	4	79
Clay	65	141	Gravel	6	85
Sand, fine	9	150	Shale, hard, gray	25	110
Clay	20	170	Shale, soft	35	145
Sand, fine	2	172	Shale and sand	5	150
Clay	3	175	Shale, gray	10	160
Sand, fine	2	177	Sand and gravel	18	178
Sand and clay	31	208	Shale, gray	11	189
Sand, fine	22	230	Sand and gravel	31	220
Sand and gravel	15	245			
Clay - bottom					

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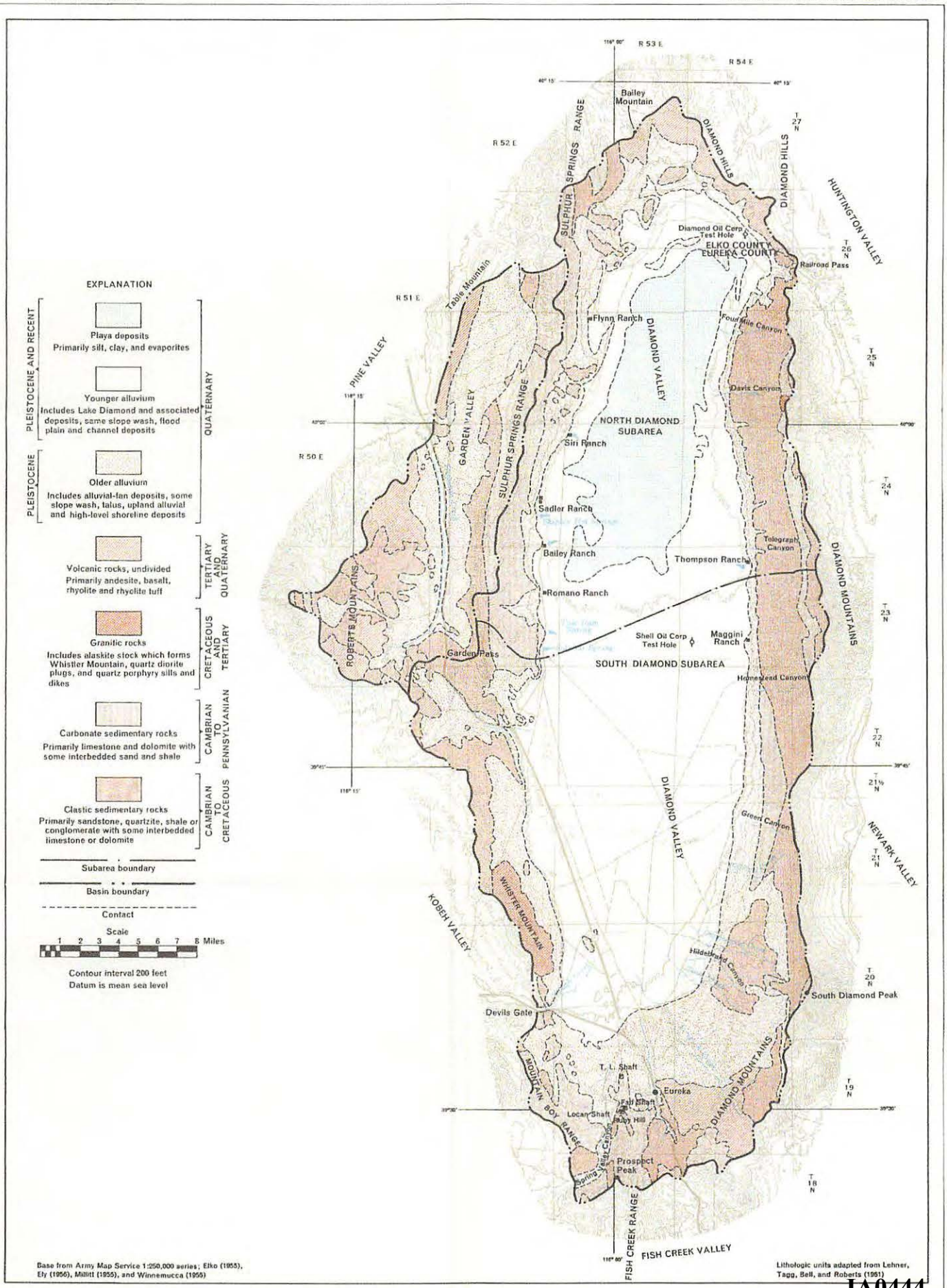


PLATE 1.—MAP OF DISTRIBUTION OF PRINCIPAL LITHOLOGIC UNITS, SUBAREAS, AND GEOGRAPHIC AND CULTURAL FEATURES, DIAMOND VALLEY, EUREKA AND ELKO COUNTIES, NEVADA

