# HISTORY OF WEATHER OBSERVATIONS
# Fort Bayard, New Mexico
# 1867 - 1893

September 2005

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**This report was prepared for the Midwestern Regional Climate Center under the auspices of the Climate Database Modernization Program, NOAA' National Climatic Data Center, Asheville, North Carolina**

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# ACKNOWLEDGMENTS

Cecilia Jensen Bell, Local Historian and Adjunct Professor at Western New Mexico University provided a tour of old Fort Bayard, explaining the history and aspects of the various buildings. Thanks to Ms. Bell, a number of critical questions were answered regarding the likely evolution of weather observing at Fort Bayard by Army surgeons, as well as by the Signal Service. Cecilia provided important insight that otherwise would not have been available.

Neta Pope and Andrea Jaquez provided information regarding the location of early hospitals at Fort Bayard during the mid to late 1860s. Documented evidence regarding the presence and location of these hospitals is sparse requiring considerable research. Neta and Andrea's expert insight helped determine the most likely location of the hospitals.

Pat Bennett made available the archives of the Silver City Museum on a day the museum normally would have been closed. She also helped in locating pictures of Fort Bayard and making digital copies.

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# HISTORY OF WEATHER OBSERVATIONS
Fort Bayard, New Mexico
1867 – 1893

**Gary Grice**

## INTRODUCTION

### Historical Overview

Fort Bayard is located in western New Mexico, approximately seven miles northeast of Silver City (Figure 1)

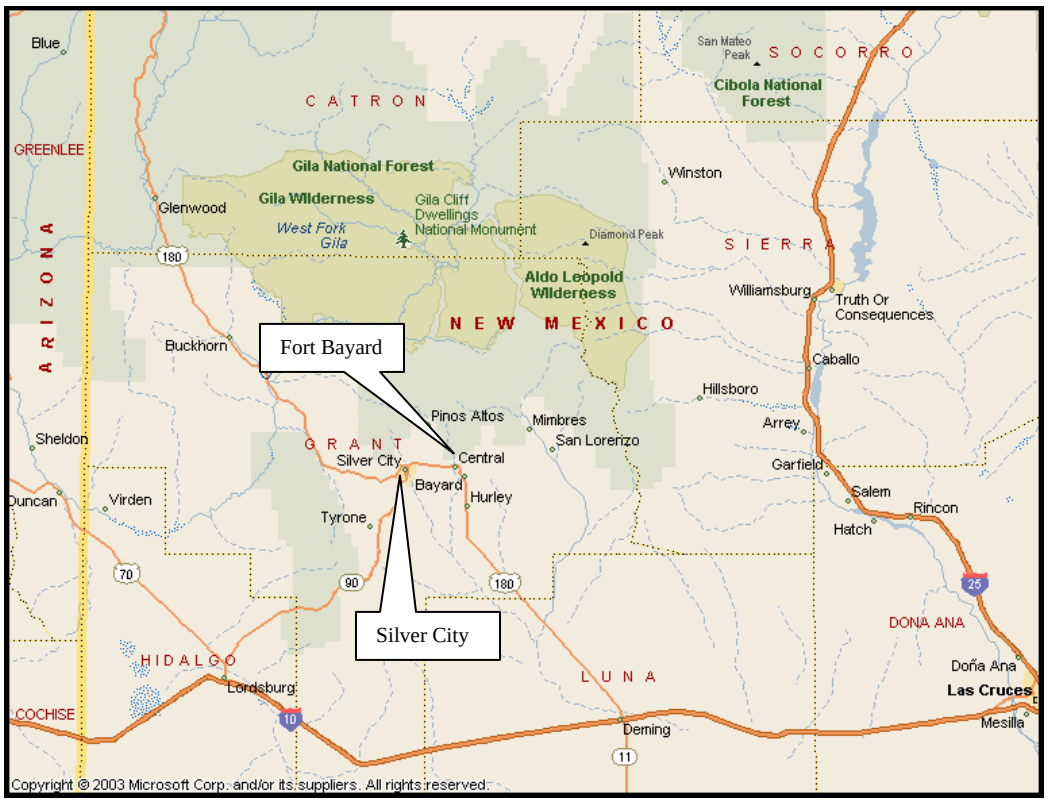



**Figure 1. Location of Fort Bayard plotted on a current map of New Mexico.**

Fort Bayard began in 1866 when a company of Union troops established a camp near the gold and silver mining communities of Pinos Altos and Silver City, New Mexico. This site was selected to allow Federal troops to monitor the Apache trails in western New Mexico. The new post was named in honor of General George D. Bayard who was killed during the Civil War. The early fort resembled a parallelogram oriented northeast to southwest with dimensions of approximately 400 feet (northwest to

southeast) by 650 feet (northeast to southwest). With time, additional buildings were added around the perimeter of the post.

During the 1870s and 1880s, Fort Bayard served as the hub of numerous campaigns against the Apaches, who were fighting the incursion of miners and pioneers into western New Mexico. Soldiers at the post were quartered in sod huts with dirt covered roofs, and slept on crude, wooden bunks. The soldiers grew much of their food in vegetable gardens and raised chickens, pigs, and cattle.

In 1875, the fort was expanded with new officers' quarters and four sets of barracks. The new buildings were built of adobe with shingled roofs.

With the surrender of Geronimo in 1886, the Indian conflict ended in western New Mexico. However, Fort Bayard continued to be an active Army post until 1899. Around 1900, talk increased to close the fort, but the facility instead was transferred to the Army Medical Department for the research and treatment of tuberculosis. On May 1, 1922, Fort Bayard came under the jurisdiction of the Veterans Administration and then in 1966, it was turned over to the State of New Mexico as a public nursing home.

Earliest weather observations at Fort Bayard were taken by U.S. Army surgeons beginning 1 March 1867. According to the National Climatic Data Center (NCDC) database, Army surgeons took observations until 28 February 1878, with an observation gap existing (according to the NCCDC database) from 1 March 1878 until1 January 1886. Fort Bayard surgeons continued to take weather observations through 31 December 1893.

The Signal Service began taking weather observations at Fort Bayard on 8 March 1877 and continued until observing responsibility was transferred to the Signal Service office at Silver City, NM (approximately 7 miles southwest of the Fort Bayard office) on 15 May 1878. After transferring weather observing responsibility to Silver City, the Fort Bayard office continued taking limited daily observations (extent of these limited observations could not be determined). The final Signal Service weather observation at Silver City was 31 March 1883.

**Goal of the Study**

The goal of this study was to document the location and exposure of weather instruments at Fort Bayard and Silver City, NM . The scope of this study primarily covered the 19$^{th}$ Century. Extrinsic observations related to the Army surgeons and Signal Service weather observing program also were considered.

## LOCATION OF OBSERVATIONS

### Weather Observations by Army Surgeons

No documentation could be found that specified exact location on the fort where Army surgeons took weather observations during the late 1860s to early 1890s. As was customary at other forts, the observations likely were taken at, or near the existing hospital. According to limited documentation, as many as three sites may have been utilized in taking weather observations at Fort Bayard – two permanent hospitals from 1869 through 1893 and one temporary location prior to 1869. The locations of the permanent hospitals are known (Figure 2), with the exact location of the temporary site unknown.

