HYDROGEOLOGIC ANALYSIS OF THE A AND B IRRIGATION DISTRICT AREA

Prepared for the

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INTRODUCTION

Water management on the Snake Plain Aquifer by the Idaho Department of Water Resources (IDWR) is dependent in large part on understanding the hydrogeologic characteristics of the aquifer. The purpose of this report is to analyze the hydrogeology of a segment of the aquifer north of Rupert in the south-central portion of the aquifer. The focus of the study is the North Side Pumping Division (A&B Irrigation District), which is a portion of the U.S. Bureau of Reclamation (USBR) Minidoka Project. Irrigation water is supplied to Unit A via a pump in the Snake River. Ground water is the source for irrigation for Unit B. The general location of the production wells is shown on Figure 1.

The objectives of this report are as follows: 1) develop a hydrogeologic conceptual model of in the general vicinity of the A&B Irrigation District with an emphasis on the presence of low hydraulic conductivity sedimentary strata interbedded with the basalt of the aquifer, 2) analyze the significance of hydrogeologic conceptual model with respect to the ability of the A&B Irrigation District wells to obtain water from the aquifer, and 3) evaluate the impacts on A&B Irrigation District production wells from declining ground-water levels in the aquifer. The report is based on a review of published reports, unpublished information from a range of sources and discussions with individuals with knowledge of the area (citations provided in the text). The unpublished information provided by the A&B Irrigation District in December 2007 and posted on the FTP portion of the IDWR website is a particularly important source.

OVERVIEW OF THE AREA

The general description of the Minidoka Project that is presented below was taken from the USBR website (www.usbr.gov/dataweb/html/minidoka.html) on November 14, 2007.

> "Minidoka Project lands extend discontinuously from the town of Ashton, in eastern Idaho along the Snake River, about 300 miles downstream to the town of Bliss in south-central Idaho.... The project works consist of Minidoka Dam and Powerplant and Lake Walcott, Jackson Lake Dam and Jackson Lake, American Falls Dam and Reservoir, Island Park Dam and Reservoir, Grassy Lake Dam and Grassy Lake, two diversion dams, canals, laterals, drains and some 177 water supply wells" (page 1).
>
> "Water is diverted from the north side of Lake Walcott into the North Side Canal, a gravity canal and lateral system serving 72,000 acres of land called the Gravity division, in the vicinity of Rupert, Idaho. The 8-mile main canal has an initial capacity of 1,700 cubic feet per second" (page 2).
>
> The North Side Pumping division consists of some 77,000 acres of irrigable public land that have been withdrawn from entry, of which some 62,000 acres (Unit B) are irrigated by pumping ground water from deep wells, and 15,000 acres (Unit A) by pumping from the Snake River.... Water for Unit A is pumped from the Snake River by a pumping plant located about 8 miles west of Burley. The plant capacity is 270 cubic feet per second and the dynamic head is 168 feet. The pumping plant delivers water to a 4.4-mile long unlined canal that has the

same capacity. Seven groups of deep wells, totaling 177 wells from 12 to 24 inches in diameter, initially supplied water for Unit B. The average discharge of these wells was about 6.4 cubic feet per second. Currently, 174 wells are being used" (page 4).

A general description of the ground-water supply for the North Side Pumping Division is presented in the Planning Report and Draft Environmental Statement for the North Side Pumping Division Extension (U.S. Bureau of Reclamation, 1986, pages 6-12 to 6-14).

> "The Snake Plain aquifer lies beneath the project area and is one of the largest and most prolific aquifers in the Nation....In the North Side Pumping Division area, the Snake Plain aquifer consists of a thick series of basalt flows in the northern part of the project area (mainly Unit B) and basalt flows interbedded with large amounts of fine-grained lake sediments in the southern part. Deep well water yields range from a high of several thousand gallons per minute in the predominantly basalt aquifer to the north to lows of a few hundred gallons per minute in the less permeable sediment-basalt aquifer to the south. One such area is near Extension Area 4 where several low yields wells are found.
>
> The Geological Survey estimates total storage in the aquifer to be about 250 million acre-feet....In an average year, about 8 million acre-feet of water enter and leave the Snake Plain aquifer. Inflow to the system includes about 3 million acre-feet of natural recharge (precipitation and stream losses) and approximately 5 million acre-feet from irrigation seepage. Outflow or depletion is made up of spring discharge from the aquifer of about 6.6 million acre-feet and pumping depletion of about 1.4 million acre-feet annually. Annual discharge by pumping from the aquifer presently does not begin to approach annual recharge.
>
> Changes in recharge and withdrawal rates within the Snake Plain aquifer affect water levels beneath the North Side Pumping Division. The three major influences which cause water levels to change in the aquifer are (1) climatic trends, (2) irrigation diversions, and (3) ground-water pumping.
>
> The most significant influence which affects the water table is long-term climatic change – prolonged wet or dry cycles.... The second major influence on water table levels is changes in the quantity of irrigation diversions onto the plain.... Beginning in 1961, large quantities of water previously diverted each winter for domestic use and stock watering were greatly reduced or stopped. The reduction in diversions in canals below American Falls during winter amounted to over 100,000 acre-feet annually, most of which would have recharged the aquifer.
>
> The third major influence on aquifer water table levels is withdrawals of ground water for irrigation. Use of ground water from the Snake Plain aquifer has reached major proportions. Based on 1979 estimates, total ground-water pumpage from the aquifer is about 2.3 million acre-feet annually. With about 40 percent of this pumpage percolating downward and returning to the aquifer, net pumpage is estimated to be about 1.4 million acre-feet per year.

Ground-water pumping is the major aquifer discharge in the North Side Pumping Division area, with over 200,000 acre-feet pumped each year with Unit B of the division. A total of 177 deep wells serve the 62,000 acres irrigated within Unit B. Additional ground-water pumping of an estimated 400,000 acre-feet occurs in the general area adjacent to the division....

Snake Plain aquifer ground-water levels generally peaked in the mid-1950's as a result of a moderately wet sequence of years and maximum amounts of surface-water irrigation diversions onto the Snake River Plain which caused abundant ground-water recharge. Ground-water levels then declined during a period of dry years and increased ground-water pumping. Water levels reached new lows in the mid-1960's.

Levels then rose for about a decade because of above average precipitation. A second general ground-water decline began in the mid-1970's because of significant reductions in surface-water diversions onto the Snake river Plain. The water level decline accelerated because of a series of dry years, and water levels reached record lows in 1982. Increased precipitation beginning in late 1981 has stabilized water levels, and some recovery has occurred. In general, the recovery of ground-water levels has continued through 1985.

Studies show that this pattern of Snake Plain aquifer water level behavior occurred both in areas with major amounts of ground-water pumping and in areas with no pumping. Although large quantities of ground water are pumped from the aquifer, they are relatively minor when compared to total aquifer discharge and recharge quantities....

There has been an estimated net 10- to 15-foot decline in the water table elevation beneath the North Side Pumping Division since the project was constructed. These amounts of ground-water level decline have been of some concern to the local area. They are very minor, however, when compared to many other aquifers used for irrigation, including local aquifers south of the Snake River and in other areas of the Northwest where water level declines have in some cases far exceeded 100 feet.

At this time, the Snake Plain aquifer shows only minor evidence of stress in response to major ground-water withdrawals. There are areas of minor decline (such as beneath the North Side Pumping Division) which in part can be attributed to ground-water pumpage. The reduction in total discharge at Thousand Springs may also in part be attributed to ground-water pumping. However, there are no significant changes in the aquifer which would indicate that the system is being overtaxed."

HYDROGEOLOGIC SETTING

Regional Geologic Setting

The A&B Irrigation District is located in a transition zone where the subsurface consists of mostly basalt to the north and northwest and mostly sediment to the south and southeast. Figure 2a is a geologic map of the area taken from Whitehead (1992). Geologic units shown on the map are described in Figures 2b and 2c. The basalt shown north of the A&B Irrigation District well field is identified as Quaternary basalt (Qb or Qtb). Sediments in the area are mapped as wind blown deposits (Qw) and older alluvium (Qts). The general relationship between basalt and sediment is shown on two figures taken from Whitehead (1992). Figure 3 shows the thickness of Quaternary basalt whereas Figure 4 shows the thickness of sedimentary rocks. The two figures show the transition from a basalt-dominated subsurface in the center of the Snake Plain to a sedimentary-dominated subsurface south of the A&B Irrigation District well field.

Local Geologic Setting

Sterns and others (1938), Nace (1948) and Crosthwaite and Scott (1956) describe the subsurface geology of the general Minidoka Project area. The dominant units are Quaternary basalt and sedimentary units. Nace (1948, p. 13) provides the following description of the sequence of geologic events in the creation of the subsurface sequence.

> "Early in the sequence of events the Sand Springs basalt was extruded from sources between Kiamam and Hazelton … spreading westward and southwestward, spilling into the old Snake River Canyon and partially filling it from the northwest part of T7S R13E for a distance of about 50 miles upstream, to the area south of Hazelton and Eden. Filling of the river channel effectively dammed the Snake River and the impounded waters spread widely over what is now called the Minidoka Project in Cassia and Minidoka Counties. In the Sterns report this body of water is called Lake Burley, and in it the Burley lake beds accumulated to a maximum thickness of 90 to 150 feet. The areal distribution of these beds approximately coincides with the area of the Minidoka Project in Cassia and Minidoka Counties. At the boundaries of the lake the shore phases of the accumulating sediments overlapped or abutted on the surrounding lavas and other rocks. Northward and westward from Burley, Rupert, and Acequia, the Burley lake beds thin and disappear against the basaltic rock masses of the unknown thickness. Probably the older sediments beneath the Burley lake beds behave similarly. The lake remnant was then drained as the Snake River entrenched a new outlet through the basalt barrier on the west. As this entrenchment progressed upstream through the lake beds, the lake floor remained as a slightly elevated terrace adjacent to the river. Quaternary alluvium, loess, and residual soil were deposited as a mantle over the Burley lake beds and surrounding lava flows."

Crosthwaite and Scott (1956, pages 7 and 9) describe the Burley lake beds and Snake River Basalt as follows.

> "The ancient lake in which the Burley lake beds were deposited covered the area of the Gravity Division but apparently did not extend into the Pumping Division. … The Burley lake beds … .consist of about 450 feet of compacted to unconsolidated clay and silt, and small amounts of sand and fine gravel. Several basalt layers are intercalated in the lake beds 150 to 225 feet below the land surface and at the base of the formation. The sand, gravel and basalt are permeable and yield moderate amounts of ground water to domestic, municipal and industrial wells. The clay and silt beds are very low in permeability and are the base on which shallow ground water is perched in overlying alluvium. At

> depth these impermeable beds confine artesian water in associated permeable sediments. "
>
> "The Snake River basalt underlies all of the Minidoka area and most of the Snake River Plain. At most places in the area of proposed ground-water development the basalt is overlain by 2 to 50 feet or more of windblown deposits, but small outcrops are common.... In Minidoka County and most other parts of the Snake River Plain the Snake River basalt is the principal water-bearing formation, and it yields water copiously to wells. Intertongued sedimentary beds are saturated below the water table but yield little or no water to wells.... The Snake River basalt consists of many individual flow sheets, 10 to 75 feet thick, which originated at numerous volcanic vents scattered over the Snake River Plain.... A few sedimentary beds are intercalated in the basalt. The total thickness of the basalt is not known. In southern Minidoka County wells 500 deep end in basalt."

The U.S. Bureau of Reclamation (1985a, page 19) describes the hydrogeology of the area as follows.

> "The aquifer, as previously discussed, is made up of sediment and basalt....The basalt is made up of a series of thin flow sheets, from a few feet to several tens of feet thick. Where the flow sheets are deposited one upon another to form a relatively thick sequence, and where the basalt is highly fractured and/or contains numerous rubble or cinder zones, the water yield is large, up to several thousand gallons per minute. Where the flow sheets are made up of dense, and massive basalt and/or is covered, penetrated, or innerbedded with fine sediment, the water yield is small to moderate. One such area is in the southwest part of Unit B located mostly in T9S/R22E where several low yielding wells are found. Here the aquifer is comprises of basalt innerbedded with substantial amounts of fine sediment. Some of the basalt in the upper part of the aquifer also contains fine sediment that reduces the permeability. The deeper basalt is relatively free of sediment, but must be thick, massive, and dense with a low permeability because water yield remains low despite more than 100 feet of exposed basalt aquifer in some wells."

Analysis of Well Logs

Records are available for a large number of wells in the general vicinity of the A&B Irrigation District. The two primary sources were used for analyze information on area wells: 1) the website for the IDWR and 2) the FTP posting of A&B Irrigation District information on the website of the IDWR. Idaho well driller reports on the IDWR website are filed by legal description (township, range and section) and include geologic information, well completion information and in some cases well yield information. The IDWR website also includes records of wells provide by the USBR. Information on these wells is similar to that provided on Idaho well driller reports except that well completion information (casing and screened intervals) is often missing but surveyed well information is often available. A legal description is provided in addition to a well number created for project wells. For example, project well 20A922 is located in section 20 of township 9 south and range 22 east. The focus of the well log analysis was on wells constructed as part of the Northside Pumping Division of the Minidoka Project.

The geologic descriptions for the project wells (identified as USBR or A&B Irrigation District) often are more detailed than for the private wells.

Hydrogeologic information on the project wells is summarized in Tables 1 and 2. The table is a compilation of information from the IDWR well log files and the A&B Irrigation District files available on the FTP portion of the IDWR website. An attempt was made to eliminate duplications in listing of project wells. This task was difficult because multiple logs are available for the wells that have been cleaned out or deepened. In some cases, information is given for deepening of a well for which the original log could not be found.

Explanations of the columns on Table 1 are given below.

- The well location is given in terms of township, range and section number. The location within the section is given as quarter section and then quarter-quarter section with the notation of A, B, C and D for the northeast, northwest, southwest and southeast quarters. Thus, well 7S 23E 34DC is located in the southwest quarter of the southeast quarter of section 34 in township 7 south and range 23 east.
- The owner is listed either as the U.S. Bureau of Reclamation (USBR) or the A&B Irrigation District (A&B).
- The next columns provide information on the well depth, land surface elevation and static depth to water at the time the well was drilled. Blanks in the table show that specific information either was not on the log or in some cases was not readable. A number of the wells have been deepened since they were originally drilled. The depth given in Table 1 is the greatest depth based on the source documents. Surveyed land surface elevations are given to tenths or hundredths of a foot on the individual USBR logs. Comparison of the 1950's surveyed elevations with topographic maps and an A&B Irrigation District summary table from the FTP site revealed an approximate 50-foot datum correction was needed. All of the surveyed elevations from the USBR logs were corrected by subtracting 50 feet. Approximate elevations (rounded to nearest foot) were given for a few wells. No elevation information is available for some of the wells.
- The geologic information of most significance is the presence of fine-grained sedimentary interbeds within the Quaternary basalt below the water table. Sedimentary interbeds were so classified if descriptive terms such as clay or clay and sand were provided on the logs. Professional judgment was used to differentiate between weathering along a basalt flow contact zone (sometimes noted as yellow clay and basalt) and the presence of unconsolidated sediments deposited between basalt placement events. Logically, the aquifer is less productive in those areas where fine-grained sediments make up much of the saturated thickness as compared to areas where the interval below the water table almost all Quaternary basalt. The geologic information on Table 1 is presented in terms of the depth intervals of identified sedimentary interbeds penetrated by the well below the water table at the time of well construction. Wells for which no geologic information is given (such as well 7S 23E 34CD) penetrated only basalt below the water level. Some of the wells in the southern portion of the project

area have as many as four sedimentary interbeds identified below the water table at the time of drilling.

Table 2 presents information on the sedimentary interbeds in terms of elevation above sea level rather than depth below land surface. Interbed elevation data are presented only for those wells where land-surface elevation data are available and sedimentary interbeds were penetrated below the water level. Information presented in Table 2 allows analysis of the lateral continuity of sedimentary interbeds within the saturated subsurface. The elevations of the bottom of wells are also given in Table 2. Many of the wells do not penetrate interbeds identified using information from deeper wells.

Information from Tables 1 and 2 can be used to document the presence or absence of sedimentary interbeds within the sequence of basalt flows penetrated by the project wells. The following is a description of the subsurface geology in various portions of the project area based on an analysis of data on Tables 1 and 2.

- Neither of the two project wells in section 34 of T7S R23E penetrate sedimentary interbeds to a bottom-hole elevation of about 3,965 feet.
- A number of project wells located in sections 30 to 33 of T7S R24E penetrate a clay interbed that is 6 to 12-feet thick generally in the elevation intervals of 3930 to 3,950 feet in sections 30 and 31 and between 3,970and 4,020 feet in sections 32 and 33. A well in section 32 penetrates about 80 feet into the basalt that underlies the interbed.
- A well in section 27 of T7S R25E penetrates a 28-foot sedimentary interbed in the depth range of 4,055 to 4,083 feet.
- The remaining wells in T7S R24E and T7S R25E do not penetrate an identified sedimentary interbed to the depths drilled.
- One of the six project wells constructed in T8S R21E penetrates a sedimentary interbed greater than six feet in thickness. The bottom 13 feet of a 420-foot well in section 24 was identified as clay (elevation interval of 3,779 to 3,792 feet). No other project wells are in this section. A 587-foot well in section 26 did not penetrate sediments in the same depth interval.
- The majority of the wells in the northern half of T8S R23E do not penetrate a sedimentary interbed to the drilled depths. The bottom elevation of the deepest well is about 3,960 feet.
- Wells in section 23, 24 and 25 of T8S R23E intercept thin (less than 10 feet thick) sedimentary interbed, mostly in the depth range of about 3,990 to 4,020 feet. The deepest well in section 24 penetrates about 77 feet of basalt below the sedimentary interbed.
- Two wells (one in section 27 and one in section 28 of T8S R23E) penetrate a slightly thicker (about 20 feet) interbed in the elevation range of 3,940 to 3,960 feet). The deeper of the two wells penetrates basalt to a depth of about 70 feet below the bottom of the interbed.

- One well in section 34 and four wells in section 35 ofT8S R23E penetrate an interbed. The variation in the thickness (4 to 27 feet) and elevation (4,034 to 4,069 feet) of the unit make it questionable whether there is a single sedimentary layer or several laterally discontinuous layers. One of the wells in section 35 penetrated about 80 feet of basalt below the potential interbed.
- Most of the wells in the northern half of T8S R24E do not penetrate a sedimentary interbed to the drilled depths.
- Two wells in section 20 ofT8S R24E penetrate multiple sedimentary layers below an elevation of about 3,990 feet. About 60 percent of the drilled section below this elevation is composed of sediment with basalt making up the remainder. Two wells are of similar depth are present in section 21 of T8S R24E. One well has two interbeds approximately in the same elevation range as the section 20 wells. The geologic log for the second section 21 well does not show the presence of sedimentary interbeds.
- The project well in section 33 of T8S R24E penetrates a seven-foot thick interbed in the elevation range of 3,966 to 3,973 feet. The well was drilled about five feet into basalt below the interbed.
- Three of the four project wells in section 3 of T8S R25E penetrate two sedimentary interbeds. The higher interbed ranges in thickness from 5 to 8 feet and in elevation from 4,012 to 4,040 feet. The lower interbed ranges in thickness from 3 to 8 feet and in elevation from 3,954 to 3,973 feet. The deepest of the wells penetrates about 40 feet of basalt below the interbed.
- The only two of the remaining project wells in T8S R25E penetrate sedimentary interbeds below the water table. Both of these zones are thin.
- Deeper wells have been drilled in the southwestern portion of the A&B Irrigation District area (T9S R21E). A 700-foot well in section 3 penetrates two sedimentary interbeds below the water table (depth ranges of 447 to 460 feet and 435 to 545 feet – elevation ranges of 3,738 to 3,751 feet and 3,653 to 3,633 feet). About 155 feet of basalt was penetrated below the lower interbed. A 587-foot deep well in section 1 penetrates sediments in the elevation intervals of 3,693 to 3,698 feet and 3,653 to 3,678 feet.
- Wells in sections 9 and 10 of T9S R22E penetrate multiple sedimentary interbeds. About 50 percent of the saturated thickness (water level elevation minus the bottom hole elevation) is composed of sediment in a well in section 9. About 38 percent of the saturated thickness of a well in section 10 is composed of sediment. The depths of these two wells are 415 and 429 feet.
- The 494-foot well in section 11 of T9S R22E penetrated a single interbed about 180 feet thick at the bottom of the well in the elevation range of 3,668 to 3,847 feet. The geologic log shows blue clay for the entire thickness.
- The 700-foot well in section 20 of T9S R22E penetrates a 54-foot thick interbed in the elevation range of 3,783 to 3,837 feet with sand underlain by clay. Thin

sedimentary interbeds (<15 feet) were also penetrated both higher and lower in the well.

- A 1,000-foot well in section 22 of T9S R22E penetrates a 199-foot thick interbed in the elevation range of 3,703 to 3,902 feet and a 55-foot interbed in the elevation range of 3,521 to 3,576 feet with several additional thin sedimentary units.
- Several wells in section 33 of T9S R22E show sediments in the general elevation interval of about 3,870 to 3,920 feet.
- A 340-foot well in section 3 of T9S R23E penetrated three interbeds greater than 20-feet thick (elevation ranges of 3,974 to 4,002 feet, 3875 to 3897 feet and 3,843 to 3865 feet). About 45 percent of the geologic section between the elevations of 3,843 to 4,002 feet is composed of sediment.
- The 646-foot well in section 2 of T10S R21E has only two thin sedimentary interbeds in the geologic section below the water table (elevation ranges of 3,928 to 3,940 feet and 3,591 to 3,597 feet). The remainder of the material penetrated is basalt.

The geologic data from wells supports the general geologic description presented by Crosthwaite and Scott (1956). The percentage of sedimentary interbeds in the subsurface below the water table increases to the south with thicker and more laterally extensive clay units. The number and thickness of clay units interbedded with the basalt below the water table in the northern portion of the project area are small.

Aquifer Characteristics

The Quaternary basalt near the center of the Snake Plain generally is considered to host a single, unconfined aquifer. Water producing zones within the Quaternary basalt occur at flow contacts which are present at depth intervals of about 15 to 20 feet. The average hydraulic conductivity of the basalt is extremely high. The inter-fingering of Quaternary basalt flows with fine-grained sedimentary in the general vicinity of the A&B Irrigation District creates a subsurface environment composed of multiple aquifers and confining units (aquitards).

The A&B Irrigation District is located the south-central portion of the Snake River Plain aquifer. Contours of Fall 2001 water-level elevation data from Cosgrove and others (2006) for this portion of the aquifer are shown on Figure 5. There is a considerable distance between the 4,050 and 4,100-foot contours on the map in the general vicinity of the A&B Irrigation District, indicating a low hydraulic gradient. Also, the 4,100-foot contour appears to follow along the Snake River in the vicinity of below and midway through Lake Walcott.

Cosgrove and others (2006, pages 14 and 16) describe the general water budget for the Snake Plain aquifer and the corresponding temporal changes in ground-water levels and aquifer discharge.

