



# WATER-RIGHT DOCKET

## Lake Mead National Recreation Area

Docket No: 14

WILLOW BEACH #1.

### Preliminary Docket Information

05-19-1976: water right/source docket information

WATER RESOURCES/WATER RIGHT

DATE: May 19, 1976

#### WATER RIGHT/SOURCE DOCKET INFORMATION

REGION Western Region AREA Lake Mead National Recreation Area  
 SITE Willow Beach  
 STATE Arizona COUNTY Mohave DOCKET NO WR #14  
 LOCATION SE  $\frac{1}{4}$ , NW  $\frac{1}{4}$ , Sec. 29, T29N, R22W, G&SRB&M  
 REGIONAL BASIN Colorado River LOCAL BASIN \_\_\_\_\_  
 ACQUIRED BY \_\_\_\_\_  
 APPLICATION \_\_\_\_\_ PERMIT \_\_\_\_\_ CERTIFICATE \_\_\_\_\_  
 ACTION DUE \_\_\_\_\_ PRIORITY \_\_\_\_\_ RESERVATION \_\_\_\_\_  
 QUANTITY 180,000 GPD USE Domestic and irrigation  
 STATUS Active SOURCE 2 wells

REMARKS Hydrology Unit #15030101

#### NARRATIVE:

In 1956, the Park Service drilled a well 68 feet deep at Willow Beach in Lake Mead NRA. The depth to the principal water bed was 16 feet below land surface datum. Between March and May of 1958, the Park Service constructed a water system at Willow Beach consisting of a 25,000-gallon reservoir, and a four inch pipeline from the pump to the reservoir and from there to the future residential area.

On April 10, 1959, Mr. A. van V. Dunn distributed Lake Mead Water Right Dockets Number 12 through 18 to the Regional Director of Region Three. Included in the dockets were prints of Drawings Number 6982, 6983, 6984, 6985, 6987, 6988, and 6989. The irrigation studies which these drawings represented were being conducted in preparation for the litigation in the case of Arizona v. California. Mr. Dunn was worried that the figures he gave in his original testimony regarding irrigation at Lake Mead may have been low.

Drawing Number NRA-IM 6984, the irrigation study for the Willow Beach area, showed the pump enclosure located in a drainage channel adjacent to a boat launching area in a small cove below a cliff overlooking Lake Mohave. The net area to be irrigated was estimated to be 19.7 acres.

A second well was drilled in the 1960's and serves as the principle well at present. This well is located about 75 feet south of well #1.

Present development of the area includes: a 147 space campground, concessionaire and 20 room motel, marina, and trailer village. A Federal fish hatchery is located in the adjoining area - this area has had two wells in the past, but are utilizing NPS supply since they capped their well about one year ago.

Water usage for 1974 was 66,000,000 gallons.

There is no evidence of any State Water Right filings.

USGS Reports shows the presence of 4 wells in the area:

29-22-29BAD1 (SEKNEK NWK Sec 29 T29N R22W)  
 29-22-29BAD2 (SEKNEK NWK Sec 29 T29N R22W)  
 29-22-29DCC1 (SWK SWK SEK Sec 29 T29N R22W)  
 29-22-29DCC2 (SWK SWK SEK Sec 29 T29N R22W)

Compiled by Kevin Kidder

Approved by W. Werrell

Page 1 of 1



## WESTERN REGION

450-GOLDEN GATE AVENUE, BOX 36063  
SAN FRANCISCO, CALIFORNIA 94102

JUN 9 '82

IN REPLY REFER TO:

L54 (WR-RNW)

June 4, 1982

Mr. Wesley E. Steiner, Director  
Department of Water Resources  
99 E. Virginia Avenue  
Phoenix, Arizona 85004

Reference: Arizona Groundwater Management Act  
(1980), A.R.S. 45-593

Dear Mr. Steiner:

Enclosed are the completed well registration forms for existing wells within the State of Arizona owned by the United States Government, Department of the Interior, National Park Service, Western Region. These forms have been completed for the following areas: Casa Grande National Monument (1 well), Chiricahua National Monument (8 wells), Coronado National Memorial (6 wells), Fort Bowie National Historic Site (1 well), Grand Canyon National Park (no wells), Lake Mead National Recreation Area (14 wells), Montezuma Castle National Monument (3 wells), Organ Pipe Cactus National Monument (21 wells), Petrified Forest National Park (3 wells), Saguaro National Monument (14 wells), Tonto National Monument (1 well), Tumacacori National Monument (3 wells), Tuzigoot National Monument (1 well), and Walnut Canyon National Monument (1 well). The location of these National Park Service areas are shown on the enclosed map (in red).

Of the total 77 wells being registered, 12 wells have a pump capacity exceeding 35 gallons per minute and therefore payment in the amount of \$120.00 (\$10.00 X 12) will be forwarded to your office by the U.S. Treasury Department under separate cover as the registration fee for these non-exempt wells.

If there are any questions with regards to this matter, or if we can be of further assistance, please contact Gerard S. Witucki, Chief, Division of Water Resources, (415) 556-8660, of this Office.

Sincerely yours,

FOR Robert M. G. Cherry

Howard H. Chapman  
Regional Director, Western Region

Enclosures

See attached sheet for bcc's

|                          |                 |
|--------------------------|-----------------|
| Roscoe Williamson        |                 |
| Regional Office          | Index<br>8/7/90 |
| Regional Director        | (K6)            |
| Deputy Regional Director |                 |
| Commissioner             |                 |
| Park Operations          | M/L             |
| Plant & Recreation       |                 |
| Crop Farm                |                 |
| Communications & EIS     |                 |
| EIS                      |                 |
| Other Eval               |                 |
|                          |                 |
|                          |                 |
|                          |                 |
|                          |                 |
| Aileen Tolson            |                 |

See Dockets for  
SAGO, CORO

bcc's sent to:

Superintendent, Casa Grande, w/respective encls., w/blank form & w/o map  
Superintendent, Chiricahua/Fort Bowie, w/respective encls., w/blank form & w/o map  
Superintendent, Coronado, w/respective encls., w/blank form & w/o map  
Superintendent, Grand Canyon, w/o encls.  
Superintendent, Lake Mead, w/respective encls., w/blank form & w/o map  
Superintendent, Montezuma Castle/Tuzigoot, w/respective encls., w/blank form & w/o map  
Superintendent, Organ Pipe Cactus, w/respective encls., w/blank form & w/o map  
Superintendent, Petrified Forest, w/respective encls., w/blank form & w/o map  
Superintendent, Saguaro, w/respective encls., w/blank form & w/o map  
Superintendent, Tonto, w/respective encls., w/blank form & w/o map  
Superintendent, Tumacacori, w/respective encls., w/blank form & w/o map  
Superintendent, Walnut Canyon, w/respective encls., w/blank form & w/o map  
General Superintendent, Southern Arizona Group, w/respective encls., w/blank form & w/o map  
Field Solicitor, San Francisco Office - Attn: J. Burke, w/encls. & w/blank form  
Field Solicitor, Phoenix Office - Attn: W. Swan, w/map, w/blank form & w/example of  
completed form  
Regional Director, Rocky Mountain Region - Attn: W. McKeel, w/map, w/blank form &  
w/example of completed form  
Regional Director, Southwest Region - Attn: G. Moore, w/map, w/blank form & w/example  
of completed form  
(WR)AF, w/SF 1034, w/o encls.

## DEPARTMENT OF WATER RESOURCES

39 EAST VIRGINIA AVENUE  
PHOENIX, ARIZONA 85004

## REGISTRATION OF EXISTING WELLS

PRINT OR TYPE - FILE IN DUPLICATE

Declaration: The United States gives certification to the State in the interest of public health, safety and the general welfare of the State has power to regulate the rights of the United States to the use of water.

|                              |                                     |
|------------------------------|-------------------------------------|
| REGISTRATION FEE (CHECK ONE) |                                     |
| EXEMPT WELL (NO CHARGE)      | <input type="checkbox"/>            |
| NON-EXEMPT WELL - \$10.00    | <input checked="" type="checkbox"/> |

|                      |                |
|----------------------|----------------|
| FOR OFFICE USE ONLY  |                |
| REGISTRATION NO. 85- | 629087         |
| FILE NO.             | B(29-22)29 dec |
| FILED                | 6-9-82 AT 1:30 |
| (DATE)               | (TIME)         |
| INA                  |                |
| AMA                  |                |

- Name of Registrant:  
National Park Service, Western Region, Division of Water Resources  
450 Golden Gate Ave., Box 36063, San Francisco CA 94102  
 (Address) (City) (State) (Zip)
- File and/or Control Number under previous groundwater law:  
 (File Number) \_\_\_\_\_ (Control Number) 35-
- The well is located within the SW  $\frac{1}{4}$  SW  $\frac{1}{4}$  SE  $\frac{1}{4}$ , Section 29, of Township 29 N N/S, Range 22 W E/W, G & SRB & M, in the County of Mohave.
  - If in a subdivision: Name of subdivision \_\_\_\_\_, Lot No. \_\_\_\_\_, Address \_\_\_\_\_.
- The principal use(s) of water (Examples: irrigation - stockwater - domestic - municipal - industrial)  
Public supply, domestic, fire protection
- If for irrigation use, number of acres irrigated from well \_\_\_\_\_.
- Owner of land on which well is located. If same as Item 1, check this box ☒  
 \_\_\_\_\_  
 (Address) (City) (State) (Zip)
- Well data (If data not available, write N/A)
  - Depth of Well 68 feet
  - Diameter of casing 8½ inches
  - Depth of casing 68 feet
  - Type of casing steel
  - Maximum pump capacity 250 gallons per minute.
  - Depth to water 16 feet below land surface.
  - Date well completed 1956  
 (Month) (Day) (Year)
- The place(s) of use of water. If same as Item 3, check this box ☒  
NE  $\frac{1}{4}$  NW  $\frac{1}{4}$  SE  $\frac{1}{4}$ , Section 29 Township 29 N Range 22 W  
¼  $\frac{1}{4}$   $\frac{1}{4}$   $\frac{1}{4}$ , Section \_\_\_\_\_ Township \_\_\_\_\_ Range \_\_\_\_\_  
Lake Mead National Recreation Area - Willow Beach #1  
 Attach additional sheet if necessary.
- DATE JUN 3 1982 SIGNATURE OF REGISTRANT (Sgd) Gerard S. Witucki

 GERARD S. WITUCKI  
 CHIEF, DIVISION OF WATER RESOURCES

CHANGE OF WELL INFORMATION

Registration Number 55 629087

I request the following information be changed in Well File Number B(29-22)29dec

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date \_\_\_\_\_, 19\_\_\_\_ Signature of Well Owner \_\_\_\_\_

STATEMENT OF CHANGE OF WELL OWNERSHIP

I, \_\_\_\_\_, state that I am (no longer) the (new) owner of the well described below:

Township \_\_\_\_\_ Range \_\_\_\_\_ Section \_\_\_\_\_, \_\_\_\_\_  $\frac{1}{4}$  \_\_\_\_\_  $\frac{1}{4}$  \_\_\_\_\_  $\frac{1}{4}$

Registration #55-\_\_\_\_\_ File No. \_\_\_\_\_

Previous Owner \_\_\_\_\_ New Owner \_\_\_\_\_

Address \_\_\_\_\_ Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

NOTE: ARS 45-593 requires that the Department be notified of change of well ownership and that the well owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within 30 days after changes take place.

