FLOOD PLAIN INFORMATION

HOBBLE CREEK

SPRINGVILLE, UTAH

PREPARED FOR THE CITY OF SPRINGVILLE
BY THE DEPARTMENT OF THE ARMY, SACRAMENTO DISTRICT CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
JUNE 1973

CONTENTS

Page

PREFACE. i

BACKGROUND INFORMATION 1

SETTLEMENT. 1

THE STREAM AND ITS VALLEY 2

DEVELOPMENTS IN THE FLOOD PLAIN 2

FLOOD SITUATION. 3

SOURCES OF DATA AND RECORDS 3

FLOOD SEASON AND FLOOD CHARACTERISTICS. 3

FACTORS AFFECTING FLOODING AND ITS IMPACT 4

Obstructions to Floodflows 4

Flood Damage Reduction Measures. 5

Other Factors and Their Impacts. 5

Flood warning and forecasting 5

Flood fighting and emergency evacuation plans . . . 8

Storage of floatable materials in flood plain areas 8

PAST FLOODS. 9

SUMMARY OF HISTORICAL FLOODS. 9

FLOOD RECORDS 9

FLOOD DESCRIPTIONS. 10

May 1952 10

FUTURE FLOODS. 15

INTERMEDIATE REGIONAL FLOOD 15

STANDARD PROJECT FLOOD. 16

FREQUENCY 17

HAZARDS OF LARGE FLOODS 17

FLOODED AREAS AND FLOOD DAMAGES 18

OBSTRUCTIONS. 19

VELOCITIES OF FLOW. 21

RATES OF RISE AND DURATION OF FLOODING. 21

PHOTOGRAPHS, FUTURE FLOOD HEIGHTS 22

GLOSSARY 27

CONTENTS (Continued)

TABLES

TABLE		Page
1	PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS	16
2	OBSTRUCTIVE BRIDGES ACROSS HOBBLE CREEK	20
3	RATES OF RISE AND DURATION OF FLOODING	22

FIGURES

FIGURE		
1	Bridge at 800 East Street	5
2	Culvert at 700 East Street	5
3	Bridge at 300 East Street	6
4	Bridge at 200 East Street	6
5	Brookside Subdivision during the snowmelt flood of May 1952	11
6	Service Station at Main Street during snowmelt flood of May 1952	13
7	Bridge at 100 West Street during snowmelt flood of May 1952	14
8	Bridge at Center Street during snowmelt flood of May 1952	14
9	Future flood heights at 3200 East Street	23
10	Future flood heights at intersection of 400 East Street and Buckley Avenue	24
11	Future flood heights at Green Acre Estates near 400 North and 400 West Streets	25

PLATES

PLATE		
1	General Map	Opposite page *i*
2	Stage Hydrograph	At end of report
3	index Map	At end of report
4-5	Flooded Areas	At end of report
6-9	Highwater Profiles	At end of report
10	Cross Sections	At end of report

+ *NOTE* +

Unless otherwise indicated, all photographs in this report were taken by Corps of Engineers personnel.

PREFACE

The purpose of this report is to present information on the flood hazard along Hobble Creek in the vicinity of Springville, Utah. Records indicate that residential and agricultural damage occurred in the study area during snowmelt floods in 1862 and 1952. Cloudburst runoff and other snowmelt floods undoubtedly occurred but damages were unrecorded. Studies made for this report show that floods larger than those of the past could occur in the study area. Floods on Hobble Creek could result from snowmelt, cloudbursts, or general rainstorms over the watershed. This report contains information on past floods, and maps, profiles, and cross sections that indicate the approximate extent and depth of inundation from large floods that can reasonably be expected to occur in the future. For the purpose of this report these floods have been designated as the Intermediate Regional and Standard Project Floods.

This report was prepared at the request of the city of Springville and Utah County, with the indorsement of the Utah Division of Water Resources, under the continuing authority provided the Corps of Engineers in Section 206 of the 1960 Flood Control Act (Public Law 86-645), as amended by the 1966 and 1970 Flood Control Acts. It is intended that this report be used by the city of Springville, Utah County, and other flood plain users, in developing and using flood plain areas in such a way that flood hazards and flood damages are minimized. The report provides a basis for further study and planning for optimum use and development of flood prone areas through zoning and subdivision regulations, construction of flood control projects, or by a combination of these and other approaches to reduce flood hazards and flood damage. Recommendations or plans for the solution of flood problems in the study area are not included in this report. Neither does it extend any Federal *authority over zoning or other regulation of flood plain uses. Information contained in this report would also be useful in programs dealing with the ecological and environmental aspects of the study area and its land-use role as part of its surroundings.*

The assistance and cooperation of the U.S. Bureau of Reclamation, the Utah State Division of Highways, Utah County, the city of Springville, the Springville Herald, and individuals who directly or indirectly aided in the preparation of this report are gratefully acknowledged.

The city of Springville and Utah County will make the information in this report available to all interested agencies and individuals. Copies of the report and information on its use are available from that office. The Sacramento District of the Corps of Engineers will, upon request, provide technical assistance to local, State, and Federal, agencies in the interpretation and use of data presented herein, and will provide other available data related thereto.

BACKGROUND INFORMATION

SETTLEMENT

Soon after the Mormon pioneers arrived in Utah in 1847, Brigham Young sent an exploring party into the regions south of Salt Lake City to look for sites that could be settled. The Hobble Creek area of Utah Valley was chosen as one of these areas, and in September of 1850 several families established a settlement there. Traders originally named the area Hobble Creek but the settlers later changed the name to Springville. The settlers constructed a fort just north of Hobble Creek near the present intersection of 200 North and 200 West Streets. Despite many hardships, the community flourished. Dams and canals were constructed for irrigation; the city grew rapidly; and in 1852 Springville was incorporated.

From these early agricultural endeavors, the people in Springville expanded into commercial and industrial activities, partly due to a scarcity of water. In 1851, a flour mill was built and in subsequent years molasses mills, woolen mills, and a sugar factory were started. Merchandising began in the old fort in 1852. Since many items had to be brought to the area by wagon, freighting and road construction became important businesses. With the advent of the railroad in the 1870's, many freighting firms turned to railroad construction and eventually to highway construction. At present, in addition to many construction firms, whose headquarters are located there, Springville has a diversified economy which includes creosote and cast iron pipe manufacturing, cattle raising, and general farming. Springville is a growing residential area, with a cultural center, and with the Brigham Young University, a major educational institution in Utah, located just a few miles away.