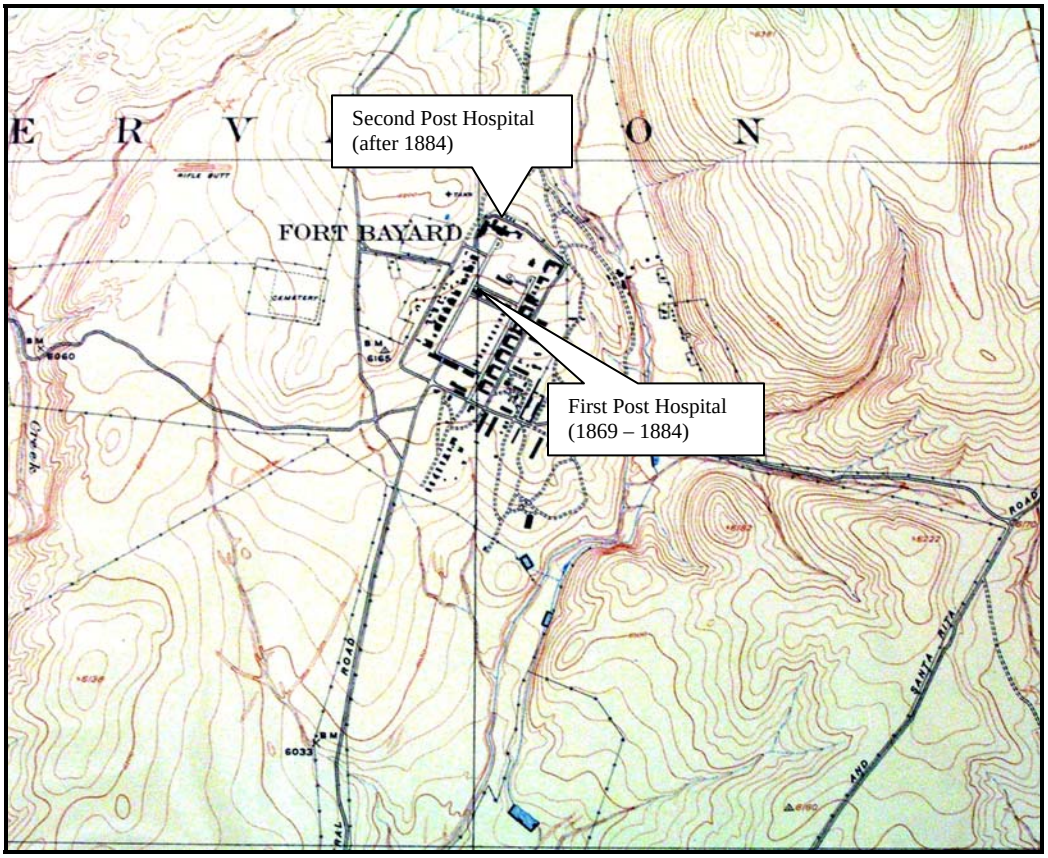



**Figure 2. Topographical map (in feet) of the Fort Bayard area (prepared by the USGS). North is at the top of the page. Distance across the map is approximately one and one-third miles.**

The terrain around the fort sloped up from the southwest to the northeast. The second hospital (after 1884) was 200 yards north of the first hospital and 37 feet higher in elevation based on GPS readings. Figure 3 is a schematic of Fort Bayard and the post hospitals in the late 1870s.

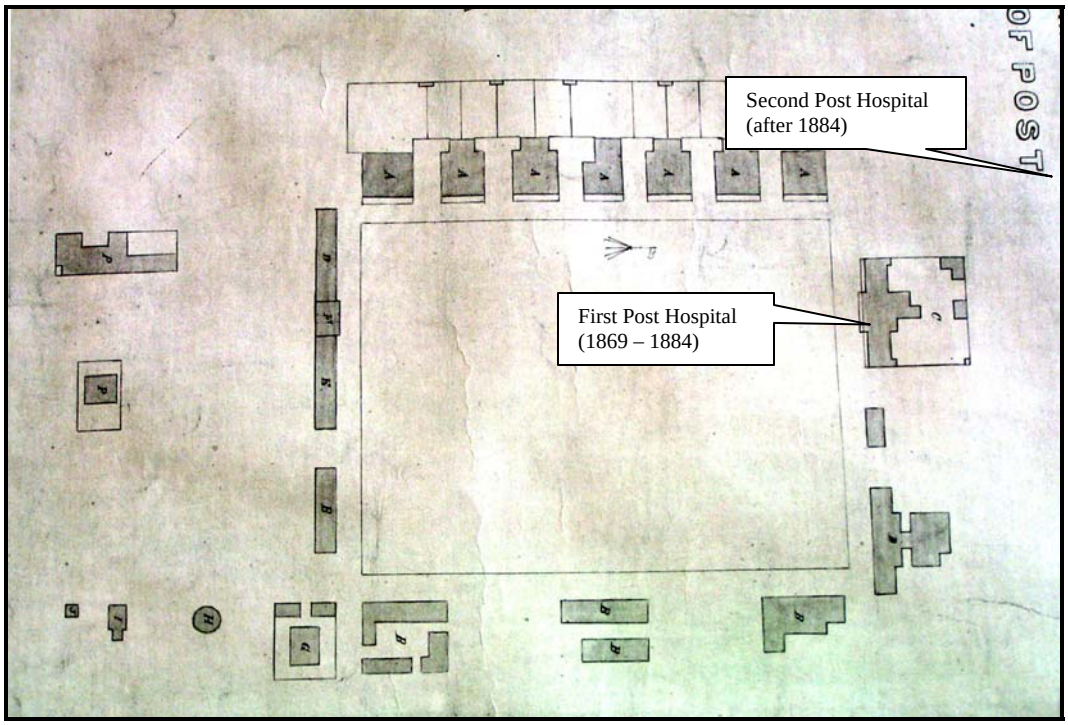



**Figure 3. Schematic of Fort Bayard and the post hospitals (circa for the map late 1870s). North is the upper right part of the figure. Distance across the page approximately 900 feet. From the Western New Mexico University Miller Library.**

Figure 4 is a photo of the post showing the two hospitals.

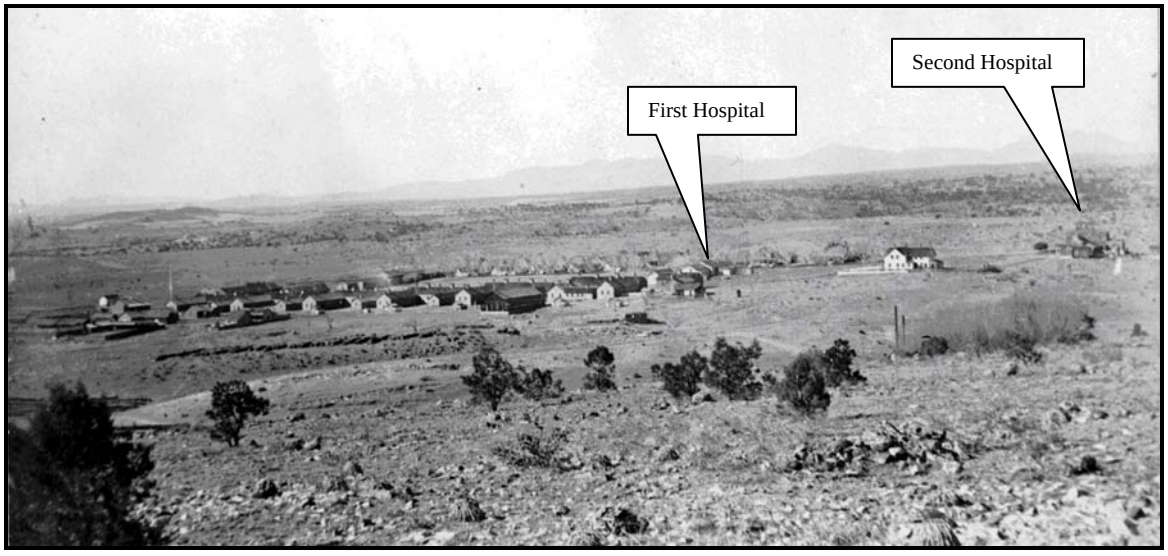



**Figure 4. View of Fort Bayard and the two hospitals, looking west southwest (circa late 1880s). Note the difference in elevation between the two hospitals. From the Silver City Museum.**

*Temporary Hospital*

Documentation is limited regarding the location of hospitals at Fort Bayard prior to 1869. Primary sources of information come from archived letters written to/from the post during the period.

First weather observations in the NCDC database by Army surgeons at Fort Bayard were taken in March 1867 and several letters (from the District Headquarters in Santa Fe, NM) and documents were found that clearly indicate the first permanent hospital at Fort Bayard was not constructed until 1869.

According to archived letters from/to the post, a hospital was in place at Fort Bayard prior to 1867. Exact location could not be determined, but evidence indicates this temporary hospital was located on the northeast part of the fort, i.e., relatively near the first permanent hospital constructed in 1869. This temporary hospital was built from logs, and the 1867 letters stress its poor condition. By 1868, the hospital had deteriorated to a point that patients were moved to a nearby tent.

*First Hospital*

The first permanent hospital at Fort Bayard was built in 1869 on the north corner of the post. Latitude and longitude for observations taken at this hospital were first logged in March 1867. At that time, the location of the observations was listed as 32°40'N, 108°25'W. The listed coordinates for the observations varied through 1889 (last observations to list latitude/longitude), primarily changes in latitude from as far south as 30°40'N, to as far north as 32°41'N. After July 1875, longitude was expressed ad degrees west of Washington D.C. GPS latitude/longitude for the first hospital is 32°47'53"N, 108°8'59"W.