NOTE: SAVE THIS FORM TO REPORT FUTURE  
CHANGES IN OWNERSHIP OR WELL  
DATA SUCH AS PUMP CAPACITY, ETC.

99 E. Virginia Avenue, Phoenix, Arizona 85004

RECEIVED  
HHS SECRETARIAT REGIONAL OFFICE

JAN 25 1982

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE

BRUCE BABBITT, Governor  
ESLEY E. STEINER, Director

JAN 25 1982

that all  
Department

W. Don Maughan  
Deputy Director

Office of Director 255-1554

Administration 255-1550, Water Resources and Flood Control Planning 255-1566, Dam Safety 255-1541, Flood Warning Office 255-1548, Water Rights Administration 255-1581, Hydrology 255-1586.

D5039 SWK

Form 10-114  
(Rev. Oct. 1965)

UNITED STATES DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

This permit is issued  
of \_\_\_\_\_

**SPECIAL USE PERMIT**

Lake Mead National Recreation Area Mono

(Also)

Fisher Contracting Co., of 2201 South 19th Ave., Phoenix, Arizona is hereby authorized during the period from August 1, 1966 to July 31, 1967 to use the following-described land in the above-named area:

A strip of land not to exceed twenty (20) feet in width, beginning at lakeshore approx. 1/5 mile North of Willow Beach Fish Hatchery and extending approximately 4 miles Northeast to near U.S. Highway 93 & 466. This is delineated on attached Exhibit 'A'.

for the purpose of installing a temporary six (6) inch water line w/pumping plant (enclosed w/6' chain link fence) for use in construction of Arizona Highway Department Project No. P 039-1(8) and FLH-2(h).

subject to the conditions on the reverse hereof and attached pages and to the payment to the Government of the United States of the sum of twenty Dollars (\$ 20.00) in advance annually (Monthly, semiannually, etc.), or as follows:

payment to be made to the Superintendent by Express or Postal Money Order, Certified Check, or Draft payable to the National Park Service, or Cash.

Issued at Boulder City, Nevada, this 16th day of August, 1966

/S/ William J. Briggie  
Acting Superintendent

The undersigned hereby accepts this permit subject to the terms, covenants, obligations, and reservations, expressed or implied, therein.

| TWO WITNESSES TO SIGNATURES                             |                                                     | * PERMITTEE (SIGNATURE) |  |
|---------------------------------------------------------|-----------------------------------------------------|-------------------------|--|
| NAME<br><u>/S/ J. C. Mason</u>                          | NAME<br><u>/S/ R. D. Fisher</u>                     |                         |  |
| ADDRESS<br><u>1138 E. Northview, Phoenix, Arizona</u>   | ADDRESS<br><u>R. D. Fisher, Vice President</u>      |                         |  |
| NAME<br><u>/S/ R. S. Bates</u>                          | NAME<br><u>FISHER CONTRACTING CO., 2201 SOUTH</u>   |                         |  |
| ADDRESS<br><u>6702 North 14th Drive, Phoenix, Ariz.</u> | ADDRESS<br><u>19TH AVE., PHOENIX, ARIZONA 85005</u> |                         |  |
| NAME                                                    | TITLE                                               | DATE                    |  |

\*Sign name or names as written in body of permit; for partnership, permittees should sign as "members of firm"; for corporation, the officer authorized to execute contracts, etc., should sign, with title, the sufficiency of such signature being attested by the Secretary with corporate seal, in lieu of witnesses.  
(This copy for the Branch of Lands, Washington)

## CONDITIONS OF THIS PERMIT

**1. Regulations.**—The permittee shall exercise this privilege subject to the supervision of the Superintendent, and shall comply with the regulations of the Secretary of the Interior, or other authorized officer of the Government, governing the area.

**2. Definition.**—The term "Director, National Park Service" as used herein shall include the appropriate Regional Director or Superintendent as the representative of the Director.

**3. Rights of the Director.**—Use by the permittee of the land covered hereby is subject to the right of the Director, National Park Service, to establish trails, roads, and other improvements and betterments over, upon, or through said premises, and further to the use by travelers and others of such roads and trails as well as of those already existing. If it is necessary to exercise such right, every effort will be made by the National Park Service to refrain from unduly interfering or preventing use of the land by the permittee for the purpose intended under this permit.

**4. Nondiscrimination.**—The use of the land covered hereby shall not be subject to discrimination on the basis of race, color, or religion. The permittee shall not discriminate against any person on the basis of race, color, or religion in the use of the land covered hereby.

**5. Damages.**—The permittee shall pay the United States for any damage resulting from this use which would not reasonably be inherent in the use which the permittee is authorized to make of the land described in this permit.

**6. Construction.**—No building or other structure shall be erected under this permit except upon prior approval of plans and specifications by the Director, National Park Service, and the premises and all appurtenances thereto shall be kept in a safe, sanitary, and sightly condition.

**7. Removal of structures and improvements.**—Upon the expiration of this permit by limitation of time or its termination for any reason prior to its expiration date, the permittee, if all charges due the Government hereunder have been paid, shall remove within such reasonable period as is determined by the Superintendent, but not to exceed 90 days unless otherwise stipulated in this permit, all structures and improvements placed on the premises by him, and shall restore the site to its former condition under the direction of the Superintendent. If the permittee fails to remove all such structures and improvements within the aforesaid period, they shall become the property of the United States, but that will not relieve the permittee of liability for the cost of their removal and the restoration of the site.

**8. Water Rights.**—The United States reserves the rights of perfect title to all rights for water which may be developed or used in connection with this permit and shall furnish water to the permittee when available, at reasonable rates to be approved by the Director, National Park Service. Should such water service be unavailable or inadequate, the permittee may, with prior approval of the Director, provide the same at his own expense, subject to such special requirements as may be prescribed.

**9. Disposal of refuse.**—The permittee shall dispose of brush and other refuse as required by the Superintendent.

**10. Timber cutting.**—No timber may be cut or destroyed without first obtaining a permit therefor from the Director, National Park Service.

**11. Fire prevention and suppression.**—The permittee and his employees shall take all reasonable precautions to prevent forest, brush, grass, and structural fires and also shall assist the Superintendent in extinguishing such fires in the vicinity of any tract which may be used hereunder.

**12. Soil erosion.**—The permittee shall take adequate measures, as directed and approved by the Superintendent to restrict and prevent soil erosion on the lands covered hereby and shall so utilize such lands as not to contribute to erosion on adjoining lands.

**13. Benefit.**—Neither Members of, nor Delegates to Congress, or Resident Commissioners shall be admitted to any share or part of this permit or derive, either directly or indirectly, any pecuniary benefit to arise therefrom: *Provided however,* That nothing herein contained shall be construed to extend to any incorporated company, if the permit be for the benefit of such corporation.

**14. Assignment.**—This permit may not be transferred or assigned without the consent of the Director, National Park Service, in writing.

**15. Revocation.**—This permit may be terminated upon breach of any of the conditions herein or at the discretion of the Director, National Park Service.

|                                       |  |            |                                                                   |          |  |
|---------------------------------------|--|------------|-------------------------------------------------------------------|----------|--|
| Form 10-114a<br>(Dec. 1956)           |  |            | UNITED STATES DEPARTMENT OF THE INTERIOR<br>NATIONAL PARK SERVICE |          |  |
| SPECIAL USE PERMIT CONTINUATION SHEET |  |            |                                                                   |          |  |
| AREA                                  |  | PERMIT NO. |                                                                   | PAGE NO. |  |
| Lake Mead National Recreation Area    |  | 3:602:705  |                                                                   | 1        |  |

16. This temporary water line is to be installed and laid on the ground and confined to a 20 foot strip. The first section, about 1 mile long extending from the lakeshore, is to be laid in the washes tying into the existing jeep trail, which it is to follow to the highway.

17. Any disturbance to trail, washes and general landscape will be obliterated. Upon completion of Arizona Highway Department Project No. F 039-1 (8) and FLM- 2 (4) this line is to be removed. Approval of clean up must be cleared through the Superintendent, Lake Mead National Recreation Area, or his designated representative.

ATTACHMENT A

CONTINUATION OF CONDITIONS OF TEYS PERMIT (Form 10-114)

United States Department of the Interior  
National Park Service

The following provisions constitute Condition 4 in accordance with Executive Order No. 11246 of September 24, 1965.

Nondiscrimination. If use of the land covered by the permit will involve the employment by the permittee of a person or persons, the permittee agrees as follows:

- (1) The Permittee will not discriminate against any employee or applicant for employment because of race, creed, color, ancestry, or national origin. The Permittee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, ancestry or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Permittee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Superintendent setting forth the provisions of this non-discrimination clause.
- (2) The Permittee will, in all solicitations or advertisements for employees placed by or on behalf of the Permittee, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.
- (3) The Permittee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Superintendent, advising the labor union or workers' representative of the Permittee's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- (4) The Permittee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- (5) The Permittee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Superintendent and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Permittee's noncompliance with the nondiscrimination clauses of this permit or with any of such rules, regulations, or orders, this permit may be cancelled, terminated or suspended in whole or in part and the Permittee may be declared ineligible for further Government contracts or permits in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Permittee will include the provisions of Paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Permittee will take such action with respect to any subcontract or purchase order as the Superintendent may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, That in the event the Permittee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Superintendent, the Permittee may request the United States to enter into such litigation to protect the interests of the United States.



IN REPLY REFER TO:

## United States Department of the Interior



### NATIONAL PARK SERVICE

Water Resources Division  
1201 Oak Ridge Drive, Suite 250  
Fort Collins, Colorado 80525

November 21, 1994

TO: Steve Spearman, LAME  
FROM: Larry Martin, Hydrogeologist, Water Resources Division  
Subject: Wells at the Willow Beach Fish Hatchery

Per your request through Alice Johns, I checked our files to see if we have any information regarding the wells at the fish hatchery. These wells are of interest to FWS because they reportedly produced water that was 80°+ water. Such water could potentially be used for rearing warm water endangered fish species.

