

L54(479)
LYJO/General

Memorandum

To: Regional Director, Southwest Region

From: Dan B. Kimball, Chief, Water Resources Division

Subject: Report for Travel by Larry Martin to Lyndon B. Johnson Historical Park on February 27 and 28, 1995

The attached trip report concerns travel by Larry Martin to Lyndon B. Johnson Historical Park near Johnson City, Texas. The trip was made at the request of the park to assess water supply problems for the Martin Well at the ranch. Water from this well is used for public drinking fountains, but primarily to irrigate pasture land. Yield from the well has declined over the years and is now insufficient to meet demands.

It was determined that the water yield problem is not a result of declining water tables or interference from adjacent wells. The pump has been replaced or repaired recently without resolving the problem. Therefore, the problem must be due to plugging of water bearing zones within the well. A new well should be constructed near the old well. Drilling a new well will provide unobstructed access to water bearing zones within the aquifer. Locating the new well near the old well will facilitate connection to the existing electrical supply and pipeline.

If you have any questions, please call Bill Jackson at (303) 225-3503 or Larry Martin at (303) 225-3515.

Attachment

cc: LYJO - Superintendent, Dillard, Rex
SWR - Kunkle
479 - Jackson, Inglis

March 8, 1995

L54(479)
LYJO/General

Memorandum

To: Chief, Water Resources Division
Thru: William L. Jackson, Chief, Water Operations Branch
From: Larry Martin, Hydrologist, Water Operations Branch

Subject: Trip Report for Travel to Lyndon B. Johnson Historical Park on February 27 and 28, 1995

PURPOSE: The purpose of this trip was to advise the park on reasons for declining yield from the Martin Well and remedies to obtain needed water supplies for irrigation.

ITINERARY: Departed Fort Collins on February 27th and arrived at Johnson City, Texas the same day. Departed on February 28th and returned to Fort Collins.

CONTACTS: Randy Jones, LYJO, Superintendent
Roger Dillard, LYJO, Facility Manager
Tom Rex, LYJO, Chief of Maintenance
Edward Meier, LYJO, Ranch Foreman
Lewis Dodds, independent geologist

DISCUSSION: The Martin Well was drilled on the LBJ Ranch in 1966. Reported yield at that time was 170 gallons per minute. There are no reliable measurements of discharge from the well or water level measurements. Following is a summary (mostly anecdotal) of significant events related to this well and the declining yield.

Approximately 10 years ago, a pump was "lost" in the well. The contractor was unable to "fish" the pump out. A new pump was installed in the well at some elevation above the old pump. It is thought that the well was producing 70 gallons per minute at that time. In September, 1994, the well was experiencing problems with the yield. The same contractor, Virdell Drilling, attempted to clean out the well by drilling through the abandoned pump. A new pump was installed and the well was producing 10-15 gallons per minute at that time. This is not enough to provide the needed irrigation water during summer months. During my site visit, we could not get the pump to turn on due to problems with the electrical supply to the well. I was able to determine that the static water table is approximately 64 feet below ground surface, but was unable to make a measurement while the well was being pumped.

There are no other large yield wells in the area, and no reason to believe that the ground water supply in the area is being depleted. Water table measurements now are approximately the same as when the well was drilled, almost 30 years ago. Therefore, yield problems from the Martin Well are not a result of water table decline or interference from other supply wells in the area.

Examination of the original driller's log shows that most of the water was entering the well through a fracture in the limestone between 238-240 feet below ground surface. It is my hypothesis that the problems with the well evolved slowly since the time the pump was lost in the well, approximately 10 years ago. The well probably gradually filled in with sediment around the abandoned pump, effectively sealing off the main water producing zone near the bottom of the well. During the attempt to drill out the abandoned pump, they probably succeeded in mashing the abandoned pump into the fracture zone, further sealing water from the well. Now, the only solution to this problem is to abandon the well and drill a new well a few feet from the old well.

