UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

REPORT ON

THE BOISE, IDAHO FLOOD

August 20, 1959

by

Boise National Forest
and
Intermountain Forest and Range Experiment Station

Forest Service

U. S. Department of Agriculture

M—5123

U. S. GOVERNMENT PRINTING OFFICE

16—73806-1

REPORT ON

THE BOISE IDAHO FLOOD

August 20, 1959

by

Boise National Forest
and
Intermountain Forest and Range Experiment Station

Forest Service

U. S. Department of Agriculture

REPORT ON
THE BOISE, IDAHO FLOOD
August 20, 1959

by

Boise National Forest
and
Intermountain Forest and Range Experiment Station
Forest Service
U. S. Department of Agriculture

In the early morning hours of August 20, 1959, a deluge of water, mud, rocks, and debris poured into the City of Boise in the worst flood in the city's recent history. Water from a high intensity summer rain storm, falling on watersheds recently denuded by range fires, flowed down the steep slopes of the Boise hills, collected in gulches leading into the city and rural areas to the east, and formed walls of water, mud, and rocks that hit with devastating force. Only through the timely efforts of the City Police Department and the Ada County Sheriff's office in rousing sleeping citizens with howling sirens and loudspeakers was the loss of life averted. Over 50 square blocks of the city were affected and damage has been estimated at a half-million dollars. At least six months will be required to complete the cleanup job and repair the damages.

In the rural areas to the east of Boise extensive damage was sustained to buildings, fields, and livestock. Highway 21 between Boise and Lucky Peak Reservoir was blocked in several places by mud and rocks up to 3 feet in depth.

It was apparent to the Land Management agencies that the severity of the flood and the nature of the damages were a direct result of the severely burned watersheds on which the heavy rain fell. It is the purpose of this report to describe in detail the character of the storm, the nature of the damage, and the condition of the watersheds before and after the storm.

STORM CHARACTERISTICS

Rain began falling in Boise about 9:00 P.M., August 19, 1959. Information from the U. S. Weather Bureau, Boise Municipal Airport, shows that several light to fairly heavy showers fell intermittently in the area during that evening and early the next morning. These showers were not of sufficient intensity to cause flooding, but they contributed significantly to the flood by saturating the upper soil layers to a limited depth before the main storm struck.

At 4:15 A.M., August 20, a severe thunder storm moved in from the southwest and apparently centered over the watersheds to the north and east of Boise. At the Weather Station, Municipal Airport, south of Boise, total precipitation during the period from 9:00 P.M. on the 19th to 5:00 A.M. on the 20th was 0.64 inches. During the peak of the storm at 4:18 A.M. a 10-minute precipitation of 0.26 inches fell, or a rate of 1.56 inches per hour. There is every reason to believe that both the total precipitation and the peak intensity were considerably higher than this on the watersheds above the city. There were no official measurements of precipitation available from the storm center, but sufficient measurements from adjacent points on the Boise National Forest, listed below, show that the storm was fairly general and covered a large area. The storm ended at the Weather Station at 4:50 A.M. Four unofficial estimates of the amount of precipitation were obtained from individuals residing near the storm center as measured in open containers. These are listed below also.

Station	Inches of precipitation
U. S. Weather Station	.64
Lucky Peak Dam	1.26
Shafer Butte	.98
Arrowrock Dam	.30
Thorne Creek Butte	.67
Boise Basin Expt. Forest (upper)	.85
Boise Basin Expt. Forest (lower)	.90
Idaho City	.70
Sunset Peak	.69
Hawley Mountain	.88
Owl Creek	1.02
Unofficial Station	
Barber Trailer Court	1.75
Hawkin's Ranch	1.00
Robie Creek	1.50
Pine Creek	1.45

The map in figure 1 shows these precipitation values plotted at their respective locations; the unofficial readings are encircled.

In an attempt to get more information on the amount and distribution of the rainfall on the flood area, a series of soil moisture samples were collected following the storm. By determining the moisture percentage by weight, together with the depth of penetration and the bulk density of the soil, fairly accurate estimates can be made of precipitation that penetrated the soil. By selecting sites where the surface was level and the

