WATER SUPPLY STUDY, PHASE I

FORT HUACHUCA
ARIZONA

FOR

U. S. ARMY ENGINEER DISTRICT
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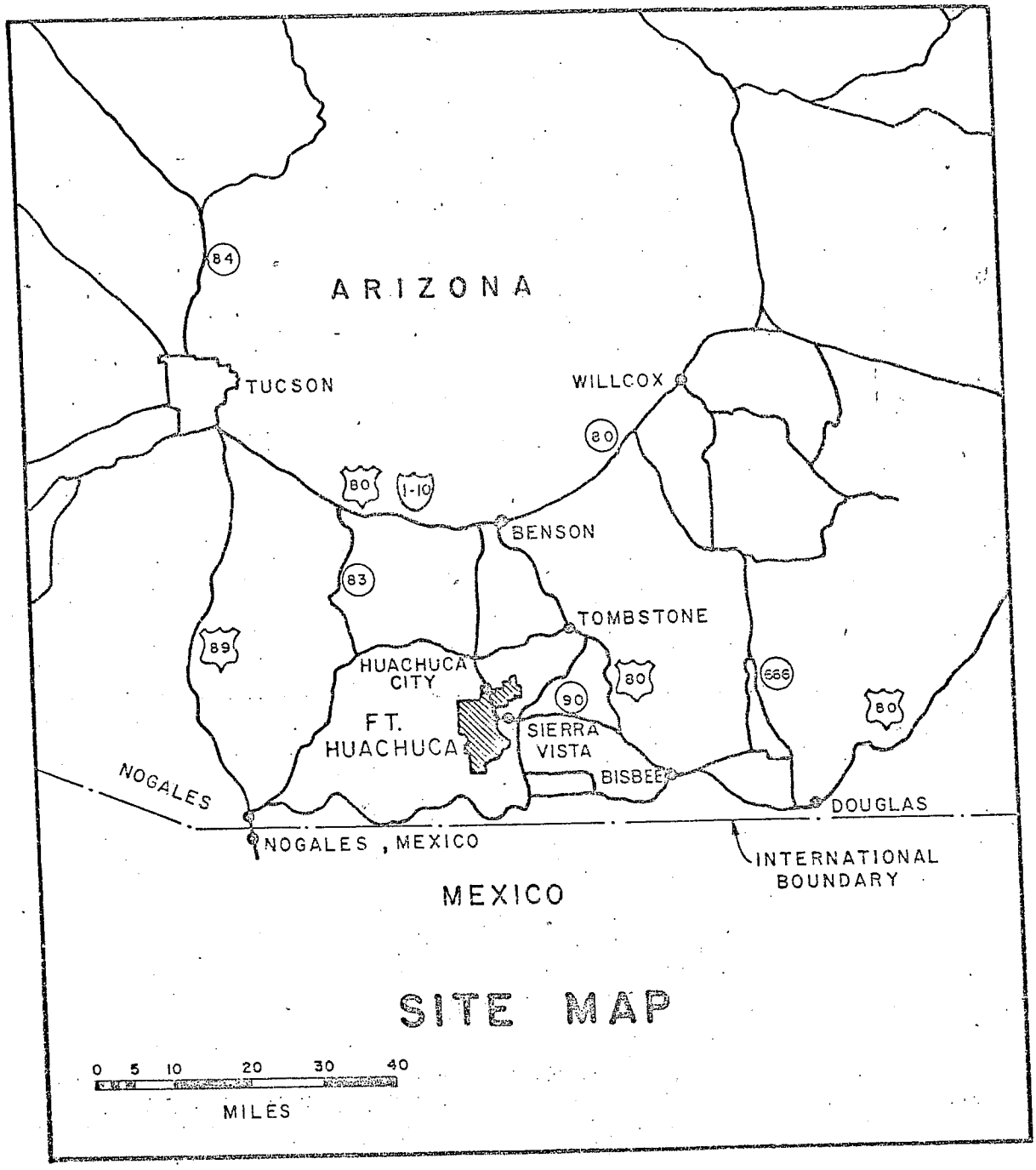
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Section 1

GENERAL

1-01 SCOPE OF STUDY

1. This study is composed of five related parts:

   a. List and analyze past, present, and future water requirements of Fort Huachuca and the off-post developments that affect the underground storage of the area's wells.

   b. Compile existing data relevant to the present and possible future water sources available to Fort Huachuca, both underground and surface.

   c. Evaluate the data compiled.

   d. Determine water rights of any available water sources.

   e. Recommendations for the necessity of developing other water supply sources, for additional geological investigations, and methods of conserving, preserving, and increasing the existing water supply sources.

1-02 LOCATION AND TERRAIN

1. Fort Huachuca is located entirely within Cochise County in the southeast portion of the state of Arizona. The most southerly boundary is approximately eight miles north of the Mexican International Boundary. The northerly boundary is approximately 35 miles south of Interstate Highway 10 (US 80). On the easterly boundary is the small town of Sierra Vista, and the smaller town of Huachuca City

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lies on the northerly boundary. The westerly boundary, in general, follows the ridge line of the Huachuca Mountains. The easterly boundary approaches within a mile of the thread of the San Pedro River.

2. The Fort Huachuca Military Reservation is irregularly shaped and comprises a total of 73,379 acres. Of this total area, approximately one-third lies in the rugged terrain of the Huachuca Mountains and foothills in the southwesterly portion of the Reservation. The remainder of the area slopes northerly to the Babocomari River and northeasterly to the San Pedro River. These rivers are ephemeral streams that have their confluence approximately two miles northeast of the northeast corner of the Reservation. Elevation within the reservation varies from 3900 to 8700 feet above sea level.

3. The Main Post area is located northeasterly from the Huachuca Mountains; the older area being partially in the foothills and at the mouth of Huachuca Canyon.

4. Vegetation on the reservation varies from desert brush and growth in the lower areas to oak, juniper, pine, and fir trees in the mountainous areas. The vegetation is typical for this terrain in the southwestern section of the United States.

1-03 CLIMATE

1. The Fort Huachuca Military Reservation is climatically dominated by mild winters and relatively warm summers. The month of June, which is the warmest month of the year, has a mean temperature of 79 degrees F. January, which is the coldest month of the year, has a mean temperature of 47 degrees F. The mean yearly average temperature is 63 degrees F.

2. Fort Huachuca has an annual average rainfall of approximately 13 inches. The maximum precipitation occurs during the summer months while the area is under a strong thunderstorm influence. During this period, thunderstorms accompanied by moderate to heavy rain are, in general, a daily occurrence. Fort Huachuca receives an annual average snowfall of 3.6 inches.

3. The area has an average wind velocity of 7 miles per hour with the prevailing direction from the west/southwest. The windiest months of the year occur in the spring when peak gusts may exceed 75 miles per hour.

4. The above climatological summary is based on observations and records made by the U. S. Army Meteorological Team at Libby Army Airfield, Fort Huachuca, Arizona, latitude 31° 35' N, longitude 110° 20' W, elevation 4666 feet.

1-04 HISTORY OF POST

1. Fort Huachuca was established in 1881 for the support of Army troops in the Apache Indian Wars, and played a prominent part in the Villa Punitive Expedition into Mexico in 1916. Various troops of Cavalry and Infantry Regiments occupied the Post from 1888 to 1942.

2. In 1942 the installation was expanded to serve as an Army Training Center during World War II.

3. In the post World War II period, from 1947 to 1951, the installation was closed, and a small crew of civilian employees was housed on the Post for fire protection and custodial maintenance.

4. From 1951 to 1953 the U. S. Air Force reoccupied the Post and utilized it for training Engineer Aviation troops.

5. From 1953 to 1954 the Post was again placed in an inactive status with custodial maintenance.

6. In 1954 the Post was again activated and was known as the U. S. Army Electronic Proving Ground. In 1967, Fort Huachuca became the headquarters of the U. S. Army Communication Command, under which it is functioning as of this date.

1-05 GEOLOGY OF THE AREA

1. HISTORY OF GEOLOGIC INVESTIGATIONS

a. A brief geological investigation of the area was made early in 1941 and was submitted as a part of a report for Water Supply, Triangular Division Camp, Fort Huachuca dated August 20, 1941 (Ref. No. 1).

b. A comprehensive report was published in 1966 by the U.S.G.S. as Water-Supply Paper 1819-D (Ref. No. 2). This report covered a period of four years of intensive field investigations relative to the basic geology and hydrology of the Huachuca Mountains and the alluvial plain from those mountains to the San Pedro River. These field investigations were made from the fall of 1959 to June 1963.

The report describes the geology, hydrology, and availability of water. The investigation included the collection and analysis of hydrologic data, including

well field analysis; determination of streamflow and groundwater interrelations; determination of the chemical quality of the waters; geologic mapping; collection and analysis of information from well logs and borings; and determination of geologic and hydrologic conditions that control the larger springs in the Huachuca Mountains.

