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UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA

HUALAPAI INDIAN TRIBE OF THE HUALAPAI INDIAN RESERVATION, ARIZONA, *Plaintiff*, vs. DEBRA HAALAND, in her official capacity as the United States Secretary of the Interior; UNITED STATE BUREAU OF LAND MANAGEMENT; RAY SUAZO, in his official capacity as State Director of the United States Bureau of Land Management; and AMANDA DODSON, in her official capacity as Field Office Manager of the United States Bureau of Land Management Kingman Field Office, *Federal Defendants.*	Case No. 3:24-cv-08154-DJH **FEDERAL DEFENDANTS' RESPONSE TO HUALAPAI TRIBE'S MOTION FOR TEMPORARY RESTRAINING ORDER FOLLOWED BY A PRELIMINARY INJUNCTION AND MEMORANDUM IN SUPPORT**

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Statutes

Regulations

TABLE OF EXHIBITS

Exhibit	Description
1	Final Environmental Assessment ("EA")
2	EA App. C
3	June 6, 2020, Letter from A. Dodson to D. Clarke
4	June 22, 2020, Email from T. Thompson to P. Bungart
5	July 2, 2020, Email from A. Dodson to P. Bungart
6	Site Visit Report
7	May 6, 2021, Email Chain
8	June 17, 2021, Letter from A. Dodson to K. Leonard
9	Arizona State Protocol Agreement
10	July 2021 Hualapai Comments on Draft EA[1]
11	Cooperating Agency Memorandum of Understanding ("MOU")
12	March 2024 Hualapai Comments on Preliminary Final EA
13	Southwest Hydro-Logic ("SWLG") Memo and Report
14	April 2024 A. Dodson Emails re. Plugging
15	Record of Decision ("ROD") and Finding of No Significant Impact ("FONSI")
16	Manera Report[2]
17	Aug. 5, 2024, Email
18	July 5, 2024, Letter from Navajo Transitional Energy Co. ("NTEC")
19	Hualapai Draft Master Plan

[1] The attachments to Hualapai's July 2021 and March 2024 comment letters are not included with these exhibits.

[2] The appendices to the Manera Report are not included in the exhibit.

INTRODUCTION

The Court should reject Plaintiff Hualapai Indian Tribe's request for a temporary restraining order and preliminary injunction halting implementation of the Sandy Valley Exploration Project, Phase III. Hualapai claims the Project's lithium exploration activities pose an imminent threat to a nearby sacred hot spring known as Ha'Kamwe', but the Bureau of Land Management's ("BLM") analysis of the Project reveals that it will have minimal, if any, impact on the spring. Specifically, BLM determined that the Project will not affect the aquifer that feeds Ha'Kamwe' and devised mitigation measures to address the unlikely scenario in which water is encountered. BLM also communicated with the Tribe throughout the Project's development and appropriately determined that the Project's temporary effects would not impair the characteristics that qualify Ha'Kamwe' for inclusion in the National Register of Historic Places. Hualapai is thus unlikely to succeed on the merits of its National Environmental Policy Act ("NEPA") and National Historic Preservation Act ("NHPA") claims and offers little more than speculation to support its assertion of irreparable harm. Further, an injunction would not be in the public interest because the Project is an important part of the United States' green energy transition. The Court should therefore deny Hualapai's motion.

BACKGROUND

Phase III of the Sandy Valley Exploration Project is a small-scale exploratory drilling action aimed at assessing the existence of lithium deposits in parts of the Big Sandy Basin near Wikieup, Arizona. *See* Ex. 1, Final Env't Assessment ("EA"), 1. Planning for the Project started in 2019 when Arizona Lithium Ltd. ("AZL")[3]—owner of the relevant mining claims on BLM land—submitted an application to continue its exploration. *Id.* This third phase of exploration follows two prior phases in 2019. *See* Ex. 2, EA App. C, Fig. 2A. The prior, completed phases involved drilling a total of 53

[3] The EA states that Big Sandy, Inc., submitted the exploration plan. EA 1. Big Sandy is a subsidiary of AZL. AZL was also formerly known as Hawkstone Mining, Ltd.

boreholes and "helped to better define the areas where lithium resources exist." EA 1.

BLM initiated consultation with Hualapai regarding Phase III on June 6, 2020. Ex. 3, June 6, 2020, Ltr. BLM's request conveyed BLM's determination that the Area of Potential Effect ("APE") to cultural resources was 613 acres. *Id.* at 1. It sought to consult with Hualapai and other tribes "for all areas that would potentially be subject to surface disturbance or other potentially adverse effects." *Id.* Hualapai requested, and BLM promptly provided, a GIS shapefile of the APE and archaeological survey, among other things. Ex. 4, June 22, 2020, Email; Ex. 5, July 2, 2020, Email. And BLM conducted a site visit with Hualapai on March 19, 2021. Ex. 6, Site Visit Rep. Following that meeting, ACHP and Arizona SHPO suggested that "BLM organize a group consulting parties meeting." Ex. 7, May 6, 2021, Emails.

BLM held such a meeting with Hualapai, Fort Mojave, Arizona SHPO, and ACHP on May 28, 2021, to "discuss the BLM's definition of the undertaking, [APE], the BLM's efforts to identify historic properties, and the BLM's finding of No Historic Properties Affected." Ex. 8, June 17, 2021, Ltr. BLM noted that the Project involves sampling rather than mining, that the "exploration plan proposes no permanent infrastructure and would involve a handful of workers," and that all disturbed areas would be reclaimed. *Id.* BLM determined that "because the exploration plan is temporary in nature and does not propose any permanent infrastructure, . . . this undertaking would not cause visual, audible, atmospheric, or cumulative impacts to a historic property." *Id.* BLM's definition of the APE as the area where the ground would be disturbed was guided by "the limited scope and magnitude of the undertaking." *Id.* BLM thus did not extend the APE beyond the area of actual ground disturbance. BLM and the SHPO "agreed that the undertaking may proceed under the" Arizona Protocol Agreement. *Id.*[4]

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[4] BLM developed a State Protocol Agreement with the Arizona SHPO to guide BLM planning and decision making as it pertains to historic properties and historic preservation in Arizona. Ex. 9. The Agreement "provide[]s BLM Arizona with a substitution for the standard procedures associated with Section 106 of the NHPA as well as a process for consistent compliance with th[ose] procedures." *Id.*

Pursuant to its NEPA obligations, BLM published a draft EA for the Project in April 2021. EA 3. After an initial 30-day comment period, BLM extended the period by 60 more days to July 10, 2021. *Id.* Hualapai submitted two comment letters during this period. *See, e.g.,* Ex. 10, July 2021 Comments. Most of Hualapai's comments focused on the Project's proximity to Ha'Kamwe' (also called "Cofer Hot Springs"), which is located on tribal land near the Project area's northern part. *See* EA App. C, Fig. 3. Hualapai also expressed concerns about noise, vibrations, and visual impacts interfering with use of the spring and the possibility that drilling could affect the spring's flow.

As part of BLM's coordination with Hualapai, on February 9, 2024, BLM and Hualapai entered into a Memorandum of Understanding ("MOU") making the Tribe a cooperating agency under NEPA. Ex. 11, MOU. Under the MOU, BLM agreed to provide Hualapai with a preliminary version of the final EA so Hualapai could provide comments on sections relating to certain resources. MOU 2.

BLM provided the preliminary final EA to Hualapai shortly after, and Hualapai provided comments on March 13, 2024. Ex. 12, March 2024 Hualapai Comments. Hualapai's letter also contained attachments, including a hydrology report completed by Southwest Hydro-Logic ("SWLG") and accompanying memorandum. Ex. 13, SWLG Memo. and Rep. BLM responded to Hualapai's comments and the SWLG Report's conclusions by updating the EA to require more rigorous procedures to plug boreholes if water is encountered during drilling. Ex. 14, April 2024 A. Dodson Emails re. Plugging.

BLM published the Final EA in June 2024. As the EA explains, the Project involves exploration over a 613-acre area divided into a northern portion with 100 new boreholes and a southern portion with 31 new boreholes. EA 4; *see also* EA App. C, Fig. 2A. Boreholes for extracting core samples would be 3.5 inches in diameter, reach no deeper than 360 feet, and utilize fresh water and biodegradable polymer for coring. *Id.* at 5. The Project also involves drilling three 3-foot diameter holes to extract a bulk sample, but these holes will not exceed 100 feet in depth. *Id.* at 6. After drilling, BLM requires holes to be backfilled and plugged and all disturbed land be reclaimed. EA 5–6. Activities are expected to disturb a total of 21 acres and will last roughly 18 months. *Id.* at 4–5.

Beyond adding rigorous plugging procedures, the EA describes other Project changes aimed at addressing Hualapai's concerns related to Ha'Kamwe'. First, the EA requires AZL and Navajo Transitional Energy Co. ("NTEC")—the Project manager—to allow Hualapai and other interested tribes to monitor ground disturbing activities with the goal of observing whether cultural materials or water are inadvertently encountered. EA 6–7. Second, whereas the draft EA envisioned drilling a well to provide water for drilling and dust suppression, the final EA requires that all water be trucked in from off-site, eliminating any need to withdraw groundwater within the Project area. *Id.* at 3, 5. Third, the EA consolidates the Project's staging areas away from Ha'Kamwe' in response to concerns about visual and auditory impacts. *Id.* at 3. Finally, the EA refines the access routes to drill sites to reduce overland travel disturbance. *Id.* In short, the Project aims to "gain maximum information" about potential lithium deposits "while minimizing surface disturbance and occupation." *Id.* at 5. BLM approved the Project and issued a Finding of No Significant Impact ("FONSI") on June 5, 2024. Ex. 15, ROD and FONSI.[5]

LEGAL STANDARDS

I. The Preliminary Relief Standard

"Preliminary injunctive relief is an 'extraordinary remedy never awarded as of right.'" *Stensrud Inc. v. Unknown Parties*, 2024 WL 894674, at *2 (D. Ariz. Mar. 1, 2024) (quoting *Winter v. Nat. Res. Def. Council, Inc.*, 555 U.S. 7, 24 (2008)). A plaintiff "must establish that he is likely to succeed on the merits, that he is likely to suffer irreparable harm in the absence of preliminary relief, that the balance of equities tips in his favor, and that an injunction is in the public interest." *Winter*, 555 U.S. at 20. Alternatively, "'serious questions going to the merits' and a balance of hardships that tips sharply towards the plaintiff can support issuance of a preliminary injunction" if the

[5] If, after exploration, AZL ultimately proposes a lithium mine, it would be required to submit a mining plan of operations, which would be analyzed through the NEPA process, triggering a separate Section 106 undertaking. June 17, 2021, Ltr.

remaining requirements are also satisfied. *All. for the Wild Rockies v. Cottrell*, 632 F.3d 1127, 1135 (9th Cir. 2011).[6] "[C]ourts must balance the competing claims of injury and must consider the effect on each party of the granting or withholding of the requested relief, and should be particularly mindful, in exercising their sound discretion, of the public consequences in employing the extraordinary remedy of injunction." *Stensrud*, 2024 WL 894674, at *2 (cleaned up).

II. Review Under the Administrative Procedure Act

Because neither NEPA nor the NHPA contain a private right of action, Hualapai's claims under both statutes are reviewed under the APA, 5 U.S.C. §§ 701-706. *See WildEarth Guardians v. Provencio*, 923 F.3d 655, 664 (9th Cir. 2019). To prevail in an APA challenge, a plaintiff must show that an agency's decision was "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. § 706(2)(A). Review is "deferential and narrow, and the court is not to substitute its judgment for the agency's judgment," *Friends of Animals v. Haaland*, 997 F.3d 1010, 1015 (9th Cir. 2021), or "fly-speck" the agency's NEPA analysis, *Audubon Soc'y of Portland v. Haaland*, 40 F.4th 967, 984 (9th Cir. 2022). Under this standard, "[a]gency action should be affirmed 'so long as the agency considered the relevant factors and articulated a rational connection between the facts found and the choices made.'" *Id.* at (quoting *Alaska Oil & Gas Ass'n v. Pritzker*, 840 F.3d 671, 675 (9th Cir. 2016)).

ARGUMENT

I. Hualapai Are Not Likely to Succeed on The Merits.

The Court should deny Hualapai's request for a temporary restraining order and preliminary injunction because it fails to meet the "threshold," dispositive requirement of demonstrating its NEPA and NHPA claims are likely to succeed or raise serious questions on the merits. *Garcia v. Google, Inc.*, 786 F.3d 733, 740 (9th Cir. 2015).

[6] Federal Defendants do not concede the validity of *Cottrell*'s reasoning that the Ninth Circuit's "sliding scale" test for issuing a preliminary injunction survives *Winter*.

A. Pursuant to NEPA, BLM Took a Hard Look at the Project's Impacts.

BLM's analysis for the Project satisfies NEPA's hard look standard by reasonably assessing impacts related to groundwater conditions in the Project area and incorporating mitigation methods to preserve water resources. Under NEPA, the question for a reviewing court is whether the agency's analysis "contains a reasonably thorough discussion of the significant aspects of the [federal action's] probable environmental consequences." *Audubon Soc'y of Portland*, 40 F.4th at 984 (cleaned up). NEPA thus requires agencies to take a "hard look" at a project's environmental impacts, but the "detail that NEPA requires . . . depends upon the nature and scope of the proposed action." *Ctr. for Sierra Nevada Conservation v. U.S. Forest Serv.*, 832 F. Supp. 2d 1138, 1159 (E.D. Cal. 2011) (quotation omitted). And a project may use mitigation measures to "aid in timely identification of threats and the need for preventative measures or project modifications." *Env't Prot. Info. Ctr. v. U.S. Forest Serv.*, 451 F.3d 1005, 1015 (9th Cir. 2006). When such measures are incorporated "throughout the plan of action," the project's "effects are analyzed with those measures in place." *Id.*

Courts in this district have applied these principles to uphold the groundwater analysis for exploratory drilling actions similar to this Project. *Concerned Citizens & Retired Miners Coalition v. United States Forest Service* ("*CCRMC*"), for example, upheld a plan to drill 16 wells up to 2,000 feet deep and 41 additional boreholes at the site of a planned mine facility. 279 F. Supp. 3d 898, 908–09, 936 (D. Ariz. 2017). The court held that, "[g]iven the relatively small scale of the project," the agency's reliance on "data collected from two studies of similar nearby basins" to establish baseline groundwater conditions satisfied NEPA. *Id.* at 934. The court further concluded that the benefits of the project's mitigation measures—including using "well-recognized techniques of well casings and fill material" to "prevent[] cross contamination of groundwater layers"—were "obvious" and did not require further support. *Id.* at 937–38.