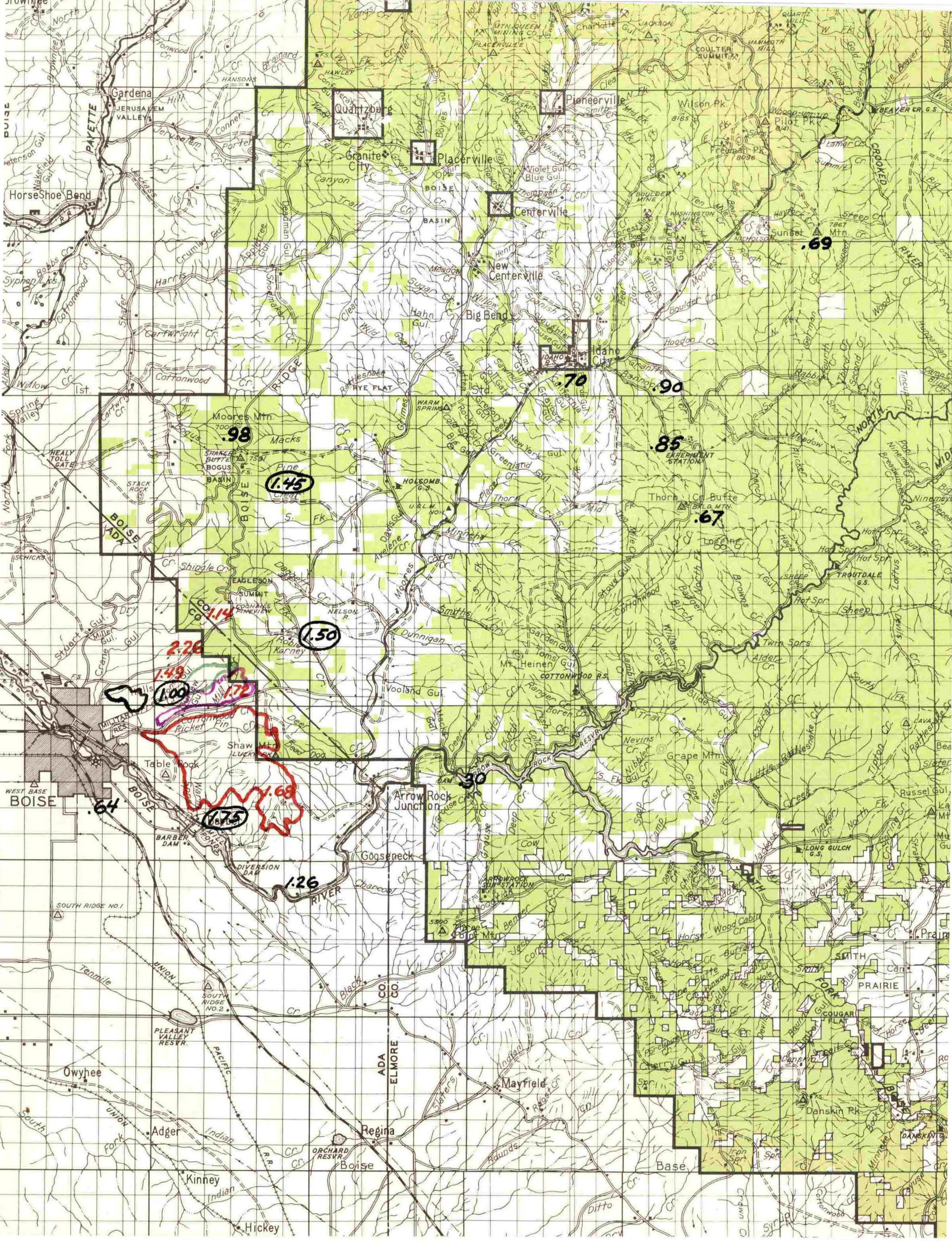
Figure 1. A map of Boise and adjoining lands showing the areas burned in 1957, 1958, and 1959. Also shown are precipitation measurements at certain locations.

LEGEND

Fire	Year burned	Color
Rocky Canyon Fire	1957	violet
Tollgate Fire	1958	green
Eighth Street Fire	1959	black
Lucky Peak Fire	1959	red

Precipitation Stations

Official stations	-	black figures
Unofficial readings	-	black, encircled figures
Soil moisture stations	-	red figures



Gardena
Horseshoe Bend
Quartzburg
Placerville
Granite City
Pioneerville
Centerville
New Centerville
Big Bend
Idaho City
Moores Mtn.
Wilson Pk.
Pilot Pk.
Freeman Pk.
Sunset Mtn
Thorn Cr. Butte
Mt. Heinen
Grape Mtn
Shaw Mtn
Table Rock
Arrow Rock Junction
Gooseneck
Mayfield
Owyhee
Adger
Kinney
Hickey
Regina
Boise
BOISE
Danskin Pk.
Prairie
ADA
ELMORE
.98
1.45
1.50
1.14
2.26
1.49
1.09
1.72
1.68
1.75
.64
1.26
.30
.70
.90
.85
.67
.69

vegetative cover adequate to prevent run-off, the estimate of total precipitation made by the soil moisture method is a fairly good approximation. These values are shown on the precipitation map in red pencil and listed below:

Soil moisture Station	Inches of precipitation
Maynard Gulch	1.68
Cottonwood Ridge	1.72
Hull's Gulch (lower)	1.49
Hull's Gulch (upper)	1.14
Hull's Gulch (middle)	2.26

Judging from what information is available, the storm was not unusually severe, but certainly in the category of a high intensity rain. Maximum intensities at the storm center will never be known; it is, of course, the intensity of the rainfall even for a short period that causes the damage in a flash flood, rather than the total amount of precipitation.