This paper is the background for several following administrative reports and investigations, and furnished the basic information for the planning of, and subsequent redevelopment of the spring areas in Huachuca Canyon and Garden Canyon, and the conveying of these waters to the Post water system.

2. GEOLOGY AND GROUNDWATER

a. A detailed description of geologic conditions in the Fort Huachuca area is contained in the U.S.G.S. Water-Supply Paper 1819-D (Ref. No. 2). The following paragraphs are a brief summary of these conditions.

b. The Huachuca Mountains are made up of a faulted complex of granite, limestone, conglomerate, and claystone ranging in age from Pre-Cambrian to Cretaceous. The rocks are impermeable, and any water stored or transmitted is dependent on fractures or solution cavities.

c. The aquifer in the area from the foot of the Huachuca Mountains to the San Pedro River is made up of two geologic formations termed the upper and lower units of basin fill. Information from well logs and a few outcrops indicate that the lower unit of basin fill is a poorly sorted, mostly heterogeneous mixture of silt, sand, pebbles, cobbles, and boulders as much as a foot in diameter. The unit is about 235 feet thick in the Post well field and Sierra Vista area, and is thicker on the western side of the Huachuca Mountains. Cementation is variable both vertically and laterally. Bedding is lenticular to tabular and some layers show cross bedding. The upper unit of basin fill consists of weakly cemented, soft reddish brown clay, gravel, and silt. It grades from a very permeable alluvial fan gravel near the mouths of major streams along the Huachuca Mountains to relatively impermeable silt and limy clay containing a few sandstone beds near the San Pedro River at Charleston. The upper unit of basin fill is 450 to 620 feet thick in the Post well field but is only about 10 feet thick along the San Pedro River. Both units of basin fill have been tilted slightly, the lower unit as much as 20 degrees and the upper unit as much as 5 degrees. The lower unit of basin fill is apparently cleaner and more permeable in the basin

away from the mountain front and apparently is the better water producer. However, the permeability of the lower unit is somewhat spotty, depending on particle size, sorting, and cementation, and varies from fair to good in one area or depth, and from poor to fair at another area or depth. The upper unit of basin fill has been divided into three principal facies on the basis of grain size and mode of deposition. The facies are fan gravel near the Huachuca Mountains with good to very good permeability, clay and silt facies near the San Pedro River with very poor to poor permeability, and sand and silt facies in the intervening areas with fair to good permeability.

d. Terrace deposits and recent stream alluvium cover a large part of the present land surface between the Huachuca Mountains and the San Pedro River. They are very permeable but relatively thin, and mostly above the groundwater table. They contribute to the groundwater resources by providing open channels for surface water to infiltrate to the basin fill units.

Section 2

PAST AND PRESENT WATER SUPPLY

2-01 HISTORY OF WATER SUPPLY ON POST

The original Army Post at the base of the Huachuca Mountains was established in 1881. The water supply was obtained from springs in Huachuca Canyon for a period of almost thirty years. In 1911, a collecting works was constructed near the junction of Garden and McClure Canyons with small pipelines up the canyons to several springs. An 8-inch steel pipeline seven miles long was constructed from the collecting box to a 250,000 gallon masonry storage reservoir and a small round tank (20 feet in diameter and 10 feet deep). During the same year, investigations were started and considerable sums were spent in prospecting for additional water supplies. Many test holes were drilled near the mouths of Garden and Huachuca Canyons to depths up to 1000 feet without much success. A small amount of water was found in one 8-inch diameter well in Garden Canyon - this was drilled and an air lift pump installed in 1912. Seventy gallons a minute could be pumped from this well for about half the time, or about 50,000 gallons a day. This well was used to augment the spring flow in times of drought. In recent years, this well has been sealed off and abandoned. In 1919, concrete inlet boxes were constructed on many of the springs and several more springs were brought into the system. At a still later date, several small concrete dams were built to catch small surface flows from seep springs in the canyons between the larger springs already developed.

In 1936, the water problem again became acute and in that year a 6-inch diameter test well was drilled near the present main gate of the reservation. Good water was found in quantities beyond the capacity of any test pump that could be used in this well. A plunger type pump was installed in the well in September 1938. This new source was further developed in January 1939, when a 14-inch diameter well was completed 90 feet west of the 6-inch well. A supply of water was encountered at approximately the same depth as in the 6-inch well, and tests showed a discharge of 700 gallons a minute with a drawdown of 43 feet. A pump was installed in the well that delivered 500 gallons a minute to a concrete "clear-well" from which the water was boosted to the Post reservoir through a new 10-inch, steel, high pressure main. A new 250,000 gallon concrete reservoir was constructed just below the old reservoir in connection with this development.

In 1940, further development was carried on with the drilling of a second 14-inch diameter well approximately 500 feet to the west of the first 14-inch well. This well was completed in November 1940 and is equipped with an electric motor and turbine pump capable of producing 700 gallons a minute.

Subsequently in 1942, three more wells, 18-inch in diameter were drilled, developed, and equipped to produce 700 gallons per minute each. All of these wells were cased to a depth of 800 feet or a little more. And in 1958, another 16-inch well was drilled, developed and equipped to produce 700 gallons per minute. The data on these wells is given in Table 1.

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Apparently in the years following World War II, during the Post's inactive period, the original 6-inch well was removed from service and now serves only as an observation well. Also, the spring collection and transmission lines from Huachuca and Garden Canyons fell into disrepair and were not used or usable for Post water supply.

Therefore, in recent years up to June of 1970, the entire Post water supply was from the six deep wells clustered in an area about 1-1/2 miles long, between the Post's Main Gate and East Gate, and about 1/4 mile wide.

June of 1970 saw the culmination of several years of planning in the completion of construction and the operation of new spring collection systems and transmission lines from the Huachuca Canyon and Garden Canyon spring areas to the Post water supply system.

2-02 WATER SUPPLY IN THE AREA OFF THE POST

The water supply in the area off the Post is principally from wells. Until World War II, the majority of the local population was scattered throughout the area on ranches, farms, and mines with a few small settlements along the San Pedro River and in mining camps in the mountains, and a small settlement adjacent to the Main Gate of the Post. For the most part, the water for these people was obtained from wells, or springs if such springs were convenient for use.

A notable exception to the above is the case of Tombstone. Tombstone is a notorious, early-day mining town that was born and grew to about 15,000 population in the late 1800's, and is located on the east side of the San Pedro River Basin about 20 airline miles

northeast of the Main Post Area. The 1970 Census for Tombstone shows a population of 1233. The principal source of water for Tombstone for many years was a group of springs in Miller Canyon in the Huachuca Mountains, five to six miles south of the south boundary of the Post. These spring waters were brought together and conveyed, by means of a pipeline, across the San Pedro River Basin to Tombstone. In later years, wells have been drilled in Tombstone, which serve as the principal source of water today. However, the pipeline from the Huachuca Mountains is still in use and does contribute some waters for Tombstone's domestic supply. It is not considered a reliable source since, according to Tombstone authorities, the spring flow is quite variable and dependent on rainfall and snow-pack in the mountains.

For the most part, the area's wells were scattered throughout the basin at the various ranches and farms, and the draft on any of these wells apparently was never serious enough to cause problems for the owner-user. The records on these wells are somewhat nebulous. A number of them are listed with pertinent available information in References No. 1 and No. 2. Also, a number of these wells are indicated on Plate 1 with information as to water level and are utilized in plotting the groundwater contours shown thereon.

Satellite settlements adjacent to the Post boundaries have been established, and incorporated in recent years. Sierra Vista, just outside the Post's Main Gate, was established about the time of World War I and in recent years has experienced an expansion that saw its population soar from 3120 in 1960 to nearly 7800 in 1970, with every indication that it will continue to grow.

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Huachuca City, just outside the Post's North Gate, is of more recent origin and due to its geographical location will probably not experience the rate of growth enjoyed by Sierra Vista.

Water for both of these satellite communities is obtained from wells tapping the same aquifer as the Post wells. The major water production wells for the Post and Sierra Vista, about 15 in number, are all clustered in an area near the main gate of the Post and can be contained in a circle of approximately three miles in diameter. The result of this high concentration of wells in this locality has been a lowering of the water table in this vicinity in what is commonly called a cone-of-depression. This condition is illustrated on Plate 1 by the closed groundwater contour in the area.

2-03 POST WELL DATA

Data on the Post's wells is summarized in Table 1. It will be noted that Well No. 6 does not have an air line for level measurement; therefore, the data given for this well as to static water level, drawdown, and production are not current data but are taken from 1966 records.

A summary of water level records in the Fort Huachuca well field is given in Table 2. The data in this table was assembled from information in References No. 1 and No. 2 and Post records. It will be noted that the average drop in water level ranges from 1.00 foot to 2.03 foot per year.