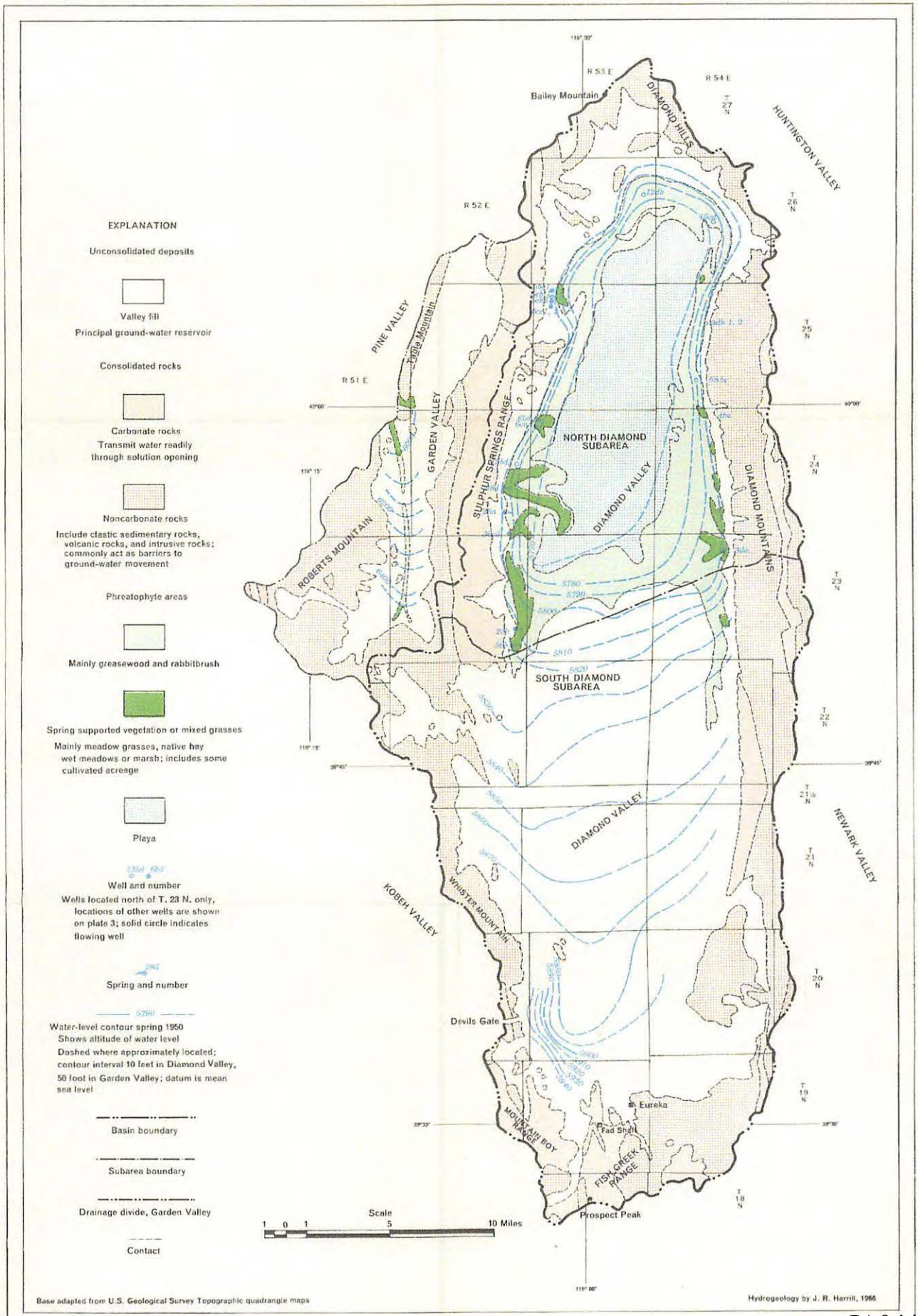
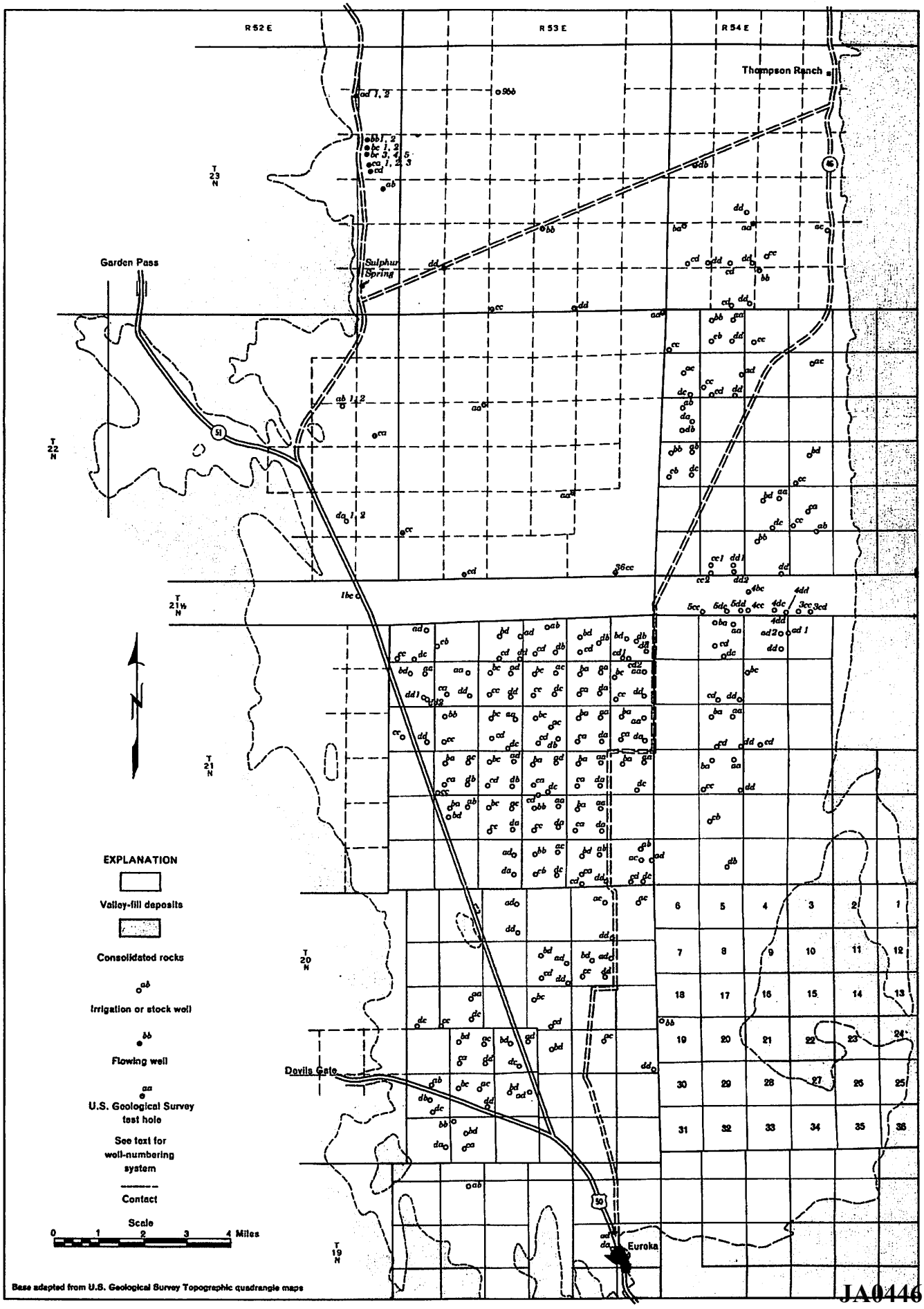


PLATE 2.—MAP SELECTED LITHOLOGIC UNITS, PHREATOPHYTES, AND WATER-LEVEL CONTOURS FOR 1950, DIAMOND VALLEY, EUREKA AND ELKO COUNTIES, NEVADA



JA0446

PLATE 3.—MAP LOCATION OF WELLS AND TEST HOLES DRILLED SOUTH OF T. 24 N. IN DIAMOND VALLEY, EUREKA COUNTY, NEVADA

IN THE OFFICE OF THE STATE ENGINEER
OF THE STATE OF NEVADA

ORDER **#1264**

DESIGNATING THE DIAMOND VALLEY HYDROGRAPHIC BASIN (153) A CRITICAL MANAGEMENT AREA

WHEREAS, the State Engineer designated the Diamond Valley Hydrographic Basin, located within Eureka County, Nevada, as provided under the provisions of Nevada Revised Statute (NRS) § 534.030, by the following Orders:

1. Order No. 277, dated March 11, 1941, designating a portion of the basin.
2. Order No. 280, dated August 28, 1964, amending the designated area described in Order No. 277.
3. Order No. 815, dated April 4, 1983, amending the description of the designated area.

