CALDER-KANKAINEN

UTAH SNOW LOAD STUDY

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by

STRUCTURAL ENGINEERS ASSOCIATION OF UTAH

With Assistance From

The Soil Conservation Service
U.S. Department of Agriculture

and the

Utah State Climatologist's Office
at
Utah State University

S.E.A.U. Technical Committee

2nd Edition 1992

Cover photos courtesy of Alexis Kelner (Cabin in Wasatch Mountains)

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UTAH SNOW LOAD STUDY

SUMMARY OF CHANGES TO THE SECOND EDITION

This second printing attempts to make the study easier for the reader to use by making the following changes.

1. Adding a synopsis located at the front of the study.
2. Adding section and paragraph numbers.
3. Referencing more clearly to the tables and figures.
4. Adding notes to the tables.
5. Putting figures 10-38 in alphabetical order.
6. Adding definitions of roof snow load and roof design snow load.
7. Changing references from 1988 UBC to 1991 UBC.

There were only two major technical changes to the report.

1. In Table V for Beaver County, P_o was changed from 71 to 43 psf and A_o was changed from 6.2 to 6.3. This change makes Beaver County more consistent with the other western counties of the state.

2. Table IX was revised to reflect more information. Consequently, the text in Section V was modified to reflect the new information.

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SYNOPSIS

OF

UTAH SNOW LOAD STUDY

INTRODUCTION

In recent years it has become increasingly apparent that the snow load design requirements for Utah were in need of uniform design criteria. For this reason, a study has been completed which quantifies much of the various criteria which must be taken into account when determining the design snow load for a given area. This synopsis will attempt to abbreviate the design recommendations given in the UTAH SNOW LOAD STUDY published by the Structural Engineers Association of Utah Technical Committee in 1990.

Based on the results of the study, an empirical equation was developed which relates ground snow load to elevation. This empirical equation is plotted in figures 10-39 of the study. Also shown on these figures are snow load data points from various recording stations. The empirical equation used is:

$$P_g = (P_o^2 + 63^2(A-A_o)^2)^{1/2} \text{ for } A > A_o \text{ and}$$

$$P_g = P_o \text{ for } A <= A_o$$

Refer to page four of the study for definition of terms and to Table V of the study for values of P_o and A_o.
P.23

Included in this synopsis are graphs of the empirical equation for each county in Utah.

It should be recognized that there are local factors which may affect the ground snow load in addition to elevation above sea level. Some of these factors include:

1. Longitude of the site (successive mountain ranges);
2. Latitude of the site;
3. Windward versus leeward side of a given mountain range;
4. Proximity of lakes windward of the site;
5. Exposure of the site to wind and sun.

These factors can possibly increase or decrease the ground snow load for a given site, and designers familiar with the site may want to bring applicable factors to the attention of the local building official to possibly modify the ground snow load for the site. Page 5 of the Utah Snow Load Study provides more specific information on the consideration of these factors.

GROUND SNOW LOAD -VS- ROOF SNOW LOAD

In the context of this report, the term roof snow load refers to the snow load on a flat roof. It is calculated by multiplying the ground snow load by the snow exposure coefficient (C_e) and importance factor (I) from UBC Table Nos. A-23-S and A-23-T. The term roof *design* snow load refers to the flat roof snow load modified by the factors discussed in UBC Appendix Chapter 23 Div. I.

The roof snow load for a particular site is obtained by utilizing the Exposure Factor found in the Uniform Building Code (UBC) Appendix 23 Tables A-23-S and A-23-T, as well as in Table VI of the Utah Snow Load Study. For example, if the site is relatively open terrain, extending one-half mile or more from the structure, the ground snow load obtained from the graph is multiplied by 0.6. If the site is located in a densely forested or sheltered area, use 0.9. For all other structures, use 0.7. The building official may determine this coefficient for specific structures with special local conditions. For roofs at or near grade with slopes less than 3:12 or decks at or near grade, the exposure coefficient shall be taken as 1.0.

Other important practical design factors which should be considered in snow country include drifting, warm vs. cold roofs, ice damming, icicles, snow sliding from an upper to a lower roof, etc. For detailed use of these factors, see the UBC Appendix Chapter 23 Div. I.

SEISMIC SNOW DESIGN

As required by the UBC, when the roof design snow load exceeds 30 psf, a portion of the load shall be included as part of the "seismic dead load" of the structure. This portion shall be calculated from the following formula:

$$C_s = 0.25 + 0.025(A - 5)$$

where:

C_s = fraction of the roof design snow load to be used in seismic lateral force calculations when the roof design snow load exceeds 30 psf;

A = elevation above sea level (feet per 1000); ie., for elevation = 5000, use A = 5.

LOAD DURATION FACTOR

The UBC 15 percent factor for increase of allowable stresses in wood loaded with short duration snow loads is based on work done by Lyman Wood, formerly of the Forest Products Laboratory. The 15 percent allowable stress increase is accompanied by the restriction that the maximum design snow load will not be on the structure for a period exceeding 60 days. The Forest Products Laboratory research demonstrated that this 60 day limitation is the cumulative time that the maximum load may be on the structure. We have been advised that there is further research on this issue underway. Hence, the SEAU makes the tentative recommendation that this factor only be used in the lower parts of lower Utah valleys until research demonstrates that it is acceptable to do otherwise. The 15 percent increase in allowable stresses for short duration snow loads should not be used for elevations above 5000 feet above sea level.

DISCLAIMER

In any western state there are large areas to be studied and limited data available. Hence, the best effort of any organization or individual cannot guarantee completely adequate guideline for all areas and conditions in that state or county. Weather conditions are never completely predictable. For any given design snow load selected, there will always be a certain probability that this design load will be exceeded. Therefore, the recommendations given herein should be used as a guide by the experienced designer and not as an absolute requirement. The experienced designer will take a number of factors such as those listed in the section entitled Ground Snow -vs- Roof Snow Load above into account when selecting design snow loadings.

A reasonable amount of care has been used in the preparation of these snow load guidelines. However, the SEAU and its members accept no liability for the use of the information provided herein.

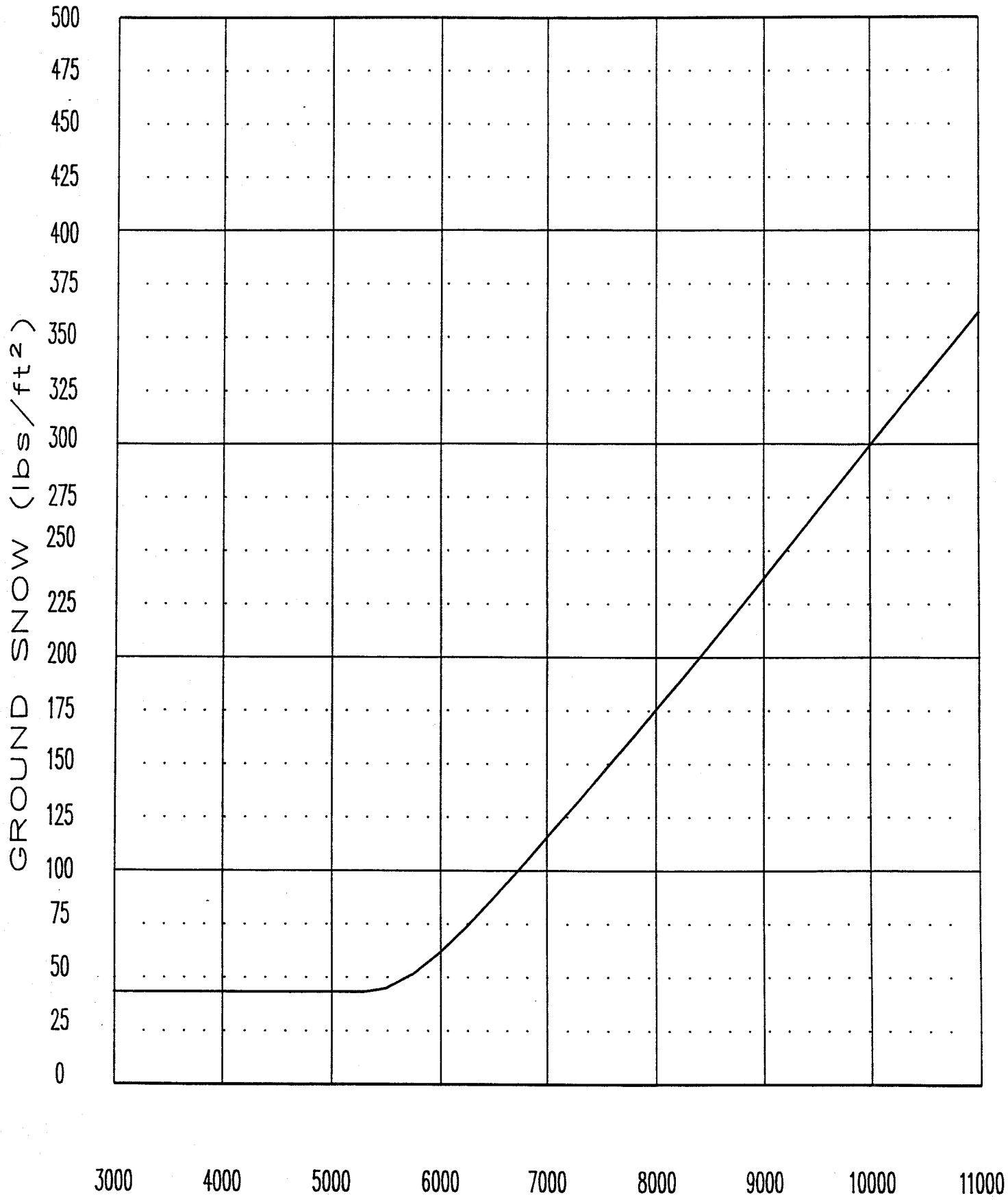


FIG. S-1 BEAVER COUNTY

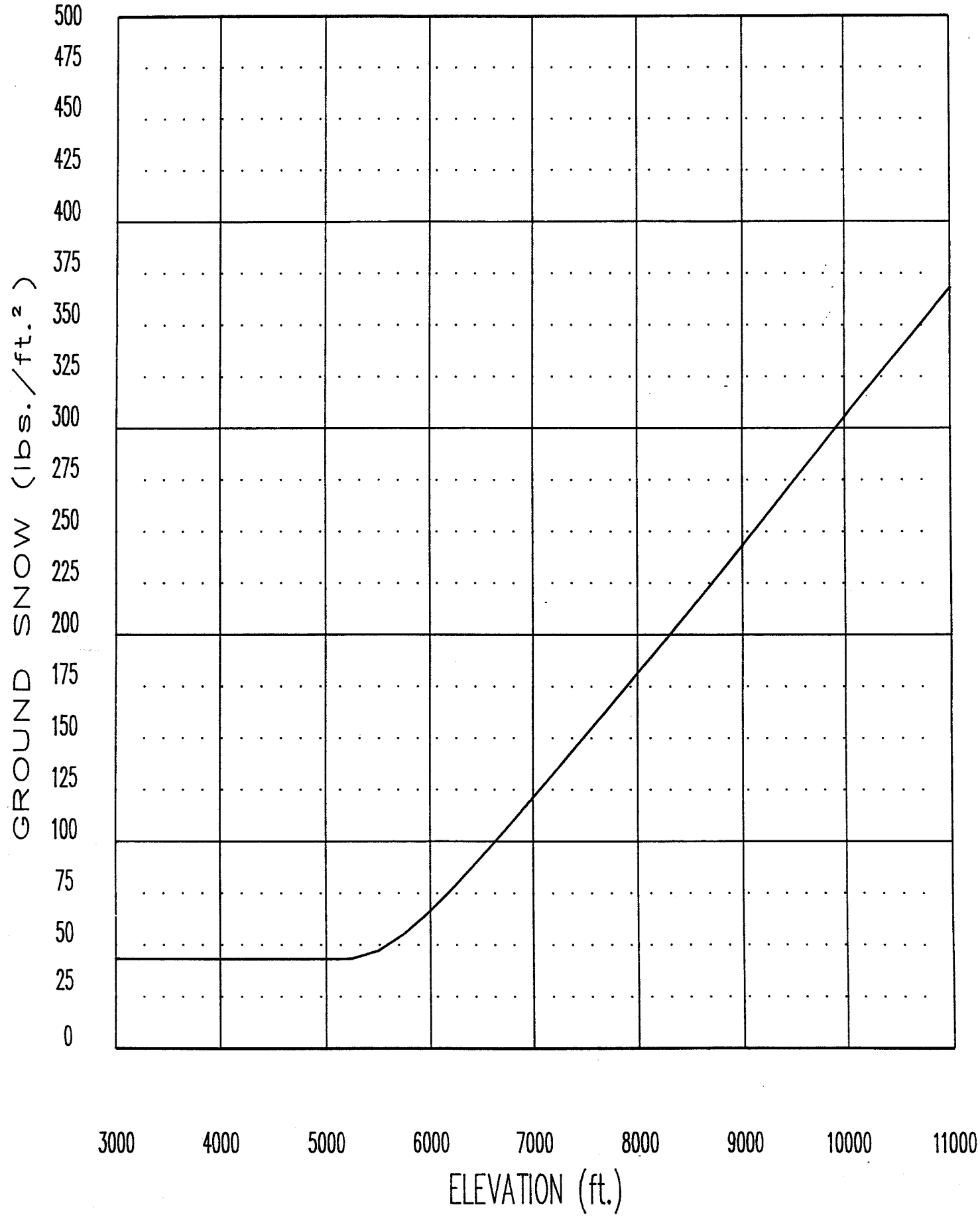
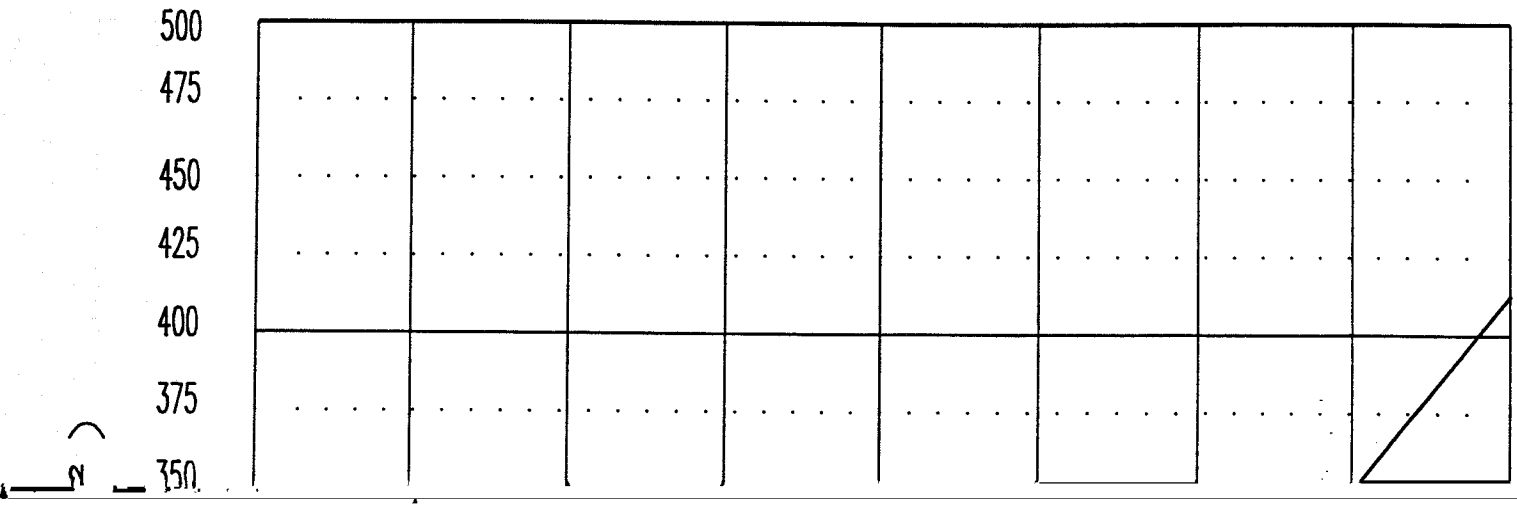


FIG. S-2 BOX ELDER COUNTY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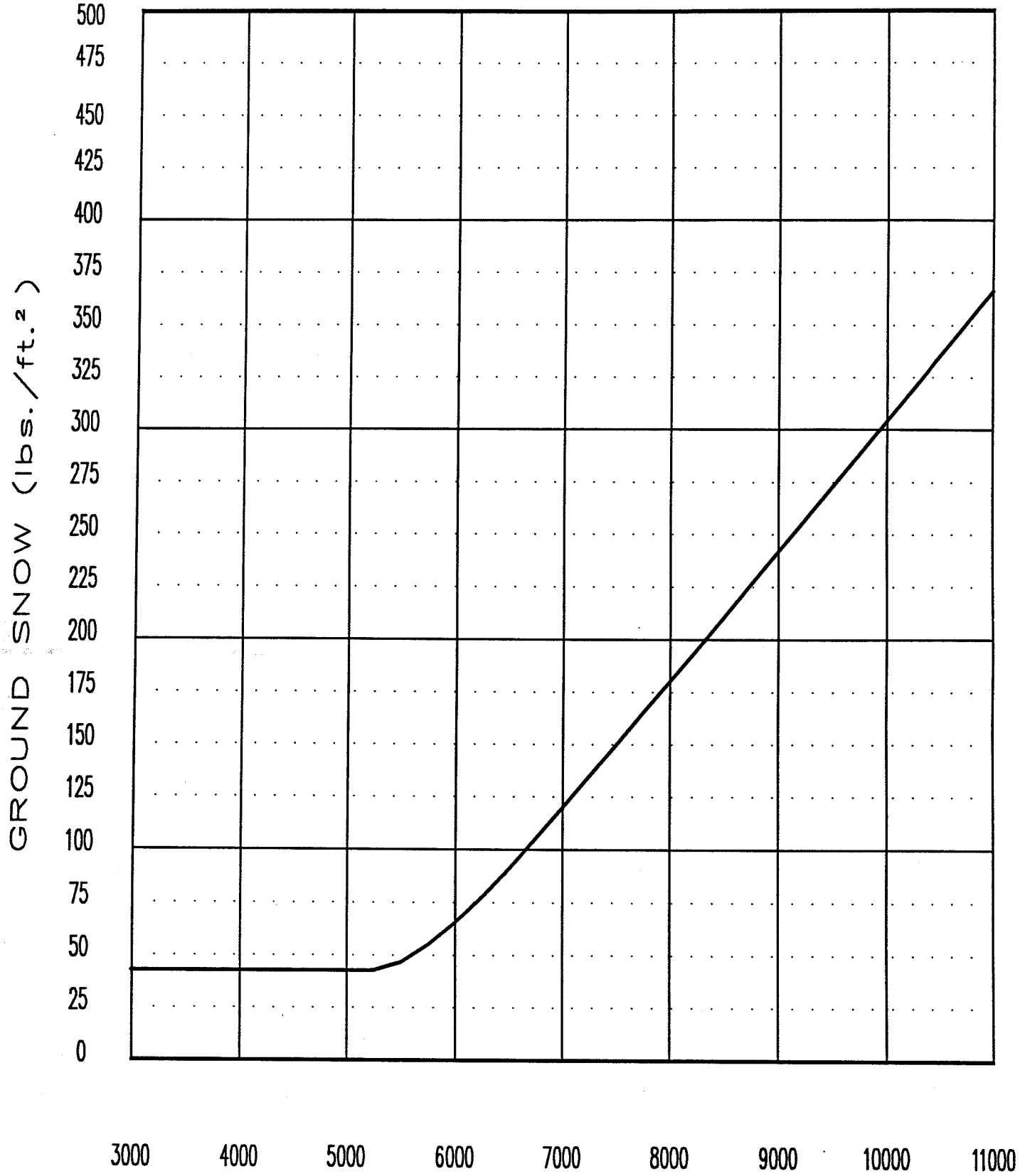


FIG. S-4 CARBON COUNTY

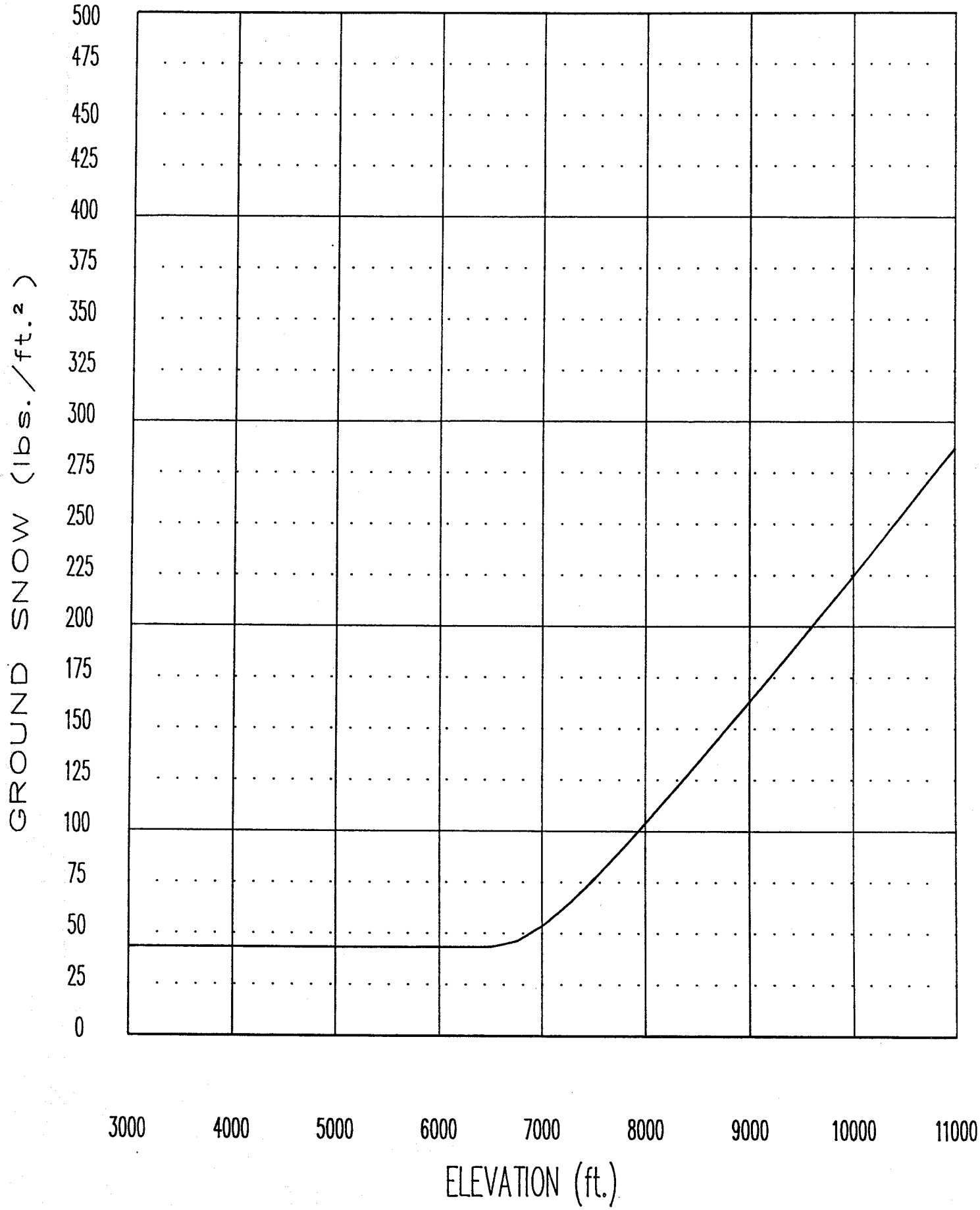
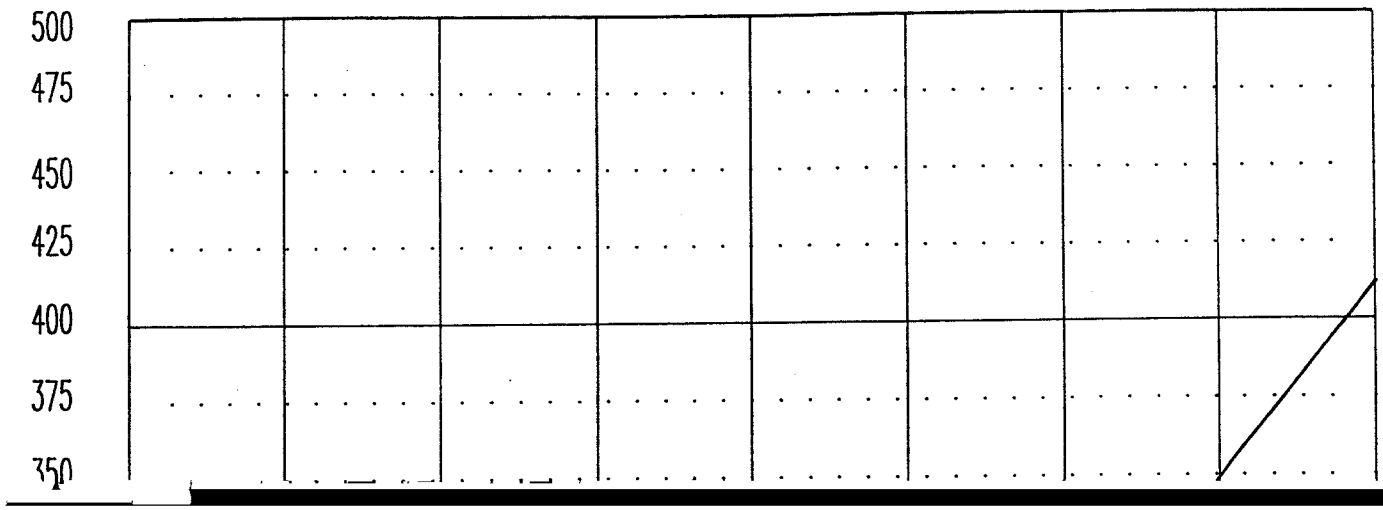


FIG. S-5 DAGGETT COUNTY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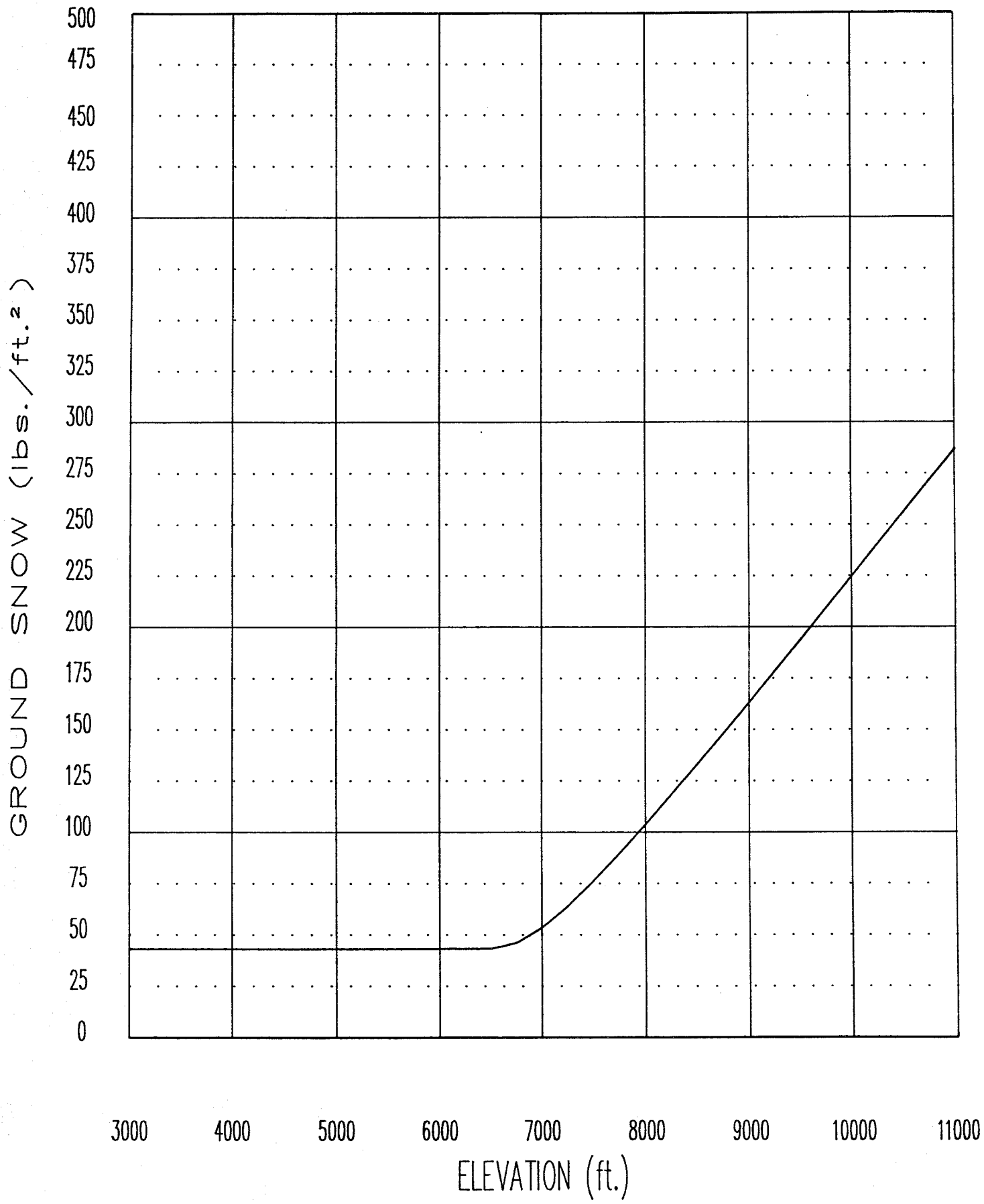

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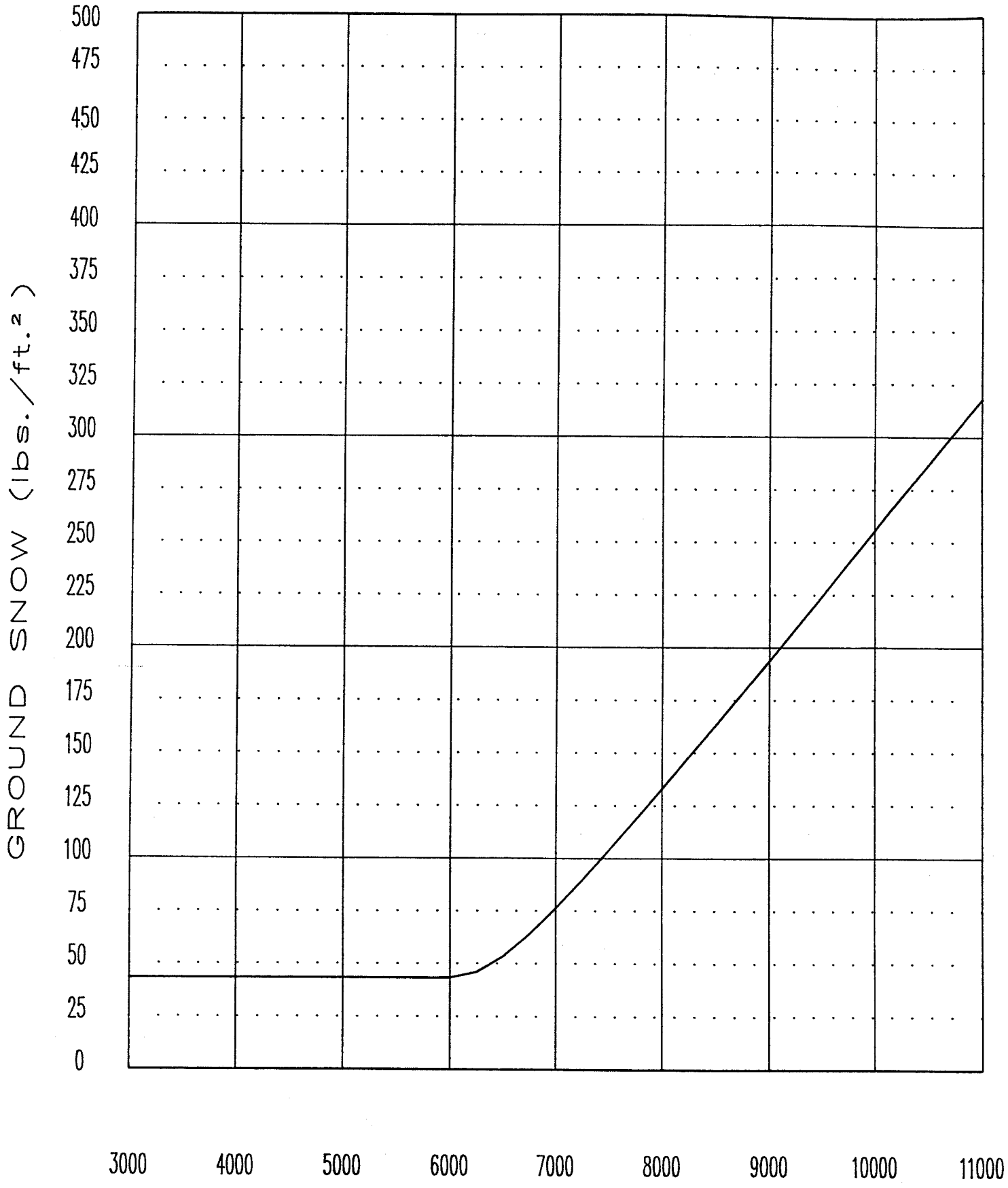