Patagonia Area Research Alliance v. United States Forest Service rejected a similar challenge to the NEPA analysis for an exploratory drilling project that would reach depths of up to 6,500 feet. 2023 WL 5723395, at *2 (D. Ariz. Sept. 5, 2023), *aff'd in part, appeal dismissed in part*, 2024 WL 2180192 (9th Cir. May 15, 2024); *id.*, Plaintiff-Appellants' Reply Brief, 2023 WL 10365059, at *23. The plaintiffs asserted that "groundwater exchange between aquifers" that could compromise "the sole source of drinking water for the Town of Patagonia." *Patagonia*, 2023 WL 5723395, at *2. Nonetheless, the court determined that the Forest Service's reliance on a single 2001 study of the same basin sufficed under NEPA and no new study was warranted. *Id.* at 6. The court also noted the EA's reasonable features to "mitigate the risk of groundwater exchange between aquifers." *Id.*

The Court should follow *CCRMC* and *Patagonia* and uphold BLM's analysis here. BLM based its analysis of groundwater conditions on a 2000 study of the southern Big Sandy Basin, referenced as "Manera 2000" in the EA. EA 20–22; Ex. 16, Manera Rep. This study involved drilling four test holes one-to-three miles south of Ha'Kamwe' to analyze the area's lithology, followed by more wells to test the aquifer. *See* Manera Rep. 12 (Figure 3). The data revealed layers with distinct porosities: (1) a shallow "upper aquifer" characterized by recent stream and floodplain alluvium; (2) a layer of low-porosity clay, known as the "Wikieup Formation," 240 to 640 feet in depth; (3) a "middle aquifer" characterized by sand, gravel, and some clay reaching 1,375 feet deep; (4) a 10-15 barrier of basalt rock; and (5) a "lower aquifer" extending to an indeterminate depth. EA 20; EA App. C, Figure 4; *see also* Manera Rep. 13–14. Only the lower aquifer was found to be pressurized and produced an artesian water flow. EA 21; *see also* Manera Rep. 11, 20–21. The report determined that the lower aquifer likely provides Ha'Kamwe's water given chemical and temperature similarities, though the EA notes the upper aquifer may contribute. EA 21; Manera Rep. 14.

In addition to the Manera Report, the EA considers the data from the prior phases of exploration, which involved drilling dozens of holes nearby the hot spring that encountered no water. EA 22; *see also* EA App. C, Fig. 2A. And the EA notes that the recharge area for the lower aquifer has recently been experiencing draught conditions, further lowering the chances of striking water. EA 21. Based on this information, the EA concludes that the drilling—which will only reach depths of 360 feet—will not encounter the pressurized aquifer that supports Ha'Kamwe'. EA 22.

Even though the Project's chances of encountering water are low, the Project incorporates measures to eliminate any potential impacts to Ha'Kamwe'. First, AZL and NTEC must "provide the opportunity to the plaintiff Tribe . . . to monitor for and observe the presence and depth of water and soils associated with spring deposits" during drilling. EA 6. Second, if a hole does encounter water, it must be plugged and abandoned in accordance with Arizona law. EA 9. If a hole encounters artesian water, drilling must *immediately* cease and the hole must be plugged using cement grout via tremie pipe to ensure pressure is maintained. *Id.* These mitigation measures along with BLM's analysis are consistent with the EAs upheld in *CCRM* and *Patagonia* and satisfy NEPA. *See* 279 F. Supp. 3d at 934–36; 2023 WL 5723395, at *6.

Hualapai's arguments to the contrary are unavailing. Hualapai starts by asserts that the Manera Report is somehow "inapplicable" to the Project at hand but does not explain how the study's purpose bears on its scientific accuracy—geology is not project-dependent—or how the area's stratigraphy could have changed since 2000. ECF No. 11, Mot. for Temp. Rest. Order and Prelim. Inj., 12. To the contrary, because the test holes used in the Manera Report were just a few miles from Ha'Kamwe' and the Project site, it is likely more informative than the two studies of "similar nearby basins" supporting the NEPA analysis that was upheld in *CCRMC*. *See* 279 F.Supp.3d at 934.

Nor is Hualapai correct that its own groundwater study—the SWHL Report—was ignored by BLM or undermines the Manera Report. Mot. 12–13. Hualapai claims that the SWHL Report proves that the EA's reference to multiple aquifers is "factually flawed," *id.* at 8, but, as the memo attached to the report acknowledges, this boils down to a dispute over "hydrologic nomenclature." SWHL Rep., Memo. at 2. After all, the SWHL Report itself *relies on* the study underlying the Manera Report (which it refers to as "Caithness Big Sandy") to conclude that the geologic "layers" in the Project area have "different degrees of porosity and lithification." *Id.* at 6. Elsewhere the SWHL Report even adopts the multi-aquifer terminology by referring to a "spring aquifer" and "basin-fill aquifer." *Id.* at 18.

And, contrary to Hualapai's assertion, BLM did not ignore the SWHL's conclusion that BLM needed to "prepare for the possibility of encountering the over-pressured artesian aquifer" by identifying "methods to isolate, plug, and permanently seal artesian groundwater discharges." *Id.*, Memo. at 2. To achieve this, the SWHL Report recommends "using downhole tremie pipes to deliver grout to the bottom of the boreholes in order to prevent vertical migration of groundwater." *Id.* at 17. This is *exactly* the procedure that BLM added as a requirement in response to Hualapai's March 2024 comments. April 2024 Emails. Hualapai offers no reason to doubt that this measure—which its own expert recommends—would be effective. In short, the SWHL Report does not "challenge the scientific basis" of the EA, Mot. 8; rather, it merely constitutes an additional scientific study that BLM appropriately considered and responded to. *See W. Watersheds Project v. Abbey*, 719 F.3d 1035, 1048 (9th Cir. 2013) (declining to "substitute [the court's] judgment" for that of BLM where the agency considered studies but "did not draw the same conclusions" as the plaintiff).

Finally, Hualapai's insistence that BLM should have conducted an independent hydrological study lacks merit. *Patagonia* rejected a similar demand as "impractical" given the limited scope of the exploratory drilling project at issue. 2023 WL 5723395, at *6; *see also* 40 C.F.R. § 1506.6(b); *Tri-Valley CAREs v. U.S. Dep't of Energy*, 671 F.3d 1113, 1129 (9th Cir. 2012) ("The purpose of an EA is not to compile an exhaustive examination of each and every tangential event that potentially could impact the local environment."). To the extent there is ambiguity about whether the upper aquifer contributes at all to Ha'Kamwe', any risk this poses is mitigated by the EA's plugging procedures. EA 9. Indeed, Hualapai offers no explanation of how striking non-pressurized water in the upper aquifer and plugging the hole could even impact flows at Ha'Kamwe'. Hualapai thus fails to show likelihood of success on its NEPA claim.

B. BLM's Consideration of Alternatives Did Not Violate NEPA.

Hualapai's claim that BLM unlawfully failed to consider a viable middle ground alternative for the Project is likewise unlikely to succeed. "Under NEPA, an agency's consideration of alternatives is sufficient if it considers an appropriate range of alternatives, even if it does not consider every available alternative." *N. Alaska Env't Ctr. v. Kempthorne*, 457 F.3d 969, 978-79 (9th Cir. 2006) (quotation omitted). An agency therefore need not consider "alternatives which are infeasible, ineffective, or inconsistent with the basic policy objectives for the management of the area." *Id.* (cleaned up). Moreover, "an agency's obligation to consider alternatives under an EA is a lesser one than under an EIS." *N. Idaho Cmty. Action Network v. U.S. Dep't of Transp.*, 545 F.3d 1147, 1153 (9th Cir. 2008). And an agency may reject alternatives if it "briefly discuss the reasons for their having been eliminated." 40 C.F.R. § 1502.14(a).

Hualapai's alternatives argument fails for multiple reasons. First, Hualapai has failed to carry its burden to demonstrate its proposed alternatives are viable. "Those challenging the failure to consider an alternative have a duty to show that the alternative is viable." *Alaska Survival v. Surface Transp. Bd.*, 705 F.3d 1073, 1087 (9th Cir. 2013) (citation omitted). Specifically, a plaintiff must show how its proposed alternative "would appropriately meet the . . . objectives" of the project, *Sovereign Inupiat for a Living Arctic v. Bureau of Land Mgmt.*, 2023 WL 7410730, at *10 (D. Alaska Nov. 9, 2023), and "was necessary to foster informed decisionmaking and public participation," *Montana Wilderness Ass'n v. Connell*, 725 F.3d 988, 1005 (9th Cir. 2013).

Hualapai has not demonstrated (here or to BLM) that its vague proposals would be consistent with the Project's objectives or necessary to informed decisionmaking. To the contrary, Hualapai's proposal to reduce the amount of exploratory drilling, Mot. 10, "begs the question," *Alaska Survival*, 705 F.3d at 1087, of how BLM could achieve the Project's purpose of "provid[ing] [AZL] an opportunity to explore its valid existing mining claims" while limiting its ability to conduct the exploration necessary to assess potential deposits. *See* EA 2. It is also unclear how, after BLM "remov[ed] redundant routes" from the draft EA, EA 3, BLM could further reduce vehicle activity while allowing access to all drill sites, *See* EA App. C, Figures 2B & 2C (mapping access to drill sites). In fact, the EA states that "new access roads" would "consist of overland travel between drilling sites . . . using existing two-track road washes," EA 4, meaning "[n]o new access roads would be constructed," *id.* 11. Hualapai's roads proposal is thus irrelevant. And to the extent Hualapai proposes "stricter controls on noise, light, vehicular traffic, and vibrations," Mot. 10, BLM *did* consider these issues after they were raised in comments and modified the Project by, for example, moving the staging area and reducing roads, EA 3. Hualapai fails to explain how more, undefined controls could be consistent with the Project's goals or necessary for informed decisionmaking.[7]

Second, BLM's decision to consider two alternatives for a Project with such a narrow scope was reasonable. The Ninth Circuit has repeatedly recognized that considering just a no-action alternative and a preferred alternative can be adequate when the agency has prepared an EA. *See, e.g., N. Idaho Cmty. Action Network v. U.S. Dep't of Transp.*, 545 F.3d at 1153–54; *Earth Island Inst. v. U.S. Forest Serv.*, 697 F.3d 1010, 1021–23 (9th Cir. 2012); *Te-Moak Tribe of W. Shoshone of Nevada v. U.S. Dep't of Interior*, 608 F.3d 592, 602 n.11 (9th Cir. 2010).

Here, the EA explains that "[n]o alternative actions were evaluated in detail because none were identified that would have fewer impacts than the Proposed Action." EA 10. This makes sense given Hualapai's failure to provide any specific proposals in its 2021 comments. The EA also states that the possible options for the Project were "limited

[7] Hualapai also waived this argument by failing to propose any specific alternatives in its 2021 comments during the NEPA process. *See* July 2021 Comments 11; *Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 764–65 (2004) (respondents "forfeited any objection to the EA on the ground that it failed adequately to discuss potential alternatives" by not identifying "any rulemaking alternatives beyond those evaluated in the EA"). While Hualapai made more specific suggestions in its March 2024 letter, those comments were provided as a cooperating agency under the MOU. March 2024 Comments 6. The MOU invited Hualapai to comment on specific sections of the preliminary final EA, but did not solicit new proposed alternatives at the final stage of NEPA review. MOU 2.

given the narrow focus of the exploration drilling program." *Id.* In other words, BLM recognized that this is a small-scale Project with a specific goal assessing if lithium deposits on AZL's claims could support a mine. *See Abbey*, 719 F.3d at 1046 ("[A] project's scope and purpose define the reasonable range of alternatives that must be analyzed," and "[a]n agency has considerable discretion to define the scope" of its own NEPA analysis). More limited drilling was thus infeasible, and BLM properly excluded such alternatives. Hualapai is unlikely to succeed on its NEPA claims.

C. Federal Defendants Complied with the NHPA.

Hualapai does not meet its burden of proving that BLM's NHPA analysis was arbitrary. BLM assessed "the temporary nature of the visual, noise, and vibration effects from the proposed drilling activities" and requirements that protect Ha'Kamwe's water, reduce noise, and ensure that disturbed land is reclaimed and determined that Phase III of exploration would not alter the "characteristics that qualify Ha'Kamwe' for inclusion in the National Register of Historic Places." EA 16. BLM thus limited its NHPA analysis to the ground that will actually be disturbed. EA 16. *Id.* BLM's definition of the APE of Phase III exploration is entitled to substantial deference and Hualapai fails to establish that BLM's decisionmaking was arbitrary.

The NHPA "is a procedural statute requiring government agencies to 'stop, look, and listen' before proceeding with agency action." *Te-Moak*, 608 F.3d at 610. It does not prohibit harm to historic properties but creates obligations "that are chiefly procedural in nature." *San Carlos Apache Tribe v. United States*, 417 F.3d 1091, 1097 (9th Cir. 2005). The NHPA requires federal agencies to "make a reasonable and good faith effort to identify historic properties; determine whether identified properties are eligible for listing on the National Register . . .; [and] assess the effects of the undertaking on any eligible historic properties found." *Wildearth Guardians*, 923 F.3d at 676. The first step in this process is to "[d]etermine and document" an undertaking's APE. 36 C.F.R. § 800.4(a)(1). "The APE is 'the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.'" *Dine Citizens Against Ruining Our Env't v. Bernhardt*, 923 F.3d 831, 846 (10th Cir. 2019). The APR "is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." 36 C.F.R. § 800.16(d). "Establishing an area of potential effects requires a high level of agency expertise, and as such, the agency's determination is due a substantial amount of discretion." *Valley Cmty. Pres. Comm'n v. Mineta*, 373 F.3d 1078, 1091 (10th Cir. 2004). The Court must assume that BLM exercised that discretion appropriately unless Hualapai meets its burden of showing that BLM arbitrarily defined the APE. *Id.* at 1091; *see also Wildearth Guardians*, 923 F.3d at 677. Hualapai falls far short of meeting that burden.

BLM was not arbitrary to determine that limited, temporary noise and visual effects from a third phase of exploration located farther from Ha'Kamwe' than prior phases would not adversely affect the characteristics that qualify Ha'Kamwe' for inclusion in the National Register. *See* EA 16. Hualapai identifies no case that suggests, much less holds, that an agency's NHPA analysis must include properties that might experience limited, temporary noise and visual impacts that will not permanently alter their characteristics. *Solenex, LLC v. Haaland*, 626 F.Supp.3d 110, 127-28 (D.D.C. 2022) (constructing well pads and extracting oil); *Colo. River Indian Tribes v. Marsh*, ("*CRIT*") 605 F. Supp. 1425 (C.D. Cal. 1985) (constructing "156-acre residential and commercial development"); *Comanche Nation v. United States*, 2008 WL 4426621, at *1 (W.D. Okla. Sept. 23, 2008) (constructing a building); *Crutchfield v. U.S. Army Corps of Eng'rs*, 154 F. Supp. 2d 878, 880 (E.D. Va. 2001) (wastewater treatment plant construction).

