WATERSHED ANALYSIS

for

PROPOSED SHERWIN SKI AREA

Mammoth Lakes, California
December, 1985

Prepared by:

Triad Engineering Corp.
P. O. Box 1570
Mammoth Lakes, CA 93546

Telephone: (619) 934-7588

Proposed Sherwin Ski Area

WATERSHED ANALYSIS

Table of Contents

Table of Contents, Continued

List of Tables

Table of Contents, Continued

List of Figures

Proposed Sherwin Ski Area

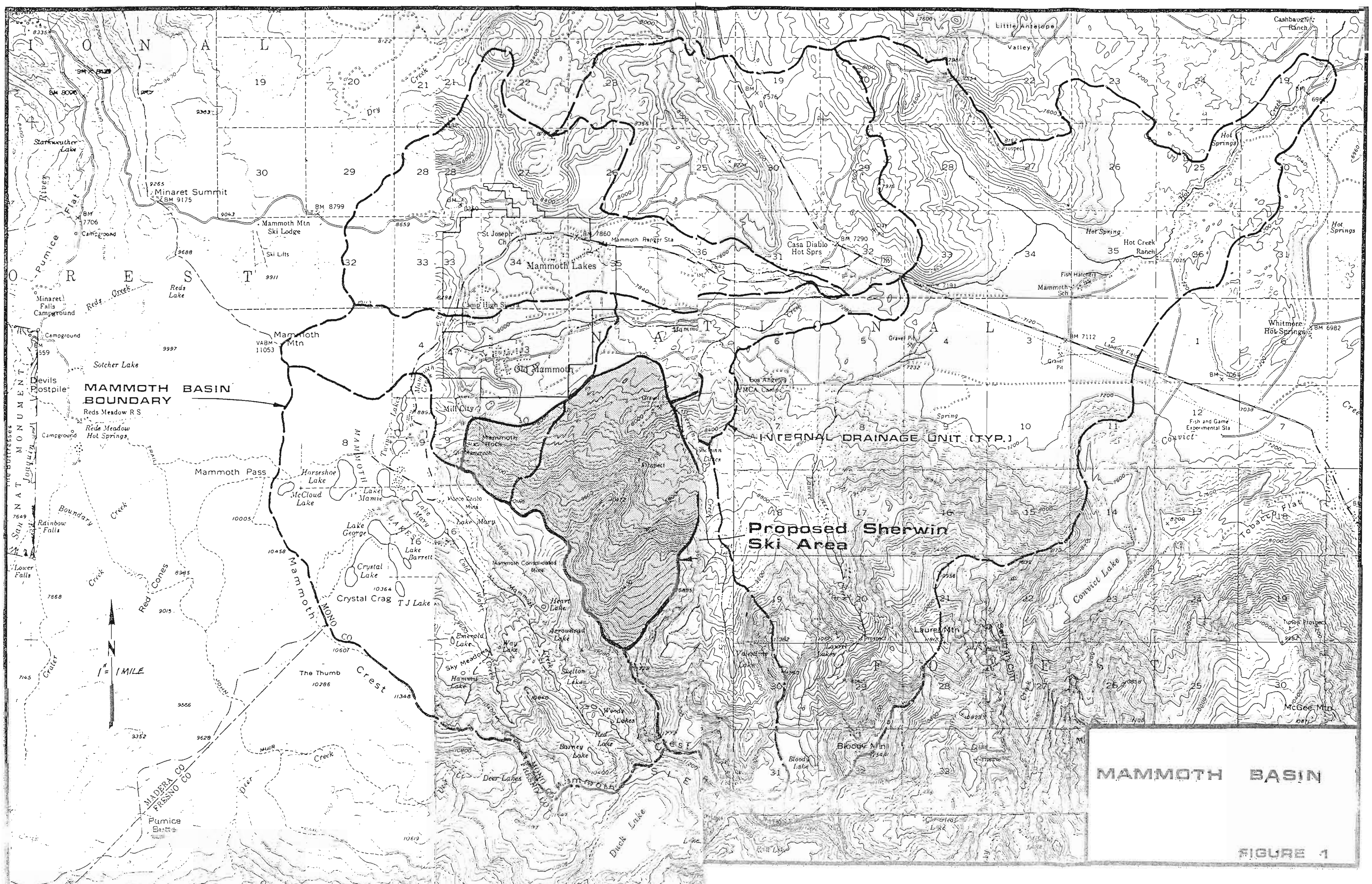
WATERSHED ANALYSIS

Hydrologic Setting

The proposed Sherwin Ski Area is situated within the Mammoth Basin drainage system of the Long subunit of the Owens hydrologic unit of the Lahontan drainage province. The Mammoth Basin has a total area of approximately 71 square miles and encompasses the entire watershed of Mammoth Creek (see Figure 1). The boundaries of the Basin are defined by the Convict Creek drainage divide to the east, the Mammoth Crest divide of the Sierra Nevadas to the south and southwest, the Dry Creek drainage divide to the northwest, and the Hot Creek Gorge to the northeast. Although it is the same surface stream, the name of Mammoth Creek changes to Hot Creek (primarily by historical tradition) after crossing U.S. Highway 395 in the eastern portion of the Basin. Principal tributary surface streams of Mammoth Creek include Coldwater Creek, Sherwin Creek, and Laurel Creek.