THE STREAM AND ITS VALLEY

Hobble Creek, with a drainage area of approximately 105 square miles, is one of the tributaries flowing off the western slope of the Wasatch Mountains into Utah Lake. The basin is bounded by the large basins of the Provo River on the north and the Spanish Fork River on the south. Below the canyon mouth, the slope of the well defined channel is about 70 feet per mile. The principal features of the basin are shown on Plate 1. The study area of this report comprises the flood plains of Hobble Creek from Mapleton Drive near the canyon mouth downstream to Interstate Highway 15, a distance of about six miles.

In the lower elevations of the basin, vegetation includes elderberry, willows, and cottonwood along the stream channel; sparse stands of sagebrush; and ground cover of native grasses and weeds. On the mountain slopes, vegetation consists of a mixture of sagebrush, deciduous brush, and patches of conifers and aspen. Climate ranges from semiarid in the lower elevations to dry-subhumid in the mountainous areas above the foothill line. Average annual precipitation in the basin is about 27 inches. Temperatures range from summer highs of more than 100 degrees to winter lows of about 0 degrees in the lower elevations, and from summer highs of about 85 degrees to winter lows of about -30 degrees in the headwater regions. Wintertime precipitation usually occurs as snow in the mountains. During the summer, high intensity convective-type cloudburst storms that may produce intense but short duration rainfall can occur.

DEVELOPMENTS IN THE FLOOD PLAIN

The flood plains within the study area include agricultural, residential and minor commercial development. Highways, city streets, the Denver and Rio Grande Western, and the Union Pacific Railroads cross the flood plain. The present population of the Springville area is estimated at 9,000 and is projected to increase to about 11,000 by the year 1990 based on Springville Chamber of Commerce data.

FLOOD SITUATION

SOURCES OF DATA AND RECORDS

A stream gage on Hobble Creek 4 miles southeast of Springville is maintained by the U.S. Geological Survey. Streamflow records from this gage have been kept for the periods from 1904 to 1916 and from 1945 to date. The location of this station is shown on Plate 1. To supplement data from this station, newspaper accounts and published and unpublished material were searched for information concerning past floods.

Maps prepared for this report were based on enlargements of U.S. Geological Survey 7½ minute quadrangle sheets entitled "Provo" (1950 edition) and "Springville" (1948 edition), both photorevised to 1969. Structural data on bridges and culverts were supplied by the U.S. Bureau of Reclamation and the Utah Division of Highways, and supplemented by field investigations during the preparation of this report.

FLOOD SEASON AND FLOOD CHARACTERISTICS

Cloudburst storms, sometimes lasting several hours, can occur in the drainage basin tributary to the study area anytime from late spring to early fall, but generally occur during the summer. Flooding from cloudbursts is characterized by high peak flows, short duration of floodflow, and small volume of runoff.

Snowmelt floods can be expected to occur from late spring to early summer. Snowmelt flooding is characterized by marked diurnal fluctuation, large volume, and long duration of flow. Prolonged general rain will cause only minor flooding because of infiltration, surface ponding, and channel and overbank storage effects. However, a rain storm may occur concurrently with a snowmelt flood causing higher peak flows and larger volumes of runoff.

FACTORS AFFECTING FLOODING AND ITS IMPACT

Obstructions to Floodflows - Natural obstructions to floodflows include trees, brush, and other vegetation growing along the streambanks in floodway areas. During floods these obstructions impede floodflows and cause backwater conditions that increase flood heights. Trees and other debris washed out during these floods are carried downstream and may collect on bridges and other obstructions, thus creating a damming effect and overbank flow. As floodflow increases, masses of debris break loose and a wall of water and debris surges downstream until another obstruction is encountered.

Man-made obstructions to floodflow in the study area consist of a number of bridges and culverts. Debris collecting against a bridge may increase to the point where its structural capacity is exceeded and the bridge is destroyed, or it may cause water levels to rise to the extent that abutments are eroded and the overlying and approach roadbeds are damaged.

In general, obstructions restrict floodflows and result in overbank flows and unpredictable areas to be flooded, destruction of or damage to bridges and culverts, and, increased velocities of flow immediately downstream. It is impossible to predict the degree or location of the accumulation of debris; therefore, for the purposes of this report, it was necessary to assume that there would be no accumulation of debris to clog any of the bridge or culvert openings. Representative obstructive bridges and culverts in the study area are shown in Figures 1-4. Pertinent data on obstructive bridges and culverts are contained in Table 2, page 20.

Figure 1 - Bridge at 800 East Street.

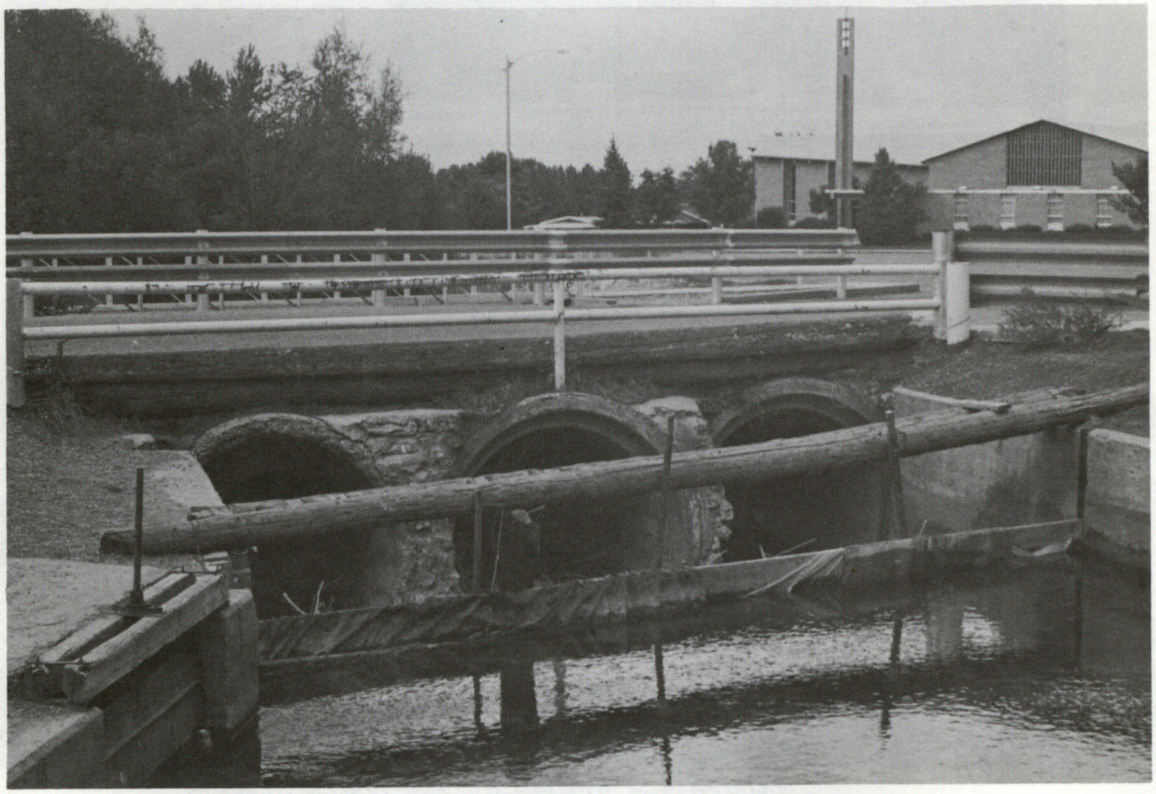


Figure 2 - Culvert at 700 East Street.