> "The Snake River Plain aquifer is recharged by irrigation percolation; canal stream and river losses; subsurface flow from tributary valleys; and precipitation directly on the plain. The aquifer discharges to the Snake River, springs along the

Snake River and to ground-water pumping, primarily for irrigation...Historically, aquifer water levels and corresponding discharges to the Snake River rose significantly at the onset of surface water irrigation... Aquifer water levels peaked around 1950 and have been declining since that time. The declines are attributed to the onset of ground-water irrigation, more efficient surface water irrigation practices such as conversion to sprinkler irrigation and canal lining, and the recent seven years of drought."

Water-level data are available from observation wells operated by the U.S. Geological Survey located across the Snake Plain aquifer. Figure 6 shows the locations of three observation wells located near the A&B Irrigation District. The hydrographs for the three observation wells, presented in Figures 7, 8 and 9, show an overall downward water-level trend with highs and lows reflecting changing climatic conditions. The long-term rate of water-level decline is about 0.5 to 0.6 feet per year.

DESCRIPTION OF PROJECT PRODUCTION WELLS

Production Well Information

The majority of the project production wells were constructed by the USBR in the 1950's with some wells deepened and a few additional wells drilled later with ownership noted as the A&B Irrigation District. The U.S. Bureau of Reclamation (1985, page 28) describes the construction of the wells as follows.

> "Since construction of the pumping division in the 1950's, well construction methods have changed, especially construction specifications written by Reclamation planners. The original 177 project production wells were drilled by drilling contractors using cable drills, and were completed using the usual completion methods at that time. Drilling was continued below the water table until the drill cuttings were "lost", which was apparently an indication of good yield. Construction completion usually consisted of installing surface casing with the balance of the well left "open hole". When caving conditions were encountered during the drilling, a casing liner was installed, generally just through the caving interval. The liner would be perforated when the caving interval was located within the "good" aquifer section of the well. After the well was completed, a pump test was run to determine the yield. If the yield was insufficient, the well would be deepened in hopes of encountering additional water.
>
> These methods were workable, but generally did not allow for much lowering of the pump if the water level declined. The project was begun about the water level peak period and was completed during a water level decline period. More than one-half of the wells had less than 100 feet of saturated well bore; therefore, as the water levels declined, drawdown increased, the thickness of the saturated well bore thinned, and yield decreased. Deepening of many of the wells was undertaken before the project was completed. About one-half of the wells have been deepened to date (1984) and about one-half of the wells still have less than 100 feet of exposed aquifer" (page 28).

The same report provides guidance with respect to how new project wells should be drilled.

> "Well construction should consist of drilling a hole of adequate diameter to the minimal total depth. The total depth can vary somewhat depending upon where the drill site is selected in each tract. The total depth is determined by selecting a depth where the pump can be placed allowing the pumped water level to remain at least 5 feet above the pump bowls after subtracting out drawdown from pumping and natural fluctuations of the water table. Below the pump intake, a pump chamber is drilled about 50 feet into the aquifer. The pump chamber is essentially that portion of the well where the pump is placed and must be deep enough to allow room to lower the pump in case of persistent water level declines.... The portion of the well deeper than 50 feet below the pump intake may be reduced in diameter. The reduction should decrease drilling costs and will not materially reduce the intake potential... Casing must be placed in the upper portions of the well to seal out caving zones in the sediment and prevent aquifer pollution form surface waters. The balance of the well can be left open hole, however, for maximum pump protection, casing should be installed throughout the pump chamber" (U.S. Bureau of Reclamation, 1985, page 32).

Information on the A&B Irrigation District production wells is presented in Table 3. The table was taken from FTP files located on the IDWR website. The columns on Table 3 are described below.

- The first two columns provide the USBR well identification number and the township range number as described previously.
- The well diameter at the deepest point in the third column is assumed to represent casing diameter if casing is present or open-hole diameter is no casing is present.
- The third through sixth columns present information on well productivity at the time of construction. The yield rate in cfs (cubic feet per second) is presented along with drawdown (assumed to be at the end of the test). The specific capacity is the pumping rate divided by drawdown with the units of gpm/ft.
- The seventh column provides ground elevation corrected from the original USBR elevations by 49.7 feet.
- The eighth and ninth columns provide the depth to water at the time of drilling and the ground-water elevation at the time of drilled using the corrected land-surface elevation.
- The tenth and eleventh columns provide the initial well depth and the date the well was drilled.
- The twelfth through seventieth columns present information on depths and years individual wells were deepened. Some of the wells have not been deepened while other wells have been deepened as many as three times.
- The eighteenth column provides the most recent well depth.
- The nineteenth column provides to depth to the top of the pump bowl in 1964.

- The twentieth and twenty-first columns present lowest water-level in 2007 and depth to top of pump bowl in 2007. The lowest water-level is represents pumping conditions for most wells.
- The remaining columns provide information on well history including identification of those wells that have been deepened or replaced.

Information presented in Table 3 is reasonably complete for 178 wells. Limited data are presented for nine additional wells. The analysis presented in this section is limited to the 178 wells for which data are reasonably complete. Summary statistics relative to the production wells when they were first drilled are presented below.

- The production wells are, in general, highly productive. The pumped yields during the tests ranged from 1.5 to 10.5 cfs with an average yield of 5.4 cfs (about 2,400 gpm). The reported specific capacity (discharge divided by drawdown) values ranged from 42 gpm/ft to 20,445 gpm/ft with an average of 1,912 gpm/ft.
- The high yields were achieved with only a small portion of the aquifer penetrated by most of the wells. The difference between the bottom of the well and the depth to water is the saturated thickness of the aquifer penetrated by each well. The saturated thickness values range from 27 feet to 403 feet with an average saturated thickness of 91 feet and a median saturated thickness of 72 feet. These numbers include those wells that have been deepened.
- One hundred and nine of the 178 production wells have been deepened at least one time since they were initially constructed. The average depth increase was 58 feet with 12 wells greater than 100 feet and 2 wells greater than 200 feet. Twenty-two wells were deepened a second time with three wells deepened a third time.
- The difference between the lowest water level in 2007 and the top of the pump bowl provide a measure of the available drawdown for each well. This value ranges from 55.1 feet to minus 6.6 feet. Sixteen of the 131 wells for which data are available had pumping water levels below the top of the pump bowls. An additional 36 wells had pumping water levels within 10 feet of the top of the pump bowls.

Water Production Characteristics

Information on the quantity of water pumped from each production well during the period of 1995 through 2007 was provided by A&B Irrigation District and posted on the FTP portion of the IDWR website. Table 4 includes a small portion of the pumping information as an example of the information provided and the format. Pumped amounts (in acre feet) are given per well for combined two month periods for each year (i.e. April-May of 1995). Totals for each well for each year (April through October) are provided. The information provided does not allow identification of the following: 1) instantaneous pumping rates for each well and any changes in the pumping rate with time; 2) pumping periods (hours per day and/or days per month) and how the pumping patterns have changed with time.

The pumping data were analyzed in several ways. The first approach was to calculate the total amount pumped per year from all of the wells to see if there was a temporal pattern for the time period of 1995 through 2007. The average was about 178,000 acre-feet per year with a low value of about 151,000 acre-feet per year in 2005 and a high value of about 207,000 acre-feet per year in 2000 (Figure 10). No pattern was evident that could be correlated to operational problems associated with water-level decline.

An average withdrawal rate for the 13-year time period was calculated for each well (Table 5). The table also summarizes the years during 1995 through 2007 when each well was pumped. A large percentage of the water withdrawal for the A&B Irrigation District is in townships T8S R23E, T8S R24E and T8S R25E. More than two-thirds of the total pumping for the project is derived from wells in these three townships.

The temporal patterns of pumping from selected individual wells were evaluated to assess whether yields are correlated to declining ground-water levels, particularly wells where pumping water levels are at or below the top of the pump bowls. Figure 10 presents annual pumping amounts from nine wells spread though the project area. Also shown on the legend is the height of the pumping water level above the top of the pump bowls in each well in fall 2007. The temporal pattern of annual pumping amounts from wells where the water level was at or below the top of the pump bowls in 2007 is similar to wells where the pumping water level was considerably higher. This may have been accomplished by pumping the wells at lower discharge rates but for longer periods of time. Information on pumping times for individual wells is not included in the files provided for the IDWR FTP website.

Discharge data for individual wells is included in 2007 Annual Pump Report for the A&B Irrigation District which was posted on the FTP portion of the IDWR website. High and low discharge rates are given for five years (2003-2007) with Idaho miner's inch as the discharge unit. One Idaho miner's inch is approximately equal to 9 gpm. The discharge data were compiled and an average discharge rate per well for each township was calculated. These results are presented in Table 6 and plotted on Figures 11A, 11B and 11C. The number of wells per township varies from T8S/R23E with 50 to T10S/R21E with 1 well. The most discernable downward trend in well production is for the three wells in T9SR21E, shown on Figure 11C. The average well yield for most of the townships changed very little over the five-year period.

DISCUSSION OF RESULTS

The historic response within the A&B Irrigation District to water-level declines has been to lower and change pumps within wells and deepen wells as needed. Part of the need for these actions stems from construction of most of the wells in the 1950's when aquifer water levels were at historic highs. A number of the original production wells were constructed less than 50 feet deeper than the water table at the time of drilling.

Four topics are addressed in the discussion of results: 1) hydrogeologic impacts on well production from continued water-level decline; 2) well operational alternatives to deal with continued water-level decline; 3) hydrogeologic limitations on well deepening; and 4) summary of A and B Irrigation District activities.

Hydrogeologic Impacts on Well Production from Continuing Water-Level Decline

Wells constructed in basalt within the Snake Plain Aquifer obtain water from one or more flow contact zones that are penetrated below the water table. The original USBR well logs do not include identification of water producing zones. The last geologic entry on the depth log for many of the wells includes the notation of "lost cuttings". Other wells were terminated when clay was penetrated. Aquifer tests were run on many of the wells with information shown on the well log. The yield and drawdown numbers given represent the sum of water derived from the unique number of flow contact zones penetrated

Water-level decline does not appreciably decrease the transmissivity of the zone penetrated by a given well until the water level drops below one of the flow contact zones that supply water to the well. The effective transmissivity of the aquifer at that well decreases abruptly at that time. This "stair-step" decrease in transmissivity in a basalt aquifer is much different than occurs in an aquifer where the hydraulic conductivity is uniform over depth (such as a thick sand zone). A step decrease in transmissivity results in greater drawdown and reduced well yield. The impacts associated with decreased transmissivity are unique to each well.

Water-level decline decreases the available drawdown (distance from the static water level to the pump setting) in a well. This is not a critical factor if the available drawdown is 100 feet, the water-level decline is 0.5 feet/year and the drawdown at the design pumping rate is 10 feet. However, this becomes a major problem when the maximum available drawdown (lowest possible pump setting) is 20 feet under the same water level and drawdown conditions. The impacts associated with reduced available drawdown are unique to each well.

Water-level decline causes a decreased pumping rate by increasing the total dynamic head against which the pump operates. The relationship between water-level decline and decreased pumping rate is dependent on the head-discharge rating curve for the given pump installed in the well.

Well Operational Alternatives to Deal with Continued Water-Level Decline

The primary approaches for dealing with continued water-level decline are to lower and change pumps, decrease pumping rates and finally deepen wells. Lowering the pump increases the available drawdown and allows well operation at nearly the design pumping rate. Decreased pumping rates results in less drawdown and allows continued operation of the pump. The pump and motor are changed when the total dynamic head has increased to the extent that the desired pumping rate cannot be achieved or the overall efficiency of the pump has decreased to an unacceptable level.

Wells typically are deepened to increase transmissivity and thus yield and also increase the available drawdown by allowing the pump to be set deeper below land surface. Well deepening can be a relatively simple operation if the well is stable (caving conditions are not encountered) and the strings of casing are not involved. Well deepening may not be possible in some circumstances because of casing configurations, well alignment or penetration of unstable formational material. In this case a replacement well may need to be drilled.

The unique construction of each of the project wells controls the ease and success of lowering pumps and deepening wells. Data on the casing configuration for each project well has not been located; thus, a well by well evaluation of problems associated lowering pumps and deepening wells is not possible. It is likely that decisions made in the construction history of individual project wells make lowering pumps and/or deepening wells not possible.

Depth Limitations to the Aquifer

Successful deepening of wells depends on water producing zones (dominantly flow-contact zones in Quaternary basalt) being present in the aquifer in the depth interval below the bottom of the existing well. The dominant hydrogeologic question is whether water-producing zones in the basalt are present in the depth interval (say 100 feet) below the bottom of each existing wells for which deepening is considered. An associated question pertains to determination of the effective bottom of the aquifer within different parts of the project area.

The first step in the analysis of well deepening potential is to examine the subsurface stratigraphy. Water producing zones are not present in most of the sedimentary interbeds because they are composed dominantly of clay. Thus, the presence of a clay interbed that extends hundreds of feet below the present depth of a well makes the probability of successful well deepening very low. Conversely, the presence of basalt (absence of clay interbeds) in the depth interval below the bottom of a well means that there is a reasonable chance that well deepening can be successful.

Geologic information from drilled wells provides information on the presence or absence of sedimentary interbeds (mostly composed of clay) in the sequence of basalt flows. As described previously in the "Analysis of Wells" portion of this report, sedimentary interbeds below the water table are thin and do not appear to be laterally continuous in the northern portion of the project area. In contrast, clay interbeds below the water table are thicker and are penetrated in more wells in the southern portion of the district. Thick clay units that are probably the Burley Lake Beds are present in the southern portion of the district. The potential for successful well deepening is high in the northern portion of the project and relatively low in the southern portion of the project area.

Knowledge of the subsurface geology is available to a greater depth for the southern portion of the district than the northern portion. The four project production wells that have been drilled to depths greater than 600 feet (656, 700, 700 and 1,000 feet) are all located in the southern portion of the project area (9S/21E, 9S/22E and 10S/21E). The 1,000-foot well in section 22 of T9S R22E penetrates a 199-foot thick interbed in the elevation range of 3,703 to 3,902 feet and a 55-foot interbed in the elevation range of 3,521 to 3,576 feet with several additional thin sedimentary units. Only four project production wells have been drilled deeper than 500 feet (510, 510, 516 and 587 feet) in the three townships that include more than two-thirds of the ground-water production in the northern portion of the project (8S/R23E, 8S/24E and 8S/25E). The deepest of these, a 587-foot well in section 26 of T8S R21E, did not penetrate a sedimentary interbed below the water table.

The second step in the analysis of well deepening potential is to ascertain whether water yielding zones in the basalt become more or less frequent with depth and whether they individually yield more or less water. This type of information is needed but has not been located for either within the A&B Irrigation District files or more generally within the literature dealing with the Snake Plain aquifer. The section of the U.S. Bureau of Reclamation (1985a) quoted previously in this report indicates that the basalt penetrated at depth in the southern portion of the project (T9S R22E) has fewer producing zones than the shallow basalt. This type of information is needed for the northern portion of the project area.

Summary of A&B Irrigation District Activities

Previous sections of the report ("Production Well Information" and "Water Production Information") provide summary comments on actions taken by A&B Irrigation District to respond to declining water levels. More than half of the production wells have been deepened. Summary statistics on changes in pumps and motors are not available from the FTP site. Notations on the records for individual wells show that pumps and motors have been changed at a number of wells. Notations on the district map provided on the FTP site indicate that 7 wells have been abandoned and 5 wells replaced. Water-level and pump setting information indicate that 16 of the 131 wells for which data are available had pumping water levels below the top of the pump bowls in 2007; an additional 36 wells had pumping water levels within 10 feet of the top of the pump bowls.

In contrast with the above information, data presented in the "Water Production Characteristics" section of the report indicate that nearly the same group of wells has been used to supply water for the district for the last 12 years. No decrease in the total amount pumped per year from all of the wells was evident that could be correlated to operational problems associated with water-level decline. The average well yield per township has not varied in the last five years for much of the area.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

General aquifer conditions such as water-level elevation and the temporal rate of water-level decline are regional in nature within the service area of the A&B Irrigation District and thus are predictable from well to well. However, each existing A&B production well is unique with respect to well construction characteristics and hydrogeologic conditions (such as water producing zones and water yielding characteristics) penetrated by the well. The specific steps necessary to maintain water production in an environment of long-term water-level decline are thus unique to each production well.

In general, the percentage of sedimentary interbeds in the subsurface below the water table is greater in the southern portion of the project area with thicker and more laterally extensive clay units. The number and thickness of clay units interbedded with the basalt below the water table in the northern portion of the project area are small. The hydrogeologic environment generally correlates with the centers of ground-water pumping for the district. The majority of the ground-water production by the A&B

Irrigation District occurs in northern portion of the project area with about two-thirds in townships T8S R23E, T8S R24E and T8S R25E.

The A&B Irrigation District has responded to issues raises by declining ground-water levels by lowering and replacing pumps and deepening selected project wells. Part of the need for these actions stems from construction of most of the wells in the 1950's when aquifer water levels were at historic highs.

The hydrogeologic environment makes the probability of success in well deepening greater in the northern portion of the project area than in the southern portion of the project area. The primary factor is the greater presence of sedimentary (mostly clay) units interbedded with the basalt in the southern portion of the project area.

Detailed information on the depth frequency and water yielding characteristics of water producing zones has not been compiled for A&B Irrigation District production wells. Compilation of this information, if it exists, is needed is help in development of a more quantitative predictive tool for the costs and effectiveness of well deepening efforts in different portions of the project area.

Recommendations

To the extent possible, additional information should be sought from the A&B Irrigation District relative to each of their production wells. The following is a list of the type of information that is needed.

- Information is needed relative to specific water producing zones and estimated yield amounts of these zones for each production well. This information is needed for the original drilled depth and any succeeding well deepening efforts.
- Additional temporal data on pumping rates are needed for each production well. Well-yield information has been provided to date is in the format of acre feet per two-month period from 1995 through 2007 or in the form of high and low pumping rates for the period of 2003 through 2007. This data base does not allow assessment of changed operational practices relative to pumping rate and pumping period from each well.

Construction of one or more test wells would greatly improve knowledge of the yield characteristics of the Snake Plain Aquifer with dept, particularly h in the northern portion of the A&B Irrigation District. This program should include identification of stratigraphic units and determination of yield characteristics of water producing zones.

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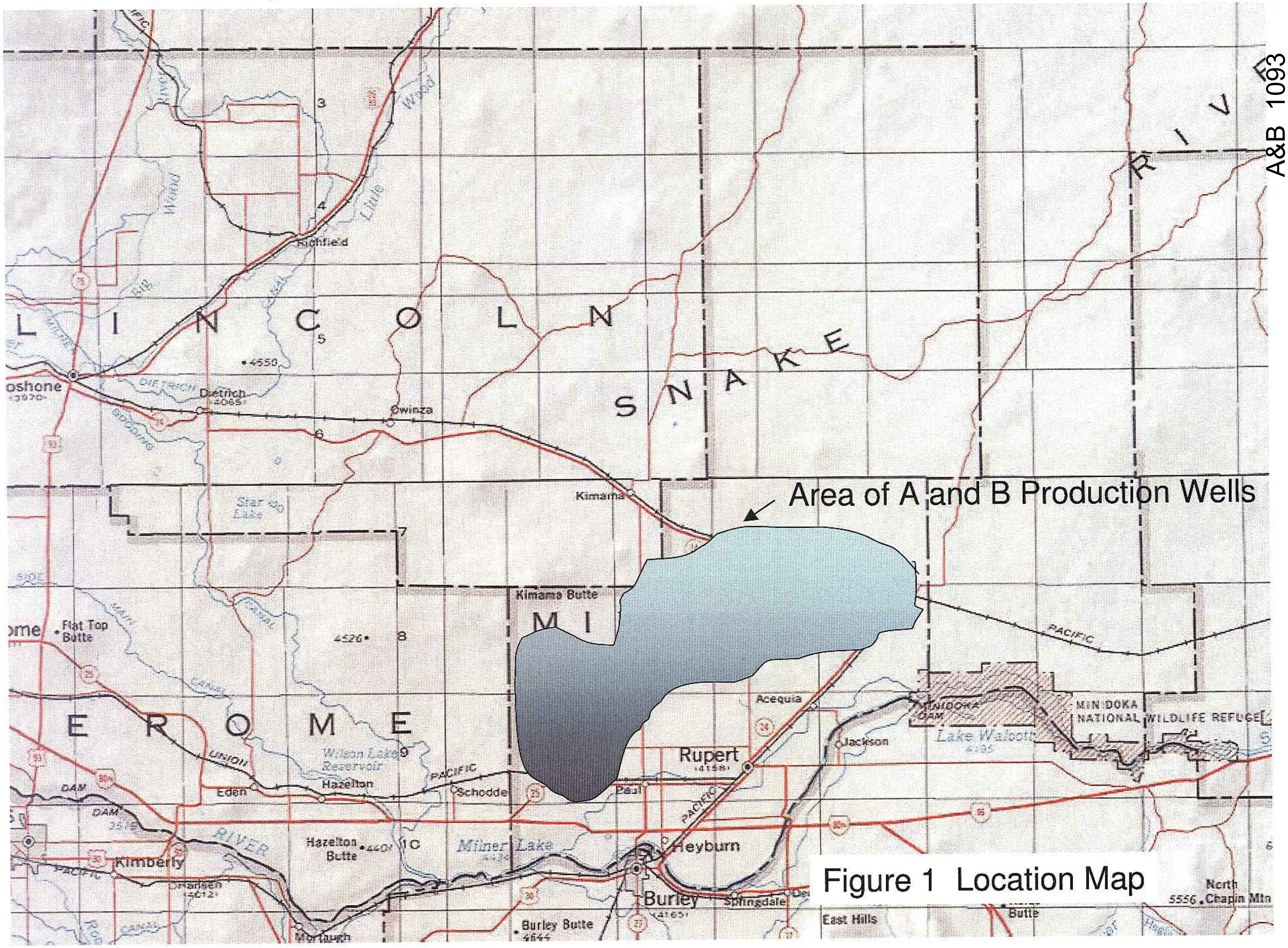

