



# TECHNICAL GUIDELINE FOR HYDROLOGIC TESTING

Bandera County River Authority and Groundwater  
District

## Overview

This technical guideline provides specifications for hydrologic testing to be conducted within Bandera County. These procedures should be complied with as closely as possible. Modification of the testing procedures must be approved in writing by the General Manager of the Bandera County River Authority and Groundwater District.

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## 1. Overview

Upon the completion of production wells and aquifer monitoring wells (observation wells), a Texas Licensed Professional Engineer or a Texas Licensed Professional Geoscientist shall conduct a hydrologic test to determine groundwater availability and quality by determining:

1. The maximum drawdown of the water level in the well at the requested pumping rate for the length of the test (The preliminary test should be run as long as necessary to project the maximum drawdown, usually about 2 hours);
2. The hydraulic properties of the production zone aquifer;
3. The degree of hydraulic connection between aquifers;
4. That the wells have been completed in the proper strata; and
5. To recognize the presence of hydraulic boundaries and recharge structures.

## 2. Test Procedure

### 2.1. Pre-Test Period

Approximately 48 hours before the initiation of the pump test, all controllable activities which could possibly affect the aquifer such as drilling and pumping, should be stopped to allow the aquifer to normalize.

### 2.2. Preliminary Pump Test

The preliminary pump test is conducted to obtain data to project the maximum drawdown at the proposed pumping rate to ensure the drawdown will not drop to 10 feet above the pump depth. The test will also check equipment for any problems before the actual pump test is run. Water levels should be made according to the schedule found in 2.5.2. The test should run for about 2 hours or until enough data is obtained for calculating the drawdown after 24-hour test. The details of the test are to be included in the pump test report.

### 2.3. Observation Wells

1. An observation well should be located at a reasonable distance from the pumped well. A minimum distance from the pumped well is to be 300 feet or greater, but less than 700 feet. A distance greater than 700 feet will require District approval.
2. Observation wells with a minimum diameter of four inches are required for all water level measurement including water level recorders. The distance from the monitor well to the pumped well must be measured and reported in the pump test report.
3. All wells must be open to the water bearing zone, remain open during the entire test, and penetrate the entire production interval so that the flow toward the pumping well is horizontal and drawdown values are not affected by partial penetration.
4. Each producing zone (if more than one zone) of the aquifer, as determined from the resistivity log, must be tested for water quality to prevent comingling of waters of different quality. The well should be completed to produce formation water of the same quality for the pump test.
5. Well numbers and reference points for water level measurements should be clearly marked on each well casing used in the test.



## 2.4. Pumping Well

1. The well should be pumped at its proposed requested yield so that the hydraulic characteristics of the well and the aquifer can be evaluated.
2. The well must be equipped to allow a water level measuring line to be lowered into the well.
3. The water must be discharged in such a way that it cannot return to the water bearing formation.
4. A constant pumping rate is necessary. The discharge pipe should be equipped with a flowmeter and a flow control valve to adjust the flow rate.
5. In the event of pump failure, recovery of water levels should be monitored to determine when the test can be repeated. Before repeating the test the well water shall be return to the original static water level.

## 2.5. Water Level Measurements

1. Antecedent Conditions – Water level measurements should be taken, either with continuous water level recorders or periodically with tape, in the pump well and in all observation wells 24 hours prior to the test to establish the initial static water level. Water levels should be measured to the nearest tenth (0.1) of a foot. All possible outside influences such as pumpage of nearby wells, barometric changes, and changes in stream flow, should be observed, recorded, and if possible, controlled to the extent that they have little or no influence on the groundwater level during the test. If the water levels fluctuate during this time interval, observations should be continued until the trend is clearly established. These data should be used to adjust the actual test data to approximate equilibrium conditions. Water level measurements made using an electrical (E-line) and sonic meter are to be made according to the schedule found in number 2 of this section. The sonic meter must be calibrated using an E-line before and after the test.
2. Test Measurements – Rapid changes in the initial static water level occur when the pump test is started. Therefore, readings should be taken as often as possible in as many observation wells as possible. Data points shall be recorded and reported as outlined in the table below.

Time Interval (minutes)	Measuring Frequency
0 – 2	Every 30 seconds
2 – 5	Every minute
6 – 10	Every two (2) minutes
11 – 30	Every five (5) minutes
31 – 60	Every ten (10) minutes
61 – 120	Every twenty (20) minutes
121 – End of Test	Every thirty (30) minutes
The same schedule should be used during the recovery period.	

## 2.6. Duration of the Test

Ideally, the well is pumped at a constant discharge rate until the radius of influence ceases to expand. The minimum pumping time recommended is 1,440 minutes, or 24 hours, at a constant discharge rate (Duration of testing may need to be longer for public water supply wells).



1. Data should be plotted graphically in the field to detect accurately the onset of any recharge boundary conditions.
2. If such effects begin to appear, the duration of the test should be increased until a definite straight line appears on the field plot of drawdown vs time and drawdown vs log of time.
3. Pumping may be discontinued if the pumping rate remains constant for at least four hours and a straight-line trend is observed on a plot of water level vs a logarithm of time during pumping.
4. Recovery data should be collected for 24 hours following the test or until water levels have recovered to within 90% of the pretesting level.
5. Near the completion of the test, water samples must be collected for laboratory analyses in containers furnished by the laboratory. The required parameters can be found in BCragd's Chapter 36 Rules.
6. Field tests should be made at several intervals during the pump test for pH, TDS, and water temperature. These values should be reported to the District with other pump test data.

### 3. Results, Analysis, and Summary of Pump Test Data

Data collected shall be analyzed using generally established and accepted methods to determine transmissivity and permeability of the production zone aquifer. The following shall be submitted with any permit application:

1. Map locating the monitor and pumped wells, with Production Area acreage indicated;
2. USGS topographic map of the area at a scale suitable show the well location and property boundaries;
3. Discussion of local geology and hydrogeology;
4. Pumped and observation well construction details complete with total depth casing size, pump depth, etc. These shall include the Driller's well logs;
5. Hydrographs for the pump test including arithmetic graph (time in min vs drawdown in feet), a plot of drawdown vs logarithm of time, and recovery. All graphs must contain pumping rates, time of pump start and finish;
6. A table providing the following:
  - a. hydraulic conductivity in  $\text{gpd}/\text{ft}^2$
  - b. transmissivity in  $\text{gpd}/\text{ft}$
  - c. specific capacity in  $\text{gpm}/\text{ft}$
  - d. storage coefficient
7. Electric logs from the pumped well and observation well if, run (3 copies each)
8. All pump test raw data with name and well no, aquifer thickness assumed, and pumping rate average used.
9. Hydrologic boundaries and recharge areas located.
10. A chart of the drawdown in feet for 10 and 30 years of pumping at the well, property line, nearest affected water well and at one and 2 miles from the pumping well. Calculations shall not include recharge to the aquifer.
11. Weather conditions during the test, including rainfall, temperature, and barometric pressure.
12. Water quality testing results.



## 4. Fluid Handling

Fluids pumped to the surface during hydrologic testing of a production area shall not be willfully or negligently released in a way that causes suffering, or allows groundwater to flow into any river, creek, natural watercourse, depression, lake, reservoir, drain, sewer, street, highway, road, or road ditch, or onto any land other than that of the owner of the well unless such discharge is authorized by permit, rule, or order issued by the Texas Commission on Environmental Quality under Texas Water Code