Hualapai stakes much, Mot. at 8, on a May 31, 2024, letter from the Advisory Council on Historic Preservation ("ACHP") requesting BLM to reconsider its definition of the APE. But ACHP participated in consultation with Hualapai and Arizona's state historic preservation officer ("SHPO") regarding the APE in May 2021. June 17, 2021, Ltr. And ACHP recognized that "it is not incumbent upon the BLM to reconsider" its definition of the APE in May 2024—three years after that consultation. ECF No. 11-7 at 2. The record on determining the APE closed well before the ACHP letters that Hualapai rely upon. *Cf. Snoqualmie Indian Tribe v. FERC*, 545 F.3d 1207, 1211 (9th Cir. 2008). And Hualapai has not demonstrated that ACHP's late request is entitled to any deference. *Grand Canyon Tr. v. Williams*, 2013 WL 4804484, at *10–11 (D. Ariz. Sept. 9, 2013). ACHP's late request that BLM reconsider the APE does not render BLM's prior consideration unreasonable or in bad faith.

Hualapai is also incorrect that BLM's definition of the APE left Hualapai unable to "consult to resolve or mitigate the Project's adverse effects." Mot. at 8-9. To the contrary, BLM consulted with the Tribe regarding its concerns about groundwater, auditory, and visual issues and modified the proposed action in response under NEPA. EA 3.[8] Hualapai does not even suggest that it would have provided different information or that the consultation process would have been different under a different statute. *Te-Moak Tribe*, 608 F.3d at 609-610. Hualapai thus does not meet its burden of establishing that BLM's NHPA analysis was arbitrary, particularly given the substantial discretion accorded to BLM in defining the APE.

II. Hualapai Has Not Demonstrated Irreparable Harm from the Project.

Because Hualapai fails to demonstrate likelihood of success on the merits or raise serious questions, the Court "need not consider the other factors" of the preliminary injunction analysis. *See Edge v. City of Everett*, 929 F.3d 657, 663 (9th Cir. 2019). Even so, Hualapai has not met its burden to "establish that irreparable harm is likely, not just possible." *All. For the Wild Rockies*, 632 F.3d at 1131 (citing Winter, 555 U.S. at 22).

Hualapai does not show that the planned exploratory drilling is likely to cause irreparable harm in the imminent future, during the pendency of this litigation, or at any

[8] Hualapai is incorrect, Mot. at 7, that BLM was arbitrary to adopt a different scope for its NEPA and NHPA analysis. Section 106 considers effects on historic property's listing characteristics, while NEPA requires consideration of any effect (regardless of whether it would impact a listing characteristic). The different statutes "mandate[] separate and distinct procedures." *Preservation Coal., Inc. v. Pierce*, 667 F.2d 851, 859 (9th Cir. 1982). Even the case Hualapai cites, Mot. at 7, notes that "the obligations imposed by NHPA are 'separate and independent from those mandated by NEPA,'" *Apache Survival Coal. v. United States*, 21 F.3d 895, 906 (9th Cir. 1994).

point in the Project's lifetime. Notably, despite claiming elsewhere that the Project will "impair the spring," Mot. 12, Hualapai's brief makes no mention of irreparable harm to water flow at Ha'Kamwe'. *Id.* at 13–14. This makes sense in light of the EA's monitoring and plugging requirements and confirmation that prior phases of exploratory drilling even closer to the spring did not encounter water, EA 6–7, 9, 22.

Instead, Hualapai claims that exploration will damage or destroy cultural or religious sites. Mot. at 13-14 (citing *Quechan Tribe of Fort Yuma Indian Reservation v. U.S. Dept. of Interior*, 755 F.Supp.2d 1104, 1120 (S.D. Cal. 2010) and *CRIT*, 605 F.Supp. at 1440). But in *CRIT*, the permit at issue would have led directly to construction of "approximately 447 lots for single-family homes, mobile homes, and commercial facilities" that irreparably destroyed resources. 605 F. Supp at 1428. And *Quechan* concerned the construction of a "large solar energy project" that included "support buildings, roads, a pipeline, and a power line." 755 F. Supp. 2d at 1107. "[T]he massive size of the project and the large number [hundreds] of historic properties and incomplete state of the evaluation virtually ensured some loss or damage." *Id.* at 1120. In contrast, the undertaking here is mineral exploration that will temporarily impact a small amount of land near a single cultural property without disturbing the ground of that cultural property. And tribal monitors may observe ground disturbing activities to provide assurance that ground disturbances will avoid cultural resources. EA 7.[9] The likelihood of destruction that was present in *CRIT* and *Quechan* is simply absent here.

Nor does Hualapai establish that the planned drilling will likely harm Ha'Kamwe', the surrounding area, or Hualapai's lifeways. The first two phases of exploratory drilling were closer to the hot spring than the exploration that is currently being challenged. EA App. C, Fig. 2A. Tellingly, Haulapai does not provide any evidence that the prior drilling "destroyed" Ha'Kamwe' or the surrounding landscape. *Cf.* Mot. at 1. Indeed, none of Hualapai's seven declarants even mention the 2019 exploration, much less identify

[9] Hualapai, Chemehuevi, and Hopi, have sent monitors. Ex. 17, Aug. 5, 2024 Email.

negative effects associated with it. *See* ECF No. 11-2–11-7. While the present phase involves drilling 100 boreholes in the part of the Project area near Ha'Kamwe' rather than the 42 holes drilled previously, EA App. C, Fig. 2A, it is otherwise comparable to the prior phases of exploration. EA 1-2. If that drilling disrupted activities at the springs in the way Hualapai fears, the motion provides no evidence of it.

And while Hualapai's declarants fear potential threats posed by noise, vibrations, vehicle traffic, and effects on plants and wildlife, they provide little evidence to substantiate these concerns. Mot. 14. Indeed, Hualapai falls far short of meeting its burden of proving that they will be harmed by noise from a "180-horsepower or less" engine operating farther away from Ha'Kamwe' than previous exploratory drilling.[10] Hualapai does not establish how the noise from a 180-horsepower drill will carry to Ha'Kamwe', much less how the minimal additional noise from such a drill will impair cultural uses. Nor does Hualapai offer any explanation as to how much vibration would lead to irreparable harm.

To the contrary, the EA indicates that vibrations and noise will be minimal. BLM responded to Hualapai's comments by relocating and consolidating the staging areas away from Ha'Kamwe'. EA at 3. BLM further required that staging and water storage be located "to reduce overall project traffic" and maintained to reduce "noise and visual impacts." *Id.* at 8-9. And BLM required that workers travel at "reduced speeds" of less than 25 miles per hour. EA 8.

Hualapai's allegations regarding purported harm to "traditional and cultural uses" are even more speculative. Mot. at 14. Hualapai does not identify any cultural observance planned during the drilling period that will be interrupted, and the facts indicate that Hualapai's speculative fears have little foundation. First, BLM required that Hualapai be allowed to monitor ground disturbing activities, in part, to avoid the possibility of cultural

[10] The average car has more horsepower. https://www.jdpower.com/cars/shopping-guides/what-is-the-average-horsepower-of-a-car.

disruption. EA 15. Second, NTEC is managing Phase III exploration. Ex. 18, July 5, 2024, Ltr 1. NTEC "is a tribally owned entity of the Navajo Nation" with a stated goal of "responsible project development that demonstrated environmental sustainability, safety, responsible mining, . . . robust and well-planned reclamation[, . . . and] transparent dialogue with Native American communities." *Id*. NTEC stated its commitment to implementing the EA's coordination provisions to avoid disruption to traditional cultural practices. *Id*. at 3.[11] Hualapai does not suggest that it has attempted to coordinate any cultural practices to avoid disruption, much less that NTEC has ignored any such request.

To the extent Hualapai's declarants express concern about plants and animals, *see, e.g.*, Craynon Dec. ¶ 11, they are speculative and disconnected from the Project's design. The EA provides for "noxious weed controls, . . . certified weed-free . . . reseeding" and monitoring of reclaimed areas. EA 7. BLM also requires that "surface disturbances will be limited as much as possible" and that plants, including cacti, will be transplanted. *Id.* BLM likewise required robust protection for wildlife, including birds and tortoises. EA 8. And Hualapai's speculation that drilling will create dust that will harm plants, Mot. 14, is similarly contradicted by BLM's requirement that Arizona Lithium transport water to the project area "for as-needed dust suppression." EA 5, 21-22.

Indeed, Hualapai's allegations regarding injury from exploratory drilling are undercut by Hualapai's openness to using the Cholla Canyon Ranch that surrounds Ha'kamwe' for "developing a water source" and "agri-business such as hemp farming" on those lands. Ex. 19, Draft Hualapai Master Plan §§ 1.5.10 & 2.5.10 (Apr. 30, 2024). In other words, Hualapai is open to using water that might otherwise recharge Ha'Kamwe' and adding agri-business related traffic. This belies Hualapai's argument that it will be irreparably injured by limited exploratory drilling and noise.

Hualapai's draft master plan instead strongly suggests that Hualapai views

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[11] NTEC is also committed to "responsible development of US-based lithium resources" as a "crucial component of the United States energy transition." *Id.*

mining—rather than exploration—as the threat to Ha'kamwe'. Id. at 2.5.10 ("The tribe's current use of the ranch and any plans for greater usage, are under threat by a potential lithium mine located on adjoining public lands, for which exploratory drilling is underway by a third-party developer to prove the richness of the lithium ore."). But no such harm is imminent, as a mining plan would require additional NEPA and NHPA review. June 17, 2021, Ltr. Hualapai does not meet its burden of establishing a likelihood that phase III of exploration will imminently, irreparably injure it.

III. The Balance of Equities and Public Interest Favor Federal Defendants.

To the extent the Project poses any risk to Hualapai, any speculative harm is outweighed by the negative impacts of enjoining the Project. When the government is a party, the analyses of the public interest and balance of equities "merge." *Drakes Bay Oyster Co. v. Jewell*, 747 F.3d 1073, 1092 (9th Cir. 2014). Courts thus must weigh the public's interest in allowing the government action to proceed against the plaintiff's alleged harm. *McNair*, 537 F.3d at 1005.

The Project at issue here is one part of the United States' larger effort to transition to renewable sources of energy. As the website for Earthjustice, Hualapai's attorneys, explains, a "clean energy transition" to electric vehicles ("EVs") would be beneficial because "EVs are much better for the climate than gas-powered cars" and "require fewer natural resources."[12] But the batteries for electric vehicles require lithium.[13] Here, Hualapai seeks to delay exploration needed to determine whether the lithium deposit in the Project area can and should be mined. Such delays are not in the public interest.

This is especially so in light of the United States' limited domestic lithium supply. As one recent article explained, demand for lithium is "expected to explode in the coming decades," but, "[d]espite having some of the world's biggest lithium deposits, the United

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[12] Are Electric Vehicles Really Better for the Environment? Yes. Available at: https://perma.cc/8WHP-CNBF.

[13] Electric vehicles are not just the wave of the future, they are saving lives today. Available at: https://earthjustice.org/feature/electric-vehicles-explainer.

States is home to just one operational lithium mine."[14] Given the speculative nature of Hualapai's alleged harm and the benefits of better defining the lithium deposits in this area, the equities favor denying the motion.

CONCLUSION

Because Hualapai have not shown a temporary restraining order or preliminary injunction is warranted, the Court should deny its motion.

Respectfully submitted this 19th day of August, 2024.

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[14] Christina Lu, *Washington Wants a White Gold Rush*, FOREIGN POLICY (Jun. 26, 2024), https://foreignpolicy.com/2024/06/26/us-lithium-mining-energy-security-china/.

Exhibit 16

Hualapai Tribe of Indians of the Hualapai Indian Reservation v. Haaland

Case No. 3:24-cv-8154-DJH (D. Ariz.)

REPORT

WATER RESOURCES OF THE SOUTHERN PORTION OF THE BIG SANDY VALLEY, WIKIEUP, MOHAVE COUNTY, ARIZONA

Submitted by:

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October 2000

REGISTERED GEOLOGIST
CERTIFICATE NO.
4788
PAUL A.
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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Figures

Tables

Appendices

EXECUTIVE SUMMARY

A water resources investigation was conducted in the southern portion of the Big Sandy Valley, south of Wikieup, to determine if adequate water resources exist for the development of the proposed Big Sandy Energy Project, a gas fired power plant. The investigation consisted of the testing of the alluvial aquifers in the valley, an exploration drilling program that culminated in the defining of three separate aquifers in the southern end of the basin, an Upper Aquifer consisting of the Upper Basin fill and Recent Stream and Flood Plain deposits, a Middle Aquifer consisting of the Lower Basin fill and the discovery of a confined basaltic aquifer, apparently limited to the southern end of the basin.

One production well was completed in the Lower (confined) Aquifer and seven observation wells were completed in the Upper, Middle and Lower Aquifers to allow monitoring of the effects of withdrawal from the Lower Aquifer.

The results of investigation indicates that a minimum volume of 1,420,281 million acre feet of water is stored in the Lower Aquifer. Nine and three-quarters percent of the volume of water in storage in the confined basaltic aquifer will provide water for the life of the Big Sandy Energy Project. This determination was made based upon geologic research to determine the aquifer areal extent and the results of an aquifer pumping test. These results were obtained through a water balance calculation.

The results of the investigation indicates that withdrawal from the confined basaltic aquifer would not impact other aquifers in the area. Drawdown was not apparent in any of the wells in either the overlying Middle Aquifer or the Upper Alluvial aquifer. The Upper Alluvial aquifer is utilized for almost all the water supplies in the valley.

The only impact that was determined from the results of the investigation is the probability that water flow will be reduced or cease from the Cofer Hot Spring over a period of time as a result of the withdrawal from the confined aquifer. This impact appears likely since the spring emanates from the same volcanic formation that is proposed for development.

A monitoring program is proposed to be established in which six of the existing observation wells would be equipped with pressure transducers and dataloggers. The dataloggers would collect one water level point per day per well. The data would be downloaded and reviewed on a quarterly basis and a report of this data and analysis would be issued annually.

The conclusions reached on the basis of this investigation are:

- the Lower (confined) Basaltic Aquifer is a heretofore undocumented aquifer which has not been utilized by any wells or withdrawal;

- the Lower (confined) Basaltic Aquifer and its recharge area has a minimum areal extent of approximately 57 square mile of which 31 square miles is within the Big Sandy Basin and the remaining 26 square miles, forming the recharge area, consists of the Volcanic Rocks of Sycamore Creek to the east of the basin;

- the minimum volume of water in storage in the Lower (confined) Basaltic Aquifer is 1.4 million acre feet;

- the maximum demand of the power plant over the 40 year period of the proposed project is 193,561 acre feet;

- recharge to the Lower (confined) Basaltic Aquifer will replace 55,854 acre feet in the 40 year life of the project;

- during the life of the project, the project will withdraw 9.75 percent of the volume of water in storage;

- withdrawal from the Lower (confined) Basaltic Aquifer does not effect the water levels in the Middle or Upper Aquifers, therefore, the withdrawal to satisfy the demand of the project will not impact the existing wells which penetrate only the Upper Aquifer or the Recent Stream and Flood Plain alluvial fill;

- there is sufficient water available in the Lower (confined) Basaltic Aquifer to satisfy the demands of the project for 40 years without depleting the aquifer and without impacting the existing wells.

