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November 2009

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Garton Lake and Well White Sands National Monument

Garton Lake is located approximately 1½ miles east of the headquarters area of White Sands National Monument. The lake is estimated to have a surface area of two acres. It is contained within a circular clay dike that is 3-4 feet high and 50 feet wide.

Garton Lake is not natural. It formed in 1916 when an oil & gas test well encountered an artesian flow of warm water (94°F) issuing from a cavity between shale seams at a depth of 890 feet. The well was not plugged, thus permitting a continuous flow of water to collect in a shallow pond and surrounding marsh area. The initial flow was reportedly 1100 gallons per minute.

The drilling log shows that the well encountered lake sediments from 0-883 feet. The lake sediments would be mostly clay and gypsum. The water issues from a cavity from 889-892 feet.

The well was originally cased with 10-inch steel casing to an unknown depth. It's likely the casing extended at least to the bottom of the lake sediments and into the first limestone layer at 802 feet. It's likely the casing extended deeper than that.

Before the well was acquired by the National Park Service, a 16-foot section of 8-inch steel casing was lowered into the 10-inch casing and clamped in place. A cement pad was poured around the wellhead; 42" diameter and 28" deep. A gate valve was placed on the 8-inch casing.

Sometime in June or July 1936, the valve was closed and shortly thereafter, numerous spring-like discharge areas formed at the ground surface within about 40-50 feet of the wellhead. Obviously, the casing had broken at some fairly shallow depth, allowing water to find new pathways to the surface. (If the casing break had occurred deep underground, the weight of the overlying sediments would have been too great for the artesian pressure to overcome.) When the valve was reopened, quantities of sand and gravel were ejected and the flow from the casing was almost stopped. Flow from the "springs" adjacent to the casing continued and additional sand and gravel was ejected from the well and deposited to a depth of 0-3 feet in an area 70 feet or more from the well. The sand and gravel ejected from the well created an undetected cavity underground.

A company was contracted to remove the 16-foot section of 8-inch casing and install new 8-inch casing to some depth. They started work on the project with 840 feet of 8-inch casing at the site, which would have been enough to set new casing all the way through the lake-bed sediments and cement it into the underlying limestone bedrock formations. On the fourth day of work (Nov. 7, 1936), as they were pulling casing out of the hole, the ground around the well collapsed, creating a crater about 40 feet in diameter and 30 feet deep at the casing. The casing and wellhead settled into place about 13 inches southeast of its original location.

Several truckloads of broken concrete were dumped in the crater to fill and stabilize the hole. Later a steel and timber framework was built over the crater to make a stable working platform for further work on the well. Work resumed on the well in June 1937. Initially, they attempted to drill down through the 8-inch casing to clear the borehole. Sand and mud kept rising into the bottom of the casing. They concluded that the casing was broken at about 35-40 feet below ground, possibly at the second joint in the casing. They used dynamite to sever the upper, displaced section of the casing and concrete well pad. The well casing was severed about 16 feet below ground. The drill rig was repositioned over the exact center of the original well location and they attempted to drill down to enter the top of the remaining well casing, below the original break, about 35-40 feet below ground surface. The drill bit and other tools were continually thrown off course by debris in the crater at a depth of about 19 feet. After 4 days, they gave up on trying to reenter the old casing, which was out of sight and buried by several tens of feet of debris.

I could find no information regarding work on the well after 1936-37. It's likely that the condition of the well has not changed. The original casing is still in place, starting at some unknown depth below ground surface. It's likely that the top of the original casing is about 35-40 feet below ground surface, coinciding with the depth that they were able to drill through the displaced casing in June 1937. If the casing was not still in place through the majority of the well, it's likely that the borehole would have slumped shut at a depth great enough that the artesian flow would not have been able to continue at the land surface.

The temperature and flow rate has decreased since 1937. By the spring of 1980, the temperature was 75°F and the flow rate was less than 10 gpm (Sprester, 1980). The reduced flow rate is likely a combination of two causes. The aquifer is being depleted after many years of uncontrolled flow and the borehole is gradually sloughing closed following the removal of 500 feet of casing.

