

**ARCHAEOLOGICAL INVESTIGATION AND RECORDING OF THE
HISTORIC GLEN CREEK TO MAMMOTH WATER SUPPLY SYSTEM
(48YE754), YELLOWSTONE NATIONAL PARK, WYOMING**

By

Paul H. Sanders

Prepared for

National Park Service
Intermountain Region
Denver, Colorado

Submitted by

Office of the Wyoming State Archaeologist
Wyoming Department of State Parks and Cultural Resources
P.O. Box 3431, University Station
Laramie, Wyoming 82071

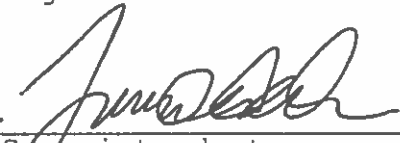
OWSA Project Number WY-1-2002
National Park Service Cooperative Agreement Number CA 1248-00-005
University of Wyoming Task Agreement Number UWY-11

March 2003


REPORT CERTIFICATION

I certify that *Archaeological Investigation and Recording of the Historic Glen Creek to Mammoth Water Supply System (48YE754), Yellowstone National Park, Wyoming*. By Paul H. Sanders 2003 has been reviewed against the criteria contained in 43 CFR Part 7(a)(1) and upon recommendation of the Park Archeologist has been classified as AVAILABLE (DELETIONS).

Figure 1



Superintendent
Yellowstone National Park



Date

Classification Key Words:

"Available"--making the report available to the public meets the criteria of 43 CFR 7.18(a)(1).

"Available (deletions)"--Making the report available with selected information on site locations and/or site characteristics deleted meets the criteria of 43 CFR 7.18(a)(1). A list of pages, maps, paragraphs, etc, that must be deleted for each report in this category is attached.

"Not Available"--Making the report available does not meet the criteria of 43 CFR (a)(1).

ABSTRACT

This report documents the recording of the historic Glen Creek to Mammoth Water Supply System (48YE754) in the northern edge of Yellowstone National Park. The investigation involved walking the entire length of the ditch that connects the Glen Creek head gate to a water storage reservoir, just above Mammoth. The water system was initially built in 1901 with subsequent modifications in 1911 and the 1930s. The head gate has been previously recorded as 48YE218 and storage reservoir as 48YE754. The head gate has been determined not eligible for nomination to the National Register of Historic Places by the Wyoming State Historic Preservation Office, while the ditch and reservoir are also recommended as not eligible. The ditch also passes through sites 48YE147, 48YE204, 48YE486, and 48YE520.

ACKNOWLEDGMENTS

The completion of this investigation was aided by a number of individuals. National Park Service, Branch of Cultural Resources personnel: Ann Johnson and Elaine Hale were very helpful. Lee Whittlesey and personnel in the Archives at Mammoth provided valuable assistance in locating historic documents and maps. NPS staff at the Maintenance Division at Mammoth also graciously provided access to microfiche copies of early engineering plans. OWSA staff contributions included Carmen Clayton who drafted the maps and Martha Rogers who provided editorial assistance. Finally, Lavonne Haskins collated and paginated the final report.

SURVEY REPORT COVER PAGE

| | |
|---|--|
| Consultant Project No: WY-1-2002 | Agency No: |
| Review and Compliance No: | Cultural Records Office No: 42470 |

AUTHOR(S): Paul H. Sanders

REPORT TITLE (include client name, undertaking name, survey project type, and report number): Archaeological Investigation and Recording of the Historic Glen Creek to Mammoth Water Supply System (48YE754), Yellowstone National Park, Wyoming

DATE OF REPORT (MO/DY/YR): March 21, 2003

LEAD AGENCY (e.g., BLM ADMINISTRATIVE UNIT): National Park Service, Yellowstone National Park

SURVEY ORGANIZATION/NAME: Office of the Wyoming State Archaeologist

FEDERAL PERMIT NO. (e.g., BLM CULTURAL RESOURCE USE PERMIT):

DESCRIPTION OF UNDERTAKING: Proposed rehabilitation

SURVEY METHODS:

____ Standard 30 Meter Transects **X** Non-Standard (Describe in body of report)

Survey Width (Linear Projects Only): ____ feet

COUNTY(IES): Park

USGS QUAD MAPS (NAME, DATE):* Mammoth (1986)

LAND OWNER:

* ____ BLM ____ BuREC ____ FS **XX** NPS ____ PRIVATE ____ STATE ____ USFWS ____ OTHER
(Specify):

LEGAL DESCRIPTION (T/R/Sec):*

UTM Zone 12, 523060 mE, 4976415 mN (south end) to 523450 mE, 4979120 mN (north end)

ACREAGE:

| | | |
|---------------------|----------------|--------------------|
| FEDERAL: | BLOCK: | |
| NON-FEDERAL: | LINEAR: | TOTAL: N.A. |

FILE SEARCH DATE(S): NA

FIELD WORK DATE(S) (MO/DY/YR): July 26 and August 13, 2002

FIELD PERSONNEL:* Paul H. Sanders and Carmen Clayton

SITE SUMMARY TABLE

| Smithsonian/ Isolated Find # | Field Number | Previously recorded? (Y/N?) | Previous Eligibility Determination | Site/isolate type | Land owner | UTM (All Zone 12) | Collection |
|---------------------------------|-----------------|-----------------------------------|--|--|---------------|--|------------|
| 48YE754 | NA | Y | E? | Historic Glen Creek to Mammoth water supply ditch, head gate and reservoir | NPS | 523450 mE, 4979100 mN to 523060 mE, 4976400 mN | No |
| 48YE147 | | Y | E | Prehistoric lithic scatter and a portion of the Glen Creek to Mammoth water supply ditch | NPS | 523380 mE, 4978420 mN | No |
| 48YE204 | | Y | U | Historic trash and a portion of the Glen Creek to Mammoth water supply ditch | NPS | 523560 mE, 4978740 mN | No |
| 48YE218 | | Y | NE | Glen Creek Water Intake | NPS | 523060 mE, 4976415 mN | No |
| 48YE486 | | Y | E | Fort Yellowstone - Mammoth Hot Springs Historic District | NPS | multiple | No |
| 48YE520 | | Y | E | Grand Loop Road Historic District | NPS | multiple | No |

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| 48YE218 | | Y | NE | Glen Creek Water Intake | NPS | 523060 mE, 4976415 mN | No |
| 48YE486 | | Y | E | Fort Yellowstone - Mammoth Hot Springs Historic District | NPS | multiple | No |
| 48YE520 | | Y | E | Grand Loop Road Historic District | NPS | multiple | No |

INTRODUCTION

This project involves the recording of the historic Glen Creek to Mammoth water supply system which extends from an intake on Glen Creek (48YE218) to a storage reservoir (48YE754) (Figure 1). The project was conducted to document the route of the ditch and evaluate its eligibility for nomination to the National Register of Historic Places. There are also some plans to revegetate and rehabilitate this former water supply system. This project is an additional task order (No. UWY-11) to cooperative agreement (No. CA-1248-00-005) between the National Park Service-Intermountain Region (NPS) and the University of Wyoming. Involvement of the Office of the Wyoming State Archaeologist (OWSA) is through a Memorandum of Understanding with the University of Wyoming, Department of Anthropology.

Archaeological project personnel included David G. Eckles (principal investigator), Paul H. Sanders (field and project director), and crew member, Carmen Clayton. Fieldwork was conducted on July 26 and August 13, 2002. Weather conditions were warm and dry.

ENVIRONMENTAL AND CULTURAL SETTING

The site area consists of moderate to steep hill slopes to the southwest of Mammoth and originates on Glen Creek in a narrow V-shaped portion of the drainage valley (Figure 1). The ditch extends north toward Mammoth, snaking along the east-facing hill slopes. Vegetation is primarily conifer forests with some open grasslands/meadows and scattered sagebrush. Surface visibility was estimated at 5-25 percent, with higher 25-100 percent visibility within the historic ditch itself. Geologically, much of the area is comprised of travertine, deposited by the thermal vents at Mammoth Hot Springs. Late Pleistocene, Pinedale age, glacial till and landslide deposits are also present (Pierce 1973). The project area is presently home to a variety of animals, most notably elk and deer with occasional sightings of bison and bears. The Mammoth area is a part of Yellowstone's Northern Winter Range (NPS 1997), critical habitat for many of the large mammals inhabiting the Park.

Past and present developments at Mammoth have impacted the area to varying degrees. Within the vicinity of the present project area, road building, and construction of the YCC housing area and adjacent NPS maintenance center are the most prevalent modern disturbances.

The file search of the NPS, Branch of Cultural Resources records found that a number of previous cultural resource inventories and previously recorded sites occur within the vicinity of the present project area (Figure 1). Six previous inventories have been conducted in the vicinity of the present project area.

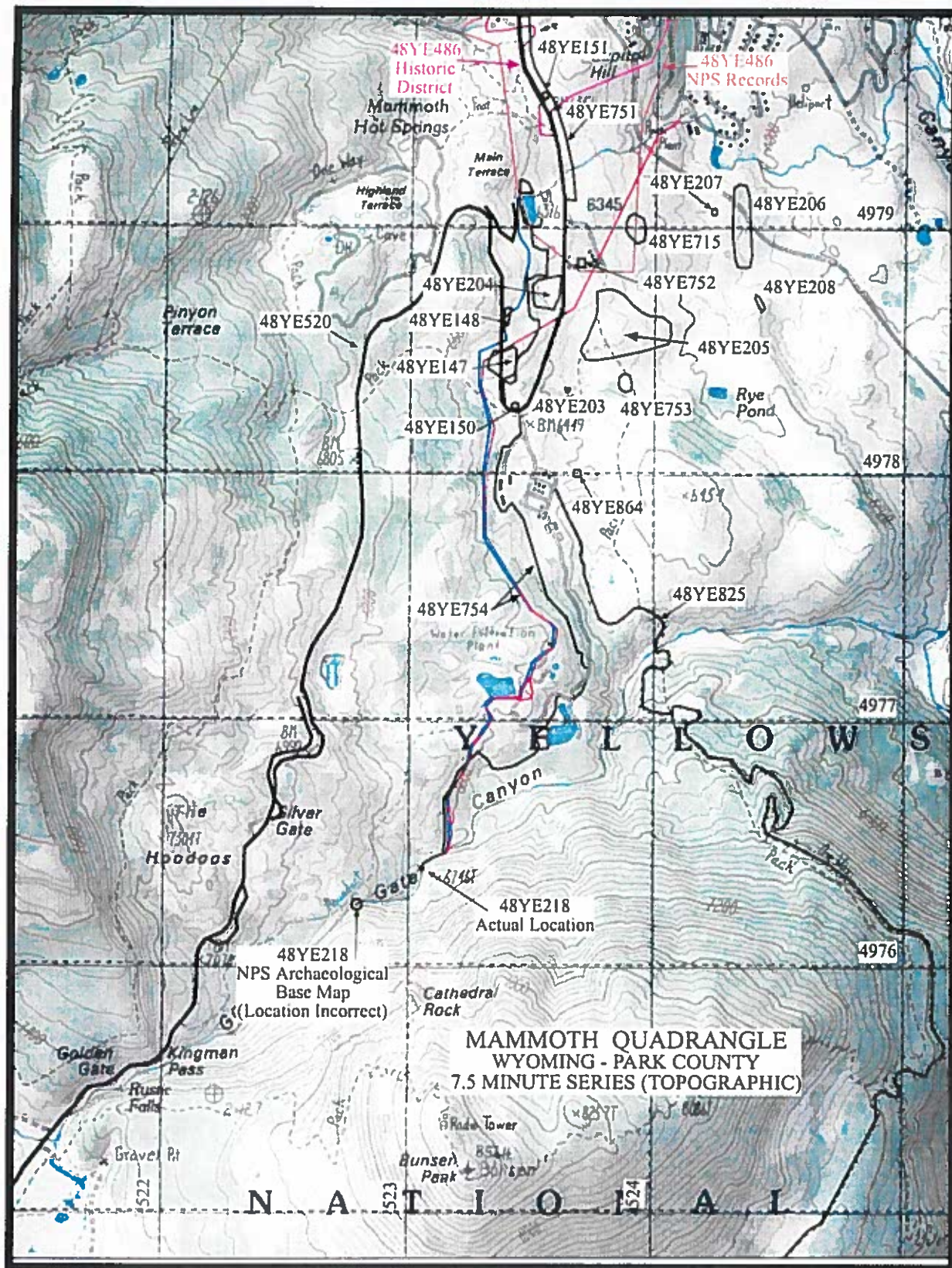


Figure 1. Location of the project area and recorded sites. Map adapted from USGS Mammoth quadrangle, 7.5' topographic series.

Ann Johnson (NPS) conducted a block inventory of the YCC camp (Johnson 1987) with no sites recorded. The 48YE754 ditch skirts along the western edge of the YCC camp.

The NPS, Midwest Archeological Center (MWAC) conducted a block inventory to the east of the YCC camp (Cannon and Phillips 1993). A prehistoric lithic scatter (48YE715) and three isolated finds were identified. Site 48YE715 is considered unevaluated by the Wyoming State Historic Preservation Office (SHPO).

MWAC also conducted a block inventory and a proposed cable route south of Mammoth for a US West Parkwide Telephone Modernization Project (Daron 1995a). Four new sites (48YE751-754) were recorded with additional investigations conducted at 48YE486 (Fort Yellowstone-Mammoth Hot Springs Historic District). Site 48YE751 is a historic trail, 48YE752 is a military cemetery, 48YE753 is a prehistoric lithic scatter, and 48YE754 is the water storage reservoir. The 48YE751 trail is curbed with cut sandstone blocks and runs along the east side of the present Mammoth to Norris Road (48YE520). Sites 48YE752 and 48YE753 are also located to the east of the Mammoth to Norris Road and outside of the present project area. The water storage reservoir (48YE754) is a part of the present site investigation and is discussed in detail later in this report.