The only information I could find regarding the 2 wells that did exist at the fish hatchery was in a USGS Administrative Report, "Geohydrologic Reconnaissance of Lake Mead National Recreation Area -- Hoover Dam to Mount Davis, Arizona" by C.B. Bentley, August, 1971. All of the information for these two wells are contained in tables 2 & 3 (copies attached).

The wells were drilled to depths of 80 & 90 feet and completed in granitic and metamorphic rocks. One well had a reported yield of 10 gallons per minute and a static water level 41 feet below land surface. Information for the other well is not available. Both wells were reported to be abandoned and destroyed.

Water quality data is available for both wells from the fish hatchery (see attached table 3). Water has high concentrations of sulfate, 1,800 and 1,050 mg/l and dissolved solids, 3,420 and 2,219 mg/l. Data from this table may be useful in evaluating whether new wells should be constructed in the area to supply warm water for the fish hatchery.

If I can be of any other assistance in this matter, please give me a call at (303)-225-3515.

cc: Bill Burke, LAME  
Alice Johns, WRD

*Larry Martin*

Table 2. --Occurrence of water in wells and springs in the Lake Mead National Recreation Area—Hoover Dam to Mount Davis

Location: See figure 3 for description of well-numbering system.

Land-surface altitude: Determined from U.S. Geological Survey topographic maps.

Water level: R, reported.

Yield: E, estimated; R, reported.

Use: N, not used; PS, public supply.

Remarks: C, chemical analysis of water shown in table 3.

| Location        | Name or type of occurrence            | Aquifer                        | Depth of well (feet) | Diameter of casing (inches) | Depth of casing (feet) | Land-surface altitude (feet above mean sea level) | Water level                     |                             | Yield (gpm) | Use | Remarks                                                         |
|-----------------|---------------------------------------|--------------------------------|----------------------|-----------------------------|------------------------|---------------------------------------------------|---------------------------------|-----------------------------|-------------|-----|-----------------------------------------------------------------|
|                 |                                       |                                |                      |                             |                        |                                                   | Depth below land surface (feet) | Date measured (month, year) |             |     |                                                                 |
| (B-29-22)29bad1 | Willow Beach Fish Hatchery well No. 1 | Granitic and metamorphic rocks | 90                   | -----                       | -----                  | 660                                               | -----                           | -----                       | -----       | N   | C; well abandoned and destroyed; unsurveyed.                    |
| 29bad2          | Willow Beach Fish Hatchery well No. 2 | do.                            | 80                   | -----                       | -----                  | 660                                               | 41 R                            | 5/67                        | 10 R        | N   | C; well abandoned and destroyed; unsurveyed.                    |
| 29dec1          | Willow Beach Camp-ground well No. 1   | Younger alluvium               | 68                   | 8                           | 68                     | 660                                               | 24.9                            | 10/70                       | -----       | PS  | Unsurveyed.                                                     |
| 29dec2          | Willow Beach Camp-ground well No. 2   | do.                            | -----                | 11                          | -----                  | 660                                               | 26.0                            | 10/70                       | 425         | PS  | C; unsurveyed; 16 foot water level at high lake level reported. |
| (B-30-23)10bcd  | Hot spring                            | Volcanic rocks                 | -----                | -----                       | -----                  | 650                                               | -----                           | -----                       | 30 E        | N   |                                                                 |
| 10cac           | do.                                   | do.                            | -----                | -----                       | -----                  | 650                                               | -----                           | -----                       | 20 E        | N   | C; temperature 61.0°C.                                          |
| 10cba           | do.                                   | do.                            | -----                | -----                       | -----                  | 660                                               | -----                           | -----                       | 100 E       | N   | Temperature 61.5°C.                                             |
| 10cbb           | do.                                   | do.                            | -----                | -----                       | -----                  | 680                                               | -----                           | -----                       | 100 E       | N   |                                                                 |
| 15cbd           | do.                                   | do.                            | -----                | -----                       | -----                  | 750                                               | -----                           | -----                       | 5 E         | N   |                                                                 |
| 26bcc           | do.                                   | do.                            | -----                | -----                       | -----                  | 760                                               | -----                           | -----                       | 50 E        | N   | C; temperature 45.0°C.                                          |

Table 3. --Chemical analyses of water from selected sources and drinking-water standards, Lake Mead National Recreation Area—Hoover Dam to Mount Davis

[Analyses by U. S. Geological Survey, except as indicated. Results in milligrams per liter, except as indicated. Dissolved solids calculated as the sum of the determined constituents, using the carbonate equivalent of the bicarbonate]

| No.                  | Source                                | Date of collection | Temperature (°C) | Silica (SiO <sub>2</sub> ) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium and potassium (Na + K) | Bicarbonate (HCO <sub>3</sub> ) | Carbonate (CO <sub>3</sub> ) | Sulfate (SO <sub>4</sub> ) | Chloride (Cl) | Fluoride (F) | Dissolved solids | Hardness as CaCO <sub>3</sub> |               | Specific conductance (micro-mhos at 25°C) | pH    | Aquifer                         |
|----------------------|---------------------------------------|--------------------|------------------|----------------------------|-----------|--------------|----------------|-------------------------------|---------------------------------|------------------------------|----------------------------|---------------|--------------|------------------|-------------------------------|---------------|-------------------------------------------|-------|---------------------------------|
|                      |                                       |                    |                  |                            |           |              |                |                               |                                 |                              |                            |               |              |                  | Calcium, magnesium            | Non-carbonate |                                           |       |                                 |
| 11/1                 | Willow Beach Fish Hatchery Well No. 1 | 1962               | -----            | 32                         | Trace     | 401          | 82             | 498                           | 178                             | 0                            | 1,800                      | 311           | -----        | 3,420            | 1,380                         | 1,234         | -----                                     | 8.1   | Granitic and metamorphic rocks. |
| 11/2                 | Willow Beach Fish Hatchery Well No. 2 | 1967               | -----            | -----                      | .4        | 252          | 50             | 300                           | -----                           | -----                        | 1,050                      | 156           | 2.7          | 2,219            | 840                           | -----         | 2,780                                     | ----- | Do.                             |
| 12                   | Willow Beach Fish Hatchery Well No. 2 | 9/28/70            | 30.0             | 27                         | ----      | 118          | 33             | 196                           | 209                             | 0                            | 440                        | 128           | .9           | 1,050            | 430                           | 250           | 1,680                                     | 8.1   | Younger alluvium.               |
|                      | Hot spring                            | 10/23/70           | 61.0             | 38                         | ----      | 270          | 9.8            | 731                           | 66                              | 0                            | 845                        | 910           | 4.2          | 2,840            | 715                           | 661           | 4,400                                     | 8.0   | Volcanic rocks.                 |
|                      | do.                                   | 10/23/70           | 45.0             | 37                         | ----      | 230          | 13             | 600                           | 35                              | 0                            | 560                        | 890           | 2.8          | 2,350            | 630                           | 602           | 3,830                                     | 7.7   | Do.                             |
|                      | Lake Mohave                           | 1/9/69             | -----            | 9.5                        | 0         | 88           | 31             | 109                           | 163                             | 0                            | 300                        | 97            | .6           | 715              | 348                           | 215           | 1,150                                     | 8.2   |                                 |
| m-<br>intra-<br>-ing |                                       | -----              | -----            | -----                      | .3        | -----        | -----          | -----                         | -----                           | -----                        | 250                        | 250           | 4/.8         | 500              | -----                         | -----         | -----                                     | ----- |                                 |

Analysis reported by Willow Beach Fish Hatchery, Bureau of Sport Fisheries and Wildlife.

Analysis reported by Arizona State Health Laboratory.

Data from U.S. Public Health Service (1962).

Mandatory maximum content: 1.4 mg/l.

S.W. Type Analysis A-1, no Fe soln. USGS CHEMICAL ANALYSIS Account 20NP  
 River Basin Station Ident. No. Date Collected 1-12-68 Project 34  
 Station Name Willow Beach, Lake Mead Nat'l. Recreation Area, Arizona County Mohave Time  
 Appearance Gage Height (ft) Discharge (cfs) Collector G. Wohlbrandt  
 pH..... 7.3 Temp. (°C)      Specific Conductance, micromhos at 25°C ..... 1,520  
 Hardness as CaCO<sub>3</sub>: Total, mg/L ..... 396 Concentrations in milligrams per liter (mg/L)  
 Noncarbonate, mg/L ..... 226 Silica (SiO<sub>2</sub>)..... 28 Bicarbonate (HCO<sub>3</sub>)..... 207  
 Color..... 0 Sodium-adsorption ratio..... 3.9 Carbonate (CO<sub>3</sub>)..... 0  
 %Na..... 49 Tons per acre ft.....      Calcium (Ca)..... 111  
 Density, g/ml at 20°C      Sulfate (SO<sub>4</sub>)..... 406  
 Owner: NPS, Boulder City, Nev. Magnesium (Mg)..... 29  
 Rmks: Chlorinated Chloride (Cl)..... 126  
 Composite Period      Sodium (Na)..... 180  
 Mean Daily Discharge (cfs)      Potassium (K)..... 8.6  
 Field Conductance      Na+K (Calculated).....       
 Field pH      Dissolved Iron (Fe).... 0.00  
 Dissolved Oxygen (mg/L)      Total Iron (Fe)..... 0.01  
 B.O.D. (mg/L)      Boron (B)..... 0.75  
 Coliform (counts/100 ml)      Dissolved Solids:  
 Chemist RL, SWM, Checked By EFW Sum of Constituents..... 1020  
 Date Completed 1-8-68 Residue on Evaporation  
 Date Transmitted      at 180°C..... 1040  
 Laboratory No. 663016

Provisional records, subject to revision.