THE DAMAGE

The principal damage sustained by the City of Boise and its residents was flooded basements, mud-covered lawns, and clogged sewers. The deluge that struck the city came from Cottonwood Creek and its tributaries. One week after the flood it was estimated that 200 tons of mud had been removed by the city and untold quantities are left to be washed gradually into the storm sewers. The total clean-up will take months. Newspaper clippings, included with some copies of this report, give a vivid written and pictorial account of the damage. The map in figure 2 shows the extent of flooding within the city.

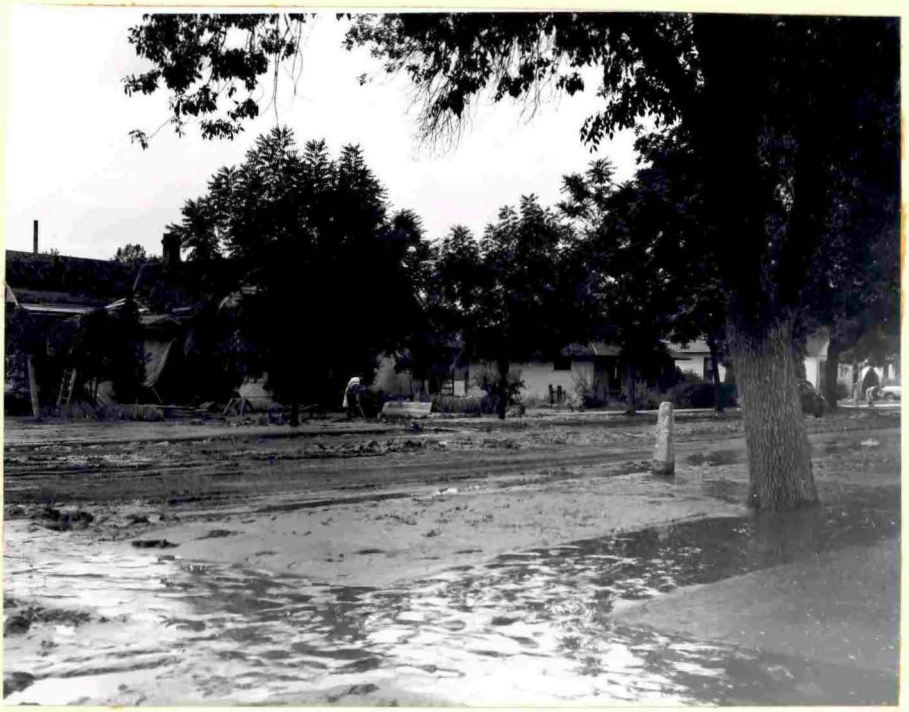
Outside the city, damage was heavy in Curlew Gulch where the policemen's lodge was totally destroyed and the Hawkins ranch severely damaged. At the mouth of Warm Springs Creek, the Eckert ranch was ripped and partially covered with mud and boulders. Hay was washed away, soil covered with mud and rocks, and buildings and equipment damaged. Several head of sheep were lost both at the Hawkins and Eckert ranches.

Farther to the east, Squaw Creek, Maynard Gulch, Highland Valley Gulch, and two minor drainages above Lucky Peak Dam produced mud-rock flows. The flow from Maynard Gulch caused the principal damage to the highway and railroad track. Warm Springs Creek also carried mud and debris across the highway. A smaller amount of sediment and debris was deposited on the highway above Lucky Peak Dam from one of the minor drainages.

The accompanying photographs with their captions help to tell the story of the damage.

Damage to property near the mouths of the major drainages was heavy. The Boise City Police clubhouse was totally destroyed.

Lawns were covered with several inches of silt and sand. Many basements were flooded, with heavy damage to furniture and other items.



Much time and effort will be needed to clean up the portion of east Boise hit by the flood waters.