Daron's report of this investigation is confusing, because the only place that sites 48YE751, 48YE752 and 48YE754 are clearly delineated is on his project area map (1995a:Figure 3). Within the body of the report, the trail (48YE751) is described as feature 33, the cemetery (48YE752) as feature 34, and the reservoir (48YE754) assigned as feature 32 with all three discussed under site 48YE486 (Fort Yellowstone-Mammoth Hot Springs Historic District) (Daron 1995a:15-17). Daron (1995a:28) recommends that the boundaries of the Fort Yellowstone-Mammoth Hot Springs Historic District (48YE486) be expanded to include features 32-34, as well as the other 31 features he investigated to the south of Capitol Hill. The cemetery (48YE752) has been incorporated into the Fort Yellowstone National Historic Landmark, while sites 48YE751, 48YE753, and 48YE754 are unevaluated (Ann Johnson, personal communication 2003), but still recognized as separate sites within the Wyoming Cultural Records Office database.

Daron (1995b) also conducted an inventory near the YCC camp and recorded a prehistoric lithic scatter (48YE864) that he recommended as not eligible. The inventory area and site are outside of the present project area.

OWSA conducted a linear inventory along the Mammoth to Norris Road (Sanders et al. 1996a), which crosses the present project area. Four sites were recorded in the vicinity of the project area: 48YE147, 48YE148, 48YE150, and 48YE204. Site 48YE147 consists of a prehistoric lithic scatter, a 1890-1905 historic trash scatter, and a ditch segment of 48YE754. Sanders et al. (1996a:187) recommends the

historic trash scatter as not eligible, and the prehistoric component and historic ditch as unevaluated. The prehistoric component was tested by archaeologists with the Museum of the Rockies (MOR) in 1996 who recommend the prehistoric component as eligible (Shortt 1997:58), which has received SHPO concurrence. Site 48YE148 is a historic depression and 48YE150 is a historic gravel pit and prehistoric lithic scatter, both determined by SHPO as not eligible. Site 48YE204 consists of an 1870-1920 historic trash scatter, a spring box, and a ditch segment of 48YE754. It is unevaluated pending historical research (Ann Johnson, personal communication 2003).

OWSA also conducted a large block inventory to the south of Mammoth, recording seven new sites (48YE151, 48YE203, and 48YE205-209) (Sanders et al. 1996b). The sites include prehistoric lithic scatters (48YE151 and 48YE209), a historic/recent log structure (48YE203), a historic trash scatter (48YE205), a prehistoric rock alignment (48YE208), and two sites with both historic and prehistoric artifacts (48YE206 and 48YE207). Determinations of eligibility by SHPO are as follows: 48YE205 and 48YE208 are eligible, 48YE206 is unevaluated, the historic component of 48YE205 is eligible (the prehistoric component is not eligible), while 48YE151, 48YE207 and 48YE209 are not eligible. The block inventory is to the east of the Mammoth to Norris Road and outside of the present project area.

Also of interest are sites 48YE520 (Grand Loop Road Historic District) and 48YE825 (Bunsen Peak Road Historic District) that were recorded by Mary Culpin (1994) and are recommended as eligible. The Mammoth to Norris section of the Grand Loop Road passes through the present project area, the Bunsen Peak Road is to the east of the project area.

Site 48YE486 (Fort Yellowstone-Mammoth Hot Springs Historic District) occurs in the site vicinity and has been recommended as eligible for nomination to the National Register. WYCRO records depict the district boundaries as outside the present project area, although the NPS, Archeological Base Maps show a much larger boundary (Figure 1). The latter appears to represent the expanded boundaries recommended by and based on Daron's (1995a) investigation; a report that was apparently never sent to WYCRO. Using Daron's boundaries, the water storage reservoir (48YE754) would fall within the district boundaries. Even with the expanded boundaries, the vast majority of the historic district is outside of the present project area.

Finally, Tom Olliff (1996) with the NPS recorded the Glen Creek Intake (48YE218), which is the head gate for the Mammoth water supply system investigated by the present project. He recommended the intake as not eligible, which has received SHPO concurrence. As depicted in Figure 1, the location of the site shown on Olliff's (1996) map and the NPS Archeological Base Maps is incorrect and should be plotted approximately 300 m downstream.

The high site density in this area is primarily related to the historic developments of Fort

Yellowstone and later Mammoth Hot Springs, although a few prehistoric lithic scatters also have been recorded. Most relevant to the present project is that site 48YE754 passes through three previously recorded sites: 48YE147, 48YE204, and 48YE486, while the Grand Loop Road (48YE520) has obliterated a portion of the 48YE754 ditch.

FIELD METHODS

Site 48YE754 was investigated by OWSA personnel walking the entire length of the ditch from the Glen Creek head gate (48YE218) at the south end to the water storage reservoir at the north end. In places the ditch was obliterated by roads or was filled in with colluvium from the hill slopes. The entire length was mapped in using a handheld Garmin 12XL GPS unit (using the 1927 North American Datum) with UTM coordinates recorded at varying intervals. These coordinates were transferred onto the USGS Mammoth topographic quadrangle which serves as a site map. No datum was established, as the physical location of the site is obvious. Photographs were taken at varying intervals along the expanse of the site as well as both ends. In addition to the field methods, historic document searches were conducted at the Branch of Cultural Resources, Archives with the aid of Lee Whittlesey and his staff, and within the engineering records held at the NPS, Maintenance Department. From these documents, it is evident that the 2002 inventory followed the original 1901 ditch, but that it ended at a head gate that was constructed in the 1930s. Sections of the 1911 and 1934 modifications were also noted at the two drop flume locations and head gate locale, once the physical inventory results were collaborated with the historical documents and engineering plan. Much of the latter happened after the fact, when the range of modifications depicted on the historic documents could be sorted out with the physical evidence. As a consequence, the routes of most of the buried 1911 and 1930s pipelines were not verified in the field. No cultural materials were collected during this investigation. Associated records will be curated at the NPS, Branch of Cultural Resources, Archives, Yellowstone National Park, Mammoth under accession number 2009.

RESULTS OF ARCHAEOLOGICAL INVESTIGATION

The present investigation concerns documenting the Glen Creek to Mammoth Water Supply System (48YE754). This supply system passes through three previously recorded sites: 48YE147, 48YE204, and 48YE486, and heads at the Glen Creek Intake (48YE218). Description of site 48YE754 is presented below.

SITE NUMBER: 48YE754

DESCRIPTION: This historic site consists of the Glen Creek to Mammoth Water Supply system and includes a concrete head gate on Glen Creek (48YE218), associated ditch, pipelines, and storage reservoir (Figure 2). The ditch portion of the site was noted during the recording of sites 48YE147 and 48YE204 (Sanders et al. 1996a). The storage reservoir was originally recorded by the NPS Midwest Archeological Center (Daron 1995a) and assigned site number 48YE754. However, Daron's report is confusing, because the reservoir is clearly delineated on his project map with site number 48YE754 (1995a:Figure 3), but within the body of the report the reservoir is assigned as feature 32 and discussed within Fort Yellowstone-Mammoth Hot Springs Historic District (48YE486) (1995a:16). In discussions with NPS, Branch of Cultural Resources and the Wyoming SHPO, Cultural Records Office, it was decided to utilize the 48YE754 site number for the reservoir and expand the number to include the entire water supply system. The head gate/water intake on Glen Creek was previously recorded as 48YE218.

Historic documents and engineering plans indicated that the original water supply system was built in 1901 by the US Army Corps of Engineers under the direction of Capt. Hiram M. Chittenden, US Army Corps of Engineers, one of the more prominent individuals in the history of Yellowstone National Park. Chittenden (1902:3042-3044) describes the construction in the following:

The plan of work had been carefully worked out by the middle of July. This plan consisted in bringing to the vicinity of Mammoth Hot Springs, through an open ditch, the waters of Glen Creek...In the vicinity of Mammoth Hot Springs, just under the hot-spring terraces, it was decided to build a reservoir in which to store the waters of this stream.....The actual work on the system began July 22, when the excavation for the ditch was commenced. On the 24th of the same month work was begun upon the head gate. This structure was very strongly made, and everything was put together with sufficient strength to withstand any probable force of the spring floods. A sand box was fitted in the flume leading from the head gate so that all dirt or rock that might wash into the flume can be cleared out and be conveyed back into the channel of the stream again through a gate provided for this purpose. A coarse wooden grate is provided to arrest all driftwood and other large floating material, and strong net with one-fourth-inch meshes is provided to arrest leaves and small matter and also fish. A movable needle gate is provided to control the flow of the water. The flume leading from the head gate is carried to a point where a suitable soil is reached, and from that point the water is carried to the site of the reservoir, mainly through an open earth ditch. In order to adapt the ditch advantageously to the topography there are several points where it is dropped through flumes to lower levels. The total length of these flumes amounts to about 500 feet. They are all thoroughly constructed and are placed on the ground in order that they may be better protected from the frost and snow than they would be if standing upon trestles, and each flume has a capacity of about 10 cubic feet, sufficient for all needs of the system. The total length of the ditch is about 2 miles. Where the ditch enters the reservoir a concrete flume is provided, with sand box and screen similar to those at the head gate, in order that all soil and other dirt can be arrested before the water flows into the reservoir. For the purpose of getting an easy means of measuring the inflow to the reservoir a weir is built across the flume so that the water entering the reservoir flows over it. By means of the ordinary weir tables the inflow can be measured with great accuracy.

The reservoir itself comprises an area of a little over an acre, and its capacity is very nearly 2,000,000 gallons. The site is a natural depression near the Mammoth Hot Springs formation, but

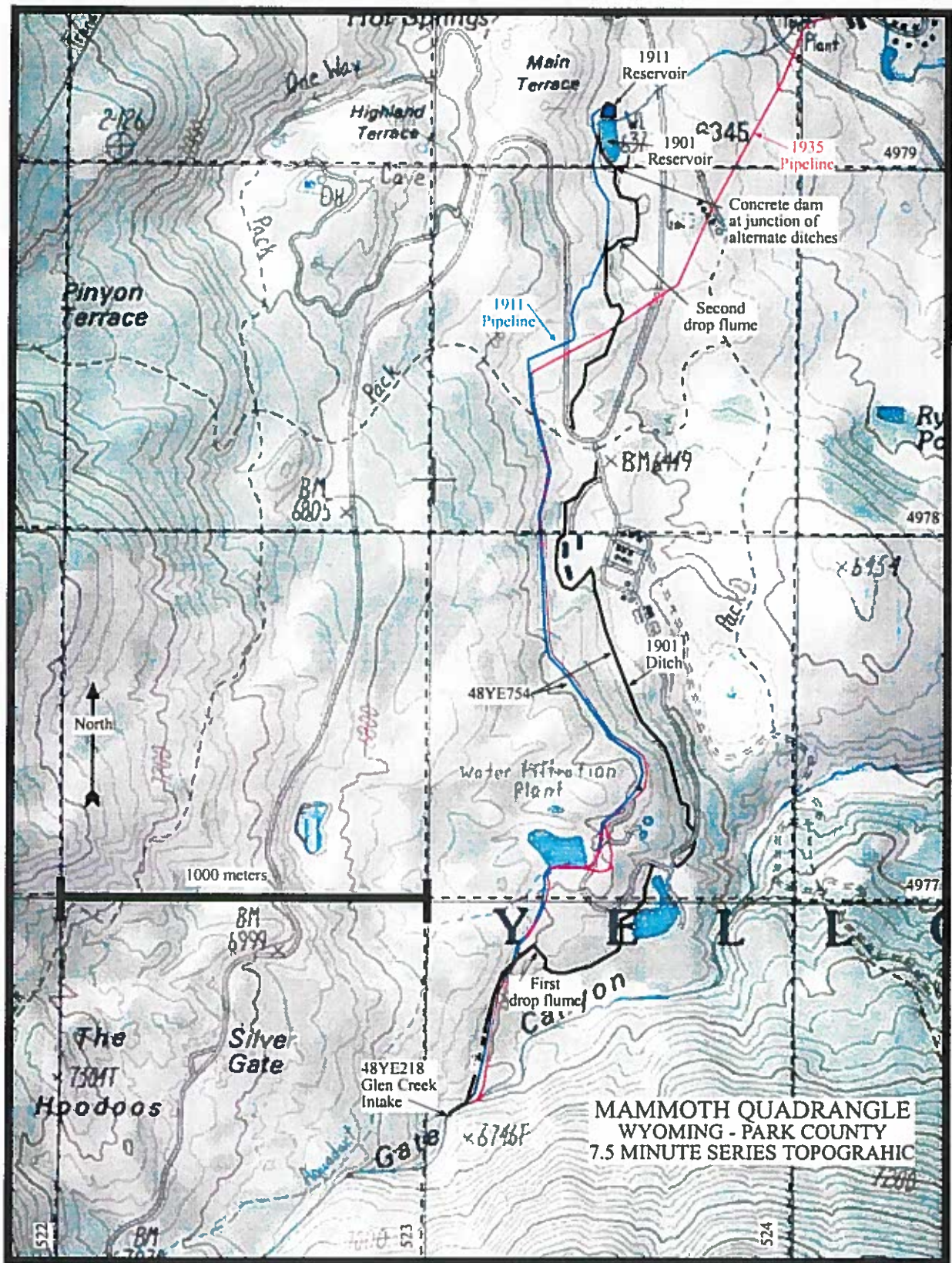


Figure 2. Map of site 48YE754. Enlargement of USGS Mammoth quadrangle, 7.5' topographic series.