FIG. S-8 EMERY COUNTY

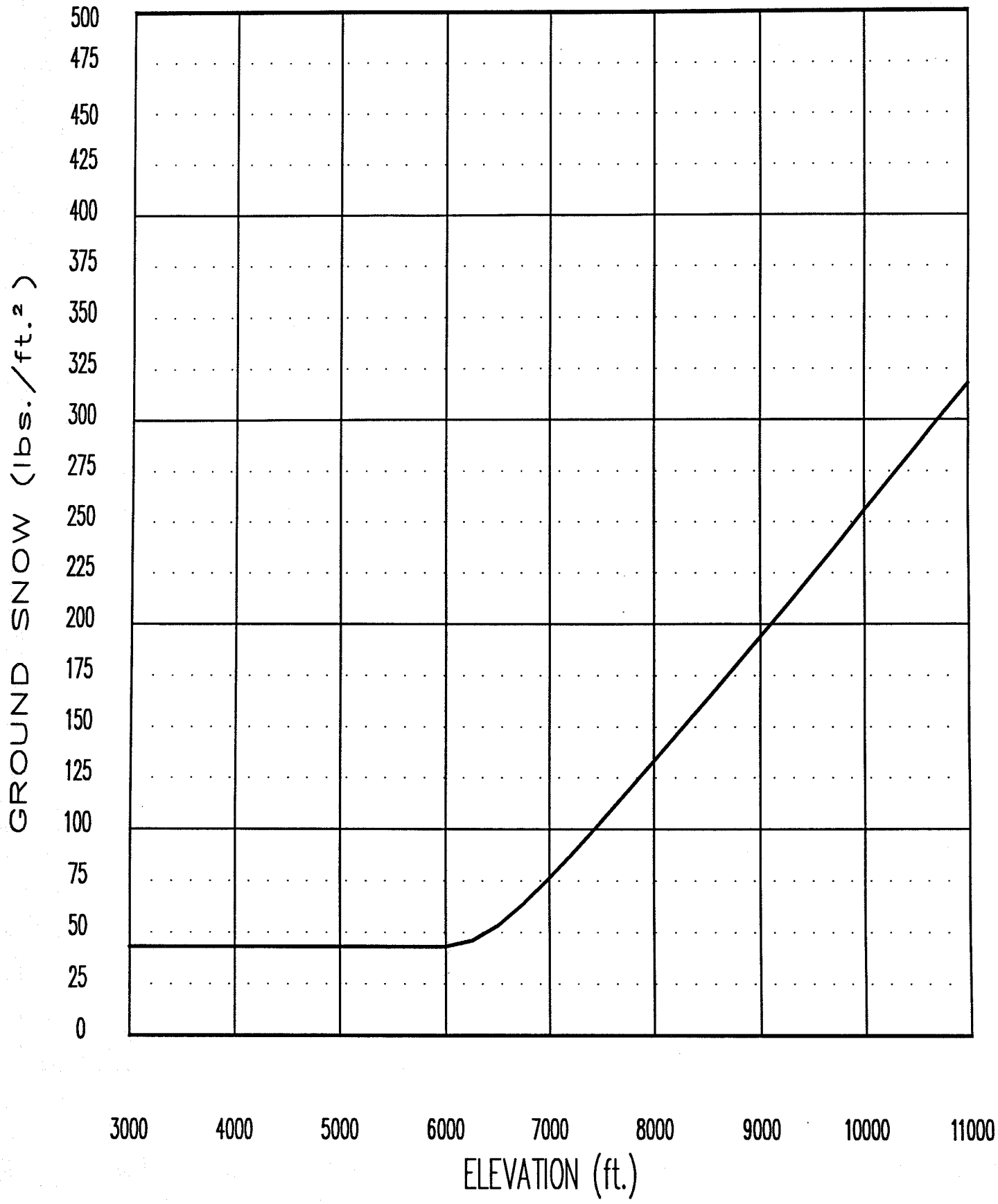


FIG. S-9 GARFIELD COUNTY

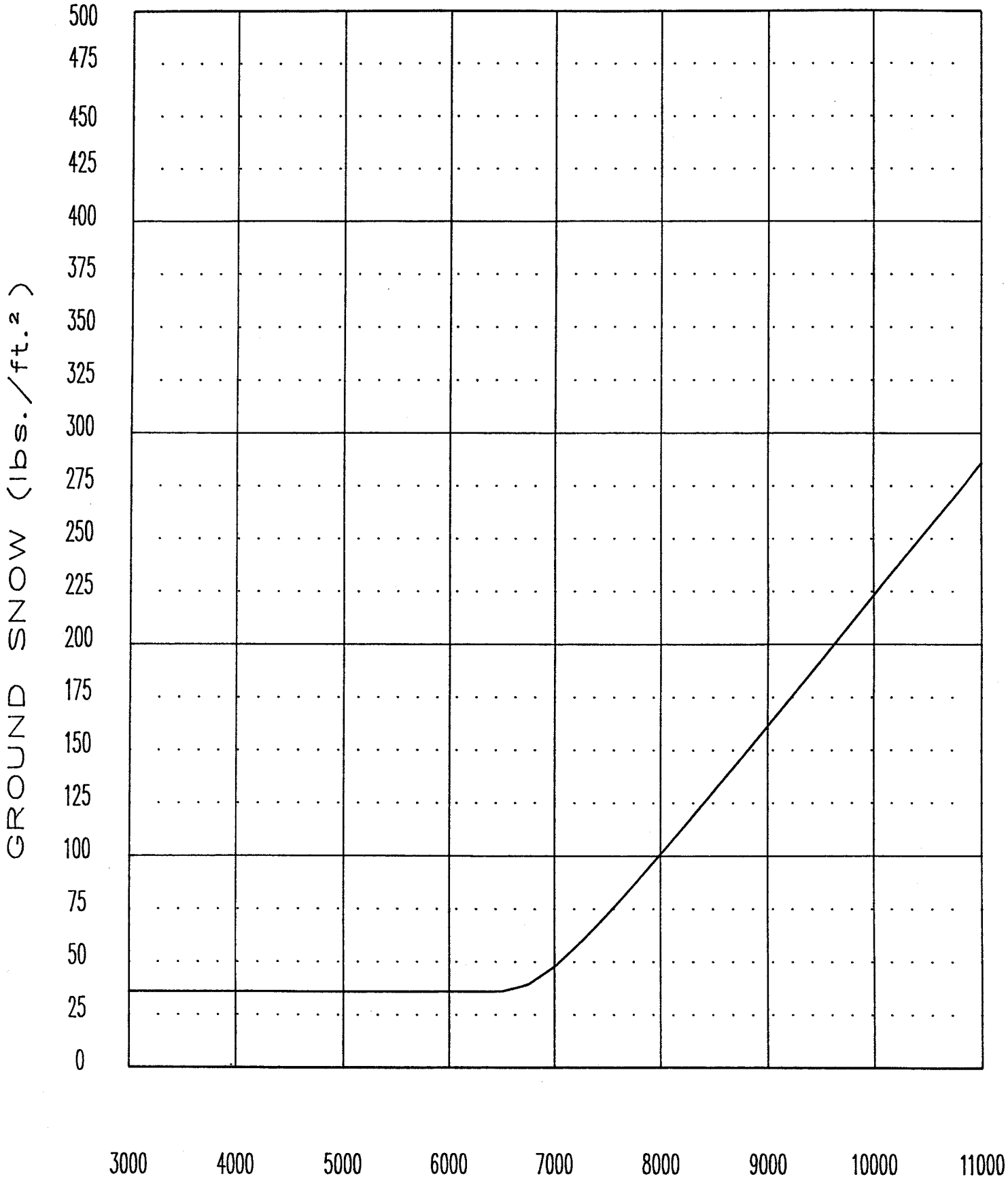


FIG. S-10 GRAND COUNTY

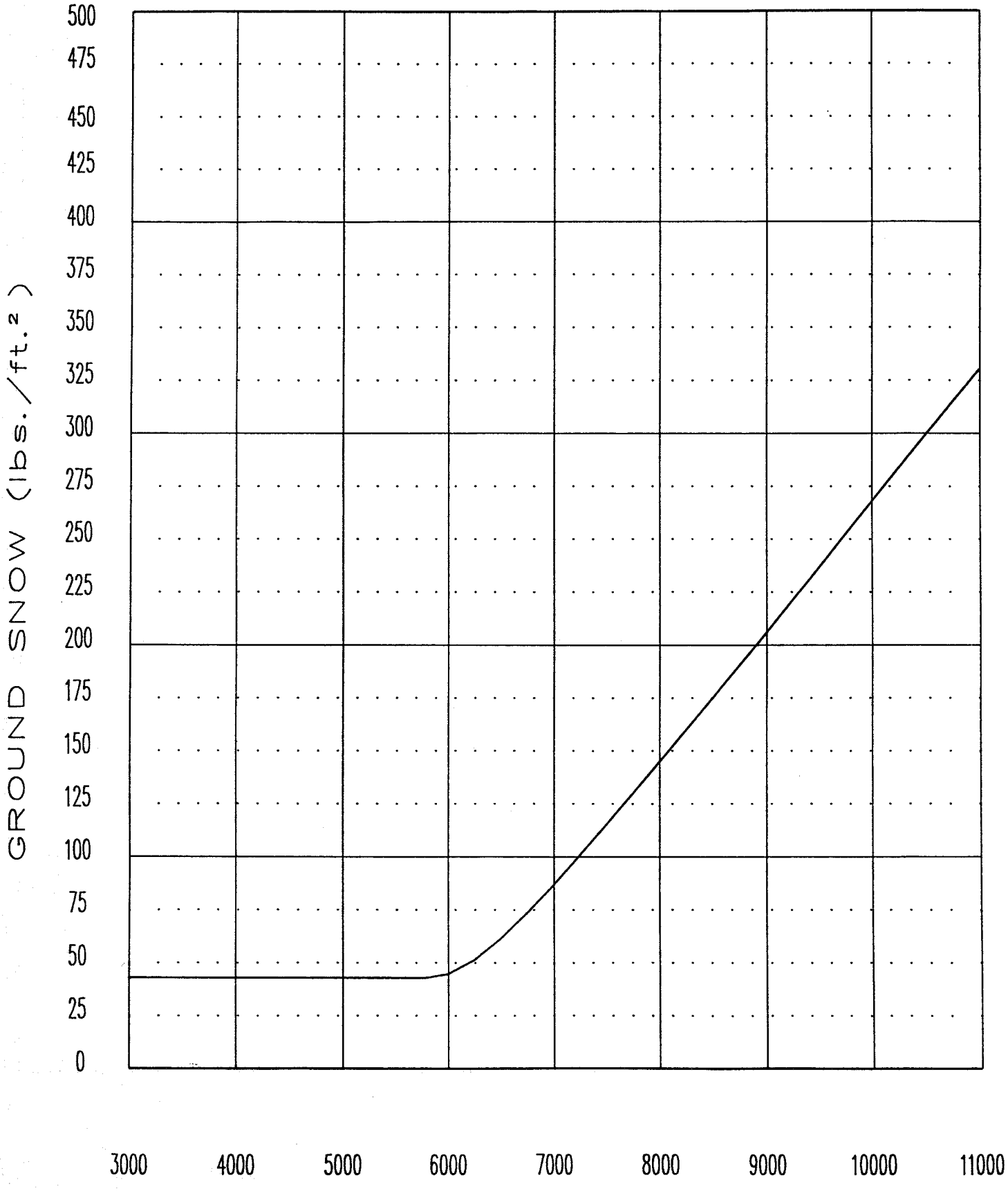


FIG. S-11 IRON COUNTY

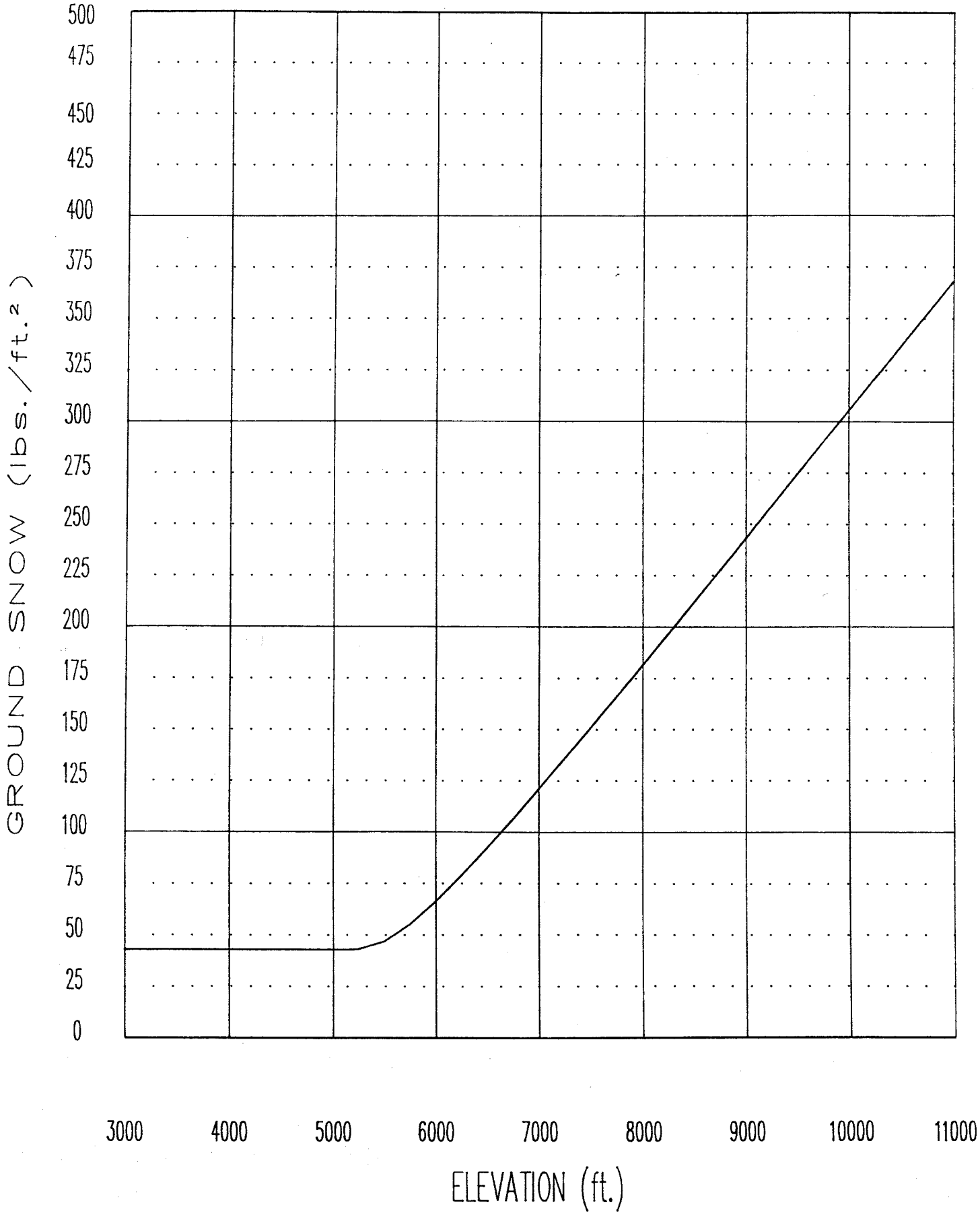


FIG. S-12 JUAB COUNTY

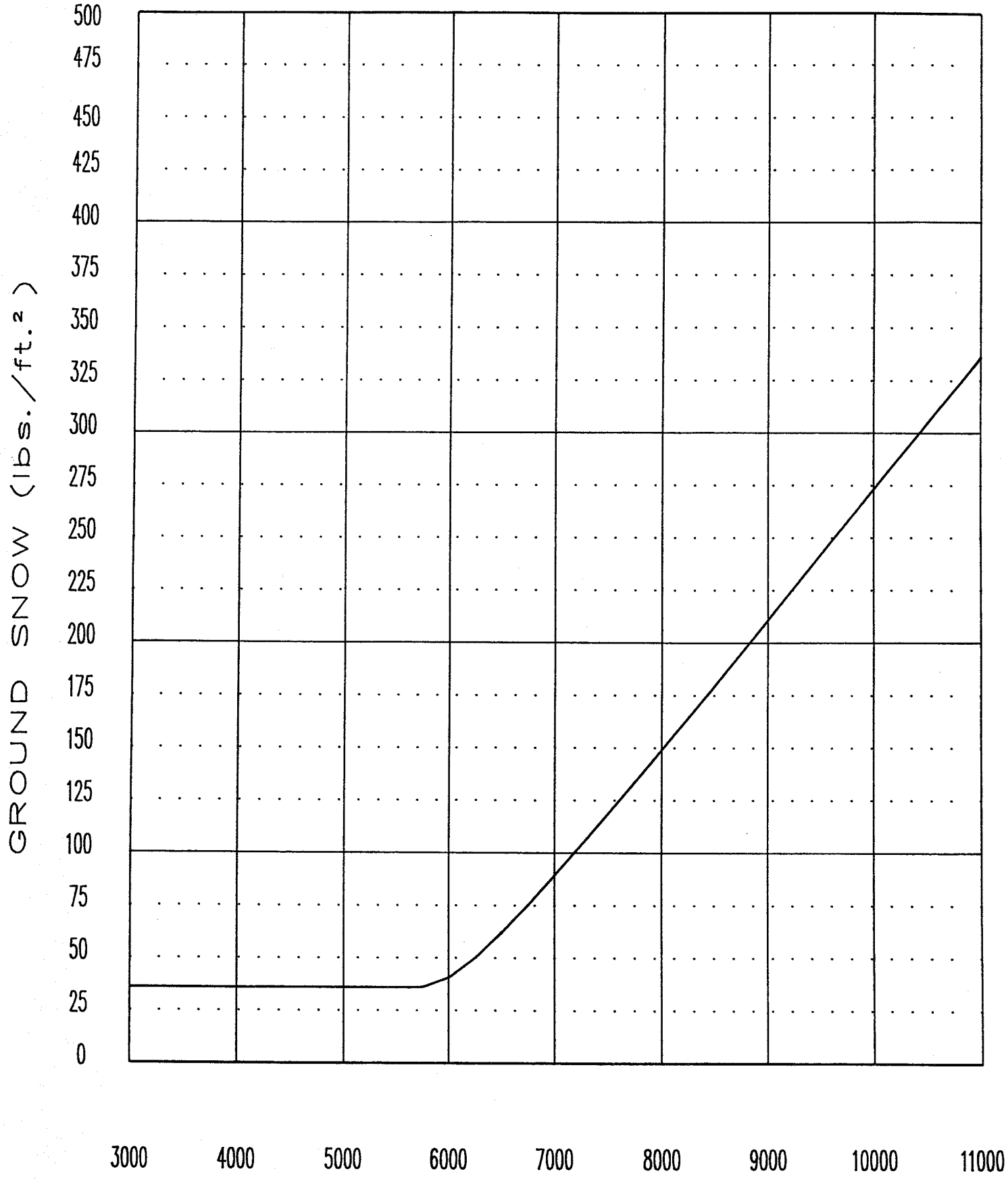


FIG. S-13 KANE COUNTY

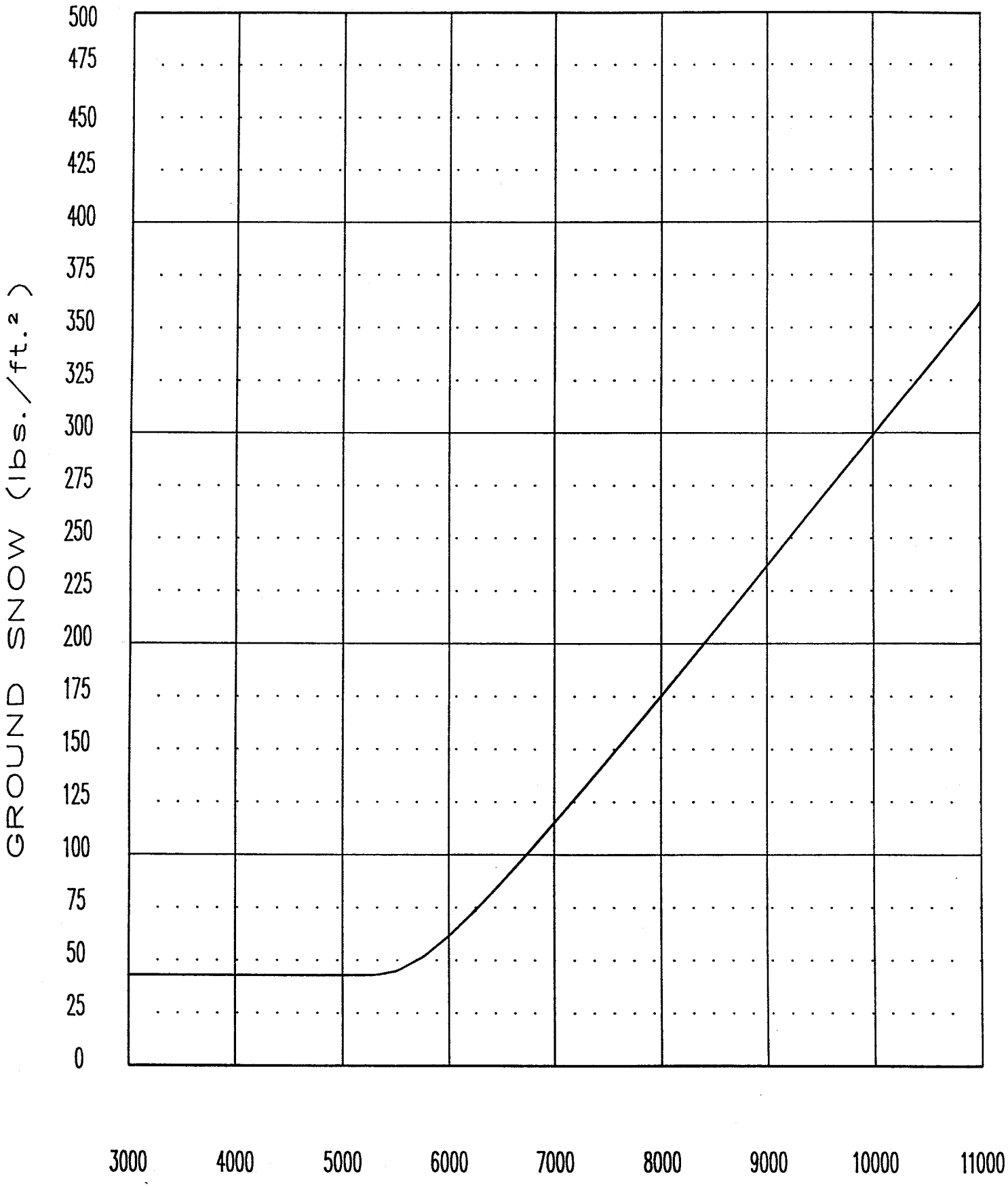
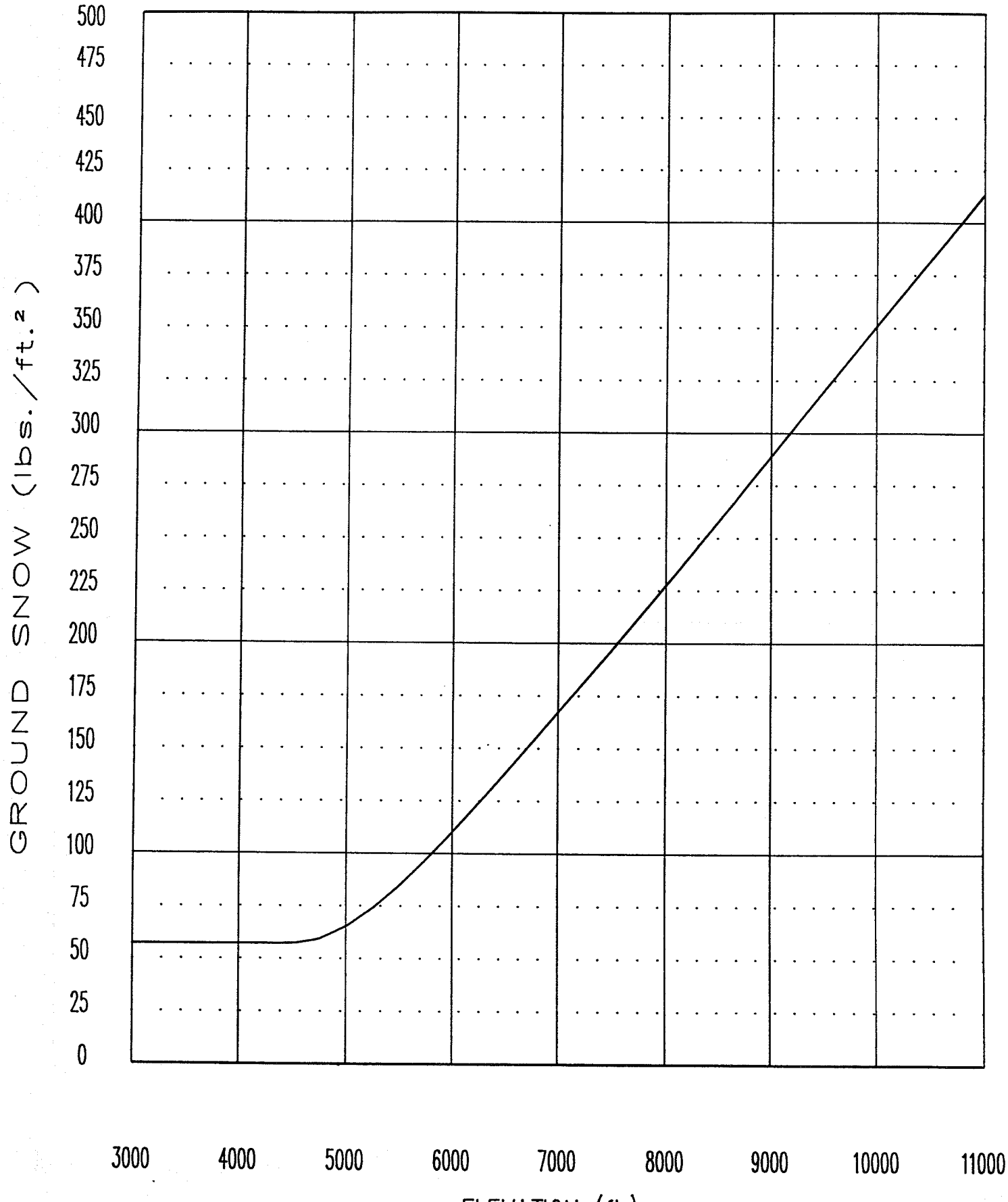


FIG. S-14 MILLARD COUNTY


GROUND SNOW (lbs./ft.²)
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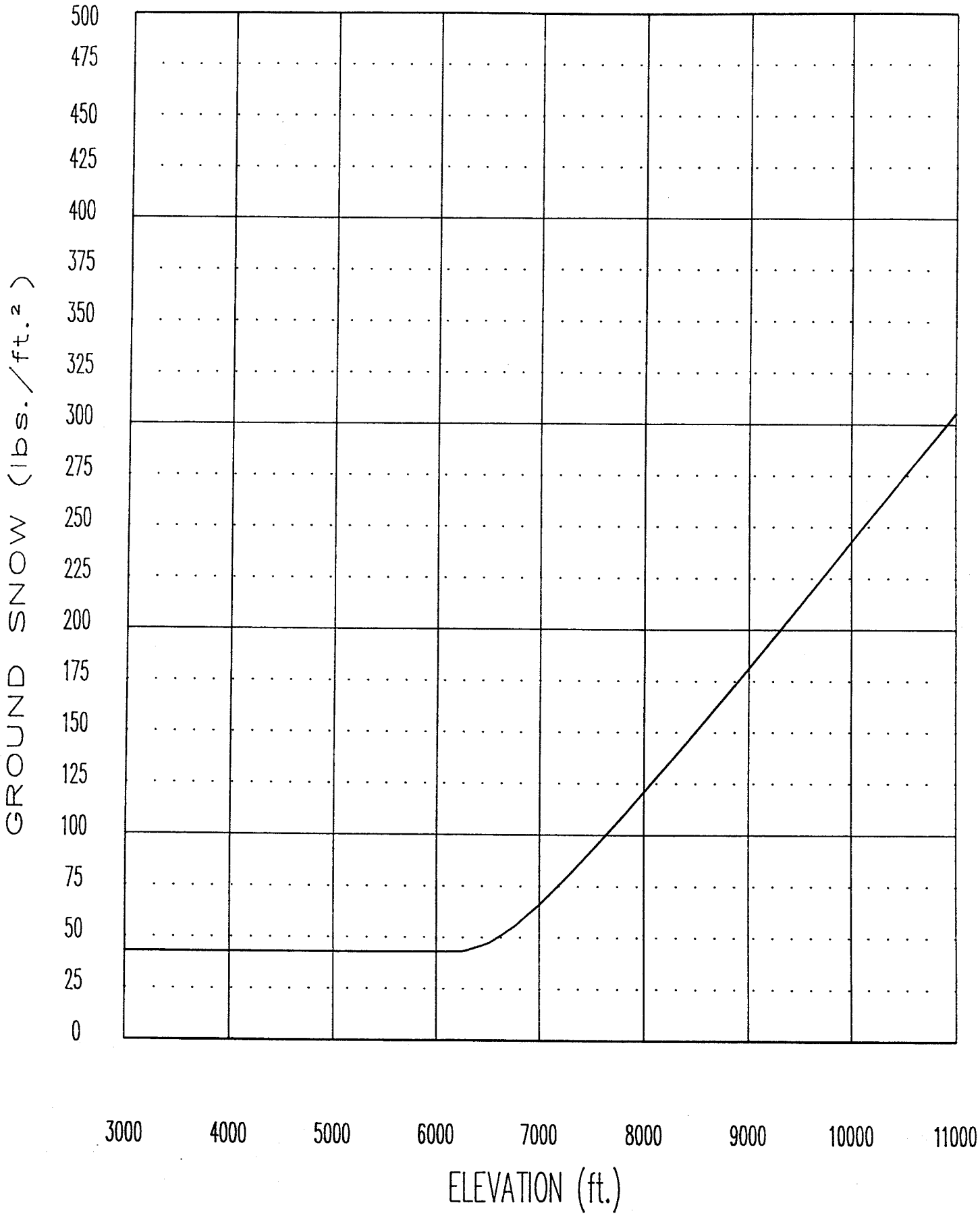
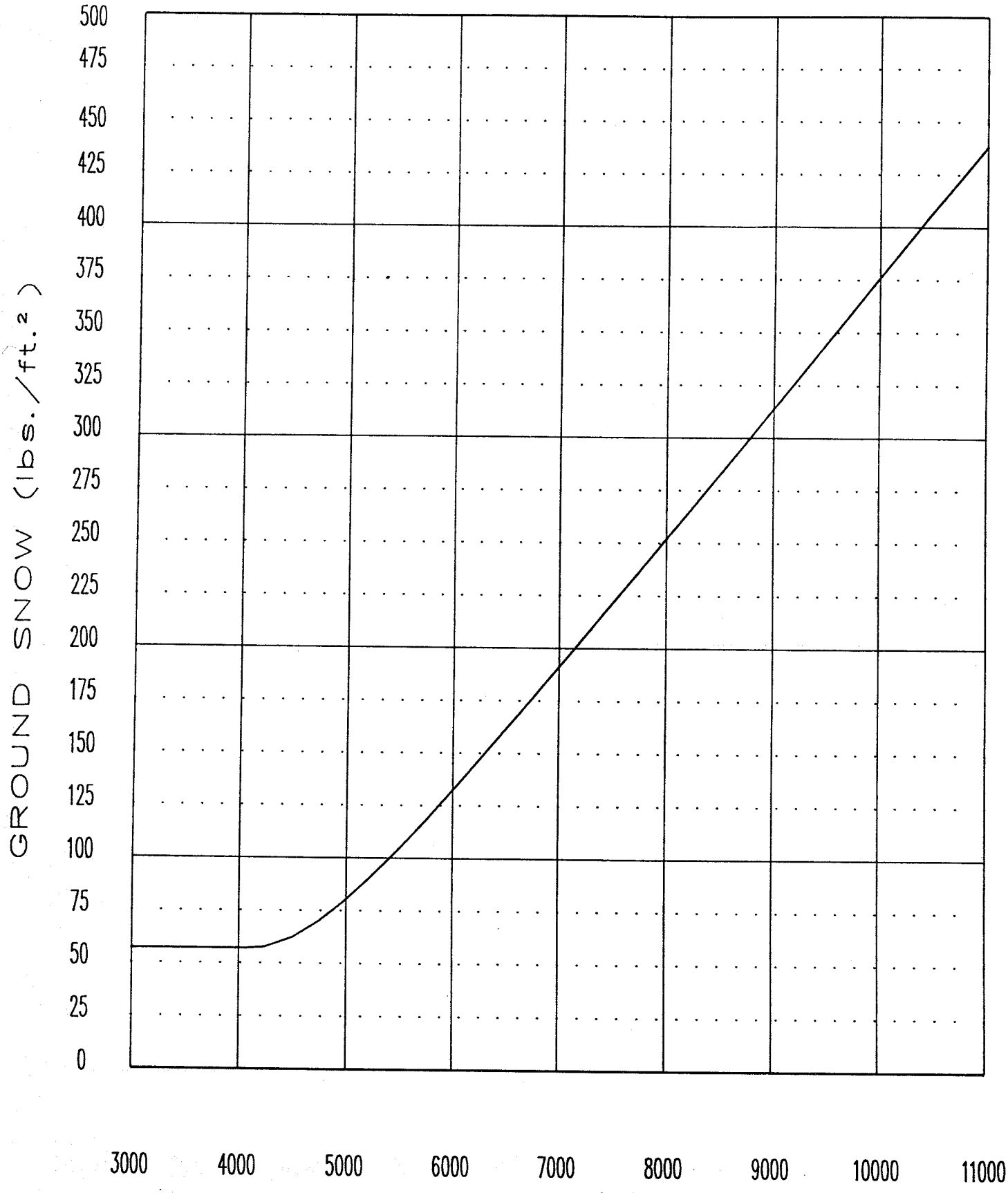


FIG. S-16 PIUTE COUNTY



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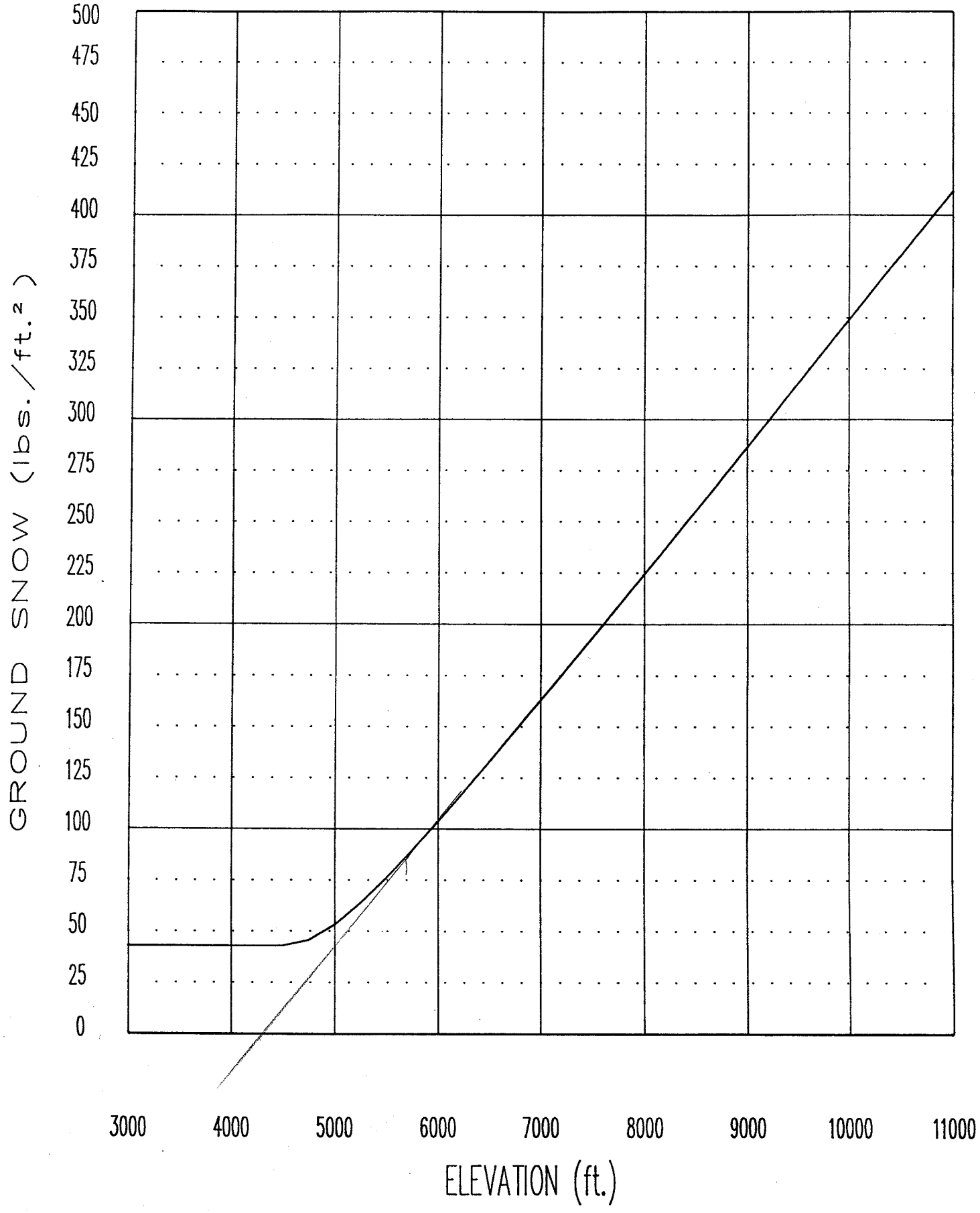

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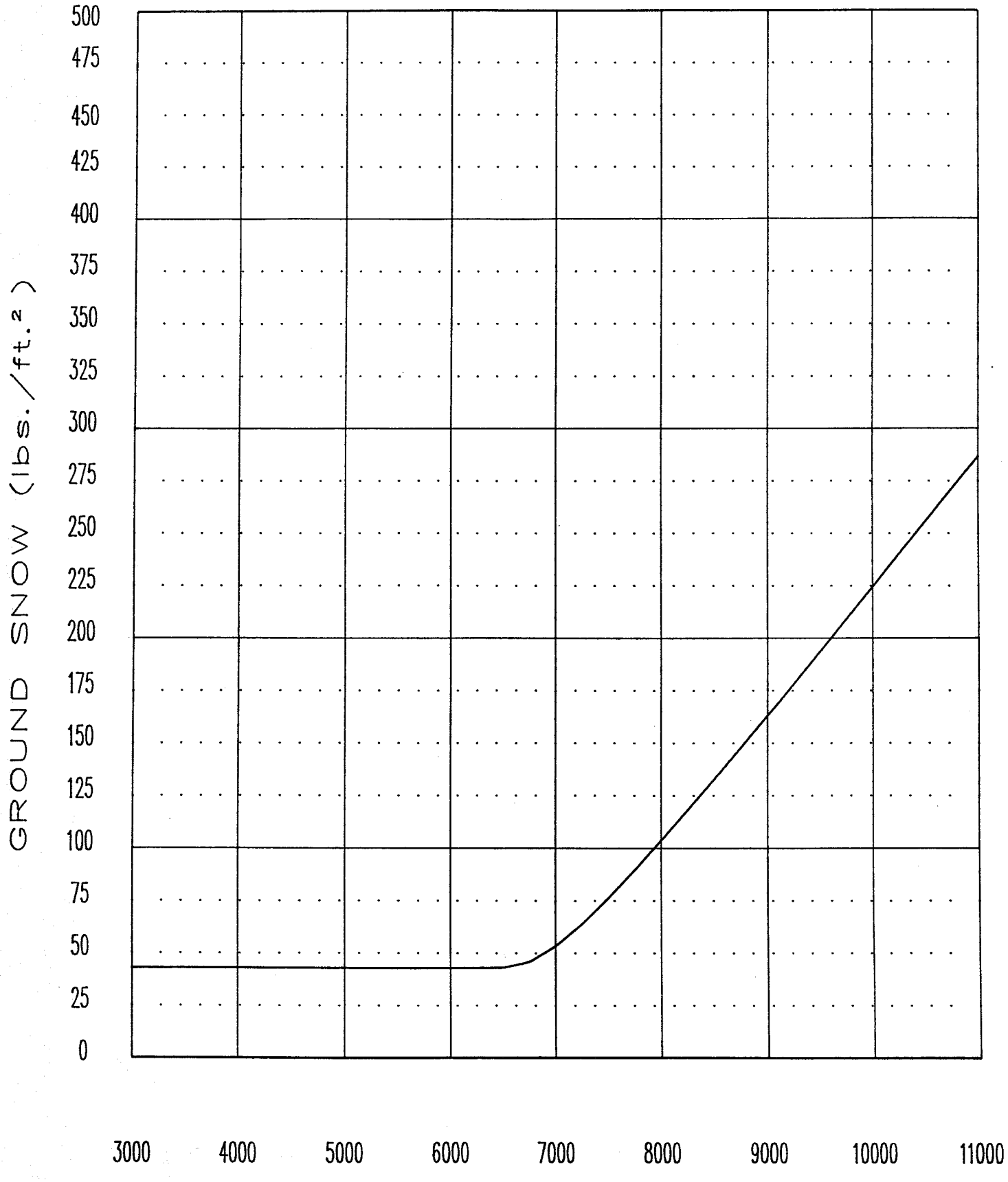