| Geological Survey                         |              | UNITED STATES DEPARTMENT OF THE INTERIOR |        |                    |              |         |  |  |  |             |          | Water Resources Division |  |  |  |             |                |          |  |  |  |  |
|-------------------------------------------|--------------|------------------------------------------|--------|--------------------|--------------|---------|--|--|--|-------------|----------|--------------------------|--|--|--|-------------|----------------|----------|--|--|--|--|
| Experimental (1966)                       |              | Ground Water Analysis                    |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| State                                     | Ariz.        | County                                   | Mohave | Latitude           |              |         |  |  |  | Longitude   |          |                          |  |  |  | Seq. No.    |                |          |  |  |  |  |
| Local well No.                            | Willow Beach | Owner                                    | NPS    | Collected by       | Cal L. Keele |         |  |  |  | Lab. Anal.  | A-1      |                          |  |  |  | Project No. | 20-NPS-C       |          |  |  |  |  |
| Lake Mead Nat'l. Recreation Area          |              |                                          |        | Boulder City, Nev. |              |         |  |  |  | No Fe soln. |          |                          |  |  |  |             |                |          |  |  |  |  |
| WBF                                       |              |                                          |        | Appearance         | Wc           | Wa      |  |  |  |             | Lab. No. | 61650                    |  |  |  |             | Sampling depth | 26 29 30 |  |  |  |  |
| Kx10 <sup>6</sup>                         | 22.2         | 358                                      | R      | MC1                | 257          | 1390    |  |  |  |             | 1390     |                          |  |  |  |             |                |          |  |  |  |  |
| pH                                        | 7.5          |                                          |        | Temperature °F     |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| SiO <sub>2</sub>                          | 50.5         | 10                                       | ml     | 23                 | 23           |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Abs                                       | 459          |                                          |        | ppm                | 42           |         |  |  |  | epm         | 44       |                          |  |  |  |             |                |          |  |  |  |  |
| Ca                                        | 2.04         | 10                                       | ml     | 102                | 102          |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Mg                                        | 0.05         | 2.04                                     |        |                    | 45           | 49      |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Subtotal cations (Ca, Mg)                 |              |                                          |        |                    |              | 6.96    |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Na                                        | 51.8         | 169                                      | 169    | 735                |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| K                                         | 0.10         | 62.1                                     | 62     | 62                 |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Subtotal cations (Ca, Mg, Na, K)          |              |                                          |        |                    |              | 14.47   |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| HCO <sub>3</sub>                          | 9.60         | 50                                       | ml     | 192                | 192          |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| CO <sub>2</sub>                           | 0.00         | 7.60                                     |        |                    | 62           | 65      |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| SO <sub>4</sub>                           | 25.10        | 370                                      | 370    | 377                |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Cl                                        | 25           | 113                                      | 113    | 113                |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Source of data                            | d            | 79                                       | Card Q | 80                 | Q            |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| F                                         | 10           | 1.340                                    | 1.340  | 0.5                |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| NO <sub>3</sub>                           | 0.117        | 10                                       | ml     | 20                 | 20           |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| PO <sub>4</sub>                           |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Abs                                       |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| HPO <sub>4</sub>                          |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Total anions                              |              |                                          |        |                    |              | 14.54   |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| B                                         | 1.28         | 1.0                                      | ml     | 0.71               | 0.71         |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Al                                        |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Abs (Al + Fe)                             |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Remarks and explanation on other side     |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Fe                                        | 1.91         | 25                                       | ml     | 0.02               | 0.02         |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Total                                     |              |                                          |        |                    |              | 42      |  |  |  |             | 45       |                          |  |  |  |             |                |          |  |  |  |  |
| Dissol.                                   |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Mn                                        |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Total                                     |              |                                          |        |                    |              | 46      |  |  |  |             | 49       |                          |  |  |  |             |                |          |  |  |  |  |
| Dissol.                                   |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Cu                                        |              |                                          |        |                    |              | 50      |  |  |  |             | 52       |                          |  |  |  |             |                |          |  |  |  |  |
| Pb                                        |              |                                          |        |                    |              | 53      |  |  |  |             | 54       |                          |  |  |  |             |                |          |  |  |  |  |
| Zn                                        |              |                                          |        |                    |              | 55      |  |  |  |             | 57       |                          |  |  |  |             |                |          |  |  |  |  |
| Subtotal cations (Al, Fe, Mn, Cu, Pb, Zn) |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Subtotal cations (Ca, Mg, Na, K)          |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Total cations                             |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Dissolved solids                          |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Residue at 180°                           | 100          |                                          |        |                    |              | 923     |  |  |  |             | 58       |                          |  |  |  | 63          |                |          |  |  |  |  |
| Dish No.                                  | X-127        |                                          |        |                    |              | 58.7230 |  |  |  |             | 928      |                          |  |  |  | 69          |                |          |  |  |  |  |
| Calculated                                | 58.6307      |                                          |        |                    |              | 928     |  |  |  |             | 64       |                          |  |  |  | 69          |                |          |  |  |  |  |
| Hardness                                  |              |                                          |        |                    |              |         |  |  |  |             |          |                          |  |  |  |             |                |          |  |  |  |  |
| Ca, Mg                                    | 25           |                                          |        |                    |              | 348     |  |  |  |             | 348      |                          |  |  |  | 73          |                |          |  |  |  |  |
| Noncarbonate                              | 8.70         |                                          |        |                    |              | 190     |  |  |  |             | 190      |                          |  |  |  | 74          |                |          |  |  |  |  |
| Color                                     | 3            |                                          |        |                    |              | 78-79   |  |  |  |             | 3        |                          |  |  |  | 80 R        |                |          |  |  |  |  |

Provisional records, subject to revision.

| State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | County                                                                    | Lat. | Long. | Seq. No. | Date | Samp. depth | c |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------|-------|----------|------|-------------|---|------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|---------------------------------|----------------------------------------------------|--|----------|--|--------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <div style="float: left; width: 30%;">           Remarks:<br/>           DD: 7/3/56<br/>           Depth: 68'<br/>           Producing intervals from: 16' to 52'<br/>           Use: Dom.         </div> <div style="float: right; width: 70%;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">           Br _____ ml<br/> <div style="text-align: right;">26 28</div> </td> <td style="width: 50%;">           Radiochemical<br/>           Alpha (pc/l)<br/> <div style="text-align: right;">55</div> </td> </tr> <tr> <td>           I _____ ml<br/> <div style="text-align: right;">29 31</div> </td> <td>           Beta (pc/l)<br/> <div style="text-align: right;">58 60</div> </td> </tr> <tr> <td>           Alk. as CaCO<sub>3</sub><br/> <div style="text-align: right;">32 35</div> </td> <td>           Ra (pc/l)<br/> <div style="text-align: right;">61 63</div> </td> </tr> <tr> <td>           Free CO<sub>2</sub><br/> <div style="text-align: right;">36 38</div> </td> <td>           U (ug/l)<br/> <div style="text-align: right;">64 66</div> </td> </tr> <tr> <td>           SAR<br/> <div style="text-align: right;">(3.7) 39 41</div> </td> <td>           Other data (67-79)<sup>e</sup> </td> </tr> <tr> <td>           RSC<br/> <div style="text-align: right;">42 44</div> </td> <td></td> </tr> <tr> <td colspan="2">           Organics         </td> </tr> <tr> <td>           MBAS (ABS) _____ ml<br/> <div style="text-align: right;">45 47</div> </td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td colspan="2">           a Master card A (21-34)<br/>           b Master card A (52-66)<br/>           c Type:<br/>           1. Pumped      4. Spigot<br/>           2. Bucket      5. Bailer<br/>           3. Forest      6. Special<br/>           d Source of data:<br/>           1. USGS      5. Industrial<br/>           2. UPHS      6. Private<br/>           3. State Health      7. Educational<br/>           4. State         </td> </tr> </table> </div> |                                                                           |      |       |          |      |             |   | Br _____ ml<br><div style="text-align: right;">26 28</div> | Radiochemical<br>Alpha (pc/l)<br><div style="text-align: right;">55</div> | I _____ ml<br><div style="text-align: right;">29 31</div> | Beta (pc/l)<br><div style="text-align: right;">58 60</div> | Alk. as CaCO <sub>3</sub><br><div style="text-align: right;">32 35</div> | Ra (pc/l)<br><div style="text-align: right;">61 63</div> | Free CO <sub>2</sub><br><div style="text-align: right;">36 38</div> | U (ug/l)<br><div style="text-align: right;">64 66</div> | SAR<br><div style="text-align: right;">(3.7) 39 41</div> | Other data (67-79) <sup>e</sup> | RSC<br><div style="text-align: right;">42 44</div> |  | Organics |  | MBAS (ABS) _____ ml<br><div style="text-align: right;">45 47</div> |  |  |  |  |  |  |  |  |  | a Master card A (21-34)<br>b Master card A (52-66)<br>c Type:<br>1. Pumped      4. Spigot<br>2. Bucket      5. Bailer<br>3. Forest      6. Special<br>d Source of data:<br>1. USGS      5. Industrial<br>2. UPHS      6. Private<br>3. State Health      7. Educational<br>4. State |  |
| Br _____ ml<br><div style="text-align: right;">26 28</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Radiochemical<br>Alpha (pc/l)<br><div style="text-align: right;">55</div> |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| I _____ ml<br><div style="text-align: right;">29 31</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Beta (pc/l)<br><div style="text-align: right;">58 60</div>                |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| Alk. as CaCO <sub>3</sub><br><div style="text-align: right;">32 35</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ra (pc/l)<br><div style="text-align: right;">61 63</div>                  |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| Free CO <sub>2</sub><br><div style="text-align: right;">36 38</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | U (ug/l)<br><div style="text-align: right;">64 66</div>                   |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| SAR<br><div style="text-align: right;">(3.7) 39 41</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Other data (67-79) <sup>e</sup>                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| RSC<br><div style="text-align: right;">42 44</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| Organics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| MBAS (ABS) _____ ml<br><div style="text-align: right;">45 47</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| a Master card A (21-34)<br>b Master card A (52-66)<br>c Type:<br>1. Pumped      4. Spigot<br>2. Bucket      5. Bailer<br>3. Forest      6. Special<br>d Source of data:<br>1. USGS      5. Industrial<br>2. UPHS      6. Private<br>3. State Health      7. Educational<br>4. State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |
| <div style="float: left; width: 30%;">           Chemist <u>Richard L. Lapp</u><br/>           Date began <u>JUN 13 1967</u><br/>           Punched by <u>○</u> </div> <div style="float: right; width: 70%;">           Checked by <u>E. F. WILLIAMS</u><br/>           Date transmitted _____<br/>           Verified _____<br/>           e Indicate constituent and card columns.<br/>           Card S         </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                           |      |       |          |      |             |   |                                                            |                                                                           |                                                           |                                                            |                                                                          |                                                          |                                                                     |                                                         |                                                          |                                 |                                                    |  |          |  |                                                                    |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                     |  |

Geological Survey Lake Mead Rec. Area  
Experimental form: qw-sw (1966)