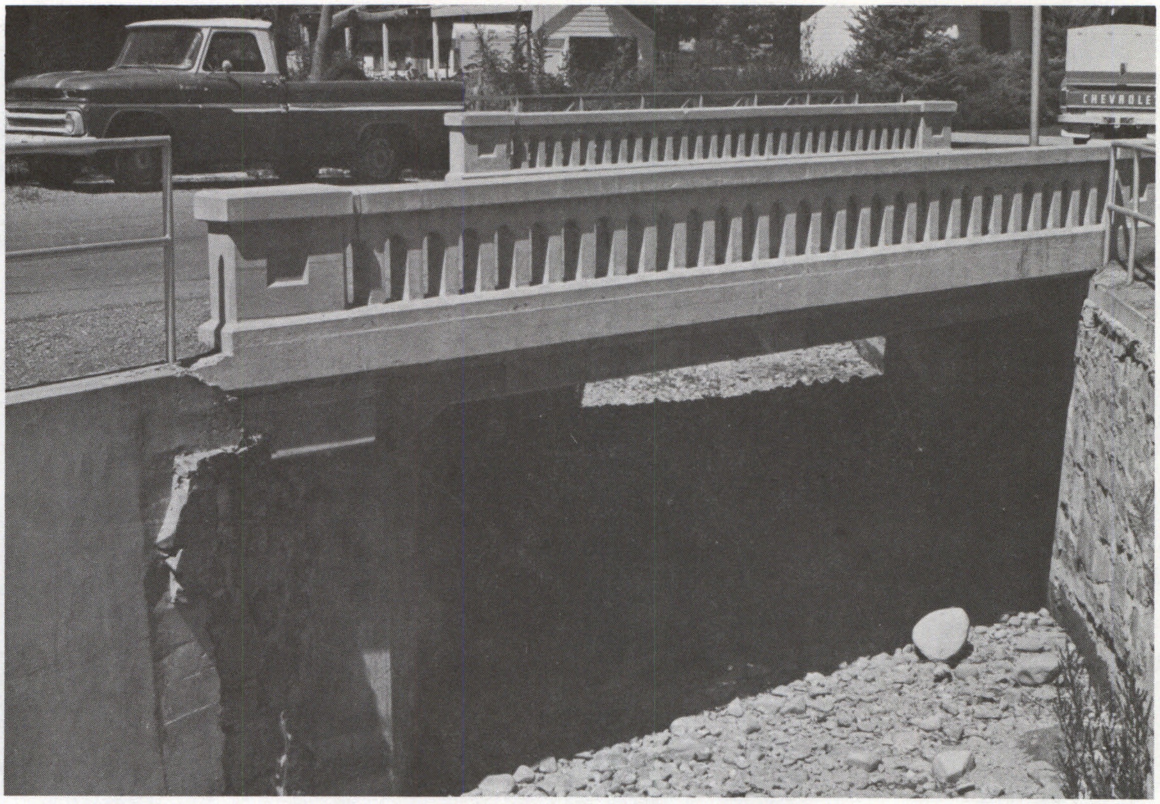


Figure 3 - Bridge at 300 East Street.

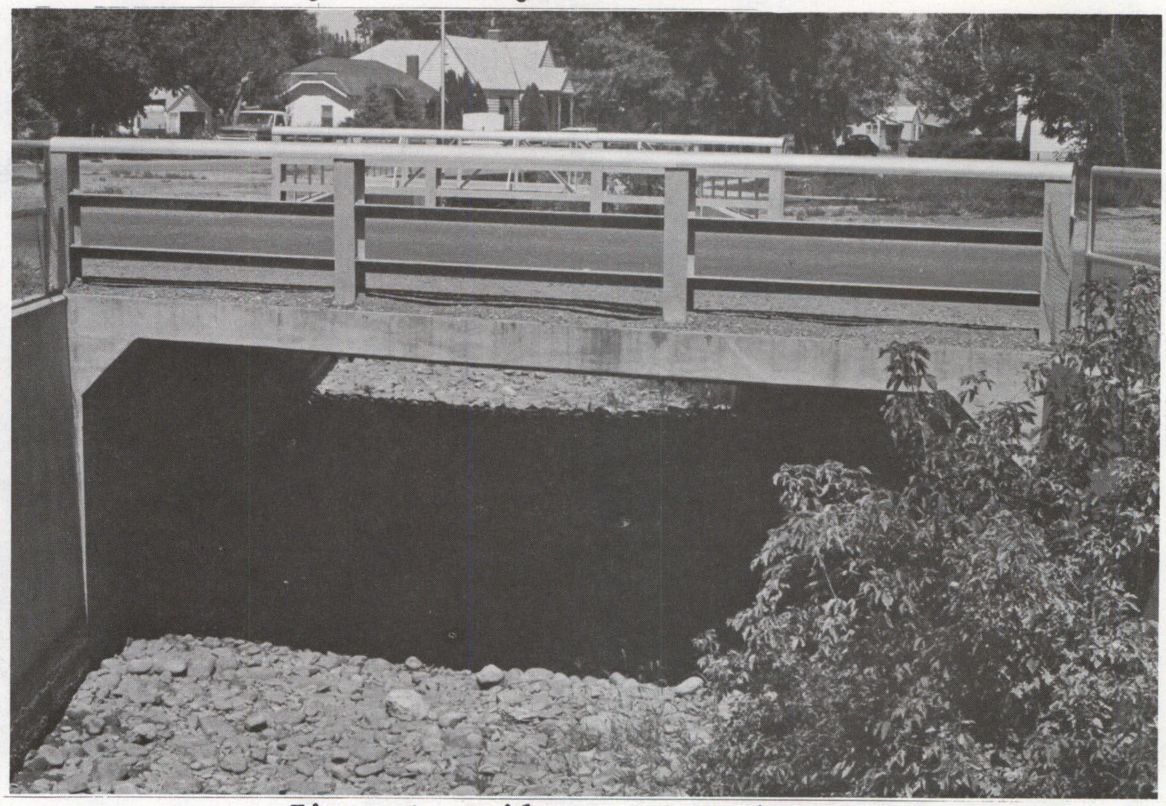


Figure 4 - Bridge at 200 South Street.