INTRODUCTION

Caithness Big Sandy, L.L.C. purchased the Banegas Ranch located in the southern end of the Big Sandy River Valley near Wikieup in southeastern Mohave County, Arizona with the intention of developing a gas fired power plant in Section 5, T. 15 N., R. 12 W. Gila and Salt River Base and Meridian.

The Ranch property consists of portions of Sections 5 and 7, T. 15 N., R. 12 W., Sections12 and 13, T. 15 N., R. 13 W. and Section 36, T. 16 N., R. 13 W.

This report is the result of the exploration program to determine the potential of developing a sufficient quantity of water to supply the project for a forty year time period within the property boundaries. The location of the project is depicted on **Figure 1.**

R. 13 W.

LEGEND

- Well
- Highway
- Secondary Road
- River/Stream

Transverse Mercator Projection
1927 North American Datum
Zone 12

N

SCALE 1 : 100,000

BIG SANDY ENERGY PROJECT

FIGURE 1
PROJECT LOCATION

LITHOLOGIC UNITS

The descriptions of the lithologic units in that portion of the Big Sandy Basin extending from Deluge and Tule Wash (T. 16 ½ N) south to the Big Sandy River outlet through Signal Gorge were obtained from earlier studies (Davidson, 1973, Sheppard and Gude, 1972 and Moyer, 1982) with modifications based on field observation and description length (refer to Davidson and or Sheppard and Gude for complete descriptions of the rock units). The lithologic units from the oldest to the youngest are:

Granitic Gneiss

The granitic gneiss forms the core of both the Aquarius Mountains on the east and the Hualapai Mountains forming the western boundary of the Big Sandy basin. The granitic gneiss appears to underlie the sedimentary and volcanic rocks filling the basin. The granitic gneiss is considered to be Pre-cambrian in age (Wilson and Moore, 1959) with dikes and small intrusive bodies of granitic composition of younger age.

The gneiss of the Aquarius Mountains is a banded and foliated light-yellow to yellowish-white granodiorite. The main dark mineral is chloritized biotite mica. The granodiorite generally is medium grained and uniform in texture, although it contains a few segregations of very coarse granodiorite and bands of pegmatite. The gneiss that forms the Hualapai Mountains consists of banded and foliated, fine to medium grained light yellow granodiorite, coarse to pegmatic pink granite to granodiorite, banded quartzite and schistose rocks that contain more dark minerals than most of the gneiss outcrops.

Arkosic Gravel

The arkosic gravel is exposed in a few scattered outcrops in the southeastern part of the area. The most extensive exposures are near the confluence of Cane Springs Wash and the Big Sandy River and along Bitter Creek. The arkosic gravel underlies dated volcanic rocks and probably is Oligocene and Miocene in age.

The arkosic gravel in most of the area is reddish-brown, planar to lenticular bedded, semiconsolidated, and composed entirely of fragments of graodiorite and granodiorite gneiss. No volcanic rock fragments were noted in the unit except in the upper few inches, where the unit is directly overlain by an andesite flow.

Volcanic Rocks of the Sycamore Creek

The centers of volcanic activity extruding the volcanic rocks of Sycamore Creek appear to have been faults and vents in the Aquarius Mountains. The volcanic rocks crop out extensively along Sycamore Creek and eastward into the Aquarius Mountains. The aggregate thickness of the volcanic rocks exceeds 1,000 feet in the Aquarius Mountains and in other places east of the Big Sandy River. The age of the volcanic rocks of Sycamore Creek are placed at Oligocene and Miocene based on lithologic similarities to volcanic rocks in the Paulden and Milk Creek areas to the east of the study area.

The volcanic rocks consist mainly of andesitic flow, flow breccia, tuff and agglomerate. Rhyolitic flows, welded tuff and volcanic conglomerate are present but significantly less common than the andesitic rocks. The flows and flow breccia are generally dark greenish gray. The tuff and agglomerate are white to light grey.

The volcanic rocks encountered in the drill cuttings in Sections 5 and 7, T. 15 N., R. 12 W. appear to be cinders or scoriaceous flows. These materials have been exposed to extended saturation and flow of ground water as illustrated by the presence of water deposited copper minerals observed in the drill cuttings.

Volcanic Rocks of the Kaiser Spring Area

The volcanic rocks of the Kaiser Spring area rest directly on the Precambrian gneiss and granodiorite forming the crystalline basement. Small areas of arkose and laucustrine deposits are present directly on the basement complex which are covered by the volcanics.

The volcanic rocks are predominantly thick tuff units with interbedded ash flows and basalt flows. The tuff units have been subdivided by Moyer (1982), based on lithic types, into the basement lithic tuff, the basement and basalt lithic tuff and the lava lithic tuff. Basaltic eruptions filled the Burro Creek channel and spilled over the tuff platform forming a thick sequence of basalt layers on top of the tuff units.

Lower Basin Fill

The lower basin fill, composed of sedimentary rocks, crops out extensively along dissected ridges east of the Hualapai Mountains and is exposed in canyons and low ridges in most of the area east of the Big Sandy River. As much as 3.000 feet of the unit is exposed, but the total thickness is unknown.

The lower basin fill includes the flat lying Big Sandy formation member of Sheppard and Gude (1972) and a more extensive moderately tilted and faulted sedimentary deposit. The Big Sandy formation member crops out in the southern and central parts of the valley of the Big Sandy River and the moderately tilted and faulted sedimentary deposit is the main unit of outcrop in the Big

Sandy area. Sheppard and Gude (1972, p. 5)describe the Big Sandy formation as follows "The Big Sandy formation consists chiefly of green and brown laucustrine mudstone or a calcareous silty or sandy variant. These rocks grade laterally into coarser clastic rocks, including conglomerate." The more extensive sedimentary deposit ranges from a sandy gravel to silt and marl. Sheppard and Gude (1972) believe that the Big Sandy formation unconformably overlies the more steeply dipping surrounding sediment, mainly because the Big Sandy formation is flat lying and the surrounding sedimentary deposit generally is more tilted and faulted, however, no exposed contact between these two units has been observed in the field.

The lower basin fill is Pliocene in age based on vertebrate fossils (Lance, 1960, p. 156) found in the Big Sandy formation. Sheppard and Gude (1972) stated that the Big Sandy formation is definitely Pliocene and probably late Pliocene in age.

That lower basin fill encountered by the drill in Section 7, T. 15 N., R. 12 W. consisted of the Big Sandy formation overlying layers of granitic sand and gravel alternating with layers of volcanic sands and gravel. The granitic sand and gravel are usually reddish in color while the volcanic rocks are predominantly light to dark grey.

In Section 5, T. 15 N., R. 12 W., the Big Sandy formation rests directly on the volcanic rocks of Sycamore Creek.

Upper Basin Fill

The upper basin fill is present mainly along the central axis of the basin. The thickness of the upper basin fill is about 300 feet thick at Wikieup and extends downstream in the Big Sandy River bed to the Signal Gorge. The upper basin fill presumably is Pleistocene in age.

The upper basin fill is a silty gravel to a sandy silt that is loosely consolidated. The upper basin fill overlies the lower basin fill in an erosional unconformity and is itself eroded and overlain by the alluvium of the present day stream system. During deposition of the upper basin fill, the streamflow direction was toward the present course of the Big Sandy River and then southward toward the present outlet. The drainage system was through going, as is the present system, but the streams were aggradational and sediment was deposited in a broad trough carved into the faulted lower basin fill.

Stream and Flood-Plain Alluvium

The stream and flood-plain alluvium is an unconsolidated deposit of Holcene gravel and sand that underlies the streams and their flood-plain. The alluvium commonly is bounded by steep stream-cut banks as much as 15 feet high. The alluvium ranges from 30 feet to 50 feet thick.

The alluvium consists of lenses of sandy gravel, sand and silt. The unit is pale brown and contains well rounded to subrounded grains of quartz and feldspar and eroded detritus from all the older formations in the area.

Regional Geology

The Big Sandy River basin is one of the typical northwest - southeast trending valleys in the Sonoran Desert Section of the Basin and Range Province of Fenneman (1931 p. 328). Lease (1981) describes the regional geology of the area in the following manner.

> "The geology of the province is very complex. In the Sonoran Desert section of the province, block faulting began as early as the Oligocene and continued into late Cenozoic time. It was during this time that the many basins were formed between the block faulted mountain ranges and were filled with fluvial and lacustrine sediments and volcanics of various types and compositions. Each of the basins records a complex geologic history since it was formed by Basin and Range faulting and even though the overall geologic history of the basins is similar, each basin appears to be a distinctly separate geologic feature.
>
> In the Arizona portion of the Basin and Range Province, east of the Colorado river, the late Pre-cambrian and Paleozoic sedimentary rocks are thin, consequently, the exposed cores of the mountain ranges are predominantly Pre-cambrian to Mesozoic intrusive and metamorphic rock types.
>
> The area of study has undergone multiple tectonic events. Only the latter two events have affected Tertiary basin fill sediments, first, early Tertiary (Laramide) uplift created high relief, then erosion stripped vast amounts of detritus from the uplands, dissecting and exposing Mesozoic, Paleozoic and later Pre-cambrian rocks throughout the area. The detrital materials were transported by streams and deposited in intermontane basins and vallleys. This was accompanied and followed by high-angle, normal faulting, which is present everywhere in the desert and mountain regions of Arizona. Most of these faults are middle and late Tertiary age, although some predate the Laramide orogeny and others are as young as Pleistocene. The early Tertiary basin deposits were tilted by the later faulting and covered by later Tertiary deposits. In some basins these fluvial and lacustrine sediments, accumulated to thicknesses of thousands of feet. Sedimentation during Tertiary time was accompanied by volcanic activity, and locally, volcanic flows are present in the sedimentary column. The effects of basement topography, discontinuous faulting, and volcanic activity were intermittently dammed streams, which created lakes, playas and swamps. These effects and/or climatic changes resulted in the sporadic intercalation of lacustrine/paludal limestone, siltstone, clay and mudstone beds within the predominantly fluvial sequence.
>
> The second tectonic event reactivated Basin and Range type faulting and continued intermittently throughout the Quaternary. Both uplift and erosion were renewed. The resulting abundant detritus deeply buried the earlier Cenozoic basin fill sequence under younger, predominantly fluvial and minor lacustrine deposits.
>
> The stratigraphic relationships of the valley fill sediments are complex. Depositional facies change over short distances and local unconformities are common. These factors make surface and subsurface correlations difificult."

Geology of the Southern Portion of the Big Sandy Basin

The Big Sandy Valley is a graben extending from approximately ten miles south of Wikieup northward to Interstate 40. The basin in this area is roughly five miles wide at the southern end and widens to ten miles north of Wikieup. The graben extends both south and north beyond these limits, however, the graben becomes shallower and less pronounced to the south and the Basin narrows to the north as it passes into the Hualapai basin.

During the Laramide tectonic disturbance, the graben was formed by the uplifting and tilting of the Pre-cambrian rocks to form the Hualapai Mountains on the western boundary and the Aquarius Mountains on the eastern boundary with the central block of Pre-cambrian rock downthrown in relation to the two mountain ranges. Normal faulting occurs on both sides of the graben. The bounding fault on the west side of the Aquarius Mountains may be a southerly extension of the Grand Wash fault system (Young, 1979).

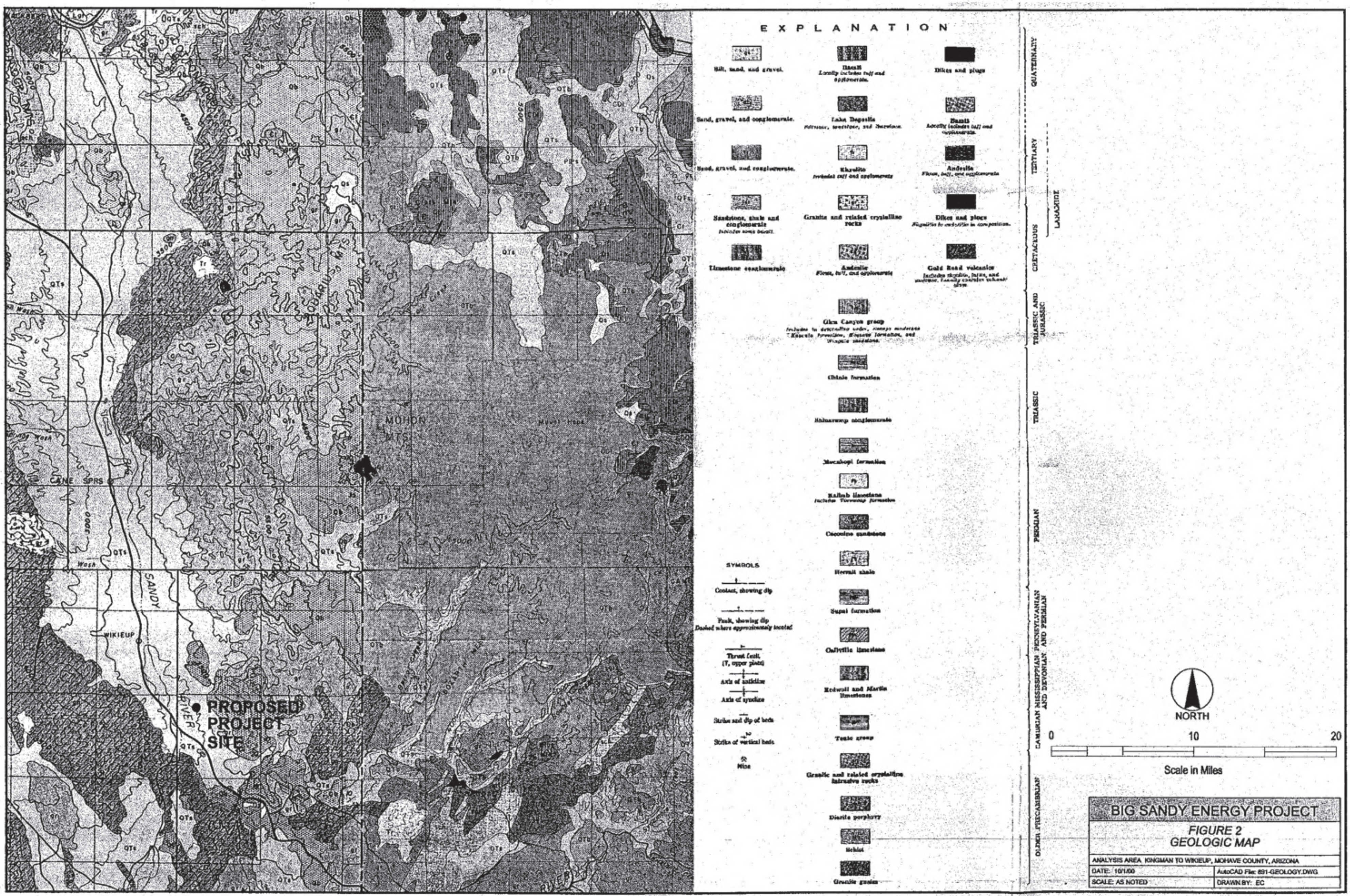
The southern portion of the Big Sandy basin, that portion of the basin south of Deluge and Tule Washes, differs from the northern portion of the basin, in that various forms of extruded volcanic rocks intermingle with the alluvial sequence. In general, there were two areas of volcanic activity, the Volcanic Rocks of Sycamore Creek in the study area and the Volcanics of the Kaiser Spring area (Moyer, 1982) to the south.