UNITED STATES DEPARTMENT OF THE INTERIOR  
Surface Water Analysis

A-1 + Tot Fe  
- Fe Sol'n

Frequency <sup>a</sup> \_\_\_\_\_ M <sup>b</sup> D <sup>c</sup> Y

River basin Colorado Sta. Ident. No. 1 Date of collection Jan. 12, 1966

Location Willow Beach Lake, Ariz. County Mohave Discharge (cfs) 15 Time 21

Collected by \_\_\_\_\_ Lab. No. 58963 Project No. NPS Appearance Wc \_\_\_\_\_ Wa \_\_\_\_\_ Gage height (ft) \_\_\_\_\_

| ppm              |                             | epm |  | ppm                            |                                       | epm |  |
|------------------|-----------------------------|-----|--|--------------------------------|---------------------------------------|-----|--|
| SiO <sub>2</sub> | f 5.12 10 ml (90) 9.0       |     |  | HCO <sub>3</sub>               | 50 ml                                 |     |  |
|                  | 175                         |     |  |                                | 15.40<br>7.90<br>7.50                 |     |  |
| Al               | f _____ ml                  |     |  | CO <sub>2</sub>                | 50 ml                                 |     |  |
|                  |                             |     |  |                                | 0.00                                  |     |  |
| bs (Al + Fe)     | _____ ml                    |     |  | SO <sub>4</sub>                | 50 ml                                 |     |  |
| re               | f 1.94 25 ml (0.02) 0.02    |     |  |                                | 4.27<br>0.00<br>4.27<br>-0.22<br>4.05 |     |  |
| Total            | _____ ml Abs. 0.12 28 ml 31 |     |  | Cl                             | 25 ml (10.9) 10.9                     |     |  |
| Dissolved        | _____ ml                    |     |  |                                | 3.07                                  |     |  |
| Abs              | _____ ml                    |     |  | Mg · AgNO                      | 0.5                                   |     |  |
| Mn               | f _____ ml                  |     |  |                                | 5.53<br>-1.0<br>5.43                  |     |  |
| Total            | _____ ml Abs. _____         |     |  | F                              | 10 ml Abs. 4.10 (0.3) 0.3             |     |  |
| Dissolved        | _____ ml Abs. _____         |     |  |                                | 0.030                                 |     |  |
| Ca               | 25 ml (4.84) 9.7            |     |  | Sample No. c                   | 79                                    |     |  |
|                  | 4.84                        |     |  | Card No. 1                     | 80                                    |     |  |
| Mg               | _____ ml (30) 3.0           |     |  | NO <sub>3</sub>                | 10 ml (3.0) 3.0                       |     |  |
|                  | 2.48                        |     |  |                                | 11.91<br>2.50<br>9.41                 |     |  |
| Sr               | _____ ml                    |     |  | PO <sub>4</sub>                | _____ ml                              |     |  |
| Na               | 50-200 ml 30.14             |     |  |                                |                                       |     |  |
| Reading          | 326 (120) 12.0              |     |  | Abs                            | _____ %                               |     |  |
| K                | _____ ml (5.5) 5.5          |     |  | HPO <sub>4</sub>               | _____ %                               |     |  |
| Reading          | 54.7 (5.5) 5.5              |     |  | H <sub>2</sub> PO <sub>4</sub> | _____ %                               |     |  |
| Li               | _____ ml                    |     |  | Total anions                   | 12.60                                 |     |  |
| Reading          | _____                       |     |  |                                | 12.58                                 |     |  |
| Total cations    | 12.68                       |     |  |                                |                                       |     |  |

B 142 1 ml Abs. 190 (0.27) 0.27

Dissolved solids: 50 ml 42.5466 (784) 78.4

Residue at 180°C 42.5074

Dish No. 4-5 0.0372

Calculated (784) 78.4

Hardness: 30.75

Ca, Mg 21.60 25 ml (366) 36.6

TH 7.32

Noncarbonate (243) 24.3

Acidity H+1 \_\_\_\_\_ ml

SAR (2.7) 2.7

Kx10<sup>6</sup> 23.5 T 350 R KC1 288 (220) 22.0

pH 7.4 Color 5

Oxygen cons. filtered or DO 65 67

Oxygen cons. unfiltered or BOD 68 70

Organics: Phenol 71 73

Organics: MBAS 74 76

Temperature °F 77-78

Sample No. c 79 Card No. 2 80

Chemist JOE O'NEILL E. F. WILLIAMS

Date began \_\_\_\_\_ Completed \_\_\_\_\_

Punched by \_\_\_\_\_ Verified by \_\_\_\_\_

Remarks and explanation (other side)

Provisional records, subject to revision.

Geological: Lake Mead Rec. Area

Experimental: gw-gw (1966)

UNITED STATES DEPARTMENT OF THE INTERIOR  
Ground Water Analysis

State Ariz. 02 County Mohave M10 Latitude 35 11 00 Longitude 112 18 00 Seq. No. 19 Date coll. 01 11 26 66

Local well No. a Willow Beach Well Owner b U.S. NPS Collected by \_\_\_\_\_ Lab. Anal. A-1-1000 Project No. NPS

WBF \_\_\_\_\_ Appearance Wc \_\_\_\_\_ Wa \_\_\_\_\_ Lab. No. 58965 Sampling depth 28 29 Type c 30

|                                                                                                               |                                                                                                   |                                                                           |
|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Kx10 <sup>6</sup><br><u>23.0</u> <u>352</u> R KCl <u>270</u> <u>(300)</u> <u>1</u> <u>3</u> <u>0</u> <u>0</u> | SO <sub>4</sub> <u>50</u> <u>→ 200</u> <u>(351)</u> <u>3</u> <u>5</u> <u>1</u> <u>1</u> <u>73</u> | Fe f <u>1.94</u> <u>25</u> ml <u>(0.10)</u> <u>0</u> <u>1</u> <u>0</u>    |
| pH <u>7.3</u> <u>7.3</u> Temperature °F <u>72</u>                                                             | f <u>_____</u> ml <u>68</u> <u>4.46</u> <u>2.08</u> <u>4.40</u> <u>4.39</u>                       | Total <u>_____</u> ml Abs <u>0.51</u> <u>42</u> <u>45</u>                 |
| Ca <u>4.61</u> <u>25</u> ml <u>(92)</u> <u>9</u> <u>2</u> <u>4.59</u>                                         | Cl <u>25</u> ml <u>(110)</u> <u>1</u> <u>1</u> <u>1</u> <u>0</u>                                  | Dissol. <u>_____</u> ml Abs <u>_____</u>                                  |
| Mg <u>_____</u> ml <u>(22)</u> <u>2</u> <u>2</u> <u>1.81</u>                                                  | Mg · AgNO <sub>3</sub> <u>4.0</u> <u>17.30</u> <u>14.50</u> <u>2.80</u> <u>2.75</u>               | Mn f <u>_____</u> ml <u>_____</u>                                         |
| Subtotal cations (Ca, Mg) <u>6.40</u>                                                                         | Source of data d <u>79</u> Card Q <u>80</u> Q <u>3.10</u>                                         | Total <u>_____</u> ml Abs <u>_____</u> <u>46</u> <u>49</u>                |
| Na <u>25</u> <u>→ 50</u> ml <u>(153)</u> <u>1</u> <u>5</u> <u>3</u> <u>6.66</u>                               | F <u>10</u> ml Abs <u>1.318</u> <u>(0.6)</u> <u>0.6</u> <u>0.93</u>                               | Dissol. <u>_____</u> ml Abs <u>_____</u>                                  |
| Reading <u>81.5</u> <u>55.1</u> <u>odil</u> ml <u>(5.5)</u> <u>5</u> <u>5</u> <u>0.14</u>                     | NO <sub>3</sub> <u>115</u> <u>10</u> ml Abs <u>400</u> <u>(48)</u> <u>4</u> <u>8</u> <u>0.08</u>  | Cu <u>_____</u> ml <u>50</u> <u>52</u>                                    |
| Subtotal cations (Ca, Mg, Na, K) <u>13.20</u>                                                                 | PO <sub>4</sub> <u>_____</u> f Abs <u>_____</u> <u>33</u> <u>35</u>                               | Pb <u>_____</u> ml <u>53</u> <u>54</u>                                    |
| HCO <sub>3</sub> <u>30.70</u> <u>50</u> ml <u>(176)</u> <u>1</u> <u>7</u> <u>6</u> <u>2.88</u>                | Abs <u>_____</u> % <u>_____</u>                                                                   | Zn <u>_____</u> ml <u>55</u> <u>57</u>                                    |
| CO <sub>3</sub> <u>21.90</u> <u>8.80</u> <u>(176)</u> <u>1</u> <u>7</u> <u>6</u> <u>2.88</u>                  | HPO <sub>4</sub> <u>_____</u> % H <sub>2</sub> PO <sub>4</sub> <u>_____</u>                       | Subtotal cations (Al, Fe, Mn, Cu, Pb, Zn) <u>13.20</u>                    |
| Remarks and explanation on other side                                                                         | Total anions <u>13.40</u>                                                                         | Subtotal cations (Ca, Mg, Na, K) <u>13.20</u>                             |
|                                                                                                               | B <u>1.42</u> <u>1</u> ml <u>(0.54)</u> <u>0</u> <u>5</u> <u>4</u>                                | Total cations <u>13.20</u>                                                |
|                                                                                                               | Abs <u>380</u> <u>(0.54)</u> <u>36</u> <u>38</u>                                                  | Dissolved solids <u>44.0636</u> <u>(852)</u> <u>8</u> <u>5</u> <u>2</u>   |
|                                                                                                               | Al <u>_____</u> ml <u>39</u> <u>41</u>                                                            | Residue at 180° <u>46.021050</u> <u>58</u> <u>63</u>                      |
|                                                                                                               | Abs (Al + Fe) <u>_____</u>                                                                        | Dish No. <u>27</u> <u>(848)</u> <u>8</u> <u>4</u> <u>8</u>                |
|                                                                                                               |                                                                                                   | Calculated <u>_____</u> <u>64</u> <u>69</u>                               |
|                                                                                                               |                                                                                                   | Hardness <u>9.00</u> <u>25</u> ml <u>(320)</u> <u>3</u> <u>2</u> <u>0</u> |
|                                                                                                               |                                                                                                   | Ca, Mg <u>1.00</u> <u>8.00</u> <u>70</u> <u>73</u>                        |
|                                                                                                               |                                                                                                   | Noncarbonate <u>176</u> <u>1</u> <u>7</u> <u>6</u>                        |
|                                                                                                               |                                                                                                   | Color <u>5-78-79</u> <u>5</u> Card R <u>80</u> R                          |

Provisional records, subject to revision.