Figure 1 Location Map

A&B 1093

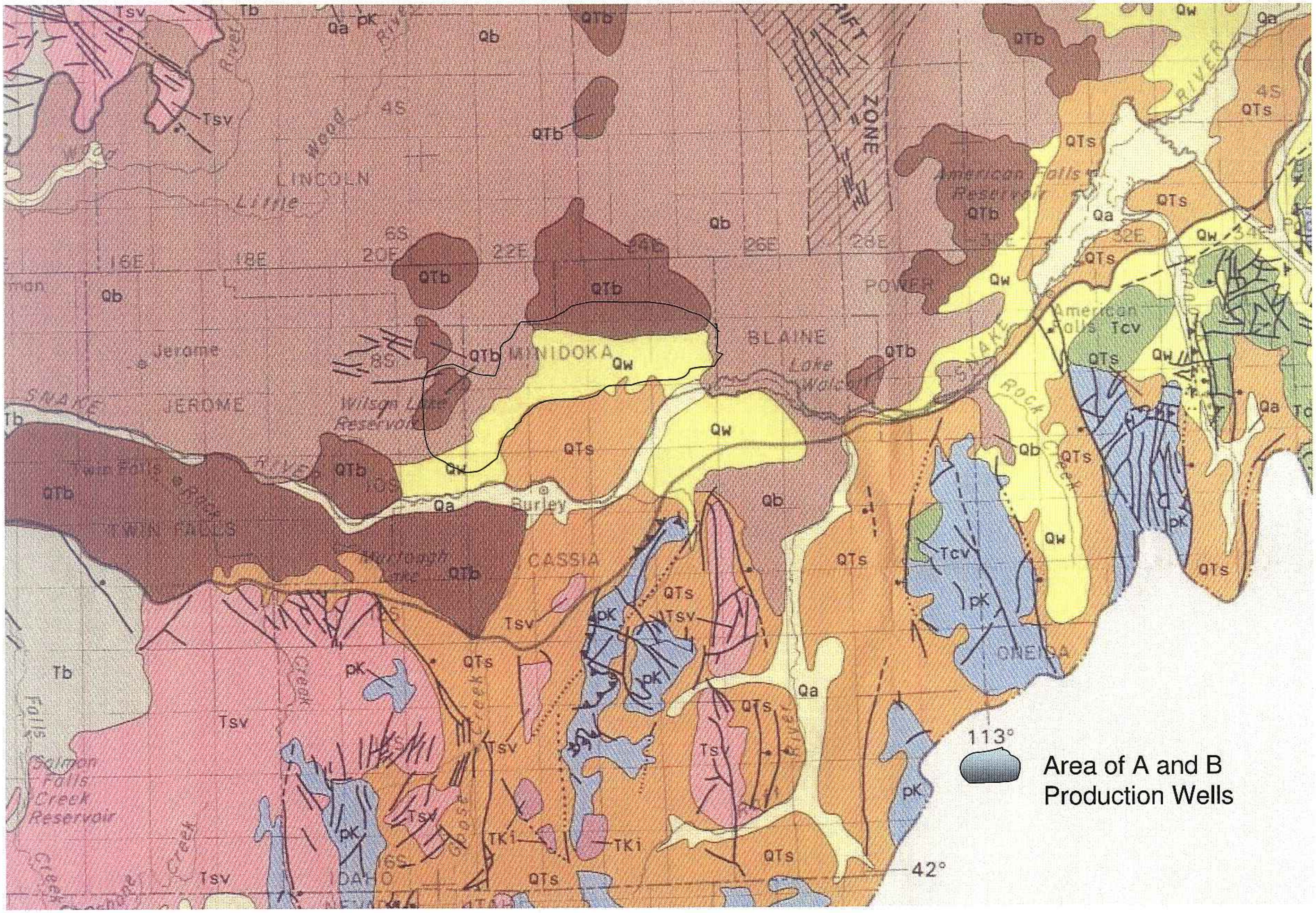

Figure 2a Geologic Map (from Whitehead, 1992)

EXPLANATION AND DESCRIPTION OF MAP UNITS

System	Series	Rock unit and map symbol	Physical characteristics and areal distribution	Water-yielding characteristics	Known thickness (ft)
QUATERNARY	Holocene	Alluvium — Qa	Chiefly flood-plain deposits. May contain some glacial deposits and colluvium in the uplands. Clay, silt, sand, gravel, and boulders; unconsolidated to well compacted; unstratified to well stratified. Alluvium floors the tributary valleys and flood plains of the main streams and forms fans at mouths of some valleys.	Hydraulic conductivity variable, moderately high in coarse-grained deposits. Sandy and gravelly alluvium yields moderate to large quantities of water to wells. Transmissivity ranges from about 16,000 to more than 160,000 ft^2/d (Nace and others, 1957, p. 55). Specific capacities commonly range from 20 to 100 (gal/min)/ft. An important aquifer.	<250 (?)
QUATERNARY	Holocene	Windblown deposits — Qw	Chiefly windblown deposits, include some lake and glacial-flood deposits; mantle much of the lowland areas; include active sand dunes in places, generally in northern Owyhee County and in northern part of eastern plain.	Generally above the water table.	<100 (?)
QUATERNARY	Holocene–Pleistocene	Younger basalt — Qb	Olivine basalt, dense to vesicular, aphanitic to porphyritic; irregular to columnar jointing; thickness of individual flows variable, but averages about 20-25 ft (Mundorff and others, 1964, p. 143). Includes beds of basaltic cinders, rubbly basalt, and interflow sedimentary rocks. Chiefly basalt of the Snake River Group. Crops out in much of Snake River Plain; mantled in many places with alluvium, terrace gravel, and windblown deposits.	Hydraulic conductivity variable but extremely high in places; formational conductivity high because of jointing and rubbly contacts between numerous flows; rock conductivity low. Unit constitutes the Snake River Plain aquifer east of King Hill (Mundorff and others, 1964, p. 8). Specific capacities of 500-1,000 (gal/min)/ft are common. Transmissivity determined from aquifer tests ranges from about 100,000 to more than 1,000,000 ft^2/d in much of the Snake River Plain (Mundorff and others, 1964, p. 159; Nace and others, 1957, p. 55).	>4,000 Includes QTb below
QUATERNARY	Pleistocene	Younger silicic volcanic rocks — Qsv	Rhyolitic ash-flow tuff, occurs as thick flows and blankets of welded tuff with associated fine- to coarse-grained ash and pumice beds. Include rocks of upper part of the Yellowstone Group and Plateau Rhyolite. Mantle much of Yellowstone Plateau in northeastern part of basin.	Hydraulic conductivity generally unknown but may be high as indicated by rapid percolation of surface runoff (Whitehead, 1978, p. 10). Tightly welded in places. Specific capacities range from 2 to 60 (gal/min)/ft. An important aquifer locally.	>3,000
QUATERNARY AND TERTIARY	Pleistocene, Pliocene, and Miocene	Basalt — QTb	Olivine basalt similar to Qb above. Included as part of the Snake River Plain aquifer. Tentatively assigned to upper part of Idaho Group. Exposures generally have well-developed soil cover.	Hydraulic conductivity slightly lower than Qb above. It decreases with increasing age.	Included with Qb above
QUATERNARY AND TERTIARY	Pleistocene, Pliocene, and Miocene	Older alluvium — QTs	Subaerial and lake deposits of clay, silt, sand, and gravel. Compacted to poorly consolidated; poorly to well stratified; beds somewhat lenticular and intertongued; contains beds of ash and intercalated basalt. Widespread tuffaceous sedimentary rocks and tuff in western part of basin. Includes upper part of Idaho Group and Payette and Salt Lake Formations. In places, underlies the older basalt (Tb).	Hydraulic conductivity highly variable; generally contains water under confined conditions; yields to wells range from a few gallons per minute from clayey beds to several hundred gallons per minute from sand and gravel. Specific capacities range from 5 to 60 (gal/min)/ft. In places, an important aquifer.	>5,500

Figure 2b Geologic Units (from Whitehead, 1992)

A&B 1095

EXPLANATION AND DESCRIPTION OF MAP UNITS

Age		Rock unit and map symbol		Physical characteristics and areal distribution	Water-yielding characteristics	Known thickness (ft)
TERTIARY	Pliocene and Miocene	Older basalt	Tb	Flood-type basalt, dense, columnar jointing in many places; folded and faulted (except for the Banbury Basalt); may include some rhyolitic and andesitic rocks; some flows of vesicular olivine basalt (Banbury), interbedded locally with minor amounts of stream and lake deposits. Includes Columbia River Basalt Group or equivalent (Miocene) and the Banbury Basalt of the Idaho Group (Miocene).	Hydraulic conductivity variable, may be high in places. Locally yields small to moderate amounts of water to wells from fractures and faults; some interbedded zones of sand and silt yield good supplies of water under confined or unconfined conditions. Specific capacities range from 3 to 900 (gal/min)/ft. An important aquifer.	>7,000 (The Banbury Basalt is generally <1,000. The older basalt may be >7,000 in the western plain)
TERTIARY	Pliocene to Oligocene	Older silicic volcanic rocks	Tsv	Rhyolitic, latitic, and andesitic rocks, massive and dense; jointing ranges from platy to columnar; occur as thick flows and blankets of welded tuff with associated fine- to coarse-grained ash and pumice beds (commonly reworked by flowing water) and as clay, silt, sand, and gravel; locally folded, tilted, and faulted. Include Idavada Volcanics.	Hydraulic conductivity highly variable. Joints and fault zones in flows and welded tuff and interstices in coarse-grained ash, sand, and gravel yield small to moderate, and rarely large, amounts of water to wells. Commonly contain thermal water under confined conditions. Specific capacities range from 1 to >2,000 (gal/min)/ft and are generally <400 (gal/min)/ft. An important aquifer.	>3,000
TERTIARY	Eocene and Paleocene	Volcanic rocks, undifferentiated	Tcv	Extrusive rocks range in composition from rhyolite to basalt; include welded tuff, pyroclastic, tuffaceous, and other clastic and sedimentary rocks. Chiefly Challis Volcanics; mainly crop out in mountains and foothills north of the eastern plain; may include some intrusive rocks.	Hydraulic conductivity generally low. Little information available on yields to wells. May be an important aquifer locally for domestic and stock use.	>5,000
TERTIARY AND CRETACEOUS		Sedimentary rocks, undifferentiated	TKs	Undifferentiated shale, siltstone, sandstone, and freshwater limestone of Tertiary and Cretaceous age. Younger rocks composed chiefly of breccia, conglomerate, and sandstone. Exposed in eastern part of basin. May include a few small outcrops of Jurassic age.	Hydraulic conductivity generally low. Little information available on yields to wells; weathered zones and fractures may yield moderate quantities of water to wells; large yields may be obtained in places. May be an important aquifer locally.	>10,000
TERTIARY AND CRETACEOUS		Intrusive rocks	TKi	Chiefly granitic rocks of the Idaho batholith; include older and younger crystalline rocks; crop out in a few places south of Snake River in Idaho and northern Nevada.	Hydraulic conductivity generally low. Faults, fractures, and weathered zones may yield small quantities of water to wells. Not an important aquifer.	Unknown
PRE-CRETACEOUS		Pre-Cretaceous rocks, undifferentiated	pK	Well-indurated sedimentary and metamorphic rocks that have been folded, faulted, and intruded by igneous rocks. Crop out in mountainous areas. Include extrusive rocks of Permian and Triassic age in western part of basin. May include Cretaceous or younger sedimentary rocks.	Hydraulic conductivity low. Faults, fractures, and weathered zones may yield small quantities of water to wells. Little information available on yields to wells. Not an important aquifer.	>12,000

Figure 2c Geologic Units (from Whitehead, 1992)

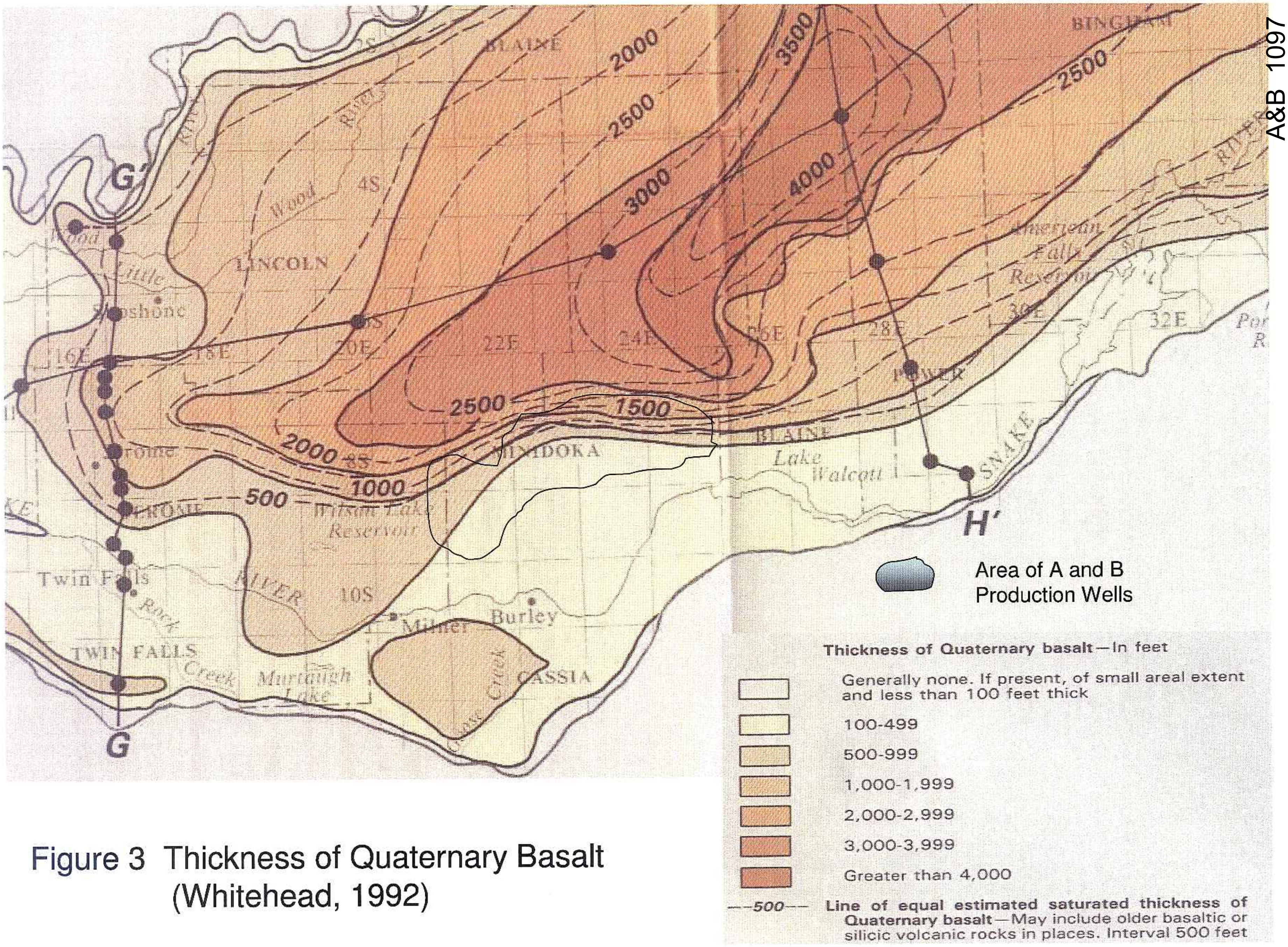

Figure 3 Thickness of Quaternary Basalt
(Whitehead, 1992)

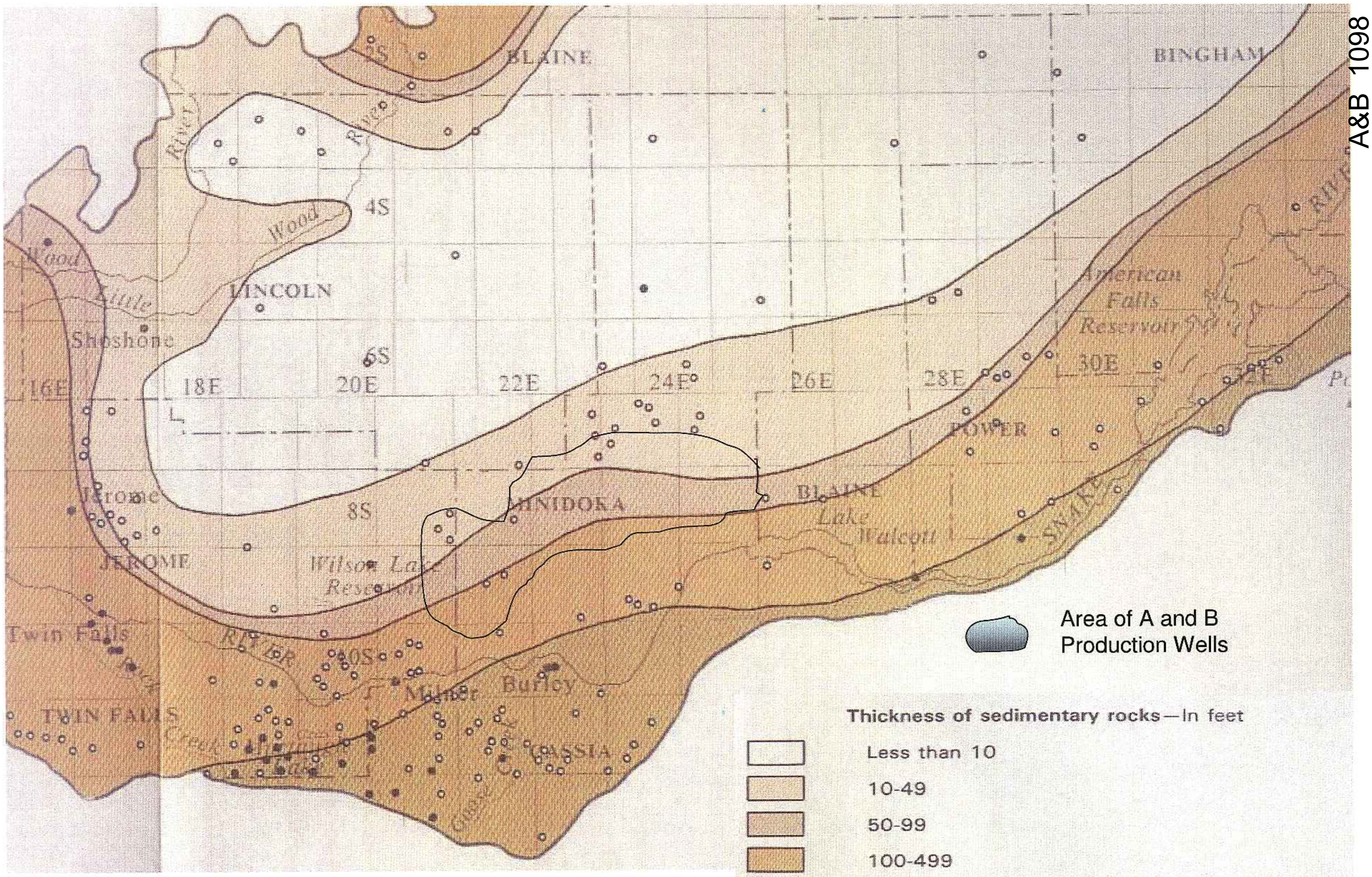

Figure 4 Thickness of Sedimentary Rocks (Whitehead, 1992)

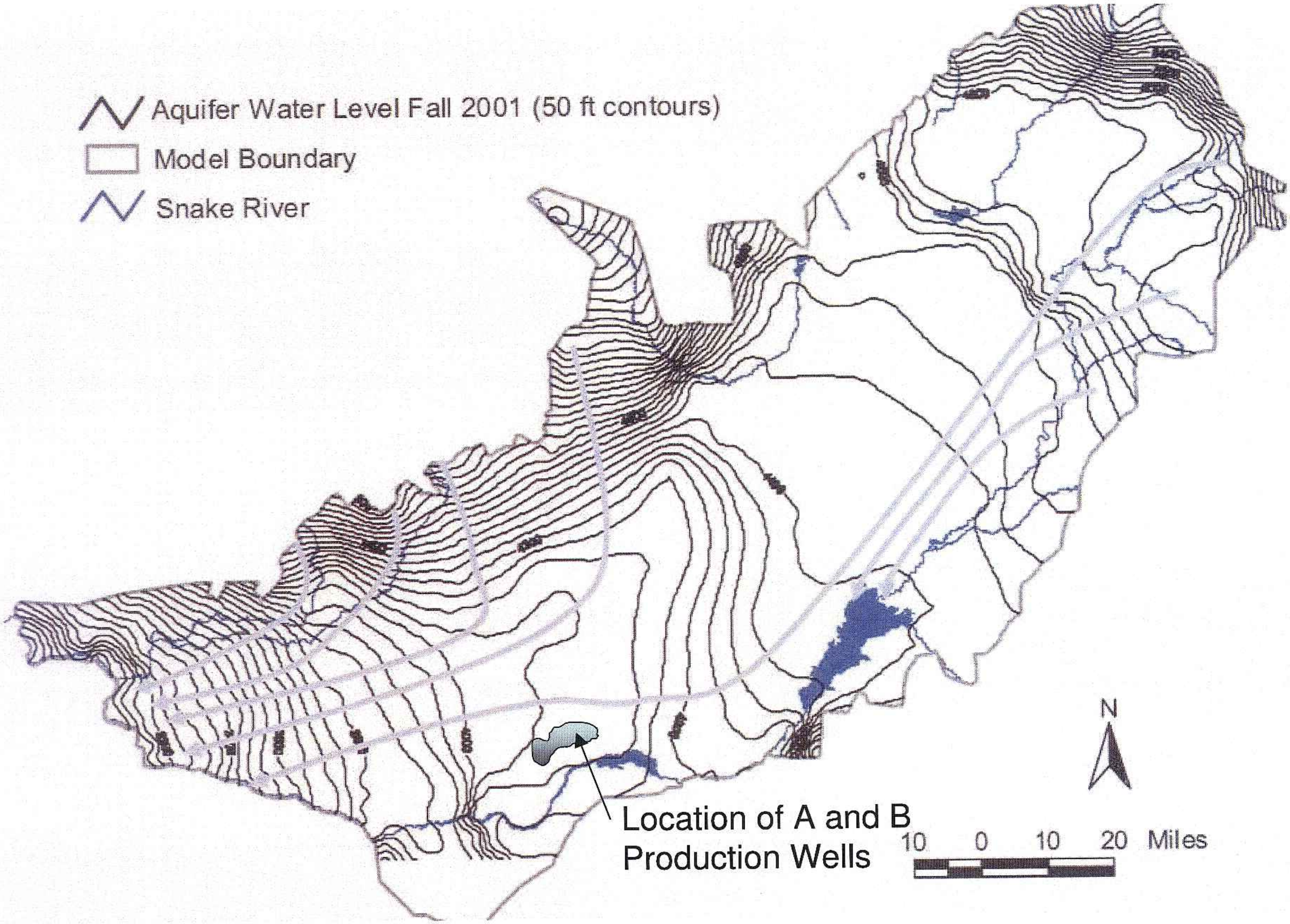

Figure 5 Water-Level Contours (from Cosgrove and others, 2006)