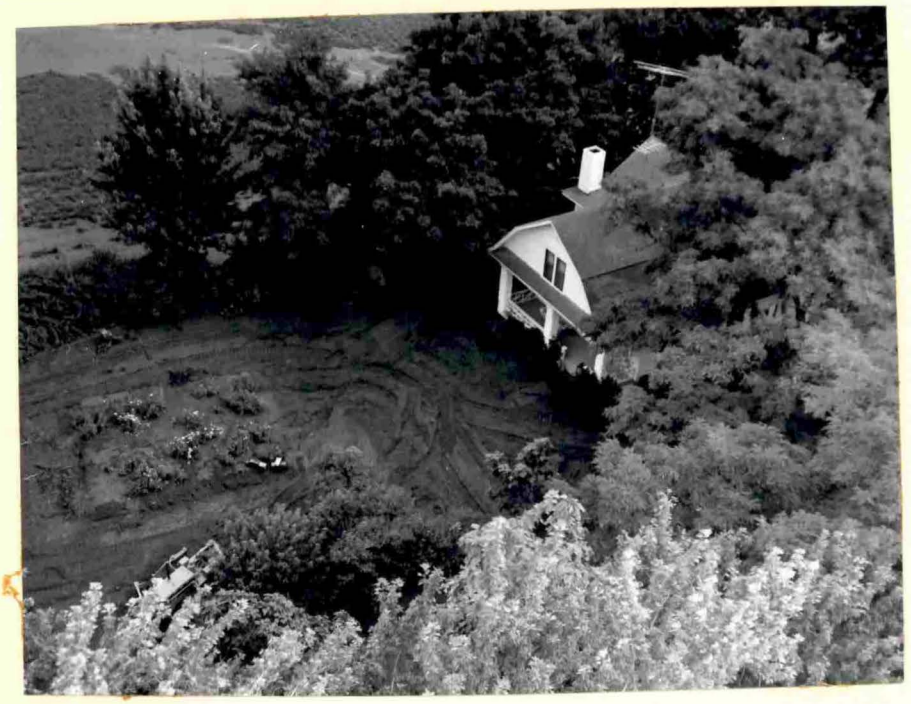
Heavy damage was done by the waters from Cottonwood Creek to the irrigation canals in the east Boise area.

Mud and rock cover a large area to depths of 2 to 6 feet between the mouth of Maynard Gulch and Highway 21. At this point the highway was blocked for several hours.

An amount of water, soil, and debris equaling or exceeding that which roared out of Maynard Gulch came down Warm Springs Creek. Both of these watersheds were burned off in the fire of August 3, 1959.

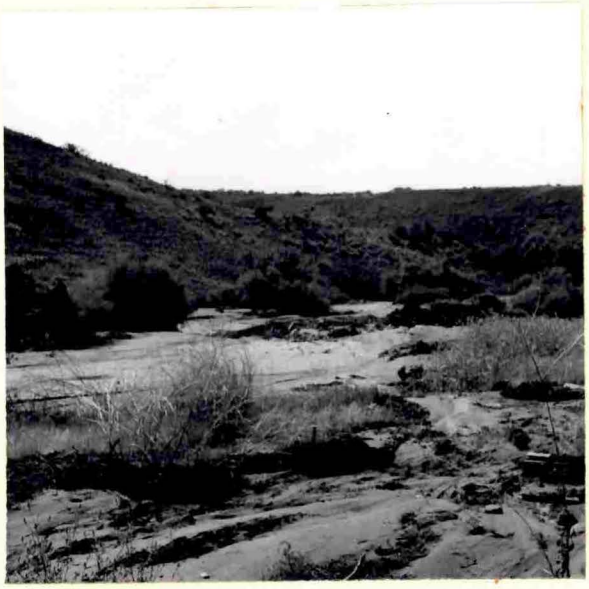
Flood waters from Cottonwood Creek cut a wide channel as they passed the Aldape Ranch. Run-off from the areas burned in both the Lucky Peak fire of 1959 and the Rocky Canyon fire of 1957 came together at the mouth of Picket Pin Creek.

The watershed drained by this small gulch near the Highland Valley road was partially burned off in the August 3, 1959, fire. A large amount of water and debris came down the dry stream channel and filled a catch basin at the edge of Highway 21.



The Eckert ranch home, surrounded by mud and rocks, near the mouth of Warm Springs Creek.

Pastures and hay fields of the Eckert ranch, near Barber, was severely damaged. Large amounts of rock will make rehabilitation of the land difficult.



Flood waters from Curlew Gulch destroyed the City Police clubhouse and narrowly missed two other homes. The upper Curlew watershed was burned off by a fire of 1958. Another portion was burned during the Rocky Canyon fire of 1957.

THE WATERSHED

The Drainages Involved

Ten streams or gulches produced mud-rock flows in the flood. Listing them from west to east they are: Freestone Gulch, Curlew Gulch, Cottonwood Creek, Picket Pin Creek, Warm Springs Creek, Squaw Creek, Maynard Gulch, Highland Valley Gulch, and two minor drainages above Lucky Peak Dam. Freestone Gulch and Curlew Gulch flow together approximately 1½ miles before reaching the city limits of Boise. Picket Pin Creek is a tributary of Cottonwood Creek whose confluence with Freestone Gulch occurs just at the edge of Boise. Thus, there are four drainages converging into a single channel northeast of the Veterans Administration Hospital on the edge of the City of Boise. These are the only drainages that contributed directly to the damage within the city.

Warm Springs Creek produced the damage to the Eckert ranch and some of the flooding of Highway 21. Maynard Gulch also contributed to the highway flooding as did the smaller drainages to the east.

The map in figure 1 shows the pattern of these drainages.

From 1871 to 1947 Boise experienced 31 floods which originated from these watersheds; approximately one-half of these were caused by local high intensity rainfall within the foothills during the summer season. The others were caused by spring snow melt.