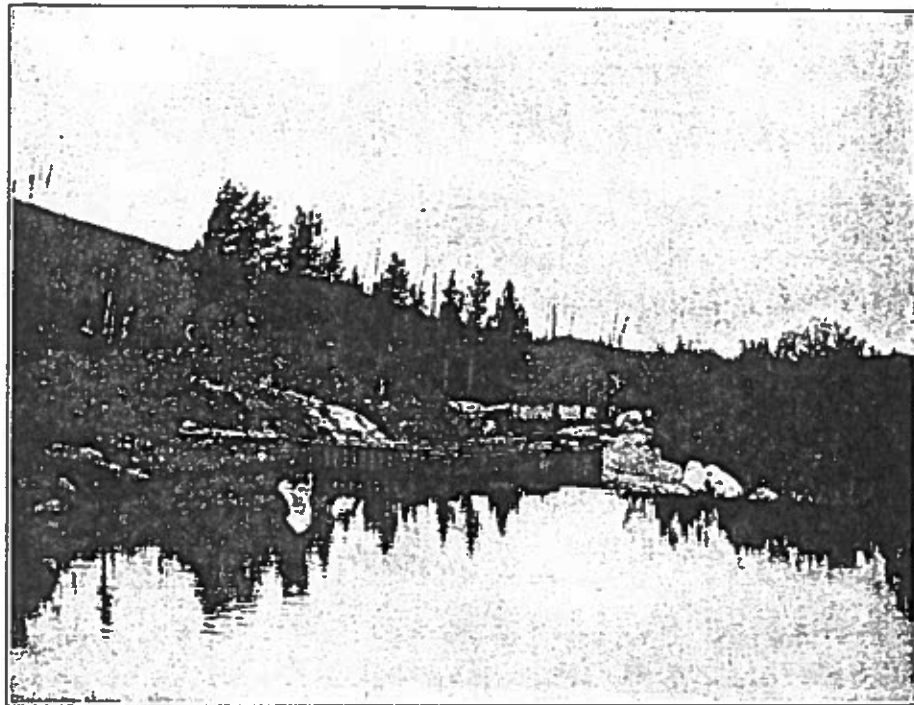
required a dam at each end in order to secure sufficient depth. The dam at the upper end was made from the excavation in the reservoir basin itself, rendered necessary for the purpose of clearing out the vegetable material from the bottom. The embankment has a width of fully 15 feet on top and 25 feet at the bottom. The main dam, holding the waters of the reservoir, consists of a concrete structure 180 feet long and about 12 feet high at its greatest height. The dam was all built on ground over which the hot springs formation extends. A trench $3\frac{1}{2}$ feet wide was dug entirely through this formation, the depth varying from 2 to 6 feet. Along the entire length of the bottom a row of sheet piling is driven to a depth of 1 to $2\frac{1}{2}$ feet. This piling consists of cedar boards 3 inches wide by $1\frac{1}{2}$ inches thick and forms an effectual barrier to the seepage of water under the dam. The upper ends project about 5 inches above the wall, and the concrete is placed around them. The concrete wall is 1 foot wide on top and $3\frac{1}{2}$ feet wide at a distance of 6 feet from the top, the batter being entirely on the lower side of the dam. The wall is built in sections of 12 feet length to provide for cracks which the contraction from cold would otherwise develop. In order to close these cracks against infiltration of the water through the dam, strips of sheet lead $3\frac{1}{2}$ inches wide are built into the concrete so that one-half of the sheet extends into the wall on each side of the crack. This expedient has proved to be an entire success.

At the lowest point of the dam the main was carried through the wall and a suitable gate and grate provided. Immediately below the reservoir a gate valve was introduced into the pipe so that the water can be closed off either above or below the dam. At this point an overflow weir was provided to carry off any excess of water. The dam proved to be entirely successful, only one leak having developed, and that of very small amount. Considering that the dam is of concrete, its imperviousness to the seepage of water under pressure is very satisfactory.

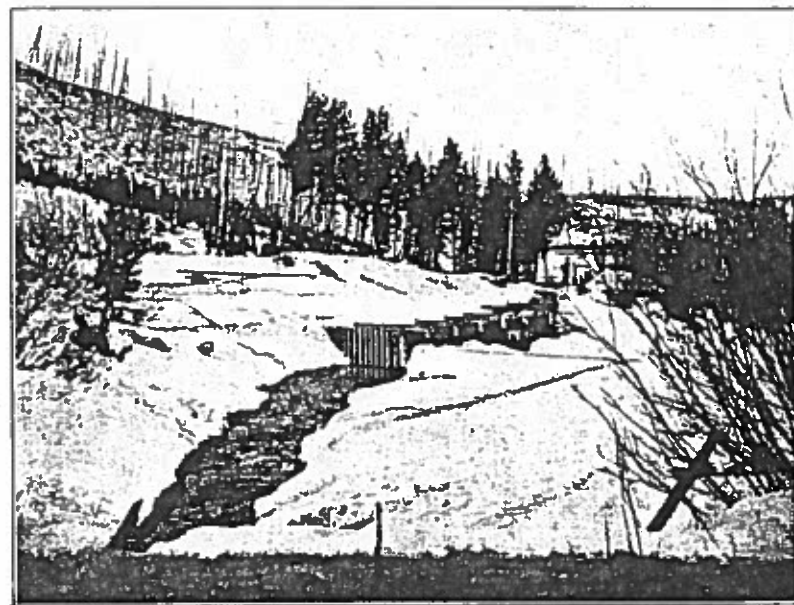
In the following year, Chittenden noted that "In order that this supply may never be taxed beyond its limit, a ditch was built leading from the Gardiner River, about 7 miles from Mammoth Hot Springs, across a low divide into Glen Creek. By means of this ditch any possible future demand can be abundantly supplied" (1903a:2888). This latter water system has been recorded as 48YE1351 and discussed in Sanders and Wedel (2003).

Figures 3-7 are illustrations from Chittenden's 1902 report, depicting various features of the Glen Creek to Mammoth supply system, during its construction. Chittenden's 1902 report states that a blue-print map showing the route of the water supply system and reservoir accompanied the report, but a footnote in the report (1902:3045) states that the map was not printed. The location of this map is not known (Lee Whittlesey, personal communication 2002) as there is no copy in the NPS, Branch of Cultural Resources, Archives or within the records at the NPS Maintenance office, which handles engineering functions within the Park. Copies may be available in Washington, DC. As a result, much of the original configuration is based on our tracing of the route on foot in 2002 (Figure 2 and Table 1). Additional details are available from the proposed engineering plans for the 1911 modifications to the water system (Cowell 1909; Parker 1910).

The reservoir area of the supply system is depicted in a 1903 map (Chittenden 1903b) of the Mammoth vicinity (Figure 8), which shows the ditch from Glen Creek entering the south end of the reservoir. A secondary ditch branches off of the main ditch just south of the reservoir and travels to the northeast,

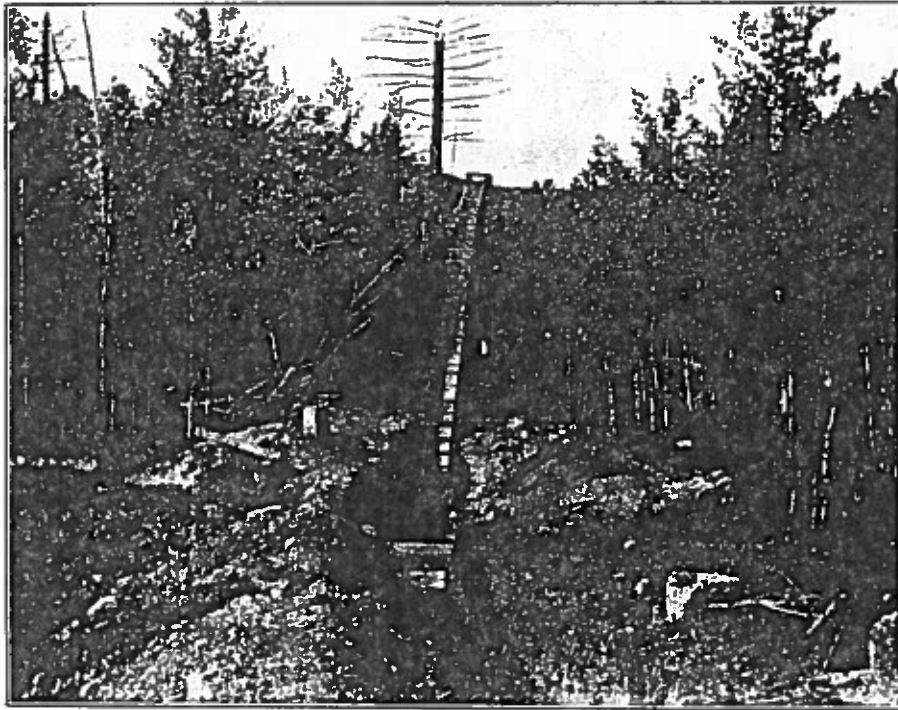


HEADGATE OF DITCH.

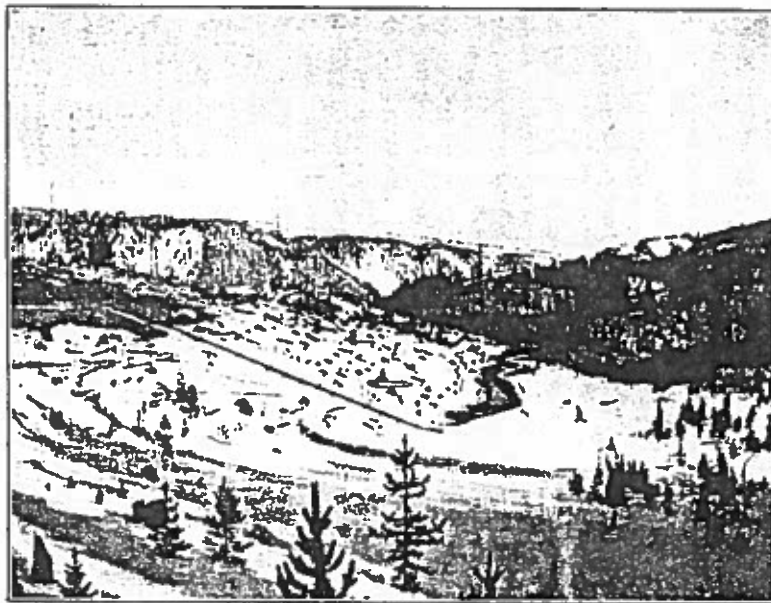


HEADGATE OF DITCH. (WINTER.)

Figure 3. Illustrations from Chittenden's report (1902) showing the 1901 Glen Creek to Mammoth water supply system construction, site 48YE754/48YE218.

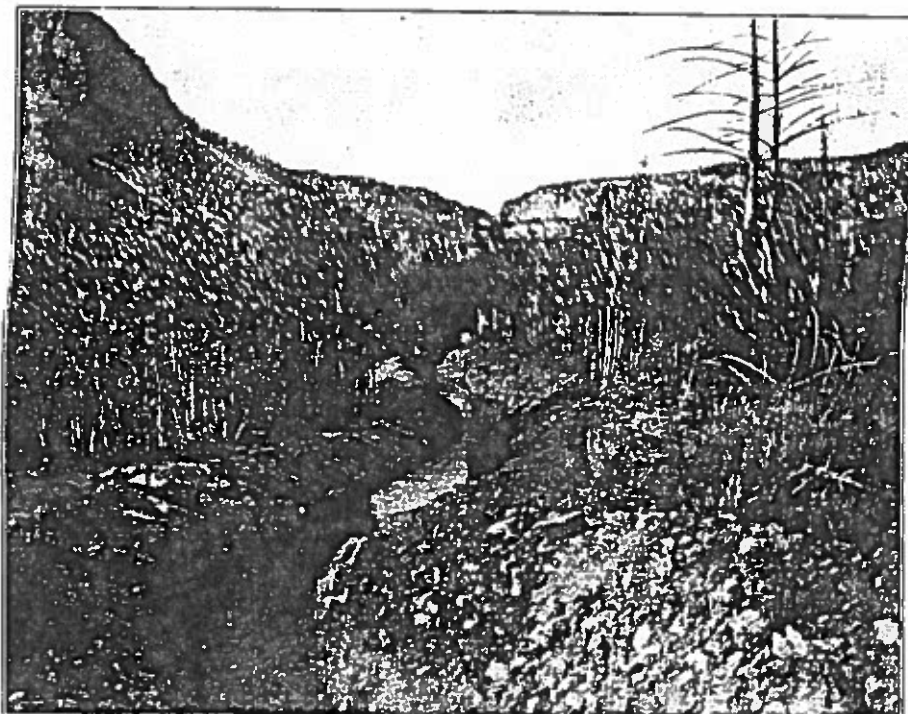


DROP FLUMES, WATER-SUPPLY DITCH.

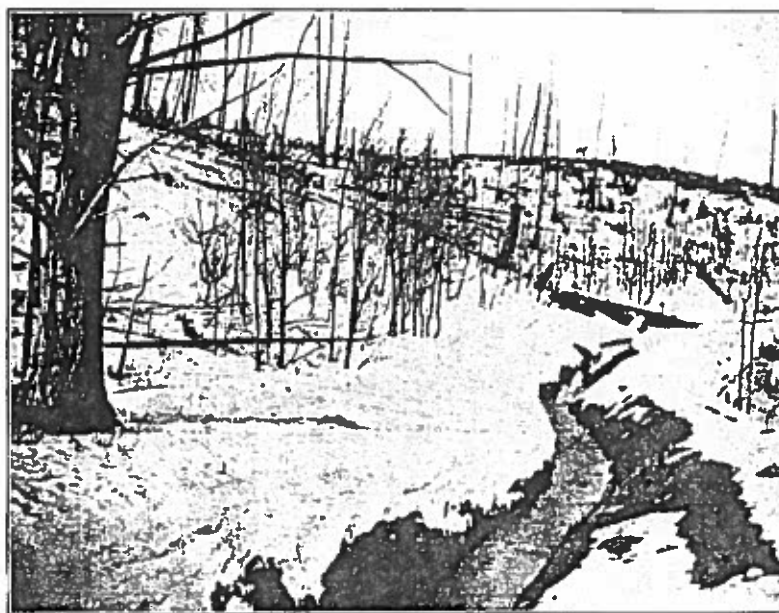


DROP FLUMES, WATER-SUPPLY DITCH.