Moyer (1982) states:

> *"That this region (the Kaiser Spring area) was a crystalline highland is evident in the paucity of fluvial or alluvial arkosic sediments. A thin, local, high-alumina basalt was deposited unconformably on the on the basement rocks probably during middle Tertiary time, although no age date has been obtained for this unit (p. 24)."*

thus indicating that the alluvial materials are absent at the southern end of the Big Sandy basin and that the Kaiser Springs volcanics effectively dams the southern end of the basin. **Figure 2** is a geological map of the area of study.

During the period, June through October, 1979, the Department of Energy (DOE) drilled 18 test holes in northwestern Arizona to determine the lateral extent of uranium-bearing, paludal/ lacustrine deposits. Six of these test holes were located in the Big Sandy Valley. Based on the drill hole cutting log data (Lease, 1981), the thickness of the alluvial fill in the basin exceeds 5,008 feet in


PROPOSED PROJECT SITE
SANDY
WIKIEUP
CANE SPRS
MOHON MTS
EXPLANATION
Silt, sand, and gravel.
Sand, gravel, and conglomerate.
Sand, gravel, and conglomerate.
Sandstone, shale and conglomerate
Limestone conglomerate
Basalt
Lake Deposits
Rhyolite
Granite and related crystalline rocks
Andesite
Dikes and plugs
Basalt
Andesite
Dikes and plugs
Gold Road volcanics
Glen Canyon group
Chinle formation
Shinarump conglomerate
Moenkopi formation
Kaibab limestone
Coconino sandstone
Hermit shale
Supai formation
Callville limestone
Redwall and Martin limestones
Tonto group
Granitic and related crystalline intrusive rocks
Diorite porphyry
Schist
Granite gneiss
SYMBOLS
Contact, showing dip
Fault, showing dip
Dashed where approximately located
Thrust fault (T, upper plate)
Axis of anticline
Axis of syncline
Strike and dip of beds
Strike of vertical beds
Mine
QUATERNARY
TERTIARY
LARAMIDE
CRETACEOUS
TRIASSIC AND JURASSIC
TRIASSIC
PERMIAN
CAMBRIAN MISSISSIPPIAN PENNSYLVANIAN AND DEVONIAN AND PERMIAN
OLDER PRECAMBRIAN
NORTH
0
10
20
Scale in Miles
BIG SANDY ENERGY PROJECT
FIGURE 2
GEOLOGIC MAP
ANALYSIS AREA KINGMAN TO WIKIEUP, MOHAVE COUNTY, ARIZONA
DATE: 10/1/00
AutoCAD File: 891-GEOLOGY.DWG
SCALE: AS NOTED
DRAWN BY: EC

Section 8 T. 16 N., R. 13 W. and Section 12, T. 16 N., R.14 W. (PQ-25 and PQ-10), north of Wikieup. The depth to the top of the basement complex and, consequently, the thickness of the alluvial fill in the area south of Wikieup, in the study area, is approximately 3,500 feet in Sections 12 (PQ-26) and 28 (PQ-29) T. 15 N., R. 12 W. The locations of six test holes PQ-10 and PQ-25-29 are shown on (**Figure 3**) and the lithologic logs for PQ-25, PQ-26, and PQ-29 are included in **Appendix A.**

The lithologic log of PQ 26, located in Section 12, T. 15 N., R. 13 W., within one mile of Test Site 2 (northwest corner of Section 12, T. 15 N., R. 12W) does not appear to encounter either the Wikieup formation or the volcanic aquifer.

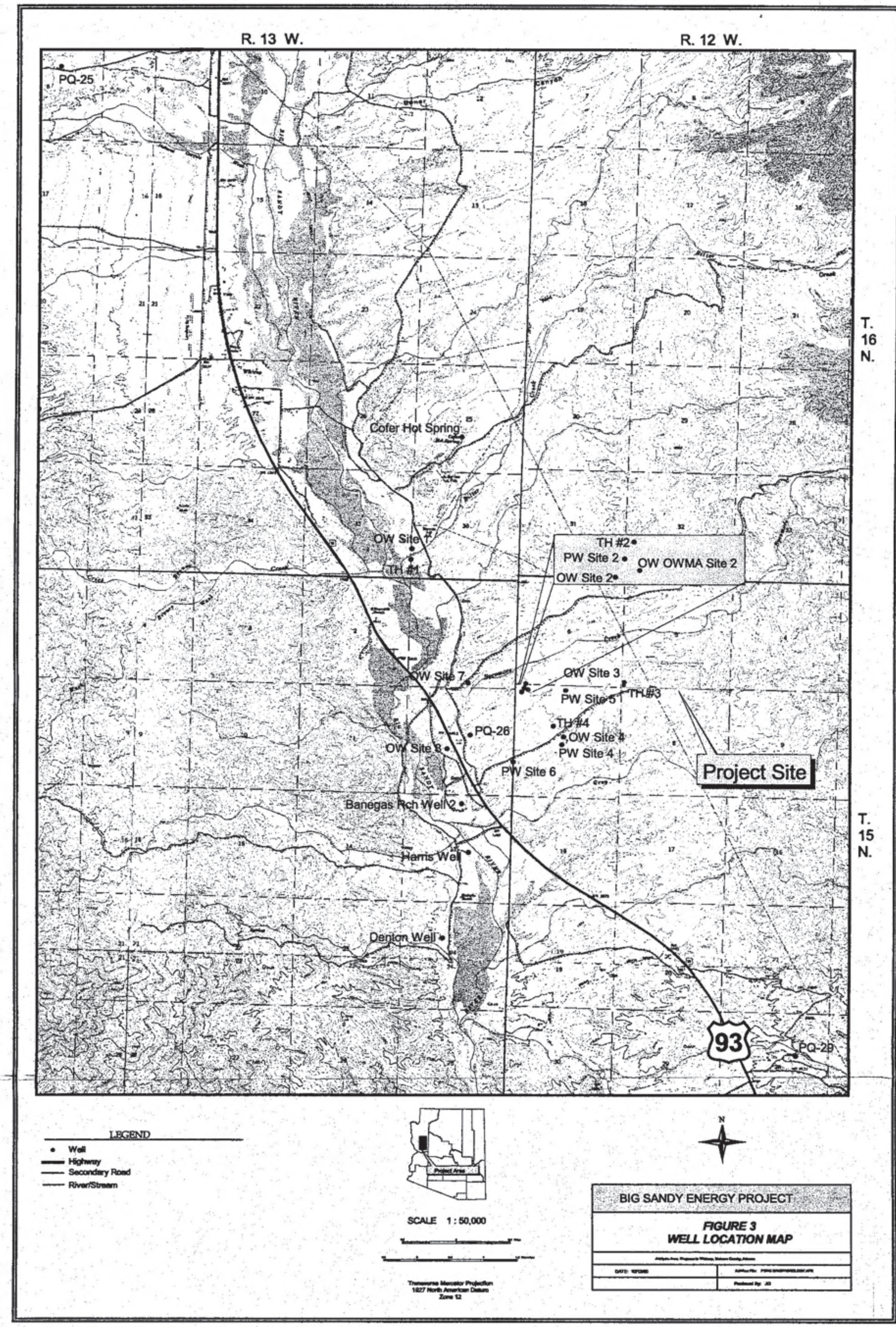
Results of the Exploration Drilling Program

The exploration drilling program was established to determine the presence of a sufficient volume of ground water to satisfy the demand of the proposed electrical power generating plant.

Initially, four test holes were drilled, logged, geophysically logged when possible and abandoned. Test Hole 1 was drilled in the Big Sandy flood plain in Section 36, T. 16 N., R. 13 W. The drill encountered only the Upper Basin fill with possibly some Recent stream deposits on the top. Test Holes 2 and 4 were drilled in the northwest quarter of Section 7, T. 15 N., R. 12 W. Both wells penetrated or encountered the Wikieup formation, the Lower Basin fill and a confined aquifer in the Volcanic Rocks of Sycamore Creek. The confined aquifer was encountered at a depth of 1,135 feet in both holes. Test Hole 3 penetrated 600 feet of the Wikieup formation and 600 feet of the Volcanics Rocks of Sycamore Creek. It is believed that the volcanics penetrated in Test Hole 3 are in the confined aquifer, however, the collar elevation is higher than the piezometric surface elevation; therefore, the well does not flow under artesian pressure.

Based on this information, additional drilling, including one production well, additional piezometric wells in the confined aquifer, observation wells in the Lower Basin fill, Upper Basin fill and Recent Stream and Flood-Plain Alluvium, was instituted.

The Tertiary basin fill sequence in the southern portion of the Big Sandy basin, based on four test holes, a production well and seven piezometric wells, from bottom to top are: volcanic rocks of Sycamore Creek, Lower Basin fill (sand and gravel facies), Lower Basin fill (Wikieup formation facies), Upper Basin fill and Recent Stream Bed and Flood Plain alluvium.


R. 13 W.
R. 12 W.
T. 16 N.
T. 15 N.
PQ-25
Cofer Hot Spring
OW Site
TH #1
TH #2
PW Site 2
OW OWMA Site 2
OW Site 2
OW Site 7
OW Site 3
PW Site 5
TH #3
TH #4
OW Site 4
PW Site 4
PQ-26
OW Site 8
PW Site 6
Project Site
Banegas Rch Well 2
Harris Well
Denton Well
93
PQ-29
LEGEND
Well
Highway
Secondary Road
River/Stream
SCALE 1 : 50,000
N
BIG SANDY ENERGY PROJECT
FIGURE 3
WELL LOCATION MAP

AQUIFERS

There are at least three separate aquifers in the Big Sandy Basin south of Wikieup. These, from upper to lower, are:

The Upper Aquifer composed of the Recent Stream and Flood-Plain Alluvium and the underlying Upper Basin fill. In the southern portion of the basin, this aquifer is partially saturated in the entrenched riverbed and flood plain of the Big Sandy River.

The Middle Aquifer composed of the Older Basin fill. The Middle Aquifer is saturated in most of the southern portion of the Big Sandy basin.

The Lower Aquifer composed of the Volcanic Rocks of Sycamore Creek. Four hundred and fifty (450) feet of these volcanics were penetrated by the drill. However, only 300 feet or 66 percent of the volcanic penetrated was considered aquifer as a conservative consideration The confined aquifer is fully saturated with a piezometric surface elevation of 2,079 feet.

Prior drilling by the Department of Energy (Lease, 1981) penetrated 3,500 feet of alluvial fill or volcanic materials in the area south of Wikieup. As this work was completed to determine the presence of uranium, the water producing potential of the material was not documented. Drilling completed as part of the exploration program for the present project (Caithness Big Sandy Energy Project) only tested the formations to a depth of 1,600 feet. The volcanics or alluvial fill below 1,600 have not been penetrated by drilling during the exploration program in the area of study. Therefore, the presence and productivity of those potential aquifers is not documented at this time.

Aquicludes

Two known aquicludes, which separate the three known aquifers, are present in the study area. These are the:

Wikieup formation

The Wikieup formation (Sheppard and Gude, 1982), a lacustrine clay, varying in thickness from 200 feet to more than 600 feet, is the upper member of the Lower Basin fill. Observation Well 8 (OW8) was drilled and perforated entirely in the clay. The clay appears dry, although it did yield water after 24 hours indicating low permeability, and consequently, an aquiclude.

Top of the Volcanic Rocks of Sycamore Creek

The aquiclude, forming the top of the confined aquifer, is only indirectly known. The drill slows only slightly when it encounters the top of the confined layer and the cuttings are extremely fine. The aquiclude appears to be about ten feet thick and volcanic in nature. The fact that the artesian flow starts as soon as the layer is penetrated, signifies the presence of the aquiclude. **Figure 4** depicts an idealized stratigraphic column.

Extent of the Confined Aquifer

The probable limits of the confined aquifer, based on the geological information available, are:

- The western boundary is approximately one half mile west of Site 2, i.e. one half the distance between Site 2 and PQ-26 (PQ-26 does not appear to have encountered the confined aquifer or the Volcanic Rocks of Sycamore Creek)

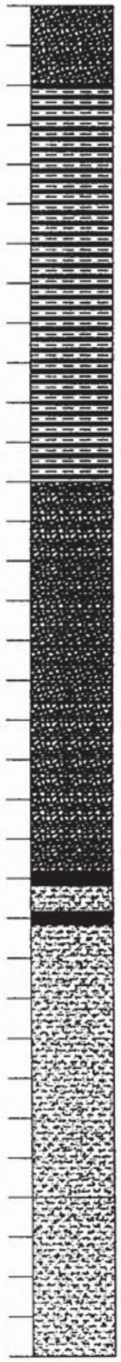
- The northern boundary trends across the basin near Wikieup (Section15, T. 16 N., R. 13 W). The rationale for this is that waters issued from Cofer Hot Spring (Section 25, T. 16 N., R.13 W.) are similar in chemical composition to waters collected from Test Site 2, therefore the confine aquifer extends north of Cofer Hot Spring but not as far north as PQ-25 (Section 8, T. 16 N., R. 13 W.) which penetrates primarily the Wikieup formation and does not encounter volcanic rocks or confined water.

- The southern boundary is located near the end of the Big Sandy Basin formed by the Volcanic Rocks of Kaiser Spring. The volcanic rocks are present in PQ-29 indicating that the southern boundary is south of PQ-29. The collar elevation is above the piezometric surface, therefore, there is no record of artesian flow.

- Eastward, the Volcanic Rocks of Sycamore Creek rise to the surface, evidenced in Test Hole 3, where they were encountered at 600 feet and become exposed one mile east of Test Hole 3, extending eastward for an additional six miles.

These relationships are depicted on **Figure 5**.