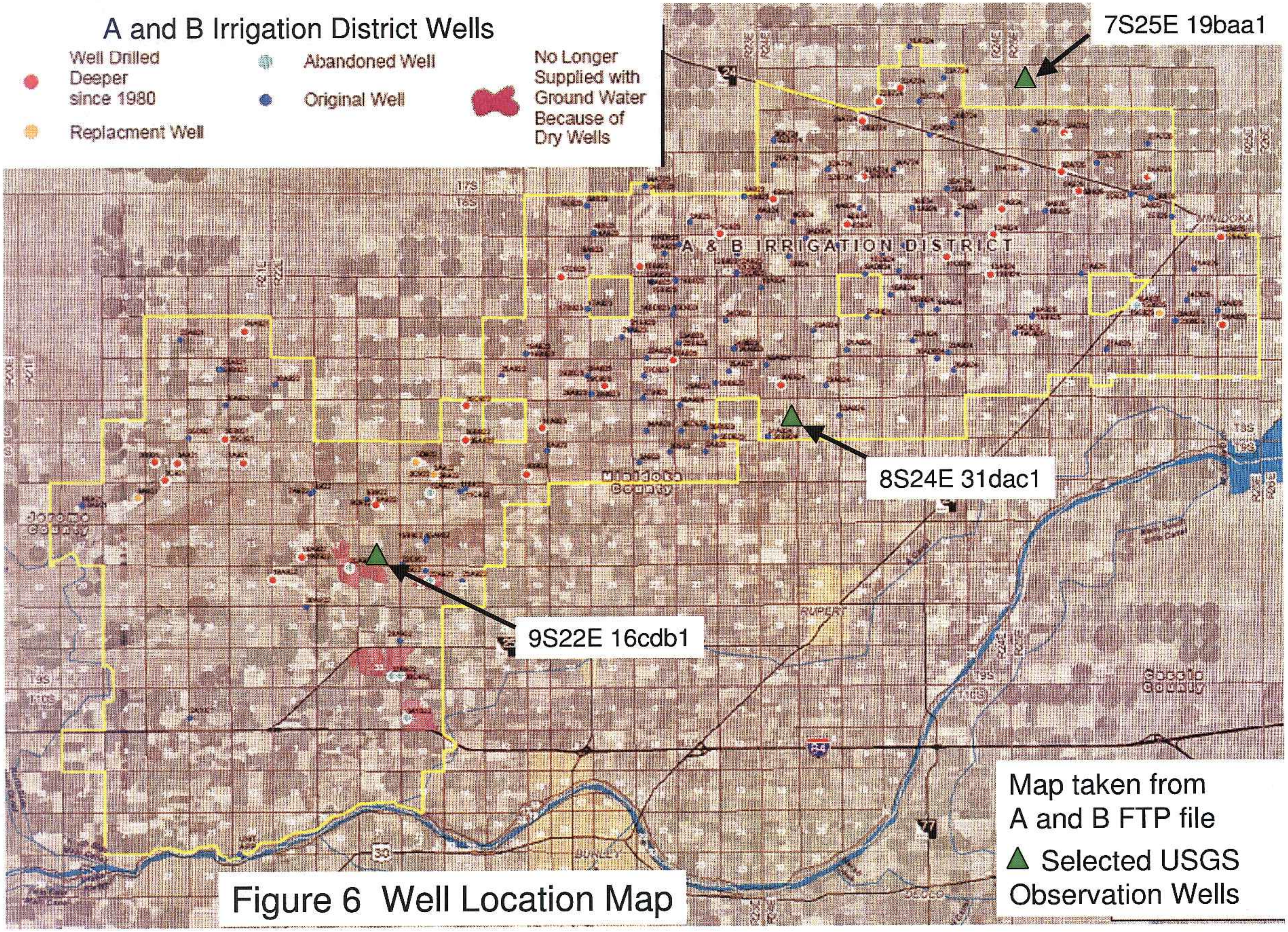

Figure 6 Well Location Map

Figure 7 Hydrograph for Well 7S25E 19baa1

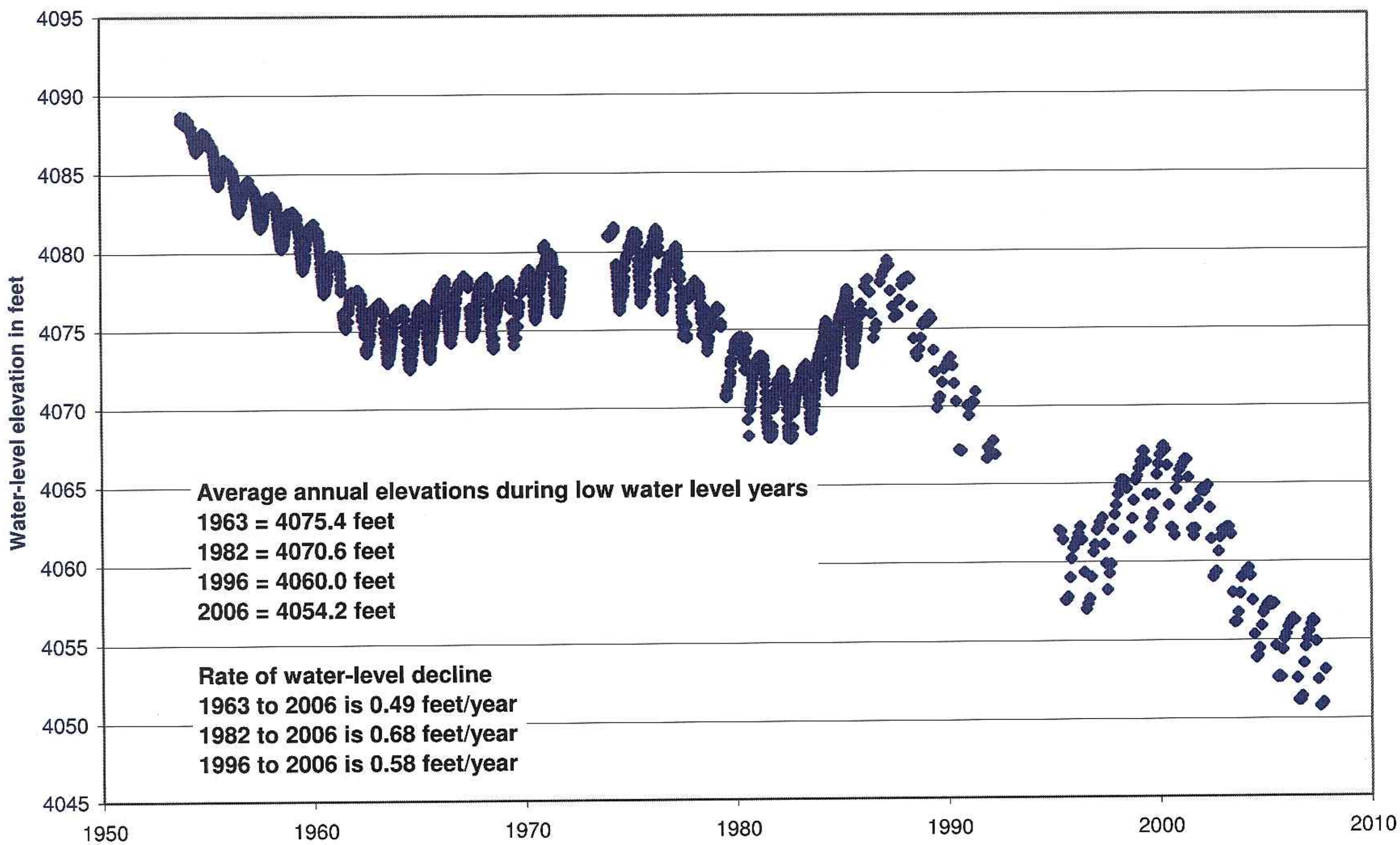

Figure 8 Hydrograph for Well 8S24E 31dac1

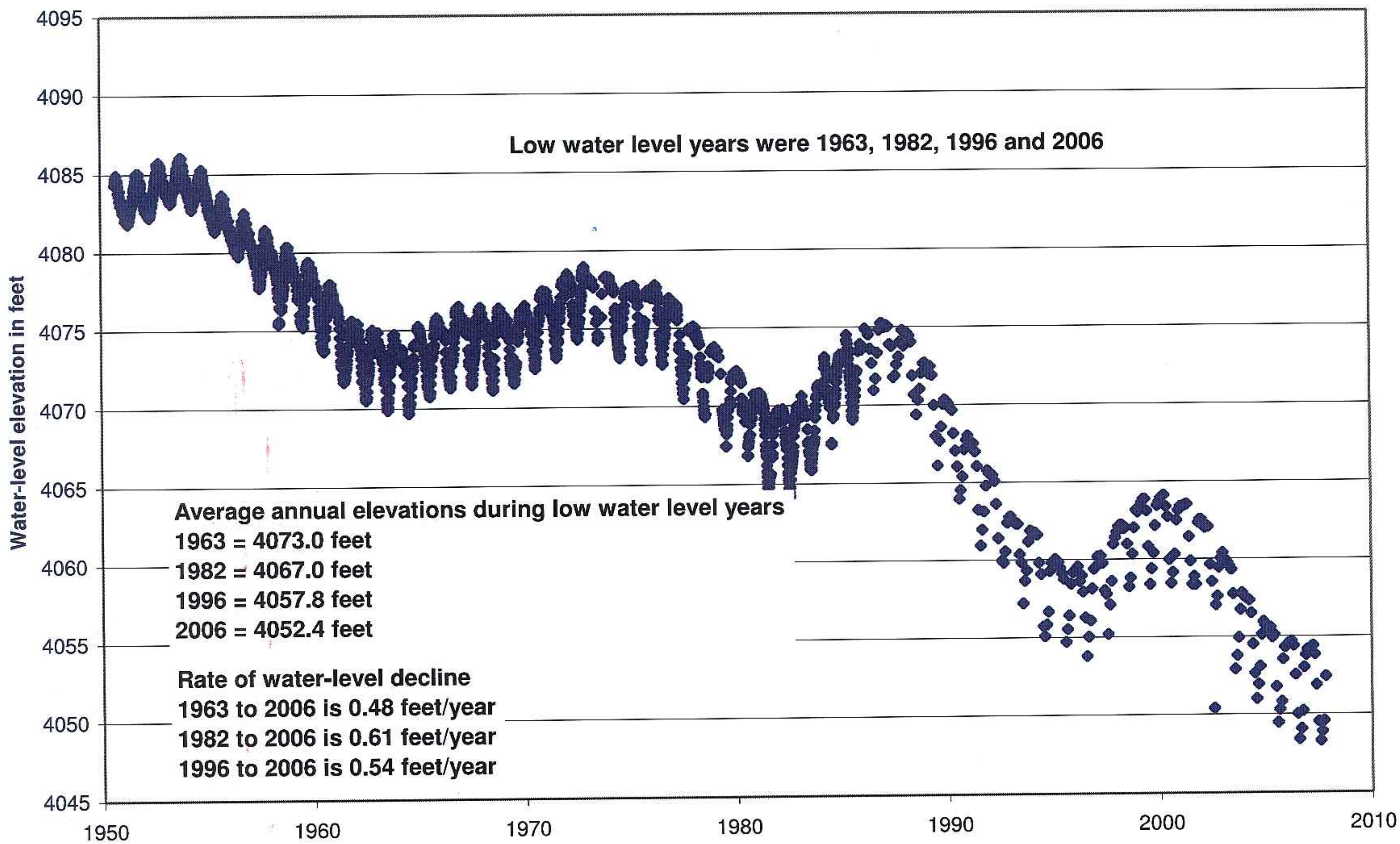

Figure 9 Hydrograph for Well 9S 22E 16cdb1

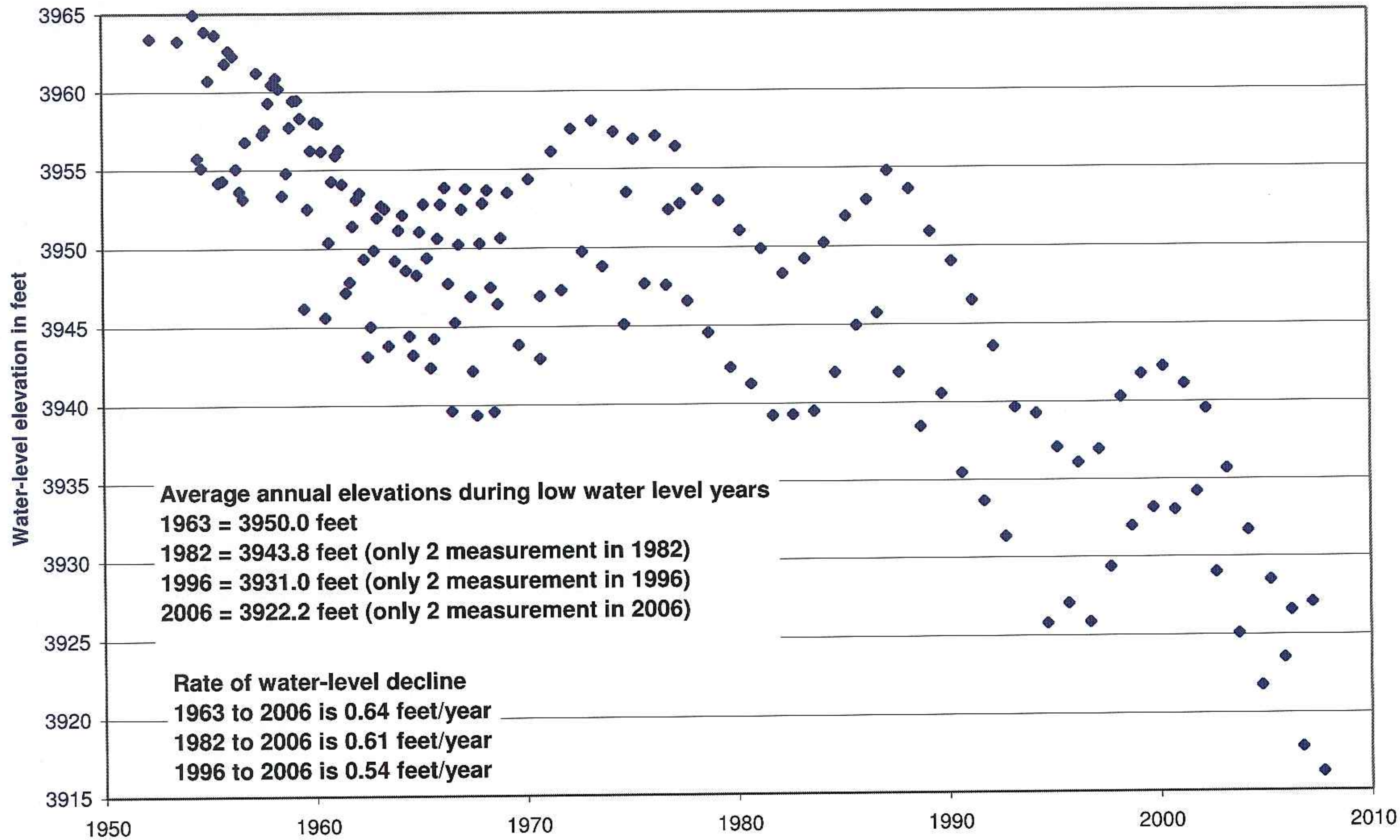

Figure 10 Temporal Pattern of Pumping From Selected Wells

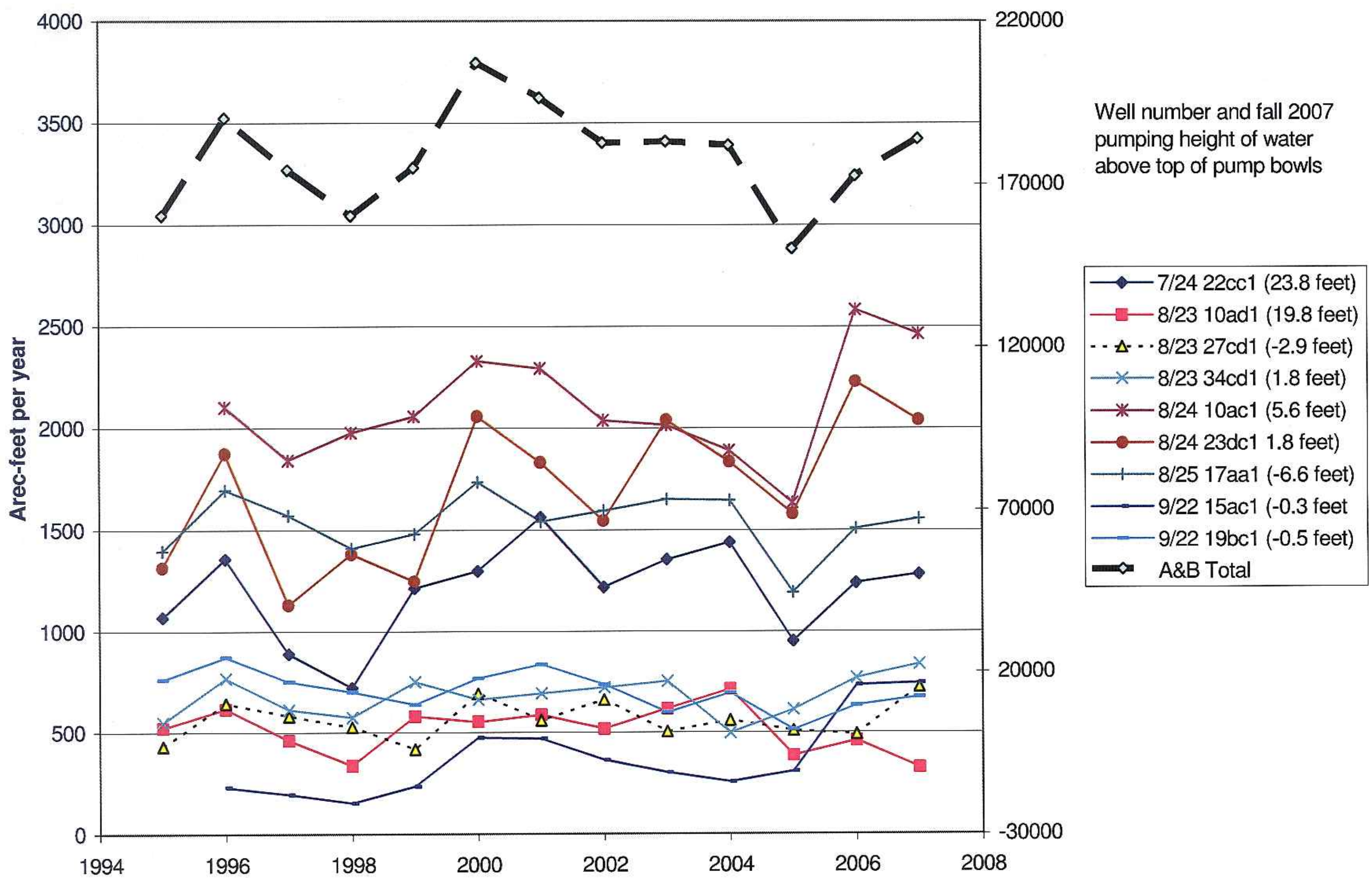

Figure 11A Average High and Low Discharge Rates from Wells in T7S and R23E, R24E and R25E

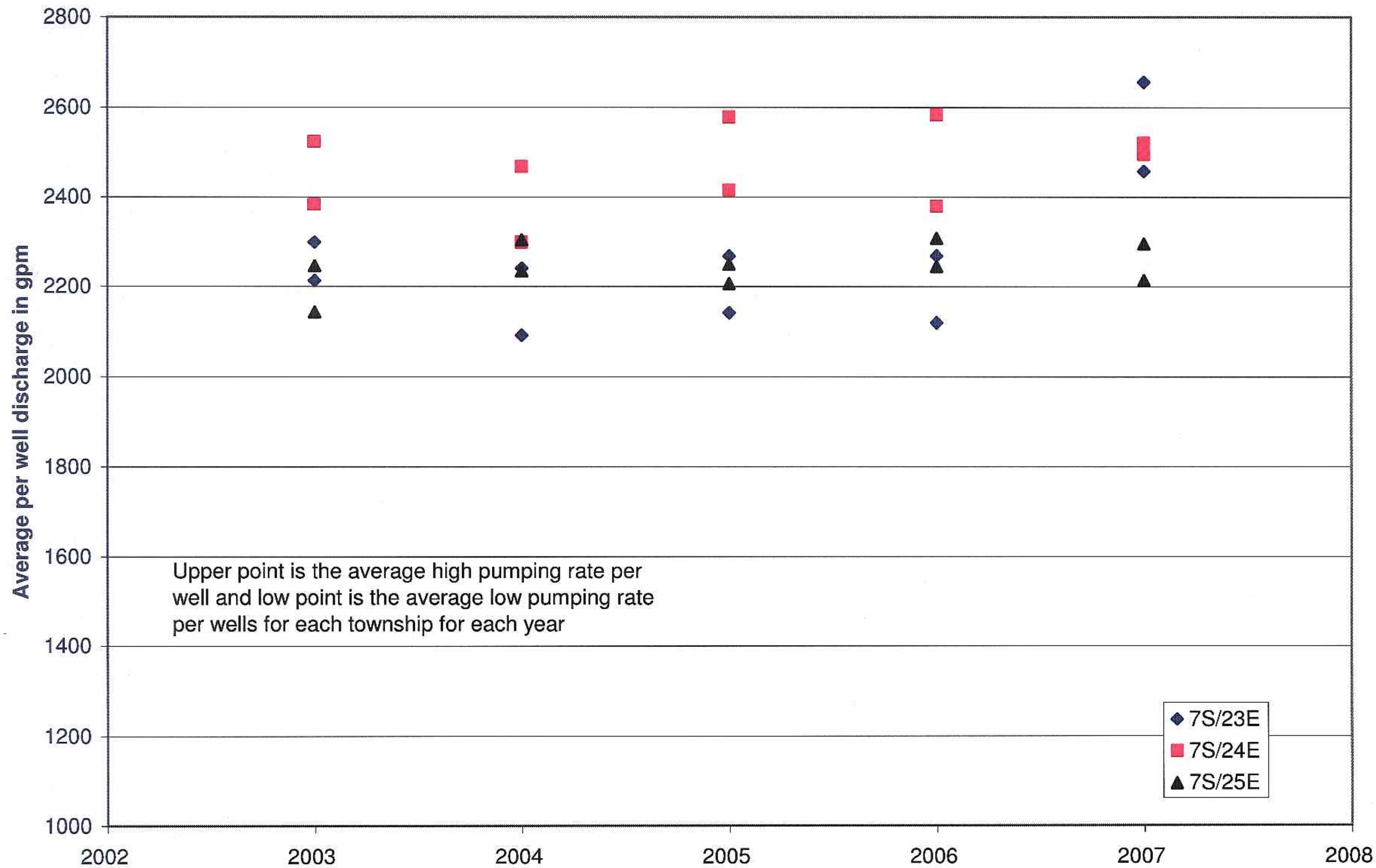

Figure 11B Average High and Low Discharge Rates from Wells in T8S and R21E, R22E, R23E, R24E and R25E