Figure 4. Illustrations from Chittenden's report (1902) showing the 1901 Glen Creek to Mammoth water supply system construction, site 48YE754.

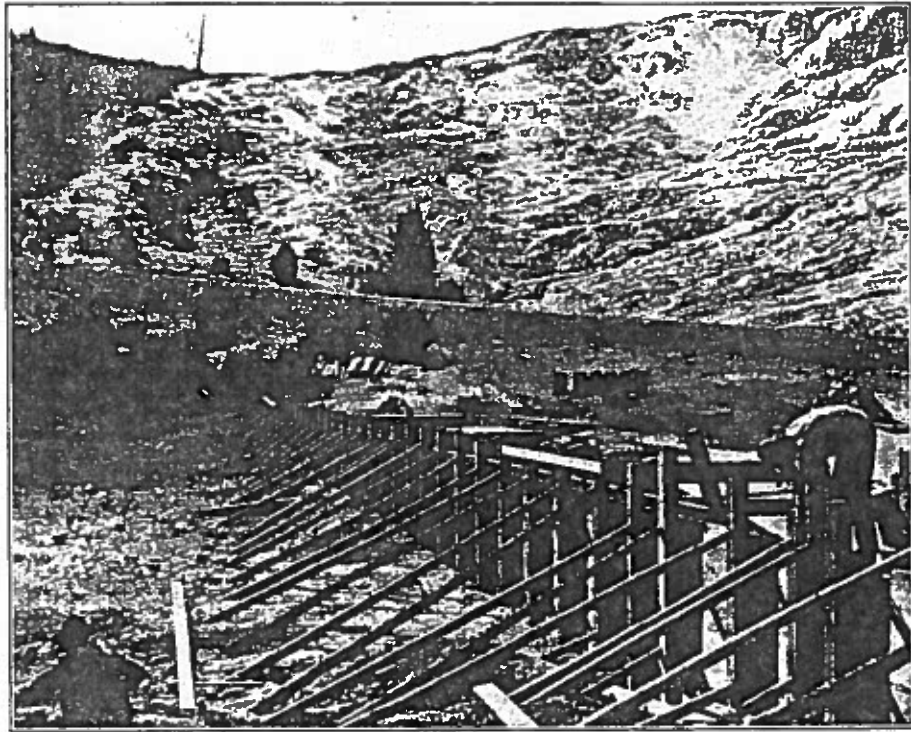


NEW WATER-SUPPLY DITCH.



NEW WATER-SUPPLY DITCH. (WINTER.)

Figure 5. Illustrations from Chittenden's report (1902) showing the 1901 Glen Creek to Mammoth water supply system construction, site 48YE754.



CONCRETE FORMING FOR RESERVOIR DAM.

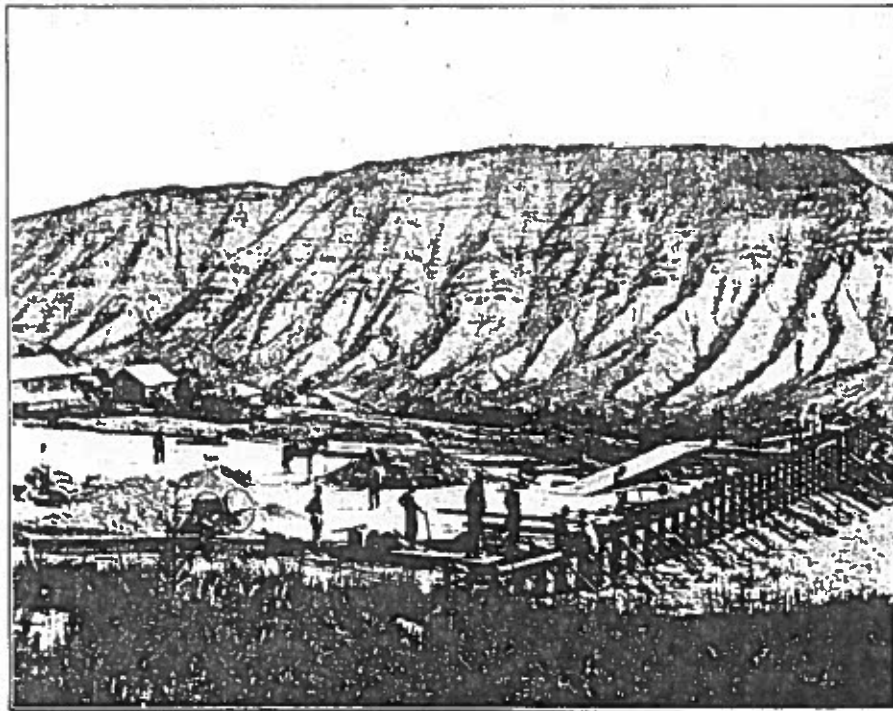
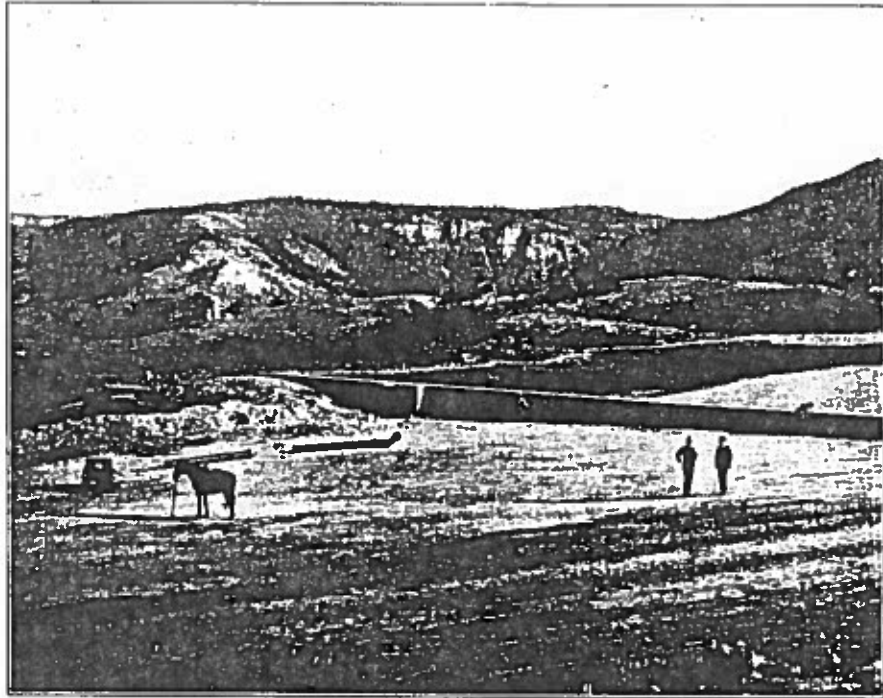
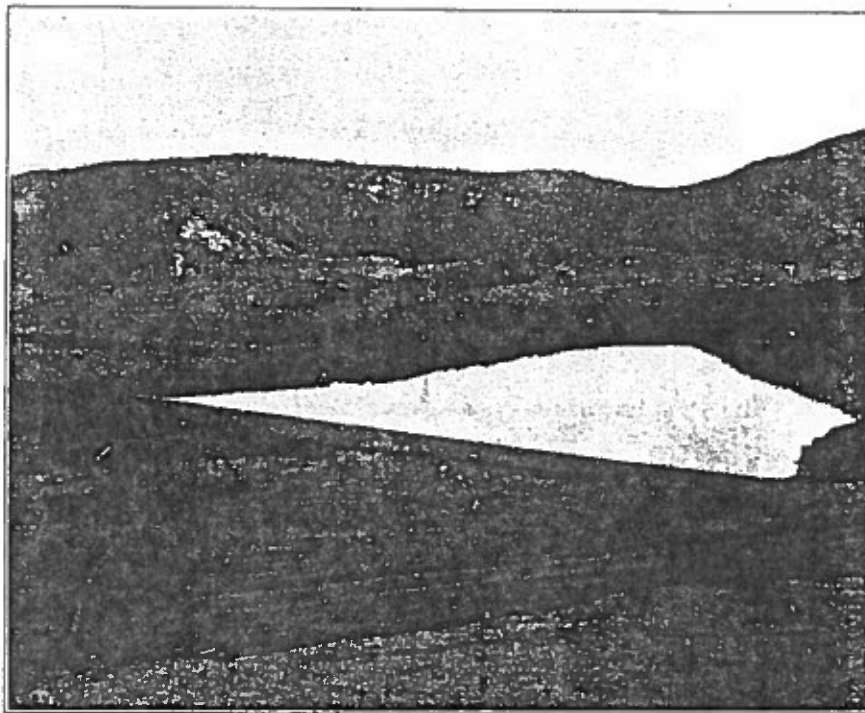


Figure 6. Illustrations from Chittenden's report (1902) showing the 1901 Glen Creek to Mammoth water supply system construction, site 48YE754.



RESERVOIR DAM, MAMMOTH HOT SPRINGS.



RESERVOIR MAMMOTH HOT SPRINGS.

Figure 7. Illustrations from Chittenden's report (1902) showing the 1901 Glen Creek to Mammoth water supply system construction, site 48YE754.

Table 1. Summary of GPS, UTM coordinates for the Glen Creek to Mammoth 1901 ditch water supply system, site 48YE754. Coordinates ordered from north to south.

| <u>Easting (m)</u> | <u>Northing (m)</u> | <u>Description</u> |
|---|---------------------|--|
| 532536 | 4979024 | end of east alternate ditch to power plant, ditch obscured |
| 532512 | 4978989 | east alternate ditch to power plant |
| 532445 | 4979097 | north end of west alternate ditch on west side of 1901 reservoir |
| 532464 | 4979012 | west alternate ditch on west side of 1901 reservoir |
| 532478 | 4979005 | west alternate ditch on west side of 1901 reservoir |
| 532492 | 4979000 | north end of main ditch where it empties into 1901 reservoir |
| 532494 | 4978986 | concrete diversion structure to funnel water to storage reservoir, alternate ditches extend to the east connect to power plant and west along the west side of the original 1901 reservoir to dump into the 1911 reservoir |
| 532494 | 4978967 | ditch |
| 532486 | 4978954 | ditch |
| 532492 | 4978939 | ditch |
| 532550 | 4978908 | ditch |
| 532543 | 4978794 | ditch |
| 532518 | 4978789 | ditch, ceramic pipe fragments, 34" long, 20" diameter |
| 532491 | 4978769 | drop flume |
| 532460 | 4978811 | end of ditch, manhole cover with ceramic pipe surrounded by rocks |
| 532469 | 4978761 | ditch, top of former drop flume |
| 532464 | 4978704 | ditch, large ceramic pipe fragment |
| 532488 | 4978623 | ditch |
| 532524 | 4978606 | ditch |
| 532521 | 4978590 | ditch |
| 532509 | 4978570 | ditch |
| 532499 | 4978550 | ditch |
| 532483 | 4978517 | ditch |
| 532478 | 4978495 | ditch |
| 532419 | 4978416 | ditch |
| 532410 | 4978391 | ditch |
| 532385 | 4978354 | ditch and east side of Mammoth to Norris highway |
| 532382 | 4978344 | ditch and east side of Mammoth to Norris highway |
| 532397 | 4978280 | south end of ditch, intersection with Mammoth to Norris highway |
| ditch obliterated by Mammoth to Norris highway and YCC camp entrance, gravel road | | |
| 532462 | 4978206 | north end of ditch on west side of YCC camp gravel road |
| 532464 | 4978176 | ditch, ca. 1 m wide, 20 cm deep |
| 532404 | 4978118 | ditch |
| 532380 | 4978114 | ditch |
| 532373 | 4978042 | south end of ditch |
| ditch location obscured, eroded and or filled in by slopewash | | |
| 532343 | 4977913 | north end of ditch, remainder obscured |
| 532371 | 4977853 | ditch |
| 532406 | 4977861 | ditch |
| 532440 | 4977909 | ditch |
| 532453 | 4977882 | ditch |
| 532450 | 4977857 | ditch |
| 532474 | 4977800 | ditch |
| 532494 | 4977714 | east side of ditch collapsed |
| 532510 | 4977652 | ditch |
| 532538 | 4977608 | ditch |
| 532568 | 4977507 | ditch |
| 532632 | 4977454 | ditch |
| 532638 | 4977440 | ditch |
| 532658 | 4977417 | ditch |
| 532680 | 4977317 | ditch |

Table 1. Continued.

| <u>Easting (m)</u> | <u>Northing (m)</u> | <u>Description</u> |
|---|---------------------|---|
| 532696 | 4977301 | ditch, 3 m wide 50-75 cm deep |
| 532704 | 4977275 | ditch |
| 532717 | 4977246 | ditch |
| 532718 | 4977210 | ditch |
| 532733 | 4977190 | beginning of ditch, west edge of gravel road |
| intervening gravel road | | |
| 532737 | 4977176 | end of ditch, east edge of gravel road |
| 532722 | 4977135 | beginning of ditch at edge of drainage |
| gravel road and drainage channel obscure ditch location | | |
| 532673 | 4977095 | end of ditch, west edge of gravel road |
| 532615 | 4977103 | ditch |
| 532600 | 4977057 | ditch |
| 532600 | 4976008 | ditch |
| 532530 | 4976950 | beginning of ditch at north side of creek |
| creek crossing, former flume location | | |
| 532515 | 4976925 | end of ditch at south side of creek |
| 532535 | 4976909 | ditch |
| 532516 | 4976865 | ditch |
| 532507 | 4976850 | ditch |
| 532433 | 4976810 | ditch |
| 532330 | 4976802 | bottom of former drop flume, beginning of ditch |
| 532315 | 4976843 | middle of former drop flume |
| 532282 | 4976887 | top of former drop flume, ceramic pipe fragments |
| 532197 | 4976772 | ditch |
| 532150 | 4976673 | beginning of ditch |
| no evidence of pipeline or ditch, pipeline buried | | |
| 532137 | 4976532 | road and buried pipe, end of visible pipeline |
| pipeline obscured by road | | |
| 532115 | 4976455 | water chamber and valve box |
| 532060 | 4976415 | concrete head gate/intake on Glen Creek (48YE218) |



MAP OF THE GROUNDS
IN THE VICINITY OF
MAMMOTH HOT SPRINGS
IN THE
YELLOWSTONE NATIONAL PARK

PREPARED UNDER THE DIRECTION OF
CAPTAIN H. M. CHITTENDEN
CORPS OF ENGINEERS, U. S. A.