FIG. S-19 SAN JUAN COUNTY

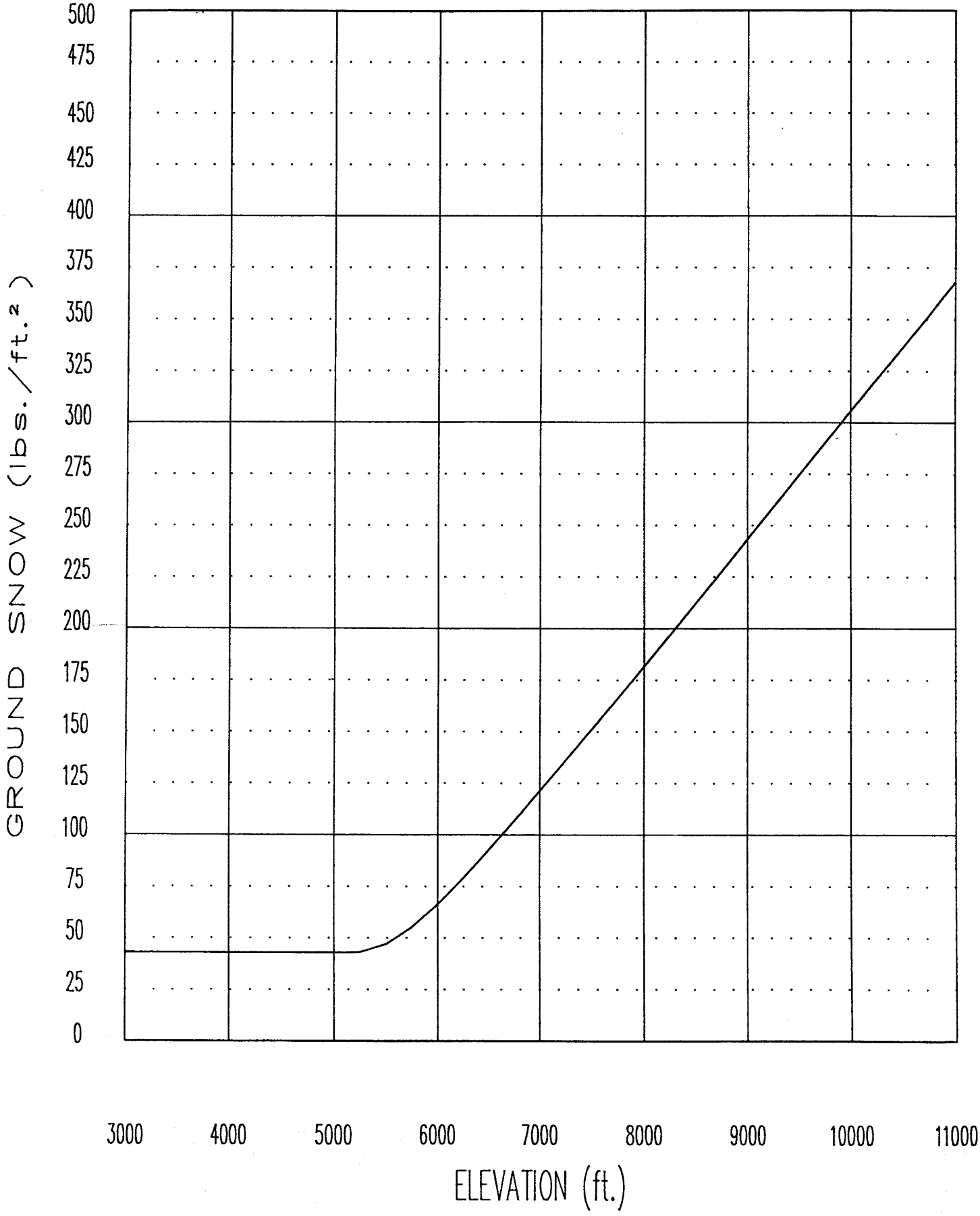


FIG. S-20 SANPETE COUNTY

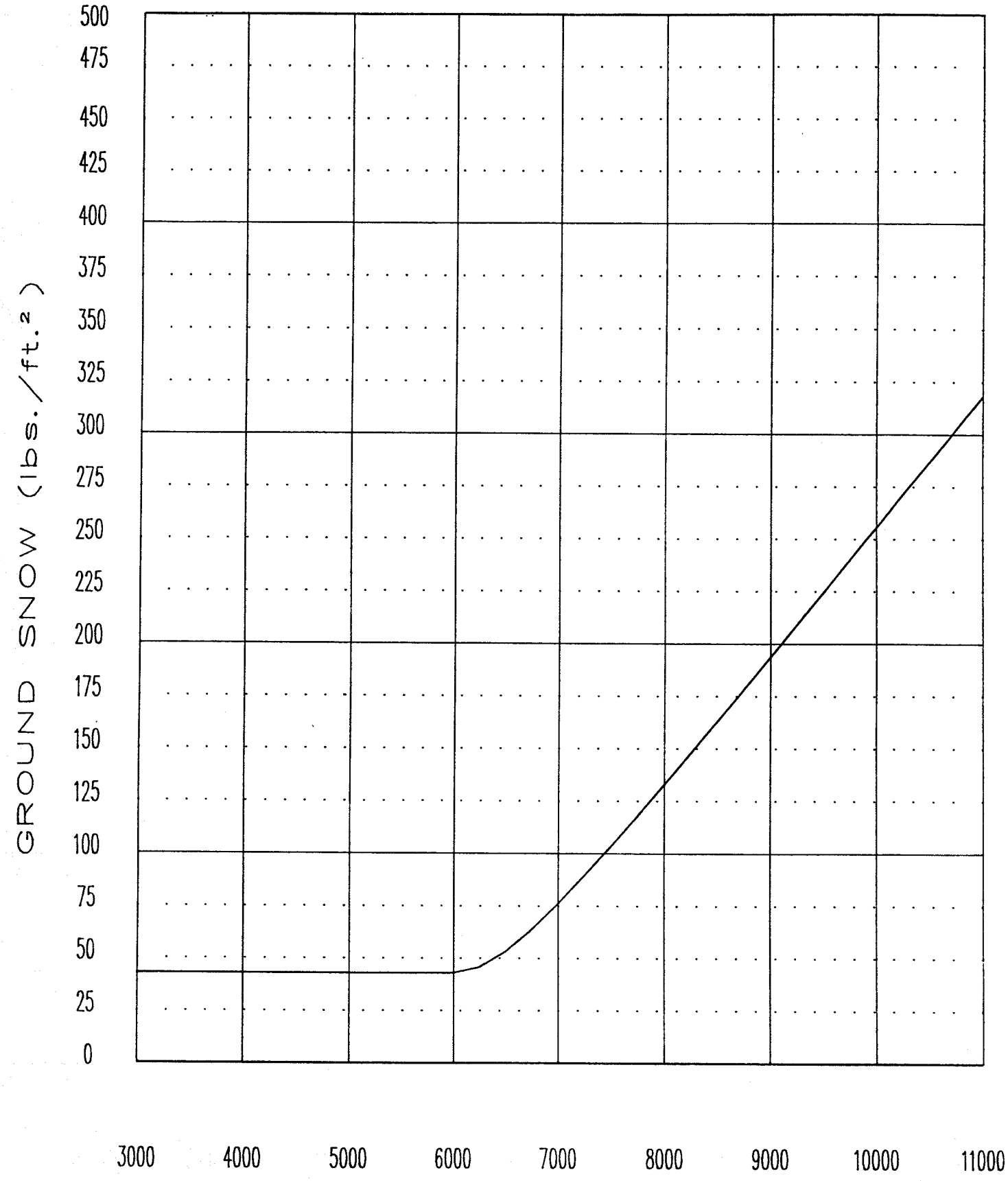


FIG. S-21 SEVIER COUNTY

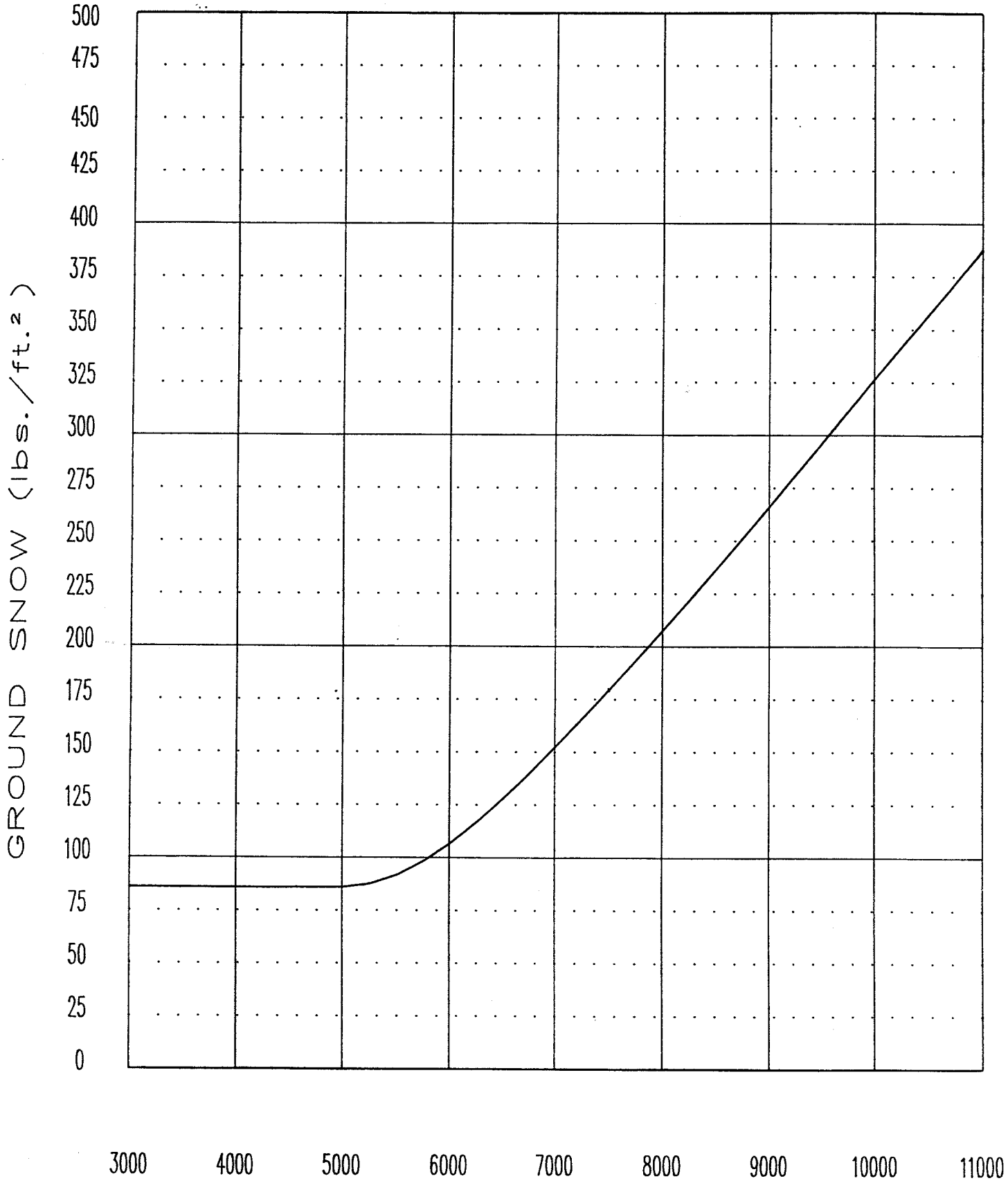


FIG. S-22 SUMMIT COUNTY

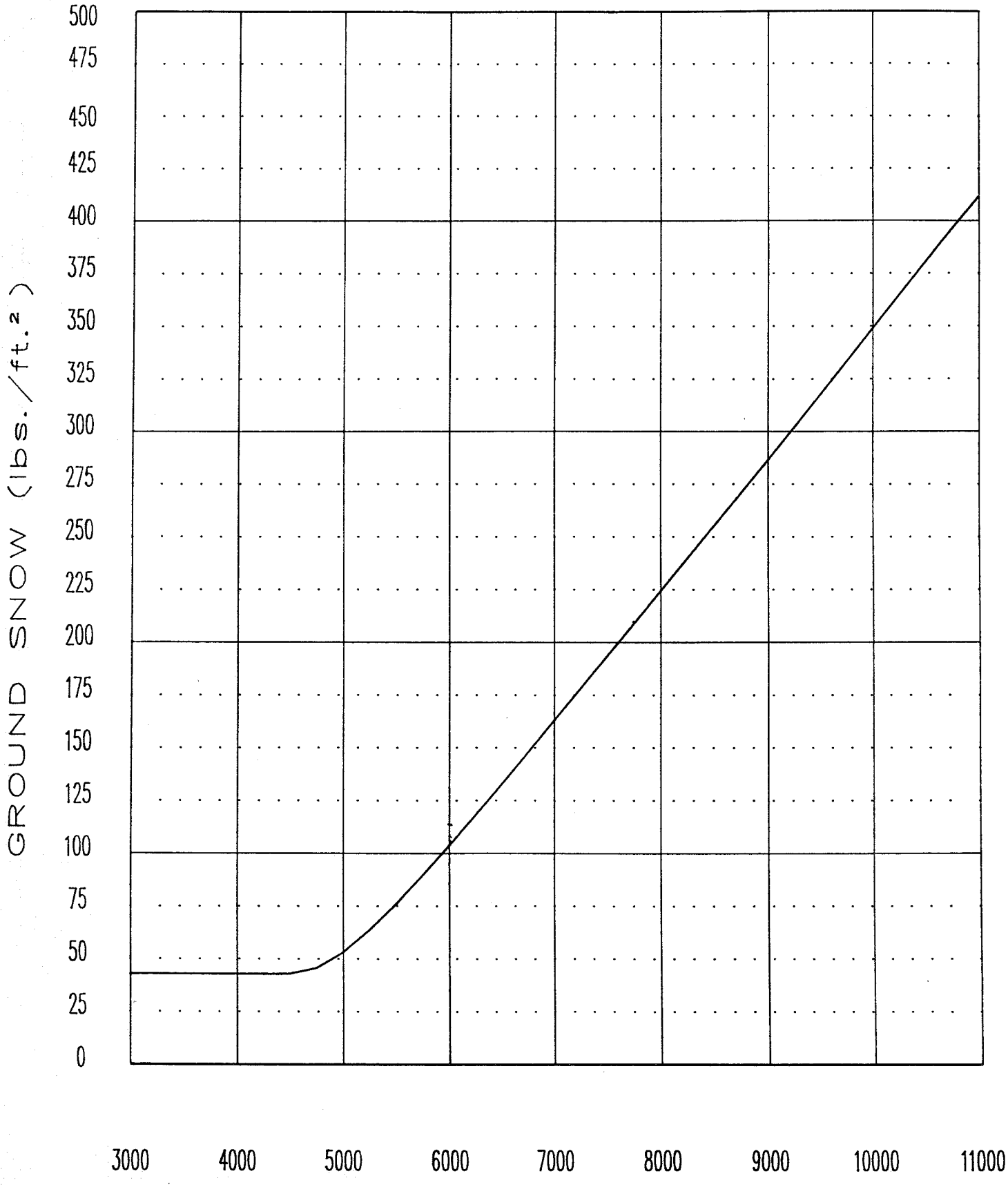


FIG. S-23 TOOELE COUNTY

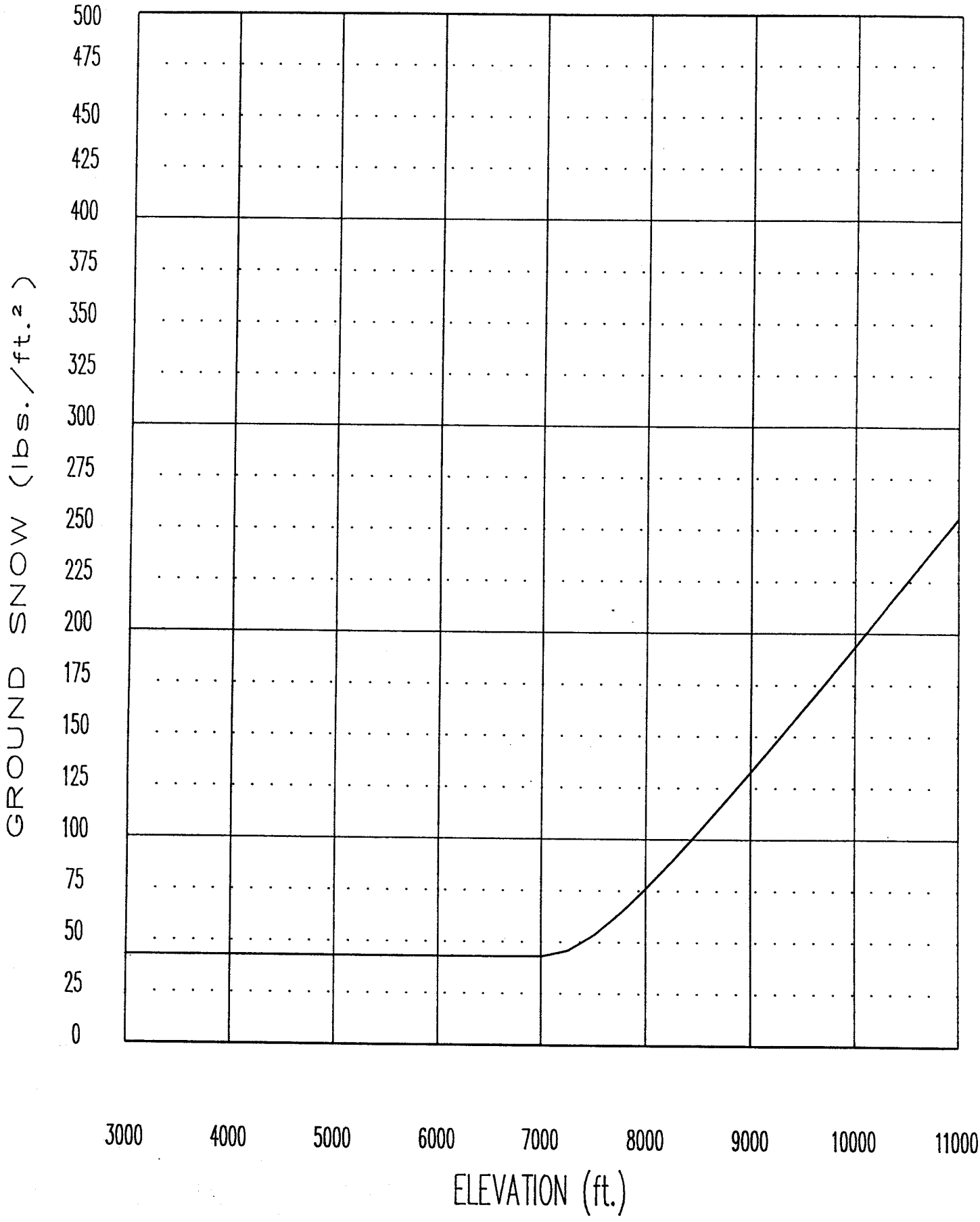


FIG. S-24 UINTAH COUNTY

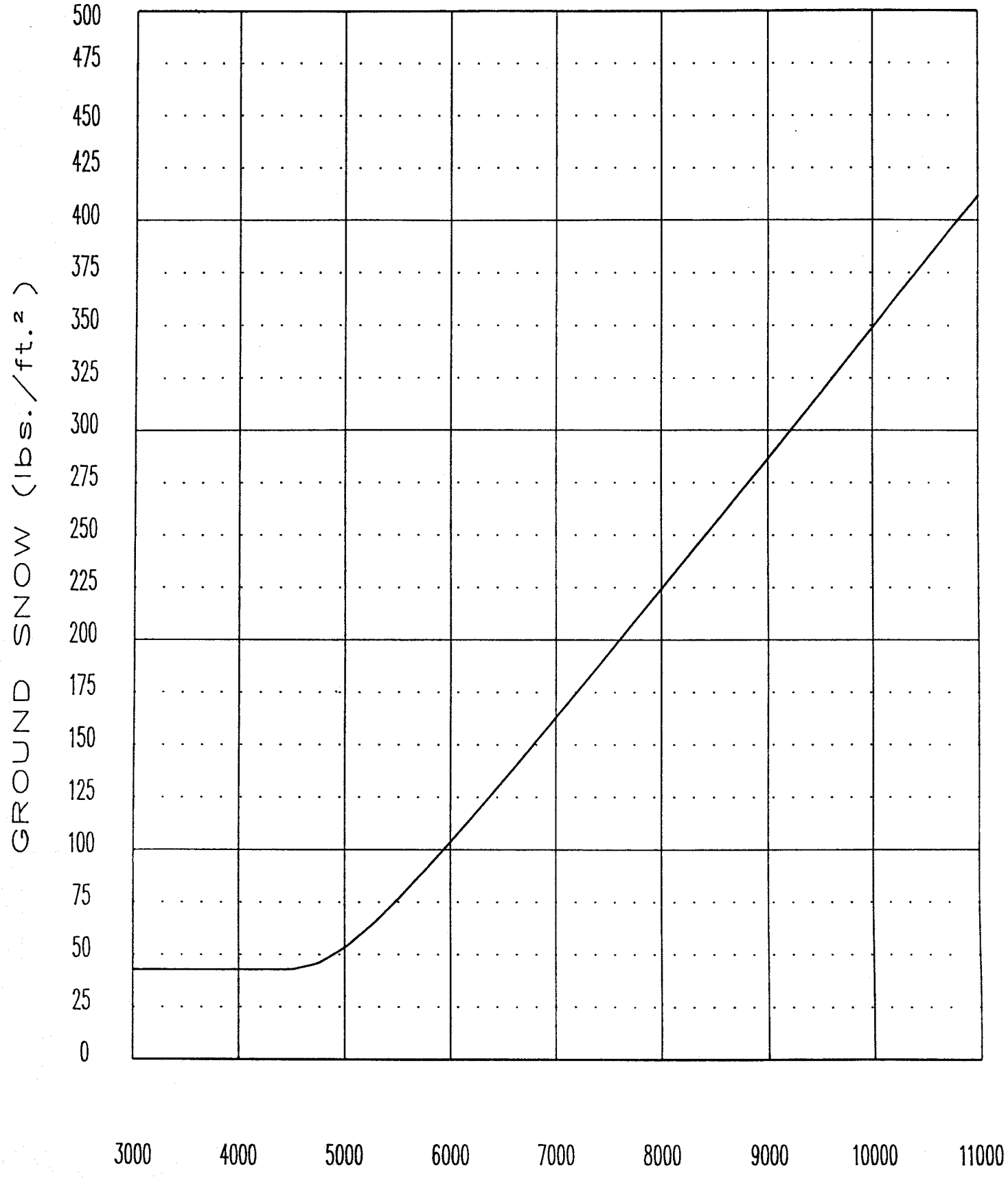


FIG. S-25 UTAH COUNTY

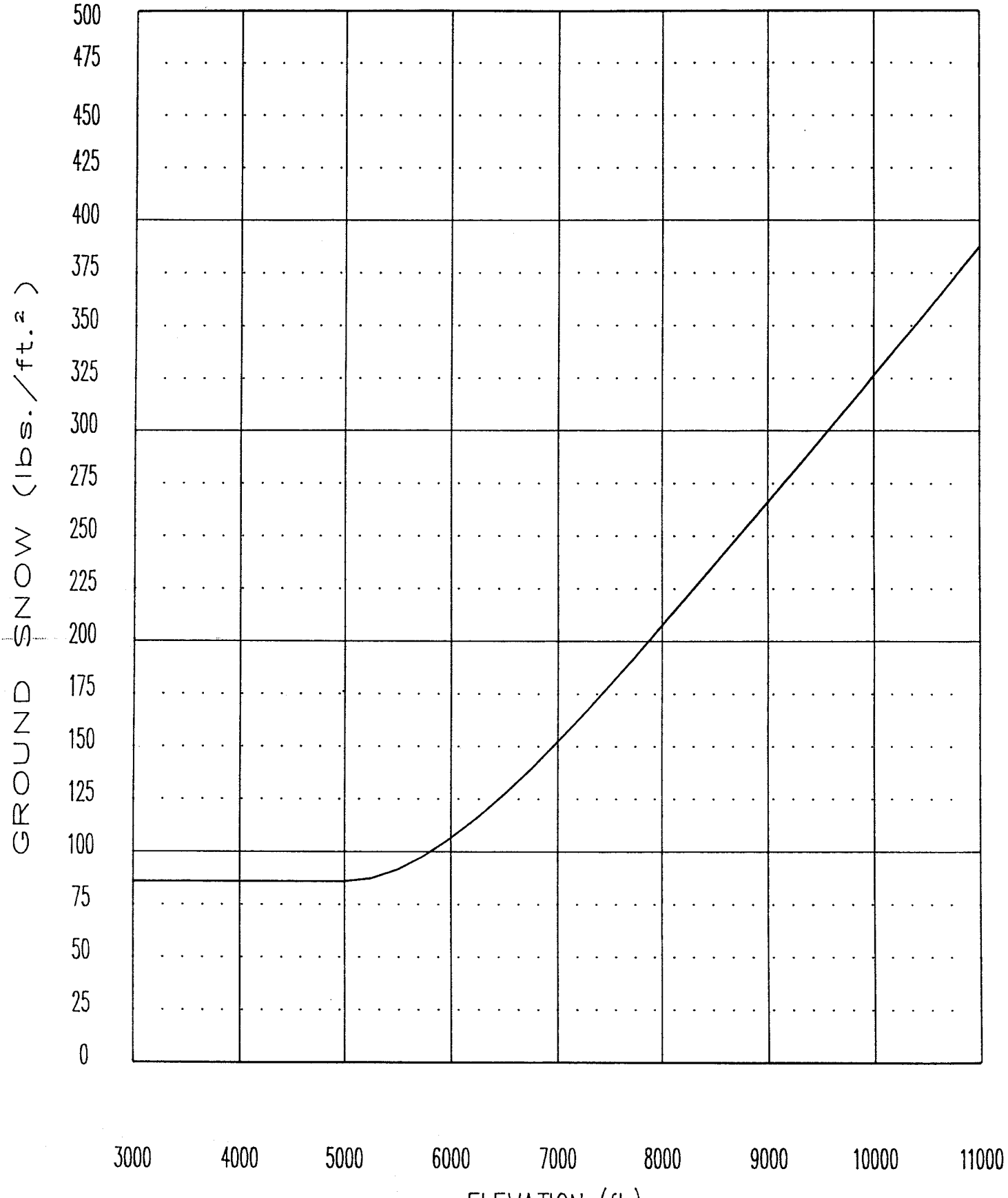


FIG. S-26 WASATCH COUNTY

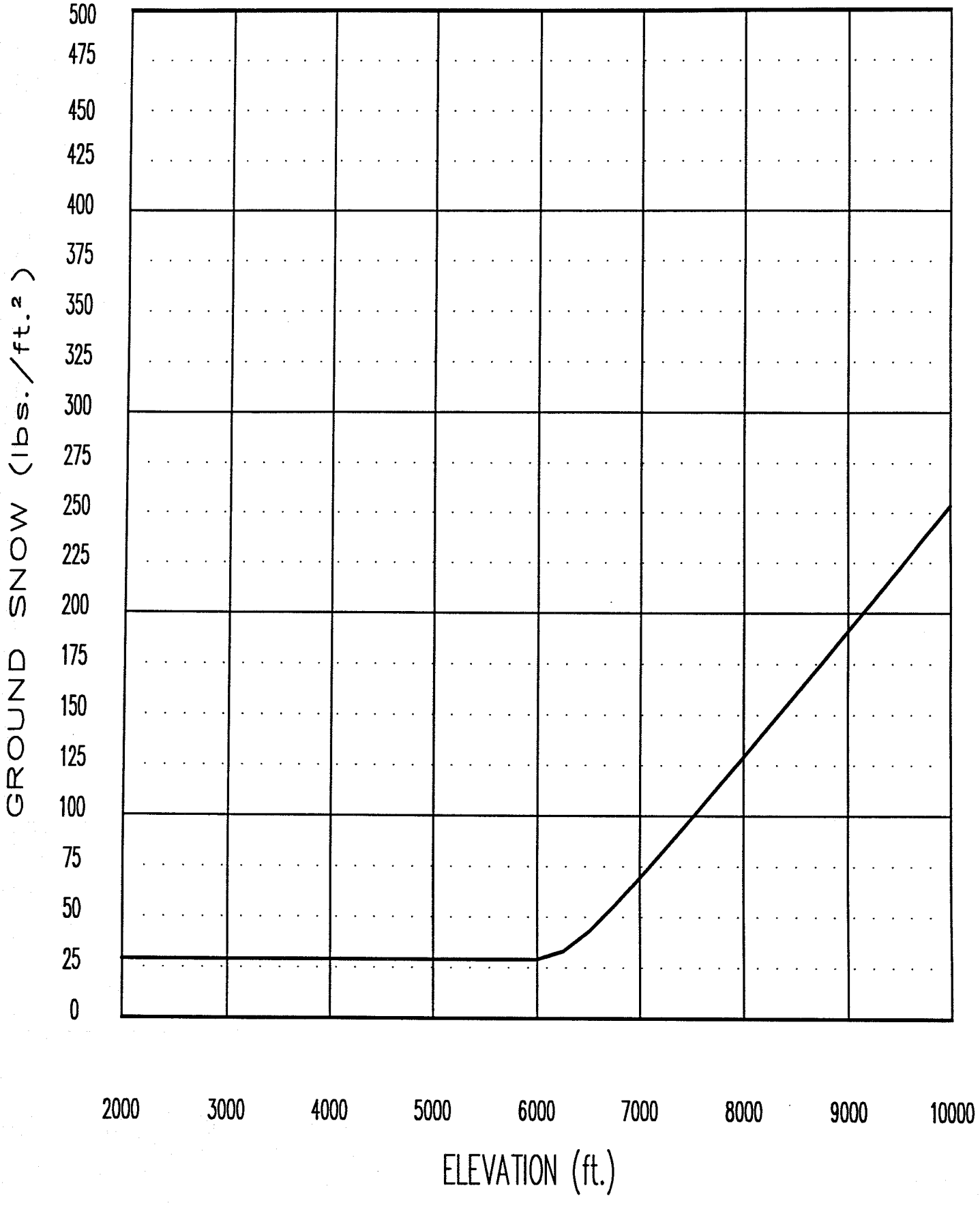


FIG. S-27 WASHINGTON COUNTY

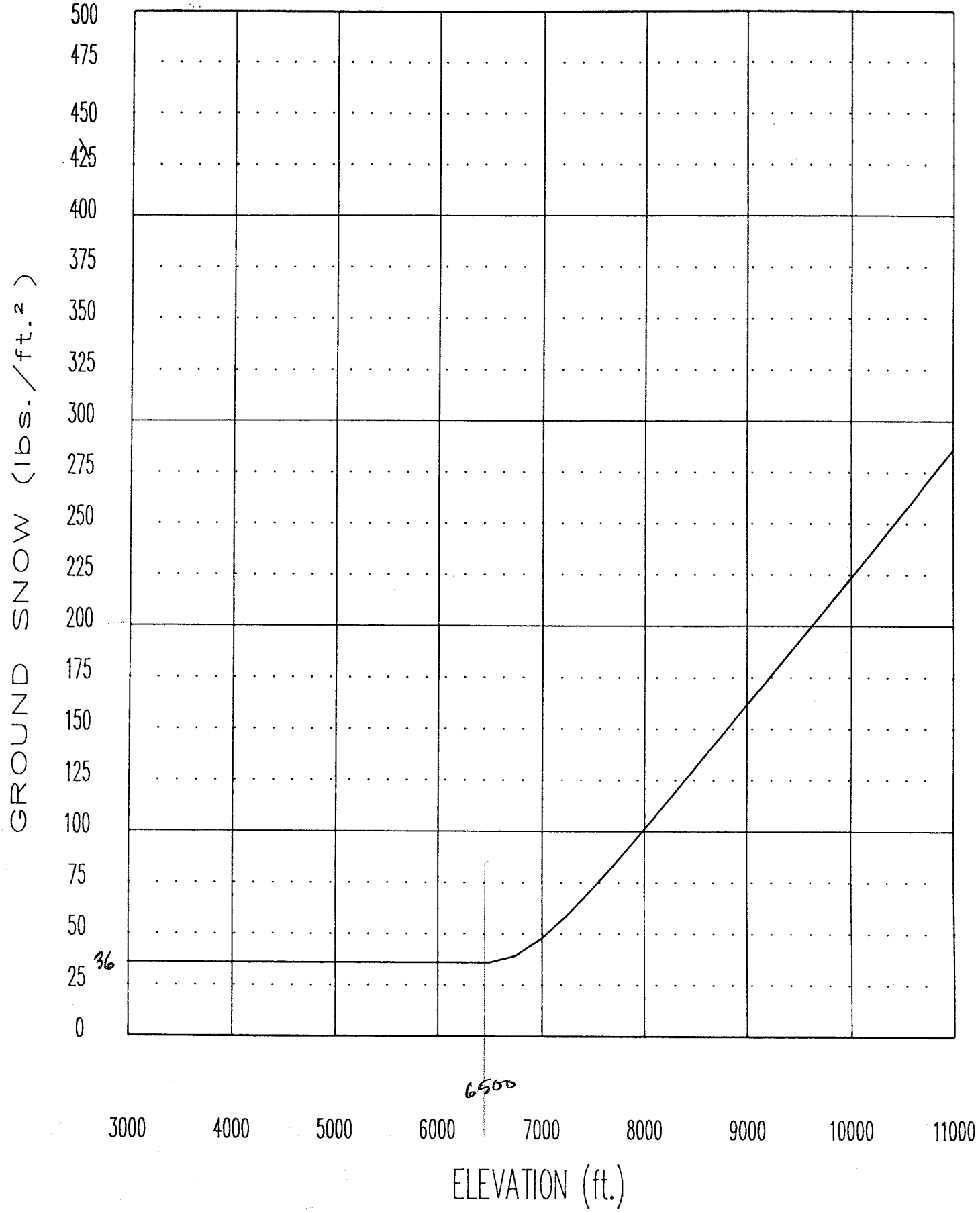
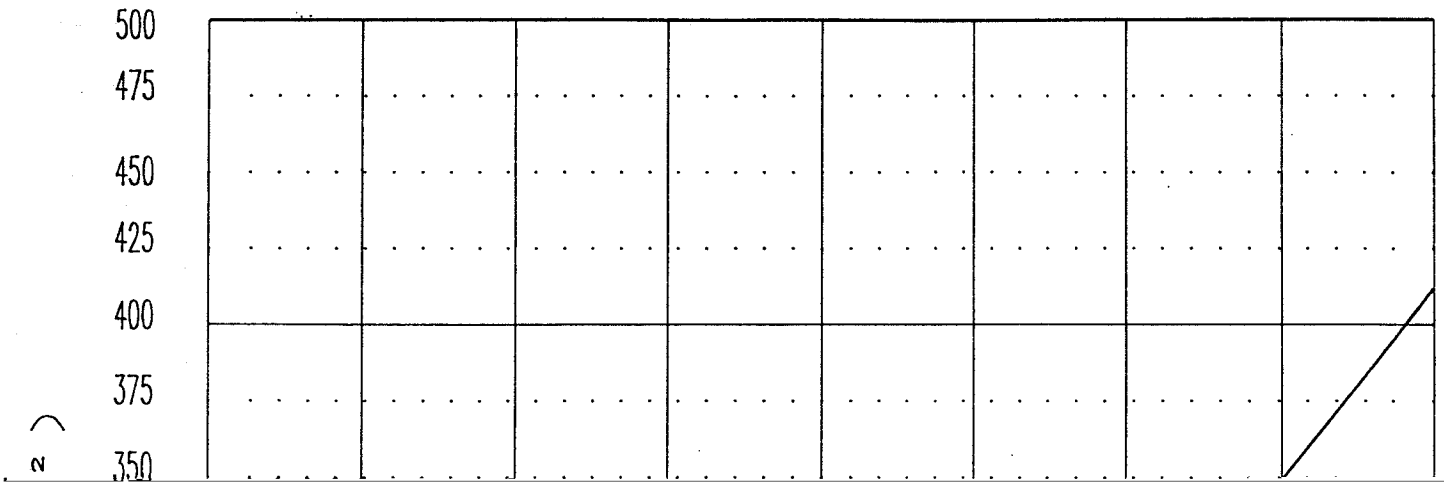


FIG. S-28 WAYNE COUNTY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LIST OF TABLES

LIST OF ILLUSTRATIONS

DISCLAIMER

In any western state there are large areas to be studied and limited data available. Hence, the best efforts of any organization or individual cannot guarantee completely adequate guidelines for all areas and conditions in that state. Weather conditions are never completely predictable. For any given design snow load selected, there will always be a certain probability that this design load will be exceeded. Therefore, the recommendations given herein should be used as a guide by the experienced designer and not as an absolute requirement. The experienced designer will take a number of factors such as those listed in the section entitled Factors Affecting Ground Snow Load into account when selecting design snow loadings.

Reasonable care has been used in the preparation of these ground snow load guidelines. However, the SEAU and its members accept no liability for the use of the information provided herein.

ACKNOWLEDGEMENTS

Mr. Bob Whaley, now retired from the SCS (Soil Conservation Service), United States Department of Agriculture, first suggested this project in about 1974. The SCS provided the data from its computer files for the first studies done at BYU (Brigham Young University). Mr. Whaley provided valuable guidance and assistance with those studies. Two students at BYU (under the direction of Dr. Kenneth W. Karren), Mr. Larry Becknell (7) and Mr. Michael Anderson (8), used this topic for their master's projects, contributing a significant effort in each case. Becknell's report, issued in 1975, contained maps with "contours" of factors of ground snow divided by elevation. Anderson's report, featured charts of ground snow versus elevation for various regions in the state. Both of these reports used only SCS snow course data. Hence, they were quite helpful in mountainous areas of higher elevation, but lacked reliable information for the valleys where the communities are located.

This study was begun in the 1980's under the sponsorship of the SEAU (Structural Engineers Association of Utah). The SCS snow course records were again used with an additional ten years of record

I. INTRODUCTION & HISTORY

In order to sense the serious need for more specific design guidance for snow loadings in the western United States, one needs only to look at Fig. 5 of the ANSI Standards (14). This figure is a map of the eleven western states showing contours for ground snow loads. Unfortunately, a majority of the map is black, indicating that "In these areas extreme local variations in snow loads preclude mapping at this scale." Another indication of the need for better dissemination of snow load design information is the fact that during the winter of 1983 - 1984, hundreds of roof failures occurred in Utah and other parts of the intermountain west. It is true that many of these failures were caused by poor details and poor installation. However, it is also true that lack of adequate snow load design criteria was a critical factor in some of the failures. One important aspect of this was the need for better design criteria for snow drifting.

A number of organizations and individuals have been deeply involved with snow load studies in the western United States for the past few decades (see References 1-16). Two main sources of recorded data have been utilized in these studies:

1. Snow Course Data from the U.S. Department of Agriculture Soil Conservation Service (SCS) and cooperating institutions such as universities, see Fig. 2 for snow course locations.
2. Weather Station Data from the National Weather Service (NWS), see Fig. 3 for weather station locations.

The SCS snow course data includes water content as well as depth of snow. Much of the NWS data includes only the depth of snow.

A partial listing of snow reports in existence for regions in the western United States is included in Table I. A variety of data sources has been used for these reports. Also, a variety of presentation methods has been used including:

1. Charts of ground snow load versus elevation,
2. Contours of ground snow load divided by elevation (sometimes called isolines),
3. Formulas in combination with maps showing variables for various regions, and
4. Tabulations of design loads for communities.

The 1982 UBC (Uniform Building Code) (18) made no specific provisions for drifting, except to say that drifting should be provided for at the design stage. Most of the reports listed in Table I referred to the Canadian method for drifting (2). While the Canadian method did have a number of very helpful provisions for drifting, the method did not take into account the lengths of tributary roof areas. Michael O'Rourke, (15) found that the most important drift factors are: upper roof length, roof elevation differences, ground snow load, and lower roof length, in that order.

Dr. Dale C. Perry, former Research Director of MBMA (Metal Building Manufacturer's Association), in Cleveland, Ohio, spearheaded an "Ad Hoc Snow Loads Subcommittee for Western States" comprised of interested parties from eleven western states. A number of these parties were representatives of the Structural Engineers Association for their respective states. The Ad Hoc Snow Loads Subcommittee proposed a set of somewhat simpler, more conservative equations than the O'Rourke equation. These drift equations can be found in an Appendix of the 1985 UBC (19) and 1988 UBC (20).

The experienced designer will take a number of factors into account when selecting design snow loadings. Factors which should be considered will be discussed later in this report.

II. METHODOLOGY

A. Statistical Methods. A number of snow report authors have used the Log Pearson, Type III, method for calculating probabilities of ground snow (17). The Ad Hoc Snow Loads Subcommittee agreed (not unanimously) to use a 2 percent probability (i.e., 2 percent probability in a given year that the design snow load would be exceeded) for normal structures and a 1 percent probability for essential or important facilities. Such statistical methods work best when applied to large data bases. Mr. Leo Beard (17) stated, "It is impractical to base the skew coefficient to be used in a frequency study on a single record of annual flows that is less than 100 years in length." None of the records used to produce this report is as long as 100 years. Stations with less than seven years length have been eliminated from the data. The maximum water content observed for each year was used as input to a computer program prepared to calculate the probabilities. It is recognized that the length of record for many of the snow courses is too short to expect good statistical performance.