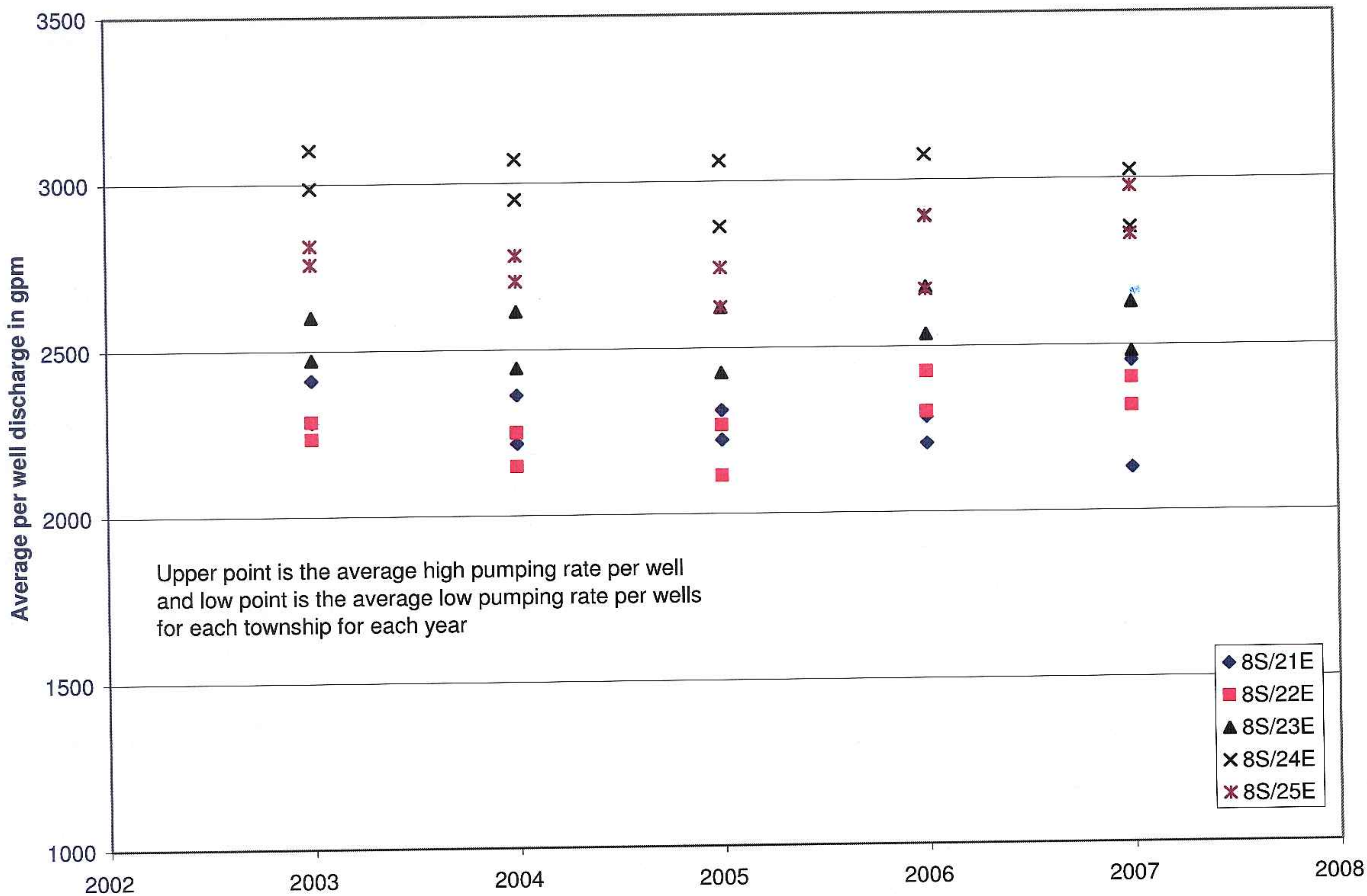

Figure 11C Average High and Low Discharge Rates from Wells in T9S and R21E, R22E and R23E and T10S and R21E

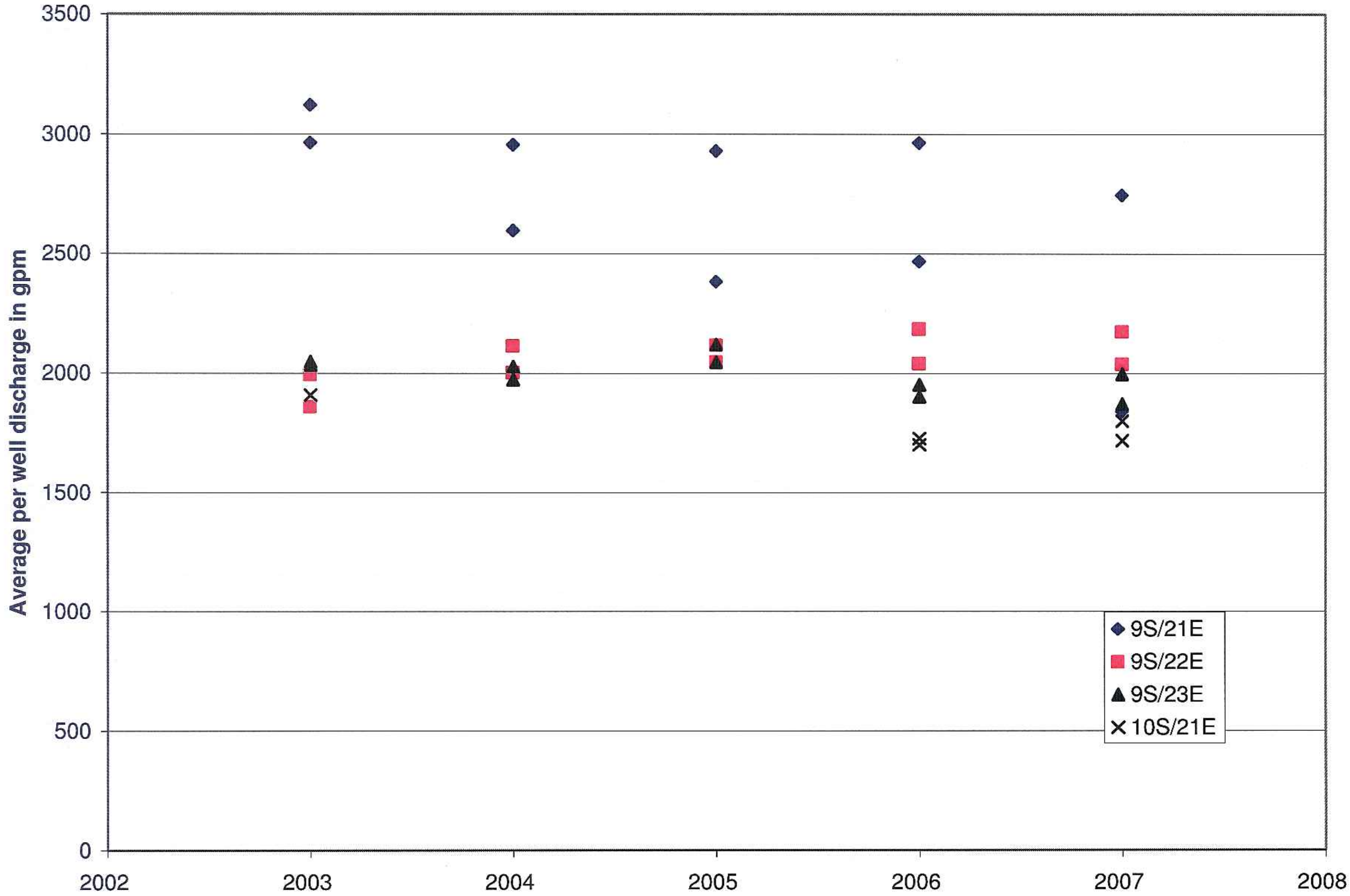

Table 1 Project Wells Depth Data for Interbeds Below the Water Table

Location	Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
7S 23E 34 DC	USBR	321	4288.08	229								
7S 23E 34 CD	USBR	325	4287.55	226								
7S 24E 7 AD	USBR	308	4270.87	188								
7S 24E 22 DB	USBR	318	4284.98	206								
7S 24E 22 DD	USBR	307	4477.48	197	194	205						
7S 24E 22 CC	USBR	352	4290.76	211								
7S 24E 23 AC	USBR	262	4288.01	206								
7S 24E 26 CB	USBR	290	4276.68	193								
7S 24E 28 AC	USBR	351	4274.97	213								
7S 24E 28	USBR	353	4293.17	213								
7S 24E 30 DB	USBR	394	4317.51	247	383	390						
7S 24E 30 DB	USBR	393		246								
7S 24E 31 AD	USBR	363	4305.1	234	356	363						
7S 24E 32 AD	USBR	395	4288.1	210	302	314						
7S 24E 32 BD	USBR	397	4285.1	210	308	314						
7S 24E 33 CB	USBR	282	4284.77	209	272	280						
7S 24E 33 DB	USBR	316	4284.9	203	260	284						
7S 24E 34 BD	USBR	259	4273.2	107								
7S 24E 34 DC	USBR	324	4287.55									
7S 24E 35 DC	USBR	230	4277	189								
7S 24E 35 DC	USBR	229	4477	188								
7S 24E 35 DC	USBR	270										
7S 24E 36 DB	USBR	516	4219.12	280								
7S 25E 19 AA	USBR	284		232								
7S 25E 27 CD	USBR	346	4299.4	208	216	244						
7S 25E 29 DA	USBR	296	4314.13	227								
7S 25E 29 CA	USBR	365	4328.66	241								
7S 25E 30 DA	USBR	296	4314.13	227								
7S 25E 31 DA	USBR	252	4271.6	186								
7S 25E 32 CA	USBR	257	4273.14	184								
7S 25E 33 BC	USBR	301	4294.01	204								
7S 25E 34 CA	USBR	340	4501.01	216								
8S 21E 22 DA	USBR	399	4219.45	307	395	399						
8S 21E 24 BD	USBR	480	4259.32	311	467	480						
8S 21E 26 DA	USBR	587	4249.6	325	280	286						
8S 21E 35 DD	USBR	425	4232.09	320	420	423						
8S 21E 35 DD	USBR	365	4232.09	320								
8S 21E 35 CC	USBR	406	4216.5	312								
8S 22E 30 DB	USBR	516	4219.12	280								
8S 22E 35 DC	USBR	290	4247.24	203	254	290						
8S 22E 35 AB	USBR	350	4280.11	237	290	313						
8S 22E 35 DC	USBR	246	4247.03	203								
8S 23E 1 AB	USBR	371	4302.9	235								
8S 23E 1 AB	USBR	309	4302.81	235								
8S 23E 1 CC	USBR	316		228								
8S 23E 1 C	USBR	369	4302.81	255								

Table 1 Project Wells Depth Data for Interbeds Below the Water Table (continued)

Location			Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
8S	23E	2 CC	USBR	327	4268.05	214	212	220						
8S	23E	4 CC	USBR	368	4290.76	233								
8S	23E	4 CC	USBR	310	4290.37	232								
8S	23E	4 BD	USBR	238		196								
8S	23E	5 CB	USBR	263		224								
8S	23E	5 AD	USBR	333	4296.54	239								
8S	23E	5 AD	USBR	388	4296.98	238								
8S	23E	8 DC	USBR	168										
8S	23E	8 DA	USBR	351	4286.4	232								
8S	23E	10 AC	USBR	227		181								
8S	23E	10 CA	USBR	236		181								
8S	23E	10 DC	USBR	222		178								
8S	23E	10 DA	USBR	255	4267.62	204								
8S	23E	10 DA	USBR	332										
8S	23E	10 CC	USBR	261	4272.48	214								
8S	23E	10 CC	USBR	326										
8S	23E	11 BC	USBR	241		175								
8S	23E	12 CD	USBR	267	4263.25	198								
8S	23E	12 AC	USBR	316	#VALUE!	210								
8S	23E	12 AA	USBR	252		201								
8S	23E	12 CD	USBR	298	4263.01	196								
8S	23E	12 A	USBR	314	4276.66	211								
8S	23E	14 CC	USBR	238		176								
8S	23E	14 DC	USBR	207		163								
8S	23E	14 B	USBR	278	4258.66	198								
8S	23E	15 DD	USBR	287	4251.1	193								
8S	23E	15	USBR	307	4268.16	219	235	245						
8S	23E	15 A	USBR	302	4268.03	209								
8S	23E	17 DD	USBR	278	4253.73	198								
8S	23E	17 DD	USBR	305	4253.89	199								
8S	23E	17 BA	A and B	330		246	325	330						
8S	23E	19 DB	USBR	300	4265.93	216	292	300						
8S	23E	19 DD	USBR	260	4265.93	216								
8S	23E	20 AA	USBR	246		188								
8S	23E	21 CB	USBR	251										
8S	23E	21 AD	USBR	286	4243.91	187								
8S	23E	21 AD	USBR	257		112								
8S	23E	22 BA	USBR	210		175								
8S	23E	22 CA	USBR	201		157								
8S	23E	22 CD	USBR	281	4249.76	192								
8S	23E	22 BC	USBR	228		165								
8S	23E	22 CA	USBR	211		166								
8S	23E	22 DD	USBR	207		173								
8S	23E	23 CB	USBR	300	4255.2	199	289	300						
8S	23E	23 CB	USBR	290	4255.44	195	217	225						

Table 1 Project Wells Depth Data for Interbeds Below the Water Table (continued)

Location	Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
8S 23E 24 DC	USBR	257	4229.67	146	226	237						
8S 23E 24 BB	USBR	240		146								
8S 23E 24 DC	USBR	315	4229.57	149	226	238						
8S 23E 25 CC	USBR	188		132	159	168						
8S 23E 25 BD	USBR	225	4217.13	151	193	203						
8S 23E 25 AC	USBR	157		113								
8S 23E 25 DD	USBR	192		117								
8S 23E 26 BC	USBR	170										
8S 23E 26 AA	USBR	176		144								
8S 23E 26 DB	USBR	196	4223.29	163								
8S 23E 26 DA	USBR	285		151								
8S 23E 26 CD	USBR	150		57								
8S 23E 26 AA	A and B	280		151								
8S 23E 27 AA	A and B	370		209	285	300						
8S 23E 27 CC	A and B	217		168								
8S 23E 27 DC	USBR	229	4224.77	167								
8S 23E 27 BD	USBR	260	4235	178								
8S 23E 27 AA	USBR	370	4242.9	186	283	300						
8S 23E 28 CC	USBR	261	4237.37	183								
8S 23E 28 CC	USBR	262	4237.74	183								
8S 23E 28 CA	USBR	300	4232.09	176	272	292						
8S 23E 28 BB	USBR	237		170								
8S 23E 28 CD	USBR	230		159								
8S 23E 29 AD	USBR	285	4243.36	189								
8S 23E 29 AD	USBR	249	4243.57	189								
8S 23E 31 DA	USBR	235	4230.01	179								
8S 23E 34 BD	A and B	226										
8S 23E 34 DC	USBR	216		147	187	216						
8S 23E 34 BD	USBR	185		145								
8S 23E 34 AA	USBR	188		156								
8S 23E 34 BB	USBR	204		155								
8S 23E 34 CD	USBR	234	4222.36	145	184	188	221	233				
8S 23E 35 BB	USBR	234	4225.16	144	220	233						
8S 23E 35 DD	USBR	231	4222.5	140	154	171						
8S 23E 35 CC	USBR	298	4223.44	144	189	216						
8S 23E 35 DB	USBR	267	4224.9	143	164	176						
8S 24E 1 AD	USBR	227	4254.19	167								
8S 24E 1 BA	USBR	165		139								
8S 24E 1 AD	A and B	252		198	218	229	249	252				
8S 24E 2 DA	USBR	236	4248.31	165								
8S 24E 3 AA	USBR	340	4270.8	183	187	193						
8S 24E 3 AD	USBR	302	4270.02	184								
8S 24E 4 CD	USBR	304	4268	195								
8S 24E 4 CC	USBR	313	4269	192								
8S 24E 4 AC	USBR	320	4267.6	198	270	283						

Table 1 Project Wells Depth Data for Interbeds Below the Water Table (continued)

Location	Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
8S 24E 4	A and B			213	328	334						
8S 24E 5 AA	A and B	300		211								
8S 24E 5 AA	USBR	240		203								
8S 24E 5 BA	USBR	240		199								
8S 24E 6 DA	USBR	302	4262.27	197								
8S 24E 6 BA	USBR	339	4290.5	220	290	292						
8S 24E 6 CB	USBR	364	4296.05	229								
8S 24E 6 BA	A and B	290		249								
8S 24E 7 DA	A and B	307		218								
8S 24E 7 DA	USBR	240	4240	168								
8S 24E 7	USBR	285		168								
8S 24E 8 BB	USBR	233		157								
8S 24E 8 AD	USBR	265	4259	178								
8S 24E 9 DC	USBR	191		128								
8S 24E 10	USBR	258	4254.48									
8S 24E 10	USBR	238	4240.7	154								
8S 24E 10 BC	USBR	240	4245		214	225						
8S 24E 11 DB	A and B	415		183	290	293	325	415				
8S 24E 11 BA	USBR	200	4253.9	105	127	141						
8S 24E 11 DB	USBR	195	4245.4	156								
8s 24E 11 B	USBR	246	4253.9	165								
8S 24E 11	USBR	282										
8S 24E 12 AB	USBR	190	4235.1	148								
8S 24E 12 AB	A and B	266		179	267	270						
8S 24E 12 AB	A and B	258										
8S 24E 13 BC	USBR	250	4244.8	155								
8S 24E 13 DC	USBR	246		99								
8S 24E 13 AB	USBR	209	4244.8	154								
8S 24E 14 BA	A and B	210		174								
8S 24E 14 CD	USBR	235	4220.1	131								
8S 24E 14 A	USBR	175	4229.37	140								
8S 24E 15 DD	USBR	300		160								
8S 24E 15	USBR	232	4233.8		178	188						
8S 24E 18 BC	USBR	265	4247.5	182								
8S 24E 20 BC	USBR	366	4216.9	143	225	240	257	302	342	365		
8S 24E 20 BC	USBR	365	4216.9	142	225	248	257	302	342	365		
8S 24E 21 AB	USBR	346	4181	145								
8S 24E 21 B	USBR	155	4204.29	125								
8S 24E 21 CC	USBR	363	4224	140	204	221	333	363				
8S 24E 21 A	USBR	253	4231	145								
8S 24E 22 DA	USBR	246	4221.8	132	167	186						
8S 24E 22 DA	USBR	240	4221.8	132	167	186						
8S 24E 23 BC	USBR	230										
8S 24E 23 DC	USBR	250	4227.1	130	130	140						
8S 24E 24 DB	USBR	257		154	226	237						

Table 1 Project Wells Depth Data for Interbeds Below the Water Table (continued)

Location	Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
8S 24E 24 BB	USBR	174		83								
8S 24E 24 BA	USBR	191		101								
8S 24E 25 AD	USBR	277		79	182	189						
8S 24E 25 CC	USBR	194										
8S 24E 26 CC	USBR	165		94	118	135						
8S 24E 26 AC	USBR	208	4208.7	117								
8S 24E 27 CC	A and B	220		80	160	172						
8S 24E 27 CB	USBR	165			160	165						
8S 24E 29 C	USBR	234	4204.31	119								
8S 24E 30 DB	USBR	300	4206.26	124								
8S 24E 30 BA	USBR	258	4217.1	146	212	214						
8S 24E 31 CD	USBR	302	4243.44	159	127	173						
8S 24E 31 CD	USBR	270	4243.44	160	128	168						
8S 24E 31 CB	USBR	185		141	106	142						
8S 24E 31 CC	USBR	210	4243.44	160	128	168						
8S 24E 32 CB	USBR	178		87	85	125						
8S 24E 33 BA	USBR	340	4300.93	210	265	270	328	335				
8S 25E 3 BA	USBR	359	4301	208	261	269	327	334				
8S 25E 3 BB	USBR	367	4293.89		275	283	327	348				
8S 25E 3 BB	USBR	381	4494.12	203	275	282	337	340				
8S 25E 3 DA	USBR	340	4300.92	210	265	270	328	335				
8S 25E 5 AA	A and B	410		220								
8S 25E 5 AA	USBR	240	4284.59	198								
8S 25E 5 AA	USBR	280	4284.99	199								
8S 25E 6 DA	USBR	248	4252.43	166								
8S 25E 6 DA	USBR	257	4252.31	167								
8S 25E 6 DA	USBR	237	4262.27	197								
8S 25E 6 CB	USBR	365	4296.05	229								
8S 25E 11 CD	USBR	230	4263.57	172								
8S 25E 12 BB	USBR	275	4279.94	187	255	261	268	272				
8S 25E 12 BB	USBR	275	4280.33	187	255	261	268	272				
8S 25E 12 BB	USBR	295	4279.94	187	256	268						
8S 25E 13 CC	USBR	195	4249.57	157								
8S 25E 14 CA	USBR	257	4255.82	163	253	257						
8S 25E 15 CC	USBR	250	4244.45	153								
8S 25E 15 CC	USBR	271	4244.49	152	256	259						
8S 25E 15 CC	A and B	251		181								
8S 25E 17 AA	USBR	211	4220.57	131								
8S 25E 19 DC	USBR	123		86								
8S 25E 19 AB	USBR	221	4212.4	120								
8S 25E 19 BC	USBR	224	4218.51	127								
8S 25E 19 BC	USBR	222	4218.36	127								
8S 25E 21 CD	USBR	228	4216.11	128								
8S 25E 23 BB	USBR	252	4253.06	160	249	252						
8S 25E 23 BB	USBR	276	4252.77	160	253	276						

Table 1 Project Wells Depth Data for Interbeds Below the Water Table (continued)

Location	Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
8S 25E 24 BB	USBR	510	4249.32	155	234	246	390	400				
8S 25E 29 BA	USBR	145		83								
9S 21E 1 CA	USBR	587	4240.42	322	542	547	562	577				
9S 21E 3 DB	USBR	401		301	388	401						
9S 21E 3 CB	USBR	437		299	358	387						
9S 21E 3 CD	USBR	317		302								
9S 21E 3 CD	USBR	700	4197.65	302	447	460	535	545				
9S 21E 3 AB	USBR	420		330								
9S 21E 9 AA	USBR	317		292								
9S 22E 3 DD	A and B	350		242	349	350						
9S 22E 3 DD	USBR	327	4236.18	221								
9S 22E 3 AA	A and B	387		272	381	387						
9S 22E 3 AA	A and B	350		267	343	350						
9S 22E 3 DD	USBR	320	4235.78	222								
9S 22E 7 AA	USBR	543	4236.9	275	424	505	535					
9S 22E 7 AD	USBR	358	4238.44	276								
9S 22E 9 DA	A and B	590		258	256	271	301	320	405			
9S 22E 9	A and B	501		243	412	447						
9S 22E 9 CA	USBR	415	4212.56	249	256	271	301	320	405	424	505	535
9S 22E 9 BC	USBR	344	4218.13	250	270	283						
9S 22E 10 CB	USBR	429	4220.7	255	260	296	302	308	372	395		
9S 22E 10 AD	USBR	466	4220.61	210	294	340	455	466				
9S 22E 11 BD	A and B	435		220	425	433						
9S 22E 11 DB	USBR	322	4214.15	202	284	322						
9S 22E 11 DD	USBR	187		137								
9S 22E 11 BA	USBR	420	4212.64	191	308	372						
9S 22E 11 BA	USBR	494	4212	197	315	494						
9S 22E 15 AD	USBR	391	4208.28	236	382	391						
9S 22E 15 AC	USBR	239	4208.1	197	231	239						
9S 22E 18 DC	USBR	310	4201.39	247								
9S 22E 18 DC	USBR	332	4201.29	247								
9S 22E 18 DC	A and B	380										
9S 22E 19 BC	USBR	356		293								
9S 22E 20 AA	USBR	700	4209.21	251	372	426						
9S 22E 22	USBR	576	4207.85	245	309	312	360	503				
9S 22E 22 DC	USBR	456	4209.51	215	366	455						
9S 22E 22 AC	USBR	1000	4208.01	248	306	505	632	687	727	735		
9S 22E 28	USBR	442	4191.73	230	308	347	352	361	389	395		
9S 22E 30 AA	USBR	510	4186.89	236	267	302						
9S 22E 33 AA	A and B	302		245								
9S 22E 33 DA	USBR	463	4198.61	233	278	330						
9S 22E 33 DA	USBR	485	4197.12	239	278	292	306	324	376	382		
9S 23E 2 AC	USBR	247	4223.47	141	175	187						
9S 23E 3 BD	USBR	340	4222.91	167	221	249	326	348	358	380		
9S 23E 3 AA	USBR	285	4214.3	134	194	223						

Table 1 Project Wells Depth Data for Interbeds Below the Water Table (continued)