WHEREAS, pursuant to NRS § 534.120, the State Engineer determined the groundwater of the Diamond Valley Hydrographic Basin was being depleted and the following orders were entered, deemed essential for the welfare of the area involved:

1. Order No. 541, dated December 22, 1975, curtailed new appropriations in location-specific areas subject to limited exceptions.
2. Order No. 717, dated July 10, 1978, curtailed new appropriations for irrigation with limited exceptions.
3. Order No. 809, dated December 1, 1982, ordering the installation of totalizing meters on all permitted and certificated wells. The Order was suspended for one-year by Order 813, dated February 7, 1983, but was never reinstated.

Order No. 1226, dated March 26, 2013 curtailed all new appropriations with limited exceptions.

WHEREAS, the United States Geological Survey estimates that 30,000 acre-feet of water annually are available as the perennial yield from the Diamond Valley Hydrographic Basin.[1]

WHEREAS, NRS § 534.110(7)(a) states the State Engineer "[m]ay designate as a critical management area any basin in which withdrawals of groundwater consistently exceed the perennial yield of the basin."

WHEREAS, the State Engineer finds that annual crop inventories conducted by the Division of Water Resources indicate that estimated groundwater pumping for irrigation purposes totaled the following:[2]

Year	Acres Irrigated	Estimated Acre-feet Pumped
1975	17,796	53,388[3]
1976	18,717	56,151[4]
1977	19,988	52,956[5]
1978	21,855	59,760[6]
1979	22,583	61,839[7]
1980	23,055	64,035[8]

[1] J.R. Harrill, *Hydrologic Response to Irrigation Pumping in Diamond Valley, Eureka and Elko Counties, Nevada, 1950-65,* Water Resources Bulletin No. 35, (Department of Conservation and Natural Resources, Division of Water Resources and U.S. Department of Interior, Geological Survey), 1968.

[2] The State Engineer's method for estimating pumpage has changed over the years. In 1975 and 1976, pumpage was estimated at 3 acre-feet per acre irrigated. From 1977 to 2005, pumpage was estimated at 3 acre-feet per acre for alfalfa, and 2 acre-feet per acre for grain, pasture and grass hay. From 2006 to 2013, pumpage was estimated to equal the water right for the acreage irrigated, usually 4 acre-feet per acre. In 2014, a method that considers crop type and irrigation method was used to estimate pumpage. *See generally*, inventories cited *infra*.

[3] *Diamond Valley Crop and Water Survey* (November 3-7, 1975), official records in the Office of the State Engineer.

[4] *Diamond Valley Crop and Water Survey* (November 8-11, 1976), official records in the Office of the State Engineer.

[5] *Diamond Valley Crop and Water Survey* (November 14-17, 1977), official records in the Office of the State Engineer.

[6] *Diamond Valley Crop and Water Survey* (November 8-15, 1978), official records in the Office of the State Engineer.

[7] *Diamond Valley Crop and Water Survey* (November, 1979), official records in the Office of the State Engineer.

[8] *Diamond Valley Crop and Water Survey* (November, 1980), official records in the Office of the State Engineer.

1981	25,279	71,745[9]
1982	25,305	73,336[10]
1983	24,812	71,857[11]
1984	26,844	78,730[12]
1985	26,844	78,730[13]
1986	20,656	58,883[14]
1987	22,966	66,028[15]
1988	21,569	63,356[16]
1989	23,485	66,734[17]
1990	22,235	64,210[18]
1991		No report for 1991
1992	20,640	58,585[19]
1993	21,421	60,478[20]
1994	21,556	60,883[21]
1995	19,750	55,140[22]

[9] *Diamond Valley Crop and Water Survey* (November, 1981), official records in the Office of the State Engineer.
[10] *Diamond Valley Crop and Water Survey* (November 9-10, 12, 16, 1982), official records in the Office of the State Engineer.
[11] *Diamond Valley Crop and Water Survey* (November 7-10, 1983), official records in the Office of the State Engineer.
[12] *Diamond Valley Crop and Water Survey* (November 1, 7-9, 14, 1984), official records in the Office of the State Engineer.
[13] *Diamond Valley Crop and Water Survey* (December 3-4, 1985), official records in the Office of the State Engineer.
[14] *Diamond Valley Crop and Water Survey* (November 4-5, 12-13, 1986), official records in the Office of the State Engineer.
[15] *Diamond Valley Crop and Water Survey* (November 12, 17-19, 1987), official records in the Office of the State Engineer.
[16] *Diamond Valley Crop and Water Survey* (October 17-21, 1988), official records in the Office of the State Engineer.
[17] *Diamond Valley Crop and Water Survey* (November 2-3, 1989), official records in the Office of the State Engineer.
[18] *Diamond Valley Crop and Water Survey* (November 28, 1990), official records in the Office of the State Engineer.
[19] *Diamond Valley Crop Inventory* (August, 1992), official records in the Office of the State Engineer.
[20] *Diamond Valley Crop Inventory* (June, 1993), official records in the Office of the State Engineer.
[21] *Diamond Valley Crop Inventory* (June, 1994), official records in the Office of the State Engineer.
[22] *Diamond Valley Crop Inventory* (August, 1995), official records in the Office of the State Engineer.