B. SCS Data. The SCS data provide both water content and depth. The length of record for the SCS snow courses varies. Some records go back as far as 1924. Some snow courses have been discontinued. This information is routinely taken by trained, paid personnel and may be considered as a primary data source. A computer printout from the Portland Office of the SCS was reviewed manually to determine the maximum water content for each year. This data was entered into computer files and analyzed by the statistical computer program. SCS snow course descriptions are given in Table II. Maximum snow course ground snow loads are included in Table III. Figs. 7-9 are included to show typical maps which are available for the snow courses.

C. NWS Data. The NWS data is taken by a variety of persons, many who are volunteers. There is usually no attempt made to measure water content, only snow depth. Daily total precipitation in terms of water content is available, but the water content of the accumulated snow is not. Hence, the NWS data should be considered as a secondary data source. Some of the NWS stations began recording as early as the 1890's in Utah. However, much of this data is in a form which is extremely time consuming to extract. NWS data taken since the late 1940's is stored on Magnetic Tape at

the NWS Asheville, N.C., office. The Utah State Climatologist's office furnished SEAU with a disc containing station information, including year and maximum snow depth. Earlier data not transcribed to computer tapes was not included in this study.

A means was needed to convert NWS snow depths to water content. The formula used by the SEA of Colorado (3) was:

$$P_g = 0.9h \qquad \text{Eq. 1.}$$

where:

P_g = Ground Snow (psf)
h = Ground Snow Depth (in.) and

This relationship is shown in Fig. 4.

Professor Ronald Sack (9) utilized two straight line approximations to unit weight data for the Idaho report:

$$P_g = 0.90\ h \quad \text{(for } h < 22 \text{ in.)} \qquad \text{Eq. 2.}$$
$$P_g = 2.36\ h - 31.9 \quad \text{(for } h > 22 \text{ in.)}$$

where:

P_g = Ground Snow (psf)
h = Snow Depth (in.)

This relationships is shown in Fig. 5.

E. Importance Factors. A computer was used to analyze the following ratios of SCS probability outputs:

	Ratio	Average Value
(1)	1%/2%	1.05
(2)	2%/4%	1.08
(3)	2%/10%	1.18

Professor Ronald Sack (20) found these average values to be 1.04 for SCS and 1.16 for NWS data for Idaho for ratios of 1%/2% exceedance data. This average ratio is an indication of the magnitude of the importance factor for essential and important facilities. The 1991 UBC conservatively uses an importance factor of 15%.

III. EMPIRICAL EQUATION

A. County Charts. Graphs of ground snow versus elevation were prepared for each of Utah's twenty-nine counties with both the SCS and NWS points plotted. Both the maximum values recorded and the

importance factor (I) from UBC Table Nos. A-23-5 and A-23-T. The term roof *design* snow load refers to the flat roof snow load modified by the factors discussed in UBC Appendix Chapter 23 Div.

snow loads for the lower elevations of selected Utah communities as recommended by the technical committee of the SEAU. Table VIII provides a summary of the results of a questionnaire sent to local building officials in Utah.

IV. FACTORS AFFECTING GROUND SNOW

A. Introduction

0.000312, and 0.0000390 for 25%, 50%, and 75% of maximum ground snow. Comparing these values with the probability of 1/500 would give less than 25% of maximum ground snow.

Another approach would be to simply consider a weighted average of the ground snow data, ignoring the seismic probability and the bare months of summer, as follows:

% of Maximum Ground Snow (PSF)	Number of Observations in This Category
0% - 25%	91
26% - 50%	82
51% - 75%	28
76% - 100%	4

(91 x 12.5 + 82 x 37.5 + 28 x 62.5 + 4 x 87.5)/205 = 31%

Noting that the above calculations were based on a station at an elevation of 7500 ft., it appears that it would be conservative to vary the percentage of maximum ground snow to be used in seismic lateral force calculations from 25% at 5000 ft. elevation to 40% at 11,000 ft. elevation. It is recommended that the fraction of the roof design snow load (C_s) to be included in seismic design be given by:

$$C_s = 0.25 + 0.025\ (A-5) \qquad \text{Eq. 4.}$$

where

C_s = fraction of the roof design snow load to be used in seismic lateral force calculation when the roof design snow load exceeds 30 psf and
A = elevation above sea level (ft./1000).

VI. DURATION OF LOAD IN LUMBER:

Wood is a material in which yielding occurs at a low level of stress. Presumably, at any level of stress (i.e., at a certain percentage of the "normal design stress") a strain-time curve consists of three stages: (1) strain during application of load at a relatively steep slope, (2) yielding, and (3) progressive failure. At a smaller percentage of load, the time it takes to go through these three steps gets longer. An important aspect of this phenomenon is that such yielding is cumulative whether or not the loading is constant. Thus, lower levels of allowable stress should be used as more of the total load is applied over the life of a wood structural member. For example, if most of the load is dead load, then a smaller allowable design load is necessary.

Lyman W. Wood (23) proposed an empirical equation to represent the above fact

$$y = 108.4\ (x^{-0.04635}) + 18.3 \qquad \text{Eq. 5.}$$

where y = stress expressed as a percentage of the standard "5 minute" bending test strength.

x = duration of stress in seconds.

A 5 minute duration is commonly considered to define the standard test. In setting up the allowable stresses, a period of 10 years is taken as the basis for the application of the "maximum design load." The Forest Products Laboratory defines the condition of "long-time full load capacity" as the strength assumed to be 9/16 of the strength of a standard 5 minute test. Note that the duration of the "5 minute" test was actually taken as 7.5 minutes in calculating the curve from which the well known factor of 1.15 for the allowable stress increase for snow load was determined.

TABLE I
(Ref. Section I.)

WESTERN U.S. SNOW LOAD REPORTS

Locality	Study Sponsor	Principal Researcher	Report Date	Refer.	Format
Lake Tahoe Area	SEA NC	R. Toft	1964	(1)	Formula
Canada	Canadian Govt.		1970	(2)	Contours
Colorado	SEAColo		1971	(3)	Formula
Oregon	SEAO	J. Estoup	1971 Rev. 78	(4)	Charts
Arizona	SEAA	M. Elliott	1973	(5)	Charts
Washington	SEAW	C.D. Johnson	1975 Rev. 81	(6)	Contours
Utah	BYU-orig. SEAU-rev.	K.W. Karren	1975 Rev.	(7) (8)	Charts & Contours
Idaho	Univ. of ID.	R. Sack	1976	(9)	Contours
Sierra County Cal	Sierra County	C. S. Hayes	1977	(10)	Charts
Nevada County Cal	Nevada County	C.B. Read	1977	(11)	Charts
Montana	Montana State University	F. Videon	1978	(12)	Contours
Placer County Cal	Placer County	D. Crane	1985	(13)	Charts
Contiguous USA	ANSI	R. Sack	1982	(14)	Contours

TABLE II
(Ref. Section II.B.)
SCS SNOW COURSE DESCRIPTIONS
(See notes at end of table)

COURSE NAME	COUNTY[1]	COURSE#[2]	SLOPE[3]	SHADE[4]	DESCRIPTION
ASHLEY TWIN LAKES	24	09J11	f	i	Small mdw w/ 40' ldgpl at sides
ASPEN GROVE	25	11J27			
ATWOOD BASIN	7	10J27	f		200' op mdw in 40' ldgpl
ATWOOD LAKE	7	10J41	f		200' opening in 40' ldgpl
BARNARD CREEK	15	11J13			
BEAR CANYON	21	12L03			
BEAVER CREEK DIVIDE	22	11J46	f	i	100' opening in 50' ldgpl
BEAVER CREEK R.S.	26	11J24			
BEAVER CREEK-SKUNK CREEK	29	11H14	f	o	Open mdw with sage
BEAVER DAMS	20	11K13	f	o	At edge of 40' aspen
BEN LOMOND LWR	29	11H09	f	i	grass In slot in draw by 30' aspen
BEN LOMOND PEAK	29	11H08	f	i	Meadow protected by 40' ldgpl
BEN LOMOND TRAIL	29	11H30	f	i	In draw by 30' aspen
BEVAN'S CABIN	23	12J02	f	i	Sm opening in fir & aspen
BIG FLAT	1	12L07	f	d	50' opening in 50' spruce
BIRCH CROSSING	11	12M16	n	d	Narrow old road in 40'aspen
BLACK'S FLAT U.M. CREEK	21	11L04	f	i	Slot in 40' aspen

TABLE II (Cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	SLOPE[3]	SHADE[4]	DESCRIPTION
CEDAR CITY GOLF COURSE	11	12M20	f	o	Op golf course
CHALK CREEK #1	22	11J01	f	i	200' op in 50' ldgpl
CHALK CREEK #2	22	11J02	n	o	At edge of 40' aspen
CHALK CREEK #3	22	11J03	f	i	In slot in 30' aspen & sage
CHEPETA-WHITEROCKS LAKES	7	09J09	f	i	50' ldgpl
CLEAR CREEK	4	11K18			
CLEAR CREEK MEADOWS	2	13H02	n	i	Slot in 20' fir
CLEAR CREEK RIDGE #1	25	11K21	f	i	Slot in 30' aspen
CLEAR CREEK RIDGE #2	25	11K22	f	i	Sm mdw in 40' ldgpl & aspen
CLEAR CREEK RIDGE #3	25	11K23	f	i	Sm flat by aspen & juniper
CO-OP FLAT	11	12M09	f	o	Op mdw
CORRAL	4	10K05			
CURRANT CREEK	26	11J32	f	i	Op mdw by 30' aspen
CUTLER CREEK	17	11H29	n	i	40' ldgpl fir & spruce
DANIELS-STRAWBERRY SUMMIT	26	11J23	f	o	Op mdw
DESERET PEAK	23	12J05	n	i	In slot in fir & spruce
DILL'S CAMP	21	11K15	f	o	Op mdw east side of 40' aspen
DONKEY RESERVOIR	28	11L05	f	d	Sm slot in aspen
DRY BREAD POND	29	11H13			
DRY VALLEY DIVIDE	4	11K42	f	i	50' slot in 15' aspen & juniper
DRY VALLEY DVD	4	11K08	f	o	Op mdw
DUCK CREEK R.S.	13	12M04	f	o	Op mdw
DUTCHMAN R.S.	25	11J17	f	i	In canyon sparse aspen
EAST FORK-BLACK FORK	22	10J21	f	o	Op mdw
EAST PORTAL	26	11J07	f	o	Op flat by reservoir
EAST SHINGLE LAKE	22	11J45	f	o	In logged area
ED WARD FLAT	11	12M12	f	o	Op mdw
FARMINGTON CANYON (LOWER)	6	11J12	f	i	20' slot in 20' aspen
FARMINGTON CANYON (UPPER)	6	11J11	n	d	20' slot in sparse 30' aspen & fir
FARNSWORTH LAKE	21	11L01	n	d	Sm slot in 50' aspen & fir
FARVIEW	9	12M18			
FISH LAKE	21	11L03	n	o	Op sage slope
FIVE POINT LAKE	7	10J26	f	i	In neck of mdw with sparse ldgpl
FRANKLIN BASIN	3	11G08	f	i	50' ldgpl & fir around 150' op
G.B.R.C. ALPINE	20	11K16			
G.B.R.C. MEADOWS	20	11K10	f	o	Op mdw
G.B.R.C. OAKS	20	11K17	f	i	Sm mdw in oak brush
GARDEN CITY SUMMIT	17	11H07	f	i	In draw with 30'fir aspen & spruce
GEERTSEN CREEK	29	11H22			

TABLE II (Cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	SLOPE[3]	SHADE[4]	DESCRIPTION
GEORGE PEAK	2	13H04	n	i	20' fir
GOOSEBERRY R.S.	21	11L02	n	o	Op sage slope
GOOSESBERRY RES	20	11K04	f	o	Op sage
GRIZZLY RIDGE	24	09J13	f	o	In slot in ldgpl
HARRIS FLAT	13	12M05	f	o	Op flat
HAYDEN FORK	22	10J07	f	i	In campground in 50' spruce & aspen
HEAD OF BEAR RIVER	22	10J05			
HENRY'S FORK	22	10J24	f	i	In canyon near sparse ldgpl
HEWINTA G.S.	22	10J04	f	o	Op mdw
HICKERSON PARK	5	09J08	f	o	Op mdw
HOBBLE CREEK SUMMIT	25	11J22	f	i	In 40' slot near 30' aspen
HOLE-IN-THE-ROCK	22	10J01	f	i	Near 40' ldgpl in mdw
HOLE-IN-THE-ROCK G.S.	22	10J03	f	o	Op mdw
HORSE RIDGE	15	11H21	f	i	100' op in 40' aspen
HUNTINGTON-HORSESHOE	20	11K05	n	o	Op exposed ridge
HUNTSVILLE-WHEELER DIV	15	11H24			
INDIAN CANYON	7	10K01	f	i	Op flat surrounded by 40' ldgpl
JACKSON PARK	7	10J19	f	i	In neck of mdw in 40' ldgpl
JOHNSON VALLEY	21	11L06	f	o	Op sage
JONES RANCH	4	11K07	f	o	Op mdw
JULIUS PARK	24	09J06	f	d	Sm mdw with 40'ldgpl side
KILFOIL CREEK	15	11H31	n	d	Slot in 40' aspen & fir
KIMBERLY MINE	16	12L06	n	i	100' op in 42' aspen & fir
KIMBERLY MINE(LOWER)	16	12L10			
KINGS CABIN (LOWER)	24	09J02	f	i	Op mdw
KLONDIKE NARROWS	3	11H01	f	i	50' op in 50' aspen
KOLOB CRYSTAL	11	13M05	f	i	50' op in 50' aspen
LAKEFORK BASIN	7	10J25	f	i	mdw on 50' spruce
LAKEFORK MOUNTAIN #1	7	10J10	f	o	200'-300' mdw
LAKEFORK MOUNTAIN #2	7	10J11	f	i	50'op in 50'aspen
LAKEFORK MOUNTAIN #3	7	10J12	f	i	50' op in 30' ldgpl
LAMB'S CANYON	18	11J41	f	i	100' mdw in 40' lsgpl & aspen

TABLE II (Cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	SLOPE[3]	SHADE[4]	DESCRIPTION
LOST CREEK RESERVOIR	15	11H32	f	o	Near creek with sage & willow
LOST LAKE	26	10J15			
MAMMOTH R.S.-COTTONWOOD C	20	11K03	f	o	Op mdw in draw
MERCHANT'S VALLEY UPPER	1	12L12	s	i	100' op in 30' aspen & fir
MERCHANT'S VALLEY	1	12L09	f	o	Op mdw
MIDDLE BEAVER CREEK	22	10J02	f	i	40' slot in 40' ldgpl
MIDDLE CANYON	23	12J03	f	i	In canyon 40' aspen on sides
MIDDLE FORK	20	11K34	n	i	North slope by 40' fir
MIDWAY VALLEY	11	12M02			
MILL D SOUTH FORK	18	11J10	f	i	40' sparse aspen
MONTE CRISTO R.S.	3	11H12	f	i	100' op in 40' aspen
MONTICELLO CITY PARK	19	09M03	f	o	In park
MOSBY MOUNTAIN	24	09J05	n	d	On narrow trail in 50' ldgpl
MOSBY MOUNTAIN (UPPER)	24	09J04			
MOUNT LOGAN	3	11H08			
MOUNT OGDEN	29	11H10			
MT. BALDY R.S.	20	11K12	n	d	North slope in 50' spruce & fir
MUD CREEK	4	11K06			30'side hill slot in 40' fir & aspen
MUD CREEK	4	11K33			
MUD FLAT RANGER STA.	3	11H18	n	d	
OAK CREEK	14	12K02	n	d	Sm op in aspen & fir
ONE MILE SUMMIT	2	13H01	n	d	30' fir & aspen
ORANGE OLSEN	8	11K40	f	o	15' juniper sage & spruce
OTTER LAKE	1	12L08	f	d	30' for bordering 20'foot road
PACKARD CANYON	25	11J31	n	i	Sm op in 40'aspen & fir
PANGUITCH LAKE	9	12M07	f	o	Op sage

TABLE II (Cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	SLOPE[3]	SHADE[4]	DESCRIPTION
REE'S FLAT	12	11K36	n	i	30' aspen & sage in draw
REYNOLDS PARK	24	09J10	f	i	Op mdw near 30' ldgpl
ROCK CREEK RANCH	7	10J18	f	i	50' ldgpl on south of open mdw
ROCKY BASIN SETTLEMENT CA	23	12J01			
RUSH POND	20	11K38	f	i	Slot in aspen
SAGEBRUSH FLAT	29	11H15	f	i	Sm mdw in draw with sparse aspen
SEELEY CREEK R.S. #2	20	11K09	f	o	Op flat mdw
SEELEY CREEK R.S. #1	20	11K20			
SERGEANT LAKES	22	11J39	f	i	Sm op road in 30' aspen
SHINGLE MILL	14	12L11	f	d	Sm op in 20' ldgpl
SILVER LAKE (BRIGHTON)	18	11J16	f	o	Op mdw
SMITH & MOREHOUSE	22	11J04	f	i	Op flat with aspen at sides
SMITHFIELD SPRINGS	3	11H19			
SNOW BASIN	29	11H11			
SNOWBIRD (GAD VALLEY)	18	11J42	f	o	40' spruce & fir
SOAPSTONE RANGER STATION	26	11J25	f	o	Op mdw
SOUTH FORK RANGER STATION	25	11J19	f	i	Sm protected pasture
SPIRIT LAKE	5	09J07	f	o	Op mdw with 40' ldgpl border
SPRING HOLLOW (LOWER)	3	11H04			
SPRING HOLLOW (UPPER)	3	11H05			
SQAUW SPRINGS	22	12L05	n	d	Sm op in 40' dense fir
STEEP HOLLOW #1	3	11H27	f	i	40' spruce & fir
STEEP HOLLOW #2	3	11H28	n	o	Op with aspen and ldgpl nearby
STILLWATER CAMP	22	10J17	f	i	In campground sparse 40' ldgpl
STRAWBERRY DIVIDE	7	110J8	n	d	Phone line slot in 50' spruce
STUART R.S.	8	11K27	f	i	In canyon with sparse ldgpl
SUSC RANCH	11	12M17	s	i	30' slot in 30' aspen
SWITCHBACK	8	11K26	n	o	Sagebrush in Huntington Canyon
TALL POLES	11	12M15	n	d	50' slot in 50' fir
THISTLE FLAT	20	11K35	f	o	Op mdw in 30' aspen
TIMPANOGOS CAVE CAMP	25	11J18	f	i	In parking lot
TIMPANOGOS DIVIDE	25	11J21	f	i	Sm op in 42' aspen
TONY GROVE LAKE	3	11H36	f	o	50' op in 60' ldgpl
TONY GROVE LAKE	3	11H02	f	o	Op flat
TONY GROVE RANGER STATION	3	11H03	f	o	Op mdw
TRIAL LAKE	26	10J08	f	i	sm mdw with 50' spruce at side

TABLE II (Cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	SLOPE[3]	SHADE[4]	DESCRIPTION
TROUT CREEK	24	09J16	f	d	Sm op in 40' ldgpl
UPPER JOE'S VALLEY	8	11K29	f	i	20' aspen spruce & fir
URIE FLAT	11	12M10	f	i	Sm op flat
VERNON CREEK	23	12K01	n	i	In draw sm op in 40' aspen
VIPONT	2	13H03	f	o	30' aspen around op mdw
WASHINGTON-LONG LAKE	26	10J16			
WEBSTER FLAT	11	12M03	f	o	Aspen surrounding op mdw
WHITE RIVER #1	4	10K02	f	i	40' slot in 40' aspen
WHITE RIVER #2	4	11K24	f	i	In draw by willows
WHITE RIVER #3	4	11K25	f	o	Op mdw
WIDTSOE-ESCALANTE #3	9	11M03	n	i	100' op in 40' fir & ldgpl
WIDTSOE-ESCALANTE #2	9	11M02	n	d	10'slot in 40' fir
WIDTSOE-ESCALANTE SM	9	11M01	f	o	Op mdw
WINDY PARK	24	09J12	n	i	Op mdw by 40' ldgpl
WRIGLEY CREEK	20	11K32	n	i	Near 40' aspen

TABLE III
(Ref. Section II. B.)

SCS SNOW COURSE MAXIMUM GROUND SNOW LOADS
(See notes at end of Table)

COURSE NAME	COUNTY[1]	COURSE#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
BEAVER RACE TRACK	1	12L13	6020	17.	17.
BIG FLAT	1	12L07	10290	190.	191.
MERCHANT'S VALLEY UPPER	1	12L12	8750	118.	141.
MERCHANT'S VALLEY	1	12L09	8200	118.	103.
OTTER LAKE	1	12L08	9600	166.	164.
CLEAR CREEK MEADOWS	2	13H02	9050	250.	226.
GEORGE PEAK	2	13H04	9000	229.	255.
ONE MILE SUMMIT	2	13H01	7330	87.	73.
VIPONT	2	13H03	7670	135.	132.
BLACKSMITH FORK	3	11H20	8400	168.	185.
BUG LAKE	3	11H37	7950	159.	158.
FRANKLIN BASIN	3	11G08	8020	238.	230.
KLONDIKE NARROWS	3	11H01	7400	154.	153.
LITTLE BEAR (LOWER)	3	11H26	6000	88.	84.
LITTLE BEAR (UPPER)	3	11H25	6550	106.	103.
MONTE CRISTO R.S.	3	11H12	8960	218.	217.
MOUNT LOGAN	3	11H08	9000	229.	244.
MUD FLAT RANGER STA.	3	11H18	6700	104.	125.
SMITHFIELD SPRINGS	3	11H19	7000	171.	205.
SPRING HOLLOW (LOWER)	3	11H04	7000	127.	120.
SPRING HOLLOW (UPPER)	3	11H05	8000	204.	205.
STEEP HOLLOW #1	3	11H27	8500	309.	305.
STEEP HOLLOW #2	3	11H28	7700	212.	217.
TONY GROVE LAKE	3	11H02	8200	286.	322.
TONY GROVE LAKE	3	11H36	8400	283.	326.
TONY GROVE RANGER STATION	3	11H03	6250	133.	126.
CLEAR CREEK	4	11K18	8150	68.	76.
CORRAL	4	10K05	8200	94.	116.
DRY VALLEY DIVIDE	4	11K42	8100	139.	114.
DRY VALLEY DVD	4	11K08	7800	135.	95.
JONES RANCH	4	11K07	7600	91.	63.
MUD CREEK	4	11K33	8600	120.	112.
MUD CREEK	4	11K06	8250	199.	230.
WHITE RIVER #1	4	10K02	8550	104.	113.
WHITE RIVER #2	4	11K24	7600	75.	69.
WHITE RIVER #3	4	11K25	7400	72.	86.
BURNT CREEK	5	09J14	7900	55.	55.
HICKERSON PARK	5	09J08	9100	76.	82.
SPIRIT LAKE	5	09J07	10300	138.	132.
FARMINGTON CANYON (LOWER)	6	11J12	6950	217.	215.
FARMINGTON CANYON (UPPER)	6	11J11	8000	269.	272.

TABLE III (cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
ATWOOD BASIN	7	10J27	10250	75.	84.
ATWOOD LAKE	7	10J41	10500	125.	145.
BROWN DUCK LAKE	7	11J09	10300	166.	157.
BROWN DUCK RIDGE	7	10J30	10600	163.	161.
CHEPETA-WHITEROCKS LAKES	7	09J09	10350	153.	146.
FIVE POINT LAKE	7	10J26	11000	159.	142.
INDIAN CANYON	7	10K01	9100	134.	123.
JACKSON PARK	7	10J19	10600	122.	120.
LAKEFORK BASIN	7	10J25	11100	181.	171.
LAKEFORK MOUNTAIN #1	7	10J10	10200	112.	95.
LAKEFORK MOUNTAIN #2	7	10J11	8900	81.	84.
LAKEFORK MOUNTAIN #3	7	10J12	8400	75.	57.
LIGHTNING LAKE	7	10J29	10950	210.	231.
ROCK CREEK RANCH	7	10J18	7900	77.	70.
STRAWBERRY DIVIDE	7	110J8	8400	226.	164.
ORANGE OLSEN	8	11K40	7200	48.	58.
RED PINE RIDGE	8	11K28	9200	151.	161.
STUART R.S.	8	11K27	7950	87.	91.
SWITCHBACK	8	11K26	8600	130.	147.
UPPER JOE'S VALLEY	8	11K29	8900	89.	95.
BRYCE CANYON	9	12M08	8000	101.	89.
CASTLE VALLEY	9	12M13	9580	135.	131.
FARVIEW	9	12M18	8200	109.	117.
PANGUITCH LAKE	9	12M07	8200	74.	59.
WIDTSOE-ESCALANTE #3	9	11M03	9500	125.	110.
WIDTSOE-ESCALANTE #2	9	11M02	9500	95.	85.
WIDTSOE-ESCALANTE SM	9	11M01	9500	102.	96.
BIRCH CROSSING	11	12M16	8100	71.	77.
BRIAN HEAD	11	12M14	10000	179.	194.
CEDAR BREAKS	11	12M01	10390	232.	228.
CEDAR CITY GOLF COURSE	11	12M20	5800	8.	14.
CO-OP FLAT	11	12M09	9500	162.	162.
ED WARD FLAT	11	12M12	8300	87.	86.
KOLOB CRYSTAL	11	13M05	9250	240.	302.
MIDWAY VALLEY	11	12M02	9800	245.	248.
SUSC RANCH	11	12M17	8200	125.	145.
TALL POLES	11	12M15	8800	144.	156.
URIE FLAT	11	12M10	8450	112.	67.
WEBSTER FLAT	11	12M03	9200	201.	209.
YANKEE RESERVOIR	11	12M11	8700	104.	100.
REE'S FLAT	12	11K36	7300	125.	124.
DUCK CREEK R.S.	13	12M04	8700	179.	165.
HARRIS FLAT	13	12M05	7700	128.	120.

TABLE III (cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
LONG VALLEY JUNCTION	13	12M06	7500	101.	98.
OAK CREEK	14	12K02	7760	140.	134.
PINE CREEK	14	12L01	8800	236.	209.
SHINGLE MILL	14	12L11	6200	116.	81.
BARNARD CREEK	15	11J13	8000	219.	226.
HORSE RIDGE	15	11H21	8260	178.	173.
HUNTSVILLE-WHEELER DIV	15	11H24	5780	98.	164.
KILFOIL CREEK	15	11H31	7300	118.	108.
LOST CREEK RESERVOIR	15	11H32	6125	52.	52.
PARRISH CREEK	15	11J29	8000	196.	228.
PINE CANYON	15	11H50	8000	126.	139.
KIMBERLY MINE	16	12L06	9300	172.	167.
KIMBERLY MINE(LOWER)	16	12L10	8300	111.	118.
CUTLER CREEK	17	11H29	6780	234.	229.
GARDEN CITY SUMMIT	17	11H07	7600	166.	140.
LAMB'S CANYON	18	11J41	7400	127.	144.
LAMB'S CANYON	18	11J14	6600	154.	129.
MILL CREEK	18	11J44	6950	160.	168.
MILL D SOUTH FORK	18	11J10	7400	179.	165.
SILVER LAKE (BRIGHTON)	18	11J16	8725	217.	202.
SNOWBIRD (GAD VALLEY)	18	11J42	9700	280.	328.
Y. L. M. I. A.	18	11J28	6000	83.	144.
BUCKBOARD FLAT	19	09M01	9000	144.	128.
CAMP JACKSON	19	09M02	8600	146.	143.
LASAL MOUNTAIN (LOWER)	19	09L01	8800	116.	101.
LASAL MOUNTAIN (UPPER)	19	09L02	9850	152.	157.
MONTICELLO CITY PARK	19	09M03	7050	48.	63.
BEAVER DAMS	20	11K13	8000	128.	113.
BUCK FLAT	20	11K31	9800	157.	173.
G.B.R.C. ALPINE	20	11K16	10240	152.	148.
G.B.R.C. MEADOWS	20	11K10	10000	262.	236.
G.B.R.C. OAKS	20	11K17	7550	60.	58.
GOOSESBERRY RES	20	11K04	8700	215.	175.
HUNTINGTON-HORSESHOE	20	11K05	9800	266.	246.
MAMMOTH RS-COTTONWOOD CR	20	11K03	8800	227.	192.
MIDDLE FORK	20	11K34	9600	243.	235.
MT. BALDY R.S.	20	11K12	9500	234.	232.
RUSH POND	20	11K38	9800	114.	129.
SEELEY CREEK R.S. #2	20	11K09	10000	214.	192.
SEELEY CREEK R.S. #1	20	11K20	10000	154.	153.
THISTLE FLAT	20	11K35	8760	148.	148.
WRIGLEY CREEK	20	11K32	9000	102.	110.
BEAR CANYON	21	12L03	7200	70.	76.
BLACK'S FLAT U.M. CREEK	21	11L04	9400	90.	105.
BLACK'S FORK	21	11K14	9200	122.	126.

TABLE III (cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
BOX CREEK	21	12L04	9300	125.	141.
DILL'S CAMP	21	11K15	9200	110.	118.
FARNSWORTH LAKE	21	11L01	9600	207.	199.
FISH LAKE	21	11L03	8700	122.	83.
GOOSEBERRY R.S.	21	11L02	8000	132.	113.
JOHNSON VALLEY	21	11L06	8850	75.	85.
PICKLE KEG SPRINGS	21	11K39	9600	184.	184.
PINE CREEK-CHALK CRK	21	12L02	8500	111.	96.
BEAVER CREEK DIVIDE	22	11J46	8280	104.	106.
BLACK'S FORK JUNCTION	22	10J22	8930	78.	83.
BUCK PASTURE	22	10J23	9700	126.	126.
BURTS MILLER RANCH	22	10J06	7900	52.	50.
CHALK CREEK #1	22	11J01	9100	202.	185.
CHALK CREEK #2	22	11J02	8200	134.	124.
CHALK CREEK #3	22	11J03	7500	75.	59.
EAST FORK-BLACK FORK	22	10J21	9340	80.	88.
EAST SHINGLE LAKE	22	11J45	9800	237.	259.
HAYDEN FORK	22	10J07	9400	124.	123.
HEAD OF BEAR RIVER	22	10J05	8600	78.	84.
HENRY'S FORK	22	10J24	10000	283.	225.
HEWINTA G.S.	22	10J04	9500	79.	82.
HOLE-IN-THE-ROCK	22	10J01	9150	150.	81.
HOLE-IN-THE-ROCK G.S.	22	10J03	8300	74.	61.
LILY LAKE	22	10J35	9050	99.	111.
MIDDLE BEAVER CREEK	22	10J02	8650	124.	82.
PARK CITY SUMMIT	22	11J43	9300	238.	255.
PARLEY'S CANYON SUMMIT	22	11J15	7500	168.	131.
REDDEN MINE (LOWER)	22	11J06	8500	178.	151.
REDDEN MINE (UPPER)	22	11J05	9000	179.	164.
SERGEANT LAKES	22	11J39	8300	180.	201.
SMITH & MOREHOUSE	22	11J04	7600	156.	108.
SQAUW SPRINGS	22	12L05	10100	132.	137.
STILLWATER CAMP	22	10J17	8550	84.	85.
BEVAN'S CABIN	23	12J02	6450	142.	102.
DESERET PEAK	23	12J05	9250	233.	278.
MIDDLE CANYON	23	12J03	7000	154.	133.
ROCKY BASIN SETTLEMENT CAN	23	12J01	8900	290.	293.
VERNON CREEK	23	12K01	7500	112.	127.
ASHLEY TWIN LAKES	24	09J11	10500	148.	135.
GRIZZLY RIDGE	24	09J13	8500	100.	90.
JULIUS PARK	24	09J06	9800	115.	132.
KINGS CABIN (LOWER)	24	09J02	8600	82.	80.

TABLE III (cont.)

COURSE NAME	COUNTY[1]	COURSE#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
MOSBY MOUNTAIN	24	09J05	9500	100.	92.
MOSBY MOUNTAIN (UPPER)	24	09J04	9700	70.	83.
PARADISE PARK	24	09J03	10100	132.	121.
REYNOLDS PARK	24	09J10	10400	164.	141.
TROUT CREEK	24	09J16	9400	94.	101.
WINDY PARK	24	09J12	9400	114.	96.
ASPEN GROVE	25	11J27	6900	139.	154.
CAMP ALTAMONT	25	11J20	7300	188.	157.
CLEAR CREEK RIDGE #1	25	11K21	9200	146.	152.
CLEAR CREEK RIDGE #2	25	11K22	8000	111.	114.
CLEAR CREEK RIDGE #3	25	11K23	6600	62.	62.
DUTCHMAN R.S.	25	11J17	7560	180.	162.
HOBBLE CREEK SUMMIT	25	11J22	7420	156.	134.
PACKARD CANYON	25	11J31	6400	78.	76.
PAYSON RANGER STATION	25	11K01	8050	184.	173.
SOUTH FORK RANGER STATION	25	11J19	6100	115.	78.
TIMPANOGOS CAVE CAMP	25	11J18	5500	125.	63.
TIMPANOGOS DIVIDE	25	11J21	8140	232.	224.
BEAVER CREEK R.S.	26	11J24	7500	97.	72.
CURRANT CREEK	26	11J32	8000	100.	89.
DANIELS-STRAWBERRY SUMMIT	26	11J23	8000	173.	141.
EAST PORTAL	26	11J07	7560	153.	120.
LOST LAKE	26	10J15	9900	198.	220.
SOAPSTONE RANGER STATION	26	11J25	7800	125.	116.
TRIAL LAKE	26	10J08	9960	219.	208.
WASHINGTON-LONG LAKE	26	10J16	10300	226.	244.
LITTLE GRASSY CREEK	27	13M04	6100	93.	116.
LONG FLAT	27	13M02	8000	110.	106.
PINE VALLEY	27	13M01	9150	172.	181.
DONKEY RESERVOIR	28	11L05	9800	225.	135.
BEAVER CREEK-SKUNK CREEK	29	11H14	7150	125.	102.
BEN LOMOND LWR	29	11H09M	6000	144.	137.
BEN LOMOND PEAK	29	11H08	8000	368.	312.
BEN LOMOND TRAIL	29	11H30	6000	159.	176.
DRY BREAD POND	29	11H13	8350	167.	162.
GEERTSEN CREEK	29	11H22	8200	143.	150.
MOUNT OGDEN	29	11H10	8600	254.	274.
SAGEBRUSH FLAT	29	11H15	6300	50.	47.
SNOW BASIN	29	11H11	6420	103.	105.

NOTES

(1). See Fig. 1 for county numbers and locations.

(2). See Fig. 2 for snow course locations.

(3). "MAX" = Maximum Recorded Snow Load.

(4) "2 Per" = Load for which there is only a 2% probability of being exceed in a given year based on the Log Pearson Type III Method. See Section II A.

TABLE IV
(Ref. Section II. C.)

NWS STATION SNOW LOADS
(See notes at end of Table)

STATION NAME	COUNTY[1]	STATION#[2]	ELEV[3]	(PSF)	(PSF)
BEAVER CANYON P H	1	527	7275	114.	147.
BEAVER	1	519	5920	58.	26.
MINERSVILLE	1	5723	5280	9.	18.
WAH WAH RANCH	1	9152	4880	16.	12.
CORINNE	2	1731	4240	62.	50.
BRIGHAM CI WASTE PLT	2	928	4230	10.	14.
BOTHWELL	2	841	4332	22.	37.
THIOKOL PLANT 78	2	8668	4600	18.	21.
BEAR RIVER REFUGE	2	506	4208	20.	18.
PARK VALLEY MUDDY RANCH	2	6660	5500	25.	25.
BRIGHAM CITY	2	924	4300	44.	40.
MIDLAKE	2	5607	4205	7.	11.
PARK VALLEY	2	6658	5530	19.	23.
GROUSE CREEK	2	3486	5320	27.	32.
GARLAND	2	3122	4350	22.	19.
SNOWVILLE	2	7931	4560	16.	14.
TRENTON	3	8828	4460	22.	25.
RICHMOND	3	7271	4680	48.	47.
LOGAN 5 SW FARM	3	5194	4490	18.	27.
LOGAN DOWNTOWN	3	5182	4530	13.	12.
LOGAN STATE UNIV	3	5186	4790	39.	33.
LOGAN USAC EXPERIMENT STA	3	5190	4608	18.	21.
HARDWARE RANCH	3	3671	5560	39.	37.
LEWISTON	3	5082	4481	133.	78.
SCOFIELD	4	7720	7720	105.	126.
CLEAR CREEK	4	1472	8303	136.	170.
PRICE WAREHOUSE	4	7026	5700	16.	18.
SOLDIER SUMMIT	4	7959	7490	145.	248.
HIAWATHA	4	[illegible]	[illegible]	[illegible]	[illegible]

TABLE IV (Cont.)

STATION NAME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				(PSF)	(PSF)
MYTON	7	5969	5080	19.	22.
FORT DUCHESNE	7	2996	5050	19.	21.
DUCHESNE AIRPORT	7	2252	5815	14.	18.
NEOLA	7	6123	5920	32.	26.
HANNA	7	3624	6870	72.	48.
DUCHESNE	7	2253	5510	51.	32.
GREEN RIVER AVN	8	3418	4070	16.	18.
FERRON	8	2798	5930	17.	21.
CASTLE DALE	8	1214	5660	16.	15.
EMERY	8	2484	6260	25.	23.

TABLE IV (Cont.)

STATION NAME	COUNTY[1]	STATION#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
OAK CITY	14	6357	5070	18.	19.
BLACK ROCK	14	730	4895	14.	14.
GARRISON	14	3138	5275	11.	14.
DESERET EXP RANGE	14	2116	5250	12.	12.
SCIPIO	14	7714	5300	48.	26.
COVE FORT	14	1792	5700	79.	122.
KANOSH	14	4527	5010	110.	67.
FILLMORE	14	2828	5120	51.	29.
ESKDALE	14	2607	4980	13.	14.
CLEAR LAKE REFUGE	14	1500	4600	13.	15.
MILFORD WSMD AP	14	5654	5028	25.	18.
DELTA	14	2090	4623	86.	32.
DESERET	14	2101	4585	16.	12.
MORGAN	15	5826	5060	20.	20.
PIUTE DAM	16	6897	5900	10.	11.
MARYSVALE	16	5477	5910	11.	9.
CIRCLEVILLE	16	1432	6060	10.	8.
LAKETOWN	17	4856	5980	51.	29.
WOODRUFF	17	9595	6315	53.	32.
ALTA	18	72	8760	390.	335.
HIGH LINE CITY CREEK	18	3929	5100	103.	209.
SILVER LAKE BRIGHTON	18	7846	8740	284.	284.
BINGHAM CANYON	18	699	5862	36.	41.
MOUNTAIN DELL DAM	18	5892	5420	60.	62.
UNIVERSITY OF UTAH	18	8922	4800	18.	15.
SALTAIR SALT PLANT	18	7578	4210	14.	14.
SALT LAKE CITY NWSFO AP R	18	7598	4222	22.	17.
CITY CREEK WATER PLANT	18	1446	5330	84.	83.
GARFIELD	18	3097	4330	16.	13.
TERMINAL	18	8631	4200	32.	27.
COTTONWOOD WEIR	18	1759	4960	169.	72.
MIDVALE	18	5610	4340	19.	20.
SLC SUBURBAN SEWAGE PL	18	7608	4235	14.	17.
SALT LAKE CITY WB CITY	18	7603	4260	19.	21.
BINGHAM CANYON 2 N E	18	700	5620	16.	18.
LA SAL	19	4946	6775	62.	60.
BLANDING	19	738	6130	34.	25.
MONTICELLO	19	5805	6820	103.	85.
ANETH PLANT	19	157	4620	10.	26.
HOVENWEEP NATL MON	19	4100	5240	12.	12.
NATURAL BRIDGES NATL M	19	6053	6500	34.	39.
BLUFF	19	788	4315	11.	12.
FAIRVIEW 8 N	20	2702	6750	48.	68.