I met with Mr. Lewis Dodds, a local hydrogeologist, and he concurred with my theory. Mr. Dodds further suggested that we might obtain additional water from deeper aquifers; the Welge and Lion Mountain sandstones. The depth to these formations should be about 350-500 feet in the vicinity of the Pedernales River. The next aquifer, the Hickory sandstone would be about another 500 feet deeper.

Drilling a replacement well near (10-20 feet) the existing well should allow us to intersect the same fracture zones encountered in the original well. We can drill the well to deeper depths, if necessary, in anticipation of obtaining increased yield from the underlying Welge and Lion Mountain sandstones. If this does not provide sufficient yield, we could try hydrofracking the new well to increase fracturing and increase permeability in the vicinity of the well.

Data available from WRD files in Ft. Collins includes water well records compiled by the USGS in 1936. These data include a log for an oil test well approximately 1 mile south of the proposed well site. This log indicates that water was encountered at depths of 138, 161, 500, and 550 feet. Thus, the new well should not be drilled deeper than about 550 feet. It is likely that we will encounter sufficient water before this depth.

Some basic record keeping needs to be done for water use from this well so that in the future we will have some idea regarding the amount of water actually being used and therefore, a reliable basis for determining water needs at the ranch. This record keeping could be as simple as recording the meter reading on a weekly basis. A form could be created with columns for date, time, meter reading, and person's name making the reading.

ACTION ITEMS:

1. Prepare description of work and bidding schedule for contract to drill a new well. Responsible Party: Martin. To be completed by: Completed.
2. Assist park staff in submitting materials to the Texas Natural Resource Conservation Commission to obtain a permit to construct a public supply well. Responsible Party: Martin. To be completed by: March 31, 1995.
3. Provide additional advice during drilling and testing of the new well. Responsible Party: Martin. To be completed by: As requested.
4. Initiate regular recording (weekly) of the quantity of water being pumped from the well. Data should include; date, time, meter reading, person's name. Responsible Party: Maintenance staff. To be completed by: Begin immediately and continue forever.

L54(479)
LYJO/General

Memorandum

To: Field Director, InterMountain Field Office

From: Dan B. Kimball, Chief, Water Resources Division

Subject: Report for Travel by Larry Martin to Lyndon B. Johnson Historical Park on October 9-12, 1995

The attached trip report concerns travel by Larry Martin to Lyndon B. Johnson Historical Park near Johnson City, Texas. The trip was made to conduct drawdown and yield testing of a new water supply well at the LBJ Ranch Unit. Testing is required by the Texas Natural Resource Conservation Commission. The well is capable of producing in excess of 100 gallons per minute. Supplies are more than adequate for the current level of demand and the foreseeable future.

A final report and documentation will be prepared for transmittal to the Texas Natural Resource Conservation Commission when the data become available from the drilling contractor. The Park can begin using the new well as soon as construction has been completed. Final approval as a public water supply is dependent on meeting water quality standards, but should not be a concern. The old well met the standards and the new well draws water from the same aquifer.

If you have any questions, please call Bill Jackson at (303) 225-3503 or Larry Martin at (303) 225-3515.

Attachment

cc: LYJO - Superintendent, Dillard, Rex
SWSO - Kunkle
479 - Jackson

October 31, 1995

L54(479)
LYJO/General

Memorandum

To: Chief, Water Resources Division

Thru: William L. Jackson, Chief, Water Operations Branch

From: Larry Martin, Hydrologist, Water Operations Branch

Subject: Trip Report for Travel to Lyndon B. Johnson Historical Park on October 9-12, 1995

PURPOSE: The purpose of this trip was to conduct yield and drawdown testing on a new well to replace the Martin Well which had become inadequate due to declining yields.

ITINERARY: Departed Fort Collins on October 9th and arrived at Johnson City, Texas the same day. Departed on October 12th and returned to Fort Collins.