1996	20,413	57,779[23]
1997	19,750	55,140[24]
1998	18,916	60,985[25]
1999	23,588	68,883[26]
2000	22,525	70,601[27]
2001		No report for 2001[28]
2002	21,850	60,900[29]
2003	21,850	60,900[30]
2004	23,126	65,687[31]
2005	23,126	65,687[32]
2006	24,152	70,000[33]
2007	24,011	69,600[33]
2008	24,220	70,200[33]
2009	24,435	70,900[33]
2010	24,608	71,400[33]
2011	24,357	70,600[33]
2012	25,234	73,200[33]
2013	25,323	73,400[33]
2014	25,181	72,236[34]

[23] *Diamond Valley Crop Inventory* (August, 1996), official records in the Office of the State Engineer.
[24] *Diamond Valley Crop Inventory* (August, 1997), official records in the Office of the State Engineer.
[25] *Diamond Valley Crop Inventory* (September, 1998), official records in the Office of the State Engineer.
[26] *Diamond Valley Crop Inventory* (November, 1999), official records in the Office of the State Engineer.
[27] *Diamond Valley Crop Inventory* (November, 2000), official records in the Office of the State Engineer.
[28] No inventory was conducted in 2001 due to lack of funding.
[29] *Diamond Valley Crop Inventory* (October, 2002), official records in the Office of the State Engineer.
[30] *Diamond Valley Crop Inventory* (December 9, 2003), official records in the Office of the State Engineer.
[31] *Diamond Valley Crop Inventory* (October 6, 2004), official records in the Office of the State Engineer.
[32] *Diamond Valley Crop Inventory* (September 15, 2005), official records in the Office of the State Engineer.
[33] The State Engineer re-estimated the pumpage for the years 2006-2013 using 2.9 acre-feet per acre, rather than the water right duties as reported in the crop inventories, as it more accurately reflects actual pumpage amounts.
[34] Preliminary data.

WHEREAS, the State Engineer finds that the withdrawals of groundwater have exceeded the perennial yield of the basin at least since 1975, and therefore, the State Engineer finds that groundwater withdrawals have consistently exceeded the perennial yield.

WHEREAS, the State Engineer finds that the groundwater levels in the area of the farms has locally declined over one-hundred feet since 1960, and that the water level continues to decline at the rate of two feet per year or more.[35]

NOW THEREFORE, it is ordered that the Diamond Valley Hydrographic Basin is hereby designated a critical management area pursuant to NRS § 534.110(7)(a).

P.E.

JASON KING, P.E.
State Engineer

Dated at Carson City, Nevada this

25th day of August, 2015.

[35] Water level data for Basin 153, official record in the Office of the State Engineer, available at http://water.nv.gov/data/waterlevel/ (last accessed June 26, 2015).

Permit No. 82268

AMENDED PERMIT

THE STATE OF NEVADA

PERMIT TO CHANGE THE PUBLIC WATERS OF THE STATE OF NEVADA HERETOFORE APPROPRIATED

Name of Permittee:	**SADLER RANCH, LLC**
Source:	**SPRING (WELL A-BIG SHIPLEY SPRINGS AND TRIBUTARIES COMPLEX)**
Basin:	**DIAMOND VALLEY**
Manner of Use:	**IRRIGATION**
Period of Use:	**JANUARY 1ST THROUGH DECEMBER 31ST**
Priority Date:	**01/01/1873**

****

APPROVAL OF STATE ENGINEER

This is to certify that I have examined the foregoing application, and do hereby grant the same, subject to the following limitations and conditions:

This permit to change the point of diversion of the waters of Big Shipley Springs and Tributaries heretofore appropriated under Claim of Vested Right V03289, is issued with the understanding that no other rights on the source will be affected by the change proposed herein. This well shall be equipped with a two (2) inch opening for measuring depth to water. A totalizing meter must be installed and maintained in the discharge pipeline near the point of diversion and accurate measurements must be kept of water placed to beneficial use. The totalizing meter must be installed before any use of water begins, or before the proof of completion of work is filed. This source is located within an area designated by the State Engineer, pursuant to NRS 534.030. The State retains the right to regulate the use of the water herein granted at any and all times. This permit is issued subject to any determination of the waters of Big Shipley Springs and Tributaries that may be made under adjudication proceedings under NRS 533.090 through 533.320.

This permit is issued subject to State Engineer Ruling No. 6371, dated November 1, 2016.

The permittee shall keep monthly records of the amount of water pumped from this well and the records must be submitted to the State Engineer on an annual basis within 30 days after the end of each calendar year.

The total combined duty of water under Permit 4273, Certificate 964 and Permits 81720 and 82268 shall not exceed 2,918.7 acre-feet annually for the irrigation of the described place of use.

This permit totally abrogates Claim of Vested Right V03289, which has a priority date of 1873 for a 2,216.1 afa portion and a priority date of January 1, 1892 for the remaining 702.6 afs portion and retains the priority dates of Claim of Vested Right V03289.

This permit does not extend the permittee the right of ingress and egress on public, private or corporate lands.

The issuance of this permit does not waive the requirements that the permit holder obtain other permits from State, Federal and local agencies.

(Continued on Page 2)

The point of diversion and place of use are as described on the submitted application to support this permit.

The amount of water to be appropriated shall be limited to the amount which can be applied to beneficial use, **and not to exceed 7.02 cubic feet per second or 2,918.7 acre-feet annually.**

Work must be prosecuted with reasonable diligence and proof of completion of work shall be filed on or before: **Filed Under 82268 on January 29, 2016**

Water must be placed to beneficial use and proof of the application of water to beneficial use shall be filed on or before: **January 29, 2020**

Map in support of proof of beneficial use shall be filed on or before: **January 29, 2020**

IN TESTIMONY WHEREOF, I, JASON KING, P.E.,

State Engineer of Nevada, have hereunto set my hand and the seal of my office, this 14th day of **July, 2017**

P.E.

State Engineer

Permit No. 81825

THE STATE OF NEVADA

PERMIT TO APPROPRIATE WATER

Name of Permittee:	**DANIEL S. VENTURACCI**
Source:	**UNDERGROUND**
Basin:	**DIAMOND VALLEY**
Manner of Use:	**IRRIGATION AND DOMESTIC**
Period of Use:	**JANUARY 1ST THROUGH DECEMBER 31ST**
Priority Date:	**04/26/2012**

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APPROVAL OF STATE ENGINEER

This is to certify that I have examined the foregoing application, and do hereby grant the same, subject to the following limitations and conditions:

This permit is issued subject to existing rights. It is understood that the amount of water herein granted is only a temporary allowance and that the final water right obtained under this permit will be dependent upon the amount of water actually placed to beneficial use. It is also understood that this right must allow for a reasonable lowering of the static water level. This well shall be equipped with a two (2) inch opening for measuring depth to water. A totalizing meter must be installed and maintained in the discharge pipeline near the point of diversion and accurate measurements must be kept of water placed to beneficial use. The totalizing meter must be installed before any use of water begins or before the proof of completion of work is filed. This source is located within an area designated by the State Engineer, pursuant to NRS 534.030. The State retains the right to regulate the use of the water granted herein at any and all times. This permit is issued subject to any determination of the waters of Taft Springs (a.k.a. Thompson Springs) that may be made under adjudication proceedings under NRS 533.090 through 533.320. The quantification of this mitigation right is not an adjudication of Claim of Vested Right V01115.