The exposed Volcanic Rocks of Sycamore Creek appear to be the recharge area for the confined aquifer present under Sections 5 and 7, T. 15 N., R. 12 W. The calculated area of the confined aquifer without the recharge area is 30.85 square miles and the recharge area is 26.19 square miles. The areal extent is depicted on **Figure 6.**



Aquifer	Lithology	Thickness	Formation	Aquifer/Aquiclude
Upper Aquifer	Sand/ Gravel	40 Ft.	Alluvium	(Upper Aquifer)
	Clay	200-600 Ft.	Wikieup Formation	(Aquiclude)
Middle Aquifer	Sand/ Gravel, some clay	735 Ft.	Intrusive and extrusive sand and granite with some clay layers	(Aquifer)
	Basalt	10-15 Ft.	Basaltic Aquiclude	(Aquiclude)
Confined (Lower) Aquifer	Basalt	450+ Ft.	Basalt aquifer	(Aquifer)

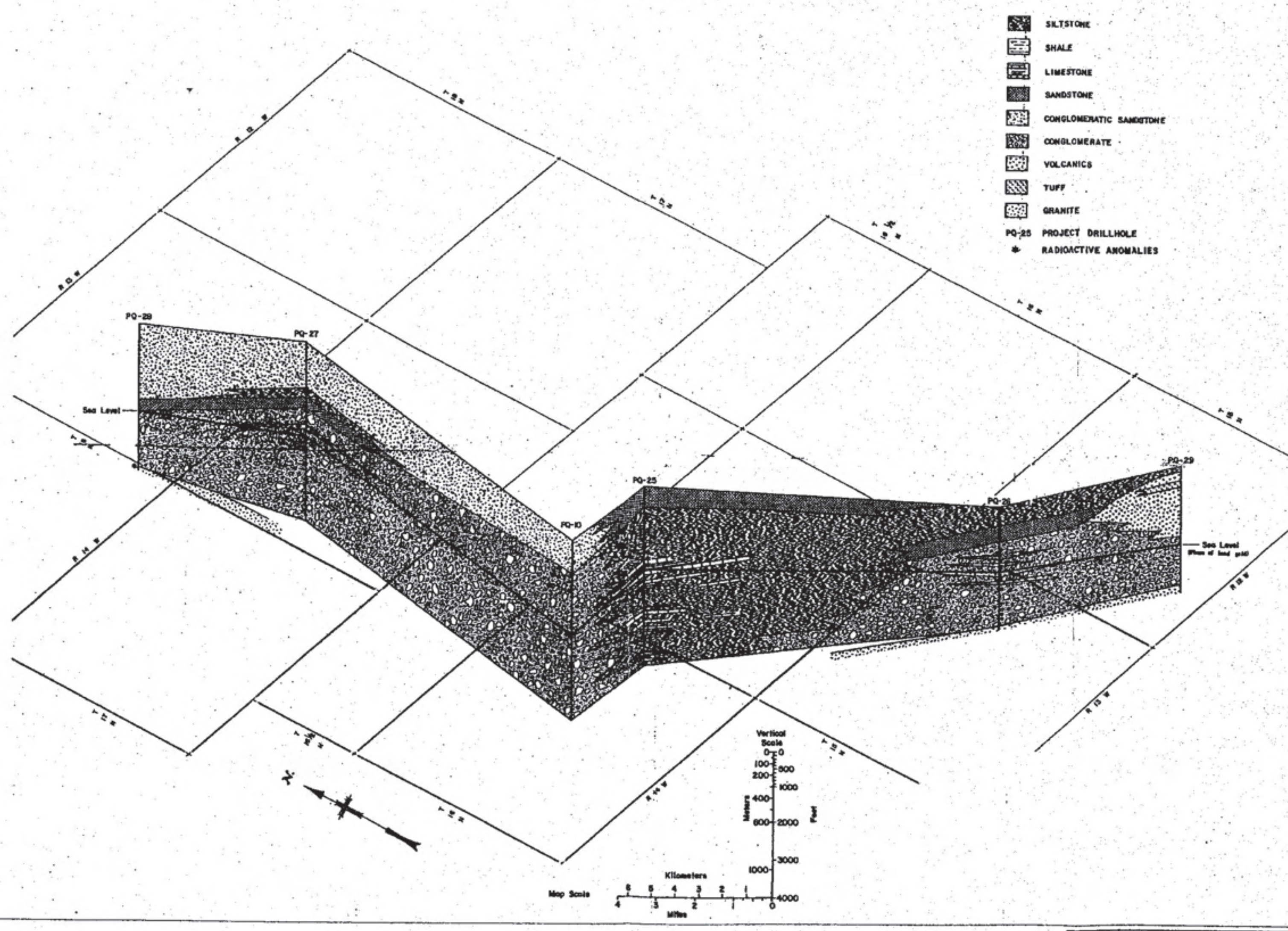
MANERA INC.

BIG SANDY ENERGY PROJECT

FIGURE 4
IDEALIZED STRATIGRAPHIC COLUMN

DATE: 10/16/00	AutoCAD File: Figure 4.dwg
SCALE: AS NOTED	DRAWN BY: MM

Figure 4.dwg
10/16/00

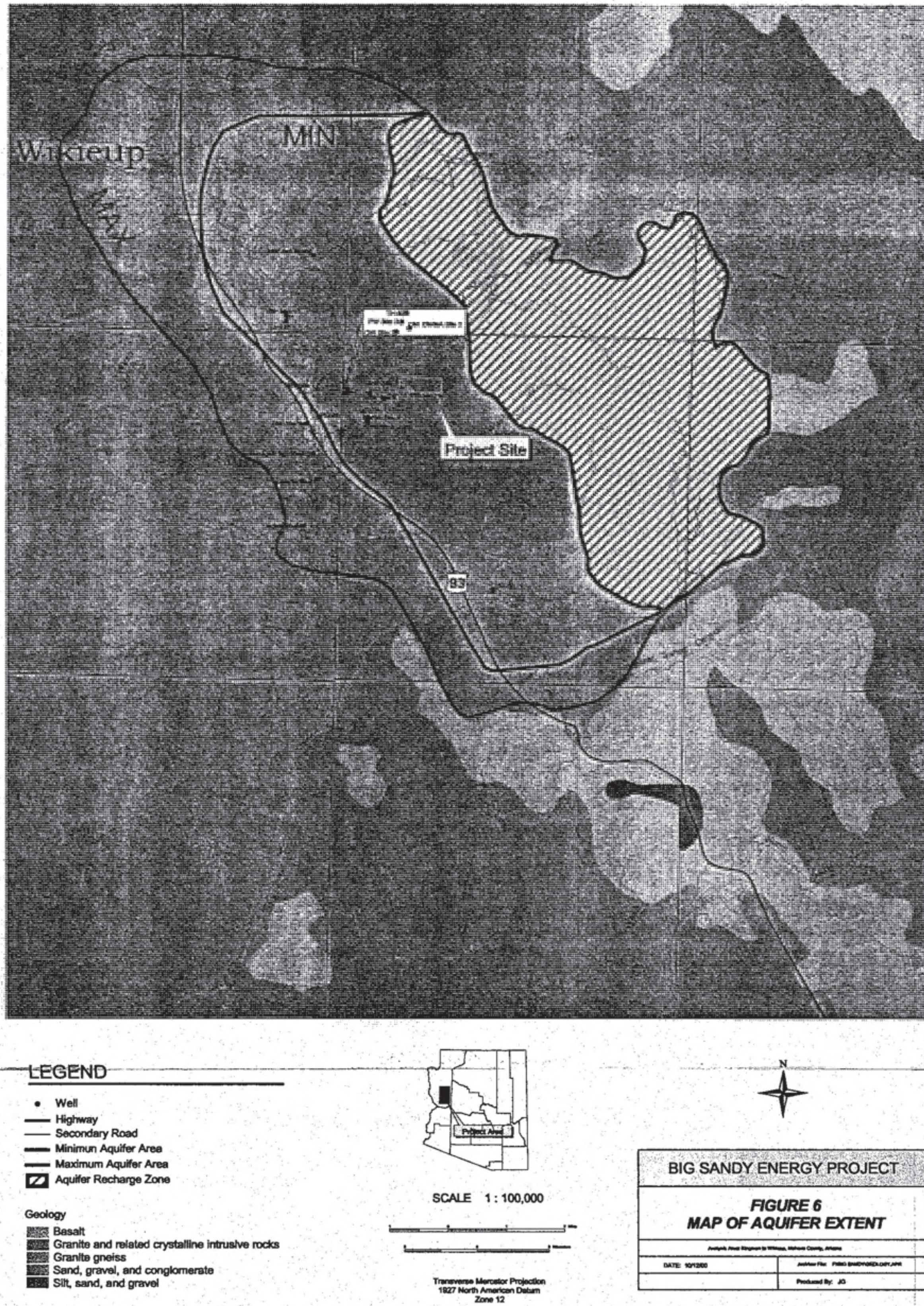


MANERA INC.

BIG SANDY ENERGY PROJECT

FIGURE 5
FENCE DIAGRAM OF DRILL HOLES
after lease, 1982

DATE: 10/13/00	AutoCAD File: 891-fence.dwg
SCALE: AS NOTED	DRAWN BY: ML



BIG SANDY ENERGY PROJECT

FIGURE 6
MAP OF AQUIFER EXTENT

DATE: 10/12/00

Produced By: JG

WATER QUALITY

Results of the chemical analysis of water samples collected from the initial flow of the confined water from well OW4, located in the SE1/4, SE1/4, NW1/4 of Section 7, T. 15 N., R. 12 W. states a total dissolved solids content of 746 milligrams per liter (mg/l) with all constituents, with the exception of arsenic and fluoride, falling within the Drinking Water Standards of the Arizona Department of Environmental Quality.

The reported arsenic content was reported as 0.08 mg/l in one analysis and 0.141 mg/l in another. In both cases, this exceeds the limit for drinking water of 0.05 mg/l. Additional analysis will be made to confirm the arsenic content of the confined water. The reported fluoride content was reported as 3.7 mg/l in both analyses. Although within the acceptable limits of 4.0 mg/l, the fluoride is high for long term human consumption. The temperature of the water in the confined aquifer was 96 degrees Fahrenheit when collected in the field as shown on the Chain of Custody Record.

The water quality is satisfactory for industrial use. Additional water samples were collected from the various aquifers as part of the test hole drilling program. The analytical data associated with these samples is included with the analyses of OW4 in **Appendix B**.

SUBSURFACE INVESTIGATIONS AND AQUIFER TESTING

Aquifer testing was performed at the proposed Big Sandy Energy Project to determine the potential for development and impacts that could be associated with the utilization of groundwater for the project. The aquifer tests were performed as part of a comprehensive assessment of the hydrologic resources of the proposed site.

The assessment was conducted in a phased approach:

- The initial phase of investigation was conducted by testing the Recent Stream Bed and Flood Plain alluvium and possibly a portion of the Upper Basin fill via a shallow well (Banegas Well) located in the SW1/4, NW1/4, NE1/4 of Section 13, T. 15 N., R. 13 W.

- The second phase of the investigation was conducted by drilling a series of test borings to determine the lithology and potential for water resources in deeper lithologic units. The results of the test drilling indicated the potential for a deep aquifer source.

- These results initiated a third phase of investigation to determine the potential for the development of this deeper aquifer. This third phase consisted of the installation of several wells to monitor the shallow and middle aquifers and to test and monitor the deeper aquifer.

- Testing was subsequently conducted in a fourth phase of investigation. This series of investigations is summarized below.

Big Sandy Alluvium Aquifer Test

A pump test was conducted on an existing well (Banegas Well) on October 29-30, 1999. A report was issued detailing results of this test on November 2, 1999. The test consisted of pumping water from this well at a rate of 387 gallons per minute (gpm) for a period of 1,635 minutes. The well pumped during the test had a total depth of 105 feet and was reportedly perforated in the bottom 20 feet. A second well located 200 feet from the pumping well was utilized as an observation well. This second well has a total depth of 60 feet, and the perforated interval is unknown.

The analyses of the drawdown in the pumped well indicates a transmissivity (T) value of 204,000 gpd/ft for the first 300 minutes and then the T value decreases to 2,064 gpd/ft for the remainder of the pumping period. The T value calculated from the data obtained from the observation well was 65,500 gpd/ft

The T values 204,000 gpd/ft during the early portion of the pumped well data and the 65,500 gpd/ft from the observation well data fall within the reported values of T of the stream bed alluvium in the Big Sandy Basin (Davidson, 1973). The change in the T values exhibited during this test may have resulted from the dewatering of a thin layer of the alluvium leaving only the lacustrine clay deposits to supply water to the well, or a hydrologic boundary may have impacted the pumping rate. Copies of the data and analyses are included in **Appendix C.**

Test Hole Drilling Program

Following the testing of the well screened in the Big Sandy Alluvium, an exploration drilling program was initiated. The investigation was completed and a report issued in March 22, 2000. The investigation consisted of the drilling of four test holes to determine the lithology and potential for development of groundwater. Specific results can be found in the report "Results Test Hole Drilling Program Wikieup, Mohave County, Arizona" included as **Appendix D.**

The test borings were drilled by means of the dual wall, air rotary drilling method. The drill cutting samples were logged and downhole geophysical logs were performed when possible. The test boring drilling program indicated that the subsurface materials below 400 feet to a minimum depth of 1200 feet were water bearing and offered a reasonable potential for the development of sufficient ground water to satisfy the demands of the energy plant.

Test Hole 1 was located in Section 36, T 16 N, R 13 W. This test hole was drilled to a total of 700 feet and encountered layers of intrusive igneous sand and gravel alternating with layers of sandstone. The sandstone as described by Lease (1981) consists of a siltstone and sandstone, very fine to fine-grained, white to medium gray, friable to well cemented with calcite, micaceous. Water was encountered at approximately 20 feet below grade with water volumes increasing with depth. At 700 feet below grade, the hydrostatic head of the confined water forced the drilling fluid out of the hole and a flow of 15 gpm occurred.

Test Hole 2 was located in Section 7 (NW1/4, NW1/4, NW1/4), T 15 N, R 12 W. This test hole was drilled to a depth of 1,155 feet below grade and encountered clay to a depth of 350 feet. Below the clay layer, alternating layers of granitic sand and gravel and volcanic sand and gravel were encountered to 1,135 feet. At 1,135 feet a cap rock on top of a volcanic rock was encountered and penetrated to the total depth of the boring. Water was encountered immediately below the clay, but the piezometric head was below the collar elevation until encountering the volcanic layer at 1,135 feet where water began to flow under artesian conditions. The volcanic layer appears to be confined.

Test Hole 3 was drilled in Section 5 (SW1/4, SW1/4, SW1/4), T 15 N, R 12 W. The lithology encountered during the drilling of this well was igneous intrusive sand and gravel (Upper Basin fill) from surface to 55 feet, clay (Wikieup formation Lower Basin fill facies) from 55 to 160 feet, and volcanic (extrusive) igneous rocks or sand and gravel to a total depth of 780 feet (total depth of the boring). The static water level in the hole was approximately 20 feet below surface as the collar elevation was 21 below the collar elevation, consequently, there was no artesian flow.