Flood Damage Reduction Measures

Although there have been no extensive permanent improvements for flood control along Hobble Creek, the Corps of Engineers cleared the channel after the 1952 flood. The clearing operation extended from the canyon mouth to Utah Lake. The adjacent property owners and local interests have also done work to stabilize the channel in Springville.

The U.S. Bureau of Reclamation completed a study on improvements for flood control along Hobble Creek as part of the authorized Central Utah Project. The improvements considered were channel enlargement, reservoir storage, and diversion works.

Unincorporated areas in the study area are eligible for flood insurance as provided by the National Flood Insurance Program. The program requires Utah County to adopt and enforce land use and control measures that will guide future development of land in flood-prone areas in order to avoid or reduce future flood damage. However, these zoning regulations and other regulatory measures that would permit optimum development and use of flood plain areas commensurate with the flood hazard have not yet been implemented in the unincorporated areas. Springville has not adopted regulatory measures relating to flood hazard areas.

Other Factors and Their Impacts

Flood Warning and forecasting - The National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather and flood conditions. Flood forecasts for the Springville area are prepared in the River Forecast Center in Salt Lake City, Utah, and are issued, along with daily weather forecasts that apply generally to the Springville vicinity, by that office through the local news media. It should be noted that although intense cloudburst activity in a general region can be forecast, such storms and resultant flooding in specific small drainage areas cannot be predicted accurately and, in any event, forecasts would provide very little advance warning.

Flood fighting and emergency evacuation plans - At the present time, no formal plans for flood fighting and emergency evacuation of people and personal property from flood plain areas have been prepared by Utah County or the city of Springville. During floods, however, agencies such as the local police force, the sheriff's office, street crews, and the local civil defense organization assist in flood fighting and evacuating people from flood areas.

Storage of floatable materials in flood plain areas - The residential, commercial, and recreational uses of flood plains in the study area do not result in the accumulation of significant amounts of floatable materials that could be carried away by floodwaters to lodge on bridges or plug culverts. Agricultural operations would result in the storage of small amounts of material subject to floatation, such as crates or cartons used in harvesting or packaging operations. This material would cause greater flooding, attendant damage to structures, lands and bridges.

PAST FLOODS

SUMMARY OF HISTORICAL FLOODS

The study area is known to have a history of flooding from Hobble Creek, but little definitive data on floods are available. Major and minor flooding is known to have occurred in 1862, 1920, 1931, and 1952. Large flows also occurred in 1909 and 1916 and flooding undoubtedly occurred, but descriptive data of these floods are not available. It is recorded, however, that snowmelt runoff in 1909 was of greater volume than in 1952 the worst snowmelt flood recorded in the area. During the 1952 flood, a flow of 1,250 cubic feet per second was recorded at the Springville gage. The snowmelt flood of May 1862 is believed to have been greater than the May 1952 flood. The 1920 and 1931 floods resulted from cloudbursts. However, due to the absence of streamflow records for these years, information on the magnitude of flow is not known.

FLOOD RECORDS

Information on historical floods in the study area is very limited because continuous streamflow records and eyewitness accounts are not available and few contemporary records exist. Streamflow measurements are available only for the May 1952 snowmelt flood. Beginning in 1950, information on flood events is contained in unpublished post flood reports prepared by the Corps of Engineers. Information on flood events may also be found in certain publications of the U.S. Geological Survey[(a)] for records of the peak stages and discharges with associated frequency analyses.

(a) See especially Geological Survey Water Supply Papers 994 (1946) and 1684 (1966).

FLOOD DESCRIPTIONS

As indicated above, definitive data on the extent of flooding and flood damage are limited. Available information on the May-June 1862 flood is contained in the following extract from a centennial history of Utah County.[a]

> "During the winter it snowed and rained almost incessently, until the snow was piled up very deep in the mountains, and even in the valley as late as the first of May. All the ravines were filled with snow, and when the spring sun began to melt the drifts, the lower lands were submerged, especially farms on the creek banks. The lake rose eight feet, reaching as far as Dry Creek. About the middle of June, the flood reached its climax and began to recede, but it was not until July 4th that the creek could be forded with safety . . . ."

May 1952

Precipitation on the Hobble Creek Basin was about 145 percent of normal in the 1951-1952 season. In general, the seasonal total was only 2½ inches less than in 1909, the previous maximum of record. At the beginning of the snowmelt season, the snowpack over the basin was about 200 percent of normal and the water content of the snow was greater than any previously known. Runoff from the basin was 260 percent of normal and the peak flow of 1,250 cubic feet per second occurred on May 4. About 745 acres were flooded, of which about 510 acres were agricultural areas and 35 acres were in the town of Springville. Practically all significant flooding was in the reach downstream from the mouth of the canyon. A very strong flood fight in Springville

---

(a) *__Memories That Live__ - __Utah County Centennial History__, Huff, et.al., Art City Publishing Co., Springville, 1947 (taken from __A Brief History of Springville, Utah__, Don Carlos Johnson, William F. Gibson Co., Springville, 1900).*

prevented much more extensive urban flooding. Agricultural flooding occurred above and below the town. Due to the steep slope of the Hobble Creek Basin, most of the area flooded was subjected to high velocity flows with attendant erosion and debris damage. The flooded areas included residential developments; growing crops; transportation, irrigation, and power facilities; and municipal structures and service facilities. Flood damage in Springville was estimated at $181,000 (1952 prices). An additional $174,000 damage occurred between Springville and the mouth of Hobble Creek Canyon.[a]

Figure 5 - Brookside subdivision during the snowmelt flood of May 1952. (Provo Daily Herald photo.)

(a) *Extracted from Report of 1952 Snow-Melt Floods . . ., Appendix A, Detailed Supporting Data, U.S. Army Engineer District, Sacramento, pp. 66-67.*

Additional information on the flood is contained in the following excerpt from a newspaper article.[(a)]

The Springville Herald, May 1, 1952

Rampaging Flood Waters of Hobble Creek Result in State of Emergency in Springville

Extensive Property Damage Evident Throughout Area

The muddy, flooding waters of old Hobble Creek and the co-operative fight in which citizens of this city have been engaged to control the raging stream, [have] made history in Springville the past several days. Never before since the settlement of the city has this pioneer-named [stream] reached such capacity and terrific overflow of its banks.