This permit is issued subject to State Engineer Ruling No. 6372, dated November 1, 2016.

The permittee shall keep monthly records of the amount of water pumped from this well and the records must be submitted to the State Engineer on an annual basis within 30 days after the end of each calendar year.

The well must be sealed with cement grout, concrete grout or neat cement from ground level to 100 feet.

The total combined duty of water under Permits 81825 and 82572 and Claim of Vested Right V01115 shall not exceed 632 acre-feet annually for irrigation within the described place of use.

This right is issued to mitigate the loss of discharge from the spring source under Claim of Vested Right V01115, which has a priority date of 1880; thus, this permit cannot be severed from Claim of Vested Right V01115. Additionally, Permit 81825 may be exercised in conformity with the priority date of Claim of Vested Right V01115 during the periods the basin is regulated.

The point of diversion of this permit shall not be moved outside of the spring discharge area as determined by the State Engineer.

(Continued on Page 2)

This permit is totally supplemental to Claim of Vested Right V01115 and serves as an additional point of diversion for Claim of Vested Right V01115 whenever Claim of Vested Right V01115 is in priority.

This permit does not extend the permittee the right of ingress and egress on public, private or corporate lands.

The issuance of this permit does not waive the requirements that the permit holder obtain other permits from State, Federal and local agencies.

The point of diversion and place of use are as described on the submitted application to support this permit.

The amount of water to be appropriated shall be limited to the amount which can be applied to beneficial use, **not to exceed 2.01 cubic feet per second or 632.0 acre-feet annually, and is limited to 3.0 acre-feet per acre from all sources.**

Work must be prosecuted with reasonable diligence and proof of completion of work shall be filed on or before: **Filed Under 81825 on September 23, 2015**
Water must be placed to beneficial use and proof of the application of water to beneficial use shall be filed on or before: **September 15, 2020**
Map in support of proof of beneficial use shall be filed on or before: **September 15, 2020**

IN TESTIMONY WHEREOF, I, JASON KING, P.E.,

State Engineer of Nevada, have hereunto set my hand and the seal of my office, this 14th day of **August, 2017**.

J. K. P.E.
State Engineer

Permit No. 82572

THE STATE OF NEVADA

PERMIT TO APPROPRIATE WATER

Name of Permittee:	**DANIEL S. VENTURACCI**
Source:	**UNDERGROUND**
Basin:	**DIAMOND VALLEY**
Manner of Use:	**IRRIGATION AND DOMESTIC**
Period of Use:	**JANUARY 1ST THROUGH DECEMBER 31ST**
Priority Date:	**02/25/2013**

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APPROVAL OF STATE ENGINEER

This is to certify that I have examined the foregoing application, and do hereby grant the same, subject to the following limitations and conditions:

This permit is issued subject to existing rights. It is understood that the amount of water herein granted is only a temporary allowance and that the final water right obtained under this permit will be dependent upon the amount of water actually placed to beneficial use. It is also understood that this right must allow for a reasonable lowering of the static water level. This well shall be equipped with a two (2) inch opening for measuring depth to water. A totalizing meter must be installed and maintained in the discharge pipeline near the point of diversion and accurate measurements must be kept of water placed to beneficial use. The totalizing meter must be installed before any use of water begins or before the proof of completion of work is filed. This source is located within an area designated by the State Engineer, pursuant to NRS 534.030.The State retains the right to regulate the use of the water granted herein at any and all times. This permit is issued subject to any determination of the waters of Taft Springs (a.k.a. Thompson Springs) that may be made under adjudication proceedings under NRS 533.090 through 533.320. The quantification of this mitigation right is not an adjudication of Claim of Vested Right V01115.

This permit is issued subject to State Engineer Ruling No. 6372, dated November 1, 2016.

The permittee shall keep monthly records of the amount of water pumped from this well and the records must be submitted to the State Engineer on an annual basis within 30 days after the end of each calendar year.

The well must be sealed with cement grout, concrete grout or neat cement from ground level to 100 feet.

The total combined duty of water under Permits 81825 and 82572 and Claim of Vested Right V01115 shall not exceed 632 acre-feet annually for irrigation within the described place of use.

This right is issued to mitigate the loss of discharge from the spring source under Claim of Vested Right V01115, which has a priority date of 1880; thus, this permit cannot be severed from Claim of Vested Right V01115. Additionally, Permit 82572 may be exercised in conformity with the priority date of Claim of Vested Right V01115 during the periods the basin is regulated.

The point of diversion of this permit shall not be moved outside of the spring discharge area as determined by the State Engineer.

(Continued on Page 2)

This permit is totally supplemental to Claim of Vested Right V01115 and Permit 81825 and serves as an additional point of diversion for Claim of Vested Right V01115 and Permit 81825 whenever Claim of Vested Right V01115 is in priority.

This permit does not extend the permittee the right of ingress and egress on public, private or corporate lands.

The issuance of this permit does not waive the requirements that the permit holder obtain other permits from State, Federal and local agencies.

The point of diversion and place of use are as described on the submitted application to support this permit.

The amount of water to be appropriated shall be limited to the amount which can be applied to beneficial use, **not to exceed 2.01 cubic feet per second or 632 acre-feet annually, and is limited to 3.0 acre-feet per acre from all sources.**

Work must be prosecuted with reasonable diligence and proof of completion of work shall be filed on or before: **September 15, 2018**
Water must be placed to beneficial use and proof of the application of water to beneficial use shall be filed on or before: **September 15, 2020**
Map in support of proof of beneficial use shall be filed on or before: **September 15, 2020**

IN TESTIMONY WHEREOF, I, JASON KING, P.E.,

State Engineer of Nevada, have hereunto set my hand and the seal of my office, this 14th day of **August, 2017**

J.K. P.E.