Elevation for the first hospital was first listed as 4,450 feet and was changed to 6,000 feet in September 1873. Listed elevation remained at 6,000 feet when changed to 6,750 feet in November 1889. GPS elevation for this site is 6,144 feet.

Figures 5 through 7 depict the slope of the terrain in the vicinity of the first hospital.

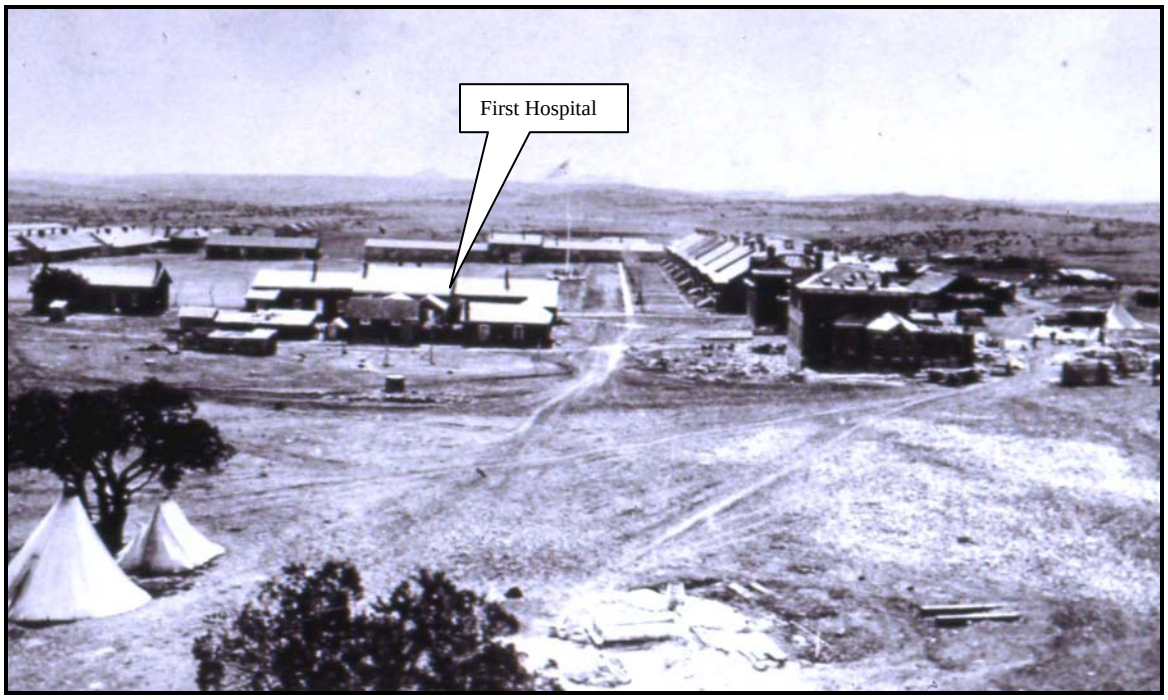



**Figure 5. Fort Bayard first hospital from second hospital, looking southwest (circa 1886). From the Silver City Museum.**

**Figure 6. Location of first hospital at Fort Bayard (view is north). Original hospital building no longer exists but was located on almost exact site as this building. Photograph by author (August 2005).**

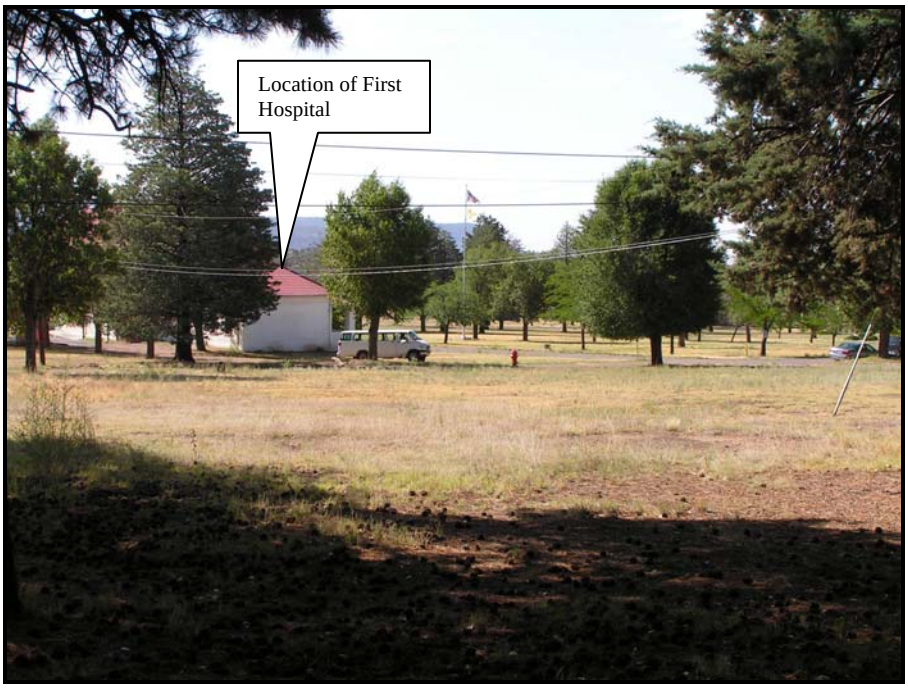



**Figure 7. Terrain surrounding first Fort Bayard hospital (view is south). Original hospital building no longer exists but was located on almost exact site as the building with the red rood. Photograph by author (August 2005).**

*Second Hospital*

The second post hospital was built in 1884 (Figure 8) and was located approximately 200 yards north of the first hospital. GPS latitude/longitude for this site is 32°47'59"N, 108°8'56"W. GPS elevation is 6,181 feet which is 37 feet higher than the first hospital. This hospital was located on top of a knoll (Figure 9) that extended northwest to southeast along the northern perimeter of the fort (see Figure 2). Figure 10 shows the slope of the terrain along the southern foundation of the second hospital.

**Figure 8. Second Fort Bayard hospital (circa late 1880s) looking northeast. From the Silver City Museum.**

**Figure 9. Front foundation of the second hospital at Fort Bayard (view is northeast). First hospital was located to the right and down the knoll. Photograph by author (August 2005).**

**Figure 10. Front foundation of the second Fort Bayard hospital (view is southeast). First hospital was located to the right and down the knoll. Photograph by author (August 2005).**

The coordinates for the second hospital were listed as, 32°40'N, 108°25'W, except longitude was expressed as degrees and minutes west of Washington DC beginning July 1885. The elevation of the station continued to be listed on the forms as 6,000 feet until changed to 6,040 feet in January 1886 and changed to 6,750 feet in November 1889 (the Army surgeons stopped including latitude, longitude, and elevation on the observation forms in January 1890). No information could be found as to any relevancy of the elevation changes.

**Signal Service Observations**

Weather observations by Signal Service observers were taken in the Fort Bayard/Silver City area from August 1877 through March 1883 (based on the NCDC database). The first Signal Service observation at Fort Bayard was taken 8 August 1877. On 21 May 1878, official weather observing responsibility was transferred from Fort Bayard to Silver City, with the last observation at Silver City recorded 31 March 1883.

In 1877, Signal Service offices were in operation at both Fort Bayard and Silver City, NM and both were telegraph repair offices classified as "Special River Stations." The Silver City office was approximately seven miles southwest of the Fort Bayard office. In addition, observations by Army surgeons overlapped Signal Service observations from August 1877 through February 1878 (based on the NCDC database).

*Fort Bayard Signal Service Office*

According to the Signal Service Annual Report, the Fort Bayard office was located in the headquarters building with listed coordinates 32°46'N, 108°10'W. No elevation was given for the Fort Bayard office. No firm information could be found as to the exact location of the mentioned headquarters building. However, sketchy documentation suggests the headquarters building was actually the Quartermaster (or Commanding Officer) Headquarters building located on the south side of the post complex and across the parade ground from the first hospital (see Figure 3). This location would have been approximately 400 feet south of the first hospital.

According to the Signal Service Annual Report, limited weather observations were started at Fort Bayard office on 12 June 1876, consisting of one daily observation of temperature, rainfall, wind, and weather. These observations were sent to Signal Service headquarters at the end of each month. On 8 August 1877, the Fort Bayard office started taking three observations daily which were transmitted in real time via telegraph. This continued until observing responsibility was transferred to Silver City. The Signal Service Annual Report mentioned the following with regard to the Fort Bayard office after Silver City assumed weather observing responsibility: "Observations of maximum and minimum temperatures and rainfall are made daily at the hour of sunset, which, with the direction of the wind and state of the weather during past twenty-four hours, are reported monthly by mail to this office (Signal Service headquarters). A daily journal is kept. The daily sunset observation is taken and forwarded by telegraph." The Fort Bayard office also continued as a telegraph repair office.