Docket No. 14

SW. Type Analysis A-1 U.S. GEOLOGICAL SURVEY ANALYTICAL NOTES Project NRS Collector M. C. Ott  
 State Arizona County Mohave City (at or near) Willow Beach  
 Latitude-Longitude \_\_\_\_\_ Well No. \_\_\_\_\_ Date Collected 1/20/65  
 Owner Govt. Date Drilled 1956 Cased to \_\_\_\_\_ Depth (ft) 68 Diam. (in) \_\_\_\_\_

pH 7.7 7.7 Temp. (°F) 80  
 Hardness as CaCO<sub>3</sub> Total 316 316  
 Noncarbonate 168 168  
 S.A.R. 4.2 4.2  
 % Na 53 53 T/af. 1.20 1.20  
 Density (g/ml) \_\_\_\_\_  
 V.B.F. sand - gravel  
 Producing Intervals from 16' to 52'  
 W.L. 16'  
 Sampled after Pumping (Time) \_\_\_\_\_  
 Yield Est. 250 GM 215 GPM  
 Point of Collection \_\_\_\_\_  
 Appearance \_\_\_\_\_  
 Use Dom.  
 Remarks: Source: Well  
 Chemist Kim Ong Checked By E.F.W.  
 Date Completed MAR 31 1965  
 Date Transmitted \_\_\_\_\_  
 Laboratory No. 56342

| Spec. Cond. (micromhos at 25°C): T <u>243</u> R KCl <u>343</u> R Sample <u>256</u> (1340) <u>1,340</u>                  |     |     |                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------|-----|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                         | PPM | EPM |                                                                                                                                                        |
| Silica f <u>48.6</u> vol <u>10</u> (21) <u>21</u><br>o.d. <u>0.44</u>                                                   |     |     | Bicarbonate <u>16.55</u> (189) <u>180</u> 2.95<br>vol <u>50</u> <u>7.55</u> 81<br>Carbonate <u>9.00</u> (0) <u>0</u> 0.00                              |
| Calcium <u>4.56</u> EPM TH <u>6.32</u><br>vol <u>25</u> <u>0.00</u> (91) <u>91</u> 4.54<br>vol <u>25</u> <u>4.56</u>    |     |     | Sulfate <u>4.64</u><br>vol <u>50</u> <u>0.80</u> (366) <u>366</u> 7.62<br>vol <u>50</u> <u>0.07</u> 300<br>vol <u>50</u> <u>4.57</u>                   |
| Magnesium <u>35.60</u><br>vol <u>25</u> <u>21.70</u> (22) <u>22</u> 1.78<br>vol <u>25</u> <u>7.90</u>                   |     |     | Chloride <u>17.30</u><br>vol <u>25</u> <u>14.60</u> (106) <u>106</u> 2.99<br>vol <u>25</u> <u>2.70</u> 705<br>AgNO <sub>3</sub> <u>1.0</u> <u>2.65</u> |
| Sodium vol <u>50</u> <u>200</u><br>0-100 range <u>58.07</u> (170) <u>170</u> 7.40<br>vol <u>25</u> <u>58.0</u> 42.5 x 1 |     |     | Fluoride vol <u>10</u><br>o.d. <u>1.31</u> (0.6) <u>0.6</u> 0.03                                                                                       |
| Potassium vol <u>50</u><br>0-10 range <u>58.17</u> (5.9) <u>5.9</u> 0.15<br>vol <u>25</u> <u>58.6</u>                   |     |     | Nitrate f <u>22.9</u> vol <u>5</u><br>o.d. <u>0.626</u> (14) <u>14</u> 0.23                                                                            |
| Na+K (Calculated) _____                                                                                                 |     |     | Boron f <u>1.53</u> vol <u>1</u><br>o.d. <u>0.45</u> (0.7) <u>0.70</u>                                                                                 |
| Iron f <u>1.92</u> vol <u>25</u>                                                                                        |     |     | Sum of Constituents (886) <u>886</u>                                                                                                                   |
| In sol. o.d. _____                                                                                                      |     |     | Residue on Evaporation at 180°C<br>vol <u>100</u> <u>63.2187</u> (891) <u>891</u><br>dish <u>131</u> <u>63.1246</u> 0.0891                             |
| Total: o.d. <u>0.125</u> (0.24) <u>0.24</u>                                                                             |     |     | TOTAL CATIONS <u>13.87</u> TOTAL ANIONS <u>13.77</u>                                                                                                   |

Provisional records, subject to revision.

FORM 9-1367 (9-1960)  
U. S. DEPT. OF INTERIOR  
GEOLOGICAL SURVEY

ANALYTICAL STATEMENT  
Well No. 1 NPS

GW COR Mohave (Ariz) 79793  
LAB 54825

Location 22 miles SE of Date of collection Recd. July 20, 1964  
Boulder City, Nev. Ignition Loss 1 Color 1 epm ppm  
SE 1 sec. 29 T29N R22W GSRM Dissolved Solids: SiO<sub>2</sub> 24  
Source (type of well) Lake infiltration Residue at 180°C 874 Fe (total) 0.05  
Owner NPS - Box 127 Calculated (Sum) 883  
Boulder City, Nev. Tons per Acre Foot 1.20 Ca 4.34 87  
Date drilled July 1956 Cased to ft Hardness as CaCO<sub>3</sub> 298 Mg 1.62 20  
Depth 65' Diam Non-carbonate Hardness 170 NO 7.22 166  
Use Sand & gravel 1 No 54 4.2 ps 7.6 K 0.16 6.4  
Water level varies ft Specific Conductance 13.34  
Sampled after pumping years (micromhos at 25°C) 1,310 Na + K  
Yield 200 GPM (meas) 0000 pump  
Pt of well Willow Beach, Ariz. campground HCO<sub>3</sub> 2.57 157  
Appearance Clear CO<sub>3</sub> 0.00 0  
Temp (°F) 80 Use Dom., Ps, Irr. Producing intervals SO<sub>4</sub> 7.37 354  
Collector from 10' to 65' Cl 2.88 102  
Chemist KO F 0.04 0.7  
Date completed Aug. 14, 1964 NO<sub>3</sub> 0.73 45  
Checked by RLL 13.59 B 0.56  
Date transmitted \_\_\_\_\_

Provisional records, subject to revision.

FORM 9-1367 (1960)  
U. S. DEPT. OF THE INTERIOR  
GEOLOGICAL SURVEY

ANALYTICAL STATEMENT  
NPS

SW CORNER Mohave (Ariz) 79783  
LAB NO. 54727

|                                                 |                                                         |                                               |  |  |
|-------------------------------------------------|---------------------------------------------------------|-----------------------------------------------|--|--|
| Location <u>22 miles SE of</u>                  |                                                         | Date of collection <u>Recd. July 20, 1964</u> |  |  |
| <u>Boulder City, Nev.</u>                       |                                                         | Ignition Loss _____ Color <u>3</u>            |  |  |
| <u>SE 1/4 sec. 29 T29N R22W</u>                 |                                                         | Dissolved Solids: _____                       |  |  |
| Source (type of well): <u>GSRM, Lake Mohave</u> |                                                         | Residue at 180°C <u>731</u>                   |  |  |
| Owner <u>NPS - Box 127</u>                      |                                                         | Calculated (Sum) <u>709</u>                   |  |  |
| <u>Boulder City, Nev.</u>                       |                                                         | Tons per Acre Foot <u>0.96</u>                |  |  |
| Date driled _____                               | Cased to _____ ft                                       | Hardness as CaCO <sub>3</sub> <u>338</u>      |  |  |
| Depth _____                                     | Diam _____                                              | Non-carbonate Hardness <u>212</u>             |  |  |
| WSP _____                                       | T H <sub>2</sub> <u>40</u> SAR <u>2.5</u> pH <u>7.5</u> |                                               |  |  |
| Water level _____ ft                            | Specific Conductance _____                              |                                               |  |  |
| Sampled after pumping _____ hrs                 | (micromhos at 25°C) <u>1,100</u>                        |                                               |  |  |
| Yield _____ GPM (meas or est)                   |                                                         |                                               |  |  |
| Pt of coll. <u>Willow Beach ramp area</u>       |                                                         |                                               |  |  |
| Appearance <u>Clear</u>                         |                                                         |                                               |  |  |
| Temp (°F) <u>60</u> Use _____                   |                                                         |                                               |  |  |
| Collector _____                                 |                                                         |                                               |  |  |
| Chemist <u>KO</u>                               |                                                         |                                               |  |  |
| Date completed <u>Aug. 3, 1964</u>              |                                                         |                                               |  |  |
| Checked by <u>JON</u>                           |                                                         |                                               |  |  |
| Date transmitted _____                          |                                                         |                                               |  |  |

|                  |              |               |
|------------------|--------------|---------------|
|                  | _____ epm    | _____ ppm     |
| SiO <sub>2</sub> |              | <u>10</u>     |
| Fe (total)       |              | <u>0.03</u>   |
| Ca               | <u>4.59</u>  | <u>92</u>     |
| Mg               | <u>2.17</u>  | <u>26</u>     |
| Na               | <u>4.57</u>  | <u>105</u>    |
| K                | <u>0.13</u>  | <u>5.1</u>    |
|                  | <u>11.46</u> |               |
| Na + K           |              |               |
| HCO <sub>3</sub> | <u>2.51</u>  | <u>153</u>    |
| CO <sub>3</sub>  | <u>0.00</u>  | <u>0</u>      |
| SO <sub>4</sub>  | <u>6.20</u>  | <u>298</u>    |
| Cl               | <u>2.68</u>  | <u>95</u>     |
| F                | <u>0.02</u>  | <u>0.4</u>    |
| NO <sub>3</sub>  | <u>0.04</u>  | <u>2.3</u>    |
|                  | <u>11.45</u> | <u>B 0.13</u> |

Provisional records, subject to revision.