Sprester (1980) estimated the flow from the well at 10 gpm, which would be 16 acre-feet over the entire year. Given a surface area of 2 acres, there would be 8 feet, or 96 inches of inflow to the pond. He estimated the annual evaporation rate for the pond at about 67 inches per year, leaving a surplus of about 30 inches for infiltration and evapotranspiration by vegetation surrounding the pond.

Sprester (1980) states that in the late 1970s, explosives were used to clear debris that had accumulated over the wellhead. The explosion likely further contributed to collapse and closing of the uncased section of the wellbore near land surface, resulting in reduced flow from the well.

Tularosa Basin

The Garton well (18S.8E.5.144) is in the Tularosa Basin on the White Sands National Monument grounds, about a mile east of the Sands themselves. It was drilled as an oil test before 1929, but the exact date is not known. This well flows naturally at the surface.

In a letter dated June 5, 1965, Donald A. Dayton, Superintendent of the White Sands Monument, said,

The hole had a 15 inch, a 10 inch, and an 8 inch casing at the surface in 1937. In July 1937, the casings were broken when an attempt was made to pull the casings. The casing was evidently offset at the break. Cratering occurred and the project of relining the well was abandoned. A copy of the log is attached.

The flow is said to have been 1100 gallons per minute initially. An estimate in 1937 placed the rate of flow at ten to twenty gallons per minute. We suspect the present rate is about half of that figure. It is sufficient to maintain two acres of open lake and several acres of marsh.

In 1937 the temperature of the water was reported as 96°F. A measurement at the well head earlier this year gave a reading of 92°F.

The driller's log by George E. Moffett follows:

0-783	Valley fills, clays and gypsum
783-797	Red sandstone

797-802	Clay and gypsum
802-821	Limestone
821-846	Red limes
846-858	Hard lime (red)
858-889	Soft green shale, gas pockets
889-892	Open cavity, artesian water
902-907	Brown shale, flowing oil, gas, the best free oil showing
907-909	Light thin limes
909-913	Brown and greenish clays
913-926	Limestone, red, gas
926-930	Limestone, hard, red
930-937	Limestone
937-945	Shale and thin lime, red
945-952	Hard lime
952-953	Soft brown shale, flowing oil
953-989	Tough gray lime

The measurements in table 29 for December 12, 1965, were made in the pond near the well. The average temperature of the water near the well was 89°F, the maximum at a depth of about 15 ft was 92.7°F, and the shallow pond, remote from the well, had an average temperature of 52°F. Air temperature was 64°F.

Table 29 - Field data for Pecos River basin

Location	Date	Discharge (gpm)	Temperature (°F)	pH	Specific conductance (micromhos)	Density gm/ml	H ₂ S ppm	NH ₃ ppm	SiO ₂ ppm
Montezuma Hot Springs (17N.13E.36.440)	1-3-66	5.8	131.3	8.8	790	.974	1	0.3	78
Garton Well (18S.8E.5.144)	12-17-65	---	92.7	7.1	5000	.995	0	3.4	20

from W.K. Summers (1976)

References

Sprester, Forrest R., 1980, *Hydrologic Evaluation of Garton Lake, White Sands National Monument, New Mexico*, unpublished report of the USAF Hospital, Environmental Health Service, Holloman AFB, New Mexico, 19 pp.

Summers, W.K., 1976, *Catalog of Thermal Waters in New Mexico*, New Mexico Bureau of Mines and Mineral Resources, Hydrologic Report No. 4.

Veale, John H., 1937, *Report of the Condition, Work Done, and Recommendations for Restoring the Garton Well at White Sands National Monument*, unpublished document available from DSC-TIC, 13 pp.