*Silver City Signal Service Office*

The Signal Service office in Silver City began taking weather observations on 15 May 1878 (partial observations were taken from 15 May 1878 until 21 May 1878 when full observations commenced). The Silver City office took weather observations until it was closed on 31 March 1883.

The Silver City Signal Service office was located on the southeast corner of Main and Yankie Streets (Figure 11). Main Street essentially extended north-south through the city and Yankie Street was east-west. Official listed address was 43 Yankie Street. Coordinates for the Silver City office were listed as 32°48'N, 108°15'W and elevation was listed as 6,896 feet. GPS coordinates for the site are 32°46'13"N, 108°16'32"W and elevation 5,889 feet.

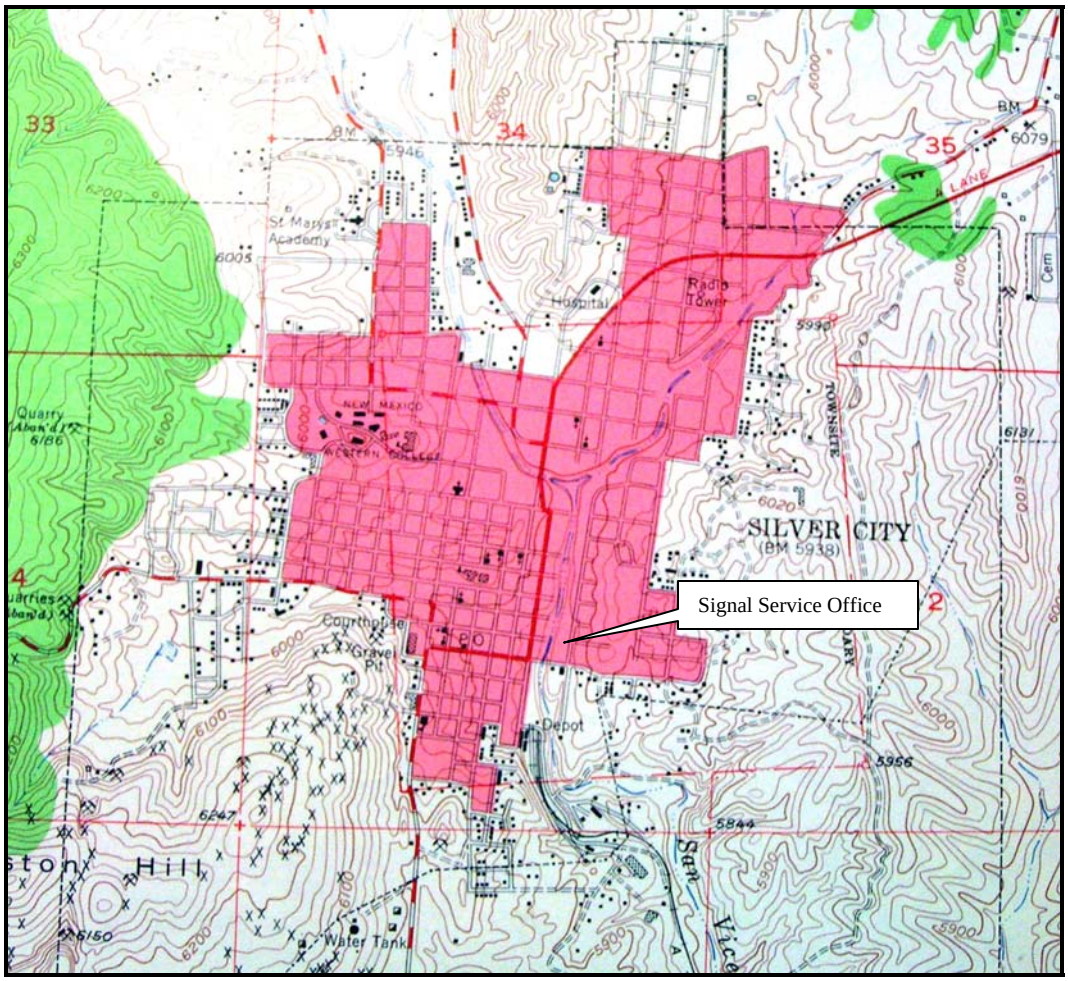


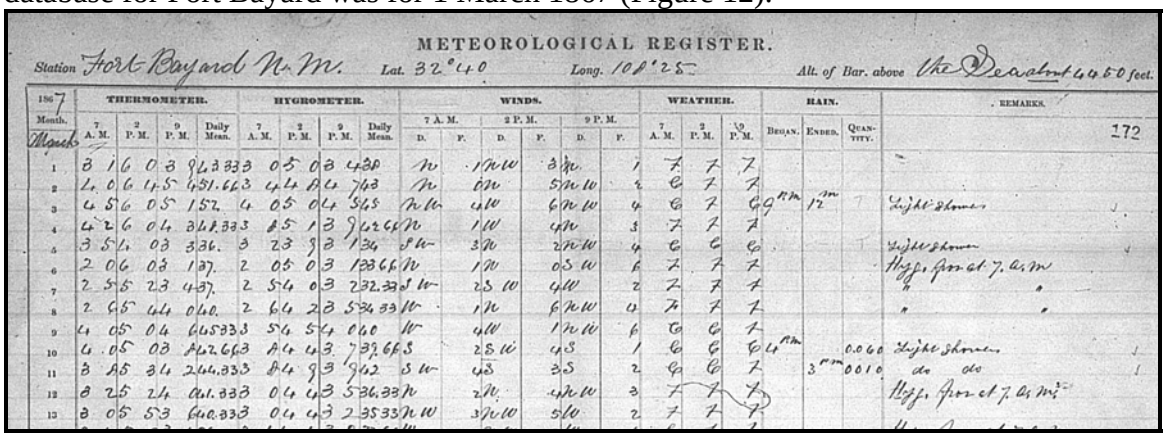

**Figure 11. Topographical map (USGS map) showing location of the Signal Service office (southeast corner of Main and Yankie Streets). North is at the top of the page. East-West distance across the map approximately eight miles.**

Following floods during the late 1800s and early 1900s, and especially after the devastating flood of 1902, Main Street was turned into a major gully (or arroyo) through the center of Silver City. Buildings in the immediate vicinity of old Main Street were destroyed, including the one that housed the Signal Service office. That arroyo remains today.

## INSTRUMENTATION

### Weather Observations by Army Surgeons

The first observation available in the National Climate Data Center (NCDC) database for Fort Bayard was for 1 March 1867 (Figure 12).



METEOROLOGICAL REGISTER.

Station Fort Bayard N. M. Lat. 32°40 Long. 108°25 Alt. of Bar. above the Dead about 4450 feet.

1867 Month. March

THERMOMETER. 7 A.M. | 2 P.M. | 9 P.M. | Daily Mean.

HYGROMETER. 7 A.M. | 2 P.M. | 9 P.M. | Daily Mean.

WINDS. 7 A.M. D. F. | 2 P.M. D. F. | 9 P.M. D. F.

WEATHER. 7 A.M. | 2 P.M. | 9 P.M.

RAIN. Began. | Ended. | Quantity.

REMARKS.