State Engineer

Permit No. 81720

THIRD AMENDED PERMIT

THE STATE OF NEVADA

PERMIT TO APPROPRIATE WATER

Name of Permittee:	**SADLER RANCH LLC**
Source:	**UNDERGROUND (WELL D)**
Basin:	**DIAMOND VALLEY**
Manner of Use:	**IRRIGATION**
Period of Use:	**JANUARY 1ST THROUGH DECEMBER 31ST**
Priority Date:	**03/30/2012**

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APPROVAL OF STATE ENGINEER

This is to certify that I have examined the foregoing application, and do hereby grant the same, subject to the following limitations and conditions:

This permit issued for diversion rate only is issued subject to existing rights. It is understood that the amount of water herein granted is only a temporary allowance and that the final water right obtained under this permit will be dependent upon the amount of water actually placed to beneficial use. It is also understood that this right must allow for a reasonable lowering of the static water level. This well shall be equipped with a two (2) inch opening for measuring depth to water. A totalizing meter must be installed and maintained in the discharge pipeline near the point of diversion and accurate measurements must be kept of water placed to beneficial use. The totalizing meter must be installed before any use of water begins or before the proof of completion of work is filed. This source is located within an area designated by the State Engineer pursuant to NRS 534.030.The State retains the right to regulate the use of the water granted herein at any and all times. This permit is issued pending any determination of the waters of Big Shipley Springs and Tributaries that may be made under adjudication proceedings under NRS 533.090 through 533.320.

This permit is issued by and subject to the order of the Findings of Fact, Conclusions of Law; Order Partially Granting Supplemental Petition for Judicial Review; Order for Issuance of Mitigation Rights Permit; Order Partially Denying Supplemental Petition for Judicial Review; Case No. CV-1409-204; in the Seventh Judicial District Court of the State of Nevada, in and for the County of Eureka; dated March 21, 2018.

The permittee shall keep monthly records of the amount of water pumped from this well and the records must be submitted to the State Engineer on an annual basis within 30 days after the end of each calendar year.

The well must be sealed with cement grout, concrete grout or neat cement from ground level to 100 feet.

This right is issued to mitigate the loss of discharge from the spring source under Permit 82268, a change of Claim of Vested Right V03289, a portion of which has a priority date of 1873 for 4,397.4 acre-feet annually; and a priority date of January 1, 1892 for the remaining 702.6 acre-feet per season portion; thus, this permit cannot be severed from Permit 82268, a change of Claim of Vested Right V03289. Additionally, Permit 81720 may be exercised in conformity with the priority dates of Claim of Vested Right V03289 during the periods that the basin is regulated.

(Continued on Page 2)

The point of diversion of this permit shall not be moved outside of the spring discharge area as determined by the State Engineer.

The total combined duty of water under Permit 4273, Certificate 964 and Permits 81720 and 82268 shall not exceed 5,100 acre-feet annually for the irrigation of the described place of use.

This permit is totally supplemental to Permit 82268, which changed the point of diversion of Claim of Vested Right V03289, and may be exercised as an alternate point of diversion whenever Permit 82268 is in priority.

The total combined rate of diversion for Permit 4273, Certificate 964 and Permits 81720 and 82268 shall not exceed 7.02 cubic feet per second.

This permit does not extend the permittee the right of ingress and egress on public, private or corporate lands.

The issuance of this permit does not waive the requirements that the permit holder obtain other permits from State, Federal and local agencies.

The point of diversion and place of use are as described on the submitted application to support this permit.

The amount of water to be appropriated shall be limited to the amount which can be applied to beneficial use, **and not to exceed 7.02 cubic feet per second or 5,100 acre-feet annually.**

Work must be prosecuted with reasonable diligence and proof of completion of work shall be filed on or before: **January 29, 2018**

Water must be placed to beneficial use and proof of the application of water to beneficial use shall be filed on or before: **January 29, 2020**

Map in support of proof of beneficial use shall be filed on or before: **January 29, 2020**

IN TESTIMONY WHEREOF, I, TIM WILSON, P.E.,

Acting State Engineer of Nevada, have hereunto set my hand and the seal of my office, this 6th day of **March, 2019**

Tim Wilson, P.E.

Acting State Engineer

Nevada Division of Water Resources

IN THE MATTER OF THE PETITION FOR APPROVAL OF A GROUNDWATER MANAGEMENT PLAN SETTING FORTH THE STEP TO REMOVE THE CRITICAL MANAGEMENT AREA DESIGNATION FROM THE DIAMOND VALLEY HYDROGRAPHIC BASIN (153) WITHIN EUREKA, ELKO, AND WHITE PINE COUNTIES, NEVADA.

ON THIS DATE, TUESDAY, OCTOBER 30, 2018

Ex. No.	List of Exhibits	OFF.	AD.
	STATE ENGINEER		
1	Petition for approval of the Diamond Valley Groundwater Management Plan	X	X
2	Diamond Valley Groundwater Management Plan	X	X
3	Notice of Hearing to County Commissioners with Certified Mail Receipts	X	X
4	Public Notice with Proofs of Publication	X	X
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DATE: August 16, 2018

TO: Jason King, Nevada State Engineer

CC: Adam Sullivan, Deputy State Engineer

SUBJECT: Petition for approval of Diamond Valley Groundwater Management Plan

Dear Mr. King:

Enclosed, please find the consolidated petition from groundwater permit holders in Diamond Valley requesting your approval of the also enclosed Diamond Valley Groundwater Management Plan (GMP).

Also enclosed is a table of water rights holders and associated permits used to track receipt of individual petitions and any clarifying notes or follow-up. Based on this table, which is unofficial, 290 of 493, or 58.8%, total groundwater permits signed the petition requesting GMP approval by August 15, 2018. It is understood that your office will independently evaluate the petition signatures and associated permits and the final, official total may be different.

An electronic copy of the GMP may also be downloaded at:

https://drive.google.com/open?id=1jEYzKBsqOg3WbZuNb58v_5OYIrYZDCw5.

If you have any questions or need clarification, please contact the GMP Advisory Board through the Eureka County Department of Natural Resources (Jake Tibbitts).