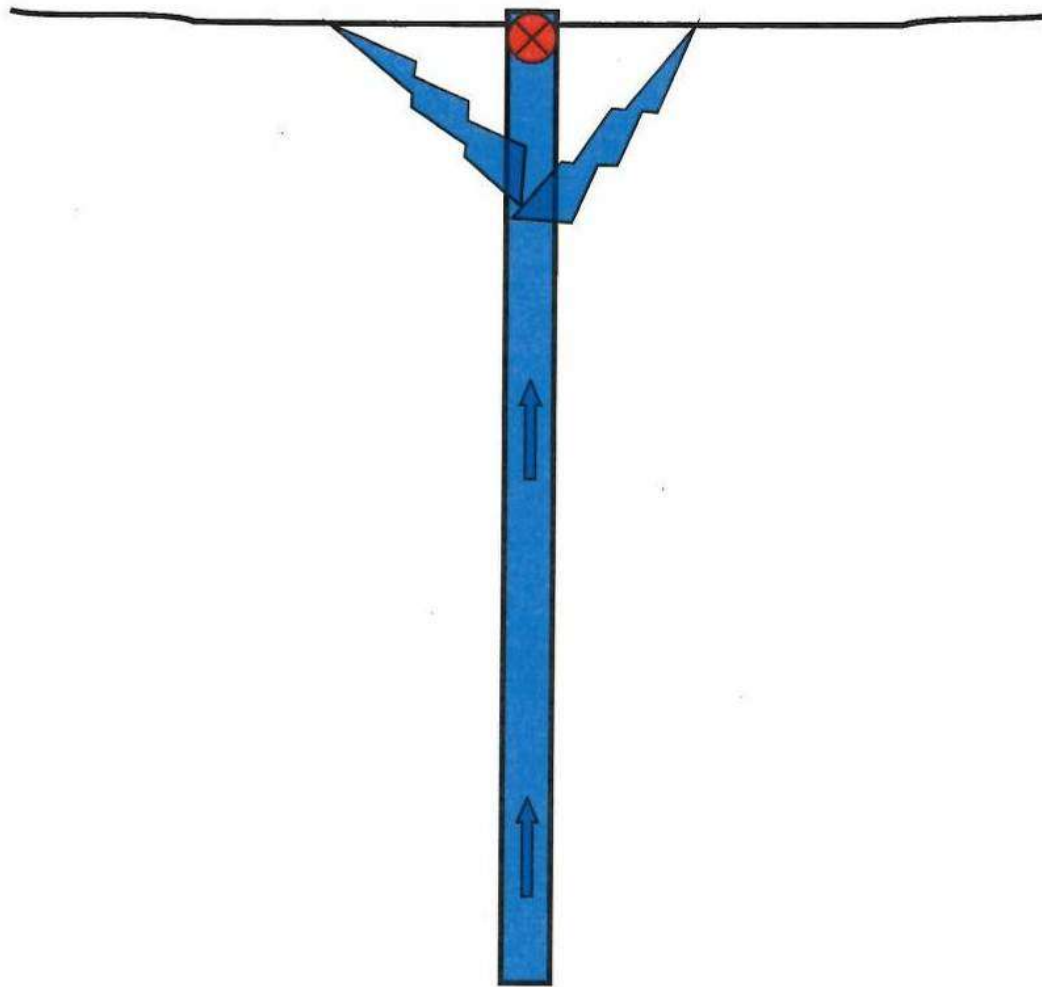


Figure 1. Sketch of probable conditions at the Garton Well when it was fitted with a valve and the valve was closed in 1936. The artesian pressure in the well caused a rupture of the steel casing at a depth of about 35 feet. Uncontrolled flow of water eroded underground cavities that eventually collapsed when they attempted to remove the cement pad and 8-inch well casing.