2-04 POST SPRING SUPPLY

This source of water for the Post has just recently been redeveloped in Garden and Huachuca Canyons under a construction program completed in the summer of 1970. This program entailed the

development of various springs; the collection of their waters; the collection of stream underflow waters in perforated pipes; conducting all waters through sand-traps and to the Post water supply with chlorination just prior to introduction into the system.

2-05 POST WATER PRODUCTION

1. Water production from the Post well field is tabulated, in Table 3, for the years 1964 through August 1970. Maximum-day-per-month water production for the years 1960 through May 1970 is tabulated in Table 4.

2. Water production from the springs in Garden and Huachuca Canyons are as tabulated in Table 5 for the seven months of record.

2-06 POST WATER STORAGE

Water storage facilities for the Fort Huachuca water system are listed in Table 6. This tabulation does not include the ground storage tanks at each well into which the wells discharge prior to having the water boosted into the system.

2-07 WATER QUALITY

Water samples have been collected intermittently since 1941 from the Fort Huachuca well field and springs in Garden and Huachuca Canyons. In general, the water from all sources sampled is of excellent quality and is satisfactory for most uses without extensive treatment. Table 7 lists the results of chemical analysis of well waters at two different periods of time; as well as the average values of characteristics as found in all waters derived from Garden Canyon and Huachuca Canyon from tests made on these waters between 1941 and 1960.

2-08 OFF-POST WATER SUPPLY

1. Huachuca City's water supply consists of four existing wells and is owned and operated by the City. A new well is planned for construction in the near future. Of the four wells used by the City, only two are in daily use, one is not equipped, and the fourth is a private well which is utilized as a standby for the system. Production records are as tabulated in Table 8.

2. The Sierra Vista area is served water by three different privately-owned water companies. These companies are the Southwest Water Company with six wells, the Arizona Water Company with four wells, and Cochise Enterprises, Water Division, with four wells. Production records are as tabulated in Table 8.

3. With the exception of the Arizona Water Company, who does keep a record on production, static water table, and drawdown, information on production, static water table and drawdown of the wells in Huachuca City and the Sierra Vista area are practically non-existent on a continuing basis. Some records are available on a spotty or intermittent basis.

4. Chemical analysis of waters of these off-Post wells were not available. However, since these waters are drawn from the same aquifer as the Post water, it is not unreasonable to assume that these waters will have about the same chemical constituents as do those of the Post well waters, and are of good quality.

Section 3

ON-POST FUTURE CONDITIONS

3-01 BASIS FOR FORECAST

1. The nature of population expansions and reductions at a military post is, normally, as a result of a change by units. The curves associated with population records from municipalities are therefore dissimilar to the fluctuations shown for military posts.

2. Existing facilities, facilities under construction, and planned facilities for family housing, barracks, and BOQ's are inadequate to meet the requirements of the 1966 DA Stationing Plan. The following tabulation is from records of the Office of the Post Engineer.

1966 DA STATIONING PLAN

Officers	783	
Enlisted Men	6,935	
Total Military	7,718	
Non-Resident Civilians		1,800

ON-POST HOUSING SPACES

	E.M. Barracks	E.M. Housing	BOQ	Off. Housing
Existing	1,830	1,229	94	257
Und. Const.	1,630	100	-	-
Planned	789	100	209	-
Totals	4,249	1,429	303	257

Grand Total = 6,238 Spaces

3. Post population as calculated from the above figures and the criteria as set forth in Department of the Army Technical Manuals, is as follows:

Resident		
BOQ		303
Officer Housing	257 x 4	1,028
E.M. Barracks		4,249
E.M. Housing	1,429 x 4	5,716
Total Resident		11,296
Non-Resident		
Officers	783 - (303 + 257)	223
E.M.	6,935 - (4249 + 1429)	1,257
Civilians		1,800
Total Non-Resident		3,280

Effective Population = 11,296 + 3280/3 = 12,389

Design Population = 12,389 x 1.23 Cap. Fact. = 15,238

4. Future population is based upon the assumption that the 1966 DA Stationing Plan will be in effect and that the Post population will be as calculated above.

5. Recent studies of military installations in the southwest, by John Carollo Engineers, have indicated an average daily water consumption of as high as 450 gallons per capita per day. Also, recent studies of municipalities in the southwest, by John Carollo Engineers and other consulting engineering firms, have indicated a rising per capita consumption of water, which is probably attributable to the higher standard of living with an increasing use of home washing machines, dishwashers, garbage disposals, evaporative coolers, and added yard irrigation. As a general rule, the use of water is always higher where the water service is unmetered, as is the Post's service.

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For the above reasons it is felt that the per capita demand for water use on the Post should be set higher than the 150 gallons per capita per day criteria prescribed in the Technical Manuals.

6. Fire flow requirements on the Post will be satisfied by reserve in the existing water storage facilities and not by production facilities.

7. Use will be made of sewage effluent for the purpose of irrigating the golf course and parade ground areas. This will decrease the draft on the potable water supply system by approximately one mgd during irrigation time periods but would not serve to decrease the per capita demand figure.

8. The spring water supply for the Post will be capable of supplying an average of 102 million gallons to the Post's yearly demand. This quantity is conservative as compared to the estimated expected quantity of 1.2 mgd average as given on Page 3 of Reference 5.

3-02 WATER DEMAND QUANTITY

1. An estimate of the future water demand based on the criteria as set forth in the Technical Manuals, is as follows:

REQUIRED DAILY DEMAND		
Design population	15,238	
Water Allowance	150 gpcpd.	
15,238 x 150		2.286 mgd
		(834 mg Yearly)
PEAK DAILY DEMAND		
2.286 mgd x 2.5		5.715 mgd

2. A more realistic estimate of the future water demand would be based on current usage, as shown by the following figures:

Current annual use:

1,100,000,000 gallons per year

or 3,000,000 gallons per day

Current manpower (per Post)

Effective	12,056
Design	14,830

Current usage

3,000,000 ÷ 14,830 = 202 gal./capita/day

In view of the above figures, as well as the reasons presented in 3-01, 5 it is not unreasonable to assume that future per capita demand will be approximately 200 gallons per capita per day, and that future water demand would then be as follows:

REQUIRED DAILY DEMAND

Design population	15,238
Water Allowance	200 gpcpd
15,238 x 200	3.048 mgd (1112 mg Yearly)

PEAK DAILY DEMAND

3.048 mgd x 2.5	7.62 mgd

3. In the case of Fort Huachuca, whose principal source of water is from wells, established criteria require that the required daily demand for water be met by production facilities operating only 16 hours per day. The existing wells have a total capacity potential of 5.62 mgd (Table 1). Therefore: 5.62 mgd x 16/24 = 3.75 mgd, and and the well production capacity exceeds the criteria requirements by

approximately 23 percent. An additional factor of safety is injected when the water supply obtained from the springs is figured into these conditions. Since the supply from the springs is not as yet a proven quantity, no definite figures can be assigned to it for the purpose of calculating daily production at any given time during the year.

4. A graphic depiction of the record and forecast for water production on the Post is given on Figure 1.

Section 4

OFF-POST FUTURE CONDITIONS

4-01 BASIS FOR FORECAST

1. Population in Huachuca City and Sierra Vista will increase at the same rate for the next ten years as it has increased in the past five years, or from the Special Census of 1965 to the 1970 Census.

2. Water demand on a per capita basis will increase over that indicated in Table 8 for the satellite communities. For Huachuca City a factor of 150 gallons per capita per day will be used, and for Sierra Vista a factor of 175 gallons per capita per day will be used.

3. Population, water demand and production in the outlying areas on the widely scattered farms and ranches will remain the same, and will have little or no effect on the water table in the Post Well Field Area.

4-02 POPULATION FORECAST

The population record and forecast is graphically depicted on Figure 2 for both Huachuca City and Sierra Vista. The forecast indicates a population in the Sierra Vista area of 10,750 by 1980, and in Huachuca City an increase to 1,825 by 1980.

4-03 WATER DEMAND QUANTITY

Based on the above population figures and the hereinbefore stated per capita demand factors, water demand by 1980 will be 687 million gallons per year for Sierra Vista, and 100 million gallons per year for Huachuca City. This increase is graphically depicted on Figure 3.

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Section 5

POST AND SIERRA VISTA WELL FIELD

5-01 GENERAL

The fact that all wells within this portion of the San Pedro River Basin tap the same aquifer, and the added fact that the majority of the wells for the City of Sierra Vista and all the wells for the Post supply lie within an area three miles in diameter will lead to accelerated water level decline. This condition is caused by mutual interference of the drawdown cones created by each pumping well which will decrease the capacity of the wells. As a large part of the water pumped from underground is from storage in the aquifer and the recharge waters comprise a small part of the pumpage, the result has been a lowering of the water levels in the area of the well field. This condition is depicted on Plate 1 by the closed groundwater contour in the well field area.