Surveyed by Weston Small, Junior Engineer

Drawn by Paul Burgoldt, Draftsman

1903

SCALE

1" = 100' 0" 200' 300' 400' 500' 600' 700' 800' 900' 1000'

Figure 8. 1903 map of the vicinity of Mammoth Hot Springs showing storage reservoir and associated ditches (Chittenden 1903b).

connecting to the powerhouse. Our 2002 investigation found another ditch that occurs along the west side of the reservoir, which is not depicted on any of the engineering maps, but may have supplied water to the second reservoir built in 1911 at the north end of the 1901 reservoir. Figure 9 illustrates the present condition of the reservoir, as well as the concrete weir/flume structure at the south end of the reservoir that diverted water northeastward to the power plant and northwestward to the 1911 storage reservoir. Figure 10 illustrates the present condition of the ditch, while Figure 11 depicts parts of the vitrified ceramic and metal pipes at the two drop flume locales.

The drop flumes were utilized to transport the water down steep slopes, although little remains of the flumes (Figure 11). The two drop flume locales identified during the field investigation contrast with the five drop flumes noted by Chittenden's 1902 report, although he noted only four drop flumes in the following year's report (Chittenden 1903a). The present investigation found ceramic pipe fragments at the two flume locations and at a few other locales along the ditch, suggesting that some of the water that flowed through the original open ditch was subsequently funneled into pipes. The original vitrified ceramic pipe segments were 34 inches long and 20 inches in diameter. From the second or northern drop flume, the ditch continued more or less intact until it terminated at the storage reservoir.

After its construction in 1901, the water supply system went through a number of changes. Already mentioned above was the additional water that was added to the system through excavation of the open air Swan Lake Ditch in 1902 that flowed from the Gardner River (and adjacent spring) across Swan Lake Flat and dumped into Glen Creek just above Rustic Falls (Chittenden 1903a:2888; Sanders and Wedel 2003). With the construction of a hydroelectric power plant in 1903, the supply of water was inadequate, requiring new upgrades (Olliff 1996:Section 7, page 3). This construction consisted of a new head gate on Glen Creek, a buried ceramic pipeline, and another storage reservoir. Plans of the latter construction (Cowell 1909) are provided in Appendix 1. Based on these proposed plans, it would appear that the new head is located well upstream from the original 1901 head gate (Appendix 1:Sheet 2). Also a comparison of the head gate location in Figure 12 with Chittenden's photos of the original 1901 head gate (Figure 3) shows that the original head gate is in a more open locale. From this it is evident that the original head gate was not located during the 2002 investigation, but it must be nearby since the original 1901 ditch leads up to this area. Unfortunately, the southern end of the ditch (ca. 100 m) has been obliterated, making it difficult to trace. It is possible that the latter constructions obliterated this last section of ditch and the original head gate. Since no "as constructed" plans for the 1901 or 1911 are presently available, the location of the original head gate is presently unknown. Olliff (1996:2) also believes that the original head gate was located at or near the site of the present intake (48YE218).



View north at the existing storage reservoir.



View north at the concrete dam that funneled water to the reservoir and alternate ditches.

Figure 9. Photographs of site 48YE754.

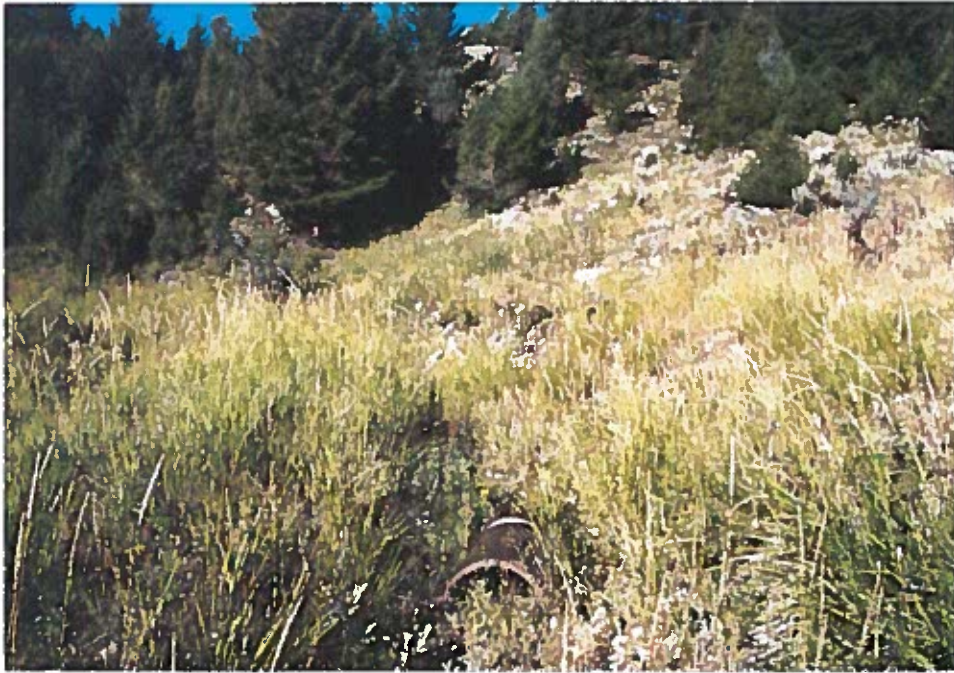


View northwest at the ditch at the southern end of the site.

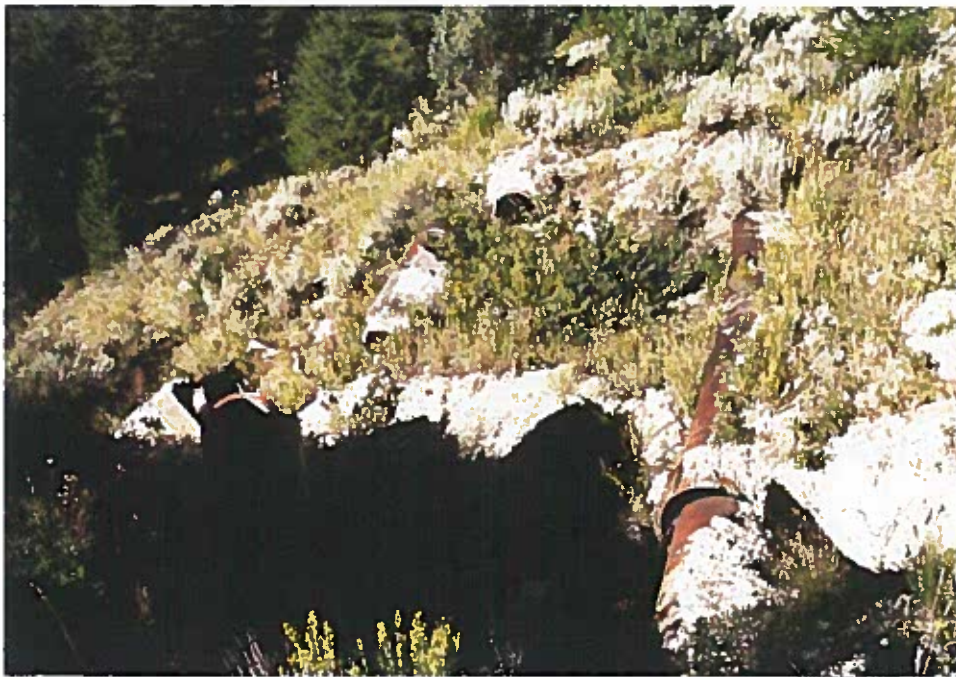


View southwest at the ditch near the southern drop flume.

Figure 10. Photographs of site 48YE754.

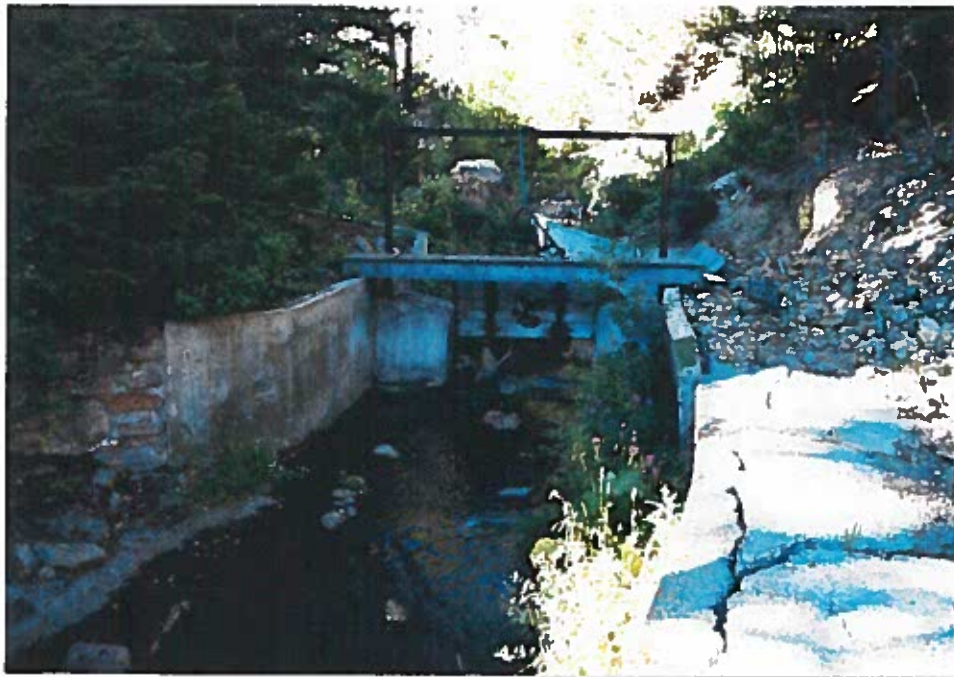


View west at ceramic pipes (foreground) in ditch below northern drop flume.



View southwest at ceramic pipes (left) and metal pipes (right) at top of the southern drop flume.

Figure 11. Photographs of site 48YE754.



View southwest (toward upstream) at the Glen Creek Intake.



View north at the upstream side of the intake, showing the debris collection grate.

Figure 12. Photographs of the Glen Creek Intake, site 48YE218.

As a part of the 1911 modifications, a new 2,000,000 gallon reservoir was built immediately to the north of the original 1901 reservoir (Figure 13). The route of the new ceramic pipeline generally parallels the original 1901 ditch from the new head gate to the first drop flume, but then follows a separate route, skirting the hill slopes about 50 to 100 m west of the original ditch (Figure 2; Appendix 1). It then matches in with the 1901 ditch at the second drop flume, but then diverts and continues northward until it drops into the new reservoir (Figures 2 and 13; Appendix 1). Only a small portion of this pipeline route was verified in the field, primarily at the two drop flumes and at the head gate. However, since much of the line is buried, most of the line would not be visible. The route is also shown as an existing pipeline on a later 1936 plan (NPS 1936). This plan was used to trace the route onto the Figure 2 site map.

Olliff (1996:Section 7, page 4) notes that modifications were made in the 1930s to supply additional water to the hydro-electric powerplant at Mammoth. He states that the present Glen Creek head gate was constructed in 1930-1931 and again modified in 1935, with a four acre reservoir also added at this time. In 1935-1936, new steel pipeline/penstock from the Glen Creek Intake to the power plant was completed.

The present investigation found the 1930s head gate to be in good condition (Figure 12). From the head gate, the water was fed through a buried pipe into a cistern or manhole (Figure 14) and that the water continued in underground pipes. The "as constructed" engineering plans (NPS 1936) shows the new pipeline extending along most of the same route as the 1911 pipeline, until it eventually diverted directly toward the powerhouse. The last series of upgrades to the Mammoth water supply system were most recently made in the 1970s with construction of a filtration plant and using water supplied directly from the Gardner River/Panther Creek head gates. In 1979, the Glen Creek head gate and associated water system were abandoned (Olliff 1996:Section 7, page 6).

TEST EXCAVATIONS: No test excavations were conducted or considered warranted.

IMPACTS: Past impacts include natural deterioration, erosion, and road construction. It is also evident that portions of ditch system have been modified through deliberate removal of the drop flumes and ceramic pipelines. Proposed future impacts involve rehabilitation and revegetation of the water system back to a natural, preconstruction context, which would mean a total obliteration of the site.