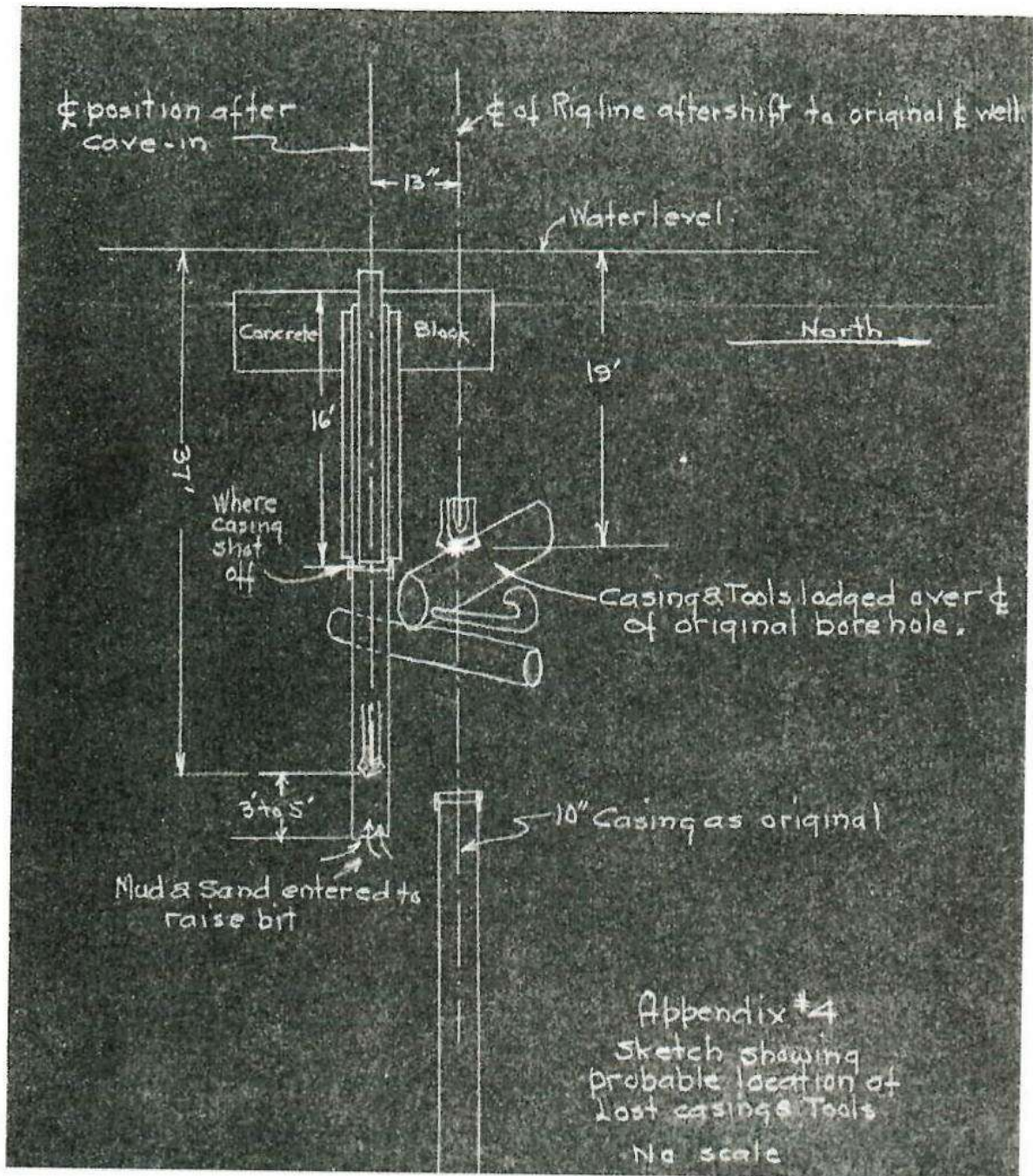


Figure 2. Sketch of the probable condition of the Garton Well immediately after collapse of land surface around the well (June 1936). Apparently the casing separated about 35 feet below ground surface when they attempted to remove the 8-inch casing. After the ground collapsed, the top section of casing settled to a new position about 13" south of the original location. The drillers were unable to reenter the 10-inch casing (the top of which was about 35 feet below original ground surface). The drill string, casing, and anything else they attempted to lower into the original casing would be deflected by tools, pipe, or other debris that fell into the crater when the collapse occurred.

