TELEPHONE 2-6629

KEITH E. ANDERSON
ENGINEER - GEOLOGIST
6932 WESTFIELD PLACE
BOISE, IDAHO

GROUNDWATER POSSIBILITIES

FROM DEEP WELLS

*****

CITY OF TWIN FALLS, IDAHO

May 1958

GROUNDWATER POSSIBILITIES FROM
DEEP WELLS

CITY OF TWIN FALLS, IDAHO

Introduction

The purpose of this investigation and report is to appraise the possibilities of developing a supplemental supply of municipal water for the City of Twin Falls, Idaho from deep wells.

At the present time the city obtains almost all of its water supply from the irrigation works of the Twin Falls South Side Canal Company which diverts water from the Snake River at Milner Dam. The capacity of the filtration and treatment plant is reportedly inadequate to meet present peak demands for one or more short periods each year and city officials are considering several possibilities for augmenting the supply--including the drilling of one or more deep wells.

Other engineering studies have shown that a supply of from one to two million gallons a day capacity, from a well or wells located in the northeastern part of Twin Falls, would alleviate existing problems in that area as well as meet present and anticipated peak demands elsewhere in the system.

This study and report were authorized by a telephone call from Mr. Norman Crossley, City Engineer, on April 29, 1958.

Summary and Recommendations

Smaller amounts of groundwater, up to 400 or 450 gallons a minute, can probably be developed from shallower wells—less than 400 or 500 feet deep—drilled into the Snake River basalts. This water is characteristically quite harder than the present city supply.

Somewhat larger amounts of water, up to possibly 1,000 gallons a minute (about 1½ million gallons a day), can be expected from deeper wells—1,000 to 1,200 feet deep—drilled into the underlying silicic volcanic rocks. This water is characteristically much softer, usually softer than the present city supply, and should not have undesirable concentrations of fluoride. The water will be warmer, probably from 75 to 85 degrees F. depending upon the depth of the principal water-bearing zones.

It is recommended that a test well be drilled in the northeastern part of the city, with a planned depth of up to 1,200 feet, to adequately test the water-bearing properties of rocks to that depth. The well should start with a diameter of 20 to 24 inches to permit completion with a diameter of 10 inches progresses to determine not only quantity of water available but also the chemical quality and temperature. In selecting the final site for the exploratory well, consideration should be given to such factors as the pipeline required to connect with the existing distribution system if the well proves satisfactory, the availability of transmission lines to serve the pump with electric power, and the proximity to other buildings that might restrict the use of explosives during drilling operations.

It is estimated that such a test well would cost about $30,000 and would require about 5 months to complete following award of the drilling contract. If the well were to be placed in final service, additional expense would be required for pipeline, pump and motor, electrical service and equipment, and housing or other shelter.

Geology

The City of Twin Falls, located on the south side of the Snake River in south-central Idaho, is underlain from the surface to a depth of many hundreds of feet by volcanic rocks of the Snake River Plain. These rocks are well exposed to depths of 500 feet or more in the canyon of the river just north of the city; the character and thickness of volcanic or other rocks below that depth are known only imperfectly from records of the few wells drilled to greater depths in the vicinity. The volcanic rock series probably overlies older sediments which are known to occur in great thickness elsewhere in the Snake River Plain.

Snake River basalts

This term is used to cover the considerable thickness of relatively unweathered, gray to black, basalts of Pliocene to Recent geologic age which immediately underlie the land surface in the vicinity of Twin Falls. These rocks are exposed in the canyon walls of Snake River and along tributaries such as Rock Creek. Individual lava flows may be as much as 50 feet or more thick with the aggregate thickness of these rocks ranging up to 500 feet or more in places. These basalts were deposited on an uneven, irregular land surface and are therefore thickest where they have filled ancient stream or river valleys. The rocks are characteristically fresher and less weathered than older volcanic flows; weathering may be more pronounced at the contacts between individual flows. Interbedded deposits of loess or windblown silt are common in some localities.

Tertiary silicic volcanics

Underlying the Snake River basalts, and continuing to an undetermined depth of many hundreds of feet in the Twin Falls area, are older silicic volcanic rocks of Miocene age. These rocks comprise flows of rhyolite, latite, and andesite with some basalt, and with associated materials such as welded tuffs, volcanic ash, and interbedded sands and gravels. Rocks of this sequence are exposed in great thickness in the mountains both south and north of the Snake River Plain, and are represented in the Twin Falls area by the Shoshone Falls andesite—the resistant rock unit resulting in the development of Shoshone Falls on the Snake River northeast of the city. Drilling to depths in excess of 1,000 feet both east and west of the city has failed to reach the base of this series of volcanic rocks.