NATIONAL REGISTER STATUS: The historic importance of the water supply system to Mammoth (Fort Yellowstone) is described by Haines (1977:165):

Funds were made available in 1897 for increasing the size of Fort Yellowstone to accommodate two troops. Another pair of duplex officers' quarters, a second troop barracks, a stable, and two more noncommissioned officers' quarters were added . . . with the addition of several service structures and a post exchange . . . The construction of an adequate water system by the Corps of Engineers in 1902-03 had several beneficial effects. The old water system, with its 100,000-gallon covered reservoir in Clematis Gulch [west of the Liberty Cap geologic formation], barely met the

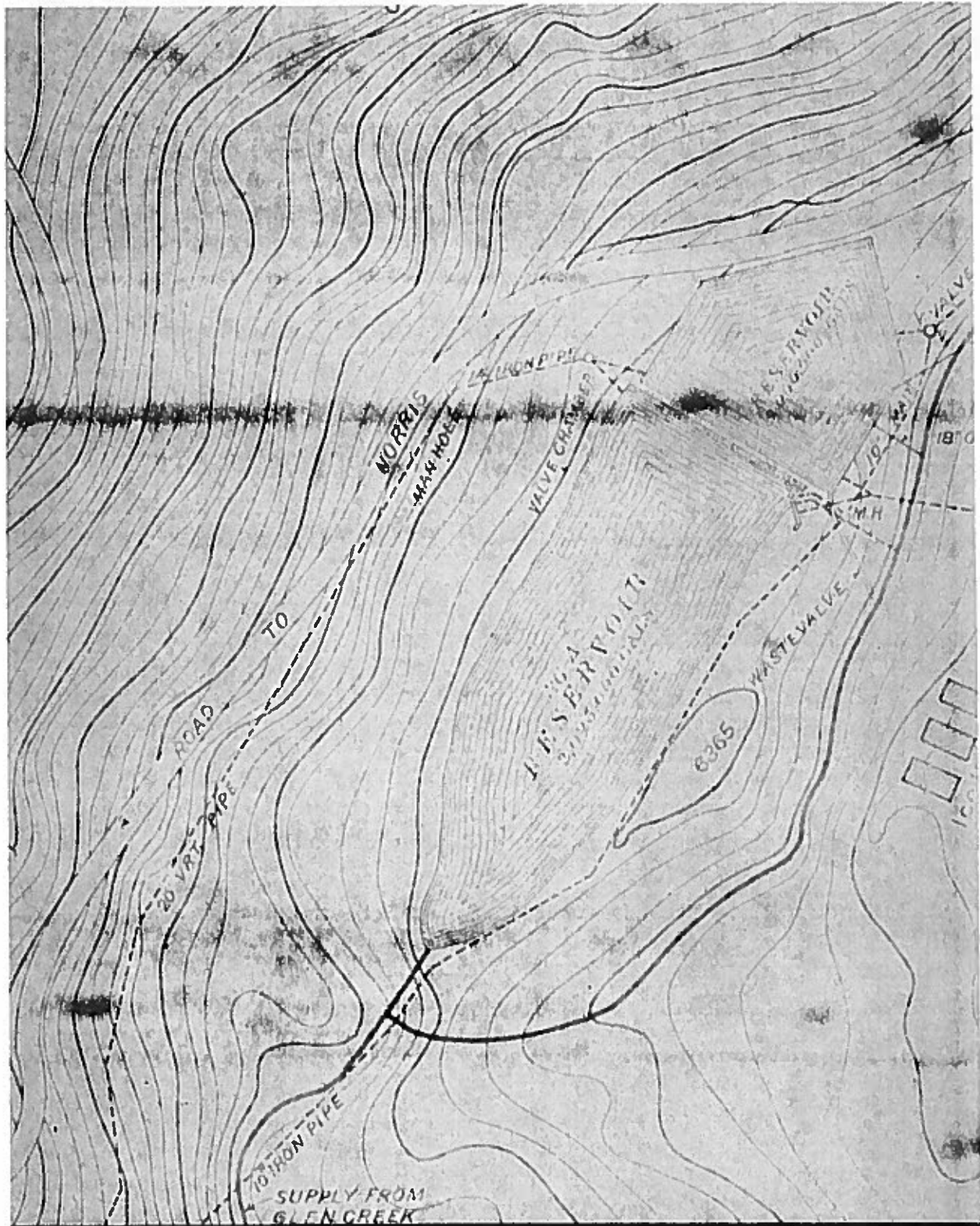


Figure 13. 1911 map of 1901 storage reservoir, new reservoir and associated pipelines, site 48YE754 (US Army, Corps of Engineers 1911).



View northwest at the water chamber and valve box just below the Glen Creek Intake.

Figure 14. Photograph of the Glen Creek Intake, site 48YE218.

demand for potable water, so that lawn watering was out of the question; but the new supply, taken from Glen Creek and the Gardner River, was adequate for all of the domestic needs of the fort and concessioners, with water to spare for irrigation and power generation. Thus, landscaping and electric lighting was at least a possibility.

Control of the dust nuisance from the parade ground - that "attractive bit of open sand, several acres in extent" - was accomplished by hauling enough topsoil from the hill north of the fort to spread a one-half-foot layer over the entire parade ground; that was covered with stable manure, seeded, and watered by a system of irrigation ditches fed from a circular fountain located in front of the U.S. commissioner's residence. In time, Major Pitcher could report "a fair crop of grass and clover . . . where it is hoped that we will eventually produce . . . lawn." It was an improvement of which the editor of the *Gardiner Wonderland* remarked: "The change that has been wrought in the face of nature on the old 'formation' at Mammoth Hot Springs is truly remarkable."

However, as Olliff (1996) points out the Glen Creek to Mammoth water supply system has undergone a series of changes and modifications, which have affected its integrity. Significant modifications were made in 1911 and the 1930s with the construction of new pipelines, head gates, and a new storage reservoir.

The ditch is in various degrees of decay, having been filled in, or obliterated through erosion, natural deterioration and other construction. The 1901 reservoir has become overgrown with vegetation and looks like a natural lake, since none of the concrete dam is visible. The 1911 reservoir is no longer present. The Glen Creek Intake (48YE218) or head gate is mostly intact, but has already been determined by SHPO (#0496TPT007) as not eligible. The rationale forwarded by Olliff (1996) concerning the non-eligibility of the Glen Creek Intake directly applies to the other components of the water supply system. As a result, the ditch, pipelines, and reservoir are recommended as not eligible for nomination to the National Register of Historic Places.

RECOMMENDATIONS: No further work is recommended.

MANAGEMENT SUMMARY

This report documents the recording of the historic Glen Creek to Mammoth Water Supply System (48YE754) in the northern edge of Yellowstone National Park. The investigation involved walking the entire length of the ditch that connects the Glen Creek head gate (48YE218) to the water storage reservoir, just above Mammoth. The water system was originally built in 1901, with subsequent modifications in 1911 and the 1930s. The Glen Creek head gate or intake, and storage reservoir are the most intact, while the ditch is highly deteriorated. The Glen Creek Intake (48YE218) has already been determined not eligible by the Wyoming State Historic Preservation Office. The rationale for the non-eligibility of the intake (48YE218) applies directly to the ditches, pipelines and reservoir encompassed under 48YE754. As a result, 48YE754 is recommended as not eligible for nomination to the National Register of Historic Places (also see Table 2). The ditch also passes through sites 48YE147, 48YE204, 48YE486, and 48YE520. No further work is recommend.

Table 2. Summary of site evaluations and justifications.

| SITE/IF# | SIGNIFICANCE | INTERPRETIVE POTENTIAL | STABILIZATION CONSERVATION NEEDS | NATIONAL REGISTER CONTEXTS | RESEARCH DESIGN QUESTIONS | INTEGRITY | WHY SITE NOT CONSIDERED ELIGIBLE | WHY SITE MUST BE TESTED TO ESTABLISH ELIGIBILITY |
|----------|--------------|------------------------|----------------------------------|----------------------------|---------------------------|-----------|---|--|
| 48YE754 | Not eligible | Possible | None | NA | NA | Poor | Limited integrity or research potential | NA |

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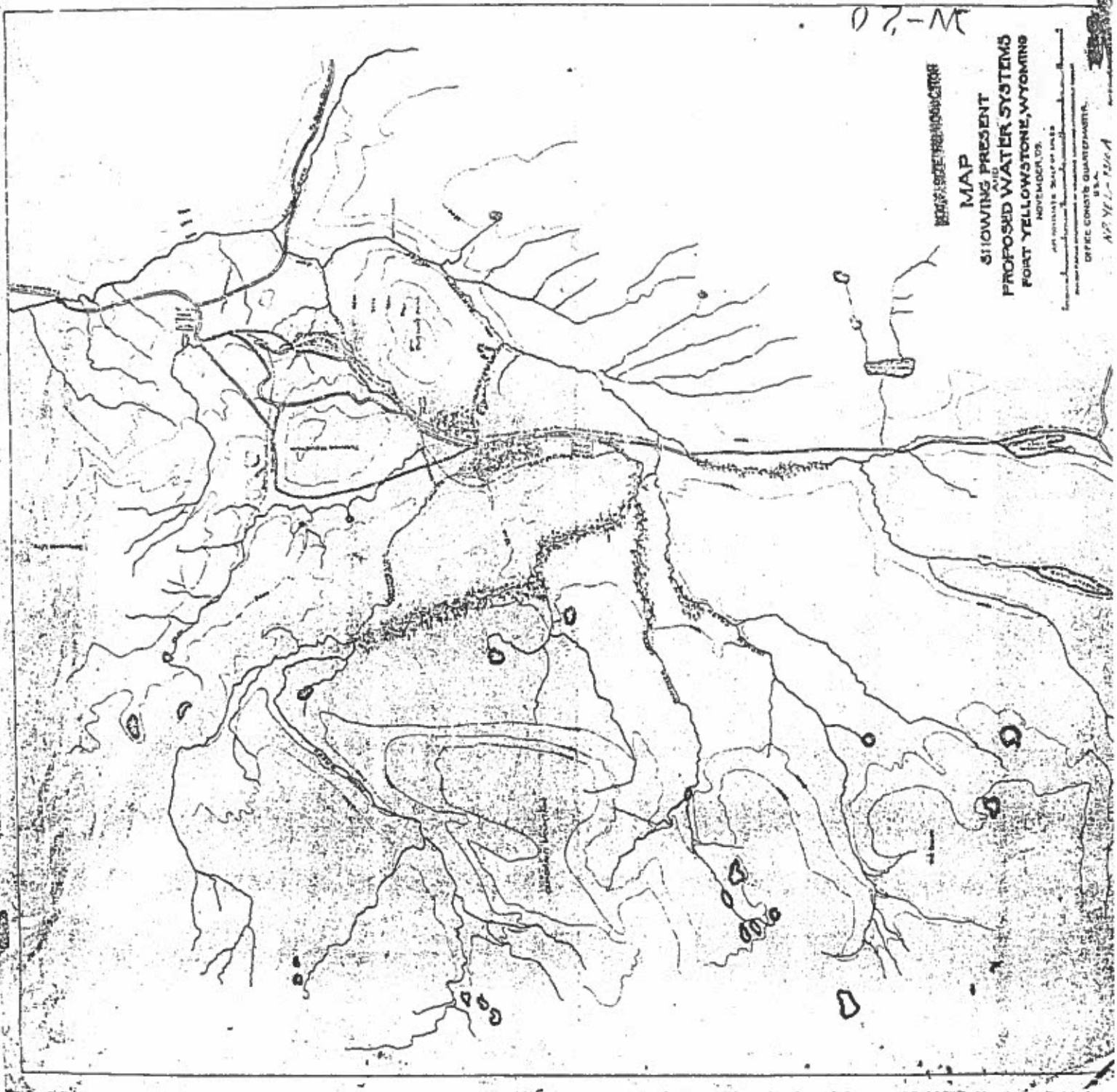
APPENDIX 1
1909 Proposed Water System