TABLE IV (Cont.)

STATION NAME	COUNTY[1]	STATION#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
GUNNISON	20	3514	5145	16.	16.
MANTI	20	5402	5740	32.	23.
MORONI	20	5837	5525	19.	20.
RICHFIELD RADIO KSVC	21	7260	5270	11.	11.
KOOSHAREM	21	4764	6930	18.	19.
SALINA	21	7557	5130	13.	16.
PARK CITY RADIO	22	6648	7080	88.	111.
COALVILLE 13 E	22	1590	6480	16.	17.
UINTA LANDS	22	8900	8400	98.	108.
PARK CITY SUMMIT HOUSE	22	6652	9270	310.	319.
WANSHIP DAM	22	9165	5940	36.	52.
ECHO DAM	22	2385	5470	32.	28.
COALVILLE	22	1588	5550	17.	20.
KAMAS RANGER STATION	22	4467	6470	39.	38.
GRANTSVILLE	23	3348	4290	14.	17.
IBAPAH	23	4174	5280	16.	15.
DUGWAY	23	2257	4340	11.	10.
GRANTSVILLE POWER HOUSE	23	3353	5163	34.	46.
JOHNSON PASS	23	4362	5630	34.	37.
BAUER	23	478	4965	32.	31.
TOOELE	23	8771	5070	39.	38.
VERNON	23	9133	5485	11.	13.
WENDOVER AUTO B	23	9382	4237	7.	8.
GOLD HILL	23	3260	5320	17.	21.
CALLISTER RANCH	23	1149	4260	16.	16.
BONANZA	24	802	5450	16.	18.
OURAY 4 N E	24	6568	4670	17.	21.
DINOSAUR NATIONAL PARK	24	2172	5080	27.	55.
VERNAL AIRPORT	24	9111	5280	22.	29.
BONANZA DUMPING STA	24	810	5700	11.	17.
LA POINT	24	4927	5489	19.	31.
JENSEN	24	4342	4760	25.	22.
PLEASANT GROVE	25	6919	4760	39.	28.
PROVO RADIO KOVO	25	7068	4470	9.	10.
ELBERTA	25	2418	4690	18.	14.
CONRAD RANCH	25	1685	5640	65.	58.
OLMSTEAD P H	25	6455	4820	18.	23.
DEER CREEK DAM	25	2057	5270	110.	106.
UPPER AMERICAN FK PH	25	8939	5330	46.	40.
ALPINE	25	61	4920	16.	18.
BARTHOLOMEW P H	25	449	5140	72.	80.
LOWER AMERICAN FORK PWR HOUSE	25	5219	5063	185.	91.
GENEVA STEEL EXP STA	25	3183	4504	13.	12.

TABLE IV (Cont.)

STATION NAME	COUNTY[1]	STATION#[2]	ELEV	MAX[3] (PSF)	2 PCT[4] (PSF)
PAYSON 1 SE	25	6726	4800	27.	26.
SPANISH FORK 1 S	25	8114	4570	18.	27.
MURDOCK POWER HOUSE	25	5958	5970	100.	140.
PAYSON	25	6724	4643	39.	32.
BIRDSEYE	25	716	5700	65.	78.
SPANISH FORK PWR HOUSE	25	8119	4720	27.	24.
UTAH LAKE LEHI	25	8973	4497	27.	17.
FAIRFIELD	25	2696	4880	14.	15.
TIMPANOGOS CAVE	25	8733	5640	172.	121.
HEBER	26	3809	5630	72.	69.
SNAKE CREEK P H	26	7909	6000	145.	158.
ENTERPRISE	27	2558	5340	27.	20.
GUNLOCK POWER HOUSE	27	3506	4110	18.	35.
SAINT GEORGE	27	7516	2760	16.	21.
ZION NATIONAL PARK	27	9717	4050	14.	14.
VEYO POWER HOUSE	27	9136	4600	13.	19.
NEW HARMONY	27	6181	5290	81.	66.
LOA	28	5148	7080	11.	12.
FRUITA	28	3046	5418	16.	19.
CAPITOL REEF NATL PK	28	1171	5500	16.	16.
HANKSVILLE	28	3611	4308	14.	15.
CANYON LANDS - THE NEEDLE	29	1168	5040	13.	16.
MONTEZUMA CREEK	29	5795	6700	16.	22.
CEDAR POINT	29	1308	6760	70.	73.
OGDEN SUGAR FACTORY	29	6414	4280	36.	32.
CANYON LANDS - THE NECK	29	1163	5930	25.	31.
MONUMENT VALLEY MISS	29	5812	5300	7.	9.
RIVERDALE	29	7318	4400	39.	31.
UINTAH	29	8885	4830	46.	67.
NAVAJO MNT	29	6076	6020	18.	29.
WEBER BASIN PUMP PL 3	29	9346	4900	74.	64.
OGDEN PIONEER P H	29	6404	4350	53.	37.
HUNTSVILLE MONASTERY	29	4135	5140	53.	78.
PINE VIEW DAM	29	6869	4940	105.	119.

NOTES

(1). See Fig. 1 for county numbers and locations.
(2). See Fig. 2 for snow course locations.
(3). "MAX" = Maximum Recorded Snow Load.
(4). "2 per" = Load for which there is only a 2% probability of being exceeded in a given year based on the Log Pearson Type III Method. See Section II A.

TABLE V
(Ref. Section III. B)

GROUND SNOW PARAMETERS FOR USE IN EQ 3

COUNTY	P_o (PSF)	S (PSF/1000FT.)	A_o (FT./1000)
BEAVER	43	63	5.3
BOX ELDER	43	63	5.2
CACHE	50	63	4.5
CARBON	43	63	5.2
DAGGETT	43	63	6.5
DAVIS	43	63	4.5
DUCHESNE	43	63	6.5
EMERY	43	63	6.0
GARFIELD	43	63	6.0
GRAND	36	63	6.5
IRON	43	63	5.8
JUAB	43	63	5.2
KANE	36	63	5.7
MILLARD	43	63	5.3
MORGAN	57	63	4.5
PIUTE	43	63	6.2
RICH	57	63	4.1
SALT LAKE	43	63	4.5
SAN JUAN	43	63	6.5
SANPETE	43	63	5.2
SEVIER	43	63	6.0
SUMMIT	86	63	5.0
TOOELE	43	63	4.5
UINTAH	43	63	7.0
UTAH	43	63	4.5
WASATCH	86	63	5.0
WASHINGTON	29	63	6.0
WAYNE	36	63	6.5
WEBER	43	63	4.5

TABLE VI
(Ref. Sections III. C. and VIII)

SNOW EXPOSURE COEFFICIENT, C_e
(From Table A-23-S of 1991 UBC)

	C_e
Roofs located in generally open terrain extending one-half mile or more from the structure	0.6
Structures located in densely forested or sheltered areas	0.9
All other structures	0.7

NOTES:

1. The building official may determine this coefficient for specific structures with special local conditions.

2. For roofs at or near grade with slopes less than 3:12 or decks at or near grade, $C_e = 1.0$.

TABLE VII
(Ref. Section III. B.)

RECOMMENDED SNOW LOADS FOR SELECTED UTAH CITIES AND TOWNS
(See notes at end of Table)

Title 7.

		Roof Snow Load[1] (PSF)	Ground Snow Load (PSF)
Beaver County			
Beaver	5920 ft.	43	62
Box Elder County			
Brigham City	4300 ft.	30	43
Tremonton	4290 ft.	30	43
Cache County			
Logan	4530 ft.	35	50
Smithfield	4595 ft.	35	50
Carbon County			
Price	5550 ft.	30	43
Daggett County			
Manilla	5377 ft.	30	43
Davis County			
Bountiful	4300 ft.	30	43
Farmington	4270 ft.	30	43
Layton	4400 ft.	30	43
Duchesne County			
Duchesne	5510 ft.	30	43
Roosevelt	5104 ft.	30	43
Emery County			
Castledale	5660 ft.	30	43
Green River	4070 ft.	25	36
Garfield County			
Panguitch	6600 ft.	30	43
Grand County			
Moab	3965 ft.	25	36
Iron County			

TABLE VII (Cont.)

		Roof Snow Load[1] (PSF)	Ground Snow Load (PSF)
Kane County			
Kanab	5000 ft.	25	36
Millard County			
Millard	5000 ft.	30	43
Delta	4623 ft.	30	43
Morgan County			
Morgan	5064 ft.	40	57
Piute County			
Piute	5996 ft.	30	43
Rich County			
Woodruff	6315 ft.	40	57
Salt Lake County			
Murray	4325 ft.	30	43
Salt Lake City	4300 ft.	30	43
Sandy	4500 ft.	30	43
West Jordan	4375 ft.	30	43
West Valley	4250 ft.	30	43
San Juan County			
Blanding	6200 ft.	30	43
Monticello	6820 ft.	35	50
Sanpete County			
Fairview	6750 ft.	35	50
Mt. Pleasant	5900 ft.	30	43
Manti	5740 ft.	30	43
Ephraim	5540 ft.	30	43
Gunnison	5145 ft.	30	43
Sevier County			
Salina	5130 ft.	30	43
Richfield	5270 ft.	30	43
Summit County			
Coalville	5600 ft.	60	86
Kamas	6500 ft.	70	100
Park City	6400 ft.	85	121
Summit Park	7200 ft.	90	128

5.0

TABLE VII (Cont.)

		Roof Snow Load[1] (PSF)	Ground Snow Load (PSF)
Tooele County			
Tooele	5100 ft.	30	43 ?
Uintah County			
Vernal	5280 ft.	30	43
Utah County			
American Fork	4500 ft.	30	43
Orem	4650 ft.	30	43
Pleasant Grove	5000 ft.	30	43
Provo	5000 ft.	30	43
Spanish Fork	4720 ft.	30	43
Wasatch County			
Heber	5630 ft.	60	86
Washington County			
Central	5209 ft.	25	36
Dameron	4550 ft.	25	36
Leeds	3460 ft.	20	29
Rockville	3700 ft.	25	36
Santa Clara	2850 ft.	15[2]	21
St. George	2750 ft.	15[2]	21
Wayne County			
Loa	7080 ft.	30	43
Hanksville	4308 ft.	25	36
Weber County			
North Ogden	4500 ft.	40	57
Ogden	4350 ft.	30	43

NOTES
(1). Roof snow load (Pf) is based on snow exposure coefficient C_e =.7.
(2). The UBC requires a minimum of 20 psf.

TABLE VIII
(Ref. Section III. B.)

SNOW LOAD QUESTIONNAIRE RESULTS
(See notes at end of Table)

Municipality	County	Elev (FT.)	Topo[1]	Design[2] Snow Load (PSF)
Beaver	Beaver	5970	v	50.
Garland	Box Elder	4500	v	
Amalga	Cache	4470	v	30.
Cache County	Cache	4700	vh	30.
Hyde Park	Cache	4750	vh	30.
Logan	Cache	4660	v	30.
Logan	Cache	4900	h	35.
North Logan	Cache	4453	h	30.
Paradise	Cache	4700	h	30.
Richmond	Cache	4790	vh	30.
River Heights	Cache	4600	h	30.
Smithfield	Cache	4600	v	30.
Wellsville	Cache	4690	vh	30.
Price	Carbon	5450	v	35.
Bountiful	Davis	4300	vh	30.
Bountiful	Davis	4700	h	40.
Bountiful	Davis	5200	hm	50.
Centerville	Davis	4360	h	40.
Clinton	Davis	4325	v	30.
Farmington	Davis	4270	vh	30.
Fruit Heights	Davis	4500	v	40.
Layton	Davis	4400	h	30.
Woods Cross	Davis	4222	v	30.
Orangeville	Emery	5800	v	
Cedar City	Iron	5831	v	30.
Cedar West	Iron	5500	vh	40.
East Iron County	Iron	9999	m	150.
Kanab	Kane	5000	m	
Millard County	Millard	5000	v	30.
Midvale City	Salt Lake	4341	v	40.
Murray	Salt Lake	4300	v	30.
Sandy	Salt Lake	4350	vh	30.
South Salt Lake	Salt Lake	4247	v	30.
West Jordan	Salt lake	4400	v	40.
West Valley City	Salt Lake	4300	v	30.
Blanding	San Juan	6200	h	30.
Mt. Pleasant	Sanpete	5900	v	30.
Coalville	Summit	5600	v	60.
Kamas	Summit	6500	v	70.
Park City	Summit	6800	v	90.
Pine Meadows	Summit	8000	m	90.

TABLE VIII (Cont.)

Municipality	County	Elev (FT.)	Topo[1]	Design[2] Snow Load (PSF)
Pine Mountain	Summit	7600	m	100.
Summit Park	Summit	7200	m	90.
Upton	Summit	6400	h	60.
Wilderness Acres	Summit	8700	m	100.
Tooele	Tooele	5100	h	30.
Naples	Uintah	5280	v	30.
Roosevelt	Uintah	5000	v	30.
Vernal	Uintah	5200	v	30.
American Fork	Utah	4500	v	
Orem	Utah	4650	v	30.
Pleasant Grove	Utah	5000	h	40.
Provo	Utah	5000	v	30.
Central	Washington	5209	h	25.
Dameron	Washington	4550	v	25.
Kolob	Washington	8000	m	150.
Leeds	Washington	3460	v	20.
Pine Valley	Washington	6900	m	75.
Santa Clara	Washington	2850	vh	
St. George	Washington	2750	v	15.
Veyo	Washington	4479	h	25.
Washington	Washington	2800	v	15.
North Ogden	Weber		vh	30.
Ogden	Weber		vh	30.
South Ogden	Weber	4200	h	40.
Syracuse	Weber		v	
Washington Terrace	Weber		v	30.
West Point	Weber		v	

NOTES

(1). In Column "Topo"

v = valley

m = mountain

TABLE IX
(Ref. Section V.C.)

WATER CONTENTS - BEAVER CREEK RANGER STATION*

Percentage of Maximum Ground Snow	Number of observations in which percentage was exceeded						
	Jan.	Feb.	March	April	May	June	Totals
25	9	24	33	47	5	0	118
50	0	3	9	19	1	0	32
75	0	0	1	3	0	0	4
Total Number of Monthly Observations:	31	35	36	54	35	14	205

*Number of Water Content Depths Exceeding Certain Percentages of Maximum Observed Ground Snow.

LIST OF REFERENCES

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2. National Research Council of Canada, "National Building Code of Canada," 7th ed., NRCC No. 15555, Associate Committee on the National Building Code, Ottawa, Canada, 1977.

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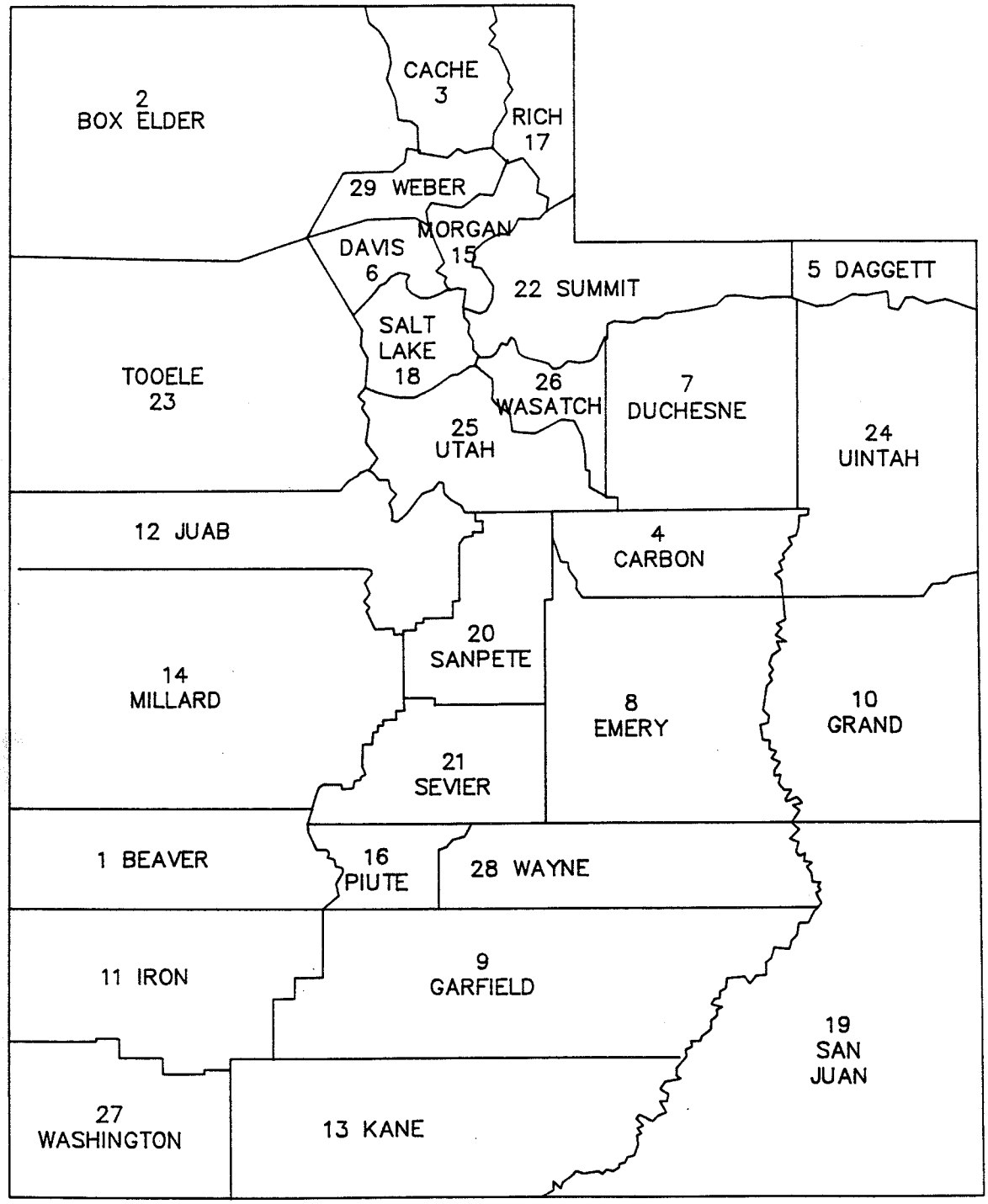
13. Placer County snow Design Ordinance," C. Coen, 1985.

14. American National Standards Institute, Inc., 1982, "American National Standard Building Code Requirements for Minimum Design Loads for Buildings and other Structures," ANSI A58.1-1982, New York.

15. O'Rouke, Michael J., Speck, Robert S., Jr., and Stiefel, Ulrich, "Drift Snow Loads on Multiple Roofs," Journal of Structural Engineering, ASCE, Vol. 111, No. 2, New York, N.Y., Feb., 1982.



COUNTY INDEX

1. BEAVER COUNTY
2. BOXELDER COUNTY
3. CACHE COUNTY
4. CARBON COUNTY
5. DAGGETT COUNTY
6. DAVIS COUNTY
7. DUCHESNE COUNTY
8. EMERY COUNTY
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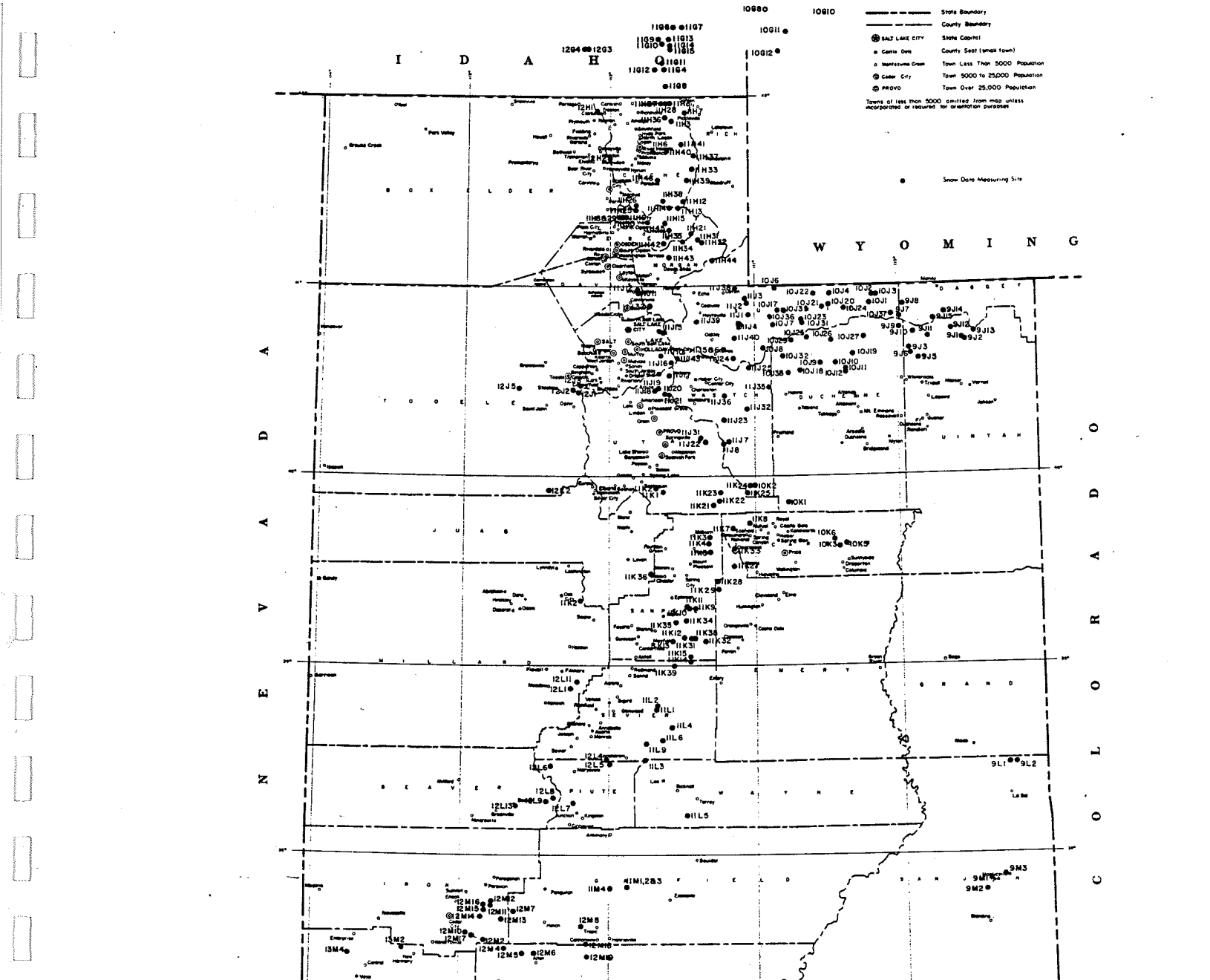

State Boundary
County Boundary
SALT LAKE CITY State Capital
County Seat (small town)
Town Less Than 5000 Population
Town 5000 to 25,000 Population
PROVO Town Over 25,000 Population
Towns of less than 5000 omitted from map unless incorporated or required for orientation purposes
Snow Data Measuring Site
IDAHO
WYOMING
NEVADA
COLORADO
BOX ELDER
TOOELE
JUAB
MILLARD
BEAVER
PIUTE
WAYNE
SANPETE
EMERY
GRAND
UINTAH
DAGGETT
DUCHESNE
SALT LAKE
UTAH
SUMMIT
WASATCH
CACHE
RICH
DAVIS
WEBER
MORGAN
SAN JUAN

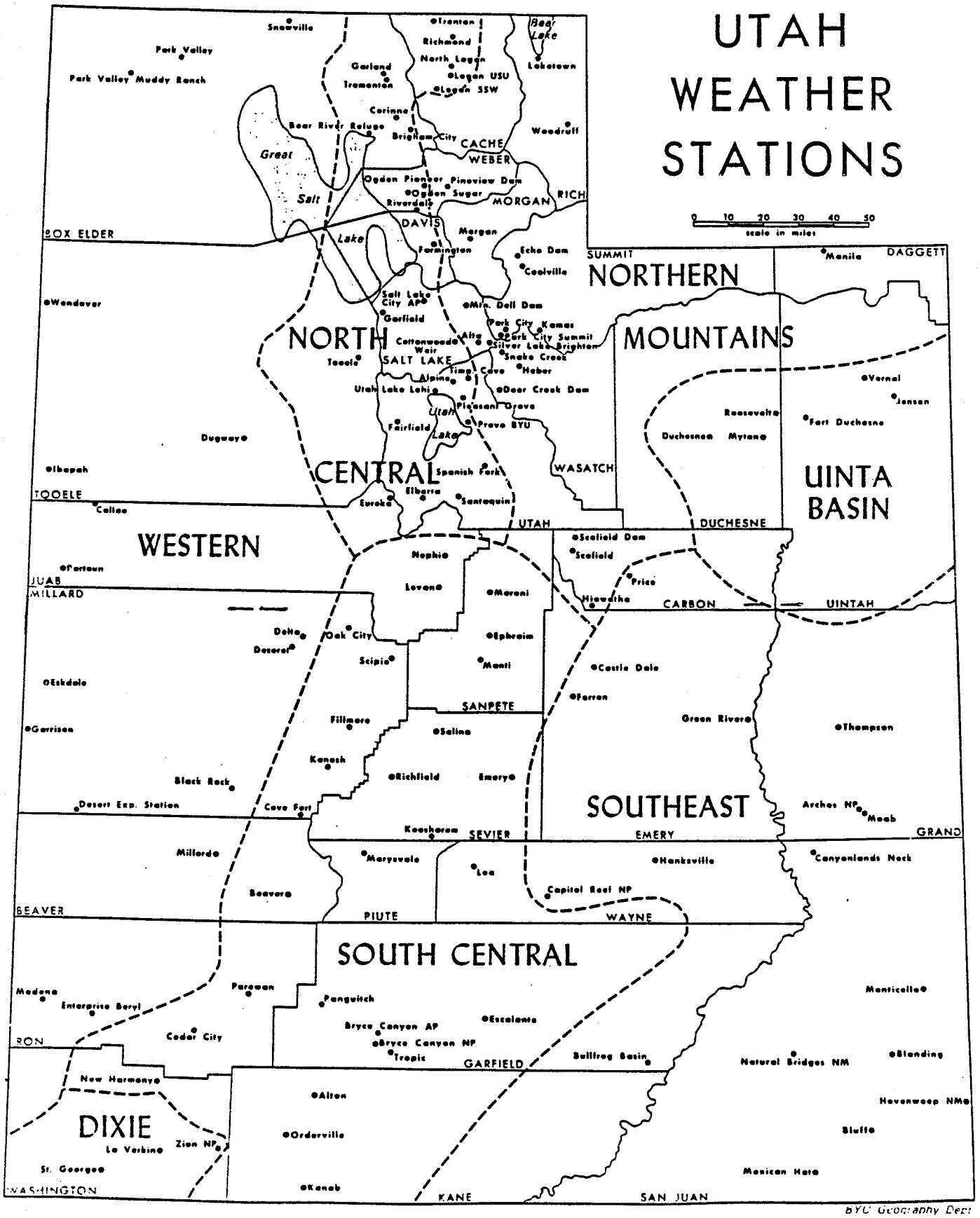


Fig. 3 UTAH WEATHER STATIONS
(Used by Permission)

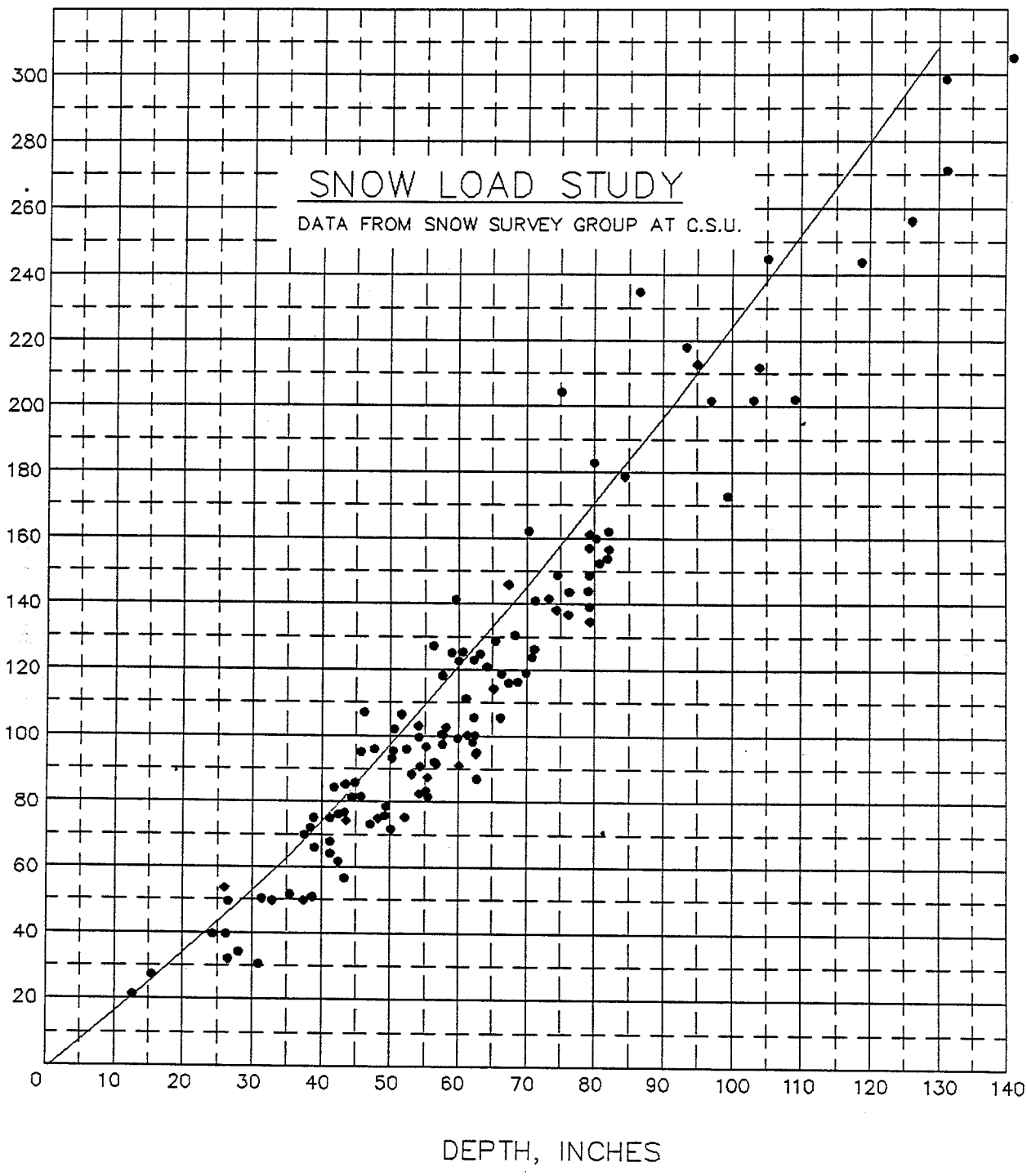
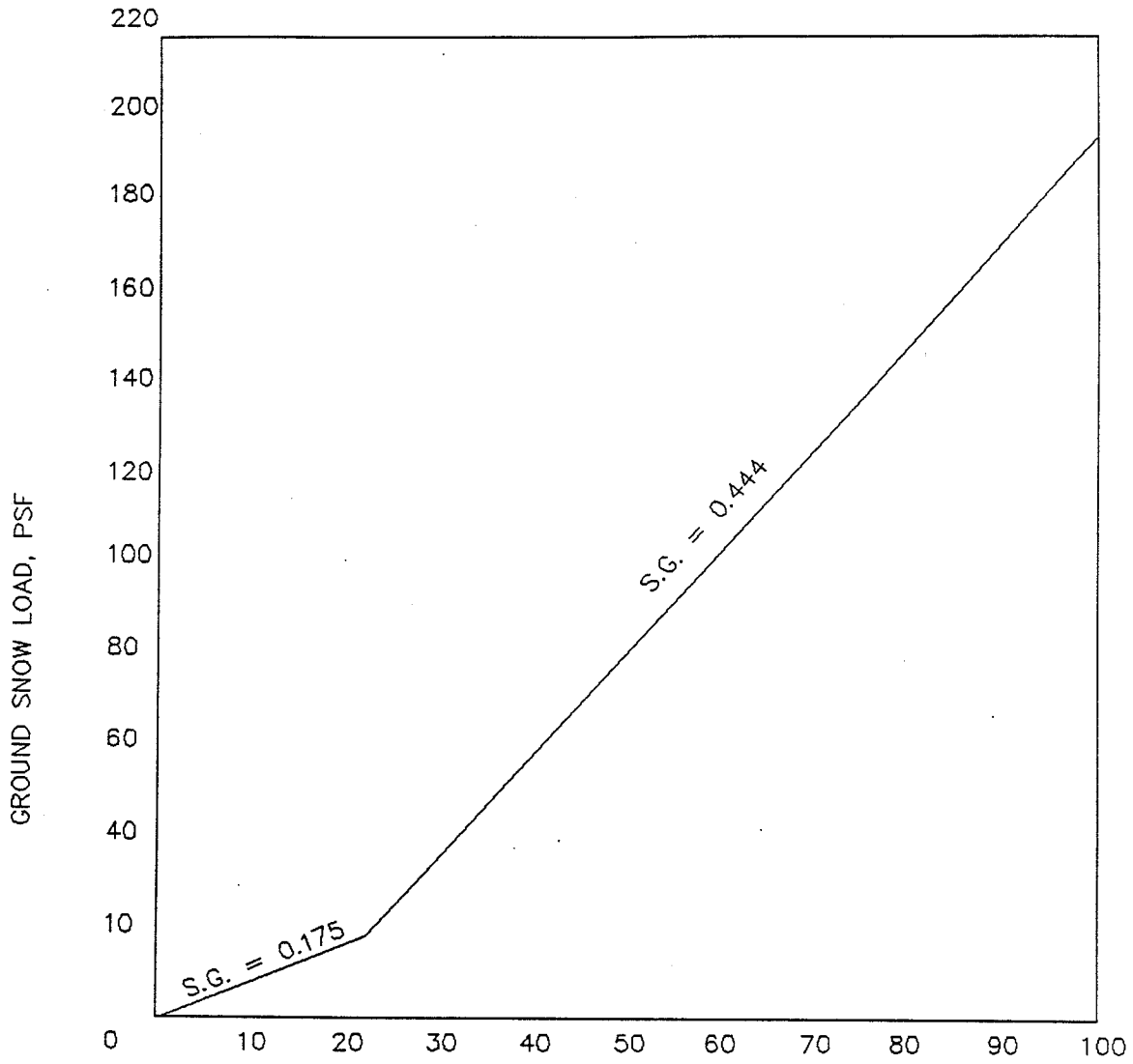


FIG. 4. SNOW UNIT WEIGHTS (from Colorado Study)



IF DEPTH < 22", LOAD = 0.909 (DEPTH)