CONTACTS: Roger Dillard, LYJO, Facility Manager
John Steil, LYJO, Maintenance worker
Randy Best, J.Tucker Pump Service (contractor)

DISCUSSION:

My previous trip report, dated March 8, 1995 provides more detailed background on this issue. The Martin Well is the primary source of potable water for park staff and visitors at the show barns and bus maintenance facility at the ranch. Water is also used to irrigate lawns. Declining yields from the old well necessitated construction of a new well. The new well is located approximately 20 feet northeast from the old well and is completed in the same geologic formations.

Construction was started on the well on September 27. A 12-3/4 inch borehole was drilled to a depth of 70 feet. Surface casing (8 inch inside diameter) was centered in the borehole and grouted in place to prevent surface water from entering the well. Grouting was completed on Friday, September 29 and allowed to cure over the weekend. Drilling resumed on Monday, October 2. An 8 inch bit was used to drill inside the casing. Drilling was conducted using the air rotary method, wherein a large volume of air is forced through the drill pipe. The air returns to the surface between the drill string and the borehole, carrying with it cuttings and water produced by the geologic formations. The driller is able to estimate the amount of water being produced by the geologic formations as drilling proceeds.

Drilling was halted at a depth of 360 feet because the driller estimated that the well was producing in excess of 100 gallons per minute. The main water producing zones were at about 238 feet and 348 feet below ground surface. The well was equipped with a test pump set at 317 feet below ground surface. An airline was installed to facilitate water level measurements, but a break in the line caused it to be inoperative. Discharge from the well was routed through a 2 inch line to a ditch which carried water to a nearby stockpond. The discharge line was equipped with a flow meter to measure discharge.

Water levels in the well were measured initially with a steel tape or electrical water level meter. This procedure was difficult due to the amount of wires, pipe, and airline in the well. It was difficult to get the tape or wire to drop freely to the water surface. Eventually, as the water level in the well dropped during pumping, water cascading into the well from permeable zones rendered these measuring devices inoperative. A pressure transducer had been installed in the well to a depth of about 252 feet. The transducer was connected to a datalogger and provided water level data throughout the course of the drawdown and recovery test.

A drawdown test was initiated at 11:45 on Tuesday, October 10. Pumping continued for nearly 44 hours at rates between 100 and 110 gallons per minute. The pumping rate gradually decreased during the test as the water level in the well was lowered. (The pump works more efficiently early in the test when the water level is nearer the surface.) Water level recovery was monitored for about 4 hours following the end of the pumping period before it was necessary to remove the pressure transducer from the well. A data plot is attached to this report to show the water level drawdown and recovery during the test.

The old well continued to be operated during the test of the new well. The drawdown cone from the old well undoubtedly extended to the new well and added to the measured drawdown in the new well. However, the old well was pumping at a rate of about 10 gallons per minute and would have had only a minor effect on water levels in the new well. No significant variations are observed in the data plot for the new well which could be attributed to interference from the old well.

Static water level in the well was about 83 feet below ground surface. The water level in the well was drawn down to 120 feet below ground surface (37 feet of drawdown) after 10 minutes of pumping, 150 feet below ground surface (67 feet of drawdown) after 6 hours, 193 feet below ground surface (110 feet of drawdown) after 24 hours, and 210 feet below ground surface (127 feet of drawdown) after 44 hours of pumping. Water levels rose to 165 feet below ground surface within 10 minutes after pumping stopped and then slowly rose about 10 more feet over the next 3½ hours.

The well is capable of producing 100 gallons per minute on a long term basis as shown by the data collected during this test. The well likely could produce more water, but drawdowns would be greater. Likewise, equipping the well with a lower yielding pump would result in less drawdown.