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
Roger B. and Judy B.	Allen		26437, 47591	2	1	2	IP	26-Jun	Recent sale; Dusty Moyle signed
Harlow B. and Bonnie G.	Andersen		18242, 72370	2	1	2	Mail	24-Jul	Valerie Wood, daughter, signed.
Edward B. and Jerry Lee	Anderson		19191, 24214, 47518, 47519, 47520, 47521	6	1	6	Mail	24-Jul	
Timothy Lee and Constance Marie	Bailey		22194, 22195, 49731	3		0			
Fred and Carolyn, Wilfred and Barbara	Bailey	Bailey Family Trust	28035, 28036, 37933, 48948, 49732, 55727, 63497, 67144	8		0			
James E. and Vera L., Jim	Baumann		19526, 44783	2	1	2	IP	26-Jun	
Scott Thomas and Kristine Louise	Bell		33817, 33818	2	1	2	IP	24-Jul	
Craig and Kathryn	Benson		18978, 18981, 39552, 39553, 39554, 42019, 42020	7		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
Kenneth F. and Patti E.	Benson		21428, 22648, 22921, 22922, 35009, 36321, 36322, 85966, 85967, 86032, 86033, 86034, 86035, 86036, 86037, 86038, 86039	17		0			
Don and Linda	Bergener		21839	1		0			
Chad and Rosie	Bliss		44784, 78663, 78664, 83852, 83853	5	1	5	IP	26-Jun	
James or Pamela	Buffham		20487	1	1	1	Mail	24-Jul	20487 -JWL Properties; JWL/Jeff Lommori signed
James or Pamela	Buffham		24262, 24263, 24264, 24265	4	1	4	IP	26-Jun	24262 through 24265 - Diamond Valley Hay Co., Inc. (Plaskett); Plaskett signed
Dale R. and Elma G.	Conaway		24127, 24128	2		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
Kenneth E. and Beverly A.	Conley	Conley Land and Livestock, LLC	19492, 19500, 19501, 19502, 22217	5	1	5	IP	26-Jun	
Charles E.	Cooper		18999	1	1	1	IP	26-Jun	Matt Morrison signed
Ferno L. and Carrie M.	Dubray		19279, 35374, 35375, 49853, 49854, 67450	6		0			
James F.	Etcheverry		35012	1	1	1	Mail	26-Jun	
A.C. (Angelo)	Florio	Arc Dome Partners, LLC	10824, 10827	2		0			
Gary G. and Melody I.	Garaventa		81612, 81614, 81653	3	1	3	IP	26-Jun	
Daniel E.	Groth		46287, 51647	2	1	2	Mail	15-Aug	
Jayme L.	Halpin		31454, 31455, 81004	3	1	3	IP	26-Jun	
Howard Sr and Kathy	Hill		18911	1	1	1	Mail	26-Jun	
John R.	Hovious		18927, 18928	2	1	2	Mail	15-Aug	Same permits of A.G. Farm Commodities; signed by Gary Betschart.
Richard E and Mari A.	Kephart		26664, 42367, 42368, 42369, 42370, 56652	6	1	6	IP	26-Jun	
Reed W.	Marshall		20487	1	1	1	Mail	24-Jul	JWL Properties; JWL/Jeff Lommori signed

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
William C. and Rachel G.	Marshall		27976	1		0			
Juanita Ruthel	Martin	The Juanita Ruthel Martin Trust Ruth Martin Ranches, LLC	18786, 18787, 18788, 18789, 86252, 86253	6	1	6	IP	26-Jun	
John E.	Marvel		24204, 24262, 24263, 24264, 24265	5	1	5	IP	26-Jun	Marty Plaskett signed - Diamond Valley Hay Co., Inc.
Harold R. and Muriel	Miles		19111, 23893	2	1	2	Mail	15-Aug	19111 POD and POU on Galen Byler's property; 23893 POD on Mark Moyle's property (same well as 19110) but POU on Byler's. Signed by Galen Byler.
Lavon and Kristi	Miller		22566, 22567	2	1	2	Mail	24-Jul	
Anthony	Miller		21085, 23462, 23803, 65481	4		0			
Owen J. and Cheryl	Miller		19218, 21561, 23711, 23738, 23739, 41883, 41884	7	1	7	Mail	15-Aug	Recent purchase by Ropp; signed by Delmar and Trennis Ropp.
John B. and Nancy	Minoletti		20565	1	1	1	Mail	24-Jul	
Lloyd E. & Belinda Faye	Morrison		21426, 21843, 66440	3	1	3	IP	26-Jun	Martin Plaskett signed and added 66440

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
Donald E. and Alberta J.	Morrison		24129, 24130	2	1	2	Mail	26-Jun	Also included 24130
D. Lloyd	Morrison		24574, 29405, 66439	3	1	3	IP	26-Jun	
James L. and N. Jane, Dusty L.	Moyle		19145, 19378, 19379, 19381, 19492, 20000, 20015, 24605, 29557, 29873, 30102, 30913, 36070, 40402, 43397, 46461, 49185, 49188, 50095, 50650, 81268, 26437, 47591	23	1	23	IP	26-Jun	
Debra	Newton		18834, 18835, 19052, 19053	4	1	4	IP	24-Jul	Recent sale; David Groth signed.

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
William H. Jr. and Patricia A.	Norton		23918, 77646, 77695, 77696, 80717, 80718, 80879, 80880, 80881, 80926	10	1	10	IP	24-Jul	
Egidio	Oliveira		29895	1		0			
Sean	Peck		24378	1		0			Ruby Hill Ranch parcel - 5 afa
Walter L. and Tommye J.	Plaskett		19563, 19971, 19972, 19973, 28160, 34948, 46348	7	1	7	IP	26-Jun	Martin Plaskett signed
Ira R. and Montira	Renner		85131, 85132, 85133, 85134	4		0			
David M. and Sally R.	Rubio		35418	1		0			Roger and Chrissy Hubbard recently obtained Quitclaim Deed clarifying ownership.
Terry F.	Rudd	The Church of Jesus Christ of Latter-Day Saints	47304	1		0			
Robert L. and Arlene	Smith		31389	1		0			Not specifically listed in deed to LC Properties.