Resulting from the record snows of the past winter, the waters came down with such force and volume that a state of emergency was declared in the city last Thursday and since that time it has been a round the clock fight to control the water, which rose more than 12 feet.

As the swift-flowing stream, carrying trees, poles, lumber and debris of all kinds, gushed through the city, seemingly determined to cut a new channel, the rock walls in many places which heretofore have held the spring flow, have been washed away and the banks of the creek undermined and carried down-stream. Foot bridges on practically every street have been removed and channels have been dug by workmen on the sides of the street bridges to divert part of the water which overflowed and endangered cement road bridges.

Several thousand acres of land in the west fields are standing in water. Barns, milk houses and sheds are filled, those which have not gone down under the swift-moving stream. In the east section of the town, farm land, barns, sheds, chicken coops, orchards, gardens and homes have been damaged and ruined, while the flood waters have reached the middle section, flowing from a break in the bank below the mouth of the canyon, down through the Brookside sub-division, along Fourth South then north to the Stake House and to Center Street and several blocks north and west. Back yards of homes on the south side of Brookside were filled with water, while a swift-moving stream flowed in the back yards and down the street near the homes on the north.

So critical became the situation over the weekend, when the flood water broke the water line in the southeast section of town, that wholesale vaccination of townspeople for typhoid was held Sunday and over 2000 people received shots. The water was chlorinated as a precautionary measure. A scarcity of culinary water was declared and townpeople were asked to refrain from using it for sprinkling purposes. Due to the tenseness of the situation and the need for help, many meetings this week have been canceled.

Citizens in the east section of town, especially in Brookside, and along Fourth South, have filled and piled up sandbags about their homes to hold back the flood waters. In some homes nearest the creek banks, sandbags have had little effect.

Big trucks loaded with sand and gravel have formed a procession to the flooded areas, constructing dikes high around the flooding water. Huge pieces of road equipment have been rushed to the emergency scene by Springville contractors, the county and state and interested citizens and companies outside of town have also assisted.

Throughout the days and nights since the high water, blasts have been heard along the creek route as workmen and volunteers worked frantically to dislodge the fallen trees from the rushing waters. The D. & R.G. railroad bridge at 4th West could not take the full flow and swirled away to the north, flooding new areas east of the tracks.

(a) Simulated from the original.

Figure 6 - Service Station at Main Street during snowmelt flood of May 1952. (Provo Daily Herald photo.)

Figure 7 - Bridge at 100 West Street during snowmelt flood of May 1952.

Figure 8 - Bridge at Center Street during snowmelt flood of May 1952.

FUTURE FLOODS

Although flood producing storms of the same magnitude as those that have occurred in the past could recur in the future, discussion of future floods in this report is limited to those that have been designated as the Intermediate Regional and Standard Project Floods. The Standard Project Flood would be larger and would occur less frequently than the Intermediate Regional Flood. A Standard Project Flood would be a rare event, but could reasonably be expected to occur. Selection of these floods was based on hydrologic computations, which include analysis of available records of past floods, and consideration of pertinent meteorologic and physiographic conditions.

During floods, debris collecting on bridges could decrease their carrying capacity and cause greater water depths (backwater effect) upstream of these structures. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the structures were considered in preparing the maps and other illustrations showing the Intermediate Regional and Standard Project Floods. These maps and illustrations reflect consideration of vegetation normally existing in the stream channel and show the backwater effect of obstructive bridges and the culvert, but do not reflect increased water surface elevations that could be caused by debris collecting against bridges, by future deposition of silt and gravel in the stream channel under bridges, or by a debris plug in the culvert.

INTERMEDIATE REGIONAL FLOOD

The Intermediate Regional Flood is one that could occur about once in 100 years on the average, although it may occur in any year. Its magnitude was determined from statistical analysis of streamflow records, characteristic climatic conditions as they relate to snowmelt, and the runoff characteristics of the stream basin, taking into account losses from infiltration and other factors. Due to lack of adequate streamflow and precipitation data for cloudburst runoff from the creeks in the study area, a characteristic convective-type storm isohyetal developed from similar drainage areas was transposed to the Hobble Creek drainage area, and the most critical area of contribution and the rainfall over that area were found. Peak flows developed for the Intermediate Regional Flood at selected locations in the study area are shown in Table 1. A synthesized stage hydrograph of the Intermediate Regional Flood is shown on Plate 2.

STANDARD PROJECT FLOOD

Peak flows for the Standard Project Flood on Hobble Creek were determined in the same manner as peak flows for the Intermediate Regional Flood. For the purpose of determining peak cloudburst flows for the Standard Project Flood, an isohyetal pattern for a Standard Project Storm[a] was developed and applied in the same manner as described for the Intermediate Regional Flood. Peak flows derived for selected locations on Hobble Creek are shown in Table 1.

TABLE 1

PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS

Location	Intermediate Regional Flood c.f.s.	Standard Project Flood c.f.s.
At canyon mouth	1,950	4,550
At 900 South Street	1,800	3,800
At 2800 South Street	1,500	1,600

(a) *The most severe combination of meteorological conditions reasonably characteristic of the geographical region, excluding extremely rare combinations*

FREQUENCY

Frequency analyses for Hobble Creek were based on available records of snowmelt floodflows and on synthetic cloudburst and rain floods up to the magnitude of a Standard Project Flood. Because the frequency curves were obtained by the use of synthetic analysis, they should be regarded as approximate and are to be used with caution in connection with any flood plain use. They show that the 1,250 cubic feet per second flow of Hobble Creek on May 4, 1952, had a frequency of occurrence of about once in 50 years on the average.

As previously indicated, an Intermediate Regional Flood has a frequency of occurrence of about once in 100 years on the average, and a Standard Project Flood would occur less frequently than the Intermediate Regional Flood. Although the Standard Project Flood is a rare event, it can be reasonably expected to occur in the future. Floods larger than the Standard Project Flood are possible, but their occurrence would be extremely rare.

HAZARDS OF LARGE FLOODS

The amount and extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. An occurrence of the Intermediate Regional or Standard Project Flood on Hobble Creek in the study area at the present time would result in inundation of residential and light commercial areas; damage to roads, streets, and public utilities; and damages to agricultural land and appurtenant improvements. Floodwater flowing at high velocity and carrying floating debris could create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, floodwater 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep a person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed, or in vehicles that are ultimately submerged. Sewage, garbage, and other organic material carried or deposited by floodwater could create health hazards. Isolation of areas by floodwater could also create hazards in terms of medical, fire, or law enforcement emergencies.