Location			Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)	Sediment Depth Top (ft)	Sediment Depth Bot. (ft)
9S	23E	6 A	USBR	259	4225.04	174	225	226	242	256				
9S	23E	6 CB	USBR	234	4206.11	158	226	234						
10S	21E	2 CB	USBR	646	4222.11	356	282	294	625	631				
10S	22E	3 CD	USBR	225		213								

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table

Location	Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Well Bot. Elevation (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)
23E 34 DC	USBR	321	4288.08	229	3967.08						
23E 34 CD	USBR	325	4287.55	226	3962.55						
24E 7 AD	USBR	308	4270.87	188	3962.87						
24E 22 DB	USBR	318	4284.98	206	3966.98						
24E 22 DD	USBR	307	4477.48	197	4170.48	4283	4272				
24E 22 CC	USBR	352	4290.76	211	3938.76						
24E 23 AC	USBR	262	4288.01	206	4026.01						
24E 26 CB	USBR	290	4276.68	193	3986.68						
24E 28 AC	USBR	351	4274.97	213	3923.97						
24E 28	USBR	353	4293.17	213	3940.17						
24E 30 DB	USBR	394	4317.51	247	3923.51	3935	3928				
24E 30 DB	USBR	393		246							
24E 31 AD	USBR	363	4305.1	234	3942.1	3949	3942				
24E 32 AD	USBR	395	4288.1	210	3893.1	3986	3974				
24E 32 BD	USBR	397	4285.1	210	3888.1	3977	3971				
24E 33 CB	USBR	282	4284.77	209	4002.77	4013	4005				
24E 33 DB	USBR	316	4284.9	203	3968.9	4025	4001				
24E 34 BD	USBR	259	4273.2	107	4014.2						
24E 34 DC	USBR	324	4287.55		3963.55						
24E 35 DC	USBR	230	4277	189	4047						
24E 35 DC	USBR	229	4477	188	4248						
24E 35 DC	USBR	270									
24E 36 DB	USBR	516	4219.12	280	3703.12						
25E 19 AA	USBR	284		232							
25E 27 CD	USBR	346	4299.4	208	3953.4	4083	4055				
25E 29 DA	USBR	296	4314.13	227	4018.13						
25E 29 CA	USBR	365	4328.66	241	3963.66						
25E 30 DA	USBR	296	4314.13	227	4018.13						
25E 31 DA	USBR	252	4271.6	186	4019.6						
25E 32 CA	USBR	257	4273.14	184	4016.14						
25E 33 BC	USBR	301	4294.01	204	3993.01						
25E 34 CA	USBR	340	4501.01	216	4161.01						
21E 22 DA	USBR	399	4219.45	307	3820.45	3824	3820				
21E 24 BD	USBR	480	4259.32	311	3779.32	3792	3779				
21E 26 DA	USBR	587	4249.6	325	3662.6	3970	3964				
21E 35 DD	USBR	425	4232.09	320	3807.09	3812	3809				
21E 35 DD	USBR	365	4232.09	320	3867.09						
21E 35 CC	USBR	406	4216.5	312	3810.5						
22E 30 DB	USBR	516	4219.12	280	3703.12						
22E 35 DC	USBR	290	4247.24	203	3957.24	3993	3957				
22E 35 AB	USBR	350	4280.11	237	3930.11	3990	3967				
22E 35 DC	USBR	246	4247.03	203	4001.03						
23E 1 AB	USBR	371	4302.9	235	3931.9						
23E 1 AB	USBR	309	4302.81	235	3993.81						
23E 1 CC	USBR	316		228							

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table (continued)

		Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Well Bot. Elevation (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)
23E	1 C	USBR	369	4302.81	255	3933.81						
23E	2 CC	USBR	327	4268.05	214	3941.05	4056	4048				
23E	4 CC	USBR	368	4290.76	233	3922.76						
23E	4 CC	USBR	310	4290.37	232	3980.37						
23E	4 BD	USBR	238		196							
23E	5 CB	USBR	263		224							
23E	5 AD	USBR	333	4296.54	239	3963.54						
23E	5 AD	USBR	388	4296.98	238	3908.98						
23E	8 DC	USBR	168									
23E	8 DA	USBR	351	4286.4	232	3935.4						
23E	10 AC	USBR	227		181							
23E	10 CA	USBR	236		181							
23E	10 DC	USBR	222		178							
23E	10 DA	USBR	255	4267.62	204	4012.62						
23E	10 DA	USBR	332									
23E	10 CC	USBR	261	4272.48	214	4011.48						
23E	10 CC	USBR	326									
23E	11 BC	USBR	241		175							
23E	12 CD	USBR	267	4263.25	198	3996.25						
23E	12 AC	USBR	316	#VALUE!	210	#VALUE!						
23E	12 AA	USBR	252		201							
23E	12 CD	USBR	298	4263.01	196	3965.01						
23E	12 A	USBR	314	4276.66	211	3962.66						
23E	14 CC	USBR	238		176							
23E	14 DC	USBR	207		163							
23E	14 B	USBR	278	4258.66	198	3980.66						
23E	15 DD	USBR	287	4251.1	193	3964.1						
23E	15	USBR	307	4268.16	219	3961.16	4033	4023				
23E	15 A	USBR	302	4268.03	209	3966.03						
23E	17 DD	USBR	278	4253.73	198	3975.73						
23E	17 DD	USBR	305	4253.89	199	3948.89						
23E	17 BA	A and B	330		246							
23E	19 DB	USBR	300	4265.93	216	3965.93	3974	3966				
23E	19 DD	USBR	260	4265.93	216	4005.93						
23E	20 AA	USBR	246		188							
23E	21 CB	USBR	251									
23E	21 AD	USBR	286	4243.91	187	3957.91						
23E	21 AD	USBR	257		112							
23E	22 BA	USBR	210		175							
23E	22 CA	USBR	201		157							
23E	22 CD	USBR	281	4249.76	192	3968.76						
23E	22 BC	USBR	228		165							
23E	22 CA	USBR	211		166							
23E	22 DD	USBR	207		173							
23E	23 CB	USBR	300	4255.2	199	3955.2	3966	3955				

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table (continued)

		Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Well Bot. Elevation (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)
23E	23 CB	USBR	290	4255.44	195	3965.44	4038	4030				
23E	24 DC	USBR	257	4229.67	146	3972.67	4004	3993				
23E	24 BB	USBR	240		146							
23E	24 DC	USBR	315	4229.57	149	3914.57	4004	3992				
23E	25 CC	USBR	188		132							
23E	25 BD	USBR	225	4217.13	151	3992.13	4024	4014				
23E	25 AC	USBR	157		113							
23E	25 DD	USBR	192		117							
23E	26 BC	USBR	170									
23E	26 AA	USBR	176		144							
23E	26 DB	USBR	196	4223.29	163	4027.29						
23E	26 DA	USBR	285		151							
23E	26 CD	USBR	150		57							
23E	26 AA	A and B	280		151							
23E	27 AA	A and B	370		209							
23E	27 CC	A and B	217		168							
23E	27 DC	USBR	229	4224.77	167	3995.77						
23E	27 BD	USBR	260	4235	178	3975						
23E	27 AA	USBR	370	4242.9	186	3872.9	3960	3943				
23E	28 CC	USBR	261	4237.37	183	3976.37						
23E	28 CC	USBR	262	4237.74	183	3975.74						
23E	28 CA	USBR	300	4232.09	176	3932.09	3960	3940				
23E	28 BB	USBR	237		170							
23E	28 CD	USBR	230		159							
23E	29 AD	USBR	285	4243.36	189	3958.36						
23E	29 AD	USBR	249	4243.57	189	3994.57						
23E	31 DA	USBR	235	4230.01	179	3995.01						
23E	34 BD	A and B	226									
23E	34 DC	USBR	216		147							
23E	34 BD	USBR	185		145							
23E	34 AA	USBR	188		156							
23E	34 BB	USBR	204		155							
23E	34 CD	USBR	234	4222.36	145	3988.36	4038	4034	4001	3989		
23E	35 BB	USBR	234	4225.16	144	3991.16	4005	3992				
23E	35 DD	USBR	231	4222.5	140	3991.5	4069	4052				
23E	35 CC	USBR	298	4223.44	144	3925.44	4034	4007				
23E	35 DB	USBR	267	4224.9	143	3957.9	4061	4049				
24E	1 AD	USBR	227	4254.19	167	4027.19						
24E	1 BA	USBR	165		139							
24E	1 AD	A and B	252		198							
24E	2 DA	USBR	236	4248.31	165	4012.31						
24E	3 AA	USBR	340	4270.8	183	3930.8	4084	4078				
24E	3 AD	USBR	302	4270.02	184	3968.02						
24E	4 CD	USBR	304	4268	195	3964						
24E	4 CC	USBR	313	4269	192	3956						

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table (continued)

		Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Well Bot. Elevation (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)
24E	4 AC	USBR	320	4267.6	198	3947.6	3998	3985				
24E	4	A and B			213							
24E	5 AA	A and B	300		211							
24E	5 AA	USBR	240		203							
24E	5 BA	USBR	240		199							
24E	6 DA	USBR	302	4262.27	197	3960.27						
24E	6 BA	USBR	339	4290.5	220	3951.5	4001	3999				
24E	6 CB	USBR	364	4296.05	229	3932.05						
24E	6 BA	A and B	290		249							
24E	7 DA	A and B	307		218							
24E	7 DA	USBR	240	4240	168	4000						
24E	7	USBR	285		168							
24E	8 BB	USBR	233		157							
24E	8 AD	USBR	265	4259	178	3994						
24E	9 DC	USBR	191		128							
24E	10	USBR	258	4254.48		3996.48						
24E	10	USBR	238	4240.7	154	4002.7						
24E	10 BC	USBR	240	4245		4005						
24E	11 DB	A and B	415		183							
24E	11 BA	USBR	200	4253.9	105	4053.9	4127	4113				
24E	11 DB	USBR	195	4245.4	156	4050.4						
24E	11 B	USBR	246	4253.9	165	4007.9						
24E	11	USBR	282									
24E	12 AB	USBR	190	4235.1	148	4045.1						
24E	12 AB	A and B	266		179							
24E	12 AB	A and B	258									
24E	13 BC	USBR	250	4244.8	155	3994.8						
24E	13 DC	USBR	246		99							
24E	13 AB	USBR	209	4244.8	154	4035.8						
24E	14 BA	A and B	210		174							
24E	14 CD	USBR	235	4220.1	131	3985.1						
24E	14 A	USBR	175	4229.37	140	4054.37						
24E	15 DD	USBR	300		160							
24E	15	USBR	232	4233.8		4001.8						
24E	18 BC	USBR	265	4247.5	182	3982.5						
24E	20 BC	USBR	366	4216.9	143	3850.9	3992	3977	3960	3915	3875	3852
24E	20 BC	USBR	365	4216.9	142	3851.9	3992	3969	3960	3915	3875	3852
24E	21 AB	USBR	346	4181	145	3835						
24E	21 B	USBR	155	4204.29	125	4049.29						
24E	21 CC	USBR	363	4224	140	3861	4020	4003	3891	3861		
24E	21 A	USBR	253	4231	145	3978						
24E	22 DA	USBR	246	4221.8	132	3975.8	4055	4036				
24E	22 DA	USBR	240	4221.8	132	3981.8	4055	4036				
24E	23 BC	USBR	230									
24E	23 DC	USBR	250	4227.1	130	3977.1	4097	4087				

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table (continued)

		Owner	Depth	Land	Depth to	Well Bot.	Sediment Elevation		Sediment Elevation		Sediment Elevation	
				Elevation	Water	Elevation	Top	Bot.	Top	Bot.	Top	Bot.
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
24E	24 DB	USBR	257		154							
24E	24 BB	USBR	174		83							
24E	24 BA	USBR	191		101							
24E	25 AD	USBR	277		79							
24E	25 CC	USBR	194									
24E	26 CC	USBR	165		94							
24E	26 AC	USBR	208	4208.7	117	4000.7						
24E	27 CC	A and B	220		80							
24E	27 CB	USBR	165									
24E	29 C	USBR	234	4204.31	119	3970.31						
24E	30 DB	USBR	300	4206.26	124	3906.26						
24E	30 BA	USBR	258	4217.1	146	3959.1	4005	4003				
24E	31 CD	USBR	302	4243.44	159	3941.44	4116	4070				
24E	31 CD	USBR	270	4243.44	160	3973.44	4115	4075				
24E	31 CB	USBR	185		141							
24E	31 CC	USBR	210	4243.44	160	4033.44	4115	4075				
24E	32 CB	USBR	178		87							
24E	33 BA	USBR	340	4300.93	210	3960.93	4036	4031	3973	3966		
25E	3 BA	USBR	359	4301	208	3942	4040	4032	3974	3967		
25E	3 BB	USBR	367	4293.89		3926.89						
25E	3 BB	USBR	381	4494.12	203	4113.12	4219	4212	4157	4154		
25E	3 DA	USBR	340	4300.92	210	3960.92	4036	4031	3973	3966		
25E	5 AA	A and B	410		220							
25E	5 AA	USBR	240	4284.59	198	4044.59						
25E	5 AA	USBR	280	4284.99	199	4004.99						
25E	6 DA	USBR	248	4252.43	166	4004.43						
25E	6 DA	USBR	257	4252.31	167	3995.31						
25E	6 DA	USBR	237	4262.27	197	4025.27						
25E	6 CB	USBR	365	4296.05	229	3931.05						
25E	11 CD	USBR	230	4263.57	172	4033.57						
25E	12 BB	USBR	275	4279.94	187	4004.94	4025	4019	4012	4008		
25E	12 BB	USBR	275	4280.33	187	4005.33	4025	4019	4012	4008		
25E	12 BB	USBR	295	4279.94	187	3984.94	4024	4012				
25E	13 CC	USBR	195	4249.57	157	4054.57						
25E	14 CA	USBR	257	4255.82	163	3998.82	4003	3999				
25E	15 CC	USBR	250	4244.45	153	3994.45						
25E	15 CC	USBR	271	4244.49	152	3973.49	3988	3985				
25E	15 CC	A and B	251		181							
25E	17 AA	USBR	211	4220.57	131	4009.57						
25E	19 DC	USBR	123		86							
25E	19 AB	USBR	221	4212.4	120	3991.4						
25E	19 BC	USBR	224	4218.51	127	3994.51						
25E	19 BC	USBR	222	4218.36	127	3996.36						
25E	21 CD	USBR	228	4216.11	128	3988.11						
25E	23 BB	USBR	252	4253.06	160	4001.06	4004	4001				

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table (continued)

		Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Well Bot. Elevation (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)
25E	23 BB	USBR	276	4252.77	160	3976.77	4000	3977				
25E	24 BB	USBR	510	4249.32	155	3739.32	4015	4003	3859	3849		
25E	29 BA	USBR	145		83							
21E	1 CA	USBR	587	4240.42	322	3653.42	3698	3693	3678	3663		
21E	3 DB	USBR	401		301							
21E	3 CB	USBR	437		299							
21E	3 CD	USBR	317		302							
21E	3 CD	USBR	700	4197.65	302	3497.65	3751	3738	3663	3653		
21E	3 AB	USBR	420		330							
21E	9 AA	USBR	317		292							
22E	3 DD	A and B	350		242							
22E	3 DD	USBR	327	4236.18	221	3909.18						
22E	3 AA	A and B	387		272							
22E	3 AA	A and B	350		267							
22E	3 DD	USBR	320	4235.78	222	3915.78						
22E	7 AA	USBR	543	4236.9	275	3693.9	3813	3732	3702			
22E	7 AD	USBR	358	4238.44	276	3880.44						
22E	9 DA	A and B	590		258							
22E	9	A and B	501		243							
22E	9 CA	USBR	415	4212.56	249	3797.56	3957	3942	3912	3893	3808	3789
22E	9 BC	USBR	344	4218.13	250	3874.13	3948	3935				
22E	10 CB	USBR	429	4220.7	255	3791.7	3961	3925	3919	3913	3849	3826
22E	10 AD	USBR	466	4220.61	210	3754.61	3927	3881	3766	3755		
22E	11 BD	A and B	435		220							
22E	11 DB	USBR	322	4214.15	202	3892.15	3930	3892				
22E	11 DD	USBR	187		137							
22E	11 BA	USBR	420	4212.64	191	3792.64	3905	3841				
22E	11 BA	USBR	494	4212	197	3718	3897	3718				
22E	15 AD	USBR	391	4208.28	236	3817.28	3826	3817				
22E	15 AC	USBR	239	4208.1	197	3969.1	3977	3969				
22E	18 DC	USBR	310	4201.39	247	3891.39						
22E	18 DC	USBR	332	4201.29	247	3869.29						
22E	18 DC	A and B	380									
22E	19 BC	USBR	356		293							
22E	20 AA	USBR	700	4209.21	251	3509.21	3837	3783				
22E	22	USBR	576	4207.85	245	3631.85	3899	3896	3848	3705		
22E	22 DC	USBR	456	4209.51	215	3753.51	3844	3755				
22E	22 AC	USBR	1000	4208.01	248	3208.01	3902	3703	3576	3521	3481	3473
22E	28	USBR	442	4191.73	230	3749.73	3884	3845	3840	3831	3803	3797
22E	30 AA	USBR	510	4186.89	236	3676.89	3920	3885				
22E	33 AA	A and B	302		245							
22E	33 DA	USBR	463	4198.61	233	3735.61	3921	3869				
22E	33 DA	USBR	485	4197.12	239	3712.12	3919	3905	3891	3873	3821	3815
23E	2 AC	USBR	247	4223.47	141	3976.47	4048	4036				
23E	3 BD	USBR	340	4222.91	167	3882.91	4002	3974	3897	3875	3865	3843

Table 2 Project Wells Elevation Data for Interbeds Below the Water Table (continued)

		Owner	Depth (ft)	Land Elevation (ft)	Depth to Water (ft)	Well Bot. Elevation (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)	Sediment Elevation Top (ft)	Sediment Elevation Bot. (ft)
23E	3 AA	USBR	285	4214.3	134	3929.3	4020	3991				
23E	6 A	USBR	259	4225.04	174	3966.04	4000	3999	3983	3969		
23E	6 CB	USBR	234	4206.11	158	3972.11	3980	3972				
21E	2 CB	USBR	646	4222.11	356	3576.11	3940	3928	3597	3591		
22E	3 CD	USBR	225		213							

Table 3 Specifications for A&B Irrigation District Production Wells

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
02A1021	10S/21E2cc1	20	5	32.5	69		336.0		646.0	1960					
03A1022	10S/22E3cb1	16	3.5	3.3	476	4220.7	255.0	3965.7	400.0	1956	429				
34A723	7S/23E34cd2	19	6.6	5.3	559	4288.1	229.3	4058.8	281.3	1955	321	1962			
22B724	7S/24E22cc1	20	6	4	673	4290.8	211.4	4079.4	280.5	1955	352	1983			
24A724	7S/24E22db1	16	2.5	0.7	1603	4285.0	206.0	4079.0	257.5	1956	318	1983			
22C724	7S/24E22dd1	20	5	0.22	10200	4277.5	196.7	4080.8	307.7	1955					
23A724	7S/24E23ac1	20	5.9	2.2	1204	4288.0	206.6	4081.4	262.6	1955	296	1961			
26B724	7S/24E26ac1	16	2.5	0		4270.9	187.7	4083.2	234.6	1956	308	1983			
26A724	7S/24E26cb1	20	6.2	1.5	1855	4276.7	192.9	4083.8	262.8	1955	290	1964			
28B724	7S/24E28ac1	20	3.1	0.5	2783	4293.0	212.7	4080.3	353.5	1955					
28A724	7S/24E28ac2	20	6.2	2.2	1265	4293.2	213.5	4079.7	303.0	1955	351	1984			
30B724	7S/24E30bd1	20	3.9	2	875	4318.8	247.0	4071.8	394.0	1954					
30A724	7S/24E30db2	24				4318.8	246.1	4072.7	393.8	1954					
31A724	7S/24E31ac1	24	4.3	2.6	742	4305.1	234.9	4070.2	363.7	1954					
32B724	7S/24E32ad1	20	3.3	2.7	549	4285.4	210.8	4074.7	250.0	1953	302	1958	397	1963	
32A724	7S/24E32ad2	24	7.7	5.05	684	4285.4	210.8	4074.7	394.8	1953					
33A724	7S/24E33db1	20	6.1	4.5	608	4284.0	207.2	4076.8	284.0	1954	289	1957			
33B724	7S/24E33db2	20	4.3	1.2	1608	4284.8	208.8	4076.0	283.6	1956	316	2004			
34A724	7S/24E34bd1	24	6.9	1.6	1935	4273.2	187.0	4086.2	259.6	1954					
35B724	7S/24E35dc1	20	3.7	0.59	2815	4277.0	189.7	4087.3	230.0	1954	270	1961			
35A724	7S/24E35dc2	24	7.5	0.43	7828	4277.0	189.9	4087.1	229.0	1954	270	1961			
27A725	7S/25E27cd1	16	2	0.35	2565	4299.4	208.3	4091.1	346.4	1956					
29A725	7S/25E29ca1	16	4.4	0.5	3949	4328.7	241.8	4086.9	268.5	1957	323	1960	365	1983	
30A725	7S/25E30da1	24				4314.1	227.0	4087.1	295.9	1957					
31A725	7S/25E31bd1	18	4.2	0		4271.6	186.0	4085.6	222.0	1956	252	1961			
32A725	7S/25E32ca1	12	4.1	1.9	968	4273.1	184.2	4088.9	230.0	1956	257	1962	268	2003	

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
33A725	7S/25E33bb1	18				4294.0	204.2	4089.8	246.0	1955	301	1961			
34A725	7S/25E34ca1	20				4301.0	216.0	4085.0	279.0	1956	340	1983			
22A821	8S/21E22da1	20	6.2	2.6	1070	4219.5	307.5	3912.0	351.0	1956	399.4	1962			
24A821	8S/21E24bd1	16	1.6	3.4	211	4259.3	311.0	3948.3	400.0	1956	434	1984	480	1992	
26B821	8S/21E26aa1	20	2.8	4.3	292	4249.4	326.8	3922.6	587.8	1955					
26A821	8S/21E26aa2	24	6.3			4249.6	324.9	3924.7	527.0	1956					
35A821	8S/21E35aa1	20	4.7	2.3	917	4213.3	304.0	3909.3	381.0	1956					
35D821	8S/21E35cc1	20	5.8	3.6	723	4216.5	311.9	3904.6	352.0	1956	406.5	1965			
35B821	8S/21E35dd1	19	5.8	4.2	620	4232.1	319.6	3912.5	360.0	1956	425	1982			
35C821	8S/21E35dd2	20	5.8	4.6	566	4232.1	320.0	3912.1	365.0	1956	417	1963			
30A822	8S/22E30cb1	20	3.7	5	332	4239.1	280.1	3959.0	516.0	1956					
35C822	8S/22E35ab1		2.2	2.8	353	4280.1	237.0	4043.1	285.0	1955	350	1983			
35A822	8S/22E35dc1	16	10	3	1496	4247.0	203.5	4043.5	246.0	1955	350	1983			
35B822	8S/22E35dc2	20	5	12.8	175	4247.2	203.5	4043.7	245.0	1955	290	1964			
10A823	8S/23E10ad1	20	3.2	4.6	312	4267.6	204.4	4063.2	255.7	1954	332	1961			
10B823	8S/23E10cc1	20	3.2	1.9	756	4272.5	214.3	4058.2	260.5	1954	326	1983			
12A823	8S/23E12ac1	20	6.5	1.2	2431	4276.5	210.7	4065.9	316.6	1954					
12B823	8S/23E12ac2	20	3.2	0.6	2394	4276.7	210.8	4065.9	314.2	1954					
12C823	8S/23E12cd1	24	7.8	4.05	864	4263.3	197.7	4065.6	267.5	1954	290				
12D823	8S/23E12cd2	20	3.9	3.3	530	4262.0	196.5	4065.5	298.6	1954					
14B823	8S/23E14bb1	20	4.5	6	337	4258.7	198.3	4060.4	278.6	1954					
14A823	8S/23E14bb2	16	9	0.56	7213	4258.5	198.2	4060.4	251.3	1954	296.8	1961			
15A823	8S/23E15ba1	24	10	3.8	1181	4268.2	209.4	4058.8	266.2	1954	307				
15B823	8S/23E15ba2	20	5	6.4	351	4268.0	209.3	4058.7	302.2	1954					
15D823	8S/23E15dd1	20	2.2	3	329	4251.1	193.0	4058.1	258.0	1955	287	1961			
17C823	8S/23E17ba1	12	1.9	1.3	656	4275.6	223.3	4052.3	302.0	1954	330	2003			