W-20

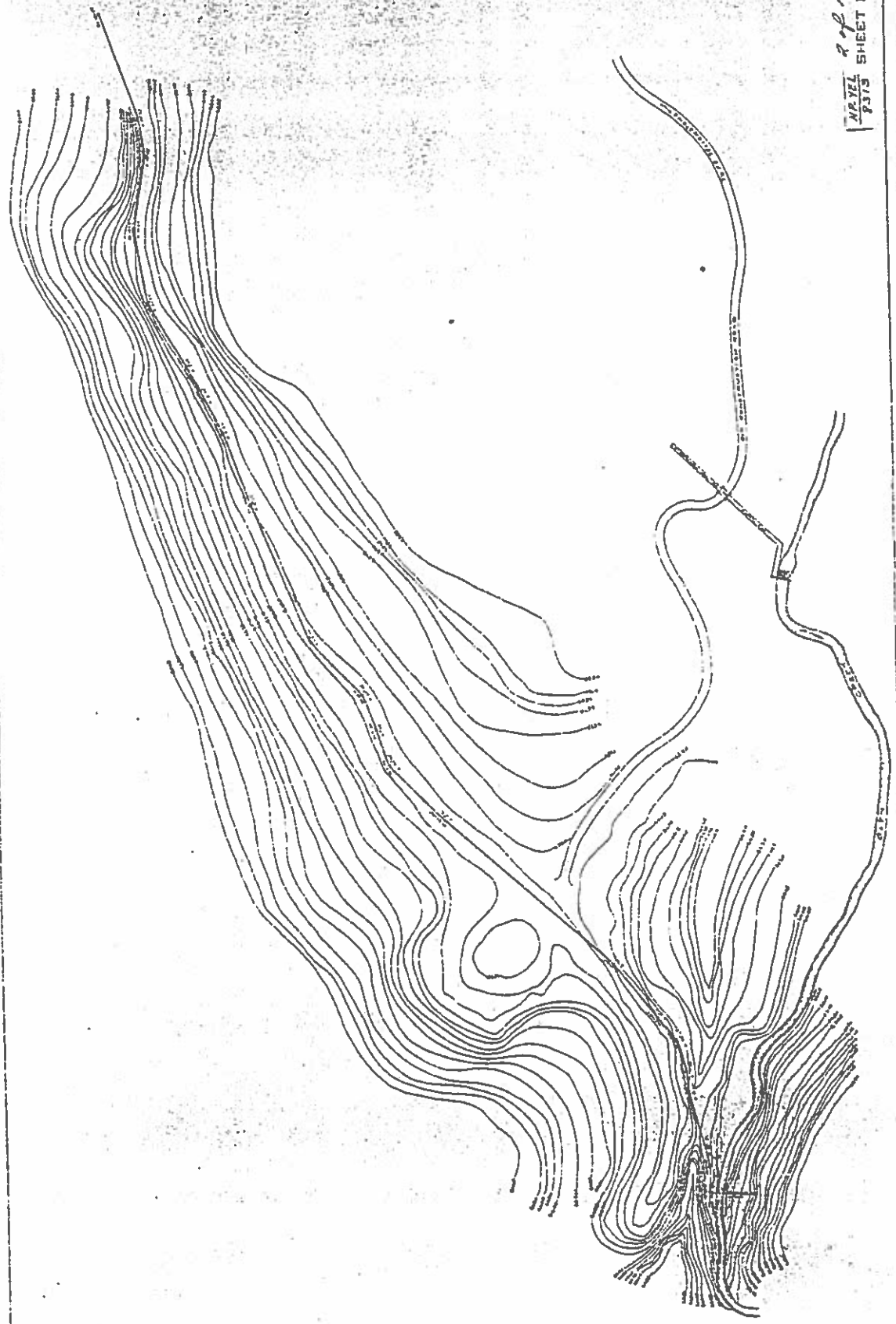
WATER SUPPLY DIVISION

MAP
SHOWING PRESENT
AND
PROPOSED WATER SYSTEMS
FORT YELLOWSTONE, WYOMING
NOVEMBER 1955

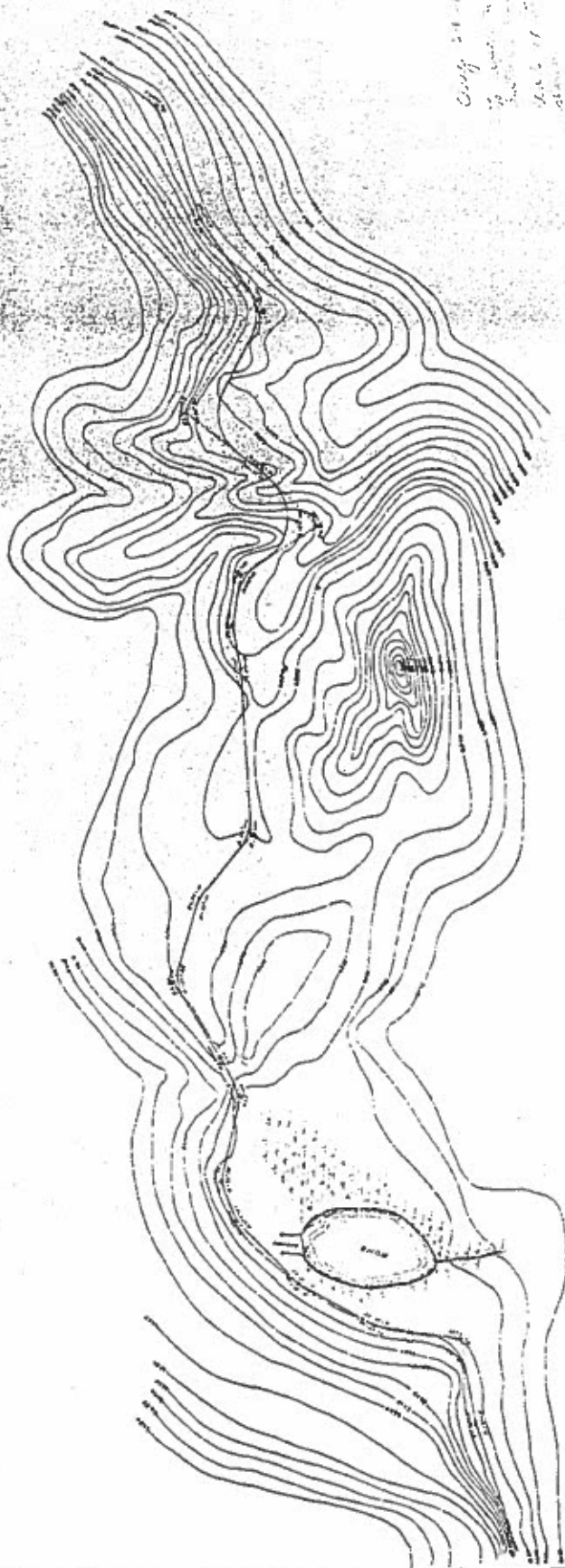
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WASHINGTON, D.C.

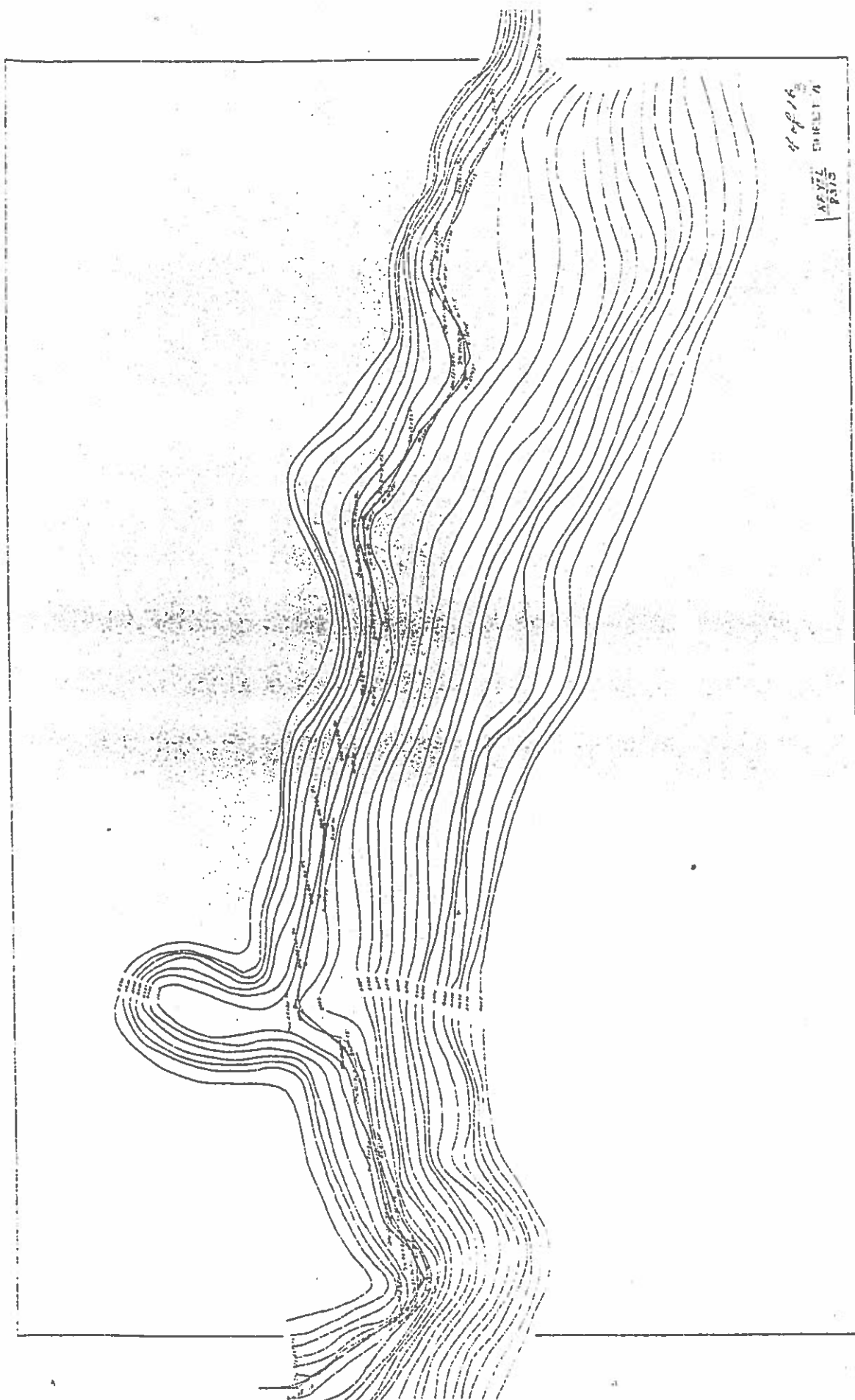


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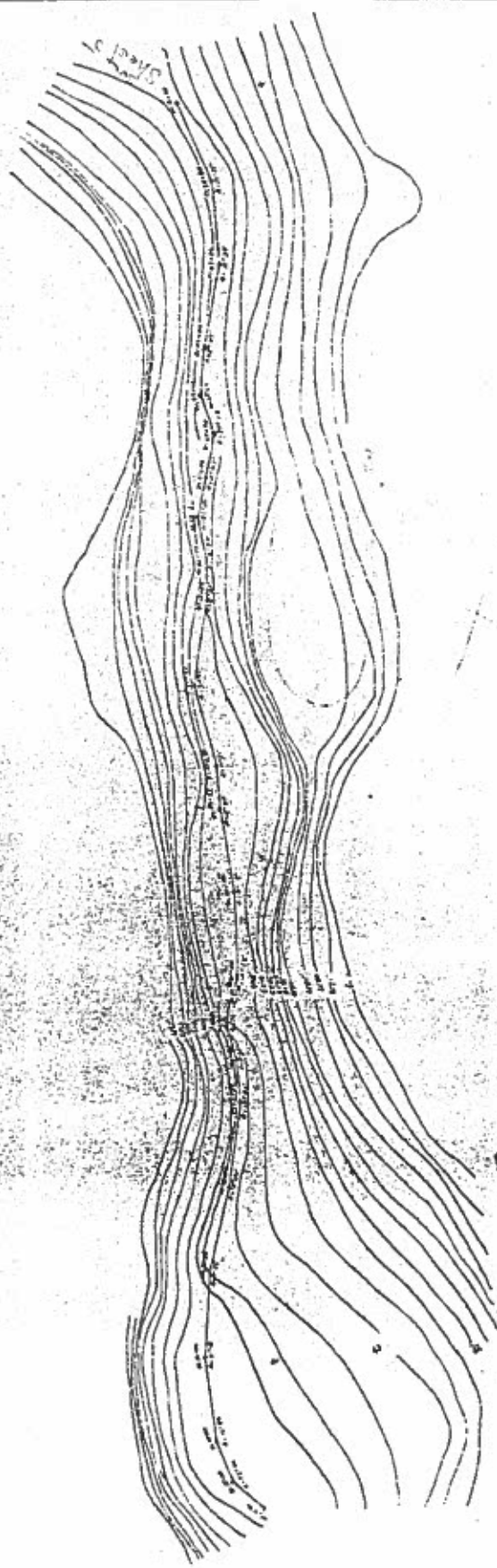


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Sheet 2 of 6





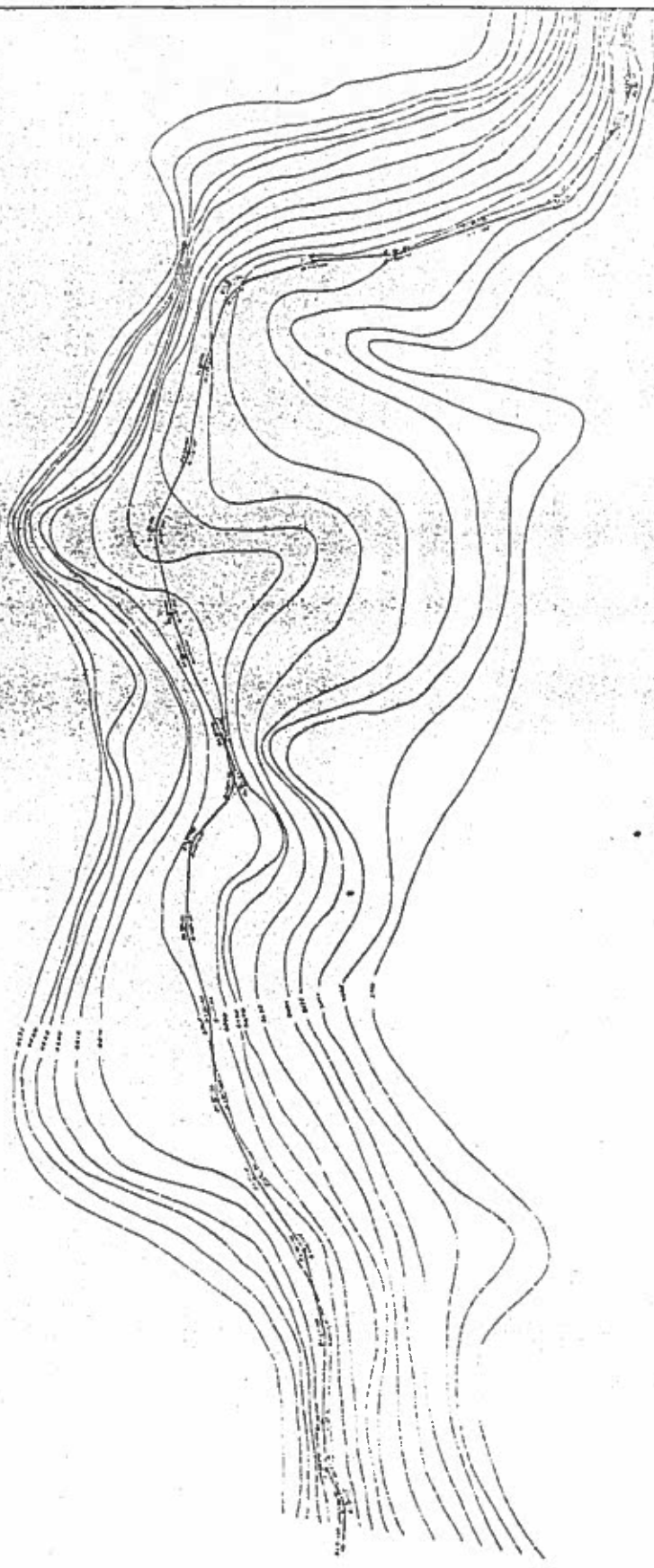
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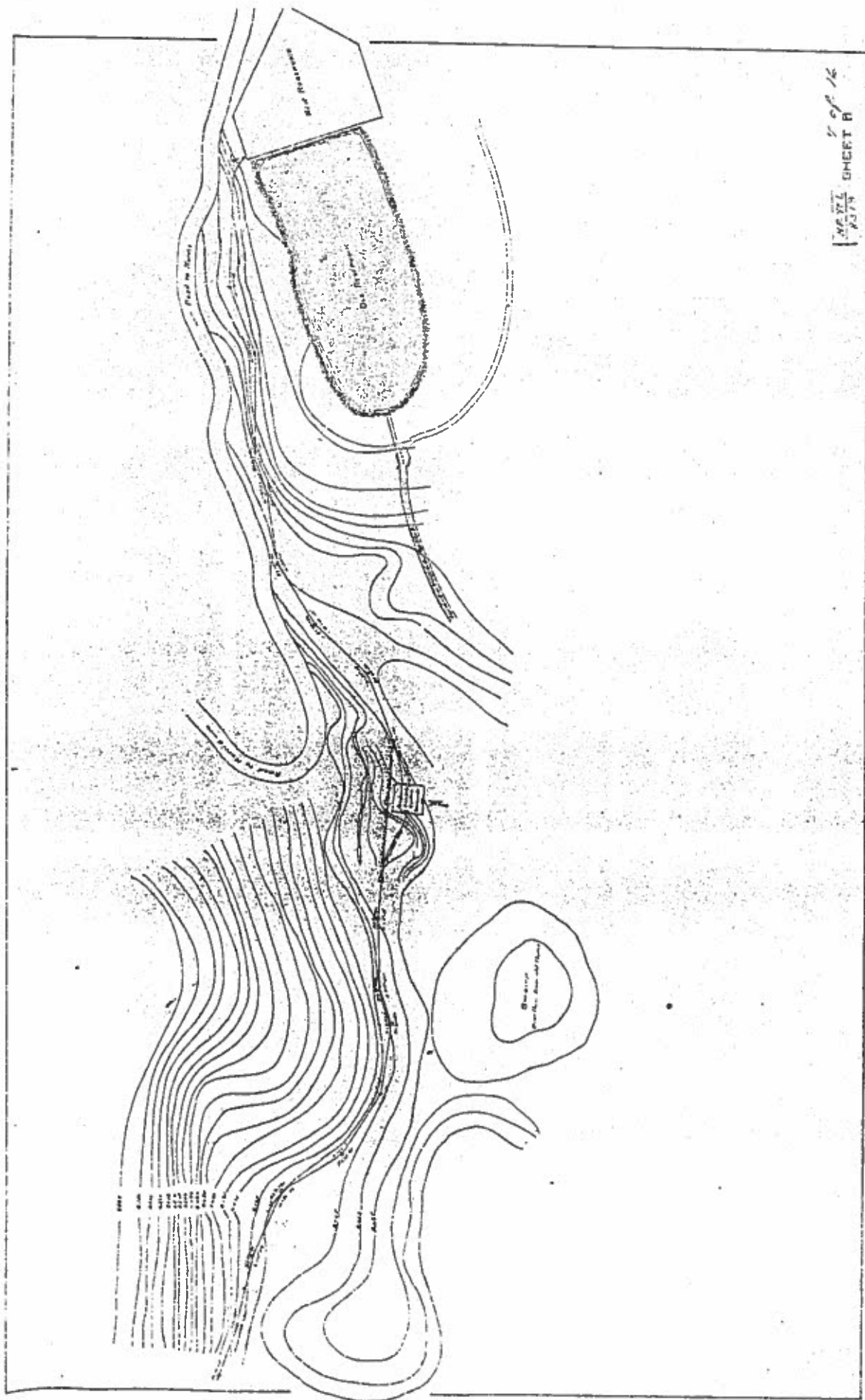