FLOODED AREAS AND FLOOD DAMAGES

The areas along Hobble Creek that would be flooded by the Standard Project Flood are shown on Plate 3, which is also an index map to more detailed maps showing the areas that would be inundated by the Intermediate Regional and Standard Project Floods (Plates 4 and 5). As may be seen from these plates, the upper study area, between the bluffs downstream from the canyon mouth, is inundated by floodwater. This area is devoted primarily to orchards and the agricultural production of corn, wheat, sugar beets, alfalfa, and hay. Near the upstream city limit, floodwaters begin to disperse and inundate by sheetflow agricultural and residential lands. Within the city limits, runoff continues to spread in the form of sheetflow. Along the channel in the city, floodwaters continually spill out of the channel and move northerly to flood by sheetflow roads and residences. From the western edge of the city to the downstream limit of the study, floodwaters back up and spread out on the uphill side of barriers such as road and railroad embankments. This area includes pastureland, cropland, and a mobile home park. The area that would be flooded by an Intermediate Regional Flood comprises about 1160 acres of which 880 acres are urban.

Floodwater could cause the loss of utilities, thus contributing to personal discomfort as well as causing temporary cessation of commercial activities. Depending on the depth and duration of inundation, the cost of emergency relief to the community and the loss of individual and regional income could be extensive. Traffic may be disrupted, schools closed, and sales and services discontinued. In communities dependent on agriculture, field crops and fields prepared for planting could be inundated, causing partial or complete loss of productivity. Costs of cleanup and repair and restoration of homes, roads, bridges, and public utilities could have a great impact on individual and community financial resources.

Due to the wider flood plain, greater depth of flooding, and higher velocity of flow during a Standard Project Flood, damage would be greater than during an Intermediate Regional Flood. Plates 6-9 show water surface profiles of the Intermediate Regional and Standard Project Floods. Depth of flow in the channel can be estimated from these illustrations. Typical cross sections of the flood plain at selected locations, together with the water surface elevation and lateral extent of the Intermediate Regional and Standard Project Floods, are shown on Plate 10.

OBSTRUCTIONS

All of the bridges, except one, and the culvert are obstructive to floodflows. Pertinent data on these structures are contained in Table 2, page 20. As may be seen from Plates 6-9, the effect of obstructions is to raise the water surface elevation upstream. Obstructive bridges are especially susceptible to structural damage from the forces of floodwater and floating debris.

TABLE 2

OBSTRUCTIVE BRIDGES ACROSS HOBBLE CREEK

Identification	Location (b)	Elevations(a) Stream-bed	Top of Under-clearance	Road-way (c)	Inter-mediate Regional Flood (d)	Standard Project Flood (d)
2800 South St.	.20	4491	4497	4498	4499	4500
U.P. Railroad	.78	4498	4504	4510	4506	4507
750 East St.	.80	4498	4503	4505	4506	4507
1150 East St.	1.36	4514	4519	4520	4521	4522
D&RGW Railroad	1.99	4539	4543	4547	4545	4546
400 West St.	2.00	4540	4546	4547	4546	4547
200 West St.	2.27	4551	4557	4558	4558	4559
100 West St.	2.38	4556	4561	4563	4563	4564
Main Street	2.51	4562	4571	4574	4573	4574
Center St.	2.55	4564	4571	4574	4574	4575
100 East St.	2.67	4571	4578	4580	4580	4581
200 East St.	2.76	4575	4581	4583	4584	4586
300 East St.	2.90	4582	4589	4590	4591	4593
200 South St.	2.93	4583	4591	4592	4592	4595
400 East St.	3.04	4587	4595	4598	4599	4600
400 South St.	3.23	4598	4604	4605	4606	4607
700 East St.(e)	3.54	4615	4621	4624	4625	4627
800 East St.	3.63	4622	4628	4629	4632	6434
900 South St.	4.04	4644	4653	4658	4659	4660
1000 North St.	4.84	4693	4707	4710	4706	4712
Farm Bridge	5.66	4751	4758	4763	4762	4763

(a) *All elevations are rounded to nearest foot, mean sea level datum.*
(b) *Distance in miles upstream from Interstate Highway 15.*
(c) *Highest road surface elevation on bridge.*
(d) *At upstream face of bridge.*
(e) *Culvert.*

VELOCITIES OF FLOW

During an Intermediate Regional Flood, velocities of flow in the main channel at the upper reach of the study area would be 5 to 8 feet per second. Water flowing at a rate of 8 feet per second or greater will cause severe channel erosion and is capable of transporting large rocks. Velocities of 6 to 8 feet per second could erode fill around bridge abutments. In the lower reach, the velocities would drop, averaging 3 to 5 feet per second. Overbank flow would average 1 to 3 feet per second. Water flowing at 2 feet per second or less will deposit debris and silt. It is expected that velocity of flow during a Standard Project Flood would be slightly higher than during an Intermediate Regional Flood.

RATES OF RISE AND DURATION OF FLOODING

Intense rainfall from cloudburst storms centered over the drainage basin rapidly collects as runoff that reaches the study area soon after the beginning of storms. The Hobble Creek channel is well defined, but has a small carrying capacity. Consequently, flows from the flood producing storms of intense rainfall quickly rise to channel capacity and spread overland. The largest cloudburst storms last only for a few hours and produce relatively small volumes of runoff and short durations of overbank flow. Snowmelt runoff has a slow rate of rise, but the large volume can sustain overbank flow for an extended period of time, often for many days. The maximum rate, height, and time of rise and the duration above flood stage for the Intermediate Regional and Standard Project Floods are given in Table 3, page 22. A synthetized stage hydrograph of an Intermediate Regional Flood is shown on Plate 2.

TABLE 3

RATES OF RISE AND DURATION OF FLOODING

Flood	Maximum Rate of Rise ft./hr.	Height of Rise[a] ft.	Time of Rise[b] days	Duration Above Flood Stage days
HOBBLE CREEK AT MILE 3.17				
Intermediate Regional	0.3	0.9	7	33
Standard Project	0.7	1.9	9	48

(a) Flood stage to maximum flood level.
(b) Time period corresponding to height of rise.

PHOTOGRAPHS, FUTURE FLOOD HEIGHTS

The levels that the Intermediate Regional and Standard Project Floods are expected to reach at selected locations in the study area are indicated in the following photographs.