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
17A823	8S/23E17dd1	20	5.8	8.2	317	4253.9	198.7	4055.2	270.0	1955	305	1964			
17B823	8S/23E17dd2	16	2.9	2.9	449	4253.7	198.4	4055.3	278.0	1955					
19A823	8S/23E19dc1	20	6.6	6	494	4265.9	215.9	4050.0	282.0	1955	300	1963			
19B823	8S/23E19dc2	20	3.2	0.2	7181	4265.9	213.7	4052.2	259.0	1955	290	1963			
01B823	8S/23E1ab1	20	4.9	6.1	361	4302.9	235.3	4067.6	371.3	1954					
01A823	8S/23E1ab2	24	10	0.8	5610	4302.8	235.1	4067.7	369.4	1954					
01C823	8S/23E1cc1	20	7.4	4.5	738	4268.1	204.9	4063.2	298.9	1954	315.5	2004			
21A823	8S/23E21ad1	24	7.3	2	1638	4253.9	186.8	4067.1	286.0	1955					
22A823	8S/23E22cd1	20	5.9	8.4	315	4249.8	192.2	4057.6	243.0	1955	282	1962			
23A823	8S/23E23cb1	20	5.4	3.4	713	4255.4	195.2	4060.2	271.0	1955	291	1963			
23B823	8S/23E23cb2	16	2.7	0.8	1515	4255.2	198.7	4056.5	300.0	1955					
24C823	8S/23E24bb1	20	7	41	77		146.0		240.0	1956					
24B823	8S/23E24cd1	20	4.5	1.1	1836	4229.7	146.2	4083.5	257.2	1954					
24A823	8S/23E24cd2	24	9	11.6	348	4229.6	149.3	4080.4	315.0	1954					
25A823	8S/23E25bd1	20	3	0.9	1496	4217.1	150.7	4066.4	191.0	1954	226	1960			
26A823	8S/23E26db1	20	4.5	2.7	748	4223.3	162.6	4060.7	196.6	1955	300	1958			
27A823	8S/23E27aa1	20				4242.9	186.1	4056.8	243.0	1950	300	1962	370	1995	
27C823	8S/23E27bd1	20	4.5	8.5	238	4234.5	178.0	4056.5	262.0	1948					
27B823	8S/23E27cd1	20	3.3	1	1481	4224.8	167.5	4057.3	229.0	1954					
28C823	8S/23E28ca1	20	4.8	0.5	4308	4232.1	176.3	4055.8	251.0	1954	300	1984			
28A823	8S/23E28cc1	24	4.8	0.5	4308	4237.4	183.0	4054.4	261.0	1954					
28B823	8S/23E28cc2	20	5.5	0.5	4937	4237.7	183.0	4054.7	220.0	1954	263	1962			
29A823	8S/23E29ad1	20	7	3.7	849	4243.6	189.4	4054.2	249.0	1955	286	1963			
29B823	8S/23E29ad2	20	7.2	3.5	923	4243.4	188.6	4054.8	250.0	1956					
02A823	8S/23E2ca1	20				4279.0	214.1	4064.9	326.5						
31A823	8S/23E31da1	20	6.3	6	471	4230.0	179.5	4050.5	235.0	1955	243	1958			

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
34A823	8S/23E34cd1	16	4.2	4.2	449	4222.4	144.6	4077.8	354.0	1955					
35A823	8S/23E35bb1	18	6.8	10	305	4225.2	144.5	4080.7	266.0	1955	308	1964			
35C823	8S/23E35cc1	20	3.8	7.1	240	4223.4	144.3	4079.1	298.5	1955					
35B823	8S/23E35da1	16	2	0.4	2244	4224.9	143.0	4081.9	267.0	1955					
35D823	8S/23E35dd1	16	1.5	6.8	99	4222.5	139.7	4082.8	198.0	1955	231	1961			
04A823	8S/23E4cc1	24	4.5	0.6	3366	4290.8	233.0	4057.8	368.0	1954					
04B823	8S/23E4cc2	24	4.5	0.7	2885	4290.4	232.0	4058.4	311.0	1954					
05C823	8S/23E5aa1	24	3.1	1.5	928	4297.0	237.8	4059.2	388.0	1955					
05B823	8S/23E5aa2	24	6.3	5.6	505	4296.5	238.7	4057.8	338.8	1955					
08A823	8S/23E8da1					4286.4	232.5	4053.9	351.0	1950					
10A824	8S/24E10ac1	24	8.4	1	3770	4254.5	171.0	4083.5	211.8	1952	258				
10C824	8S/24E10cb1	20					169.5		240.0	1959					
10B824	8S/24E10cd1	20				4240.7	154.8	4085.9	238.0	1953					
11A824	8S/24E11ba1	20	4.7	3	703	4250.6	164.0	4086.6	225.0	1948	282	1964			
11B824	8S/24E11bd1	16	7.5	1.05	3206	4253.9	164.8	4089.1	198.7	1953	247	1962			
11C824	8S/24e11db1	12	4.1	0.09	20445	4245.4	155.8	4089.6	195.1	1954	203/234	1959/60	290	1983	415
12A824	8S/24E12ab1	20				4235.1	152.3	4082.8	191.0	1955	241	1962	258	2006	
13A824	8S/24E13ab1	20	10.3	0.44	10506	4244.8	154.8	4090.0	226.7	1954	250	1963			
13B824	8S/24E13ab2	20	5	0.21	10686	4244.8	154.8	4090.0	209.4	1954	246	1984			
14A824	8S/24E14cd1	24	8.46	1.3	2921	4220.0	132.3	4087.7	235.0	1952					
15A824	8S/24E15ca1	20	5.4	0.5	4847	4233.8	148.5	4085.3	232.0	1953					
18A824	8S/24E18bc1	24	8.9	5	799	4247.5	181.9	4065.6	265.0						
01A824	8S/24E1da1	20	5.7	1.1	2326	4254.2	166.7	4087.5	211.4	1955	227.4	1960	252	2006	
21B824	8S/24E21ab1	20				4230.8	146.0	4084.8	347.0	1953					
21A824	8S/24E21cc1	20					141.3		250.0	1951	363	1964			
22A824	8S/24E22da1	20	4.7	5.4	391	4221.8	132.3	4089.5	246.0	1953					

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
23A824	8S/24E23dc1	24	9.3	4.2	994	4227.1	136.7	4090.4	250.0	1953	260				
26A824	8S/24E26ac1	24	7.7	0.87	3972	4208.7	117.7	4091.0	172.1	1953	208	1963			
29A824	8S/24E29db1	20	4.9	0.75	2932	4204.3	118.9	4085.4	234.2	1954					
02A824	8S/24E2da1	12	1.9	0		4248.3	165.3	4083.0	204.0	1956	236	1961			
30A824	8S/24E30ba1	20				4217.1	145.5	4071.6	258.4	1955					
30B824	8S/24E30db1	20	3.4	1.3	1174	4208.3	123.5	4084.8	206.0		300	1992			
31A824	8S/24E31cd1	20	8.4	11.4	331	4243.4	158.5	4084.9	212.8	1954	252.8	1954	302.8	1960	
31B824	8S/24E31cd2	20	4.2	5	377	4243.4	158.7	4084.7	210.2	1954	270	1962			
03A824	8S/24E3da1	24	8.5	3.2	1192	4270.8	183.8	4087.0	340.0	1954					
03B824	8S/24E3da2	20	4.2	0.1	18850	4270.8	184.0	4086.8	302.3	1954					
04A824	8S/24E4ac1	24	8.9	6.9	579	4267.6	185.3	4082.3	321.0	1954					
04B824	8S/24E4ca1	24	8.2	6.2	594		192.4		302.0	1952	313	1962			
04C824	8S/24E4cd1	20					196.0		305.0	1960	370	1994			
06B824	8S/24E6ba1	20	5.7	7	365	4290.5	220.2	4070.3	297.0	1954	339	2004			
06A824	8S/24E6cb1	20				4296.1	229.0	4067.1	364.0	1949					
06C824	8S/24E6da1	16	2.1	5.1	185	4262.3	197.0	4065.3	237.0	1956	302	1962			
07B824	8S/24E7da1	20	4.7	1.1	1918	4228.1	168.0	4060.1	242.0	1948	285	1964			
08A824	8S/24E8ad1	20	8.5	9	424	4252.8	186.5	4066.3	265.0	1950	333	1956			
11A825	8S/25E11dc1	20	4.2	1.5	1257	4263.6	171.7	4091.9	230.0	1956					
12B825	8S/25E12bb1	16	5	4.1	547	4279.9	187.0	4092.9	228.5	1956	295	1983			
12A825	8S/25E12bb2	24	9.9	1.4	3174	4280.3	187.0	4093.3	230.0	1956	275	1961			
13A825	8S/25E13cc1	16	2.5	5.9	190	4249.9	157.0	4092.9	195.0	1956	251.3	1960			
14C825	8S/25E14ca1	16	2.2	0.1	9874	4255.8	162.7	4093.1	209.3	1955	257.7	1964			
15A825	8S/25E15cc1	24	8.7	5.2	751	4244.5	152.0	4092.5	208.0	1955	271	1963			
15B825	8S/25E15cc2	20	4	14.9	120	4244.5	152.7	4091.8	200.3	1956	250	1959			
17A825	8S/25E17aa1	20	6.8	2.7	1130	4220.6	131.3	4089.3	170.0	1956	211	1961			

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
19B825	8S/25E19ab1	24					122.5		217.5	1954					
19A825	8S/25E19ab2	24	9.4	4.2	1004	4212.4	120.1	4092.3	217.5	1954					
19C825	8S/25E19bd1	20	7.5	1.5	2244	4218.5	126.8	4091.7	224.7	1954					
19D825	8S/25E19bd2	20	3.7	1.6	1038	4218.4	126.5	4091.9	222.0	1954					
21A825	8S/25E21cd1	20	7.4	4.7	707	4218.1	127.3	4090.8	185.6	1956	228	1961			
23B825	8S/25E23bb1	20	7	3.3	952	4253.1	159.5	4093.6	215.5	1955	252.3	1964			
23A825	8S/25E23bb2	24	9.6			4252.8	159.5	4093.3	276.0	1956					
24A825	8S/25E24bc1	20	4.6	1.6	1290	4249.3	154.5	4094.8	195.1	1955	247	1962	510	1993	
03A825	8S/25E3ab1	24	7.8	6.7	522	4301.0	208.5	4092.5	359.0	1956					
03B825	8S/25E3ab2	20	5.7	5	512	4300.9	209.3	4091.6	340.4	1956					
03C825	8S/25E3bb1	20	5.8	6.4	407	4292.9	202.3	4090.6	367.0	1955					
03D825	8S/25E3bb2	16	2.9	3.4	383	4294.1	203.0	4091.1	258.0	1956	381	1964			
03E825	8S/25E3da1	20	4.1	0.4	4600	4300.9	210.8	4090.1	303.7	1957					
05A825	8S/25E5aa1	24	10.5	3	1571	4284.6	198.5	4086.1	238.2	1957	280	1963	290	1983	
05B825	8S/25E5aa2	18	5.3	0.8	2973	4285.0	199.8	4085.2	239.5	1957	280	1963	410	1995	
06B825	8S/25E6ad1	15	3.1	0.4	3478	4252.4	165.5	4086.9	205.5	1956	248	1962			
06A825	8S/25E6ad2	20	6.1	1.8	1521	4252.3	166.9	4085.4	205.0	1957	257	1961			
01A921	9S/21E1ca1	20	3.2	1.1	1306	4240.4	322.2	3918.2	406.1	1956	587	2005			
03A921	9S/21E3ad1	16	1.9	0.8	1066	4202.0	301.4	3900.6	342.0	1956	401	1962	420	2003	
03B921	9S/21E3bd1	16	6.7	1.3	2313	4196.6	299.7	3896.9	341.0	1956	390	1962	437	1984	
03C921	9S/21E3dc1	16	7	0.3	10472	4197.7	302.4	3895.3	337.0	1956	396	1956	424	1984	700
10A922	9S/22E10ac1	12	6.3	25.2	112	4220.6	210.0	4010.6	466.0	1955	466	1992			
11B922	9S/22E11ba1	16	3	14	96	4212.6	191.3	4021.3	306.5	1956	420	1960			
11C922	9S/22E11ba2	16				4212.0	197.0	4015.0	494.0	1961					
11A922	9S/22E11bd1	12	4.8	14.8	146	4214.2	202.0	4012.2	322.0	1956	399		435	1995	
15A922	9S/22E15ac1	24	2.8	30	42	4208.3	236.7	3971.6	388.0	1957					

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
15B922	9S/22E15ac2	16				4208.1	197.5	4010.6	239.0	1957	391	1959			
18A922	9S/22E18dc1	20	5.6	1.2	2094	4201.3	247.0	3954.3	298.5	1955	332	1961	332	2006	
18B922	9S/22E18dc2	20	2.8	0.75	1676	4201.4	247.5	3953.9	310.0	1956	340	1965	380	2006	
19A922	9S/22E19bc1	18	4.4	3.4	581	4202.9	293.4	3909.5	356.2	1955	422	1959	422	1985	
20A922	9S/22E20aa1	16	6.7	5	601	4209.1	251.0	3958.1	375.0	1956	700	1981			
22A922	9S/22E22ac2					4208.0	248.5	3959.5	651.0	1956	1000	1960			
28A922	9S/22E28dd1	14	2.5	18	62	4191.7	229.6	3962.1	302.0	1956	442	1964			
30A922	9S/22E30aa1	17	6.9	2.4	1290	4186.9	238.0	3948.9	360.0	1956	510	1959			
33B922	9S/22E33ad2	24	6.2	21.5	129	4197.1	239.1	3958.0	485.0	1956					
33C922	9S/22E33da1	12	3.3	17	87	4198.6	233.0	3965.6	388.0	1956	463	1962			
03A922	9S/22E3dd1	20	5.7	2.6	984		222.0		272.5	1955	320	1959			
03B922	9S/22E3dd2	16	4.4	0.5	3949	4236.2	221.5	4014.7	267.0	1955	327	1963			
07A922	9S/22E7aa1	20	9.5	7	609	4236.9	275.7	3961.2	412.0	1957	543.2	1963			
07B922	9S/22E7ad1	20	7.5	2.35	1432	4238.4	276.5	3961.9	327.0	1957	358.8	1962			
09B922	9S/22E9bc1	12	4.3	20	96	4218.1	250.2	3967.9	345.0	1956	425	1962	501	1969	501
09A922	9S/22E9ca1	16	5.6	4.6	546	4212.6	249.7	3962.9	289.3	1957	324	1959	415	1992	
09C922	9S/22E9da1	12	N/A	N/A		4212.6	258.0	3954.6	590.0	1994					
02A923	9S/23E2aa1	17	1.7	2	381	4223.5	141.6	4081.9	213.5	1955	247	1961			
03B923	9S/23E3ad1					4214.3	133.9	4080.4	285.0	1955					
03A923	9S/23E3cb1	12	4.5	16.2	125	4222.9	167.5	4055.4	289.0	1955	340	1955	380	1963	
06A923	9S/23E6aa1	16	7.8	1.2	2917	4225.0	174.3	4050.7	226.0	1950	259	1962			
06B923	9S/23E6dc1	20	4.3	4.3	449	4206.1	158.0	4048.1	206.0	1955	234	2005			
03C922		19				4236.2	242.0	3994.2	350.0	1993					
03D922		20					267.0		350.0	2003					
07A824		19					218.0		307.0	2001					
09A921		16							465.0	1993					

Table 3 Specifications for A&B Irrigation District Production Wells (continued

Well ID	T/R Well ID	Well Dia. at Deep Point (in)	Aquifer Test Rate (cfs)	Aquifer Test Draw Down (ft)	Specific Capacity (gpm/ft)	Ground Elev. (ft)[1]	Depth to Ground Water at Time of Drilling (ft)	Ground Water Elev. at Time of Drilling (ft)	Initial Well Depth (ft)	Drill Date	2nd Well Depth (ft)	2nd Well Deep. Drill Date	3rd Well Depth (ft)	3rd Well Deep. Drill Date	4th Well Depth (ft)
15B824		20					160.0		300.0	2006					
15C825		17.5				4244.5	181.0	4063.5	251.0	2007					
21B823		24					112.0		257.0	1964					
26B823		20					151.0		285.0	2004					
34B723		24				4287.9	226.4	4061.5	324.0	1955					

Notes:

1. Ground elevations are taken from well logs supplied by A&B and BOR. The ground elevation as reported includes a reduction in elevation of 49.7 feet to account for a datum adjustment from the original BOR survey.
2. *2007 Low Ground Water Level column*: Data in italics means that drawdown was not recorded during pump operation and the data comes from static water levels.

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	02A1021	10S/21E2cc1	646	410		410						
	03A1022	10S/22E3cb1	429	290						X		
	34A723	7S/23E34cd2	321	270	272.6	290						
	22B724	7S/24E22cc1	352	250	246.2	270	X					
	24A724	7S/24E22db1	318		238.1	242	X					
	22C724	7S/24E22dd1	307.7	230	232	230						
	23A724	7S/24E23ac1	296	240	241.6	260						
	26B724	7S/24E26ac1	308	210	223	250	X					
	26A724	7S/24E26cb1	290	230	233.4	250						
	28B724	7S/24E28ac1	353.5	230	248.2	250						
	28A724	7S/24E28ac2	351	250	249.1	270	X					
	30B724	7S/24E30bd1	394	280	290.3	300						
	30A724	7S/24E30db2	393.8	280	298.8	320						
	31A724	7S/24E31ac1	363.7	280	279.1	300						
	32B724	7S/24E32ad1	397	240	243	240						
	32A724	7S/24E32ad2	394.8	240	247.3	260						
	33A724	7S/24E33db1	289	240		240						
	33B724	7S/24E33db2	283.6	240		270	X					
	34A724	7S/24E34bd1	259.6	220		220						
	35B724	7S/24E35dc1	270	220	229	240						
	35A724	7S/24E35dc2	270	220	241.2	240						
	27A725	7S/25E27cd1	346.4	240	240.9	240						
	29A725	7S/25E29ca1	365	270	275.2	300						
	30A725	7S/25E30da1	295.9	260	265.9	270						
	31A725	7S/25E31bd1	252	220	218.9	220						
	32A725	7S/25E32ca1	257	220	219.7	240	X					

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	33A725	7S/25E33bb1	301	230		250						
	34A725	7S/25E34ca1	340	240		260	X					
	22A821	8S/21E22da1	399.4	340	337.1	340						
	24A821	8S/21E24bd1	480	330	*349.9*	370	X					
	26B821	8S/21E26aa1	587.8	370	374.5	390						
	26A821	8S/21E26aa2	527	370	365.4	390						
	35A821	8S/21E35aa1	381	340	336.5	340						
	35D821	8S/21E35cc1	406.5	330		363.3						
	35B821	8S/21E35dd1	425	340	359.2	360	X					
	35C821	8S/21E35dd2	417	360		360						
	30A822	8S/22E30cb1	516	320	323.8	350						
	35C822	8S/22E35ab1	350	260		280	X					
	35A822	8S/22E35dc1	350	220		230	X					
	35B822	8S/22E35dc2	290	220	230.9	240						
	10A823	8S/23E10ad1	332	332	240.3	260						
	10B823	8S/23E10cc1	326	240			X			X		Accommodate wateruser
	12A823	8S/23E12ac1	316.6	250	250.8	270						
	12B823	8S/23E12ac2	314.2	250	251.1	270						
	12C823	8S/23E12cd1	290	240	248.5	270						
	12D823	8S/23E12cd2	298.6	230	249.5	270						
	14B823	8S/23E14bb1	278.6	220	242.9	260						
	14A823	8S/23E14bb2	296.8	297		260						
	15A823	8S/23E15ba1	307	250		250						
	15B823	8S/23E15ba2	302.2	260	249.9	260						
	15D823	8S/23E15dd1	287	230	226.7	230						
	17C823	8S/23E17ba1	302	260		280	X					

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	17A823	8S/23E17dd1	305	240	233	260						
	17B823	8S/23E17dd2	278	240	236.1	250						
	19A823	8S/23E19dc1	300	250	247.4	250						
	19B823	8S/23E19dc2	290	250	245.6	250						
	01B823	8S/23E1ab1	371.3	270		290						
	01A823	8S/23E1ab2	369.4	270	274.3	290						
	01C823	8S/23E1cc1	298.9	240	242.9	290						
	21A823	8S/23E21ad1	286	220	223.9	220						
	22A823	8S/23E22cd1	282	230	227.3	250						
	23A823	8S/23E23cb1	291	230	235.7	250						
	23B823	8S/23E23cb2	300	230	235.2	250						
	24C823	8S/23E24bb1	240	180	184.4	200						
	24B823	8S/23E24cd1	257.2	180	184.9	180						
	24A823	8S/23E24cd2	315	200	203	220						
	25A823	8S/23E25bd1	226	180	176.3	180						
	26A823	8S/23E26db1	300	190						X		Relocated to 26B823 to accommodate wateruser
	27A823	8S/23E27aa1	300	230	212	230	X					
	27C823	8S/23E27bd1	262	216	218.4	230						
	27B823	8S/23E27cd1	229	200	202.9	200						
	28C823	8S/23E28ca1	300	210	210	230						
	28A823	8S/23E28cc1	261	220	217	240						
	28B823	8S/23E28cc2	263	220		220						
	29A823	8S/23E29ad1	286	220	225	240						
	29B823	8S/23E29ad2	250	220	224.1	230						
	02A823	8S/23E2ca1	326.5	250	252.1	280						
	31A823	8S/23E31da1	243	210	211.5	230						