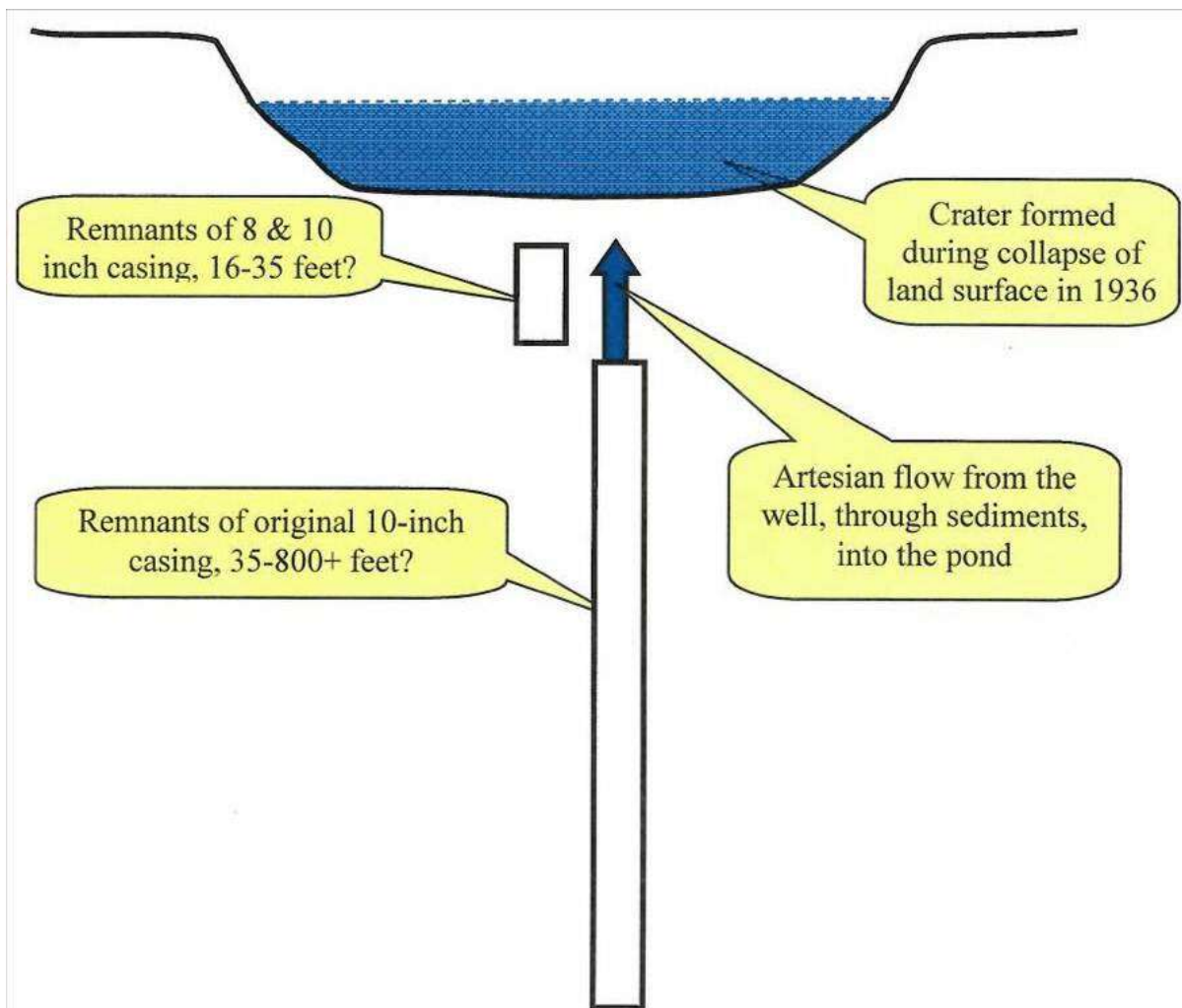


Figure 3. Sketch of probable current condition of the Garton Well. Top of the casing is probably 35 feet below ground surface. Artesian flow from the well flows through a few tens of feet of sediment to discharge into the bottom of the pond. The source of the water is a cavity in the shale and limestone bedrock unit at 889-892 feet below ground surface. About 20 feet of casing remains underground, but displaced to the side of the well. Tools, pipe, and other debris that fell into the crater during the 1936 collapse prevent access into the remnants of the original well casing.