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| | 7 A.M. | 2 P.M. | 9 P.M. | Daily Mean. | 7 A.M. | 2 P.M. | 9 P.M. | Daily Mean. | 7 A.M. D. | 7 A.M. F. | 2 P.M. D. | 2 P.M. F. | 9 P.M. D. | 9 P.M. F. | 7 A.M. | 2 P.M. | 9 P.M. | Began. | Ended. | Quantity. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 38 | 60 | 38 | 45.333 | 05 | 08 | 08 | 4.33 | N | | NW | | W | | 1 | ☓ | ☓ | ☓ | | | |
| 2 | 40 | 64 | 45 | 49.666 | 04 | 06 | 07 | 5.66 | N | | W | | NW | | 2 | ☾ | ☓ | ☓ | | | |
| 3 | 45 | 60 | 50 | 51.666 | 04 | 05 | 04 | 4.33 | NW | | W | | NW | | 4 | ☾ | ☓ | ☓ | 4 PM | 12 PM | Light Shower |
| 4 | 42 | 60 | 44 | 48.666 | 05 | 13 | 09 | 9.66 | N | | W | | W | | 3 | ☓ | ☓ | ☓ | | | |
| 5 | 35 | 40 | 38 | 37.666 | 03 | 23 | 08 | 11.33 | NW | | W | | NW | | 4 | ☾ | ☾ | ☾ | | | Light Shower |
| 6 | 20 | 60 | 38 | 39.333 | 02 | 05 | 03 | 3.33 | N | | W | | W | | 6 | ☓ | ☓ | ☓ | | | Light Shower |
| 7 | 25 | 58 | 38 | 40.333 | 02 | 04 | 03 | 3.00 | NW | | W | | W | | 2 | ☓ | ☓ | ☓ | | | Light Shower |
| 8 | 20 | 65 | 44 | 43.000 | 02 | 04 | 03 | 3.00 | N | | W | | NW | | 0 | ☓ | ☓ | ☓ | | | |
| 9 | 40 | 50 | 44 | 44.666 | 04 | 05 | 04 | 4.33 | N | | W | | NW | | 6 | ☾ | ☾ | ☓ | | | |
| 10 | 40 | 50 | 38 | 42.666 | 04 | 03 | 03 | 3.33 | NW | | W | | W | | 1 | ☾ | ☾ | ☾ | 4 PM | | 0.060 Light Shower |
| 11 | 38 | 56 | 34 | 42.666 | 04 | 03 | 03 | 3.00 | SW | | W | | W | | 2 | ☾ | ☾ | ☓ | | 3 PM | 0.010 do do |
| 12 | 38 | 52 | 34 | 41.333 | 04 | 03 | 03 | 3.00 | N | | W | | NW | | 3 | ☓ | ☓ | ☓ | | | Light Snow |
| 13 | 38 | 05 | 53 | 46.666 | 04 | 03 | 02 | 3.00 | NW | | W | | SW | | 2 | ☓ | ☓ | ☓ | | | |

**Figure 12. Fort Bayard weather observing form for March 1867. Only the top part of the form is shown. From the official station history files at the National Climatic Data Center.**

Initial weather measurements/observations at Fort Union consisted of the following parameters:

1. Temperature (Fahrenheit) – Measured three times daily (7:00 a.m., 2:00 p.m., and 9:00 p.m.)
2. Hygrometer (wet bulb temperature) – Measured three times daily coincident with temperature readings
3. Wind direction and force – Three times daily coincident with temperature readings (direction expressed on an eight-point compass and wind force expressed on a scale from "0" for calm conditions, to "10" for a "violent hurricane"; e.g., SW4)
4. Weather (fair or cloudy) – Observed three times daily coincident with temperature readings
5. Daily rainfall – Beginning, ending, and daily amount
6. Significant weather in Remarks section

NOTE – Army surgeons took weather observations based on local times, as opposed to the U.S. Signal Service which took observations based on Washington DC times. Weather observing by the U.S. Signal Service and Army Medical Department overlapped by at least seven months at Fort Bayard, i.e., August 1877 through February 1878. Based on Meridian Time used by the Signal Service Office at Fort Bayard and Silver City, observations were taken 2 hours and 5 minutes earlier than listed on the forms, e.g., a 7:00 a.m. observation actually was taken at 4:55 a.m. local time. Recorded observations at 7:00 a.m. by Army surgeons were taken at 7:00 a.m. local time.

Based on available data, it appears Fort Bayard surgeons used the following weather instruments in 1867:

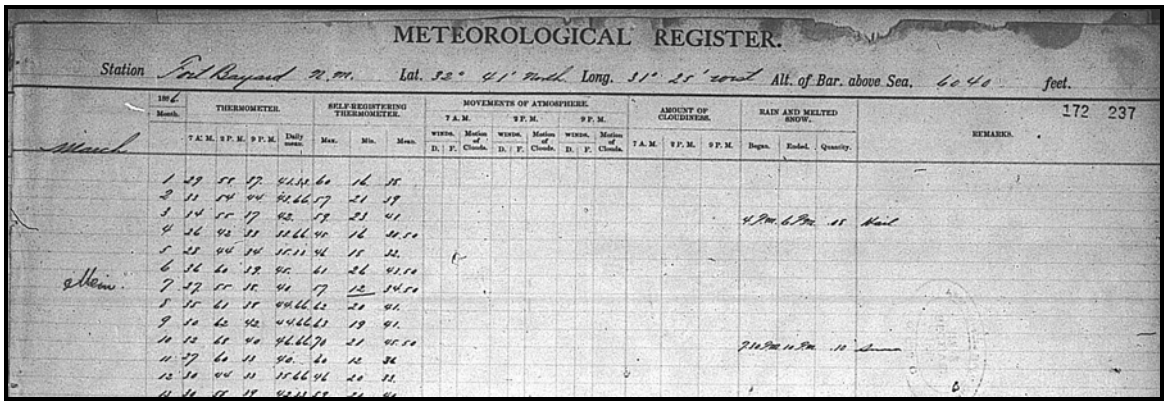
1. Thermometer
2. Hygrometer
3. Rain gage
4. Wind vane (wind force was estimated subjectively)

Although specific information was lacking regarding weather instruments used by Fort Bayard Army surgeons, the Army Surgeon General's Office issued descriptions and instructions to field surgeons in 1856 and 1868 regarding instrument exposure and how the observations were to be taken. Those instructions are contained in the Fort Union, NM report (under this general contract). The general instructions listed in the Fort Union report also applied to Fort Bayard.

In January 1870, Fort Bayard surgeons began using observation forms that contained columns for maximum/minimum temperatures and barometric readings. Both sets of columns were left blank, implying the station did not have maximum/minimum thermometers or a barometer. A note on the November 1870 form stated: "Have no self-registering thermometers. Not observed. Have the old-style register at this Post State." Maximum/minimum thermometers were received at the station and measurements began in February 1872. Descriptions of maximum/minimum thermometers furnished field surgeons and observation instructions are contained in the Fort Union, NM report.

On 1 September 1871, the wet bulb thermometer was broken and observations were not taken after that date. The wet bulb thermometer was replaced between July 1873 and November 1873 (exact date unknown due to lack of data in the NCDC database), and measurements resumed.

A gap exists in the NCDC database from March 1878 until January 1886 for weather observations at Fort Bayard by the Army surgeons. When observations resumed beginning January 1886, temperature (7:00 a.m., 2:00 p.m., and 9:00 p.m. local time), maximum temperature, minimum temperature, daily rainfall, and a few remarks were the only parameters recorded (Figure 13). The weather instruments likely were transferred to the second post hospital by 1886.



METEOROLOGICAL REGISTER.

Station Fort Bayard N.M. Lat. 32° 41' North. Long. 31° 25' west Alt. of Bar. above Sea. 6040 feet.