IF DEPTH > 22", LOAD= 2.36 (DEPTH) – 31.9

FIG. 5 ROCKY MOUNTAIN CONVERSION DENSITY

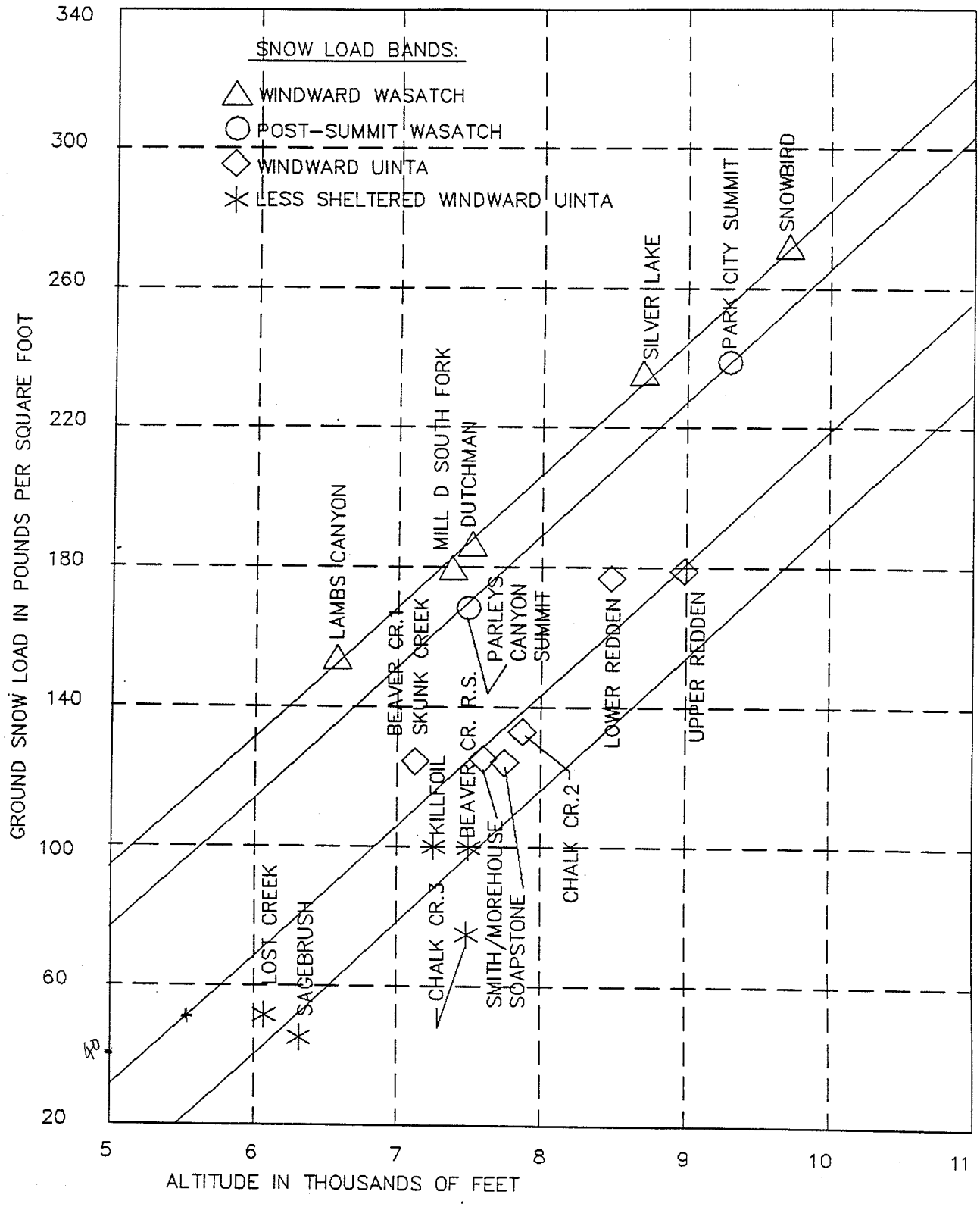


Fig. 6. Ground Snow Loads vs. Elevations— Wasatch to Uinta Mountain Region

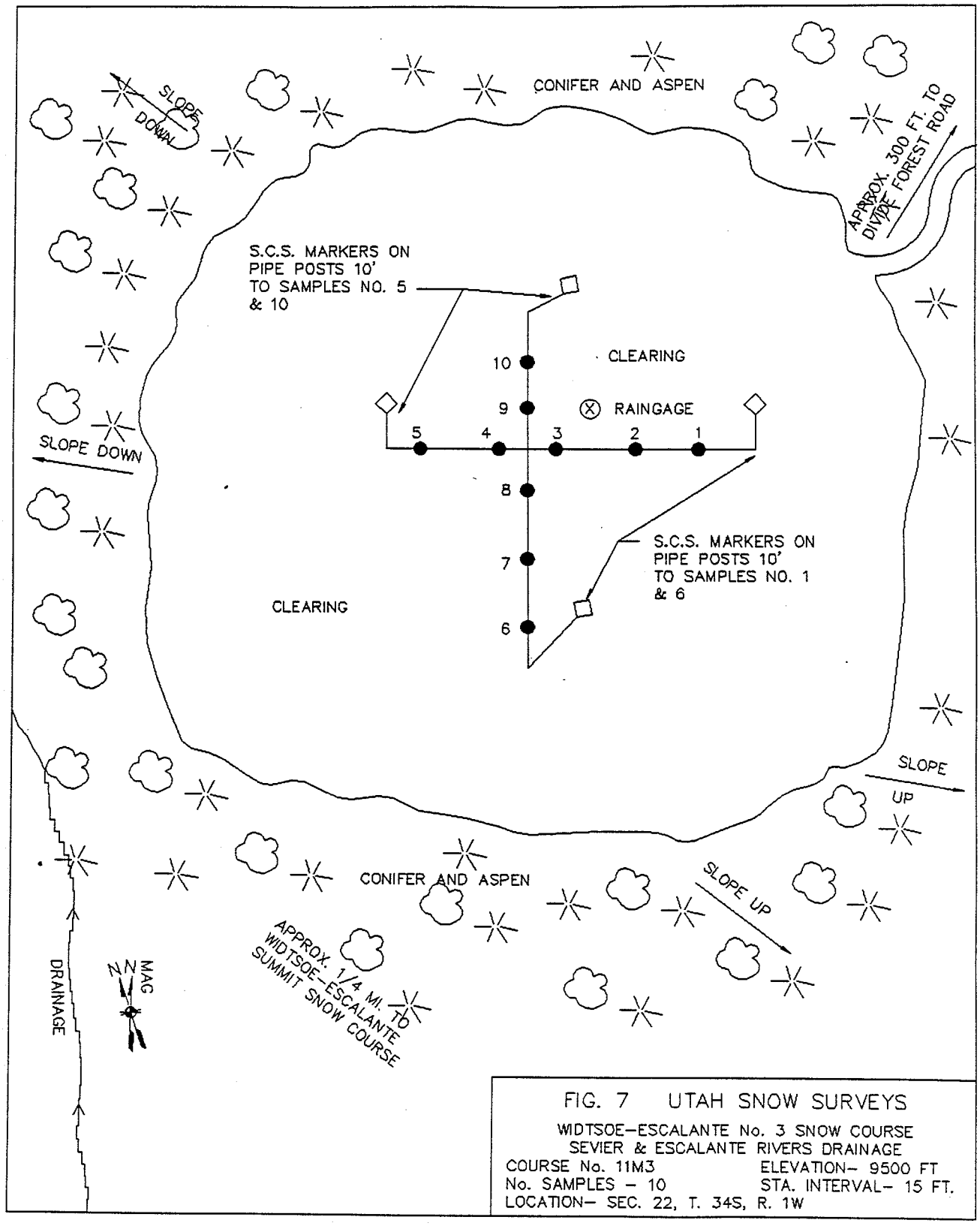


FIG. 7 UTAH SNOW SURVEYS

WIDTSOE–ESCALANTE No. 3 SNOW COURSE
SEVIER & ESCALANTE RIVERS DRAINAGE

COURSE No. 11M3 ELEVATION– 9500 FT
No. SAMPLES – 10 STA. INTERVAL– 15 FT.
LOCATION– SEC. 22, T. 34S, R. 1W

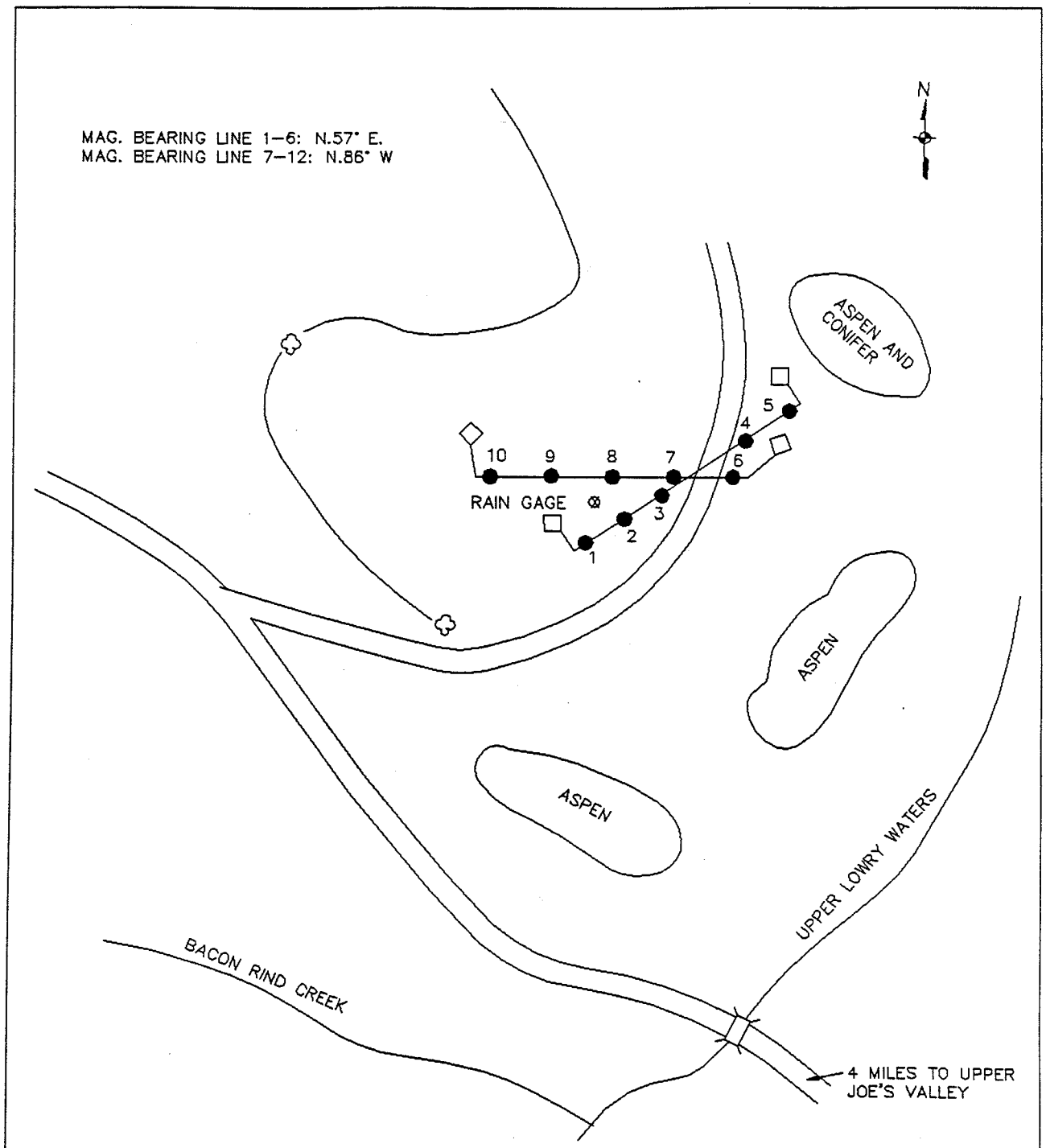
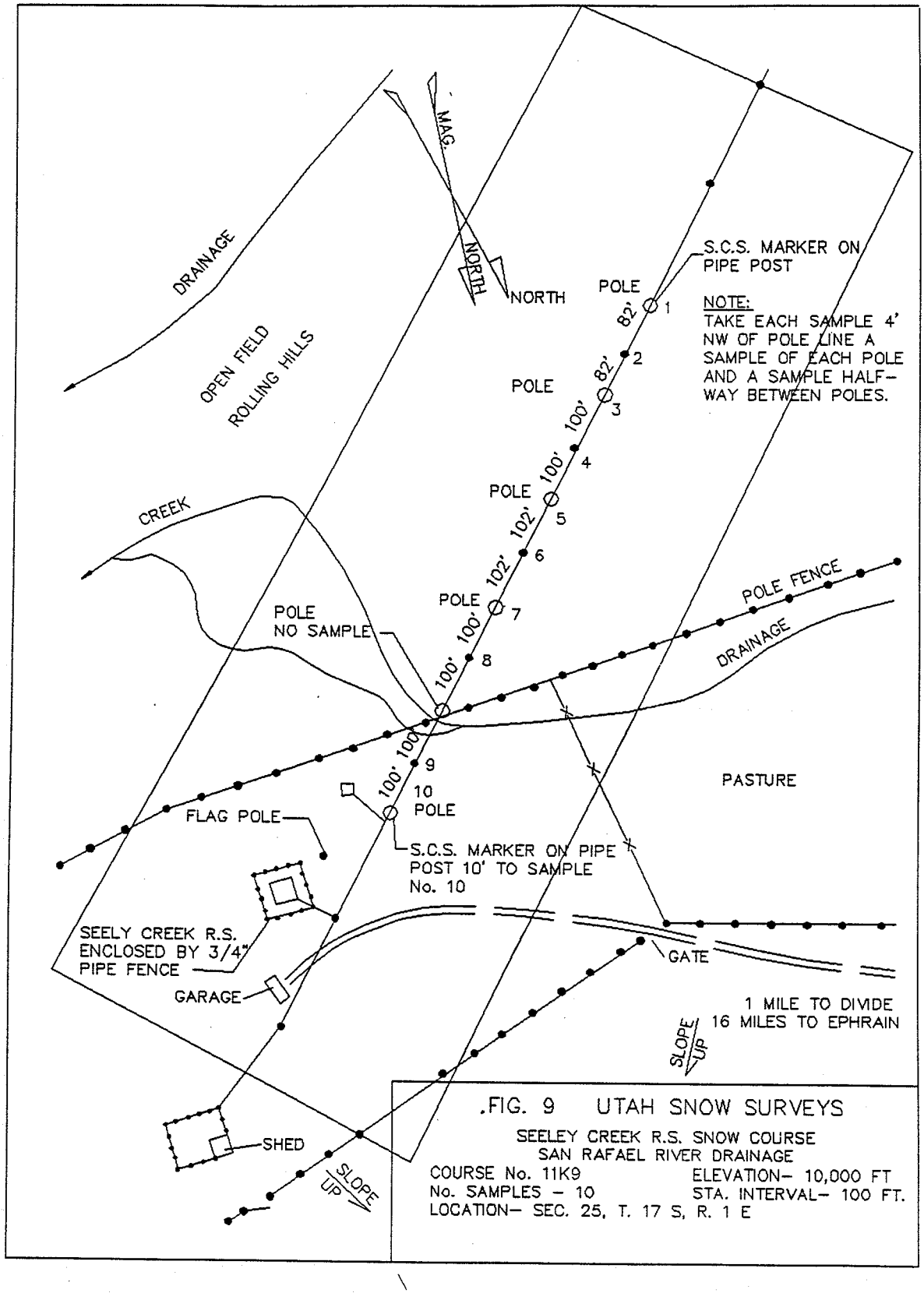


FIG. 8 SNOW SURVEYS

RED PINE RIDGE SNOW COURSE
COTTONWOOD CREEK– SAN RAFAEL DRAINAGE

COURSE No. ELEVATION– 9400 FT
No. SAMPLES – STA. INTERVAL– 50 FT.
LOCATION–



.FIG. 9 UTAH SNOW SURVEYS

SEELEY CREEK R.S. SNOW COURSE
SAN RAFAEL RIVER DRAINAGE

COURSE No. 11K9 ELEVATION– 10,000 FT
No. SAMPLES – 10 STA. INTERVAL– 100 FT.
LOCATION– SEC. 25, T. 17 S, R. 1 E

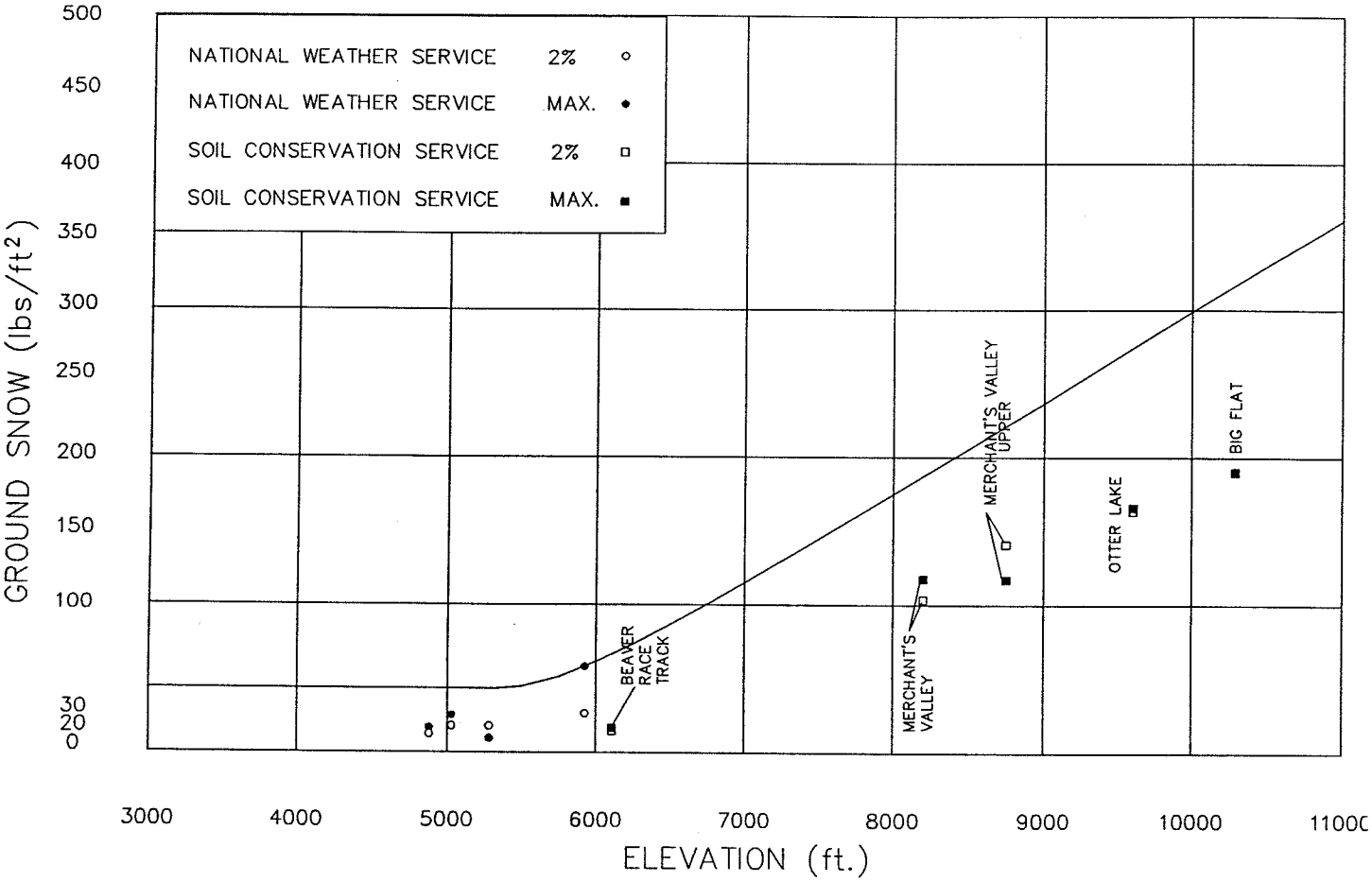


FIG. 10. BEAVER COUNTY

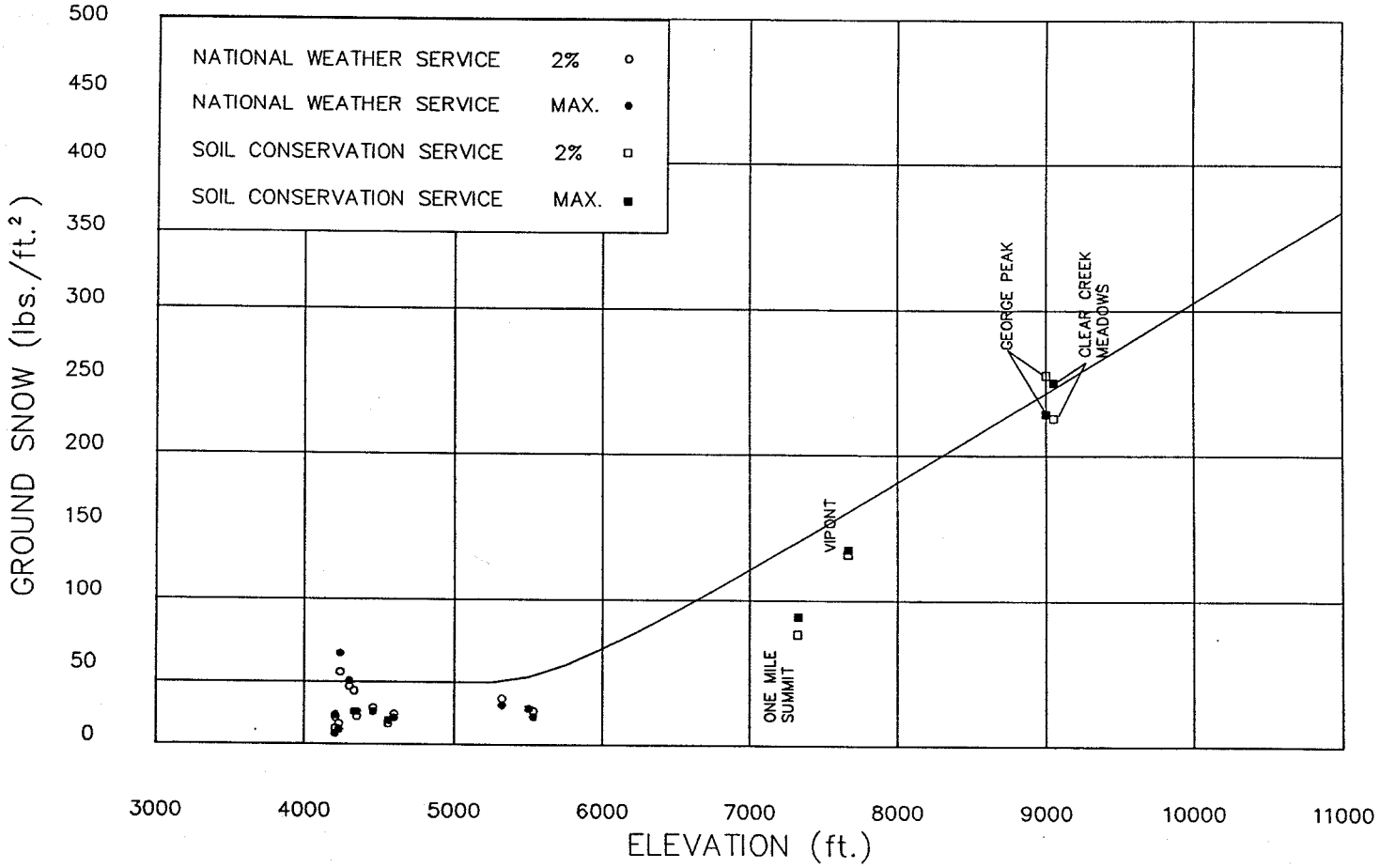


FIG. 11. BOX ELDER COUNTY

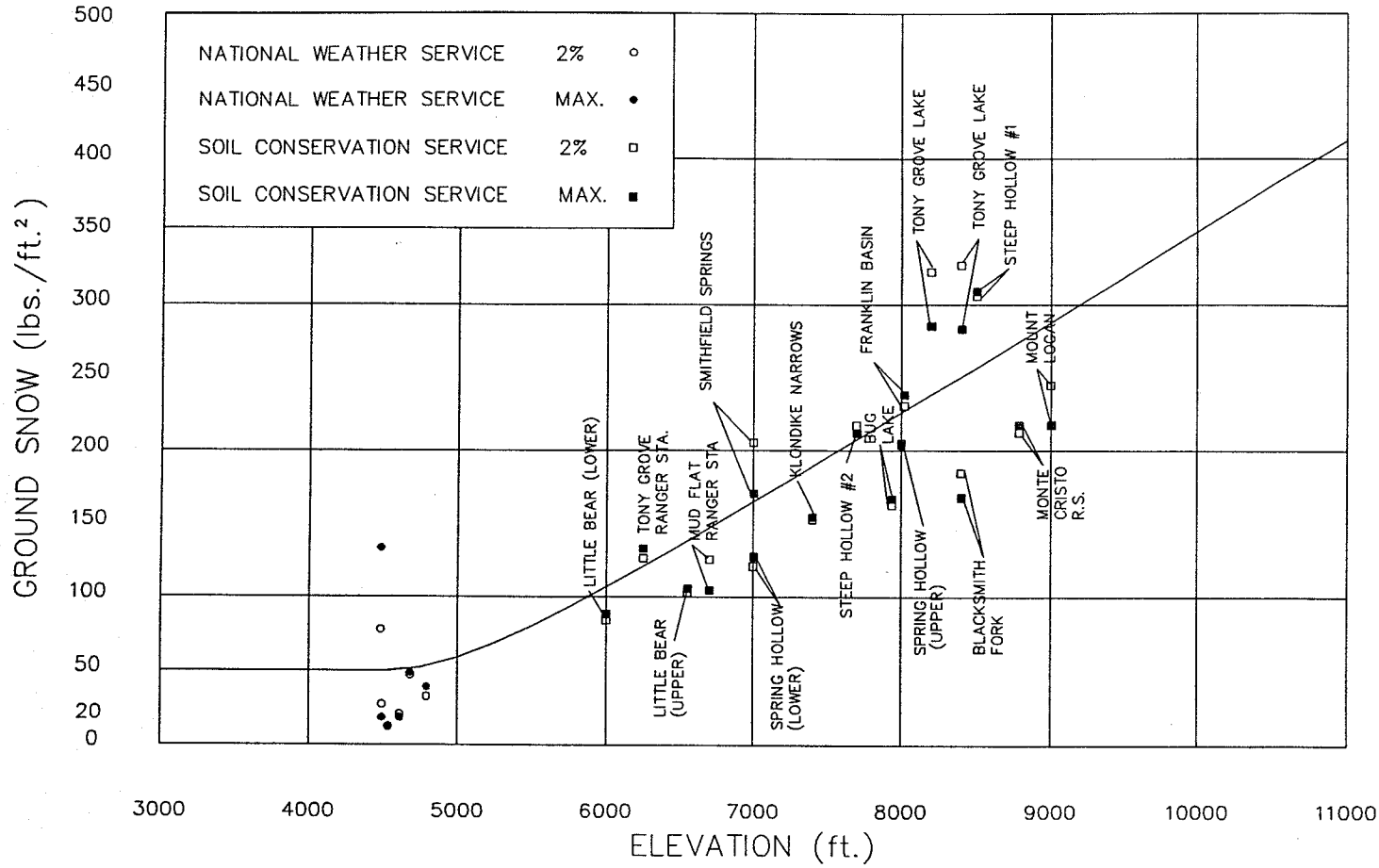


FIG. 12. CACHE COUNTY

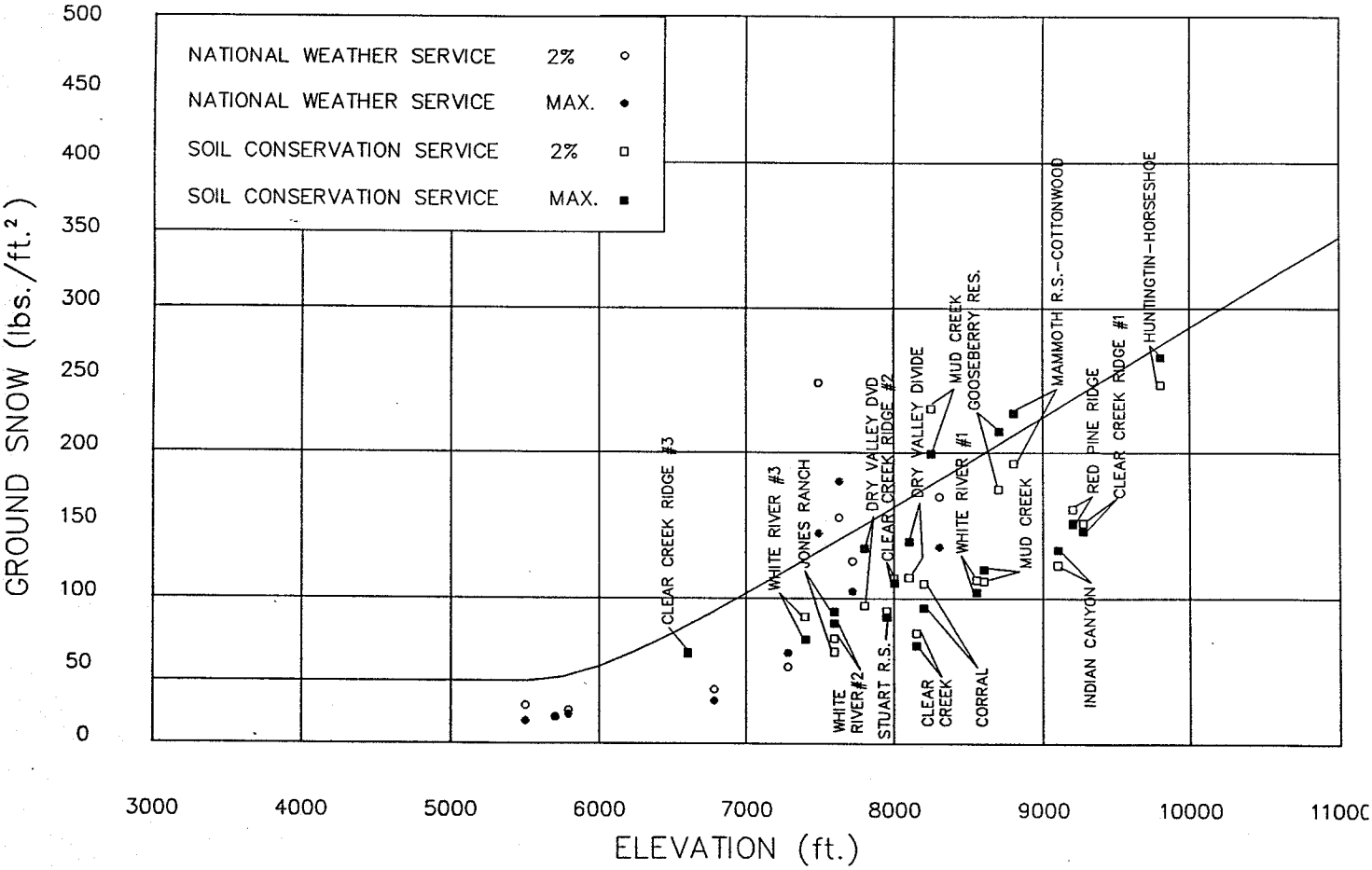


FIG. 13. CARBON COUNTY

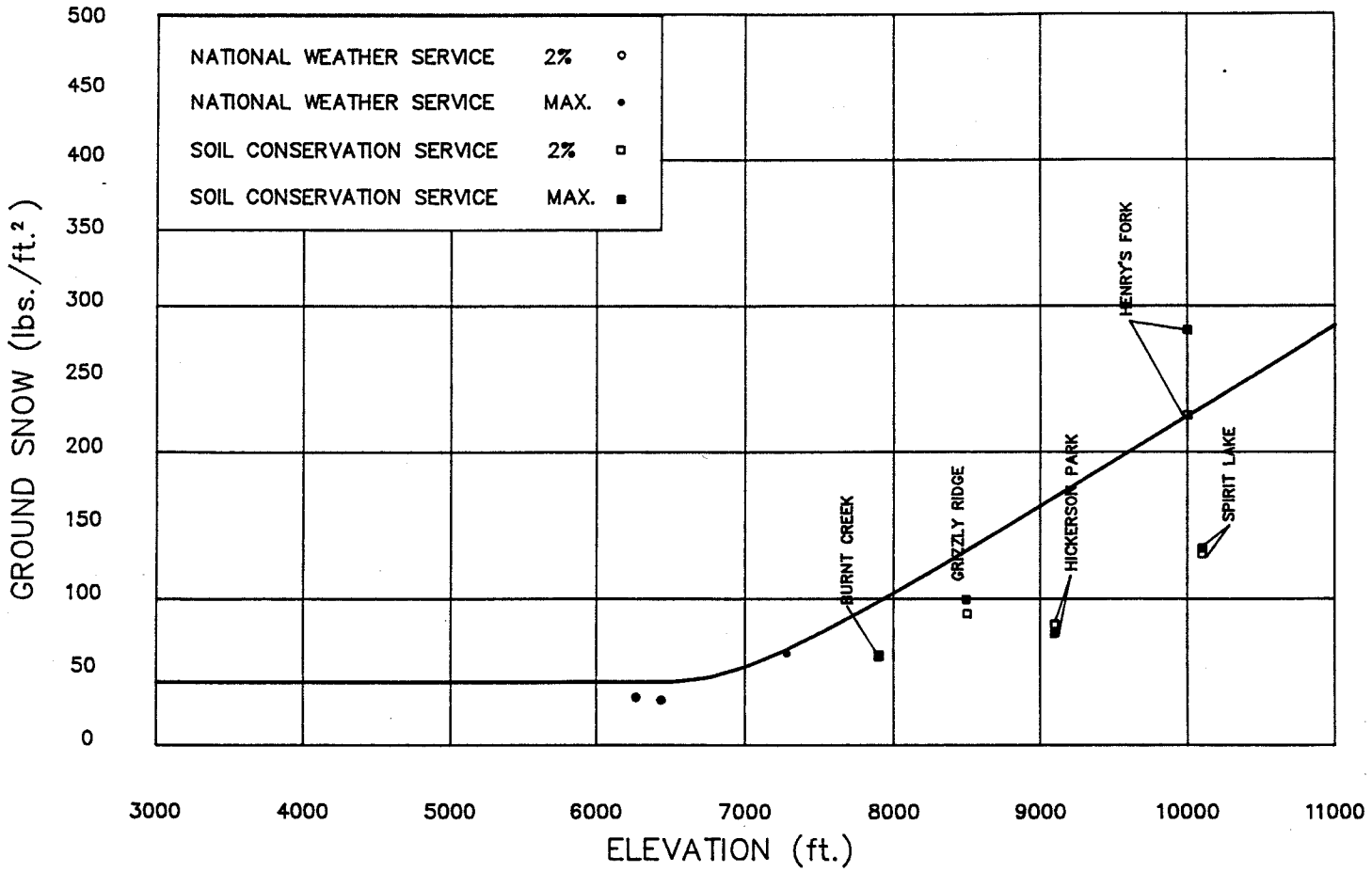


FIG. 14. DAGGETT COUNTY

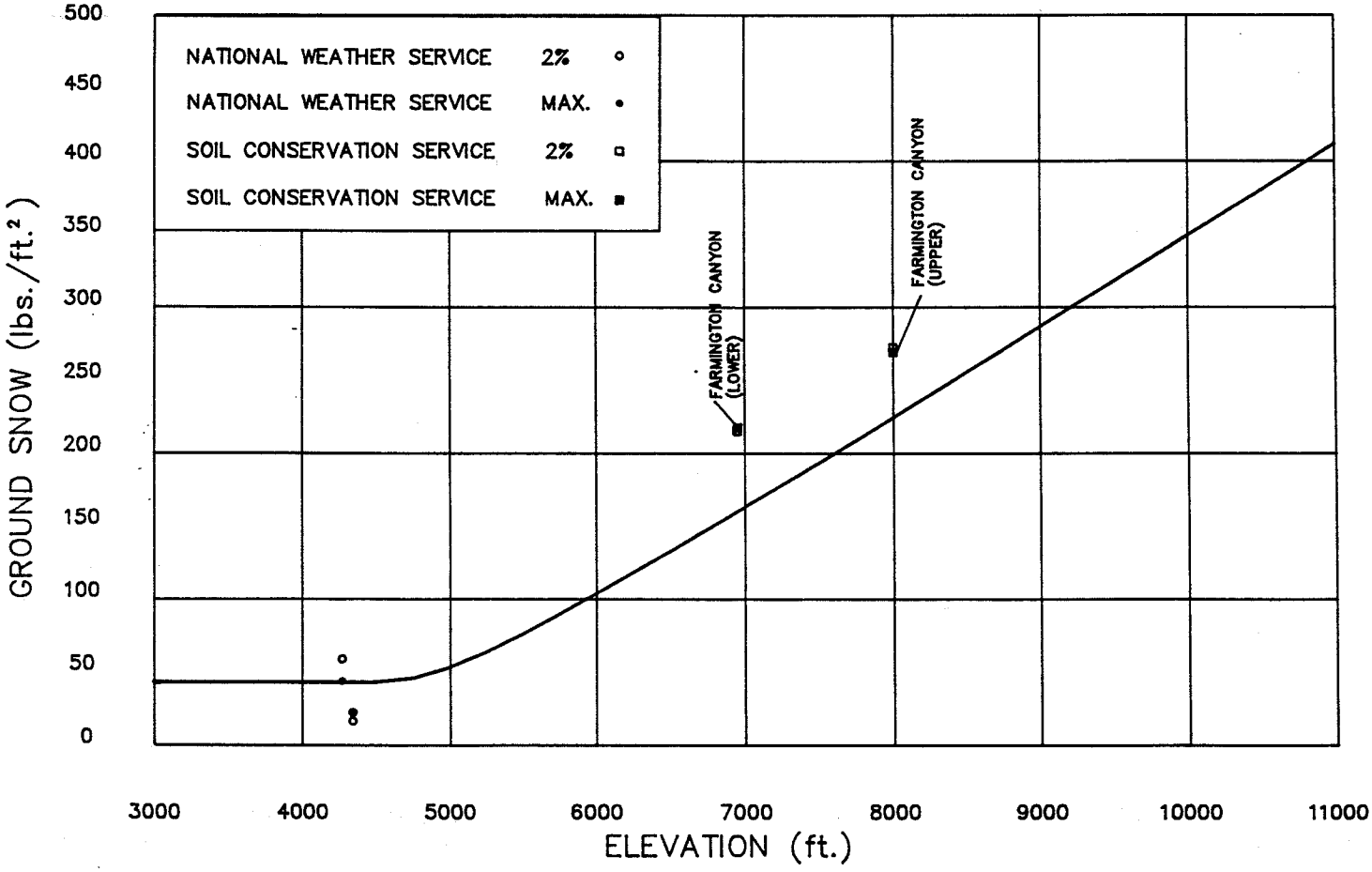


FIG. 15. DAVIS COUNTY

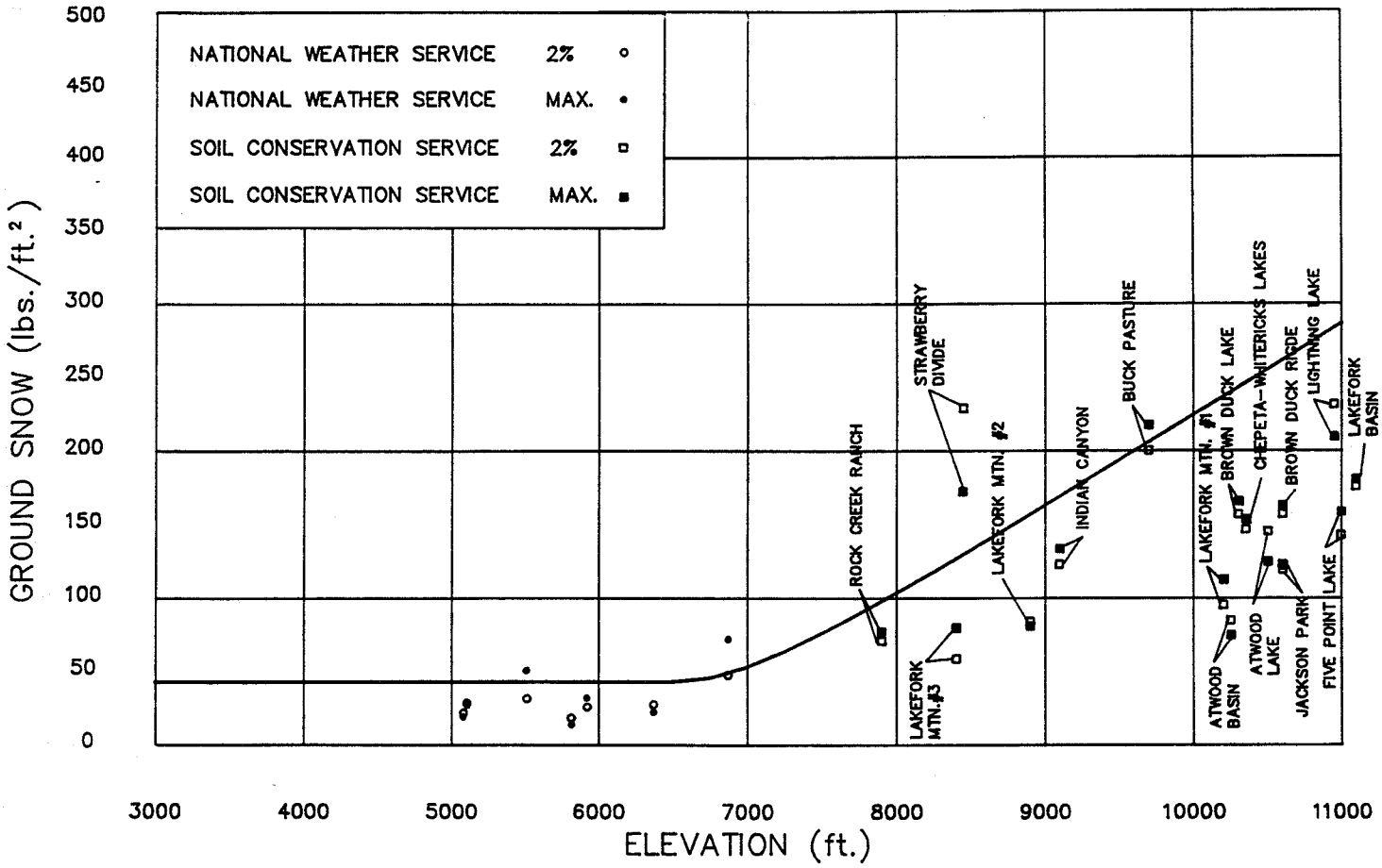
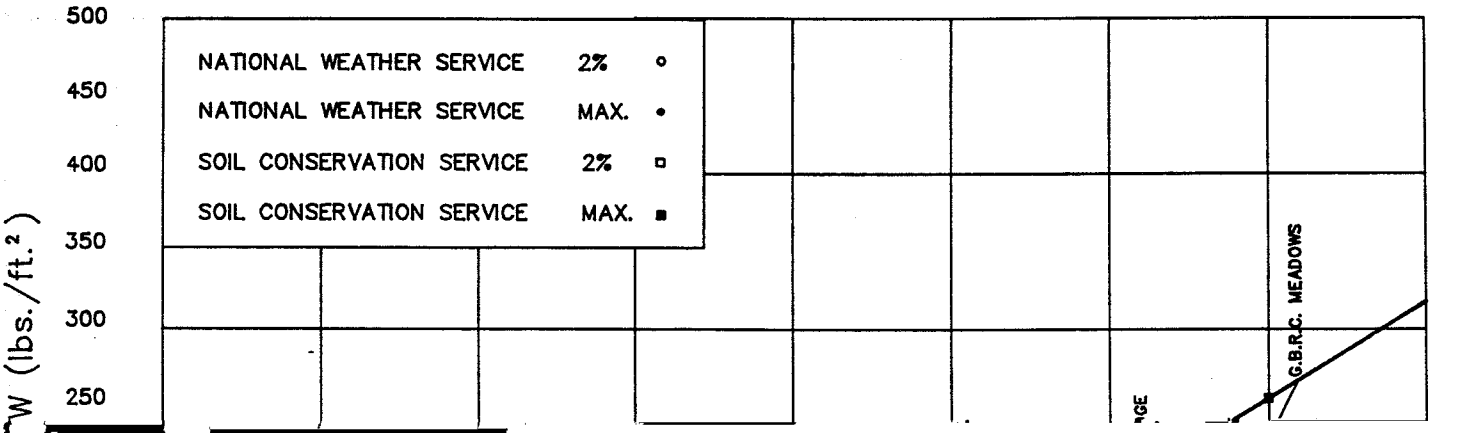