5-02 DRAFT ON UNDERGROUND WATERS

Combining factors from Figures 1 and 3, a graphic depiction of draft on the underground waters in the well field, is shown on Figure 4.

This diagram illustrates that, even though Fort Huachuca obtains appreciable amount of its water supply from the spring areas, the draft on the underground waters will be considerably greater in the future, and by 1978, it will be approximately equal to the present-day draft.

At present, Fort Huachuca uses approximately three times the amount of water from the well field as does Sierra Vista; however, with the full development and use of the spring waters and reclaimed sewage and due to the projected growth of Sierra Vista the ratio will drop to approximately 1.5 to 1 in 1980.

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Section 6

WATER SOURCES AVAILABLE TO FORT HUACHUCA

6-01 PRESENT EXISTING WATER SOURCES

1. The principal present source of water supply for the Post is from the underground waters stored in the aquifer within the Upper and Lower Units of Basin Fill of the San Pedro alluvial basin.

This source is termed principal only in the sense that it is present and available, with the quantity dependent upon the capacity of the wells and pumps which tap this source. However, it must be remembered that the groundwater is a resource which can be irrevocably damaged by imprudent planning and continued overdraft and over-development.

2. The other source of water supply for the Post is the spring water which is collected in Huachuca and Garden Canyons in the Huachuca Mountains, and conveyed by pipelines to the Post water system.

This water source is in reality the prime supply of water for the Post, in the sense that it is the first water used by the Post and requirements for water above the amount available from this source will be supplied by the Post wells tapping the groundwater reservoir.

The quantity of water available from this spring flow is, as yet unknown as the present system has only been in service since June 1970, and there has not been adequate historical background to predict future yield. However, it is known that this source of water is largely dependent upon the rainfall and snow pack on the watershed

of these canyons and therefore the supply can be highly variable. It is felt that there may be times when the amount of water from this source may exceed the total demand of the Post and the surplus going to waste; and at other times it may form only a small portion of the Post's water demand.

3. A third source of water supply for the Post is the effluent from the sewage treatment plants. This effluent is to be used for the irrigation of the golf course area and the Chaffee Parade Ground. It is not adequate for potable use and is pumped, piped, and distributed in a separate system from the potable supply.

The use of this sewage treatment plant effluent for the purpose of irrigating the golf course and parade ground will decrease the demand for water for this purpose from the Post's water system in the future. However, it will not decrease or have any effect upon the overall per capita demand forecasted for the future use on the Post.

The quantity of water available for this purpose is more than adequate to satisfy the irrigation demand for an 18-hole golf course. One million gallons per day is the usual figure used in calculating the amount of irrigation water required for an 18-hole golf course in this section of the country. Based on present records of the Post Engineer's Office, sewage represents approximately 55 percent of the water production. In other words, for every 100 gallons of water produced for use on the Post, approximately 55 gallons is returned as waste to the Post's sewage treatment plant. Thus, from average daily demand and production of 3.048 mgd, approximately 1.57 mgd will be returned as

sewage and be available for irrigation use, less a small amount of loss in treatment and evaporation.

There is no present need for further development of this source of water because water of this type can be used only for non-residential irrigation (or non-crop irrigation).

6-02 POSSIBLE ADDITIONAL WATER SOURCES

1. A possible additional water source that can be considered is the development of spring areas in the Huachuca Mountains outside the Post, south of the Post's south boundary line.

There are several canyons in the Huachuca Mountains, which drain toward the San Pedro Basin, in which springs are located. Notable among these is Miller Canyon where springs have served as a source of water for the Town of Tombstone since the late 1800's.

2. Another additional source of water is the springs on the western slopes of the Huachuca Mountains. These springs are widely scattered and yield only small amounts of water.

3. The only body of surface water in the area is Parker Lake; a small, artifically made lake formed several years ago by the damming of Parker Canyon. Parker Lake is located about five miles southwesterly from the westerly boundary of Fort Huachuca, and is principally a recreational lake on the Coronado National Forest property. The lake is about 200 surface acres in size and is fed by surface run-off and springs.

Use of this water as an additional source of water supply would first entail the negogiation with the Forest Service for a right to the use

of this water and a quantity. Secondly, use of this water would be extremely expensive as it would be necessary to build, operate, and maintain a booster pumping station to lift the water over or around the Huachuca Mountains, a long water transmission line through extremely rough country to deliver the water to the system, and a surface water treatment plant.

4. Another additional water source in the area is the water in the San Pedro River. However, at present these waters are involved in the Central Arizona Project, a plan which envisions bringing water from the Colorado River to Central Arizona; and as a part of the overall plan, construction of a dam in the narrows at Charleston which would impound the waters of the San Pedro and form a lake. If and when this dam is completed and the lake formed, then there might be a possibility that water could be allocated from this body of water for use by Fort Huachuca. This time is probably more than 10 years in the future. At present, the Post Engineer for Fort Huachuca has filed with the U. S. Department of the Interior, Bureau of Reclamation, Central Arizona Project, an "Expression of Interest in Project Water" for securing 12,000 acre-feet of water per year.

5. Another water source is in the Blacktail Canyon area and West Cater area where four springs are located. Each of these springs could be developed in the same manner as Garden and Huachuca Canyons, namely with a cut-off wall, perforated pipe, filter gravel, and covered with select fill. Blacktail Canyon is seven miles to the furthest spring where Garden Canyon is eight miles to the furthest spring.

Section 7

RECAPITULATION AND EVALUATION OF WATER SUPPLY SOURCES

7-01 SPRING SUPPLY

1. To all intents and purposes the water supply from springs in Huachuca and Garden Canyons is almost fully developed. The actual quantity of water which will be available from this source is still a matter of conjecture due to the short period of time that this system has been in operation.

2. Additional spring supply from canyons off-post and farther south in the Huachuca Mountains could probably be developed. The actual quantity, quality, and reliability of these sources are not known as the scope of this report did not entail the exploration for and/or development of additional sources. Therefore, it is known only that springs are present in canyons south of Fort Huachuca, that some of these waters are undoubtedly privately owned, and that probably some of these waters could be contracted for or collected together and transported to the Post for use in the water system.

3. Springs on the west side of the Huachuca Mountains yield only small amounts of water and are not considered as a reliable source. The above, coupled with the fact that the waters would have to be pumped across the mountains for use in the Post's water system, would place this supply of water as having a low priority comprising a last possible source in the case of an extreme emergency.

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7-02 UNDERGROUND WATER SUPPLY

1. Underground water, as delivered to the Post water system by the wells, is the principal source of water for the Post, as earlier defined.

Water level records and Plate 1 clearly show that the water table in the area of the Post Well Field has been depressed over a wide area, and the water level has been dropping at the various Post wells at a rate which ranges from 1.0 foot to 2.0 feet per year during the life of the wells. This situation is aggravated by the fact that the water supply for the Town of Sierra Vista is obtained from wells tapping this same aquifer. The majority of their high-production wells are so close to the Post wells that a mutual interference of the depression cones has occurred. There is no indication in the well data records or operating methods of the Sierra Vista water systems which will change or alter this condition.

Therefore, in future years, the cone-of-depression in the water table will become deeper and wider in extent. Consequently, wells will have to be deepened and larger pumps and motors installed in order to lift the water from a greater depth.

2. The underground water in the San Pedro alluvial basin is the best and most dependable source of water for the Post's water supply. There is a large area which encompasses nearly the entire East Range as well as the area north of Libby Field in which the underground waters are virtually undeveloped.

7-03 SURFACE WATER SUPPLY

1. The expense of construction, operation, and maintenance of the facilities required for the use of Parker Lake waters, plus the fact that the quantity of water available, if any, is unknown and would remain so until negotiations with the Forest Service could be finalized, makes this a very doubtful source of water supply. Due to the above factors, it is felt that this possible source of water supply should be eliminated from consideration, except as a last resort.

2. Sometime in the future, upon the construction of the Charleston Dam across the San Pedro River as a part of the Central Arizona Project, the proposed lake would be adjacent to the east boundary of the Post. The completion of this project, however, is probably more than 10 years in the future. Also, there is no assurance that waters from this project will be allocated to Fort Huachuca's use.

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Section 8

CONCLUSIONS

8-01 WATER SOURCE

1. The Post has developed readily available sources of water within a reasonable transport distance to the point of usage.

2. Further development of springs in off-Post areas is a doubtful venture due to unknown quantity, quality, and availability of rights to these waters. For all practical purposes, surface water in the area is non-existent, at present.

3. The best water source, from the point of quantity and availability, is the groundwater contained in the Upper and Lower Units of Basin Fill of the San Pedro alluvial basin.

8-02 WATER QUANTITY

1. The two present sources of water supply, the Huachuca and Garden Canyon spring areas and the Post's wells, have supplied the Post's water demand up to the present.