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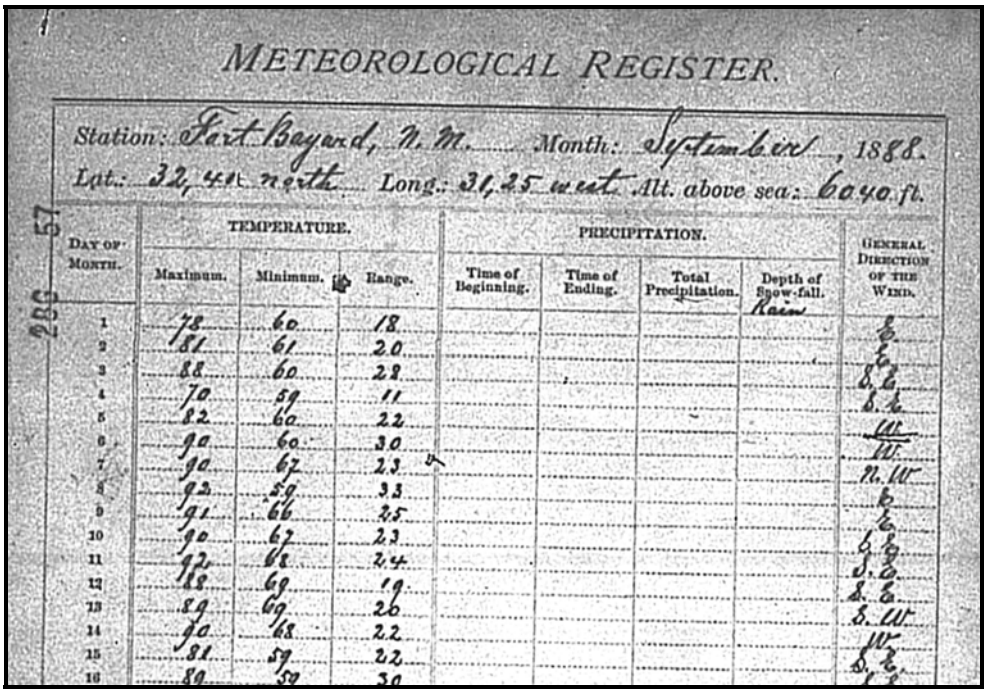
| 1886 Month. | THERMOMETER. 7 A. M. | 2 P. M. | 9 P. M. | Daily mean. | SELF-REGISTERING THERMOMETER. Max. | Min. | Mean. | MOVEMENTS OF ATMOSPHERE. 7 A. M. Winds. D. | F. | Motion of Clouds. | 2 P. M. Winds. D. | F. | Motion of Clouds. | 9 P. M. Winds. D. | F. | Motion of Clouds. | AMOUNT OF CLOUDINESS. 7 A. M. | 2 P. M. | 9 P. M. | RAIN AND MELTED SNOW. Began. | Ended. | Quantity. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| March | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 29 | 55 | 37 | 40.33 | 60 | 16 | 38 | | | | | | | | | | | | | | | | |
| 2 | 31 | 54 | 44 | 42.66 | 57 | 21 | 39 | | | | | | | | | | | | | | | | |
| 3 | 34 | 55 | 37 | 42 | 59 | 23 | 41 | | | | | | | | | | | | | 4 P.M. | 6 P.M. | .15 | Hail |
| 4 | 36 | 42 | 33 | 37.00 | 46 | 16 | 31.50 | | | | | | | | | | | | | | | | |
| 5 | 25 | 44 | 36 | 35.33 | 46 | 15 | 32. | | | | | | | | | | | | | | | | |
| 6 | 36 | 60 | 38 | 45. | 61 | 26 | 43.50 | | | | | | | | | | | | | | | | |
| Mem. 7 | 47 | 55 | 35 | 46 | 57 | 12 | 34.50 | | | | | | | | | | | | | | | | |
| 8 | 35 | 61 | 35 | 44.66 | 62 | 20 | 41. | | | | | | | | | | | | | | | | |
| 9 | 40 | 62 | 42 | 44.66 | 63 | 19 | 41. | | | | | | | | | | | | | | | | |
| 10 | 42 | 61 | 40 | 47.66 | 70 | 31 | 45.50 | | | | | | | | | | | | | 7 P.M. | 11 P.M. | .10 | Snow |
| 11 | 37 | 60 | 41 | 46. | 60 | 32 | 36 | | | | | | | | | | | | | | | | |
| 12 | 30 | 44 | 31 | 35.66 | 46 | 20 | 33. | | | | | | | | | | | | | | | | |
| 13 | 34 | 58 | 38 | 43.33 | 58 | 24 | 41 | | | | | | | | | | | | | | | | |

**Figure 13. Fort Bayard weather observing form for March 1886 (month of March shown because of improved readability of the document). Only the top part of the form is shown. From the official station history files at the National Climatic Data Center.**

The January 1886 observation form contained a note stating the office did not have a serviceable maximum thermometer. It stated a replacement from the Army Surgeon General's Office had arrived broken and that the office had requested a replacement, but it had not arrived. The note also stated the minimum thermometer was not in good working condition prior to 8 January 1886. However, minimum temperatures continued to be recorded. A replacement maximum thermometer was received and readings were commenced 19 February 1886.

Beginning January 1888 neither maximum nor minimum temperatures were recorded. A note on the January 1888 observation form stated, "The Maximum and Minimum thermometers are so unreliable from age and service that no observations with them have been made during the month."

Army Medical weather observation forms changed September 1888 requiring only maximum/minimum temperatures to be recorded, along with daily rainfall (beginning, end, and amount; see Figure 14). Fort Bayard surgeons began recording maximum/minimum temperatures 1 September 1888, and on the December 1888 form provided the following note: "In the absence of Maximum and Minimum thermometers, the coldest and warmest periods of the day were recorded by the ordinary thermometer." Maximum/minimum temperatures continued to be recorded through most of 1889 with no mention of receiving maximum/minimum thermometers. However, beginning 12 December 1889, maximum temperatures ceased to be recorded and the word "broken" was inserted in the column. Minimum temperatures continued to be recorded. Recorded maximum temperatures resumed 1 February 1890. Final observation by the Fort Bayard Army surgeons was taken 31 March 1893.



METEOROLOGICAL REGISTER.

Station: Fort Bayard, N. M. Month: September, 1888.

Lat.: 32, 41 north Long.: 31, 25 west Alt. above sea: 6040 ft.

| Day of Month. | Temperature. Maximum. | Minimum. | Range. | Precipitation. Time of Beginning. | Time of Ending. | Total Precipitation. | Depth of Snow-fall. Rain | General Direction of the Wind. |
|---|---|---|---|---|---|---|---|---|
| 1 | 78 | 60 | 18 | | | | | E. |
| 2 | 81 | 61 | 20 | | | | | E. |
| 3 | 88 | 60 | 28 | | | | | S. E. |
| 4 | 70 | 59 | 11 | | | | | S. E. |
| 5 | 82 | 60 | 22 | | | | | W. |
| 6 | 90 | 60 | 30 | | | | | W. |
| 7 | 90 | 67 | 23 | | | | | N. W. |
| 8 | 92 | 59 | 33 | | | | | E. |
| 9 | 91 | 66 | 25 | | | | | E. |
| 10 | 90 | 67 | 23 | | | | | S. E. |
| 11 | 92 | 68 | 24 | | | | | S. E. |
| 12 | 88 | 69 | 19 | | | | | S. E. |
| 13 | 89 | 69 | 26 | | | | | S. W. |
| 14 | 90 | 68 | 22 | | | | | W. |
| 15 | 81 | 59 | 22 | | | | | S. E. |
| 16 | 80 | 59 | 30 | | | | | |

**Figure 14. Fort Bayard weather observing form for September 1888. Only the top part of the form is shown. From the official station history files at the National Climatic Data Center.**

## Signal Service Observations

From 12 June 1876 to 8 August 1877, the Fort Bayard Signal Service office took once daily observations of temperature, rainfall, wind, and weather. These observations were sent to Signal Service Headquarters at the end of each month by mail and could not be found in the NCDC database. On 8 August 1877, Signal Service observers began taking observations three times daily and sending those observations via telegraph to Washington DC. The office had the following weather instruments for those observations:

1. Two barometers
2. Thermometer (exposed)
3. Maximum thermometer
4. Minimum thermometer
5. Rain gage
6. Psychrometer
7. Anemometer
8. Wind vane

No information could be found regarding the location or exposure of these instruments at the Fort Bayard Fort.

On 15 May 1878, responsibility for weather observing was transferred from Fort Bayard to Silver City. However, the Signal Service Annual Report stated that Fort Bayard continued to take daily observations at sunset of maximum/minimum temperature, rainfall, wind direction, and state of the weather. These sunset reports were sent to Signal Service Headquarters by mail and also telegraphed daily to Washington D.C. These observations are not available in the NCDC database. The annual report indicated the following instruments remained at the Fort Bayard office following the transfer of weather observing responsibility to Silver City: maximum thermometer, minimum thermometer, and rain gage.

Observations at Silver City were of the same atmospheric parameters and at the same time of the day as observed at Fort Bayard. The station also was furnished the same instruments as used at Fort Bayard.

Elevation of the barometer at Silver City was listed as 6,896 feet, but the GPS elevation for the site is 5,889 feet.

From 1 December 1878 through 31 May 1879, observations were missing for rainfall, wind speed, as well as average daily pressure, average daily temperature, and average daily humidity. A note was made on each of the forms stating, "No local observations were taken at this station." Observations on the remainder of the forms were recorded. No explanation was given regarding the meaning of the note or the missing observations. On 1 September 1879, the daily averages ceased being recorded and the note included, "No local observations taken at this station. On the September 1879 form, a note stated, "Local observations discontinued on station." Also no daily average humidity recordings were made on the September 1879 form or afterward. However, beginning December 1880, the observers began recording monthly humidity averages.

On 1 July 1881, the Silver City Signal Service observers began completing the entire observation form, including measurements of pressure, temperature, humidity, rainfall, and wind direction and speed. Beginning October 1881, instrument numbers were logged on the observation forms. Based on these instrument numbers, the same barometer, thermometer, wet bulb thermometer, maximum thermometer, minimum thermometer, and anemometer were used at the Silver City office from at least October 1881 until the office ceased taking weather observations 31 March 1883.