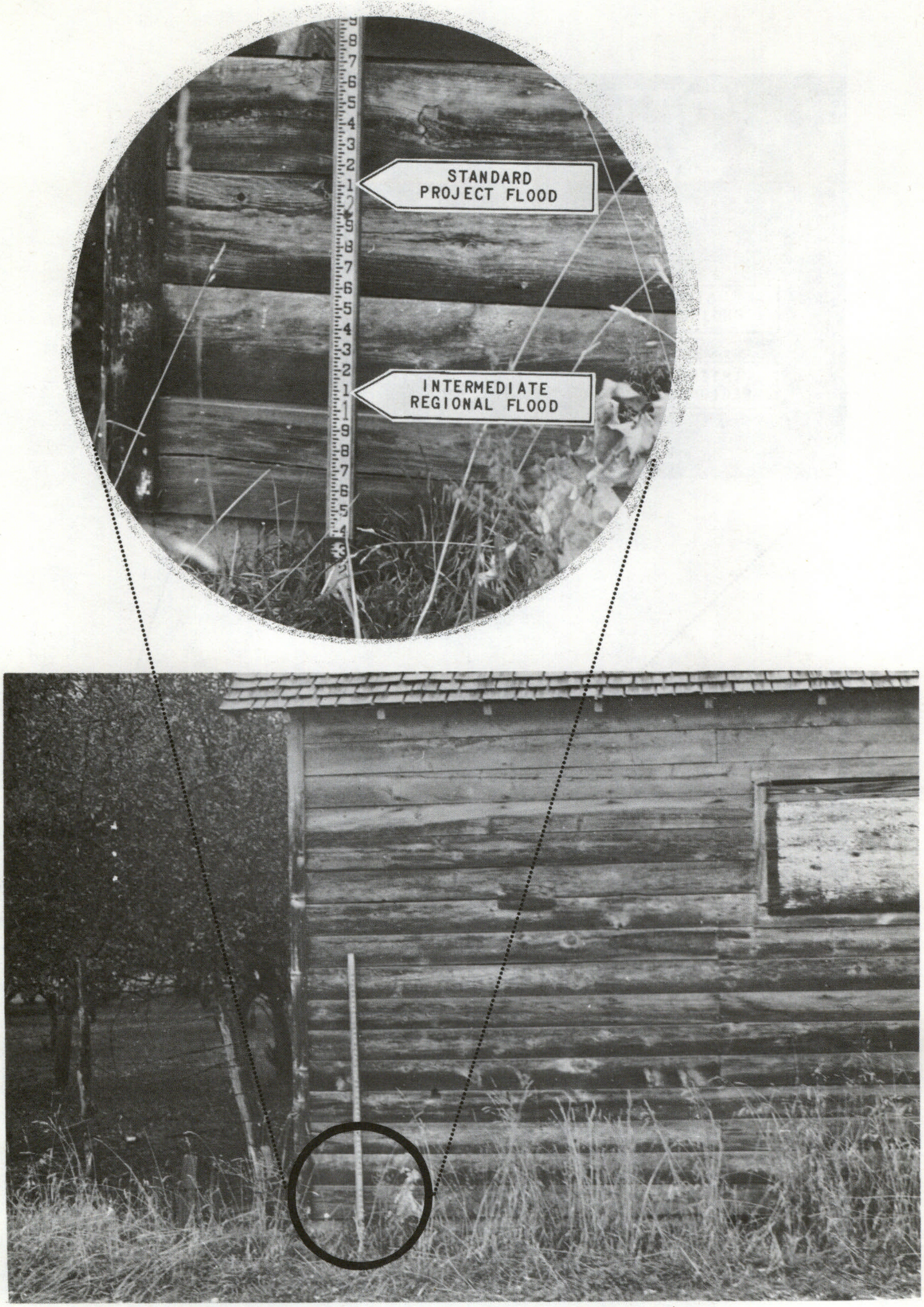


Figure 9 - Future flood heights at 3200 East Street.

Figure 10- Future flood heights at intersection of 400 East Street and Buckley Avenue.