The Survey Report of the Boise River Watershed made by the Intermountain Forest and Range Experiment Station in cooperation with the Soil Conservation Service in 1949 contains a predicted flood path for various drainages based on an assumed discharge of 4,000 c.f.s. A comparison of the damaged area resulting from the August 20 flood and the predicted damage area for Cottonwood Creek contained in the 1949 report shows excellent agreement.

The Condition of the Vegetation

It is of great significance that the vegetation on these watersheds was either completely eliminated by recent burns or was only partially recovered from burns of 1957 and 1958. The map in figure 1 shows the area covered by four fires. They are:

Rocky Canyon Fire,	1957	2,100 acres
Tollgate Fire,	1958	650 acres
Eighth Street Fire,	1959	400 acres
Lucky Peak Fire,	1959	9,517 acres

The headwaters of Maynard Gulch, Squaw Creek, Warm Springs Creek, Picket Pin Creek and smaller drainages to the east lie within the recent Lucky Peak fire. These watersheds are completely devoid of vegetative cover within the burned area. Being a very hot fire burning at the peak of the fire season, nothing was left in its wake except scattered stumps of sagebrush. Most of the grass cover was cheatgrass which was consumed completely by the fire. The perennial bunchgrasses, scattered sparsely throughout the area--principally on north exposures--were burned level to the ground leaving no protection to the soil.

This fire occurred on August 3, and because of extremely hot, dry weather in the intervening period between the burn and the rainstorm, no vegetative regrowth had occurred.

The same situation, of course, exists on the area recently burned in Freestone Gulch in the Eighth Street fire.

The area burned in 1958 in the Tollgate fire lies principally in Curlew Gulch. The watershed was still in critical condition insofar as inadequacy of vegetative cover was concerned. It gave very little protection to the soil when the rains came.

The Rocky Canyon fire of 1957, principally on the northwest side of Cottonwood Creek, covered most of the Fivemile Creek drainage and part of Orchard Gulch. Both of these small tributaries to Cottonwood Creek produced mud-rock flows which washed out 2 or 3 miles of the Rocky Canyon road.

Extensive and detailed aerial and ground observations established beyond question the fact that the flood waters that poured into Boise and vicinity originated on those areas where plant cover had been destroyed by fires.

The Ground Condition

The slopes leading into all of the flood-producing drainages are riddled with sheet erosion, rills, and gullies. The ground surfaces appear as if they had been swept by a broom and trenched by a giant rake. Small rills join to form larger rills and these in turn converge to form gullies leading to the stream channels. These channels are swept clean of all vegetation and scoured to bedrock in many instances. It is evident that the flow progressed by increasing spurts as one temporary dam after another broke. Finally, a huge wall of water crushed its way down the creeks and was gone almost as quickly as it came.

Three successive 100-foot transects were established for the purpose of determining the frequency of rills in the upper reaches of Warm Springs Creek. In the first 100 feet, 86 rills were counted; 84 in the second 100 feet; and 78 in the third 100 feet. These rills measured from 1 inch

to 18 inches in width and 1/2 inch to 8 inches in depth. This rill intensity was measured at approximately 100 feet below the crest of the divide. Channel cutting to a depth of 6 feet, 300 to 400 yards from the top of Warm Springs Creek basin was measured.

Measurements of peak water flows are not available but will be published later by the Geological Survey. Rough measurements as evidenced by the marks on the canyon walls in Maynard Gulch are listed below:

Grade (Percent)	Depth (feet)	Width (feet)
6	12	90
8	12	75
7	16	55

These measurements give a clue to the size of the flow which ripped this canyon. On curves in the channel, where the flow was forced to change its course, water marks as high as 30 feet above the channel bottom were evident.

In addition to the damage that this flood inflicted on lower areas, the damage to the soil mantle on the watersheds themselves with its far-reaching effects on forage production is tremendous. Livestock carrying capacity will be seriously reduced. Furthermore, the entire area within the Lucky Peak, Tollgate, and Rocky Canyon burns is deer winter range. The fires virtually eliminated all browse on these portions of the range. Unless a much heavier than normal deer harvest is taken this fall, over-stocking will undoubtedly result on the adjacent unburned range.

It is difficult to estimate the number of deer that normally winter on the areas that have been burned and eroded. In trend counts made each March, 320, 313, and 347 deer were tallied in 1955, 1956, and 1957, respectively, in the Warm Springs drainage. These represent, of course, only a portion of the actual numbers of deer in Warm Springs Creek, and an even smaller portion of actual numbers in the entire burned area.

Photographs with captions are included here to show the condition of these watersheds.

The Unburned Watersheds

The precipitation pattern indicates that areas adjacent to the flooded drainages, particularly Hull's Gulch west of Cottonwood Creek, received approximately the same amount of water as the damaged watersheds. Hull's Gulch did not flood. There is evidence that the main channel carried an above normal flow of water, but very little sediment was brought down and no damage resulted.