NOTE - From 1877 through 1881, the U.S. Signal Service conducted six inspections of its Silver City office. No inspection reports were found for the Fort Bayard Signal

Service office. The inspection reports for Silver City were conducted on the following dates:

30 August 1877
27-29 December 1878
27-30 April 1879
8-11 May 1880
19 December 1880
17-18 October 1881

The inspection reports, available at the National Archives and Records Administration (NARA), contained drawings and text regarding weather instrument placement and exposure. The quantity and quality of the reports varied, depending primarily on the inspector. However, these documents contained revealing information not available from other sources, especially with regard to instrument location and exposure. The following descriptions of instrument locations and exposures at the Silver City Signal Service office are from the inspection reports.

Figure 15 is a drawing from the 8-11 May 1880 inspection report that is representative of the Silver City office and instrument location/exposure.

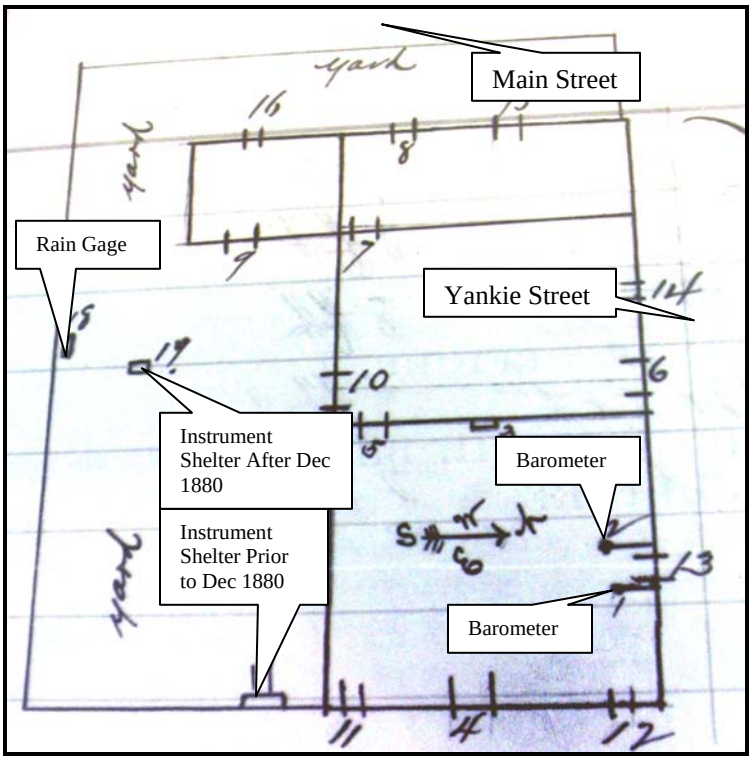



**Figure 15. Schematic of the Silver City Signal Service office (8-11 May 1880). North is to the right. From the National Archive and Records Administration.**

Weather instruments at Silver City 15 May 1878 – 31 March 1883

Barometer – The station had two mercurial barometers (one operational and the other extra) located at the north wall in the northeast part of the building. The barometers were three feet above ground. The May 1880 inspection report described in detail erroneous readings from the barometer due to air in the cylinder, for both the operational and extra instruments. The air was removed and the barometers correlated. The December 1880 inspection report stated that air continued in the barometer columns and that new barometers should be supplied to the office. No documentation was found regarding whether new instruments were shipped to the office.

Instrument Shelter – Initially, this site may have been lacking a suitable instrument shelter, or the existing shelter was not up to standards. A note on the December 1878 inspection report stated, "The shelter ordered for the station has not arrived and is at Mesilla awaiting transportation." The shelter had arrived by the April 1879 inspection and was installed in the yard immediately south of the office building and adjacent to the east wall of the yard. A note in the April 1879 inspection report stated, "As soon as practical, the shelter will be moved on the top of the office." According to subsequent reports, the shelter was moved to a new location in the yard but was never moved to the roof of the office. The shelter was described as a shelter with single lattice work. It was four feet high, three feet wide, and two feet deep.

The exposed thermometer, hygrometer, and maximum/minimum thermometers were five feet above ground. By April 1879, the number of exposed thermometers on station had increase to two (extra thermometer was added as backup) and by May 1880, an extra maximum thermometer and extra minimum thermometer were added to the station equipment list. An extra hygrometer was added by December 1880.

The following note was included in the inspection report in May 1880:

> "The instruments in the shelter do not have a desirable exposure. Shelter is in backyard surrounded by high walls and thereby obscured from free circulation of air. Have ordered it moved to center of the yard and away from the walls."

The instrument shelter was moved to near the center of the yard by the December 1880 inspection (see Figure 15).

Rain Gage – The rain gage was located along the southern wall of the yard and was three feet above ground. The May 1880 inspection report contained the following note with respect to the rain gage:

> "The rain gage could not have a worse exposure. On one side and one and one-half feet from it is a high wall. On the opposite side and eight feet distant is the house. The gage should be placed on top of the house."

In the December 1880 inspection report, the elevation of the rain gage changed to nine feet above ground, indicating the instrument likely was moved to the roof of the building. The rain gage also was listed as nine feet above ground in the October 1881 inspection report; however, no mention was made of the move or the exact location of the gage.

Wind Instruments – Exact location of the wind instruments was not stated in the inspection reports. The station had an anemometer, anemoscope, and large wind vane (12 foot with a small 3 foot vane added by December 1880). The wind instruments were listed in the inspection reports as 30 feet above ground in December 1878, 25 feet above ground in April 1879, 20 feet in May 1880, 20 feet in December 1880, and 23 feet in October 1881 (the last inspection).

## OTHER OBSERVATIONS

Around1890, the U.S. Signal Service listed an index of meteorological observations made in New Mexico prior to 1890. This index is contained in the NCDC database. This document indicates Army surgeons at Fort Webster, an older nearby post (approximately five miles east of Fort Bayard), took weather observations from February 1852 through November 1853. These data are in the NCDC database. The observations consisted of temperature, clearness of the sky, wind, clouds, rainfall, and observed weather (in the remarks section). See Figure 16 for approximate location of Fort Webster and other observing sites. Listed coordinates for Fort Webster in the Signal Service document were 32°46'N, 108°4'W. Elevation was listed as 6,350 feet. No coordinates or elevation were listed on the observation forms in the NCDC database.

No information could be found with regard to weather observing sites in the immediate Fort Bayard/Silver City area from 1893 until 1901. Weather Bureau Substation History documents indicate a cooperative site was established "near Silver City Post Office" on 1 April 1901 with the observer Mr. Charles H. Lyons. Mr. Lyons took observations until 31 March 1902, consisting of a standard rain gage and maximum/minimum thermometers in a cotton region shelter. Coordinates for the site were listed as 32°46'N, 108°17'W with an elevation of 5,937 feet above sea level.

The 1956 Weather Bureau document, *Substation History*, stated that employees at the Fort Bayard Post and Hospital took weather observations well into the 20th Century, beginning 1 January 1897. The document stated that several minor moves around the grounds occurred during the observing period. The document also stated that in 1920, the observations were taken by the Public Health Service and in January 1923, the observations were taken by employees of the Veterans Administration. Listed coordinates were 32°48'N, 108°9'W with the elevation 6,152 feet. The station contained a standard rain gage and maximum/minimum thermometers in a cotton region instrument shelter. However, monthly bulletins published in the mid 1890s by the Territorial Weather Service of New Mexico show weather observations by Post Surgeons at Fort Bayard during that period (see the reference or the Albuquerque report for an explanation of the publications). Cooperative observations are taken at Fort Bayard at the date of this report (September 2005).

On 1 January 1911, a cooperative station was established four blocks east northeast of the Silver City Post Office. The observer was Mr. E. M. Brumback. Mr. Brumback took weather observations until 31 December 1922, consisting of a standard rain gage and maximum/minimum thermometers in a cotton region shelter. Coordinates for the site were listed as 32°46'N, 108°17'W with an elevation of 5,937 feet above sea level. Mr. Brumback's observations began a path of almost continuous weather observing in the Silver City area through 1950. Information on weather observations by Mr. Lyons, Mr. Brumback, as well as by subsequent cooperative observers is contained in Weather Bureau/National Weather Service Substation History publications and also in the Local Climatological Data.