9-285a  
(Jan 1927)UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
WATER RESOURCES BRANCH

DOCKET NO. 14

## RECORD OF WELL

1. Location: State Arizona County Mohave  
 Nearest P. O. Boulder City Direction from P. O. SE  
 Distance from P. O. \_\_\_\_\_ miles; \_\_\_\_\_  $\frac{1}{4}$  sec. \_\_\_\_\_, T. \_\_\_\_\_, R. \_\_\_\_\_  
 If in city, give street and number Willow Beach
2. Owner: National Park Service Address Boulder City, Nevada  
 Driller: Effinger Bros. Address Box 589 Las Vegas, Nevada
3. Situation: Is well on upland, in valley, or on hillside? Valley
4. Elevation of top of well: \_\_\_\_\_ ft. \_\_\_\_\_ the level of \_\_\_\_\_  
(Above or below)
5. Type of well: Drilled (Dug, driven, bored, or drilled); kind of drilling rig used Cable Tools (See, depot, lake, or stream)  
(Solid tool, jetting, rotary, etc.)
6. Depth of well: 68 ft.; year in which well was finished 1956  
 Does well enter rock? No; if so, at what depth? \_\_\_\_\_ ft.; kind of rock loose gravel
7. Diameter: At top 8 5/8" OD inches; at bottom 8" ID inches.
8. Principal water bed: Gravel, sand & gravel (Gravel, sand, clay, or rock. If rock, state kind)  
 Depth to principal water bed 16 ft.; thickness of bed 52 ft.  
 If other water supplies were found, give depth to each \_\_\_\_\_
9. Casings: Kind Steel; size 68; length 68 ft.; between depths of \_\_\_\_\_ and \_\_\_\_\_ ft.  
 Kind \_\_\_\_\_; size \_\_\_\_\_; length \_\_\_\_\_ ft.; between depths of \_\_\_\_\_ and \_\_\_\_\_ ft.  
 Kind \_\_\_\_\_; size \_\_\_\_\_; length \_\_\_\_\_ ft.; between depths of \_\_\_\_\_ and \_\_\_\_\_ ft.
- Packers (if any): Depth at which packers were used None; kind \_\_\_\_\_
- Screen or Strainer: Was well finished with screen? None; kind of screen Perforated casing  
 length of screen \_\_\_\_\_ ft.; diameter \_\_\_\_\_ inches; size of openings \_\_\_\_\_
10. Head: Does well at present overflow without pumping? No; did it overflow when new? No  
 if flowing, give pressure X lb. per sq. inch; or height water will rise in a pipe X ft. above surface;  
 original pressure or head \_\_\_\_\_; if not flowing, give water level in well 16 ft. below surface.
11. Pump: Is the well pumped? Tested; kind of pump Berkeley rite angle turbine  
 size or capacity of pump \_\_\_\_\_; kind of power \_\_\_\_\_
12. Yield: Natural flow at present (if any) None gallons per minute; original flow \_\_\_\_\_ gallons per minute;  
 well has been pumped at \_\_\_\_\_ gallons per minute continuously for \_\_\_\_\_ hours;  
 quantity of water ordinarily obtained from well \_\_\_\_\_ gallons per day.
13. Use: For what purpose is the water used? Domestic
14. Quality of the water: Hard (Hard or soft, fresh or salty, etc.); is there an analysis? No
15. Cost of well, not including pump: \$812.00 Temperature of water 80 ° F.
- Name of person filling blank A. F. Effinger  
 Date July 9, 1956 Address Box 589 Las Vegas, Nevada

On the back of this sheet give the record of the beds through which the well passes and any other facts not given above.

6-9642

## LOG OF WELL

[illegible]

Docket No. 1

Sample from Willow Beach Well, Depth 68 Ft.

Tested 7/4/56

|                                              |            |
|----------------------------------------------|------------|
| Alkalinity to Phenolphthalein -----          | 0 - P.P.M. |
| " " Methyl Orange (Carbonate Hardness) ----- | 132 - "    |
| Hydrogen Ion (pH) -----                      | 7.9 - "    |
| Chlorides (Salinity) -----                   | 108 - "    |
| Calcium -----                                | 86 - "     |
| Magnesium -----                              | 18 - "     |
| Sulphates -----                              | 343 - "    |
| Non-Carbonate Hardness -----                 | 160 - "    |
| Total Hardness (as calcium carbonate) -----  | 292 - "    |
| Total Dissolved Solids -----                 | 600 - "    |
| Carbon Dioxide (Free) -----                  | 3.0 - "    |

Water that this sample represents is in close agreement with the Colorado River water.

/s/ A. Leo Courtney

Other Supporting Information



IN REPLY REFER TO:

## United States Department of the Interior

NATIONAL PARK SERVICE

WESTERN REGION

450 GOLDEN GATE AVENUE, BOX 36063  
SAN FRANCISCO, CALIFORNIA 94102

L54 (RNW)

April 20, 1982

### Memorandum

To: All Superintendents, Arizona Areas, Western Region

From: ~~ACTING~~ Regional Director, Western Region

Subject: Arizona Groundwater Management Act, required filings

In compliance with the Arizona Groundwater Management Act of 1980, we are required to register all existing wells within the State on or before June 12, 1982, see enclosure.

The Field Solicitor's Office has advised us that registration of existing wells on National Park Service lands should be made either as a matter of comity, in the case of Federal reserved water rights, or as a matter of compliance with Arizona State law, in the case of Federal non-reserved water rights.

The Division of Water Resources has begun to compile the necessary information for the filings, and in the process may be contacting your offices for further information. They will submit this material to the State.

Information which you feel the Division of Water Resources may not have, concerning recently changed well conditions, pump capacities, etc., should be relayed as soon as possible to the Division of Water Resources at 556-8660.

If you have any questions concerning the well registration requirements, please do not hesitate to contact Mr. Witucki and his staff.

*W. Bruce White*

Enclosure

cc:  
General Superintendent, SOAR

L54  
(WR)RNW

September 21, 1981

Witucki  
Mills 9/21  
Kilgore 9/21

Davis 9/22  
Reg. Dir.

Memorandum

To: Field Solicitor, San Francisco  
From: **ACTING** Regional Director, Western Region  
Subject: Arizona Groundwater Management Act: Registration of Inactive Wells;  
Filing for "Grandfathered Rights"

The Division of Water Resources has received inquiries from the affected National Park Service areas concerning certain provisions of the Arizona Groundwater Management Act of 1980, and we are still awaiting a response from your Office regarding our June 11, 1981 memorandum to you. As required by the Act, all wells in the State must be registered with the Arizona Department of Water Resources by June 12, 1982. However, it is not clear whether it is appropriate to register the inactive wells located in the parks within the State of Arizona. Since registration of these inactive wells may have a bearing on the Service's right to drill new or replacement wells in the future, we have tentatively planned to register all wells located within the affected parks. With these concerns in mind, we would appreciate a legal determination and your recommendations as to the registration of inactive wells pursuant to the Arizona Groundwater Management Act.

Through field investigations conducted by the Division of Water Resources staff, telephone conversations with the field areas, and communication with your staff, we determined that it was not necessary to file for "Grandfathered Rights" for any of the wells located in the parks within the designated Active Management Areas since none of the wells in question has a pumping capacity greater than 35 gallons per minute. Under the provisions of the Act, such wells were exempt from filing for "Grandfathered Rights."

Your assistance and cooperation in this matter is appreciated.

(SGD) JOHN H. DAVIS

cc:  
General Supt., SOAR  
Supts., Saguaro, Tumacacori, & Casa Grande

(WR)RNW:Reed:Werrell:Witucki;ms 9/21/81

File w Willow  
Beach, Lake Mead

3/2/63

Ed

This is area we visited at near dusk, with Chuck Rieley  
Photos were never used because of delayed Reconstruction.

This, may or may not be well used in 1962.

CR

Boulder City, Nev.  
Aug. 14, 1947

Dear Van:

Herewith 4 prints each of the pictures you wanted taken of Mrs. Roy J. Wrights water system at Willow Beach and I also a general view of a portion of the Willow Beach camp. Hope they are all right. I'm sending them this way because its too much trouble to send them "through channels".

I thoroughly enjoyed your visit here and wish I could have spent more time with you.

We have been working exclusively on budget estimates recently & are just beginning to get to such things as ~~the~~ negotiations on the Overton water shares. More through official channels on this later.

Hastily, Ben H. Thompson

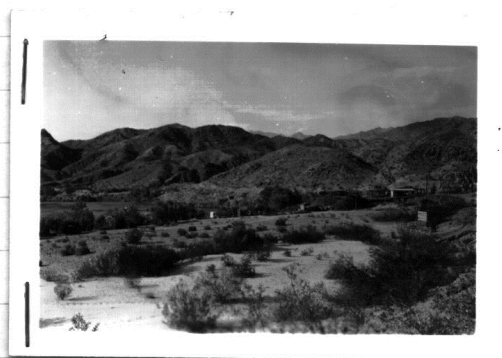
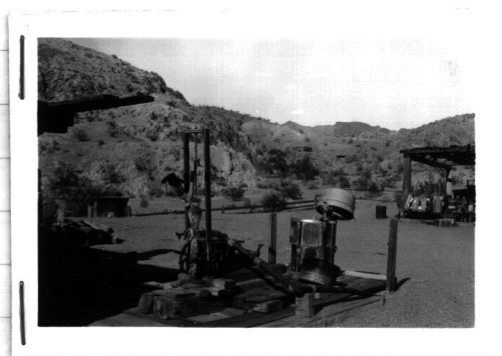
Lake Mead



Willow Beach Camp

August 1947

photos by Ben Thompson  
at Request of G. van Damm



1-54

Region Three  
Santa Fe, New Mexico

MAY 2 01959

Memorandum

To: Director  
From: Acting Regional Chief of Operations  
Subject: Water Rights Dockets 12, 13, 14, 15, 16, 17 and 18,  
Lake Head

Mr. Dunn's memorandum of April 10 transmitting the above numbered dockets arrived while Mr. Fields and Mr. Kell were enroute to Lake Head and for some reason did not arrive in the Regional Office until April 29.

By memorandum of April 24 Park Engineer Blair transmitted copies of the Well Drilling Logs for:

- (a) Katherine, Docket No. 10
- (b) Temple Bar, Docket No. 11
- (c) Willow Beach, Docket No. 14
- (d) Cottonwood Cove, Campground, Docket No. 16

Also supplied was a chemical analysis of the water from each of the above wells.

Copies of each log and analysis have been made and placed in our respective dockets. We have attached copies of each log and analysis for your Washington Office dockets and copies are being supplied to the Western Office of Design and Construction for insertion into the proper dockets.

Messrs. Fields and Kell are at Carlsbad Caverns to initiate installations of weirs and recording devices at Rattlesnake Springs. Any additional comments needed in further reply to Mr. Dunn's memorandum of April 10 must wait their return May 29.