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
Craig Allen and Shelba Kay	Smith		18796, 18797	2		0			
Albert L. and Joy D.	Snowden		54409	1	1	1	IP	15-Aug	
Daniel S.	Venturacci		13726, 13727, 81825, 82572	4		0			
Norbert and Eileen B.	Walter		19218, 21561, 24378	3		0			Ruby Hill Ranch property
Dennis L. and Kim Kennedy	West		73899, 78358	2	1	2	Mail	24-Jul	
Larry N.	Wisehart		33668, 33669, 33670, 33671	4	1	4	Mail	26-Jun	
T.C.	Woldrum	Chloe Held Trust U/W Paul R. Held First National Bank of Mpls.	6369	1		0			On Scott Bell's property (7th St.) in middle of pivot
Tim R.	Zasadny		63052	1		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		American First Federal, Inc. Berg Properties California, LLC Diamond Valley Ranch, LLC	21930, 22316, 22982 43271, 43272, 43273, 43274 19541, 19542, 19904, 20087, 20088, 21929, 23479, 23480, 24606, 24607, 24609, 24610, 78905, 78906	21	1	21	IP	26-Jun	
		Bar D Land and Livestock, LLC	19965, 19966, 31062, 31063, 77666, 78447, 80581, 83567, 83568	9		0			
		Beck Properties, Arc Dome Partners, LLC	13198, 13200, 13580	3		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Blanco Ranch, LLC	43269, 43837, 43838, 43839, 43840	5	1	5	IP	26-Jun	Arthur Berg signed
		Burnham Farms, LLC	23272, 28641, 29278, 23271	4	1	4	Mail	24-Jul	Recent sale; struck all but 23272, 28641, 29278 and added 23271. Lavon Miller signed.
		Burnham Farms, LLC	19760, 24272, 28061, 46505	4	1	4	Mail	24-Jul	Recent sale; struck all but 19760, 24272, 28061, and 46505. Chuck and Heidi Reinford signed.
		Damele Farms, Inc.	19292, 19293, 24202, 24203	4	1	4	Mail	15-Aug	
		Deanne M. Hicks and Denise L. Moyle	18794, 31108, 31110, 31111, 31113, 31114, 76358, 77569, 78062, 81269	10	1	10	IP	26-Jun	

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Fred L. Etchegaray and John J. Etchegaray Leroy W. Etchegaray and Mary Jean Etchegaray Family Trust	18802, 19360, 19361, 31249, 31563, 39156, 55535, 57777, 65483, 71748	10		0			
		Gallagher Farms, LLC J & T Farms, LLC	18851, 48871, 48872, 70587, 70588, 87072, 87073, 19014, 83615, 83616, 83617	11	1	11	IP	26-Jun	
		Halpin Family Trust	19192, 29765	2	1	2	IP	26-Jun	
		J.W.L. Properties, LLC	78771, 78772, 78773, 78774, 78775, 20487	6	1	6	Mail	24-Jul	
		LC Properties, LLC	83622, 83623	2		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Lynford and Susan Miller Revocable Family Trust	30927, 30928, 40010, 40013, 44604, 44605, 44606, 44607, 44609	9	1	9	IP	24-Jul	
		M&C Hay Morrison Trust	21844, 34596, 42021, 48225, 48226	5	1	5	IP	26-Jun	
		Mark Moyle Farms, LLC	19110, 20366, 22352, 22353, 34561, 34562, 34939, 43268, 43270, 43836, 48437, 66441, 67172, 70940, 78568	15	1	15	IP	26-Jun	

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Martin P. and Kathleen A. Etcheverry Family Trust and Mark T. Etcheverry and Jennifer Etcheverry	33018, 33019	2	1	2	Mail	24-Jul	
		Michel and Margaret Ann Etcheverry Family Limited Partnership	20694, 21399, 21841, 35013	4	1	4	Mail	15-Aug	Separate note attached to petition signed by Matthew Etcheverry.
		Robert Ithurralde and James P. Ithurralde	80799, 83503, 83504, 73629, 80799, 81229, 81230, 83503, 83504	9	1	9	IP	26-Jun	Recent sale; Chad Bliss signed
		Sadler Ranch, LLC	37933, 50581, 50582, 70305, 77083, 81720, 85145, 86600	8		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Sestanovich Hay & Cattle, LLC	18975, 18988, 18989, 19324, 34950, 70073, 80780, 80781, 86030	9	1	9	Mail	24-Jul	
		The Donald F. & Eliza M. Palmore Family Trust	14948, 44451, 44452, 53872	4	1	4	IP	26-Jun	

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Ruby Hill Mining Company, LLC	18621, 18622, 19411, 22551, 24378, 25820, 44621, 68923, 73118, 73204, 77447, 77449, 79706, 79707, 83501, 83502, 83505, 83506, 83507, 85645, 85646, 85647, 86794, 87222, 87223, 87224, 87225	27					
					1	27	Mail	24-Jul	Crossed out 25820 and 73118; added 18623 and 79705

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Ty and Michelle R. Erickson and Ari and Alisha Erickson, Solarljos, LLC	18623, 42891, 64630, 64631, 64632, 64633, 19490, 85651	8		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Eureka Moly, LLC Kobeh Valley Ranch LLC Ruby Hill Ranch, LLC	19218, 21561, 23711, 23738, 23739, 24378, 81650, 11004, 11008, 24012, 44743, 47907, 50962, 50963, 57835, 57836, 57838, 57839, 57840, 66062, 68122, 86149, 86150, 86151, 86152, 86153, 18621, 18622, 19411, 22551, 24378, 25820, 44621, 68923, 73118, 73204, 77447, 77449, 79706, 79707, 83501, 83502, 83505, 83506, 83507, 85645, 85646, 85647, 86794, 87222, 87223, 87224, 87225	53		0			
		Mt. Hope Mines, Inc.	29120, 29121	2		0			

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		Eureka County Public Works Devils Gate General Improvement District Town of Eureka Eureka County	63052, 68923, 79707, 18851, 18988, 20565, 22217, 23462, 26542, 26543, 26544, 29603, 49924, 63247, 64117, 65768, 65769, 65770, 67902, 71842, 71843, 87437, 24378, 45534, 55660, 57856, 57857, 66207, 66208, 72936, 76526, 83241, 83242, 83243, 83245, 62928, 62929	37		0			
		Eureka County Board of Education	20495	1	1	1	Mail	24-Jul	

First Name	Last Name	Company Name	Permits	# of Permits	Petition Returned? 1=Yes, 0=No	Permit Count If	Mail or In-Person	Meeting tallied	Notes/Follow Up
		A.G. Farm Commodities	18927, 18928	2	1	2	Mail	15-Aug	
		Diamond Valley Hay Co., Inc.	24204, 24262, 24263, 24264, 24265	5	1	5	IP	26-Jun	
			Totals	493		290			