Occurrence of Groundwater

Considerable amounts of groundwater can be obtained in some localities from the shallow Snake River basalts where the permeability of the formations are sufficient to permit free movement of water to wells. These basalts are generally less permeable, and therefore poorer aquifers, south of the Snake River than to the north. Water in the basalts generally occurs under water-table conditions although occasionally is found under low artesian pressure where locally confining beds of silt or impermeable basalt are present. Yields of wells drilled into the Snake River basalts in or immediately adjacent to the City of Twin Falls are generally less than 400 to 450 gallons a minute.

Groundwater can also be obtained from the underlying silicic volcanic rocks where the chief water-bearing zones appear to be along faults, in coarse-grained or jointed tuff or ash beds, or in sands and gravels associated with the volcanic rocks. Many of the flows of volcanic rocks such as rhyolite or andesite appear to be quite dense and impermeable throughout most of their thickness and in such horizons little water could be developed. Water from these deeper rocks commonly occurs under sufficient artesian pressure to bring the water level close to the land surface—probably within 50 feet of the surface in Twin Falls. Much of the extensive development of irrigation supply from wells in the Dry Creek area, as well as municipal supply wells at Kimberly, Filer, and Buhl, depend upon permeable zones in these silicic volcanic rocks and associated sediments for their supply.

Wells drilled in the northeastern part of the City of Twin Falls could be expected to furnish up to 400 or 450 gallons a minute (but more likely 150 to 350 gallons a minute) from the Snake River basalts at well depths of up to approximately 400 feet. Continued drilling into the underlying silicic volcanic rocks, to total depths of from 1,000 to 1,200 feet, could be expected to furnish a yield of as much as 600 to 1,000 gallons a minute or more ($1\frac{1}{2}$ million gallons or more a day).

Existing Developments

The following paragraphs describe briefly the conditions encountered in several nearby locations where deep wells have been drilled. A summary of these wells, as well as some of the shallower wells at Twin Falls, is given in the appendix to this report.

Dry Creek area

A number of deep wells have been drilled for irrigation in the Dry Creek area situated some 12 to 15 miles east and south of Twin Falls. These deeper wells range in total depth between 1,000 and 1,500 feet, with pump yields of from 500 to nearly 1,500 gallons a minute.

Kimberly

An old city well at the village of Kimberly, about 6 miles east of Twin F^lls, was drilled in 1937 to a depth of 1,200 feet and reportedly yielded 350 gallons a minute with a static level of 169 feet below land surface. The well was of small diamter (8 inches) which was inadequate for installation of the desired pumping equipment and subsequently additional, shallower wells have been drilled for the village supply.

Twin Falls

A well was drilled for the Twin Falls Cemetery Association in 1934-1938 to a depth of 1,154 feet. This well, also of small diameter (8 inches), furnishes supplemental water for irrigation of the cemetery grounds. No information was available on the yield or drawdown from this well; the pump is reportedly installed at a depth of 70 feet with a static water level of about 50 feet. The pump is equipped with a 5 HP motor and the well discharges into an irrigation lateral at the surface. If the motor size is matched to the well yield, the discharge is probably about 200 gallons a minute. If this is correct, a deeper pump setting and a larger well diameter would permit a much larger pump installation. It may be possible to make tests on this well during the irrigation season to learn more of the discharge-drawdown relationship.

Filer

A deep well has been drilled recently for municipal supply at Filer, 7 miles west of Twin Falls, to a total depth of 953 feet. At a depth of 800 feet this well furnished 700 gallons a minute at a pumping level of 235 feet; because of undesirable quality of water several attempts were made to case off or shut out certain zones and the yield, at the depth of 953 feet, was reportedly 272 gallons a minute. Rock cuttings from near the bottom of the well appeared to be similar to the Shoshone Falls andesite which is exposed in the Snake River canyon near Twin Falls.

Buhl

In 1946-47 a well was drilled for municipal supply at Buhl, 16 miles west of Twin Falls, to a depth of 904 feet. Upon completion of the well it was reportedly pumped for many hours at a rate of about 1,350 gallons a minute with 124 feet of drawdown from a static

Quality of Water

The chemical and bacteriological quality of water is of considerable importance in domestic or municipal supplies. In the Twin Falls area, the two chemical characteristics of most importance are the hardness and the fluoride content. The bacteriological quality of deep well water should be satisfactory provided that proper well construction methods are used.

Hardness in water is due almost entirely to the presence of soluble compounds of calcium and magnesium. Hardness is the characteristic of water that receives the most attention with reference to both industrial and domestic uses. It is usually recognized by the increased quantity of soap required to produce lather. Hard water is objectionable not only because of increased soap requirements but because of increased scale formation in boilers, water heaters, radiators, and pipes.

Fluoride is present, in varying amounts, in almost all groundwater. Too much fluoride is associated with the dental defect known as mottled enamel if the water is used for drinking by young children during formation of the teeth; conversely, however, the incidence of dental caries or tooth decay is less when there is some fluoride in the water than where there is none. Water containing in excess of 2 to 2.5 parts per millin fluoride is generally considered unsuitable for domestic supply.