Jerome C. Miller  
Acting Regional Chief of Operations

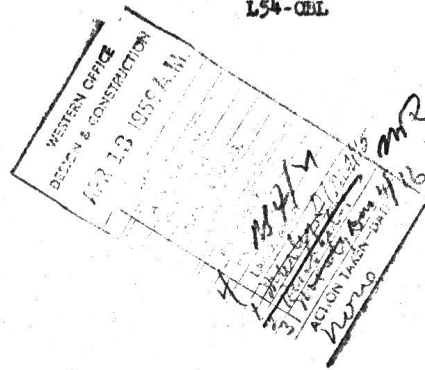
In duplicate w/4 sets attachments

Copy to: Supt., Lake Head w/o attachments  
WDC (2) w/4 sets attachments

|                                         |  |
|-----------------------------------------|--|
| WESTERN OFFICE<br>DESIGN & CONSTRUCTION |  |
| MAY 25 1959 A.M.                        |  |
| CHIEF                                   |  |
| ADMIN. ASST.                            |  |
| PLANNING                                |  |
| ENGINEERING                             |  |
| CONSTRUCTION                            |  |
| RECORDS & COMM.                         |  |
| TRAINING                                |  |
| SALES & MARKETING                       |  |
| GENERAL INVESTIGATION                   |  |
| LABORATORY                              |  |
| STATION                                 |  |
| DATE                                    |  |

April 10, 1959

154-CBL



Memorandum

To: Regional Director, Region Three  
From: Chief, Water Resources Section  
Subject: Water Right Dockets 12, 13, 14, 15, 16, 17 and 18,  
Lake Mead

With copies of this memorandum we are distributing folders  
for the subject dockets as follows:

|               |                                                                 |
|---------------|-----------------------------------------------------------------|
| Docket No. 12 | Las Vegas Wash                                                  |
| Docket No. 13 | Echo Bay                                                        |
| Docket No. 14 | Willow Beach                                                    |
| Docket No. 15 | Overton Beach                                                   |
| Docket No. 16 | Cottonwood Cove Proposed<br>Residential Area<br>Cottonwood Cove |
| Docket No. 17 | Cottonwood Vacation Cabin Sites                                 |
| Docket No. 18 | Water Line to Boulder Beach<br>Ranger Station                   |

Also attached are three extra prints of Drawing 6982, 6983, 6984, 6985, 6987 and 6989. The drawings have been prepared for interim record and study purposes. The extra prints are for you to refer to the office which can supply the corrections and extras needed for water right applications, of which a part will be either in narrative form, or preferably on the standard forms which should be obtained from the State Engineer of Nevada and Water Division of Arizona Land Department.

We cannot locate well logs for wells at Willow Beach (Docket 14), Overton Beach (Docket 15) and Cottonwood Cove (Docket 16). If you have or can obtain the well logs we would like copies for inclusion in their respective dockets.

The purpose of this study is as outlined in my memorandum of October 22, 1958, to the Regional Director, Region Three. The prints with that memorandum were chiefly to obtain section ties.

My immediate concern is the area of irrigation at Lake Mead since I believe my original estimate as testified in Arizona vs. California may be low for the dates I gave. Water right filings will reflect accelerated development if the claims exceed my testified totals in each state for 1966 and 1975. We should also estimate, and include domestic and other water uses in the applications.

These records are being sent to you as soon as we can complete computations and map compilation which we started. We expect Mr. Fields to take over the rest of the work leading to the preparation of water right applications.

SIGNED

A. van V. Dunn  
Chief, Water Resources Section

Attachments 7

Copy to: Superintendent, Lake Mead, with 7 attachments  
✓ Chief, WODC, with 7 attachments

April 1959

| LAKE MEAD - WILLOW BEACH - IRRIGATION STUDY |             |                           |                                       |                |                |
|---------------------------------------------|-------------|---------------------------|---------------------------------------|----------------|----------------|
| Location                                    | Gross Area  | Net<br>Irrigation<br>Area | % of Gross<br>Area to be<br>Irrigated | @<br>5 AF/A/AN | @<br>8 AF/A/AN |
| A. Picnic Area                              |             |                           |                                       |                |                |
| Public Camp-<br>ground                      | 14.62 acres | 10.23 acres               | 70%                                   | 51.15          | 81.84          |
| B. Residential<br>employee area             |             |                           |                                       |                |                |
| Trailer Camp                                | 13.53 acres | 9.47 acres                | 70%                                   | 47.35          | 75.76          |
| TOTAL                                       | 28.15 acres | 19.70 acres               | 70%                                   | 98.50AF        | 157.60AF       |

Derived from Drawing No. 6984

WR copy  
LSA-L  
CD

June 5, 1956

AIR MAIL

Memorandum

To: Superintendent, Lake Mead  
From: Chief, Water Resources Section  
Subject: Test Wells, Katherine and Willow Beach, Lake Mead

We have teletyped Region Three that we are allotting \$1860 under Account 140.3 (143.2) for the subject test wells, in accordance with bids reported in your memorandum of May 28.

We are not sure that the Arizona well drillers have standard forms for logs and pump tests. Attached is one copy of the form we use when the state does not supply them, and a dozen extra copies are being forwarded by regular mail. Please be sure that the necessary data is obtained during drilling, noting depths where water is intercepted under remarks following the thickness of strata on the reverse of sheet. This office should be supplied with five copies of the Record of Well, or the equivalent state form; or with one good copy of each from which photostats may be made for four assemblies of each docket, and one copy for the Geological Survey. We wish the logs of wells, even if no water is intercepted.

No water right filing is required in Arizona unless we prove that the groundwater is underground flow of the Colorado River, but we should get ties from wells to section corners, and plans for any water system, if adequate water is obtained, as soon as practical after the wells are drilled.

SIGNED

A. van V. Dunn  
Chief, Water Resources Section

Attachment

Copy to: Superintendent, Lake Mead - REGULAR MAIL  
Regional Director, Region Three  
Western Office of Design and Construction  
Mr. P. Miller  
Mr. Dunn

AvVDunn:let

Department of the Interior

National Park Service

GAS 413

May 5, 1956

VIA PBS

Regional Director, Region Three, National Park Service, Public Buildings  
Administration, Teletype Center, Room 407, U. S. Court House Building,  
Albuquerque, New Mexico

L54-L We are allotting \$1860, Account 140.3 (143.2) for test wells  
Katherine and Willow Beach, Lake Mead, per Glenn's air mail memorandum  
June 1.

SIGNED

Price  
Assistant Director

CONFIRMATION

Copy to: Superintendent, Lake Mead  
Mr. Pipes - Please allot \$800 already obligated, plus  
additional \$1060  
Mr. Dunn

AvVDunn:let 5-4-56

COPY

L54-L

May 28, 1956

Via Air Mail

Memorandum

To: Regional Director  
From: Superintendent, Lake Mead  
Subject: Proposed Test Wells, Katherine and Willow Beach, Under  
Appropriation 1461033, Account 140.3 (143.2), Lake Mead

Assistant Director Price's memorandum of May 9 to your office (copy to this office) stated that allotments would be made on receipt of bid prices.

It was further stated that half of the \$1,600 referred to in Mr. Dunn's memorandum of May 2 was available now and that the remaining \$800 could not be allotted until the supplemental 1956 appropriation was passed.

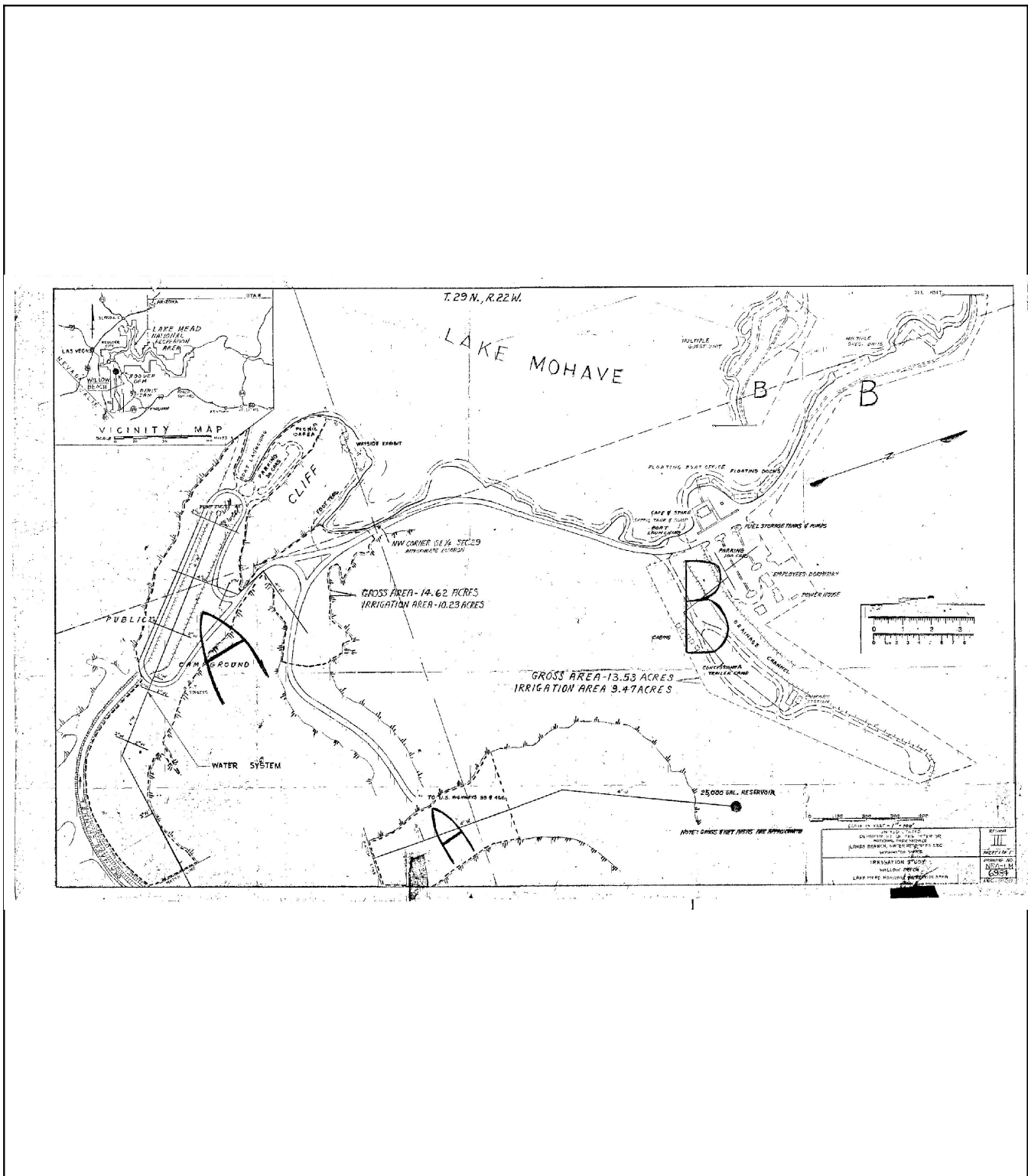
The low bid on each of the two wells was \$930, or a total of \$1,860 for the two wells.

It is requested that \$800 be allotted immediately and that the remaining \$800 be allotted immediately upon passage of the supplemental 1956 appropriation bill.

Please expedite this matter.

Charles A. Richey  
Superintendent

Maps and Miscellaneous Information



### Docket Information

Number of Documents in Docket 39

Documents Dated from 8/14/1947 to 11/21/1994

Docket Compiled: 6/2/2016