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	34A823	8S/23E34cd1	354	180	178.2	180						
	35A823	8S/23E35bb1	308	180		200						
	35C823	8S/23E35cc1	298.5	180	182.5	200						
	35B823	8S/23E35da1	267	180	176.8	200						
	35D823	8S/23E35dd1	231	190	*174.8*	190						
	04A823	8S/23E4cc1	368	270	268.9	270						
	04B823	8S/23E4cc2	311	270	267.1	270						
	05C823	8S/23E5aa1	388	260	281.5	280						
	05B823	8S/23E5aa2	338.8	280	279.9	300						
	08A823	8S/23E8da1	351	255	266.1	280						
	10A824	8S/24E10ac1	258	190	204.4	210						
	10C824	8S/24E10cb1	240	240	195.2	200						
	10B824	8S/24E10cd1	238	238	191.4	200						
	11A824	8S/24E11ba1	282	195	202.9	220						
	11B824	8S/24E11bd1	247	200		200						
1994	11C824	8S/24e11db1	415	180	200.9	240	X					
	12A824	8S/24E12ab1	241	190	186.9	210	X					
	13A824	8S/24E13ab1	250	200	191.5	200						
	13B824	8S/24E13ab2	246	180		200	X					
	14A824	8S/24E14cd1	235	160	167.7	180						
	15A824	8S/24E15ca1	232	170	186.6	210						
	18A824	8S/24E18bc1	265	212		240						
	01A824	8S/24E1da1	227.4	200	204.6	220	X					
	21B824	8S/24E21ab1	347	180	187.3	200						
	21A824	8S/24E21cc1	363	182	177.2	190						
	22A824	8S/24E22da1	246	180	171.6	180						

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	23A824	8S/24E23dc1	260	180	178.2	180						
	26A824	8S/24E26ac1	208	160	156.9	160						
	29A824	8S/24E29db1	234.2	140	156.6	180						
	02A824	8S/24E2da1	236	190		210						
	30A824	8S/24E30ba1	258.4	180	179	200						
	30B824	8S/24E30db1	300	160	157.6	160	X					
	31A824	8S/24E31cd1	302.8	200	198.7	200						
	31B824	8S/24E31cd2	270	200	195.1	200						
	03A824	8S/24E3da1	340	220		220						
	03B824	8S/24E3da2	302.3	220	221.1	220						
	04A824	8S/24E4ac1	321	220	241.3	260						
	04B824	8S/24E4ca1	313	230		230						
	04C824	8S/24E4cd1	305	240	226.3	240	X					
	06B824	8S/24E6ba1	297	260	258.9	280	X					
	06A824	8S/24E6cb1	364	251	265.3	290						
	06C824	8S/24E6da1	302	260		230						
	07B824	8S/24E7da1	285	205						X		Replaced by 7A824
	08A824	8S/24E8ad1	333	202	208.1	223						
	11A825	8S/25E11dc1	230	190	204.1	210						
	12B825	8S/25E12bb1	32	210	220.5	230	X					
	12A825	8S/25E12bb2	275	220	221.8	220						
	13A825	8S/25E13cc1	251.3	190		190						
	14C825	8S/25E14ca1	257.7	200	196.6	200						
	15A825	8S/25E15cc1	271	190	188.1	220						
	15B825	8S/25E15cc2	250	180						X		Replaced by 15C825
	17A825	8S/25E17aa1	211	160	166.6	160						

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	19B825	8S/25E19ab1	217.5	160	161.1	160						
	19A825	8S/25E19ab2	217.5	160	159.9	180						
	19C825	8S/25E19bd1	224.7	160	166.2	180						
	19D825	8S/25E19bd2	222	160	163.9	180						
	21A825	8S/25E21cd1	228	160		180						
	23B825	8S/25E23bb1	252.3	180		200						
	23A825	8S/25E23bb2	276	200	209.7	220						
	24A825	8S/25E24bc1	510	190	195	210	X					
	03A825	8S/25E3ab1	359	240	248.8	260						
	03B825	8S/25E3ab2	340.4	250	246.5	250						
	03C825	8S/25E3bb1	367	240		280						
	03D825	8S/25E3bb2	381	250	241.1	250						
	03E825	8S/25E3da1	3037	220	242.3	240						
	05A825	8S/25E5aa1	290	230	232.5	250						
	05B825	8S/25E5aa2	280	230	231.1	250	X					
	06B825	8S/25E6ad1	248	200	198.5	200						
	06A825	8S/25E6ad2	257	200		200						
	01A921	9S/21E1ca1	406.1	360	371.8	400	X					
	03A921	9S/21E3ad1	401	330	373.7	400	X					
	03B921	9S/21E3bd1	437	330	338.4	363	X					
1993	03C921	9S/21E3dc1	700	330	356.5	380	X					
	10A922	9S/22E10ac1	466	250			X			X		Abandoned due to insufficient water, replaced by 3C92
	11B922	9S/22E11ba1	420	406	258.6	260						
	11C922	9S/22E11ba2	494	230	241.8	270						
	11A922	9S/22E11bd1	435				X			X		Converted to injection well. Insufficient water for produ
	15A922	9S/22E15ac1	388	300	300.3	300						

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	15B922	9S/22E15ac2	391	330		330						
	18A922	9S/22E18dc1	322	280	297.4	310	X					
	18B922	9S/22E18dc2	340	280	298.5	320	X					
	19A922	9S/22E19bc1	422	320	340.5	340	X					
	20A922	9S/22E20aa1	700	290			X			X		Abandoned due to insufficient water supply
	22A922	9S/22E22ac2	1000	300						X		
	28A922	9S/22E28dd1	442	280		300						
	30A922	9S/22E30aa1	510	330	334.9	390						
	33B922	9S/22E33ad2	485	290						X		
	33C922	9S/22E33da1	463	290						X		
	03A922	9S/22E3dd1	320	250		270						
	03B922	9S/22E3dd2	327	260	262	260						
	07A922	9S/22E7aa1	543.2	320	351.8	390						
	07B922	9S/22E7ad1	358.8	310	322.1	330						
2007	09B922	9S/22E9bc1	425	310		350	X					
	09A922	9S/22E9ca1	415	290			X			X		Abandoned due to insufficient water, replaced by 9C92
	09C922	9S/22E9da1			287	320	X	X	X			To replace 9A922, insufficient water, so supplemented
	02A923	9S/23E2aa1	247	180	175.8	180						
	03B923	9S/23E3ad1	285	160	170.4	200						
	03A923	9S/23E3cb1	380	200		200						
	06A923	9S/23E6aa1	259	200		200						
	06B923	9S/23E6dc1	206	180	181.3	200	X					
	03C922				263.1	272	X		X			Replaced 10A922
	03D922				274.9	301.5	X	X	X			Replaced 9A922 & supplemented 9C922
	07A824				254.8	270	X		X			Replaces 7B824
	09A921					360	X	X				purchased to supplement 3B921 & 3C921

Table 3 Specifications for A&B Irrigation District Production Wells (continued)

4th Well Deep. Drill Date	Well ID	T/R Well ID	Most Recent Well Depth (ft)	1964 Depth to Top Pump Bowl (ft)	2007 Low Ground Water Level	2007 Depth to Top Pump Bowl	Well Deepened Since 1980	New Well, Supplemental	New Well, Replacement	Well Abandoned	Relocation	Comments
	15B824					203	X	X				Supplements 10A824 & 10B824
	15C825				188.7	220	X		X			Replaces 15B825
	21B823				201.1	242		X				Supplements 15A823 & 15B823
	26B823					222	X				X	Relocated from 26A823 to accommodate wateruser
	34B723				271.9	280						

Notes:

1. Ground elevations are taken from well logs supplied by A&B and BOR. The ground elevation as reported includes a reduction in elevation of 49.7 feet to account for a datum adjustment from the original BOR survey.
2. *2007 Low Ground Water Level column*: Data in italics means that drawdown was not recorded during pump operation and the data comes from static water levels.

Table 4 Example Well Yield Information

YEAR		Yield in acre feet for time period						
1995	A&B ID	April-May	May-June	June-July	July-Aug	Aug-Sept	Sept-Oct	Totals
	10A823	19.6	31.3	191.1	110.4	76.9	92.2	521.5
	10A922	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	10AB824	82.1	215.5	763.0	854.9	579.3	339.1	2833.9
	10B823	0.0	17.9	82.9	52.3	0.0	58.2	211.3
	10C824	23.9	27.8	191.1	252.3	161.9	36.1	693.1
	11A825	0.0	63.6	218.7	264.0	205.1	95.4	846.8
	11ABC824	129.5	192.4	742.8	1050.0	845.8	441.5	3402.0
	11BC922	45.9	75.0	351.0	0.0	297.7	146.6	916.2
	12A824	0.0	46.9	163.0	189.5	87.8	33.7	520.9
	12AB823	23.6	146.9	512.9	470.8	323.8	270.9	1748.9
	12AB825	160.9	273.3	654.8	496.5	548.8	177.3	2311.6
	12CD823	43.1	216.2	550.8	563.3	405.0	121.7	1900.1
	13A825	18.9	11.6	49.5	107.0	84.1	81.9	353.0
	13AB824	103.3	156.3	491.4	637.6	563.9	312.0	2264.5
	14A824	0.0	70.4	316.9	415.7	189.5	177.7	1170.2
	14AB823	21.0	103.6	424.4	473.7	380.3	319.7	1722.7
	14C824	0.0	42.6	119.4	42.0	74.1	15.8	293.9
	15A824	77.5	145.4	330.1	347.9	248.3	107.8	1257.0
	15AB823	84.0	213.7	812.7	616.2	419.7	205.6	2351.9
	15AB825	62.8	196.8	703.0	723.3	541.9	271.5	2499.3
	15AB922	17.8	71.4	156.2	189.0	165.7	48.3	648.4
	15D823	0.0	9.3	96.8	96.0	25.8	55.6	283.5
	17A825	31.3	123.7	375.1	319.5	338.2	208.9	1396.7
	17AB823	22.0	97.0	370.1	340.8	312.3	161.0	1303.2
	17C823	5.5	8.3	94.0	59.9	26.4	32.5	226.6
	18AB922	22.4	52.3	379.7	431.1	194.9	129.8	1210.2
	19A922	0.0	7.2	181.8	210.1	205.6	158.5	763.2
	19AB823	54.3	89.4	485.6	471.6	321.2	194.0	1616.1
	19AB825	115.5	175.6	720.4	609.0	425.5	481.8	2527.8
	19CD825	76.8	204.5	514.9	595.0	444.9	317.7	2153.8
	1A824	13.3	85.3	277.8	234.0	161.2	71.6	843.2
	1A921	25.2	71.1	334.1	365.4	307.5	167.5	1270.8
	1ABC823	172.7	153.9	937.6	1051.9	1007.3	636.3	3959.7
	21A823	0.0	19.1	325.5	253.7	152.9	73.4	824.6
	21A824	100.1	113.7	329.5	554.0	443.7	128.5	1669.5
	21A825	35.7	114.6	312.7	468.4	320.0	66.2	1317.6
	21B824	71.0	86.1	310.4	279.6	176.7	182.7	1106.5
	22A724	30.5	78.3	144.5	65.2	47.9	12.1	378.5
	22A821	45.7	94.1	307.8	299.9	269.8	157.6	1174.9
	22A823	42.8	40.2	231.0	254.1	209.4	156.9	934.4
	22A824	31.9	58.5	234.0	123.0	115.5	112.9	675.8
	22B724	37.2	90.6	343.5	303.9	240.6	54.4	1070.2
	22C724	31.0	107.7	326.4	269.0	144.6	143.5	1022.2
	23A724	44.0	16.6	223.1	272.4	196.0	198.6	950.7
	23A824	118.3	46.7	421.2	389.5	243.7	95.9	1315.3
	23AB823	44.9	122.4	511.2	457.5	402.0	203.1	1741.1
	23AB825	73.3	181.3	539.9	674.1	604.2	401.4	2474.2

Table 5 Average Annual Pumping Rate for Production Wells

T/R Well ID	Well ID	(AF/yr)	Starting	Ending	Comments
7S/23E34cd2	34AB723	1891.9	1995	2007	
7S/24E22cc1	22A724	528.5	1995	2007	
7S/24E22cc1	22B724	1199.2	1995	2007	
7S/24E22dd1	22C724	1160.6	1995	2007	
7S/24E23ac1	23A724	903.6	1995	2007	
7S/24E26ac1	26B724	406.9	1995	2007	
7S/24E26cb1	26A724	1301.6	1995	2007	
7S/24E28ac1	28AB724	1937.4	1995	2007	
7S/24E30db2	30AB724	2435.2	1995	2007	
7S/24E31ac1	31A724	768.4	1995	2007	
7S/24E32ad2	32AB724	2863.3	1995	2007	
7S/24E33db1	33A724	1201.9	1995	2007	
7S/24E33db2	33AB724	2027.7	1995	2007	
7S/24E34bd1	34A724	1371.8	1995	2007	
7S/24E35dc2	35AB724	2166.4	1995	2007	
7S/25E27cd1	27A725	267.7	1995	2007	
7S/25E29ca1	29A725	790.8	1995	2007	
7S/25E30da1	30A725	1044.8	1995	2007	
7S/25E31bd1	31A725	719.2	1995	2007	
7S/25E32ca1	32A725	717	1995	2007	
7S/25E34ca1	34A725	1246.4	1995	2007	
8S/21E22da1	22A821	1114.9	1995	2007	
8S/21E24bd1	24A821	257.5	1995	2007	
8S/21E26aa1	26AB821	2202.6	1995	2007	
8S/21E35aa1	35A821	888.9	1995	2007	
8S/21E35cc1	35D821	1108.8	1996	2007	Yield for 2006 and 2007 combined with 35BC821
8S/21E35dd1	35BC821	2577.2	1995	2007	Includes 35BCD821 for 1995
8S/22E30cb1	30A822	609.1	1995	2007	
8S/22E35ab1	35C822	506.3	1995	2007	
8S/22E35dc1	35AB822	2833.9	1995	2007	
8S/23E10ad1	10A823	512.2	1995	2007	
8S/23E10cc1	10B823	238.6	1995	2005	
8S/23E12ac1	12AB823	1977.3	1995	2007	
8S/23E12cd1	12CD823	2152.7	1995	2007	
8S/23E14bb2	14AB823	1444.2	1995	2007	
8S/23E15ba1	15AB823	2403.8	1995	2007	
8S/23E15dd1	15D823	297.9	1995	2007	
8S/23E17ba1	17C823	335	1995	2007	
8S/23E17dd1	17AB823	1520.8	1995	2007	
8S/23E19dc1	19AB823	2019.6	1995	2007	
8S/23E1ab2	1AB823	3100.9	1995	2007	Includes 1ABC823 for 1995
8S/23E1cc1	1C823	1166.3	1996	2007	
8S/23E21	21B823	504.1	2005	2007	
8S/23E21ad1	21A823	936.9	1995	2007	
8S/23E22cd1	22A823	983.3	1995	2007	
8S/23E23cb1	23AB823	1622.3	1995	2007	
8S/23E24bb1	24C823	987.3	1995	2007	
8S/23E24cd2	24AB823	2565.1	1995	2007	
8S/23E25bd1	25A823	556.7	1995	2007	

Table 5 Average Annual Pumping Rate for Production Wells (continued)

T/R Well ID	Well ID	(AF/yr)	Starting	Ending	Comments
8S/23E26	26B823	919.3	2005	2007	
8S/23E26db1	26A823	677.6	1995	2004	
8S/23E27aa1	27A823	990.6	1995	2007	Includes 27A823 for 1995
8S/23E27bd1	27C823	693	1996	2007	
8S/23E27cd1	27B823	560.6	1995	2007	
8S/23E28ca1	28C823	724.5	1995	2007	
8S/23E28cc1	28AB823	2981.2	1995	2007	
8S/23E29ad1	29AB823	2182.9	1995	2007	
8S/23E2ca1	2A823	987.1	1995	2007	
8S/23E31da1	31A823	1130.6	1995	2007	
8S/23E34cd1	34A823	677.4	1995	2007	
8S/23E35bb1	35A823	1228.4	1995	2007	
8S/23E35cc1	35C823	626.4	1995	2007	
8S/23E35da1	35B823	263.5	1995	2007	
8S/23E35dd1	35D823	163.1	1995	2007	
8S/23E4cc1	4AB823	2566.5	1995	2007	
8S/23E5aa2	5BC823	1657.7	1995	2007	
8S/23E8da1	8A823	1305.3	1995	2007	
8S/24E10ac1	10A824	2102.7	1996	2007	
8S/24E10cb1	10C824	742.1	1995	2007	
8S/24E10cd1	10AB824	2833.9	1995		
8S/24E10cd1	10B824	1322.1	1996	2007	Yield for 2006 and 2007 combined with 10A824
8S/24E11ba1	11AB824	2784.8	1995	2007	Includes 11AB824 for 1995
8S/24e11db1	11C824	1120.7	1996	2007	Yield for 2006 and 2007 combined with 11AB824
8S/24E12ab1	12A824	658.1	1995	2007	
8S/24E13ab1	13AB824	2636.1	1995	2007	
8S/24E14	14C824	346.3	1995	2007	
8S/24E14cd1	14A824	1477.3	1995	2007	
8S/24E15	15B824	743.7	2006	2007	
8S/24E15ca1	15A824	1193.9	1995	2007	
8S/24E18bc1	18A824	1960.9	1996	2007	
8S/24E1da1	1A824	1021.4	1995	2007	
8S/24E21ab1	21B824	1473.5	1995	2007	
8S/24E21cc1	21A824	2227.8	1995	2007	
8S/24E22da1	22A824	1148.3	1995	2007	
8S/24E23dc1	23A824	1700.6	1995	2007	
8S/24E26ac1	26A824	1266.4	1995	2007	
8S/24E29db1	29A824	1164.1	1995	2007	
8S/24E2da1	2A824	336.9	1995	2007	
8S/24E30ba1	30A824	636	1995	2007	
8S/24E30db1	30B824	535	1995	2007	
8S/24E31cd1	31AB824	2448.3	1995	2007	
8S/24E3da1	3AB824	2577.6	1995	2007	
8S/24E4ac1	4A824	1835.3	1995	2007	
8S/24E4ca1	4BC824	3050.9	1996	2007	
8S/24E4cd1	4BC-8A824	3911.4	1995		May be same as 4BC824
8S/24E6ba1	6B824	1323.7	1995	2007	
8S/24E6cb1	6A824	2725.4	1995	2007	
8S/24E6da1	6C824	292.7	1995	2007	

Table 5 Average Annual Pumping Rate for Production Wells (continued)

T/R Well ID	Well ID	(AF/yr)	Starting	Ending	Comments
8S/24E7	7A-18A824	2123.5	1995		
8S/24E7	7A824	2407.5	2001	2007	
8S/24E8ad1	8A824	1679.2	1996	2007	Yield for 2006 and 2007 combined with 4BC824
8S/25E11dc1	11A825	958.1	1995	2007	
8S/25E12bb2	12AB825	2557.1	1995	2007	
8S/25E13cc1	13A825	349.9	1995	2007	
8S/25E15cc1	15AB825	2594.1	1995	2007	
8S/25E15cc2	15AC825	3199.9		2007	
8S/25E17aa1	17A825	1535.7	1995	2007	
8S/25E19ab2	19AB825	3007.8	1995	2007	
8S/25E19bd1	19CD825	2323.3	1995	2007	
8S/25E21cd1	21A825	1470	1995	2007	
8S/25E23bb2	23AB825	2866.8	1995	2007	
8S/25E24bc1	24A825	627.6	1995	2007	
8S/25E3ab1	3AB825	2940.6	1995	2007	
8S/25E3bb1	3CD825	1671.5	1995	2007	
8S/25E3da1	3E825	829.4	1995	2007	
8S/25E5aa1	5AB825	3363.6	1996	2007	Includes 5AB-6AB825 for 1995
8S/25E6ad2	6AB825	1899	1995	2007	
9S/21E1ca1	1A921	1085.1	1995	2007	
9S/21E3ad1	3A921	308.8	1995	2007	
9S/21E3bd1	3B921	1348.4	1995	2007	
9S/21E3dc1	3C921	1265	1995	2007	
9S/21E9	9A921	594.5	2005	2007	
9S/22E10ac1	10A922	152.1	1996	2003	
9S/22E11ba1	11B922	681.3	1996	2007	
9S/22E11ba1	11BC922	916.2	1995		May be same as 11B922
9S/22E11ba2	11C922	761.8	1996	2007	
9S/22E15ac1	15A922	371.5	1996	2007	
9S/22E15ac2	15AB922	658.4	1995		
9S/22E15ac2	15B922	400	1996	2007	Yield for 2006 and 2007 combined with 15A922
9S/22E18dc1	18AB922	1657.3	1995	2007	
9S/22E19bc1	19A922	706.4	1995	2007	
9S/22E22ac2	22A922	0			
9S/22E28dd1	28A922	358.9	1995	2007	
9S/22E3	3C922	480.8	1995	2007	
9S/22E3	3D922	687	2004	2007	
9S/22E30aa1	30A922	1269.8	1995	2007	
9S/22E33ad2	33BC922	0			
9S/22E3dd1	3AB922	2446.5	1995	2007	
9S/22E7aa1	7A922	1643.9	1996	2007	
9S/22E7ad1	7AB922	1333.8	1995	2000	
9S/22E7ad1	7B922	1859.3	1996	2007	
9S/22E9bc1	9B922	826.2	1995	2007	
9S/22E9ca1	9AC922	628.5	1995	2007	
9S/23E2aa1	2A923	433.3	1995	2007	
9S/23E3ad1	3A923	932.8	1995	2007	
9S/23E3ad1	3B923	370.3	1995	2007	No pumping in 2000
9S/23E6aa1	6A923	1307.3	1995	2007	

Table 5 Average Annual Pumping Rate for Production Wells (continued)

T/R Well ID	Well ID	(AF/yr)	Starting	Ending	Comments
9S/23E6dc1	6B923	611	1995	2007	
10S/21E2cc1	2A1021	52.4	2000	2007	No pumping in 2002, 2004 and 2005
10S/22E3cb1	3A1022	155.7	1995		

Table 6 Average Pumping Rate Per Well for Each Township in Gallons Per Minute

	7S/23E	7S/24E	7S/25E
Number of Wells	2	18	7
2003 high	2300	2525	2143
2003 low	2214	2384	2246
2004 high	2241	2469	2304
2004 low	2093	2299	2235
2005 high	2268	2579	2250
2005 low	2142	2416	2206
2006 high	2268	2584	2308
2006 low	2120	2380	2245
2007 high	2655	2521	2295
2007 low	2457	2495	2214

	8S/21E	8S/22E	8S/23E	8S/24E	8S/25E
Number of Wells	8	4	50	35	26
2003 high	2411	2286	2600	3100	2814
2003 low	2283	2234	2472	2985	2759
2004 high	2363	2250	2614	3069	2782
2004 low	2216	2149	2444	2950	2705
2005 high	2312	2268	2620	3059	2740
2005 low	2222	2115	2424	2863	2622
2006 high	2286	2423	2678	3073	2888
2006 low	2206	2302	2536	2891	2670
2007 high	2451	2401	2627	3022	2974
2007 low	2129	2315	2481	2852	2830

	9S/21E	9S/22E	9S/23E	10S/21E
Number of Wells	3	19	5	1
2003 high	3123	1996	2047	1908
2003 low	2966	1861	2034	1908
2004 high	2957	2114	2027	
2004 low	2597	2003	1973	
2005 high	2931	2116	2119	
2005 low	2382	2047	2045	
2006 high	2964	2185	1951	1728
2006 low	2466	2041	1903	1701
2007 high	2745	2173	1996	1800
2007 low	1841	2039	1872	1719