A cooperative observing site was established near Cliff, NM on 1 November 1894. The site was located approximately 22 miles northwest of Silver City and 30 miles northwest of Fort Bayard. The observing site moved around Cliff over the years, with the listed coordinates for the site (when at the Post Office) as 32°57'N, 108°37'W. Elevation was listed as around 4,500 feet above sea level. This station predominantly had a cotton region shelter with maximum/minimum thermometers and a standard rain gage. The observers also took river readings beginning in 1942.

Weather observations were taken near Mimbres, NM (approximately 11 miles northeast of Fort Bayard) beginning 1 May 1905 and continuing through the first half of the 20th Century. Observations were taken near the Mimbre Post Office from 1 May 1905 until 30 November 1919 (32°51'N, 107°59'W, elevation 5,900 feet) by W.F. Moore (May 1905 – February 1906), Charles Dennis (July 1906 – September 1916), Walter Moore (November 1916 – March 1917), J.H. Harris (April 1917 – April 1919), and W.H. Acklin (May 1919 – November 1919). This site had a standard rain gage.

On 22 September 1910, a cooperative ctation was established at the Gila Planting Station (32°50'N, 108°8'W; elevation 6,470 feet), approximately three and one-half miles northeast of the Fort Bayard Post Office. Observations were taken by the U.S. Forest Service using a standard rain gage and maximum/minimum thermometers in a cotton region shelter. The observing site was near the headquarters building. Observations stopped 31 May 1919.

The Kennecott Cooper Corporation took weather observations near the Santa Rita, NM Post Office (500 feet northeast of the Post Office and approximately 5 miles east of Fort Bayard) from 1 January 1911 through 31 December 1952. Listed coordinates were 32°48'N, 108°4'W with an elevation of 6,312 feet. Observers used equipment purchased by the Kennecott Corporation, consisting of a standard rain gage and maximum/minimum thermometers in a cotton region shelter, and an evaporation station on a 10 foot tower.

On 1 July 1911, a cooperative station was established six and one-half miles northeast of Pinos Altos, NM (32°56'N, 108°8'W, elevation 7,253 feet) and approximately 13 miles north of Fort Bayard. O.L. Scott took observations with a standard rain gage until 30 November 1928, with the U.S. Forest Service assuming observing responsibility 1 August 1929 (located one-half mile southeast of Pinos Altos; 32°52'N, 108°14'W; elevation 7,040 feet). The Forest Service continued to take weather observations into 1943 with subsequent observers continuing after that time. Additional information is contained in the Weather Bureau document entitled *Substation History* (see reference list).

A cooperative station was established near Tyrone, NM (approximately 15 miles southwest of Fort Bayard) on 1 September 1914. The Phelpa-Dodge Corporation took observations until 31 July 1925 and again from 1 June 1926 until 31 May 1930. Listed coordinates were 32°40'N, 108°22'W (elevation 5,923 feet) for the period 1914 – 1925 and 32°38'N, 108°20'W (elevation 6,065 feet) for the period 1926 – 1930.

On 19 November 1929, the U.S. Forest Service began taking observations six miles northwest of the Mimbres Post Office (32°56'N, 108°1'W, elevation 6,247 feet). This site had a standard and recording rain gage. Observations continued through the first half of the 20th Century.

Weather observations were taken near Fierro, NM (33°00'N, 108°5'W, elevation 6,350 feet) from 1912 to 1918, and also in 1939 and 1940. The observation site was located approximately 16 miles northeast of Fort Bayard. Observations began 15 May 1912 by Mr. Victor Culberson and continued until 30 June 1918. Mr. Culberson used a standard rain gage and maximum/minimum thermometers in a cotton region shelter. Observations from 1 July 1939 until 31 December 1940 were taken by H.H. Estes (same coordinates and elevation) using a standard rain gage.

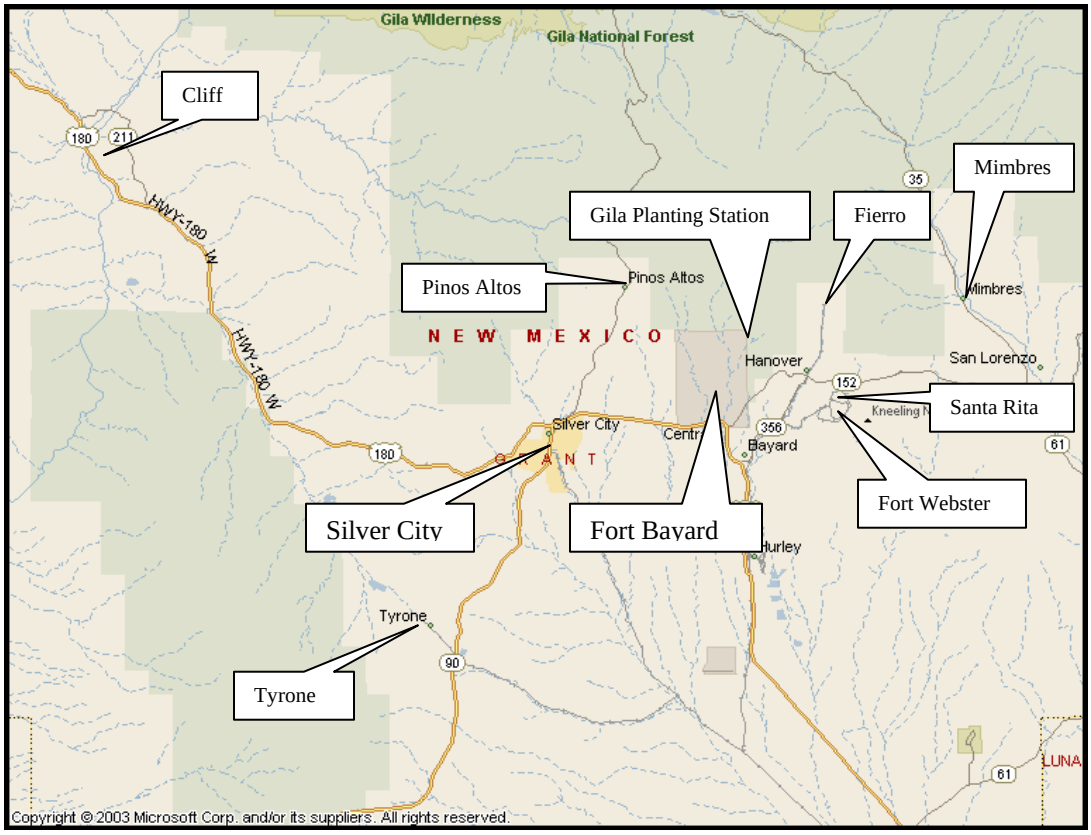



**Figure 16. Localities near Fort Bayard/Silver City with weather observing stations. North is at the top of the page. Distance across the figure (horizontal) is approximately 43 miles. Information is plotted on a current map of New Mexico.**

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# Appendix

## Appendix 1
## Methodology

Specific information regarding weather instrument location and exposure at Fort Bayard during observations by Army surgeons was almost non-existent. The NCDC database was the primary source of weather observations for this report.

General information regarding weather instruments used by the Army surgeons and procedures used in taking the observations came from publications by the Army Surgeon General's Office (1856, and 1868). This general information was included with the assumption that the military surgeons followed those instructions closely.

Annual reports by the U.S. Army Surgeon General were reviewed for the years 1860 through 1875 with only bits and pieces of revealed information. Several publications by the Army Surgeon General were obtained from the extensive government library microfiche collection at Oklahoma State University and from the National Library of Medicine in Bethesda, MD.

Photographic archives at the Silver City Museum contained a number of photographs of Fort Bayard and the hospitals.

The Miller Library at Western New Mexico University contains numerous maps and diagrams of Fort Bayard. These documents were critical for background information and to answer specific questions regarding the two hospitals. The library also possessed USGS topographical maps for the area that were very helpful. In addition, the James W. Arrott collection at the New Mexico Highlands University Library (Donnelly Library) contains various documents and maps on Fort Bayard. These documents also helped answer specific questions.

Other information and data sources checked (by person, telephone, or through the Internet) during this study were the NOAA Library, University of New Mexico Zimmerman Library, the Albuquerque Public Library, New Mexico State University Library, Chavez History Library, State of New Mexico Library, and State of New Mexico Archives. Also, relevant information regarding the Army Medical Department was obtained from the Dallas, TX Public Library, Oklahoma State University Library, and the National Library of Medicine at Bethesda, MD.