8-03 WATER QUALITY

1. The water from both present sources is of excellent quality and is satisfactory for most uses without extensive treatment.

8-04 PRESENT WELLS AND WELL FIELD

1. The wells in the Post well field and the majority of high-production wells producing water for the Town of Sierra Vista are so closely grouped that the pumping operations has created an accelerated water level decline owing to the mutual interference.

2. Due to this steady lowering water table in the well field, it is probable that at some time in the near future the Post will have to lower several or all of the pumps in the wells and/or will probably have to increase the size of the driving motor and possibly the pumps in order to maintain production to meet the water demand. Further, it may become necessary to deepen several of the wells in order to accomplish the above modifications and increase the yield from the aquifer.

3. The rate of decline of water levels in the well field area could be reduced if the rate of pumping from the aquifer in this area were reduced.

It is unlikely that the water levels in the depression cone would completely recover even if the Post's wells were curtailed or abandoned as the expanded pumpage by Sierra Vista would exceed the recharge to the well field. However, the rate of decline could be decreased if the Post developed several new wells at least two miles distant from the present well field. The mutual interference of drawdown cones caused by each well could then be reduced to have minimum effect on the water levels. In order to attain optimum conditions, it will require a careful analysis of pumping regimen, peaking conditions, and site location of the new wells.

8-05 OTHER WELLS IN AREA

1. Other wells in the area of the San Pedro River Basin, including those of Huachuca City, do not affect the present Post water supply.

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2. There are no existing wells adjacent to or available to the Post that would be economically feasible for the Post to acquire in lieu of constructing new wells on Post property.

Section 9

RECOMMENDATIONS

9-01 DEVELOPMENT OF OTHER SOURCES

1. It is recommended that no immediate consideration be given to the development and/or use of existing sources of water other than those sources being used presently. These other sources are either of minor quantity and/or economically unfeasible for development or use by the Post.

2. It is recommended that Post authorities keep abreast with the future developments of the Central Arizona Project and at the appropriate time, under the laws and regulations then existing, to advance their application for use of waters from this Project.

9-02 GEOLOGICAL INVESTIGATIONS

1. It is recommended that no further area-wide geological investigations be undertaken for the purpose of finding additional water sources.

2. It is recommended that hydrogeological investigation be made, in the area between Sierra Vista and Huachuca City on the Post property, to ascertain the potential groundwater resources in the Upper and Lower Units of Basin Fill in regard to depth, permeability, and potential production.

3. It is recommended that hydrologic studies be made which are required to reach firm conclusions with regard to the amount of overdraft of the groundwater supply and what effect a new well field will have on long term supply.

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9-03 CONSERVATION AND PRESERVATION OF EXISTING WATER SOURCES

1. SPRING AREA SOURCES

   a. It is recommended that development and management of the watershed areas for these sources be maintained on a high level and that any applicable advancement in the science of said watershed development and management be incorporated into these areas by the Post authorities.

   b. It is recommended that these waters be used as a prime source for water required by the Post prior to the use of any other water for potable supply.

   c. It is recommended, after a record of flow versus use has been established and it is found that a surplus of water exists at high flow and low use periods, that thought be given by the Post authorities concerning the economic feasibility of impounding these surplus waters and constructing a surface water treatment facility for their use in the water system.

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2. GROUNDWATER SOURCE

a. It is recommended that an additional water supply be developed from the groundwater reservoir that occurs in the alluvial Basin-Fill sediments on Post property between Sierra Vista and Huachuca City. The construction of wells in this area will provide groundwater to assure an adequate supply to meet the average daily demand requirement of 3.05 mgd. The water pumped from the new wells will serve as augmentation to the water from the Spring Areas and existing well field. In the recommended area, there would be a minimal depression-cone interference and water level decline by pumping in existing wells if wide spacing between wells is maintained.

b. The following procedures are recommended to fully explore and develop the optimum well yield.

1. Conduct a geophysical gravimetric survey from Laundry Ridge along a line N 50° E to the north boundary of T 21 S, R 20 E as shown on Plate 1, to obtain data on the depth and thickness of the alluvial sediments.

2. Construct a minimum of three, 8-inch exploration test boreholes to obtain subsurface hydrogeological data. Approximate locations for three sites are shown on Plate 1. The exact locations will be dependent upon the results obtained from the

gravimetric survey. At least one of these exploration holes to be constructed to a depth of 1500 feet if conditions warrant. These 8-inch diameter exploration holes shall be constructed with a medium-sized rotary rig capable of drilling 2000 feet of alluvial materials. Samples of drill cuttings are to be collected and core samples are to be obtained at specified depths.

3. Obtain a down-the-hole geophysical well log upon the completion of each well, consisting of Electrical Resistivity, Self Potential and Gamma-Ray logs. If holes are drilled with cable-tool and cased, Gamma-Ray logs should be run through the casing. These data are required to select the optimum site and design the test-production well.

4. Construct a test-production well equipped with a minimum 16-inch slotted casing or screen. Tentatively, it is estimated that this well would be within the triangular area enclosed by the three exploration well sites (Plate 1). The exact depth and optimum well design will be determined from the data obtained from the exploration holes. If depth of the test-production well is less than 1000 feet, it is suggested that a cable tool or churn

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drilling method would be more economical and achieve optimum well development. A rotary drilling method should be employed if the well depth is appreciably greater than 1000 feet.

5. Perform an extensive pumping test on the completed test production well. It is suggested that the test have a minimum duration of 10 days and the exploration wells be utilized as observation wells during the long-term test. The exact pumping rate will be dependent upon the exploration hole data and preliminary indications of yield from the test production well. The data obtained from the pumping test will indicate how many additional wells will be needed to produce the required water supply. The data collected from observation (exploration) wells will be used to make a prediction analysis on the extent and magnitude of the depression-cone.

c. It is recommended that a quantitative assessment and prediction analysis be prepared from the data obtained from the exploration and production wells, pump test results, and the optimum well field design. A long term prediction of the future water levels and the extent of the depression-cone is needed to design the optimum pumping operations regimen. Several

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alternative pumping schemes of new well field versus existing well field should be analyzed to assess the areal decline on water levels, pumping lift, and pumping costs.

d. It is recommended that an analysis be prepared on the optimum pumping operations and alternatives, to provide answers to such questions as, which wells should be pumped in the Post's existing well field? Shall the new wells be pumped to furnish water for peaking requirements, or should they be pumped at an optimum maximum rate and the supplemental supply to be obtained from existing wells?

e. In the event (which appears most unlikely) the results obtained from the exploration holes are not favorable for water development, consideration would be given to the exploration and development of groundwater in the area northeast of Garden Canyon in the eastern half of T 22 S, R 21 E, following the same schedule of procedures as outlined above.

3. SEWAGE EFFLUENT

a. It is recommended that the effluent from the sewage treatment plant be utilized for irrigation in the golf course area and parade ground to its greatest practical extent.

REFERENCES

1. Water Supply, Triangular Division Camp, Fort Huachuca, Arizona, August 20, 1941

2. Water Resources of Fort Huachuca Military Reservation, Southeastern Arizona, U. S. G. S. Water-Supply Paper 1819-D, 1966

3. Master Plan Analysis of Existing Facilities, U. S. Army Garrison, Fort Huachuca, Arizona, U. S. Army Engineers District, Los Angeles, March 31, 1969

4. Analysis of Water Resources, Fort Huachuca, Arizona Prepared by Post Engineer (S. Sage) June 1970

5. Summary of Ground Water Supply Conditions, Fort Huachuca, Arizona. Department of the Army, Sacramento District, Corps of Engineers, July 1970

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Table 1

WELL DATA - FORT HUACHUCA WELL FIELD

	Well Number					
	1	2	3	4	5	6 *
Date drilled	1939	1940	1942	1942	1942	1953
Elevation of land surface	4,639.5	4,640.1	4,618.4	4,619.3	4,610.0	4,645.0
Depth of well, feet	701	710	802	912	800	1,230
Casing diameter, inches	14	14	18-16	18	18-16	16
Casing depth, feet	703	710	802	807	800	803
1970 Records:						
Static water level, feet	519	520	493	490	475	(500)
Drawdown, feet @ gpm	34 @ 600	24.5@650	26 @ 700	18 @ 600	66 @ 650	(21 @ 700)
1970 Specific capacity	17.6	26.6	26.9	33.3	9.8	-
1970 capacity potential, gpd	864,000	936,000	1,008,000	864,000	936,000	(1,008,000)
Elevation of static water level, 1970	4,120.5	4,120.1	4,125.4	4,129.3	4,135.0	-