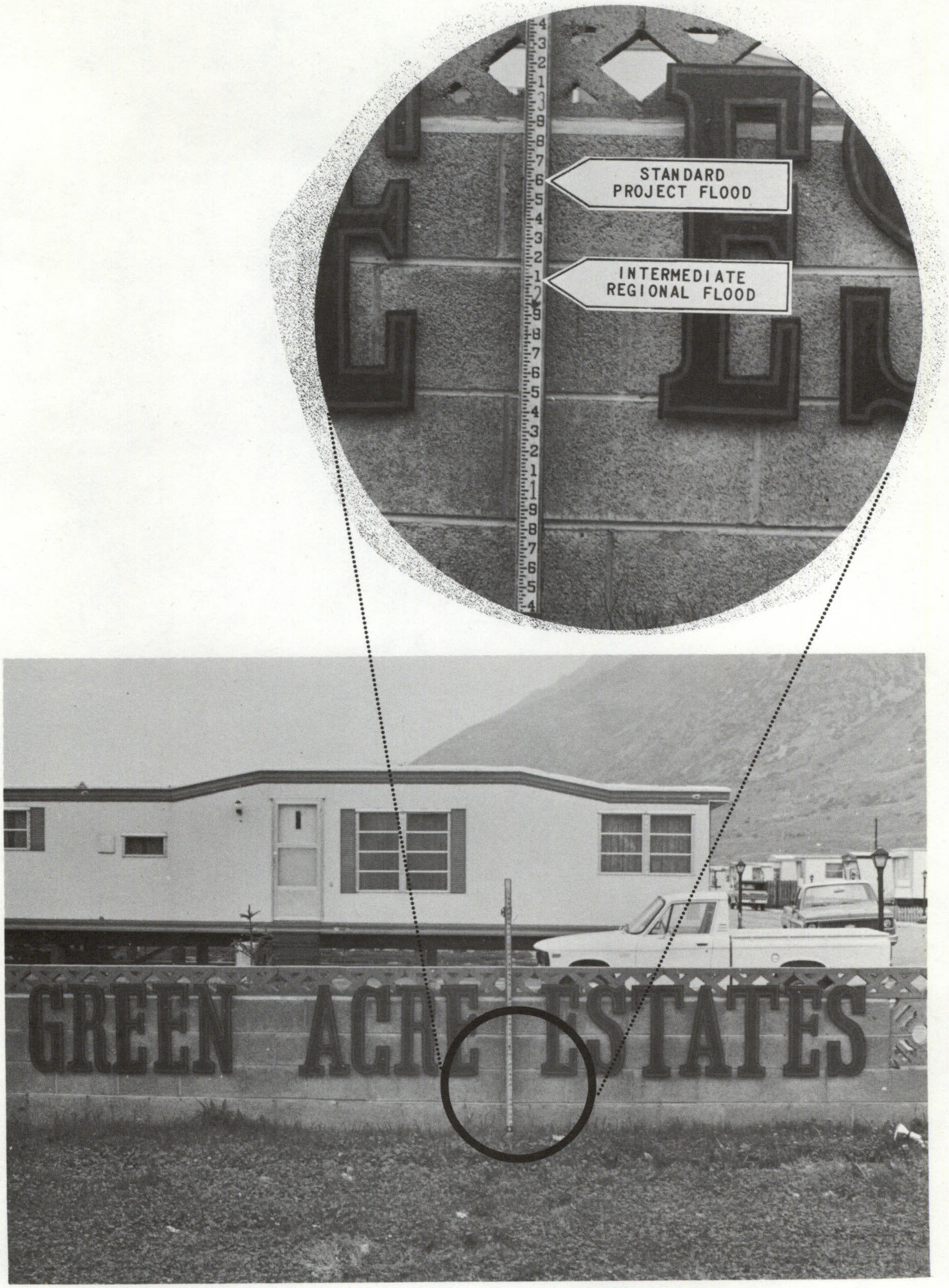


Figure 11 - Future flood heights at Green Acre Estates near 400 North and 400 West Streets.

GLOSSARY

Backwater Effect. The rise in surface elevation of flowing water upstream from and as a result of an obstruction to flow.

Cloudburst. A sudden and extremely heavy downpour of rain that is small in areal extent; of short duration; and may be accompanied by lightning, thunder, and strong gusts of wind.

Flood. An overflow of water onto lands used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean.

Normally, a "flood" is considered as any temporary rise in streamflow or stage (but not the ponding of surface water) that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials coincident with increased streamflow, and other problems.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest, the maximum stage or elevation reached by the floodflow.

Flood Plain. The relatively flat lowlands adjoining a river, stream, watercourse, ocean, or lake, which have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

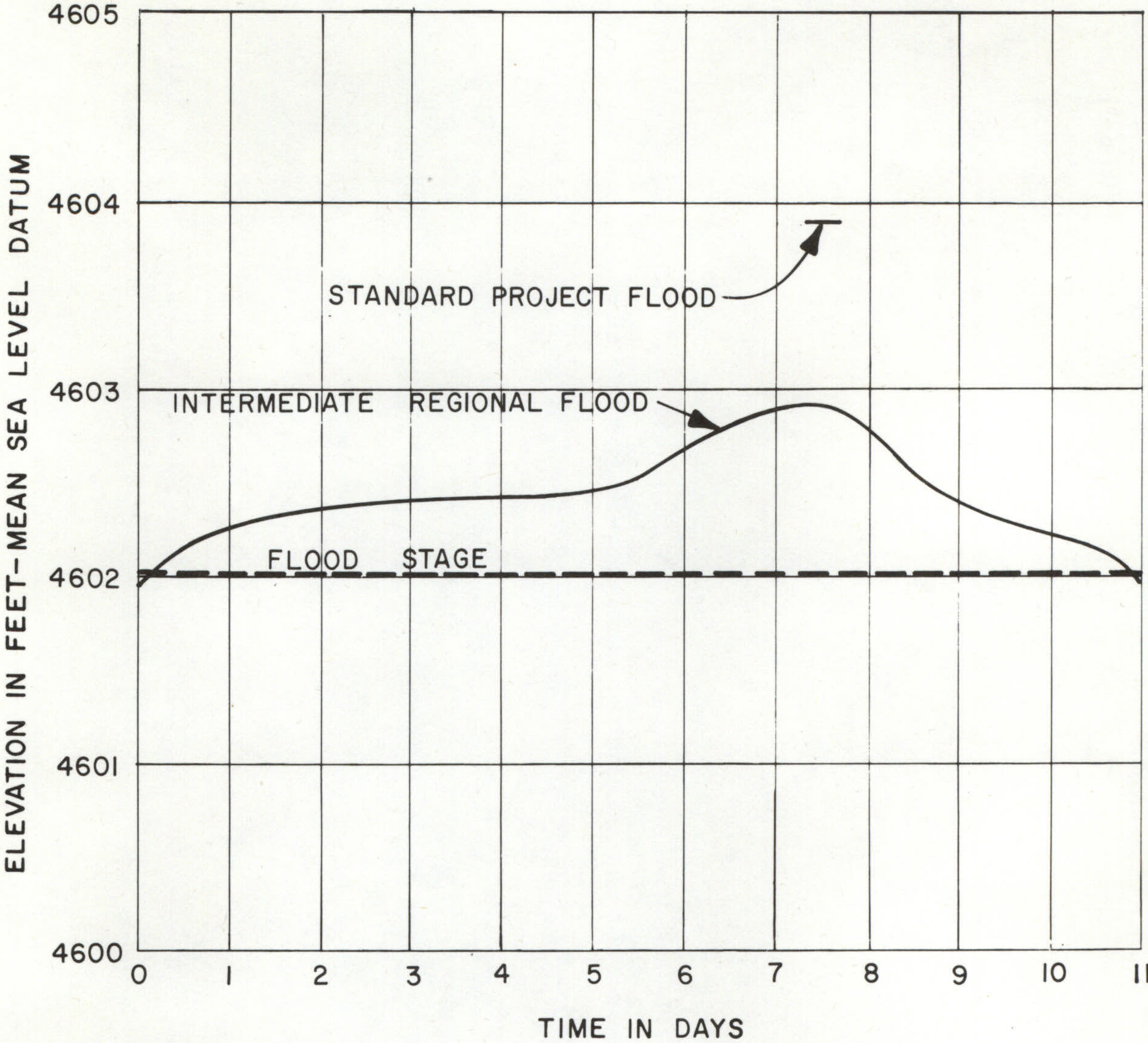
Floodway. The channel of the stream and that portion of the flood plain that would be used to carry floodflows.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year.

Sheetflow. Broad, shallow overland floodflows generally varying from a few inches to not more than 2 feet deep.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations.

Storm Isohyetal. Pattern or map of a storm as represented by lines (isohyets) connecting points having equal amounts of precipitation for any specific period.



NOTES

Hydrograph near mile 3.17.

Hydrograph based on computed data,

Snowmelt floods may last for many days as indicated on table 3.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
HOBBLE CREEK

SPRINGVILLE, UTAH

STAGE HYDROGRAPH

INTERMEDIATE REGIONAL FLOOD

JUNE 1973

PLATE 2