Water from the Snake River basalts is characteristically harder than that from either the deeper silicic volcanic rocks or from the surface streams. The hardness of the canal water presently used for municipal supply at Twin Falls is approximately 200 parts per million. Water from the Snake River basalts ranges in hardness from about 300 to over 500 parts per million; water from the deeper silicic volcanic rocks has a hardness of from 100 to 250 parts per million.

The fluoride content of untreated canal water is generally about 0.5 parts per million. Groundwaters have generally slightly higher concentrations, with the highest generally found in the deeper wells. None of the deep well waters in the vicinity show in excess of 2 parts per million fluoride, however, with the exception of the well drilled at Filer where concentrations in excess of 4 parts per million were found. This abnormally high fluoride may be the result of local proximity to a volcanic vent or to local faulting.

Water temperature is also of some importance in a municipal supply. Water from the deeper horizons will have a higher temperature than from the shallower Snake River basalts. The deep well at Buhl had a water temperature of about 68 degrees F; water from the Twin Falls Cemetery Association well is reportedly about 84 degrees F.

It is anticipated that water from a deep well in the northeastern part of Twin Falls, drilled to a depth of 1,000 to 1,200 feet, would have a hardness of about 150 parts per million, fluoride content of 1.5 parts per million or less, and a temperature of 75 to 85 degrees F.

Recommended Exploration

There are no indications that any one area within the City of Twin Falls would be superior to another for the development of groundwater from deep wells; accordingly the northeastern part of the city would be recommended for location of an exploratory well because of the other considerations as to desirability of an additional source of supply in that area. This area is considered to be Section 10, T. 10 S., R. 17 E., Boise Meridian, bounded on the north by Falls Avenue, the east by Eastland Drive, the south by Addison Avenue, and the west by Blue Lakes Boulevard.

Two considerations might be mentioned with respect to selection of a final location: availability of existing power line for pumping and separation from heavily settled areas to permit blasting during drilling. A main power line runs east-west across the middle of this area along Filer Avenue which would facilitate furnishing power to any final installation located along that line; the cost of installing pipeline to connect the well to the existing water distribution sysgem at the end of Shoshone Street would exceed powerline costs, however, so that proximity to the Filer Avenue powerline would be of somewhat secondary importance. In the course of drilling a deep well it will probably be necessary or desirable to use explosives periodically to maintain satisfactory straightness of the well bore. If the well can be situated several city blocks from any heavily settled or built up area it would permit use of heavier charges of explosives and still avoid damage (real or imagined) to existing structures or residences. The best location from such a standpoint would be near the intersection of Filer Avenue with Eastland Drive, which is actually outside the city limits by $\frac{1}{4}$ mile and which would require some $1\frac{1}{2}$ miles of pipeline to connect to the Shoshone Street system. Such a location might have advantages, however, if continued expansion and development of the city to the north and east is in prospect.

Specifications

It is recommended that a test or exploratory well be started with a minimum diameter of 20 inches and preferably 24 inches to permit completion of the hole to the desired depth with suitable size throughout for pump installation as well as accommodation of added casings or liners that may be needed to shut out unstable or caving formations or to seal out certain horizons.

The well should be drilled with sufficient straightness and plumbness to permit satisfactory installation and operation of deep-well turbine pumping equipment as well as permit free installation of the additional casings or liners that may be needed. It would be desirable to finish on bottom with a minimum 12-inch diameter.

Well casing will be required through any surface soil or overburden and should be carried suffisiently into bedrock, and sealed with cement, to insure against surface contamination. Additional casing may have to be placed as drilling progresses depending upon the character of materials and quality of water encountered.

Tests should be made as drilling progresses to determine both the quantity of water available, the drawdown, and the chemical quality of the water—with special reference to hardness and fluoride. The drilling contractor should have the necessary test pumping and sampling equipment to permit these operations with a minimum of time, effort, and cost. The entire purpose of the drilling should be to explore and determine all of the subsurface geologic and hydrologic conditions rather than to "drill a deep hole in the ground". If the exploratory well should prove suitable as an economical source of supplemental municipal supply, it will then have been so constructed as to be suitable for immediate use--perhaps supplemented later with additional similar wells.

In planning the work, a total depth of 1,200 feet is recommended for estimating purposes. Such a well is estimated to cost approximately $30,000 including drilling, casing, testing, and necessary engineering and overhead. If the well were subsequently used for a permanent installation, additional costs would be incurred for the final pump, motor, motor controls, shelter, pipelines, and electrical power service to the site. It is estimated that the drilling and testing of such a well could be completed in approximately 5 months or less following award of the drilling contract.

Keith E. Anderson

May 18, 1958

6932 Westfield Place
Boise -- Idaho