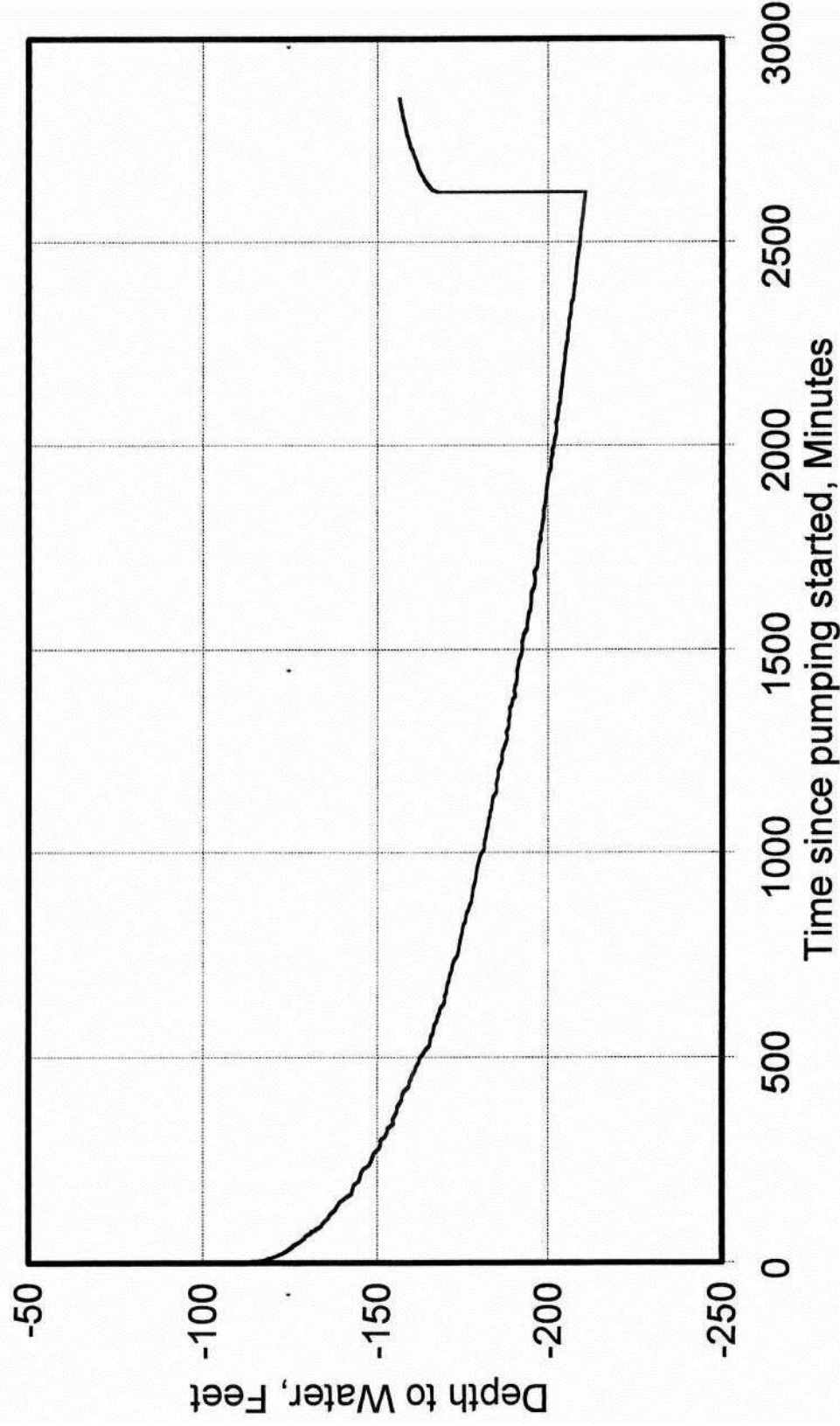
The well is probably completed in the Ellenburger-San Saba aquifer, a sequence of limestone and dolomite deposits which is described as being honeycombed and cavernous in places.

A final report will be prepared for submittal to the Texas Natural Resource Conservation Commission to complete the requirements for obtaining a public water supply permit. That report will be prepared when the well construction information is obtained from the drilling contractor.

Lyndon B. Johnson NHP

Martin Well Drawdown and Recovery Test

October 10-12, 1995



Depth to water measured from top of casing,
0.7 feet above ground surface.