FIG. 16. DUCHESNE COUNTY



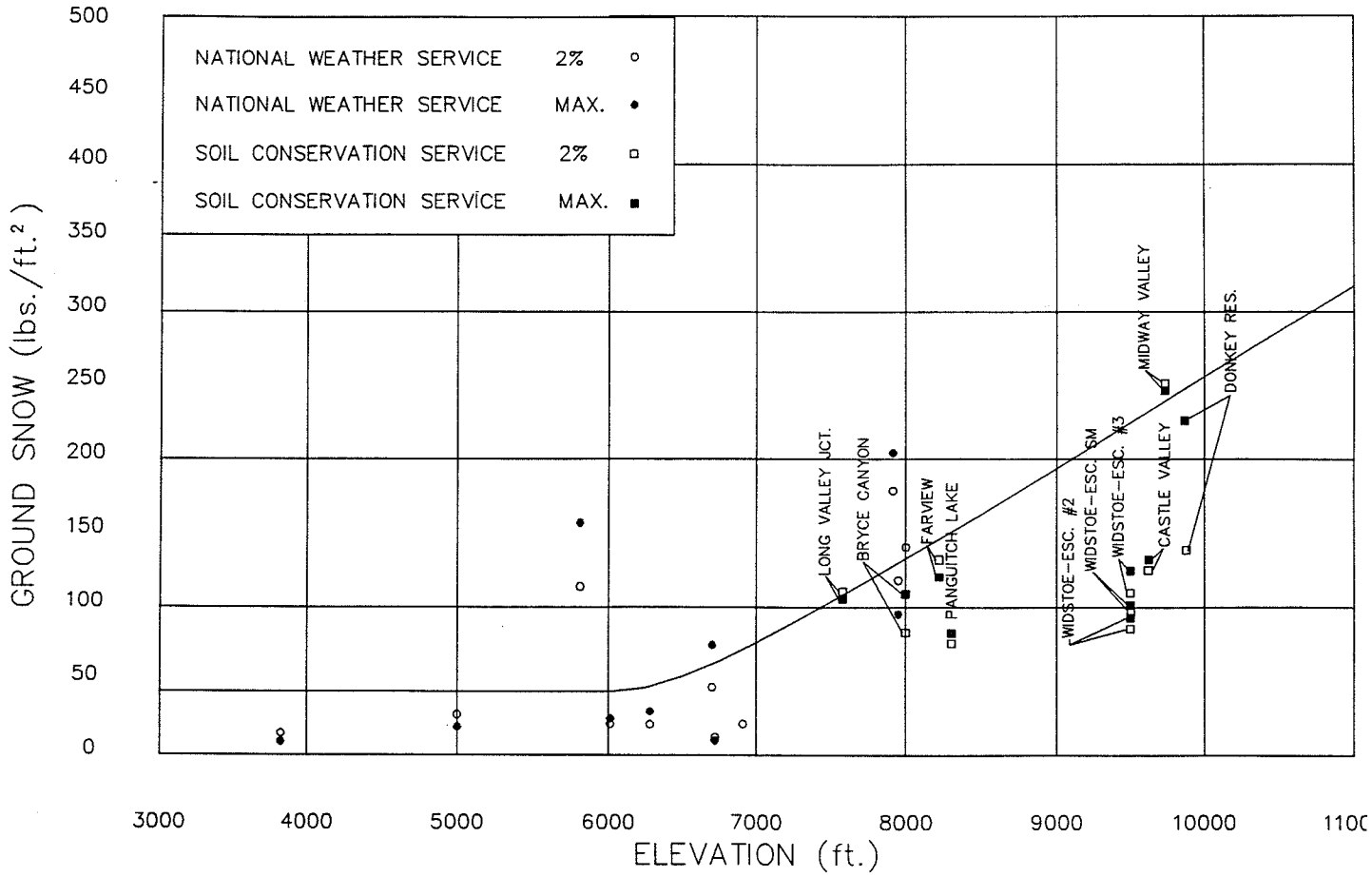


FIG. 18. GARFIELD COUNTY

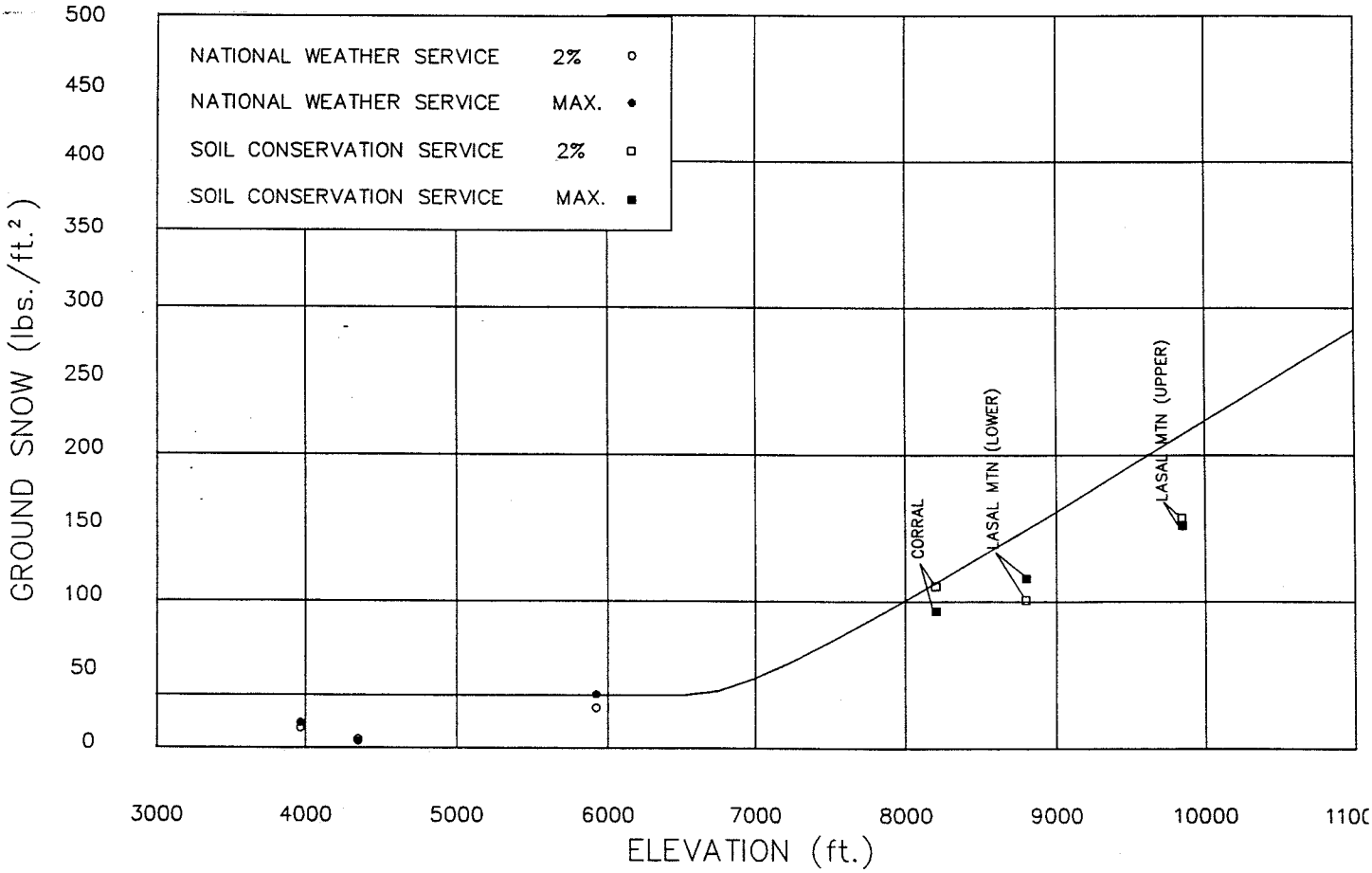


FIG. 19. GRAND COUNTY

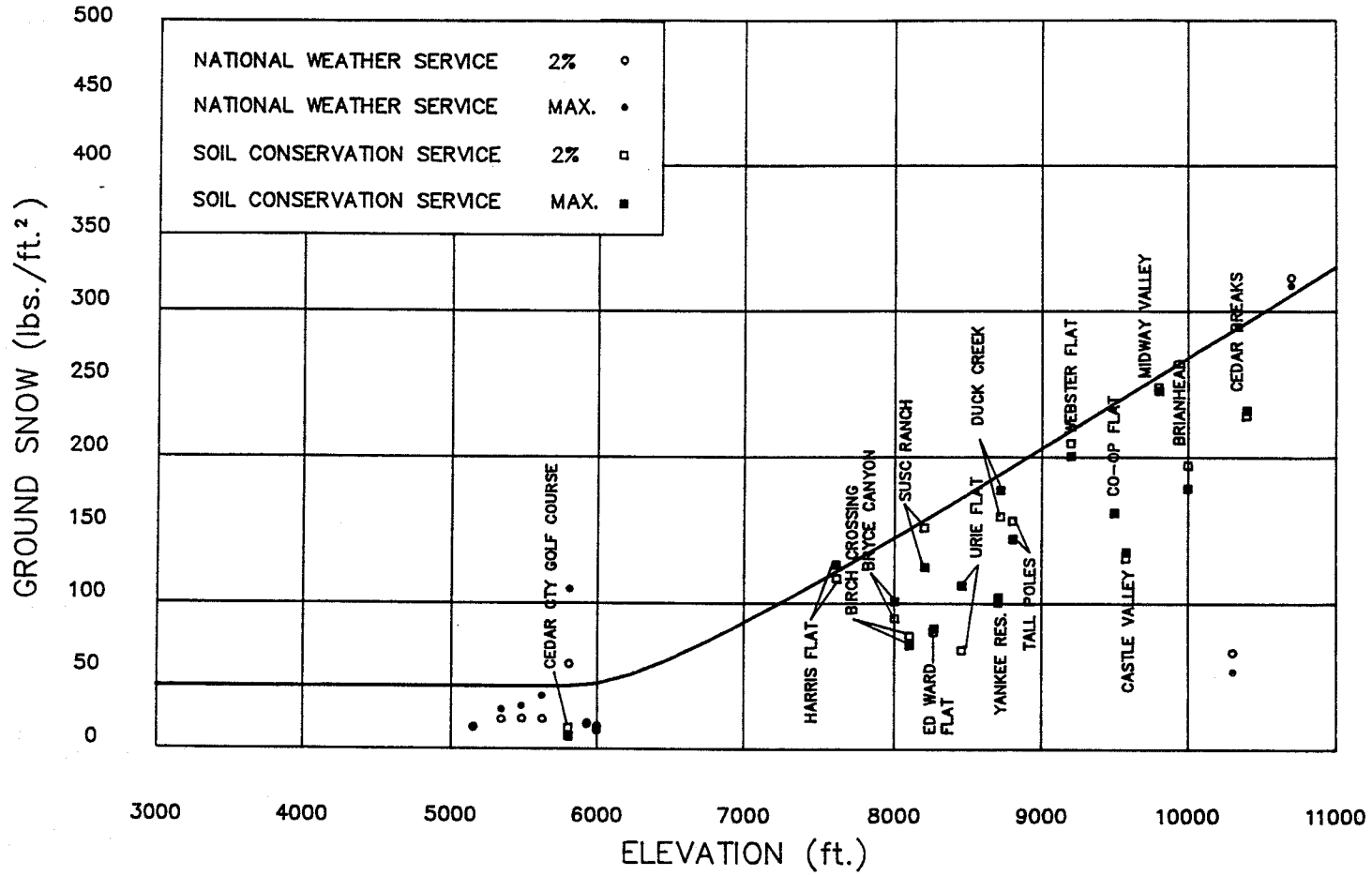


FIG. 20. IRON COUNTY

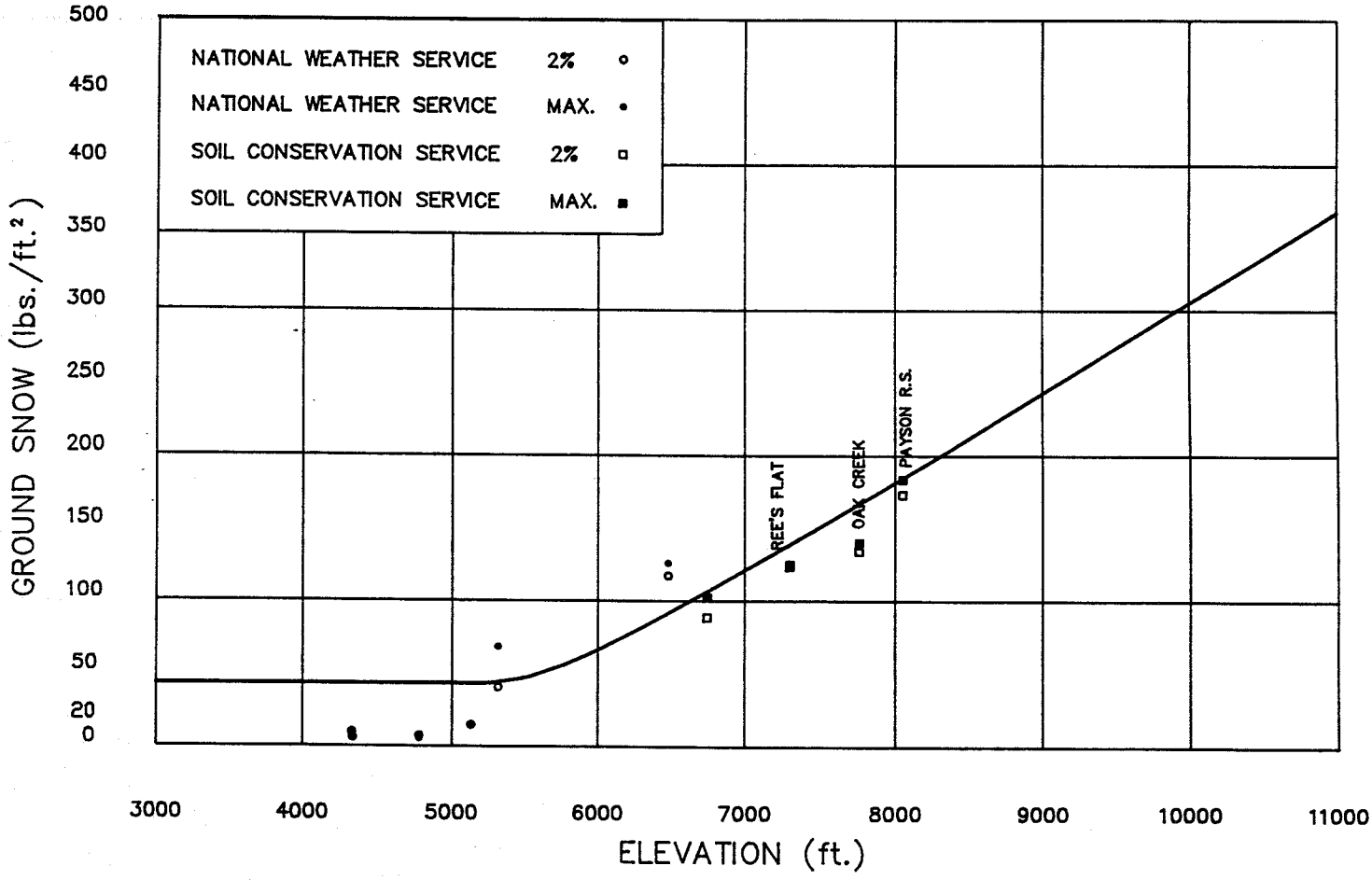


FIG. 21. JUAB COUNTY

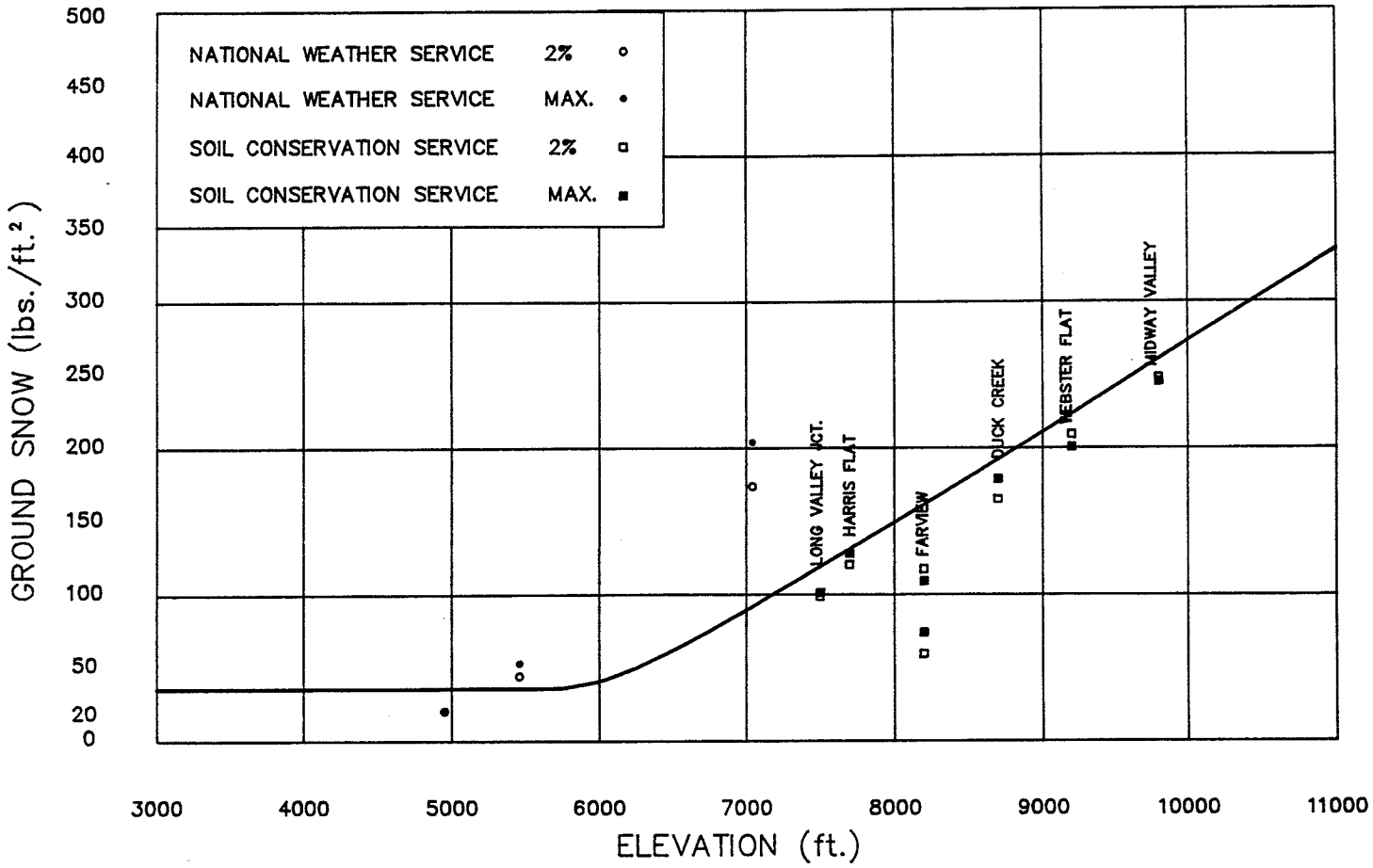
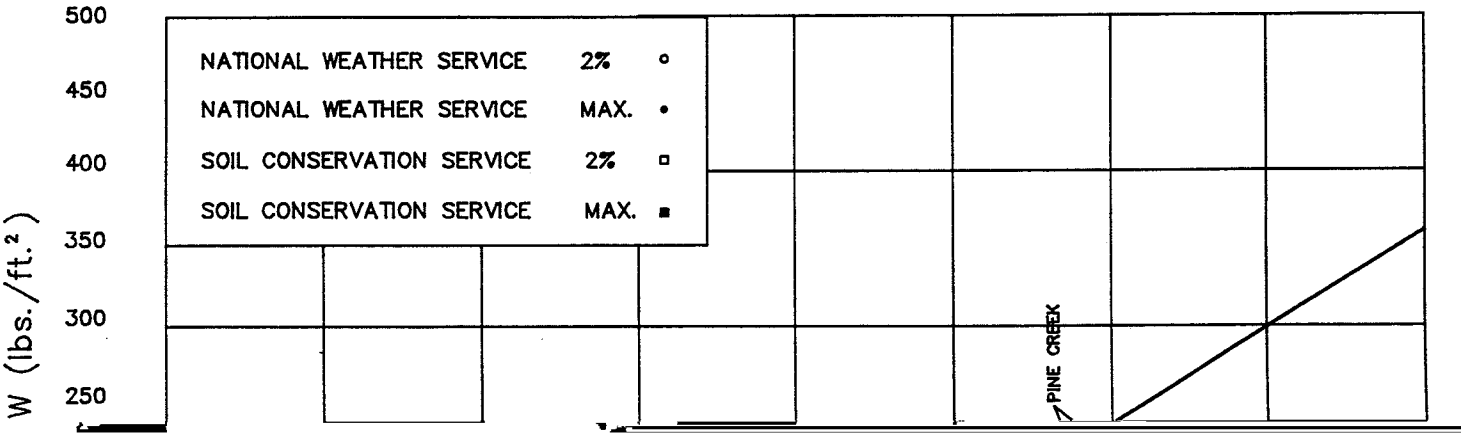