Test Hole 4 was drilled in Section 7 (SE1/4, SE1/4, NW/14), T 15 N, R 12 W. The test hole extended to a total depth of 1,200 feet with the initial 120 feet consisting of granitic sand and gravel (Upper Basin fill). The Wikieup fill was encountered from 120 feet, and from 300 feet to a depth of 1,135 feet, alternating layers of volcanic sand and gravel, granitic sand and gravel, with some clay was penetrated. At 1, 135 feet below grade a volcanic layer was penetrated which was under artesian conditions. The flow rate under artesian conditions was in excess of 125 gpm with a close in pressure of 39 psi.

On the basis of the results of the test boring program, the most likely area to develop a well field appears to be in the western half of Section 7 and possible on the plant site in Section 5, T 15 N, R 12 W. Subsequent to this investigation, a series of wells were drilled to investigate the potential for the development of the basaltic artesian aquifer.

Developmental Well Drilling and Installation

Developmental well drilling and installation was performed based upon the results of the test hole program. The objective of the developmental program was to investigate the potential of the volcanic confined aquifer as a groundwater source and to provide a network of wells that could provide information regarding potential impacts of withdrawal of the proposed groundwater development.

Based upon the test hole drilling program, a number of wells were installed to assess the potential for the development of the confined basaltic aquifer and the potential for impacts to the overlying aquifers. A total of four wells were installed in the lower aquifer, one well in the middle aquifer, and three wells were installed in the upper (alluvial) aquifer. One of the wells indicated as being installed in the upper (alluvial) aquifer, MW8, was actually installed in lacustrine clay, the upper member of the Lower Basin fill. The four lower aquifer wells were installed to determine the hydrologic properties of this aquifer via aquifer testing. The wells installed in the middle and upper aquifers were installed to determine potential impacts on these aquifers associated with the development of the lower aquifer.

Each of the wells was installed utilizing reverse circulation rotary drilling techniques. Locations of the wells is presented on **Figure 3**. Completions of the wells are detailed on **Table 1**. Lithologic logs and well construction diagrams are included in **Appendix D.**

Aquifer Step-Drawdown Test

On August 28, 2000 a step-drawdown test was performed on Production Well 2 (PW2). The test was conducted by pumping the well over a 24-hour period with the discharge rate being increased every six hours. The steps consisted of an artesian free flow at 760 gallons per minute (gpm), and pumping discharge rates of 1,204 gpm, 1,800 gpm, and 2,100 gpm.

In addition to monitoring the pumped well, a number of observation wells were monitored to observe the responses of the pumping of PW2. The observation wells that were monitored isolated all three of the aquifers, the lower confined aquifer, the middle aquifer, and the upper aquifer. Each of the wells was equipped with an In-Situ Troll or Mini-Troll in-well datalogger and transducer. The dataloggers in wells in the middle aquifer (OWMA2 and OW3) and the lower aquifer (PW2 and OW4) were all set with logarithmic data collection time schedules that were synchronized to the start of the test. The results of the aquifer test proved that OW3 was penetrated in the confined basaltic aquifer.

Table 1
Well Data
Big Sandy Energy Project

Well Designation (Currently Drilled/ Installed)	Township	Range	Section	1/4 1/4 Section	Latitude	Longitude	Collar Elevation feet	Purpose (monitor/ production/ exploration)
Test Hole #1	16N	13W	36	SW1/4,NW1/4,SW1/4	34 40' 43.4"	113 34' 54"		Exploration
Test Hole #2	15N	12W	7	NW1/4,NW1/4,NW1/4	34 39' 44.6"	113 33' 44.6"		Exploration
Test Hole #3	15N	12W	5	SW1/4,SW1/4,SW1/4	34 39' 45.3"	113 32' 47.5"		Exploration
Test Hole #4	15N	12W	7	SE1/4,SE1/4,NW1/4	34 39' 39.2"	113 33' 24.5"		Exploration
Obs Well at Site 1	16N	13W	36	SW1/4,NE1/4.SW1/4	34 40' 48.6"	113 34' 53.5	1,884.73	Piezometric
Obs Well OWMA at Site 2	15N	12W	7	NW1/4,NW1/4,NW1/4	34 39' 41.7"	113 33' 43.2"	1,994.47	Piezometric
Prod Well at Site 2	15N	12W	7	NW1/4,NW1/4,NW1/4	34 39' 42.4"	113 33' 45.4"	1,991.03	Production
Obs Well OWC at Site 2	15N	12W	7	NW1/4,NW1/4,NW1/4	34 39' 40.4"	113 33' 46.9"	1.981.32	Piezometric
Obs well at Site 3	15N	12W	5	SW1/4,SW1/4,SW1/4	34 39' 46.7"	113 32' 47.2"	2,100.36	Piezometric
Ob Well at Site 4	15N	12W	7	SE1/4,SE1/4,NW1/4	34 39' 19.0"	113 33' 21.6"	1,991.22	Piezometric
Obs Well at Site 7	15N	13W	1	SW1/4, SW1/4, SE1/4	34 39' 44.2"	113 34'18.2"	1,931.58	Piezometric
Obs Well at Site 8	15N	13W	12	NE1/4,NE1/4,SW1/4	34 39' 11.7"	113 34' 29.6"	1,852.58	Piezometric
Planned Wells								
Prod Well at Site 4	15N	12W	7	SE1/4,SE1/4,NW1/4	34 39' 39.2"	113 33' 24.5"		Production
Prod Well at Site 5	15N	12	7	NE1/4,NE1/4,NW1/4	24 39' 41.7	113 33' 21.0"		Production
Prod Well at Site 6	15N	12W	7	SW1/4,NW1/4,SW1/4	34 39' 06.3"	113 33' 50.6"		Production
Other Wells								
Harris Well	15N	13W	13	NW1/4,NW1/4,SE1/4	34 38' 21.9"	113 34' 15.2"	1,784.05	Piezometric
Denton Well	15N	13W	24	SE1/4,SE1/4,NW1/4	34 37' 39.8"	113 34' 29.3"	1,782.93	Piezometric
Banegas Rch Well 2	15N	13W	13	SW1/4,NW1/4,NE1/4	34 38' 45.2"	113 34' 20.1"	1,786.99	Piezometric

Table 1 (continued)
Well Data
Big Sandy Energy Project

Well Designation (Currently Drilled/ Installed)	Aquifer	Depth (Feet)	Casing Diameter	Borehole Diameter	Screened Interval (Feet)	Gravel Pack (annulus) feet	Cement annulus feet	Lithologic Unit
Test Hole #1		700	None	6 7/8		0	0	Alluvium
Test Hole #2		1,155	None	6 7/8		0	0	Alluvium
Test Hole #3		780	None	6 7/8		0	0	Volcanics
Test Hole #4		1,200	None	6 7/8		0	0	Alluvium
Obs Well at Site 1	Upper	110	5"	9 7/8	20-110	15 - 110	0 - 15	Alluvium
Obs Well OWMA at Site 2	Middle	730	3"	6 7/8	393 - 693	315 - 693	0 - 315	Alluvium
Prod Well at Site 2	Confined	1,500	20"/12"	28"/17.5"*	1,135 - 1,600	1,135 - 1,600	0 - 1,135	Volcanics
Obs Well OWC at Site 2	confined	1,600	5"	12 1/4	1,140 - 1,600	1,119 - 1,600	0 - 1,119	Volcanics
Obs well at Site 3	Middle	1,200	12"	17 1/2	578 - 1,180	565 - 1,200	0 - 565	Volcanics
Ob Well at Site 4	Confined	1,500	3"	12 1/4	1,070 1,500	1,070 - 1,500	0 - 1,070	Volcanics
Obs Well at Site 7		190	3"	6 7/8	20 - 190	20 - 190	0 - 20	Lakebed clay
Obs Well at Site 8	Upper	150	5"	9 7/8	90 - 150	30 - 150	0 - 30	Alluvium
Planned Wells								
Prod Well at Site 4	Confined	1,800	20"		1,400 1,800			
Prod Well at Site 5	Confined	1,500	20"		1,100 1,500			
Prod Well at Site 6	Confined	1,500	20"		1,100 1,500			
Other Wells								
Harris Well	Upper	<200	8"		unk			Alluvium
Denton Well	Upper	100			unk			Alluvium
Banegas Rch Well 2	Upper	105			85 105			Alluvium

Table 1 (continued)
Well Data
Big Sandy Energy Project

Well Designation (Currently Drilled/ Installed)	Artesian Flow/Pressure (gpm/psi)	Date Drilled	Actual or Projected Water Levels
Test Hole #1	0	Dec-00	Plugged
Test Hole #2	125/30	Feb-00	Plugged
Test Hole #3	0	Feb-00	Plugged
Test Hole #4	140/29	Mar-00	Plugged
Obs Well at Site 1	0	Sep-00	12
Obs Well OWMA at Site 2	0	Aug-00	85.3
Prod Well at Site 2	765/38	Aug-00	Flowing
Obs Well OWC at Site 2	unk/38	Sep-00	Flowing
Obs well at Site 3	0	Jun-00	16
Ob Well at Site 4	125/38	Jun-00	Flowing
Obs Well at Site 7	0	Aug-00	114
Obs Well at Site 8	0	Aug-00	63.8
Planned Wells			
Prod Well at Site 4			
Prod Well at Site 5			
Prod Well at Site 6			
Other Wells			
Harris Well	0		39.6
Denton Well	0		42.2
Banegas Rch Well 2	0		20.3

The dataloggers in the observation wells in the upper unit (OW1, OW7, OW8, Banegas, and Harris) were set to take data at arithmetic intervals during the test with initiation of data collecting prior to the start of the test program. In addition, a piezometer was installed in the Big Sandy alluvium approximately 2 mile south of the boundary of Sections 12 and 13, T 15 N, R 13 W. This piezometer was also set to obtain water levels at 30-minute intervals throughout the testing period. Down stream (approximately 100 feet) of the piezometer a v-notch weir was installed to measure flow in the Big Sandy River. Photographs of the pumping test apparatus, v-notch weir installation, and piezometer are attached.

Prior to the test, a heavy rainfall event occurred. This rain commenced on the morning of August 27th and continued throughout the day. The rain resulted in runoff in the washes, and visually increased flow in the Big Sandy River. The v-notch weir was installed in the Big Sandy River as previously described on August 28, 2000. No readings from this weir or the piezometer are included in this data, since on the morning of August 29th, a second rainfall event started at 0700 hours and continuing throughout the remainder of the test (1400 hours). Based on visual observation, this event appeared larger than the event on August 27th. The weir and piezometer were removed the morning of August 29th to avoid a potential loss of these devices from the resultant flow in the river. River measurements during this test would have reflected these storm events, and influences from pumping would not have been distinguishable in the data.

Aquifer Testing Protocol

A protocol was developed for the constant rate test as a result of the consensus among the hydrologists that represent URS Consultants, State of Arizona, Bureau of Land Management, Western Area Power Administration, U. S. Fish and Wildlife Service, Manera, Inc. and Greystone Environmental Consultants. The aquifer test was designed to determine the aquifer parameters of the lower confined aquifer and to determine whether flow exists between the lower, middle and upper aquifers. The generalized sequence of aquifers (from surface to depth) at the proposed site are an unconfined upper alluvial aquifer (underflow of the Big Sandy River), a middle aquifer, and a lower confined aquifer. Separating the upper unconfined aquifer from the middle aquifer is a layer of lacustrine clay ranging in thickness from 150 feet to more than 500 feet. Separating the middle and lower aquifers is a basalt or well indurated volcanic layer.

Aquifer Testing Well Array

The aquifer test consisted of removal of water from well PW2, while measuring responses in the surrounding wells. Prior to the constant rate pumping test, baseline monitoring and a step-drawdown test were conducted. The wells that were selected for the test are presented in **Table 2.**

Baseline Monitoring

Measurements of depth to water were conducted daily to establish a baseline for the water levels in the wells and flow at the surface station. Along with the depth to water, the time, date and weather conditions were noted. This data collection commenced approximately two weeks prior to the test.

Table 2
Aquifer Test Wells
Proposed Big Sandy Energy Project
Wikieup, Arizona

Upper Aquifer Wells	Screened Interval	Drilled Depth	Datalogger Yes/No	Logging Schedule
OW1	20 to 150	150	Yes	Arithmetic
OW7	70 to 200	200	Yes	Arithmetic
OW8	20 to 150	150	Yes	Arithmetic
Benagus Well	85 to 105	105	Yes	Arithmetic
Middle Aquifer Wells				
OWMA2	540-1000	1000	Yes	Log
Lower Aquifer Wells				
PW2	1100 to 1500	1500	Yes	Log
OW2	1100 to 1500	1500	Yes	Log
OW4	1070 to 1500	1500	Yes	Log
OW3	578 - 1180	1200	Yes	Log

For the wells that were not yet installed, measurements were conducted as the wells were installed. Daily measurements continued throughout the step-drawdown and constant rate tests.

Data from the baseline monitoring was included within plots for the aquifer test. This data was added at the time when recorded, and hydrographs generated. These hydrographs indicate the overall trend within monitor wells from the time prior to the test, through test and through recovery. Examination of the data plots indicates that groundwater elevations within the middle aquifer and upper (alluvial) aquifer wells were not affected by the aquifer test. Copies of the hydrographs are included as **Appendix F**.

Constant Rate Test

The constant rate test was to be performed at 2,000 gpm based upon the results of the step drawdown test and as agreed upon by the hydrology team. The average discharge over the period of the testing program was 1,931 gpm. The test consisted of pumping PW2 at a constant rate while observing and recording the responses in the observation wells. The observation wells that were utilized are listed on **Table 2**. No impacts to the upper (alluvial) aquifer wells were apparent during the test.

During the various phases of the aquifer test, the discharge water was dispersed by means of large sprinkler guns. These guns were positioned in Section 7, T 15 N, R 12 W.

For each well, a pressure transducer and an in-situ data logger was installed. Within **Table 2**, the schedule of data collection and the wells that were equipped with data loggers is detailed. These data loggers are devices that measure the depth to water in the well and record this level at prescribed intervals. For all the wells, except as noted, a logarithmic time scale was utilized for the data collection. All logarithmic transducers were set to start at a time synchronized with the start of pumping. Pump flow measurements were also obtained utilizing a continuous rate flow meter and totalizer. Redundant water level measurements were taken by hand to provide a backup to the electronic data gathering. Time intervals that are obtained by hand were of a greater time interval than those taken by electronic means and were for backup purposes only. Following the aquifer pumping test, data was gathered during the recovery of the aquifer.

Aquifer Test Analyses

Aquifer test analyses was conducted utilizing AQTESOLV, Aquifer Test Solver software. The methods utilized for the analyses of the test were Theis and Cooper-Jacob. Both of these methods are for confined aquifers. The Theis methodology assumes the following:

- The aquifer has infinite areal extent.
- The aquifer is homogeneous, isotropic and of uniform thickness.
- The aquifer potentiometric surface is initially horizontal.
- The pumping rate is constant.
- The pumping well is fully penetrating.
- The flow to the pumping well is horizontal.
- The aquifer is confined.
- The flow is unsteady.
- Water is release instantaneously with a decline in hydraulic head.
- The diameter of the well is very small so that storage in the well can be neglected.