Storm run-off rapidly cut gullies in the exposed soil. This SSW slope of 35 percent had an average of 83 rills per 100 feet along the contour. Rills ranged in depth from 1/2 inch to 8 inches, and from 1 to 18 inches in width.

Future rains will continue to wash soil down these completely bare slopes. It will probably be many years before perennial vegetation becomes well established under a revegetation program.

A range fire of August 3, 1959, destroyed almost all vegetation, leaving the coarse, granitic soil completely bare. Erosion channels on the steep slopes are easily visible in these photographs. Darker-colored patches are ash-covered areas where the soil stayed in place.

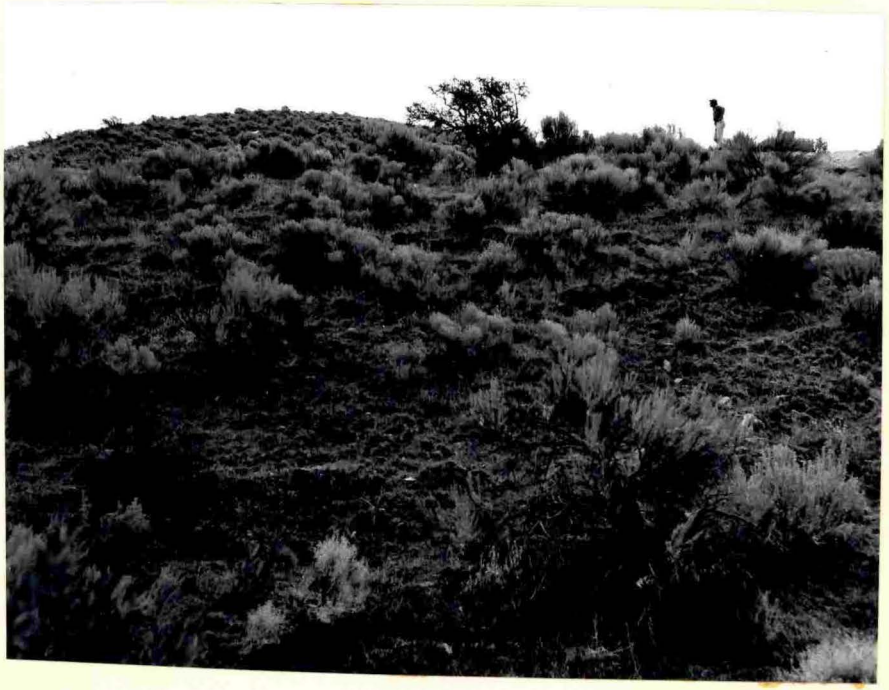
View of Maynard Gulch watershed from the Boise Ridge, near Lucky Peak. This was the source of much of the tremendous run-off that surged out of Maynard Gulch and across State Highway 21 near Barber.

Upper slopes of Picket Pin Creek. Water running off these slopes--bared by the fire of August 3, 1959--constituted a major portion of the flood waters that caused extensive property damage in the east portion of Boise.

View of a portion of the upper reaches of Warm Springs Creek. Torrents of water, rock, and soil caused great damage to Eckert's ranch at the mouth of Warm Springs Creek.

Storm run-off cut many rills and gullies on the slopes of Curlew Creek. This area burned during the summer of 1958, and had a light cover composed primarily of annual grass and forbs.

For 1½ miles upstream from the mouth, Maynard Gulch cuts through an unburned area. These photographs show the force of the flood water as it came down from the upper reaches of the watershed that had been burned.



Unburned portion of the lower Maynard Gulch watershed. Vegetation on north-facing slopes (above) contains more perennials such as bluegrass, fescue, sagebrush, and rabbitbrush. South-facing slopes (below) are dominated by annuals such as cheatgrass, fiddleneck, and groundsmoke, with a few rabbitbrush and sagebrush shrubs. Although some run-off occurred from these unburned slopes, soil erosion was negligible.

The watersheds of Hull's Gulch and adjacent Crane Creek above the "Highlands" are in better condition than those on the adjacent flood source drainages because the vegetation has not been burned for many years. There is no evidence of overland flows originating from this storm in Hulls Gulch and Crane Creek, except for small isolated spots where the vegetative cover has been depleted by road cuts or other disturbances.

The vegetative cover on these drainages, however, is principally cheatgrass which is not ideal watershed protection. It is highly variable in density from year to year due to changes in the weather pattern as well as to smut infection, and it is, of course, extremely flammable.

The only assurance of permanent safety on these watersheds is to revegetate them to perennial grasses.

The effect of vegetation on infiltration and consequently on erosion control is further shown by soil samples taken side by side in burned and unburned surfaces. Two samples at the head of Picket Pin Creek on a 15 percent slope, northeast exposure, showed an average depth of moisture penetration to be 7 inches in the burned and 10 inches in the adjacent unburned area. This would suggest that 30 percent of the rainfall ran off the burned surface. Considering the highly erodible nature of the loose, granitic soils of this area, a third of an inch of water flowing over its surface could easily cause the degree of damage observed. Studies conducted by the Forest Service on these cheatgrass covered slopes have shown that a ground cover of 70 percent or more is necessary to prevent overland flow of water during high intensity rainstorms.