FIG. 22. KANE COUNTY



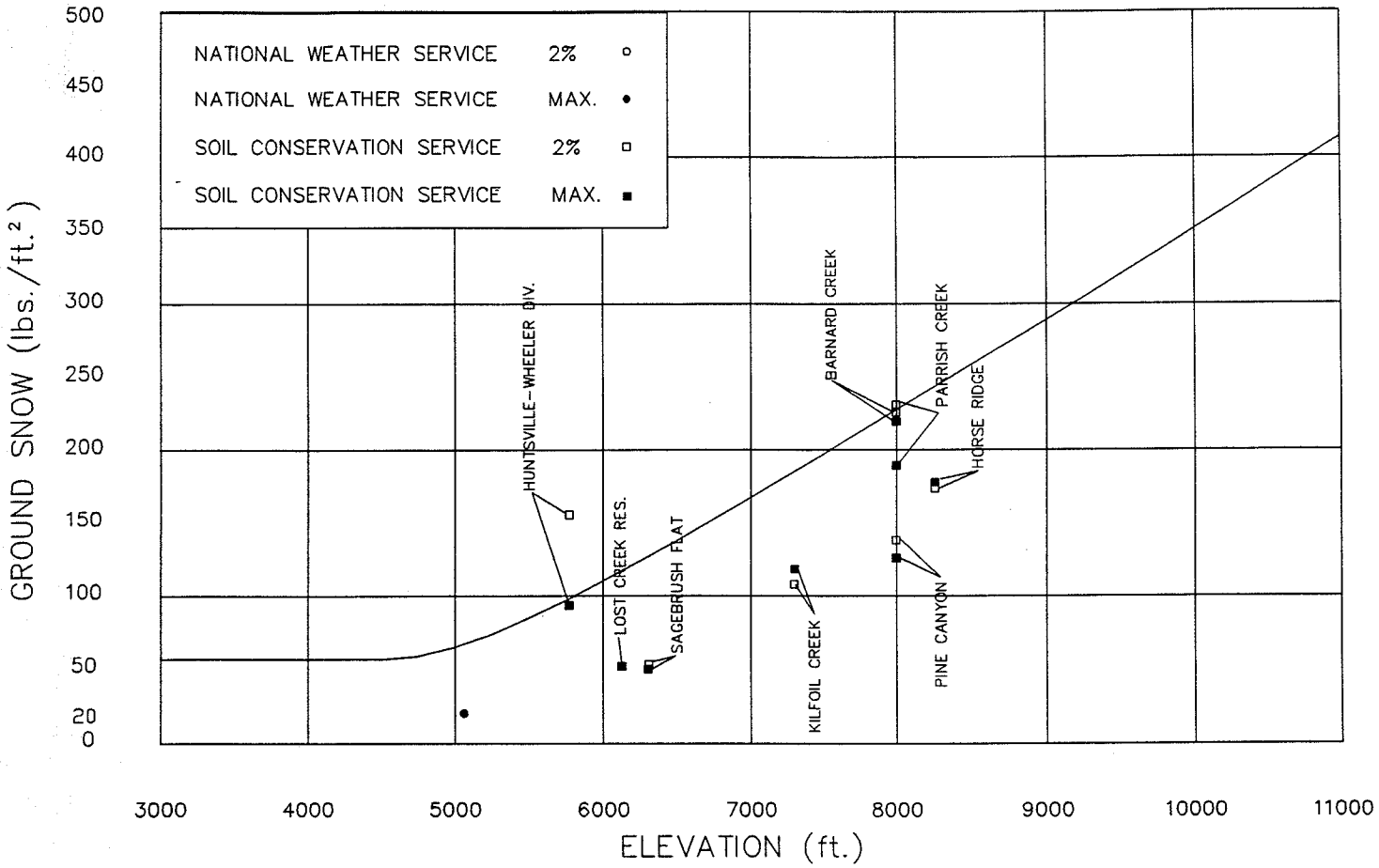


FIG. 24. MORGAN COUNTY

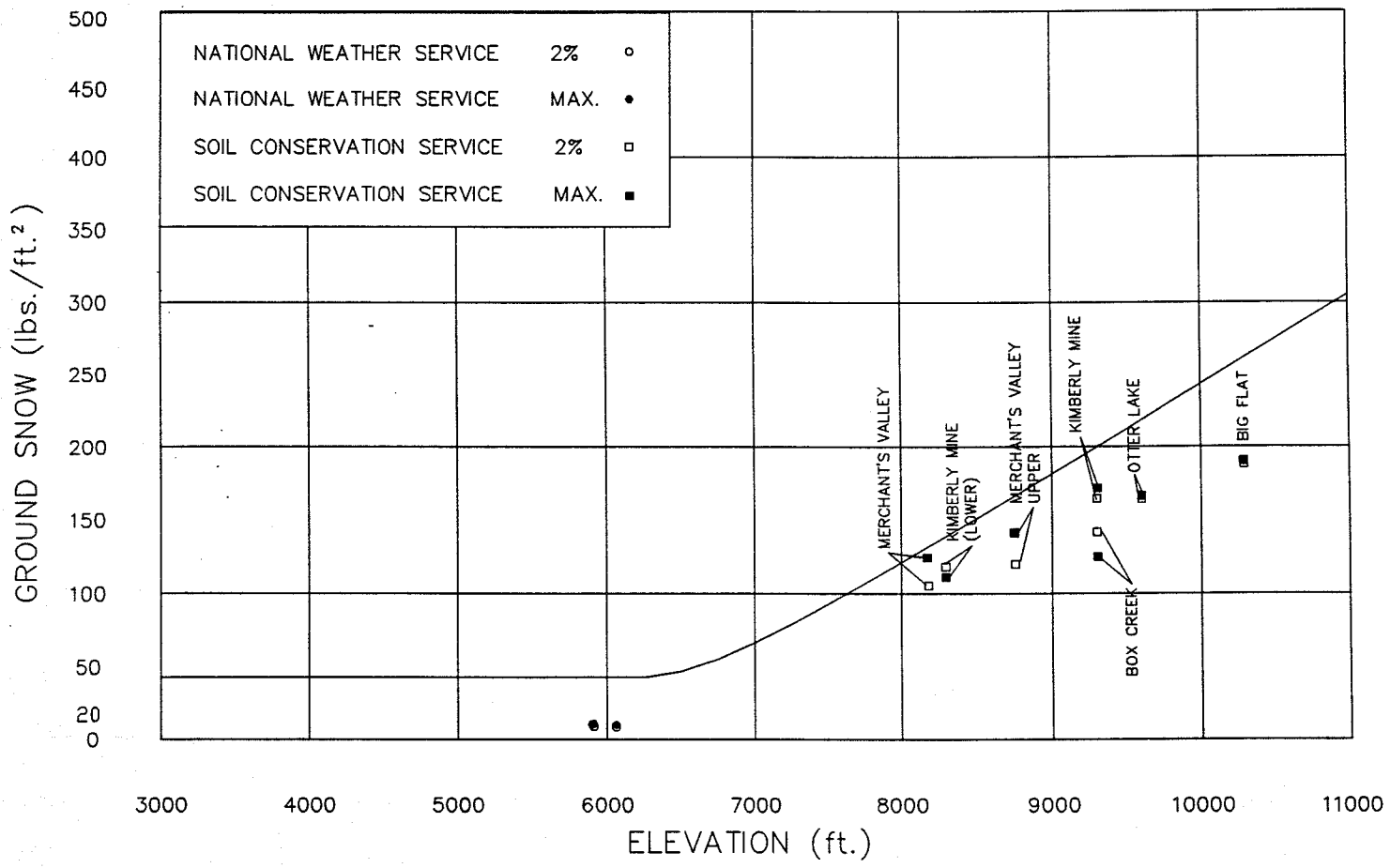


FIG. 25. PIUTE COUNTY

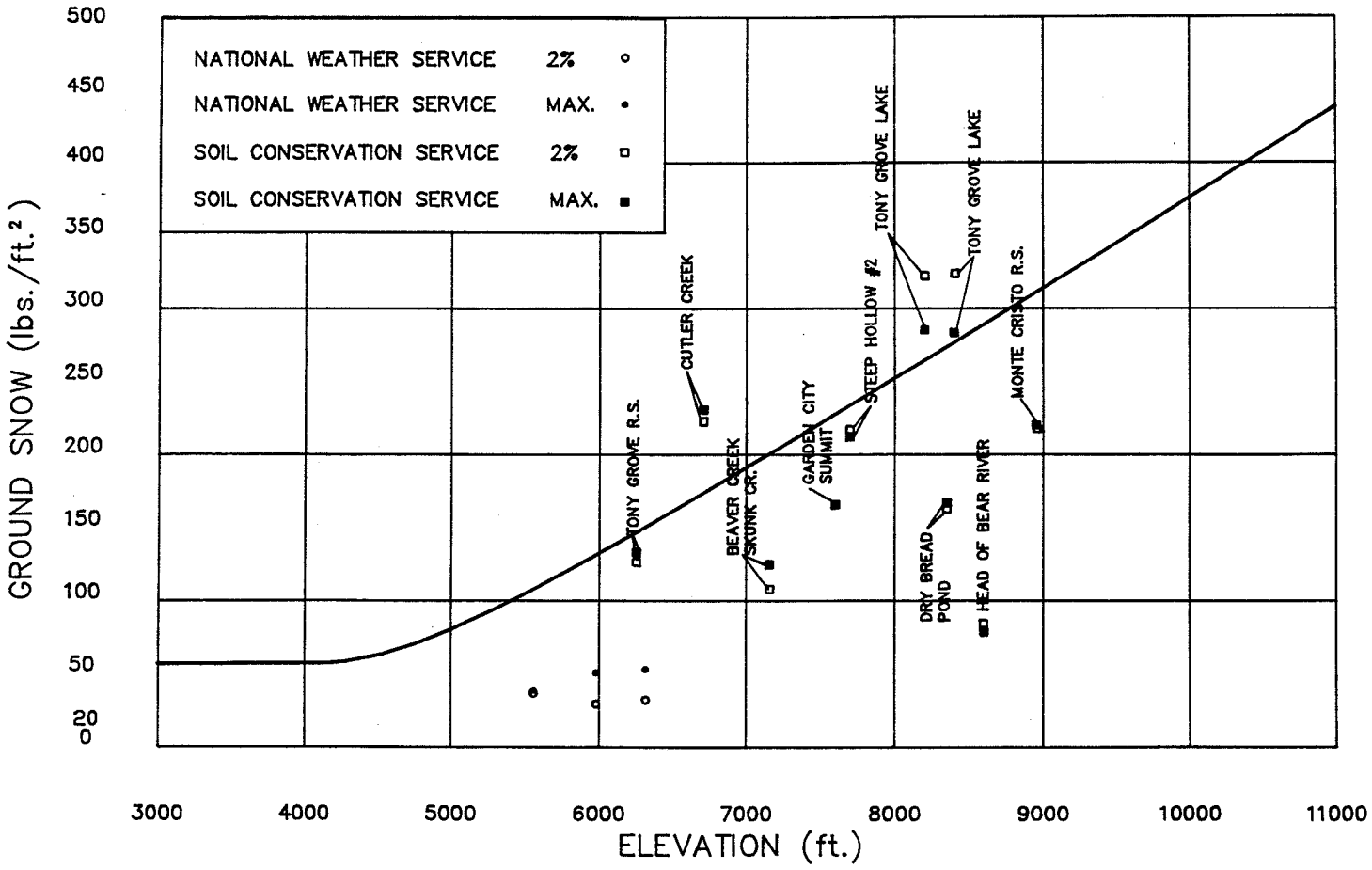


FIG. 26. RICH COUNTY

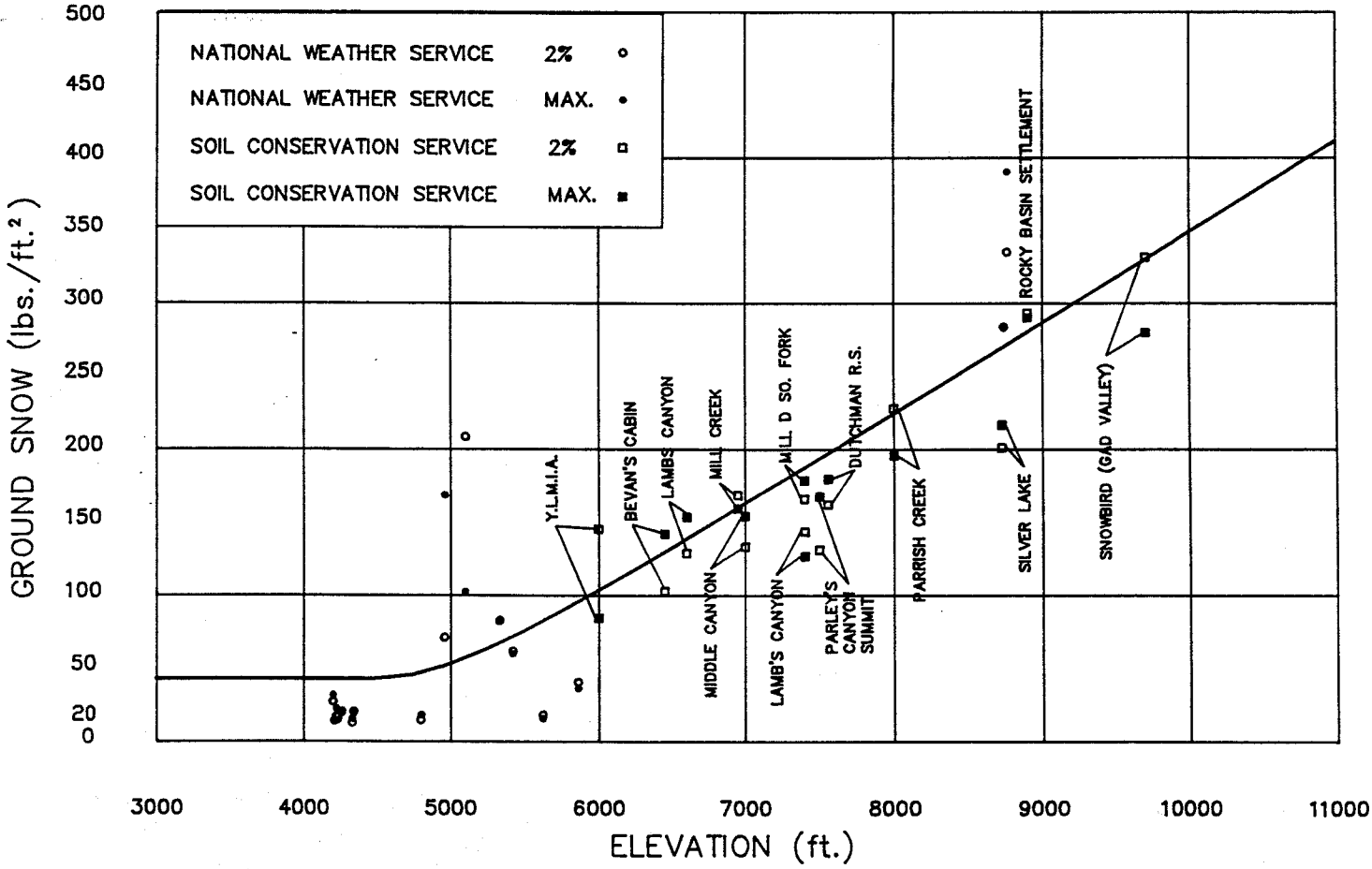


FIG. 27. SALT LAKE COUNTY

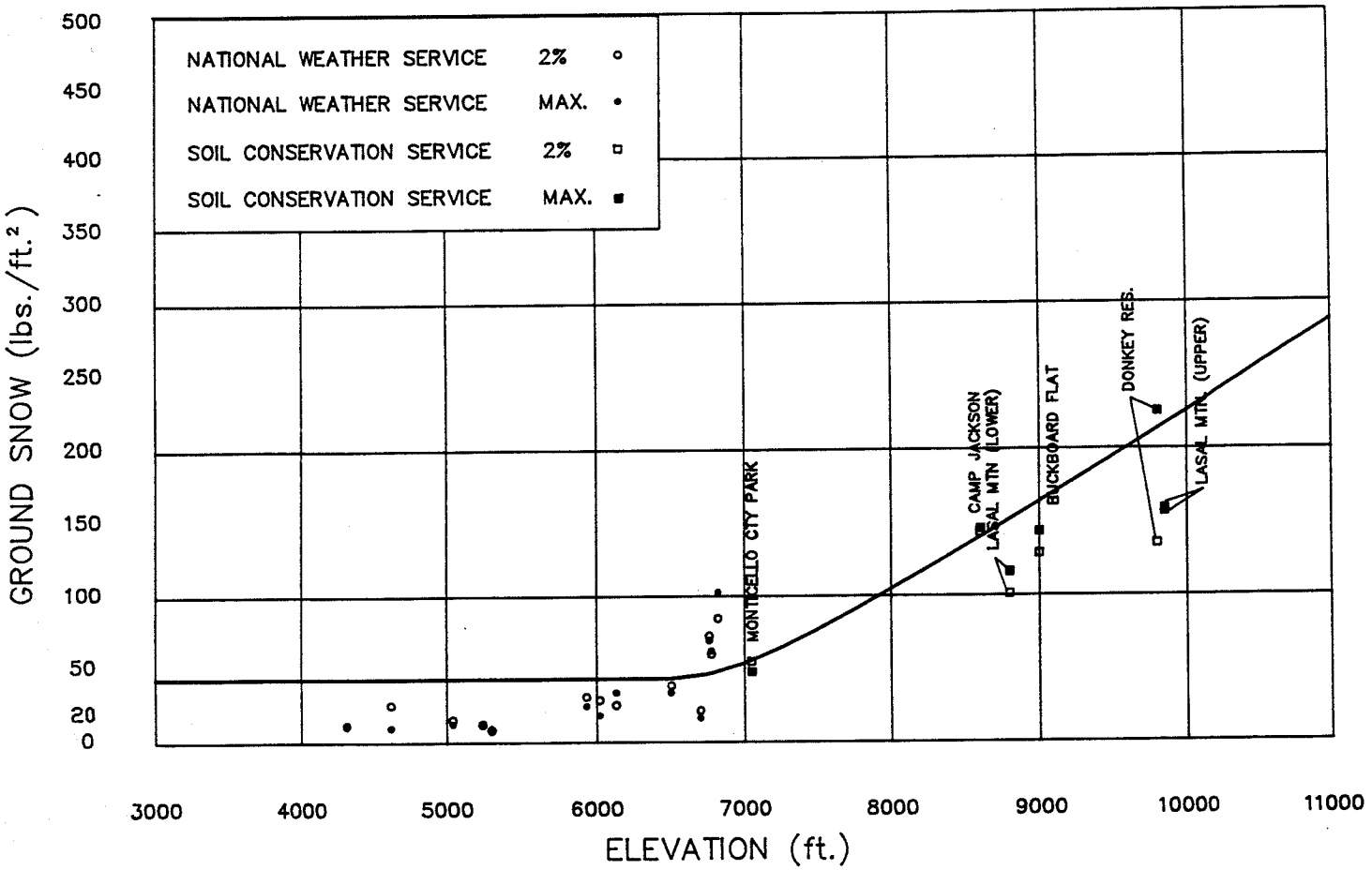


FIG. 28. SAN JUAN COUNTY

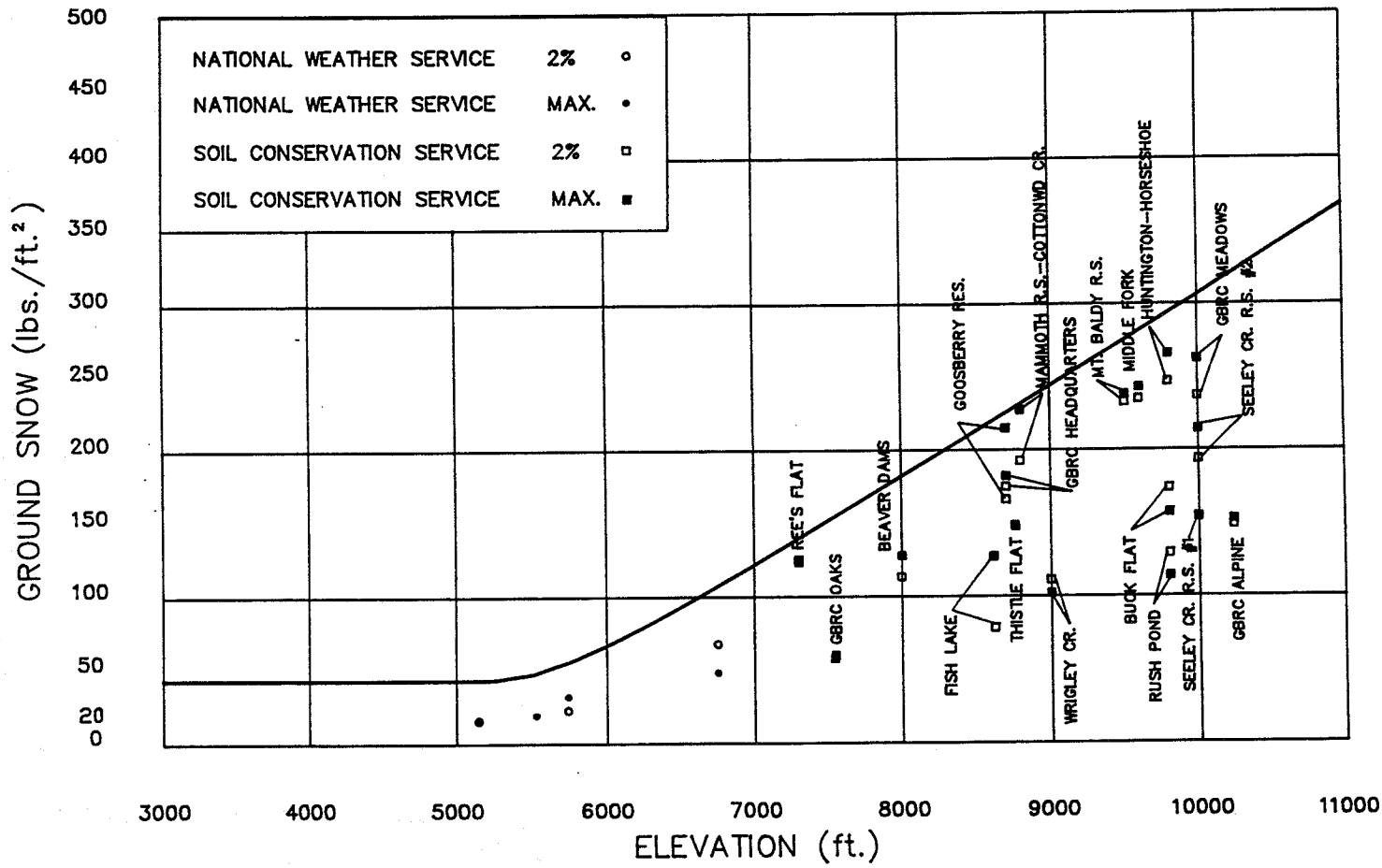


FIG. 29. SANPETE COUNTY

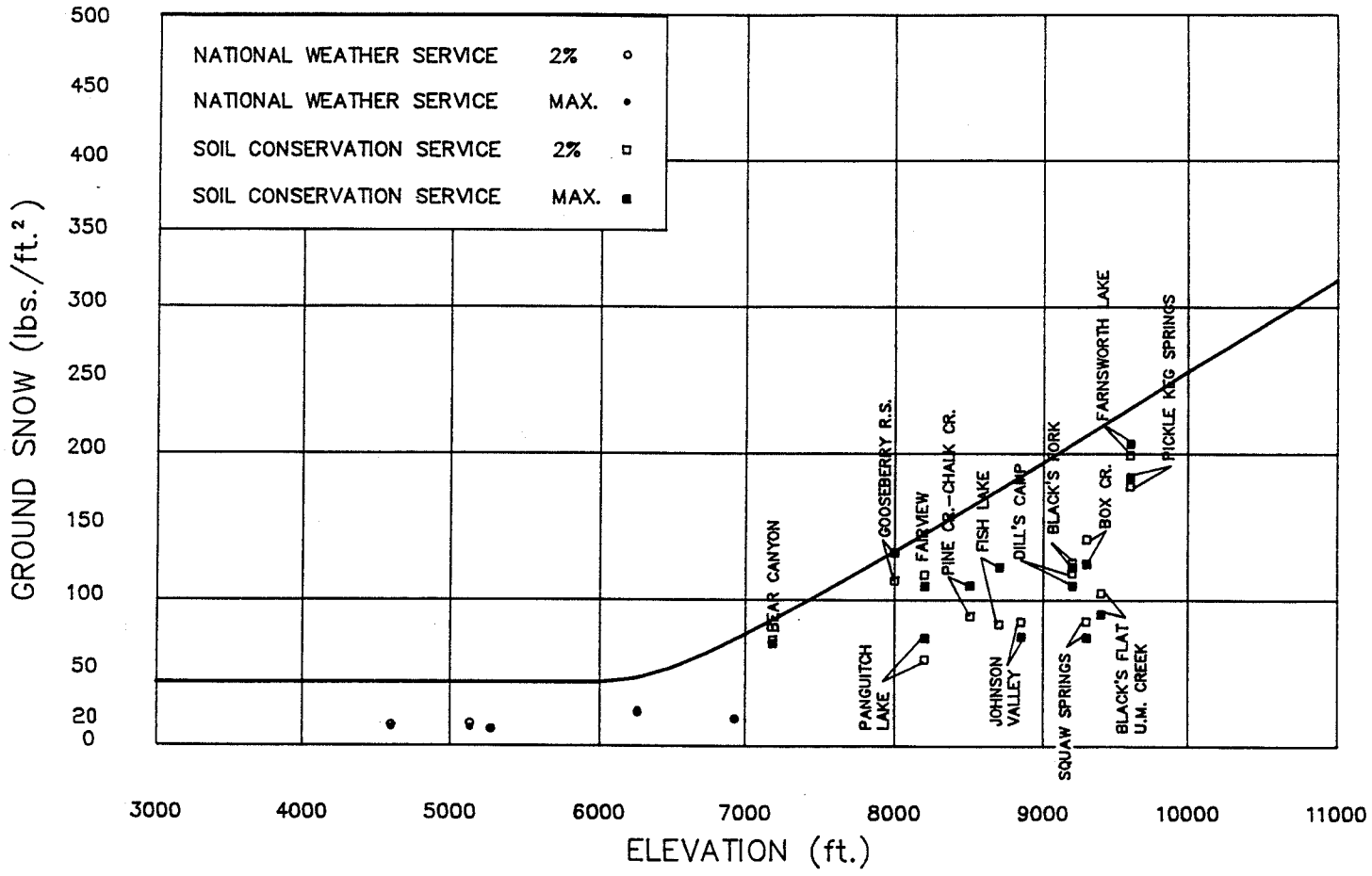


FIG. 30. SEVIER COUNTY

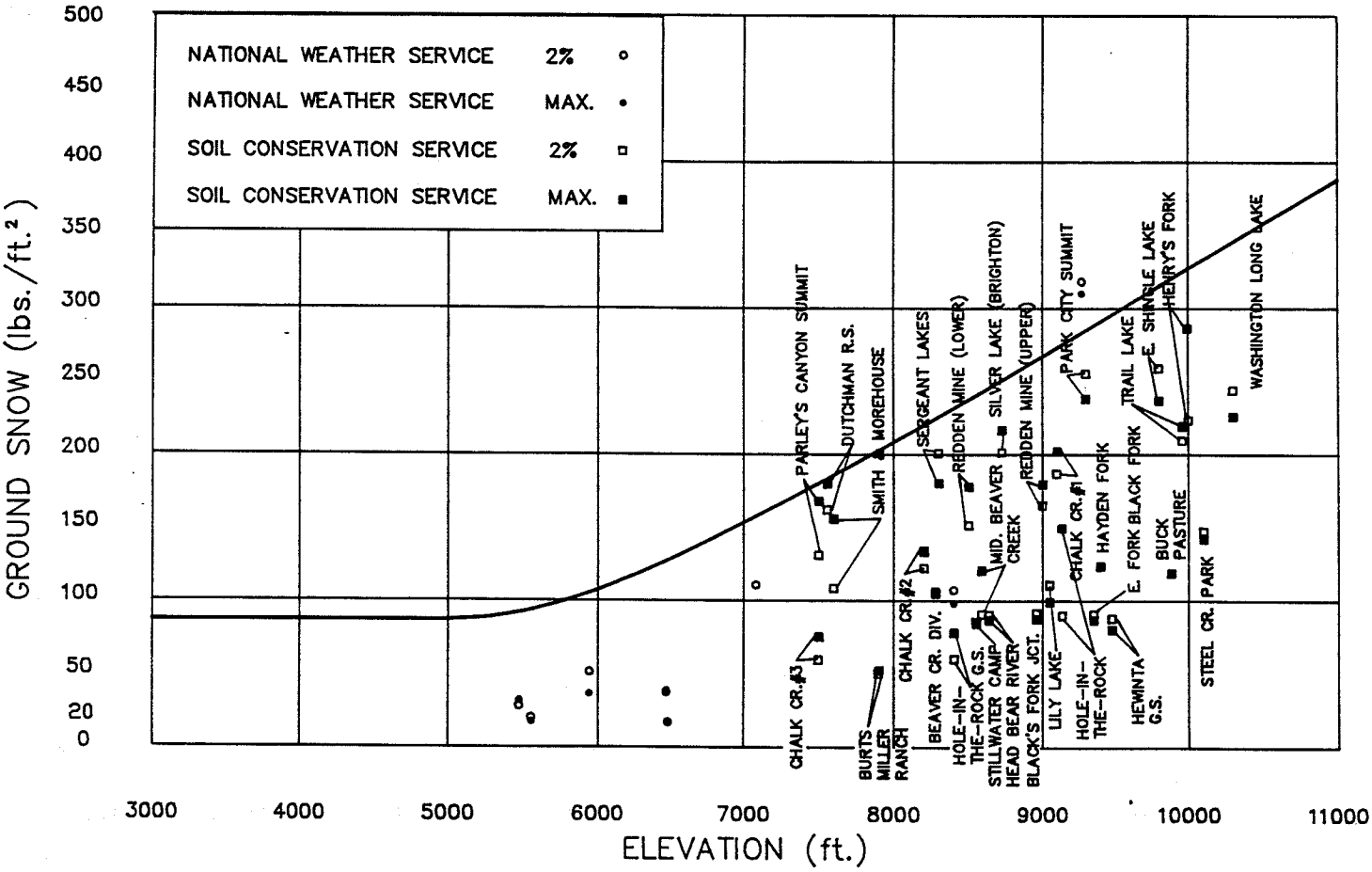


FIG. 31. SUMMIT COUNTY

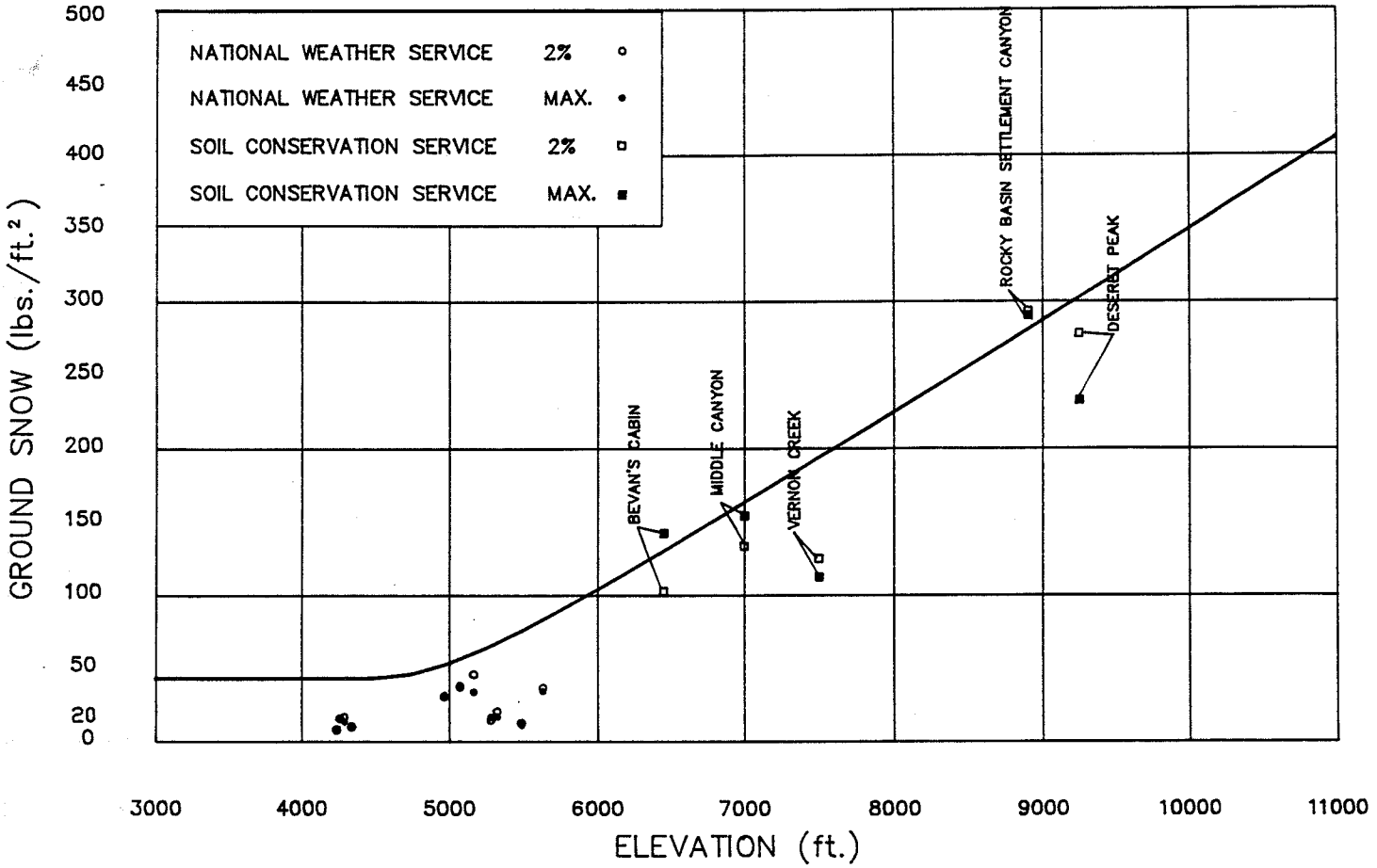


FIG. 32. TOOELE COUNTY

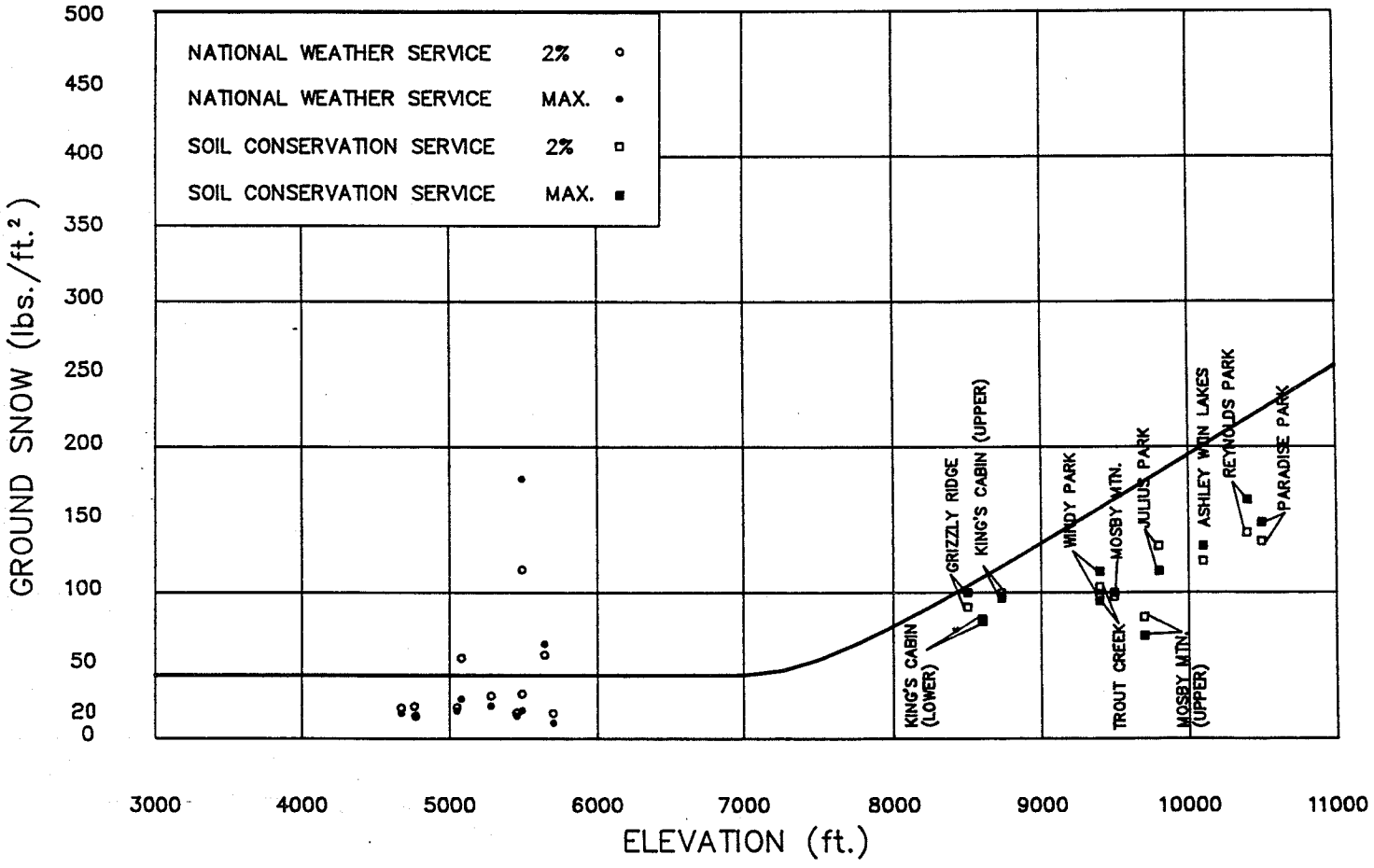


FIG. 33. UINTAH COUNTY

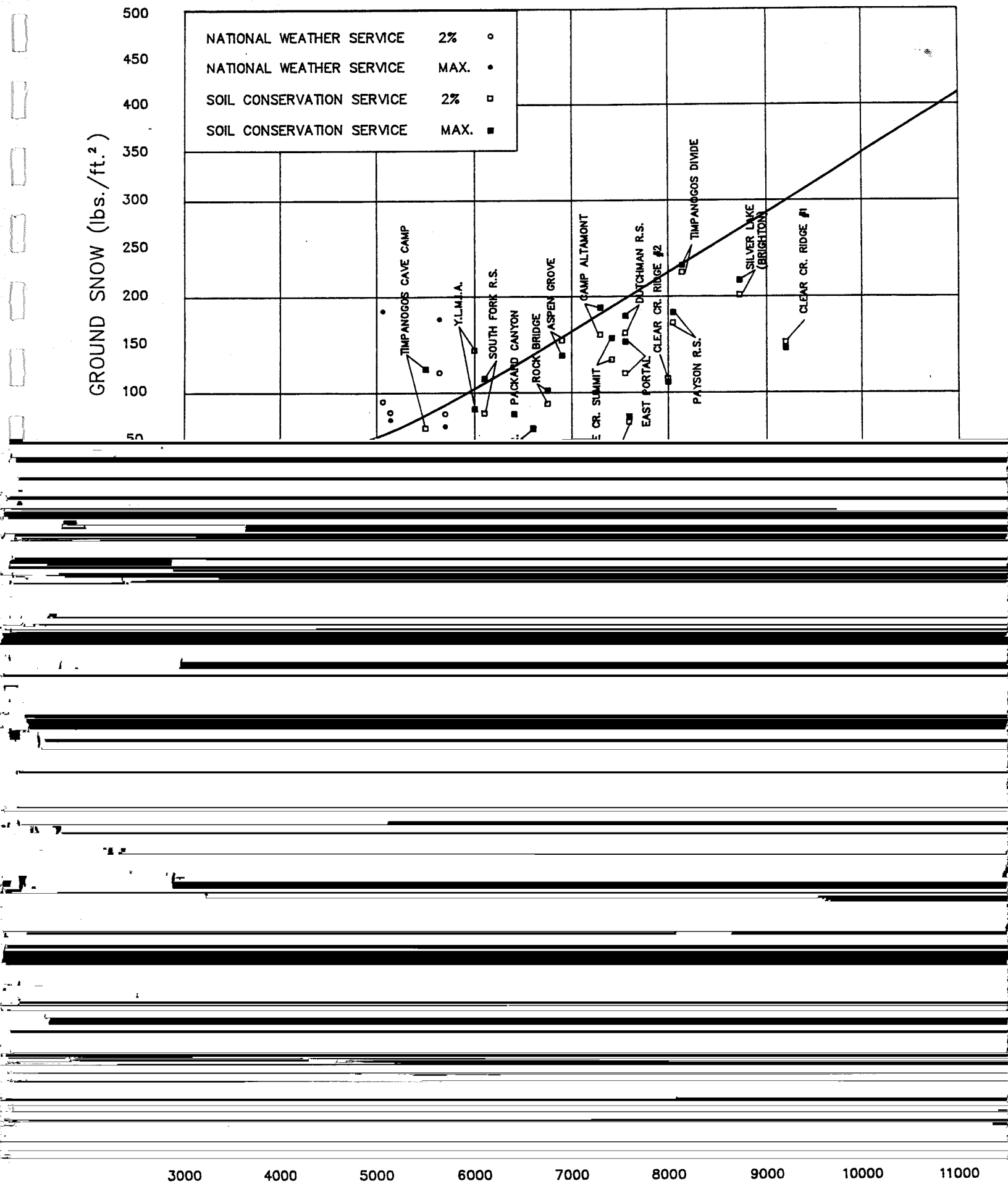


FIG. 34. UTAH COUNTY

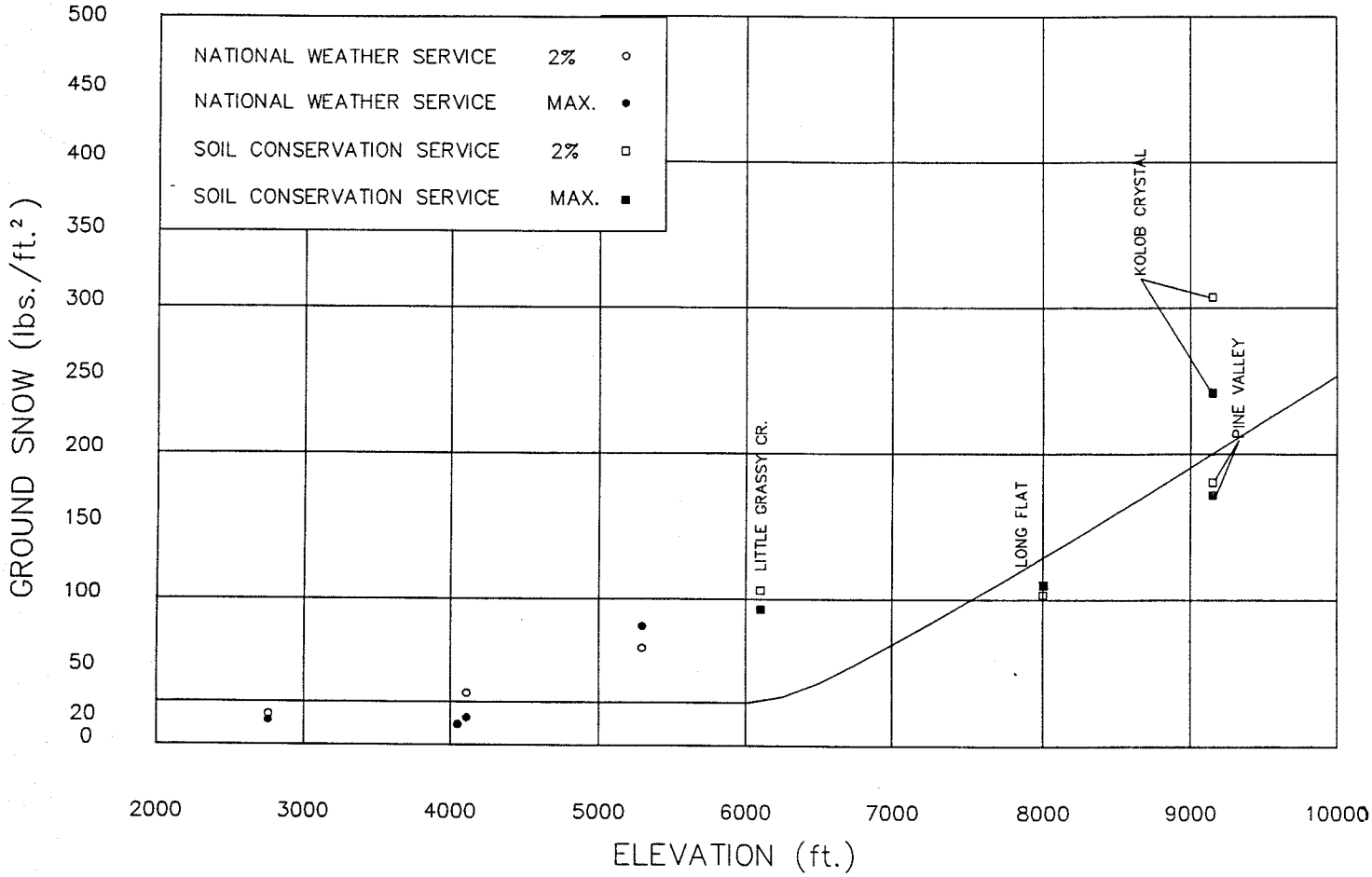


FIG. 36. WASHINGTON COUNTY

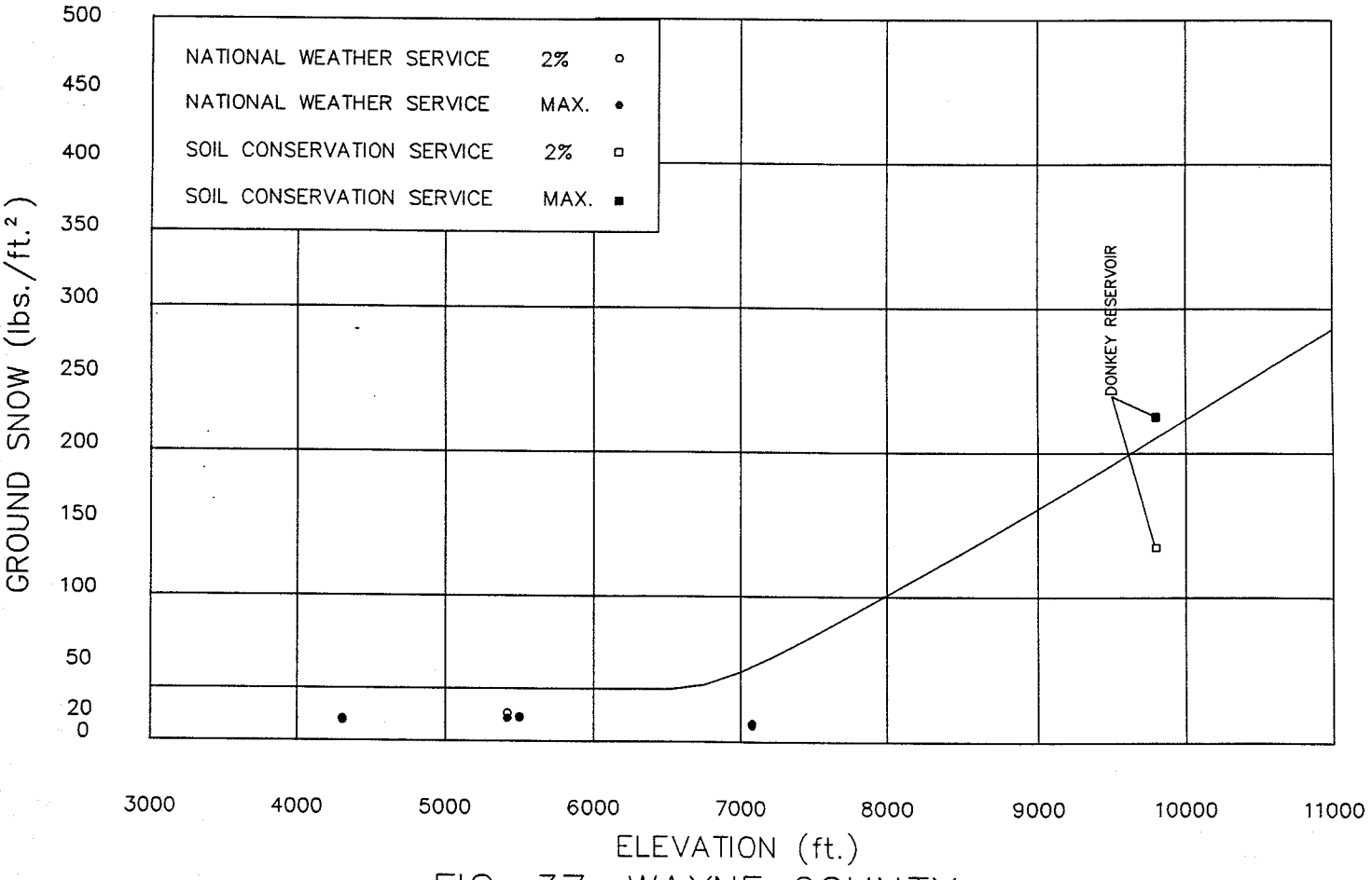


FIG. 37. WAYNE COUNTY

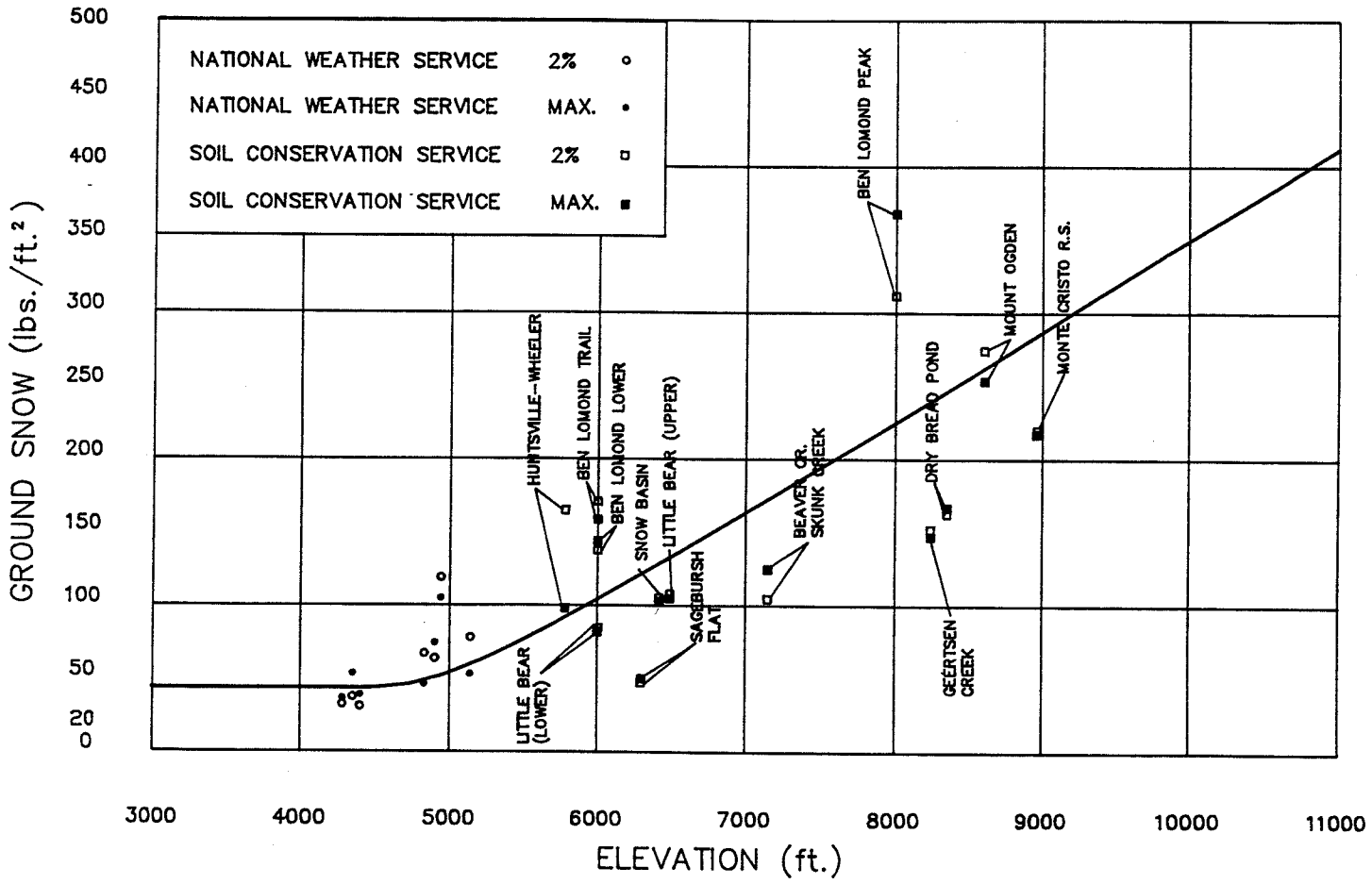


FIG. 38. WEBER COUNTY