Maximum total capacity potential including No. 6 = 5,616,000 gallons per day

* No air line for level measurements - 1966 records

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Table 2

SUMMARY OF WATER LEVEL RECORDS IN FORT HUACHUCA WELL FIELD

Well No.	Date of Earliest Recorded Water Level	Date of Latest Recorded Water Level	Time Span in Years	Earliest, Depth to Water Level	Latest, Depth to Water Level	Drop in Water Level	Average Drop in Water Level per Year
1	1941	1970	29	460	519	59	2.03
2	1941	1970	29	466	520	54	1.86
3	1948	1970	22	453	493	40	1.82
4	1942	1970	28	462	490	28	1.00
5	1943	1970	27	443	475	32	1.18
6	1958	1966	8	492	500	8	1.00

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Table 3

MONTHLY WELL PRODUCTION (1,000 GALLONS)

FORT HUACHUCA, ARIZONA

	Year						
	1964	1965	1966	1967	1968	1969	1970
January	43,768	54,894	42,887	62,824	55,562	59,517	64,151
February	43,944	58,350	40,433	70,192	63,317	57,893	71,839
March	62,224	88,146	77,902	110,266	77,481	80,824	82,113
April	73,796	87,541	82,837	89,402	80,781	97,623	94,846
May	91,675	97,097	95,971	114,644	120,722	116,505	123,237
June	102,612	110,022	105,577	119,959	124,496	140,426	125,683 *
July	73,585	94,495	90,718	79,668	94,065	95,415	99,602 *
August	63,849	75,696	67,469	77,962	79,975	86,713	77,655 *
September	59,471	68,824	64,492	71,673	95,573	96,506	
October	55,898	75,568	73,448	73,038	105,465	104,089	
November	52,117	56,634	65,375	70,350	75,537	72,269	
December	48,919	52,217 **	55,515	51,837	59,028	60,666	
TOTAL	771,858	919,484	862,624	991,815	1,032,002	1,068,446	
AVERAGE							
Monthly	64,322	76,624	71,885	88,651	86,000	89,037	
Daily	2,110	2,520	2,360	2,720	2,820	2,920	

* Huachuca and Garden Canyon Spring collection systems contributing to water system.

** Records for December 1965 unavailable; figure shown is average of December 1964 and December 1966.

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Table 4

MAXIMUM DAY WATER PRODUCTION BY MONTHS

(Million Gallons)

FORT HUACHUCA, ARIZONA

Month	Year										
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Jan	1.67	1.98	1.73	2.10	1.69	2.59	2.01	3.00	2.69	2.22	3.81
Feb	2.20	2.86	2.64	3.02	1.79	2.96	1.89	3.37	3.55	3.21	3.45
March	2.69	3.27	3.13	3.58	3.52	4.18	3.87	5.16	3.72	4.19	3.82
April	2.96	3.28	3.44	3.25	3.79	4.72	4.34	4.64	4.15	4.37	4.00
May	3.61	3.78	4.16	4.32	4.14	3.89	4.20	4.80	5.00	4.96	4.90
June	4.00	3.99	4.47	4.62	4.45	4.70	4.83	4.71	4.96	5.02	
July	3.68	3.85	3.93	4.42	4.03	5.27	4.46	3.54	4.49	4.94	
August	3.20	3.45	3.99	2.04	3.49	3.52	2.69	4.05	3.19	3.92	
Sept	2.63	2.81	3.63	2.48	3.22	3.18	2.93	3.25	4.34	4.30	
Oct	2.60	2.62	3.80	2.82	2.30	3.32	3.39	3.02	4.56	4.48	
Nov	2.12	2.40	2.89	1.96	2.27	2.81	2.62	2.93	3.42	3.46	
Dec	1.63	1.65	1.64	2.07	2.00	1.83	2.56	2.25	2.56	2.76	

Note: Data rounded to 3 significant figures.

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Table 5

WATER PRODUCTION - SPRING SUPPLY

GARDEN CANYON AND HUACHUCA CANYON SYSTEMS

Month	Total Production (1000 Gal.)	
June 1970	6,668.8	(222,000 gpd)
July 1970	4,968.0	(160,000 gpd)
August 1970	490.6	(15,850 gpd)*
September 1970	8,507.2	(255,000 gpd)*
October 1970	13,117.2	(425,000 gpd)
November 1970	9,432.1	(314,000 gpd)
December 1970	8,398.8	(271,000 gpd)
Total not including August & September	42.5 mil. gal.	

÷ 5 = 8.5 average per month

or 102 million gallons per year

* Not representative. Collection system was not operated for most of month.

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Table 6

WATER STORAGE FACILITIES

FORT HUACHUCA, ARIZONA

Building No.	Capacity (Gallons)	Type		Elevations		Size	Material	Year Built
		Ele-vated	Ground	HWL	LWL			
61609	3,000,000		X	4,887	4,870	160' I.D.	Concrete	1942
22020	1,500,000		X	5,110	5,080	92' I.D.	Concrete	1958
49001	500,000	X		4,887	4,870	60'-high	Steel	1941
70411 *	500,000	X		-	-	60' high	Steel	1942
22002	250,000		X	5,264.5	5,255	102' x 42'	Concrete	1939
22001 **	200,000		X	5,271	5,255	54'-7" x 50'-1" 56'-9" x 50'-10"	Masonry	1911
30121 ***	10,000	X		4,999.5	5,014.5	20' high	Steel	1942

Total Effective Storage (Total minus laundry) = 5,950,000 gallons

* Not in use.
** Two-compartment reservoir.
*** Laundry soft water supply.

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Table 7

CHEMICAL ANALYSIS - FORT HUACHUCA WELLS AND SPRINGS
(In Parts per Million)

Characteristic		**	Well No. 1		Well No. 2		Well No. 3		Well No. 4	
			1956	1966	1956	1966	1956	1966	1956	1966
Silica	SiO_2		32	31	33	32	33	32	30	28
Iron	Fe	0.3	0.04	0.04	0.01	0.01	0.51	0.00	0.14	0.00
Calcium	Ca		43	48	40	42	44	43	44	43
Magnesium	Mg		14	10	14	10	14	9.8	12	6.4
Sodium)	Na		11	14	12	17	9.7	15	9.2	18
Potassium)	K									
Bicarbonate	HCO_3		212	211	205	205	211	202	202	193
Carbonate	CO_3		0	0	0	0	0	0	0	0
Sulphate	SO_4	250	6.5	6.2	5.7	5.8	6.9	6.6	6.6	5.8
Chloride	Cl	250	4.2	7.2	4.8	5.0	4.8	4.3	4.2	4.4
Fluoride	F	1.0	0.1	0.2	0.1	0.5	0.1	0.3	0.2	0.6
Nitrate	NO_3	45	1.1	3.3	1.2	1.4	1.3	0.8	0.8	1.2
Dissolved Solids. Res. on Evap. @ 180° C		500	216	220	214	207	221	202	212	193
Hardness as $CaCO_3$			165	163	198	147	168	148	160	134
Non-carbonate Hardness as $CaCO_3$			0	0	0	0	0	0	0	0
Alkalinity as $CaCO_3$			174	174	168	168	173	166	166	158
Carbon Dioxide as CO_2 - Calculated			11	13	10	26	8.4	16	6.5	19
Specific Conductance - Micromhos @ 25° C			351	362	340	345	352	336	341	324
pH			7.5	7.4	7.5	7.1	7.6	7.3	7.7	7.2
Color			1	0	1	0	1	0	1	0

* Average values, all waters. Derived from U.S.G.S. Water-Supply Paper 1819-D. Various dates between 1941 and 1960.

** Max. ppm tolerable, no other source. U.S.P.H.S. Drinking Water Standards, 1962.

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Table 7, continued

CHEMICAL ANALYSIS - FORT HUACHUA WELLS AND SPRINGS
(In Parts per Million)

Characteristic		**	Well No. 5 1956	Well No. 5 1966	Well No. 6 1962	Well No. 6 1966	* Huachuca Canyon Springs	* Garden Canyon Springs
Silica	SiO_2		28	28	32	30	13	15
Iron	Fe	0.3	0.25	0.00	0.04	0.00	0.02	0.01
Calcium	Ca		37	40	46	44	81	97
Magnesium	Mg		9.2	5.8	7.1	6.3	15	19
Sodium)	Na		13	19	22	20	4.0	4.7
Potassium)	K							
Bicarbonate	HCO_3		176	180	216	201	284	351
Carbonate	CO_3		0	0	0	0	0	1.4
Sulphate	SO_4	250	5.7	5.4	6.4	6.2	18	35
Chloride	Cl	250	5.2	6.0	5.0	5.0	4.5	4.6
Fluoride	F	1.0	0.2	0.8	0.2	0.3	0.12	0.19
Nitrate	NO_3	45	2.0	2.7	0.8	1.1	0.2	1.2
Dissolved Solids. Res. on Evap. @ 180° C		500	192	204	228	214	276	339
Hardness as $CaCO_3$			130	124	144	136	252	324
Non-carbonate Hardness as $CaCO_3$			0	0	0	0	19	35
Alkalinity as $CaCO_3$			144	143	177	165	-	-
Carbon Dioxide as CO_2 - Calculated			7.0	23	8.6	13	-	-
Specific Conductance - Micromhos @ 25° C			306	316	356	340	466	572
pH			7.6	7.1	7.6	7.4	7.4	7.4
Color			1	0	0	0	3	3

* Average values, all waters. Derived from U.S.G.S. Water-Supply Paper 1819-D. Various dates between 1941 and 1960.