Photographs of Hulls Gulch and Crane Creek are included here to show the undamaged condition of their channels.

POTENTIAL THREAT

Because of the vast acreage on which plant cover has been totally destroyed and the additional large acreage supporting inadequate cover to protect against overland flow, a repetition of a storm of equal intensity and amount would probably cause two or three times the damage in the City of Boise as was caused by the flood of August 20. This prediction is based upon these observations: The drainage pattern is now definitely established and no resistance would be encountered by overland flow; huge boulders and other debris have been torn loose and deposited in low level areas of the stream channels and on surrounding flood plains. This material is sufficiently loose to be moved readily by another surge of flood water. It should be pointed out in this connection that while the flood plains extending for 1½ miles beyond the corporate limits of Boise are covered by vast areas of cobbles and boulders, no large rocks were observed in the downtown area. East of the Hawkins ranch, just above the confluence of Curlew Gulch and

Crane Gulch, 1/4 mile above a recently developed housing area (Highlands). No channel cutting resulted from the storm; however, if the large Crane watershed is ever burned there will be grave danger to the housing development at the mouth.

Hull's Gulch, at a point 200 yards upstream from the Boise Water Corporation's reservoir No. 1, shows only a small amount of new channel cutting. This watershed absorbed most of the rainfall and no damage occurred to property located at the mouth of the gulch.

Freestone Creek, boulders (that are estimated to weigh up to 15 tons each) were deposited on pasture land. Piles of brush, trees, and stumps line and litter the lower levels of the present established water channels. This material would be subject to easy transport by another flood.

LAND OWNERSHIP PATTERN

Only a small part of the recent burns and consequently of the flood source area, lies within the boundary of the Boise National Forest. Approximately 500 acres within the forest boundary are involved and of that only about half is Federally owned.

The Bureau of Land Management controls additional Federal land in scattered parcels throughout the remainder of the critical areas, but in the aggregate, it amounts only to about 2,000 acres. The remainder, or about 85 percent of the area, is privately or State owned.

RECOMMENDATIONS

Considering the condition of these watersheds as a result of the fires and the flood, and considering the increased potential for additional or worse damage resulting from future storms and snowmelt, it seems essential that measures be taken to rehabilitate the area. These measures might be divided into two general categories, (1) channel repair and (2) watershed revegetation.

Channel Repair

With the tremendous amounts of mud, silt, rocks, and debris that are now lying in the lower reaches of Cottonwood Creek, it is inevitable that normal spring run-off, to say nothing about possible future heavy rains, will bring additional material into the City of Boise. The channel should be cleared as a minimum preventative measure. Additional work such as catchment basins, dikes, and flumes probably are needed. It will be many years before the watersheds are in sufficiently good condition to hold back floods of the size of the one just experienced. Until such time that protective plant cover is restored, down-stream measures will have to be provided to accommodate the runoff.

Watershed Revegetation

Because of the steep slopes and their rilled condition revegetation of the watersheds above Boise will not be an easy task. Even on undepleted soil, re-establishment of perennial grasses and shrubs on these areas is slow and difficult because of the hot south exposures and the low precipitation.

It is very unlikely that simple reseeding without intensive site preparation measures would be successful. Seed sown on these hillsides now would have a very poor chance of becoming established if indeed it did not get completely washed away.

Site preparation in the form of contour terracing or furrowing would seem to be the only means of insuring the success of a revegetation project. Other intensive measures such as mulching and fertilizing might also be necessary.

In view of the ownership pattern of these lands, such an ambitious endeavor is very difficult to finance. Until the land can be acquired by the public, either City, County, State, or Federal, the hope of a rehabilitation program is dim.