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5 of 16

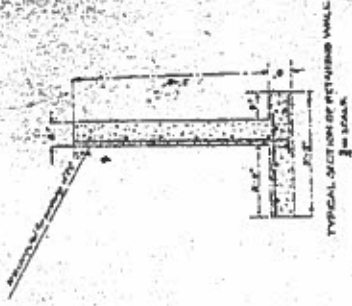
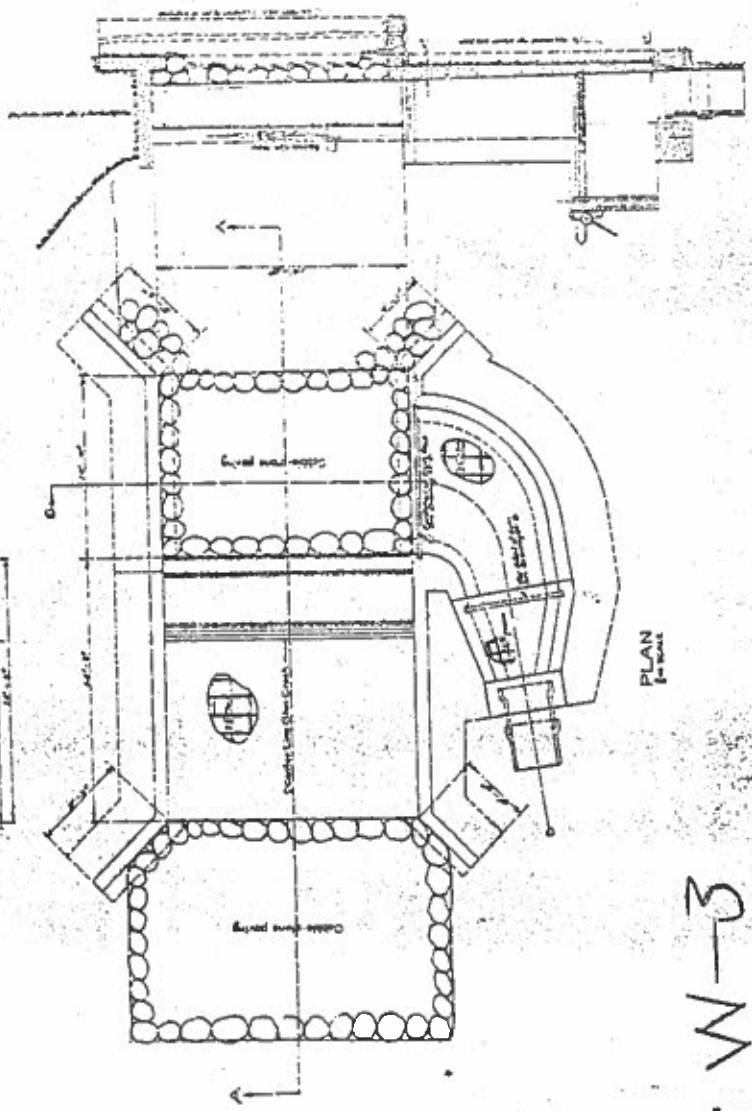
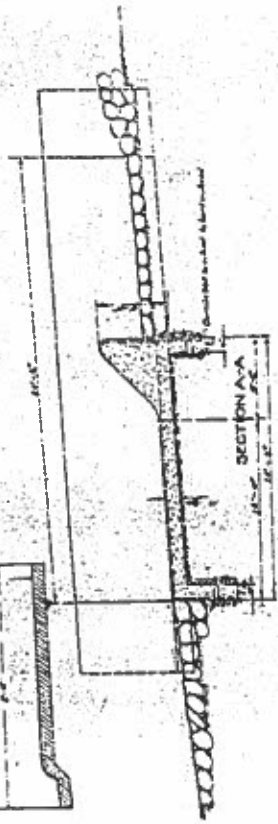
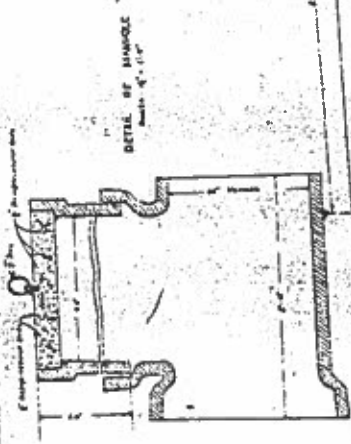
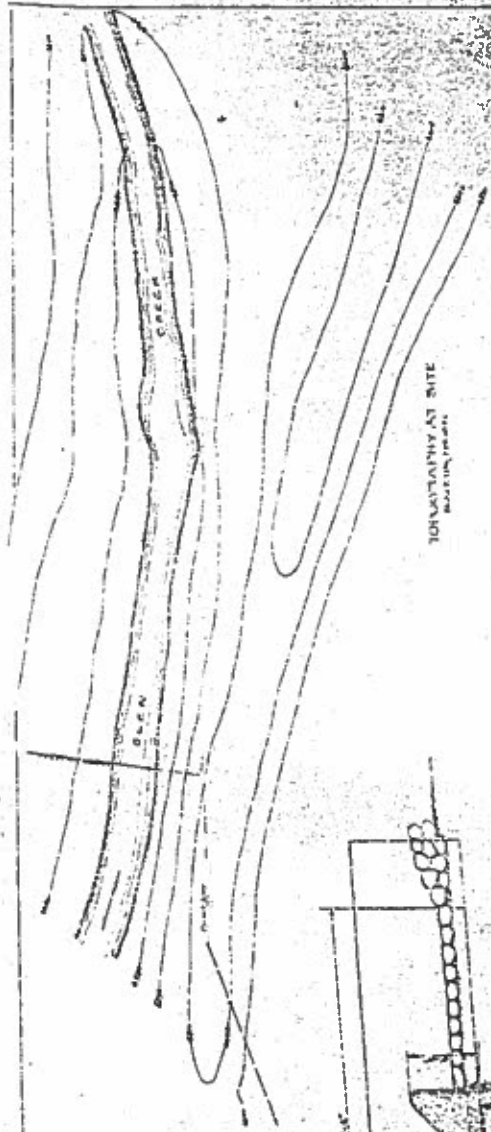
Sheet 3

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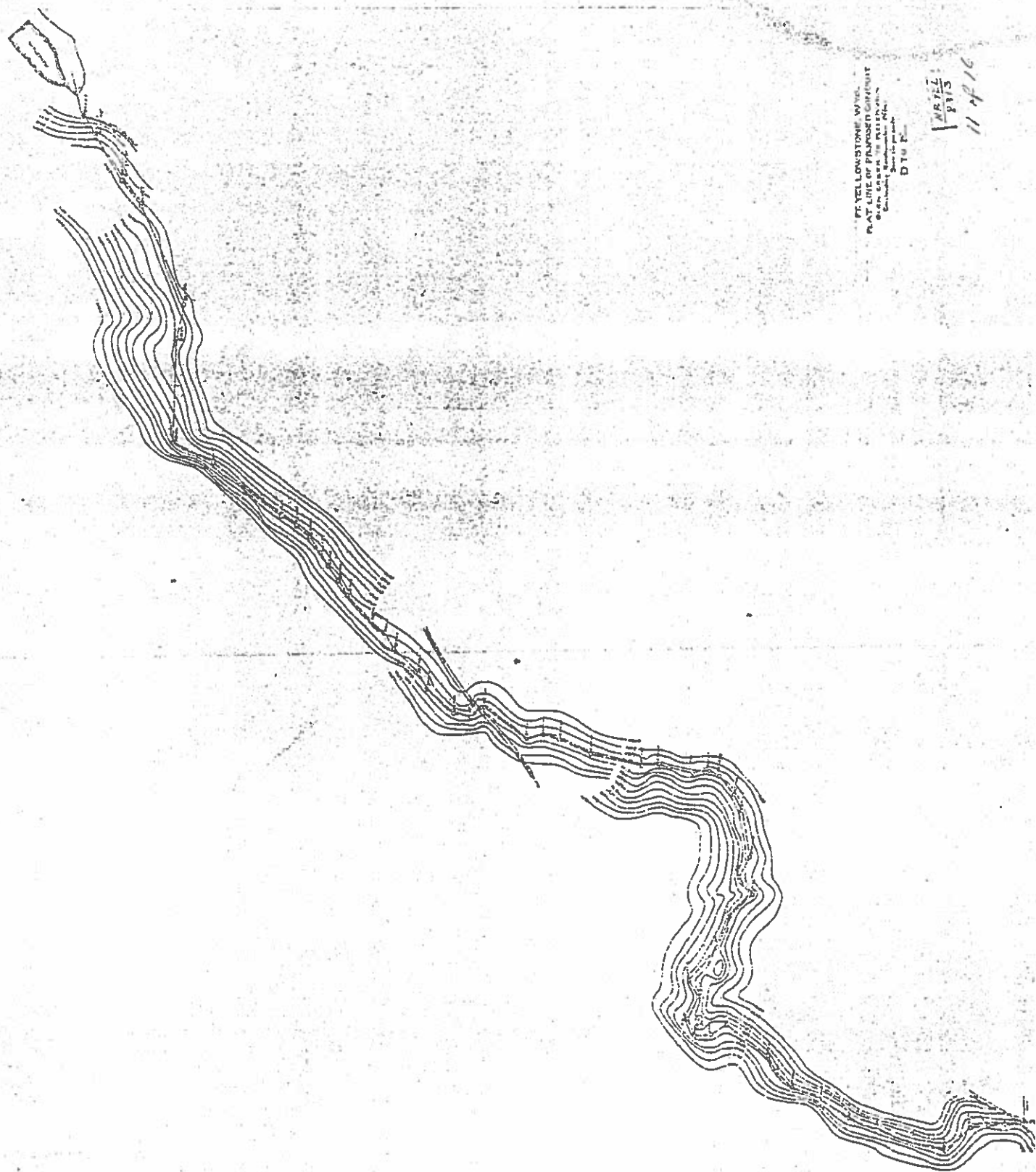


1 of 12
SHEET B
1379



9 of 12
 PORT YELLOWSTONE, WYO.
 PROPOSED WATER SYSTEM
 DIVERSION WEIR AND HEAD WORKS
 AT INTAKE ON GLEN CREEK
 U.S. GEOLOGICAL SURVEY
 OFFICE
 JANUARY 1938
 69-B

W-3



FT. YELLOWSTONE, WYOM.
PLAT. LINE OF PRINCIPAL CIRCUMFERENCE
Scale 1:50,000
D.T. 10

ART. 12
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