** Max. ppm tolerable, no other source. U.S.P.H.S. Drinking Water Standards, 1962.

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Table 8

OFF-POST PRODUCTION RECORDS

	Year	Total Production in Million Gallons	Gallons per Capita per Day
Huachuca City			
	1967	50.38	116
	1968	56.17	135
	1969	57.10	130
Sierra Vista			
Southwest Water Co.	1968	258.8	
	1969	279.0	
Arizona Water Co.	1968	53.2	
	1969	72.9	
Cochise Enterprises	1968	45.3	
(Estimated)	1969	49.0	
Total Sierra Vista	1968	357.5	158
	1969	390.5	163

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Arizona Water Co. Wells Average for 1969	Discharge GPM	Drawdown Ft.
Village Meadows No. 1	340	40
Village Meadows No. 2	350	30
East Sulger	50	1
West Sulger	23	10

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FIGURE 1

WATER PRODUCTION - WELLS AND SPRINGS FOR FORT HUACHUCA, ARIZONA RECORD AND FORECAST

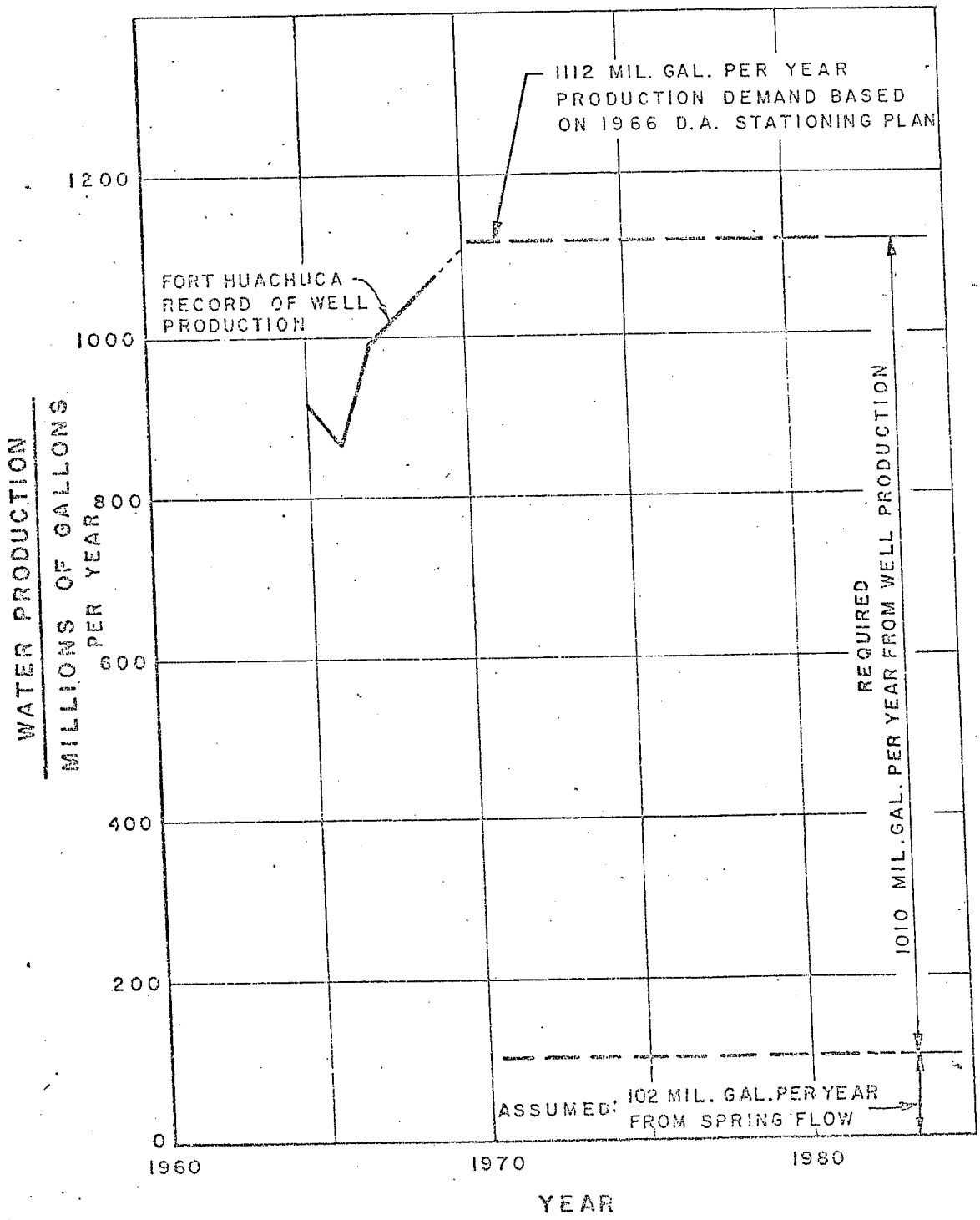

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FIGURE 2

POPULATION - RECORD AND FORECAST

ADJACENT TO FORT HUACHUCA

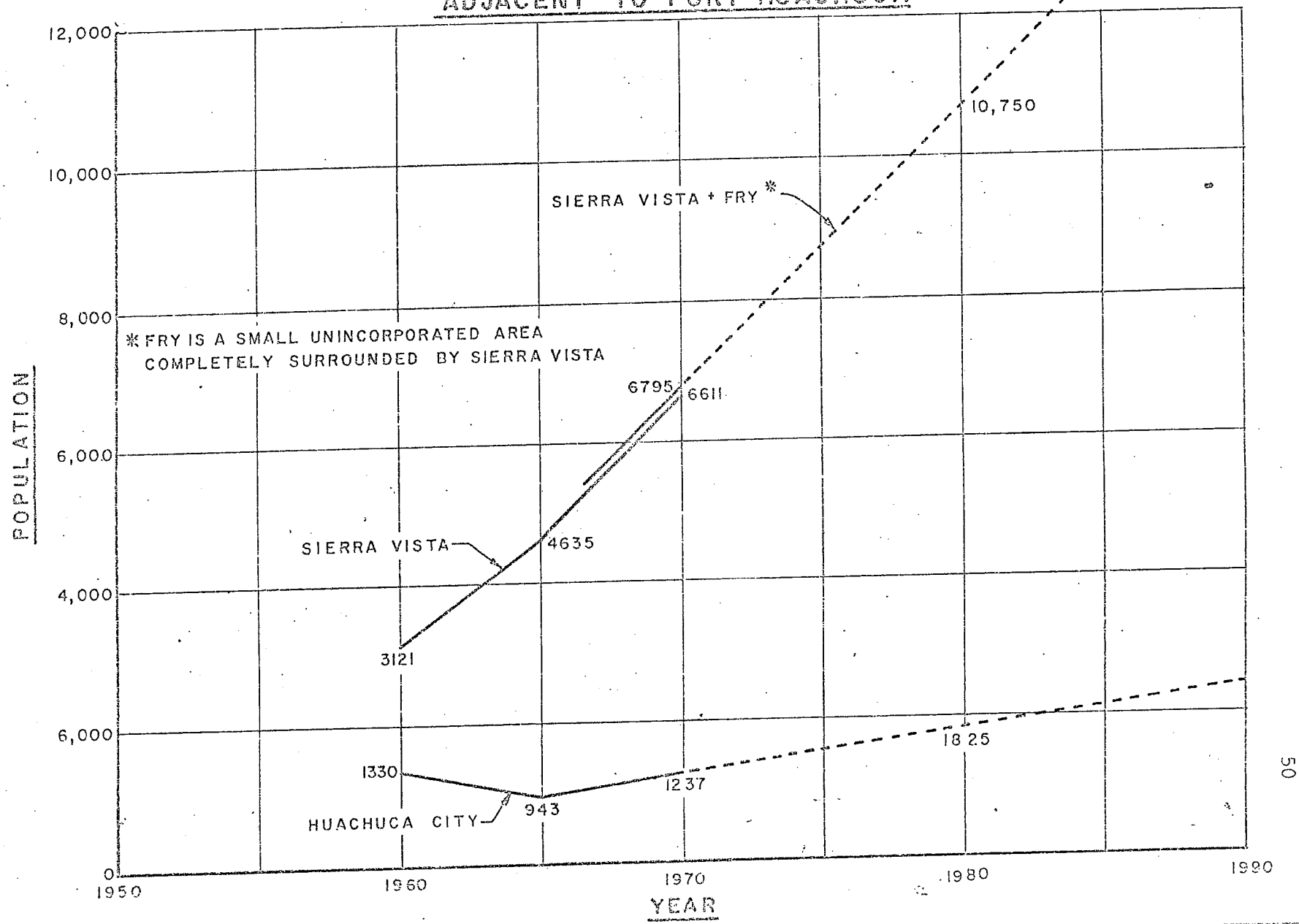

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FIGURE 3
WATER PRODUCTION - WELLS
RECORD AND FORECAST
SIERRA VISTA AND HUACHUCA CITY