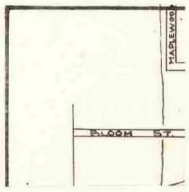
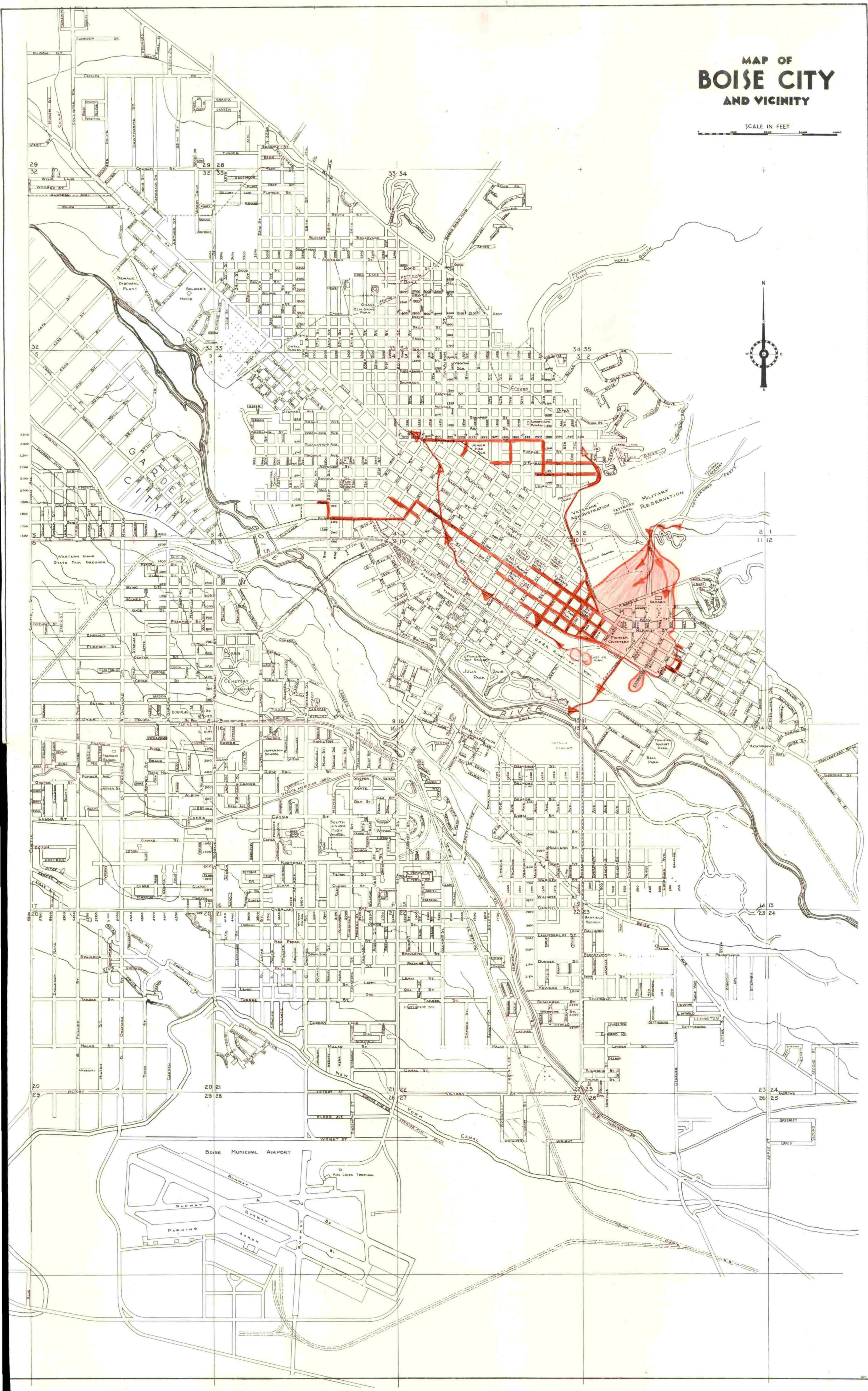


Figure 2


MAP OF
BOISE CITY
AND VICINITY
SCALE IN FEET
N
GARDEN CITY
SEWAGE DISPOSAL PLANT
SOLDIER'S HOME
WESTERN IDAHO STATE FAIR GROUNDS
MILITARY RESERVATION
VETERANS' ADMINISTRATION
VETERANS' HOSPITAL
MILITARY CEMETERY
MEMORIAL PARK
ELM GROVE PARK
LOWELL SCHOOL
WHITTIER SCHOOL
JUNIOR HIGH SCH.
LONGFELLOW SCHOOL
HIGH SCHOOL
CARNEGIE LIBRARY
CENTRAL SCHOOL
STATE HOUSE
CITY HALL
COUNTY COURT HOUSE
LINCOLN SCHOOL
ARMORY
PIONEER CEMETERY
EAST JR. HIGH
MUNICIPAL ART GALLERY
JULIA DAVIS PARK
BOISE RIVER
BOISE JUNIOR COLLEGE
MUNICIPAL TOURIST PARK
BALL PARK
NATATORIUM
MORRIS HILL CEMETERY
JEFFERSON SCHOOL
FRANKLIN SCHOOL
SOUTH JUNIOR HIGH SCHOOL
GARFIELD SCHOOL
HAWTHORNE SCH.
HULLS GULCH
COTTONWOOD CREEK
U.P.R.R. RIGHT OF WAY
UNION PACIFIC FREIGHT
RAILROAD YARDS
NAMPA MERIDIAN CANAL
NEW YORK CANAL
U.S. HIGHWAY NO. 30
STATE HIGHWAY NO. 44
STATE HIGHWAY NO. 21
BOISE MUNICIPAL AIRPORT
AIR LINES TERMINAL
RUNWAY
PARKING
APRON
UNION PACIFIC R.R.