The Cooper-Jacob solution makes the same assumptions as Theis but also assumes:

- Values of u are small (i.e. radius from the pumping well to the observation well is small and time since pumping began is large)

These methods of analyses were chosen since the aquifer is confined and of an areal extent that is great enough for no boundary conditions to be apparent in the test data. Although many of conditions specified by the methodology are not met, these two methodologies represent the closest approximation to the site conditions. In addition, several examples exist witihin the literature where these conventional methodologies of analyses have been utilized (Singhal and Gupta, 1999).

Hydrologic Parameters

The hydraulic characteristics of basalts and volcanic rocks are dependent on the rate of cooling, viscosity of the magma and the degassing that occurs during cooling (Singhal and Gupta, 1999). The openings that impart porosity and permeability to basaltic rocks are scoariae, breccia zones, cavities, shrinkage cracks or columnar joints, gas vesicles, lava tubes and fractures and lineaments (Stearns, 1942; UNESCO, 1975). The variation in permeability encompasses almost nine orders of magnitude (Singhal and Gupta, 1999).

The results of the Big Sandy Energy Project aquifer test analyses indicate transmissivity values (T) of lower aquifer ranging from 12,520 ft^2/day to 12,960 ft^2/day utilizing the Cooper-Jacob methodology. The T values determined by the Theis methodology ranged from 10,105 ft^2/day to 11,193 ft^2/day. These values present a standard deviation of 184 for the Cooper-Jacob analyses and a corresponding standard deviation of 448 for the Theis analyses. Average transmissivity of the Cooper-Jacob analyses is 12,709 ft^2/day and the corresponding average of the Theis results is 10,689 ft^2/day.

The low standard deviations of the results of the aquifer test and the directional variation of the well array indicates that the aquifer is highly homogeneous with regard to transmissivity. The relatively close results between the two types of analyses combined with the low standard deviation of the data provide a high degree of confidence in the T values.

The storativity values associated with these same wells ranges over four orders of magnitude. The values were 0.29 for OWC2, 0.00057 from OW3, and 0.00118 from OW4 utilizing the Cooper-Jacob analyses. Similar results are provided by the Theis-based analyses. Although the values vary widely, only the value from the well OWC2 is not within the normal range for a confined basaltic aquifer. The other two values are more representative of the typical basaltic aquifers. A summary of the transmissivity and storativity values from each of the analyses and each is well is presented in **Table 3** and a summary of typical values from other basaltic aquifers is provided in **Table 4.**

Table 3
Transmissivity and Storativity Values
Big Sandy Energy Project
Wikieup, Arizona

Well Name	Theis Value		Cooper- Jacob Value	
	Transmissivity (ft2/day)	Storativity	Transmissivity (ft2/day)	Storativity
OWC2	10770	0.3816	12520	0.2971
OW3	11193	0.00069	12647	0.00057
OW4	10105	0.00163	12960	0.00118

Table 4
Typical Transmissivities and Storage Values
Big Sandy Energy Project
Wikieup, Arizona

Rock Type	Age	Location	T (ft^2/day)	S
Basalt	Miocene	Columbia Snake River Area, USA	2173 - 24511 avg - 55198	2×10^{-2} 6×10^{-2}
Basalt	Miocene Quaternary	Gran Canaria,Spain	538 - 3228	--
Basalt (fractured)	Pleistocene-Holocene	Mexico	6509 - 9307	--
Basalt	Pliocene	Republic of Djibouti	365 - 54876	10^{-2} - 10^{-4}

(modified from Singhal and Gupta, 1999)

Further analyses of the data was performed by utilizing the Cooper-Jacob straight line analyses. This analyses evaluates the data from all observation wells to determine the transmissivity and storativity. This analyses was performed on the two distant wells, OW3 and OW4, since the storativity value determined by the well OWC2 is considered suspect. The results of the Cooper-Jacob straight line method indicated a transmissivity value of 163,000 g/day/ft or 21,791 ft^2/day. While this value is higher than the values determined from the individual observation wells, the value does add confidence that the transmissivity of the aquifer is high. A copy of the analyses of the individual observation wells and the straight line determination is included in **Appendix G.**

In addition to transmissivity, hydraulic conductivity can be determined utilizing the equation T=kb, where T is transmissivity, k is the hydraulic conductivity and b is the aquifer thickness. Utilizing the transmissivity values derived from the aquifer testing and the aquifer thickness (300 ft) as determined by the test drilling, the hydraulic conductivity values were determined. Hydraulic conductivity of the aquifer ranged from 41.7 ft/day to 43.2 ft/day by the Cooper-Jacob analyses. Correspondingly, the results of the Theis analyses ranged from 33.7 ft/day to 37.3 ft/day. **Table 5** summarizes the hydraulic conductivity values as determined by aquifer testing. These hydraulic conductivities are within the normal ranges for basaltic aquifers. For comparative purposes, hydraulic conductivities of differing basalt types are presented on **Table 6.**

Table 5
Hydrualic Conductivity Values
Big Sandy Energy Project
Wikieup, Arizona

Well Name	Theis Value Hydraulic Conductivity (ft/day)	Cooper- Jacob Hydraulic Conductivity (ft/day)
OWC2	35.9	41.7
OW3	37.3	42.2
OW4	33.7	43.2

Table 6
Typical Conductivity and Porosity Ranges for Basalt
Big Sandy Energy Project
Wikieup, Arizona

Basalt type	Porosity (%)	Hydraulic Conductivity (ft/day)
Dense	0.1-1	10^{-6}-10^{-2}
Vesicular	5-11	10^{-3}-10^{-2}
Fractured, weathered	10-17	10^{-3}-10^{4}

(modified from Singhal and Gupta, 1999)

Based upon the values of hydraulic conductivity determined from the aquifer test, the basalt type would appear to be fractured and or weathered. The corresponding porosity of the aquifer would therefore appear to range from 10-17 percent. In consideration that the hydraulic conductivity of the aquifer is 10^{1}, a conservative porosity of 13-14% could be assumed.

Examination of the hydrographs from the middle aquifer and alluvial aquifer wells in the area does not indicate any influence from the pumping test. No calculation can be made regarding the transmissivity of these aquifers from this test data, nor can any vertical hydraulic conductivity value be derived for the confining layers that exist between these aquifers. The test indicates that little, if any interconnection may exist between the basaltic aquifers and the other aquifers in the Big Sandy Valley. Copies of the hydrographs from all wells are included in **Appendix F.**

PROJECTED EFFECT OF WITHDRAWAL

Based upon the results of the geological research and the aquifer testing, a simplified water balance for the aquifer was utilized to determine the potential impacts to the aquifer. For the models a average withdrawal rate of 3,000 gpm was utilized.

In the first methodology, the minimum and maximum extent of the aquifer (as estimated in the geology section) is utilized along with the estimated porosity and aquifer thickness to determine the volume of water in storage. For each of the aquifer minimum and maximums:

Minimum extent:

Area of the aquifer

$57.04\ mi^2 \times 27878400\ ft^2/mi^2 = 1.59 \times 10^9\ ft^2$

Volume of the aquifer

$1.59 \times 10^9\ ft^2$ (aquifer extent) x 300 feet (assumed aquifer thickness) = $4.77 \times 10^{11}\ ft^3$ (aquifer volume)

$4.77 \times 10^{11}\ ft^3$ (aquifer volume) x 7.48 gallons/ft^3 = 3.56×10^{12} aquifer volume in gallons

Water Stored in the Aquifer

3.56×10^{12} gallons (aquifer volume) x 0.13 porosity = 4.6×10^{11} gallons, or 4.6×10^{11} / 325,851 (gallons per acre foot) = 1,420,281 acre feet of water stored in the aquifer

Maximum extent:

Area of the aquifer

$80.14\ mi^2 \times 27878400\ ft^2/mi^2 = 2.24 \times 10^9\ ft^2$

Volume of the aquifer

$2.24 \times 10^9\ ft^2$ (aquifer extent) x 300 feet (assumed aquifer thickness) = $6.73 \times 10^{11}\ ft^3$ (aquifer volume)

$6.73 \times 10^{11}\ ft^3$ (aquifer volume) x 7.48 gallons/ft^3 = 5.03×10^{12} aquifer volume in gallons

Water Stored in the Aquifer

5.03×10^{12} gallons (aquifer volume) x 0.13 porosity = 6.54×10^{11} gallons, or

6.54×10^{11} / 325,851 = 2,004,000 acre feet of water stored in the aquifer

Therefore the volume of water stored in the aquifer is between 1,420,000 acre feet and 2,004,000 acre feet.

Water enters the aquifer through recharge. Assuming that recharge only occurs as a result of precipitation directly on the outcrop, then a conservative estimate of the average annual recharge to the aquifer can be made. Meteorological data from Wikieup indicates that 10.00 inches of precipitation occurs on an annual basis (Western Regional Climate Center, 2000). Recharge in basaltic aquifers in arid regions is approximately 10 % of the annual rainfall (UNESCO, 1975). Therefore:

Recharge Zone Area:

26.19 mi^2 x 27878400 ft^2/mi^2 = 7.3×10^8 ft^2

Annual Recharge Volume:

7.3×10^8 ft^2 (recharge area) x 0.8333 ft (precipitation in feet) x 0.10 (percentage to the aquifer) = 6.08×10^7 ft^3 of water as total annual recharge to the aquifer.

6.08×10^7 ft^3 (total recharge in ft^3) x 7.48 g/ft^3 = 4.55×10^8 gallons, or

4.55×10^8 / 325,851 = 1,396 acre feet of annual recharge.

Discharge from the aquifer is assumed to be equal to the amount of recharge into the aquifer. The recharge rate equates to approximately 865gpm. Some discharge does occur through springs in the area such as Cofer Hot springs. The total amount of discharge is also assumed to be 865 gpm.

Estimation of Water Use by Simplified Water Balance Methods

One very conservative method to determine potential drawdown in the aquifer is assume the aquifer receives no recharge and to subtract the water needs for the facility from the amount of water in storage in the aquifer. While this is not a realistic scenario, this does illustrate the requirements and available supplies in a simple manner. Considering that the facility requires a maximum of 3,000 gpm or approximately 4,850-feet/year for approximately 40 years, and the total water volume in the aquifer is approximately 1.4 million acre feet (lowest estimate), then:

Total Facility Requirements:

3,000 gpm x 1440 minutes/day x 365 days/year x 40 years / 325,851 gallons/acre feet = 193,561 acre feet

Total Amount of Water Remaining Stored in the Aquifer (Minimum Extent):

1,420,000 acre feet (minimum stored in aquifer) - 193,561 acre feet (required for plant) = + 55,854 acre feet (recharge) = 1,282,293 acre feet (remaining stored in aquifer)

Percentage of Water in the Aquifer Utilized (Minimum Extent):

1,282,293 acre feet (remaining stored in the aquifer) / 1,420,767 acre feet (stored in the aquifer) = 9.75 percent utilized leaving 90.25 % of the original volume of water in storage.

This calculation includes the volume of water that would recharge the aquifer during the forty years of operations. In addition, this calculation was performed based upon the minimum extent of the aquifer believed to exist.

POTENTIAL IMPACTS ASSOCIATED WITH AQUIFER DEVELOPMENT

The aquifer proposed for development is a highly confined aquifer that does not appear to interconnected to the overlying aquifers. This lack of interconnection is evidenced in the hydrographs of measurements made in the observation wells in the Upper and Middle Aquifers, which shows no change in the trend of the water levels prior to, during and following the pumping test. Therefore, withdrawal from the Lower (confined) aquifer appears not to impact the Upper Aquifer or the flow in the Big Sandy River and consequently, will not impact the existing wells which presently penetrate only the Recent Stream and Flood Plain and the Upper Basin fill deposits. Further, it appears that the Middle Aquifer will not be effected.

Only one naturally occurring discharge point of the confined aquifer has been clearly identified through pump testing and water quality analyses. This natural discharge point issues as Cofer Hot Springs. The only impact determined from the investigation that will probably occur as withdrawal from the Lower (confined) Aquifer continues is that flow will be reduced or cease from the Cofer Hot Spring. No other currently identified springs will likely be impacted.

The Owner of Cofer Hot Spring has agreed to negotiate mitigation that will compensate for loss of flow.

PROPOSED MONITORING PROGRAM

To verify the projections made as part of this assessment of the ground water potential of the area, a monitoring program is proposed. This monitoring program is designed to verify the drawdowns and potential impacts in the Upper Alluvial, Middle and Lower aquifers. The monitoring program will utilize both existing and proposed wells.

Currently, wells exist in the Upper Alluvial Aquifer at sites 1, 7, and 8. One Middle Aquifer well exists at Site 2. In addition to these wells, Lower Aquifer wells exist at site 4 and site 2. Each of these well is proposed to be utilized as part of the proposed monitoring program. In addition to these wells, it is proposed that an additional monitoring well be installed near Cofer Hot Springs. This well will be screened in the lower aquifer and will be utilized for monitoring the lower aquifer.

Water levels in these wells will be monitored over the period of operations on a daily basis by means of transducers and data loggers. The equipment for each well will consist of an In-Situ® Troll, Mini-Troll or similar device. The water level values will be downloaded and analyzed on a quarterly basis. Repairs and or replacement of the equipment will be performed during the download periods.

The data derived from the monitoring program will be summarized and presented in an Annual Hydrology Report. This report will analyze the previous years data and project the probable drawdown for the coming year. As part of this analysis, the impact, if any, on the Middle or Upper Aquifer will be determined. The report will be available to the agencies and the public at the beginning of each monitoring year.

CONCLUSION

The conclusions reached on the basis of this investigation are:

- the Lower (confined) Basaltic Aquifer is a heretofore undocumented aquifer which has not been utilized by any wells or withdrawal;
- the Lower (confined) Basaltic Aquifer and its recharge area has a minimum areal extent of approximately 57 square mile of which 31 square miles is within the Big Sandy Basin and the remaining 26 square miles, forming the recharge area, consists of the Volcanic Rocks of Sycamore Creek to the east of the basin;
- the minimum volume of water in storage in the Lower (confined) Basaltic Aquifer is 1.4 million acre feet;
- the maximum demand of the power plant over the 40 year period of the proposed project is 193,561 acre feet;
- recharge to the Lower (confined) Basaltic Aquifer will replace 55,854 acre feet in the 40 year life of the project;
- during the life of the project, the project will withdraw 9.75 percent of the volume of water in storage;
- withdrawal from the Lower (confined) Basaltic Aquifer does not effect the water levels in the Middle or Upper Aquifers, therefore, the withdrawal to satisfy the demand of the project will not impact the existing wells which penetrate only the Upper Aquifer or the Recent Stream and Flood Plain alluvial fill;
- there is sufficient water available in the Lower (confined) Basaltic Aquifer to satisfy the demands of the project for 40 years without depleting the aquifer and without impacting the existing wells.

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