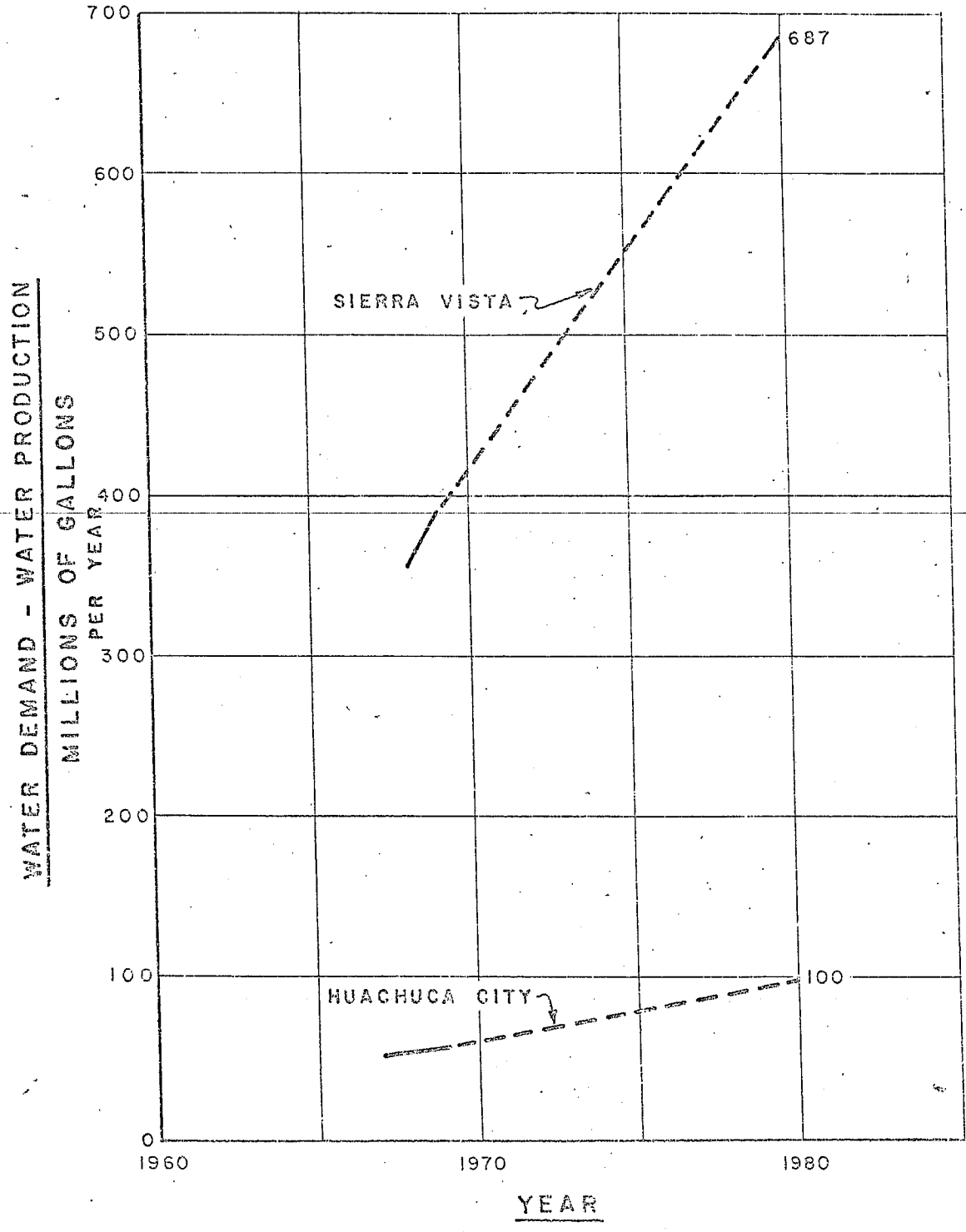
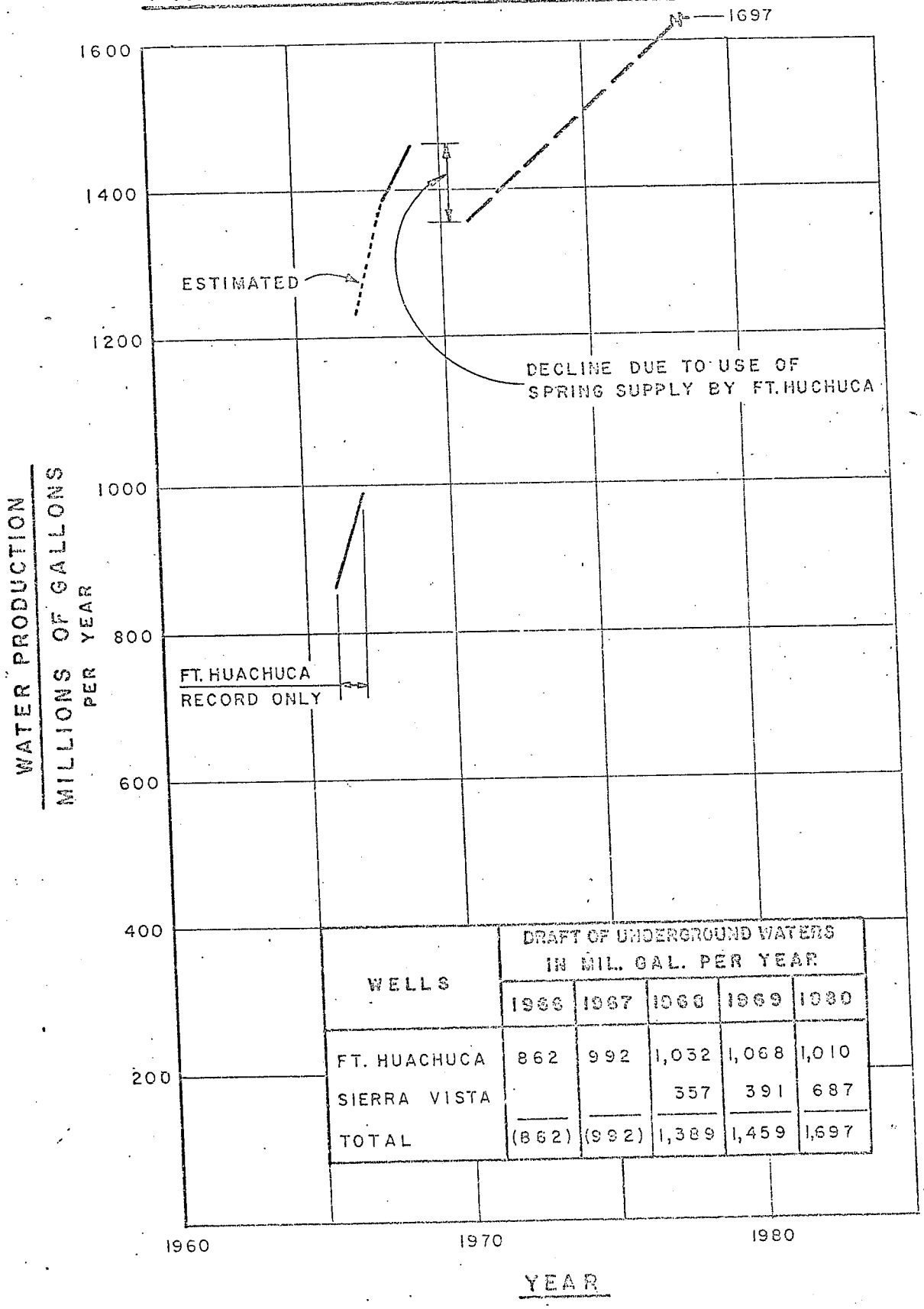


FIGURE 4

DRAFT ON UNDERGROUND WATER

FT. HUACHUCA - SIERRA VISTA WELL FIELD



WELLS	DRAFT OF UNDERGROUND WATERS IN MIL. GAL. PER YEAR				
	1966	1967	1968	1969	1980
FT. HUACHUCA	862	992	1,032	1,068	1,010
SIERRA VISTA			357	391	687
TOTAL	(862)	(992)	1,389	1,459	1,697

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