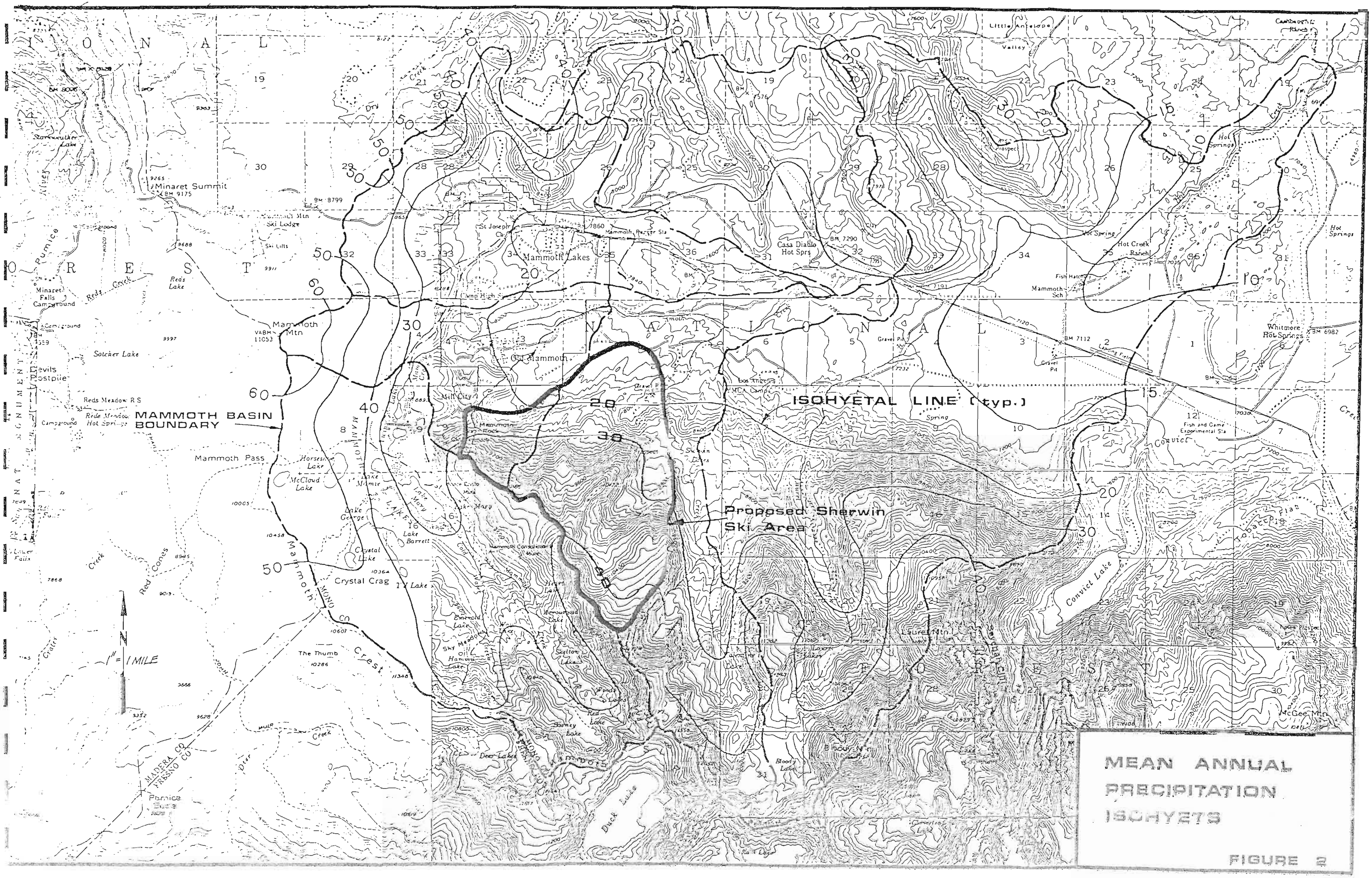
The Mammoth Basin is a relatively broad, easterly trending basin with only one surface outlet: Hot Creek to the northeast. The Basin is physically described as a two-mile wide valley floor distinctly confined by the steep slopes of the Eastern Sierra Nevadas to the south and west, and relatively high ridges to the north and east. Topographic relief is dramatic, with elevations varying from 7,000-8,000 feet on the valley floor to 11,000-12,000 feet along the crest of the Sierra Nevadas.

The climate of the Basin is heavily influenced by its location with respect to the crest of the Sierra Nevadas and the Mammoth Pass gap. Mild summers with daily highs of over 80°F are contrasted by harsh winters with lows near 0°F. Relatively high wind conditions are prevalent due to orographic effects. Humidities are low, varying from 15% to 30% with higher values usually occurring in the spring and autumn seasons. Precipitation occurs primarily as winter snow, although rain showers are common throughout the remaining seasons. Annual precipitation varies considerably within the Basin, ranging from less than 10 inches in the northeasterly extremities to over 60 inches at Mammoth Mountain on the west. Mean annual precipitation isohyetals (50-year record) for the Basin are shown on Figure 2.



MAMMOTH BASIN

FIGURE 1



MEAN ANNUAL PRECIPITATION ISCHYETS

FIGURE 2

Watershed Characteristics

Project Location. The general location of the proposed Sherwin Ski Area with respect to the Mammoth Basin is shown on Figure 1. It is situated in the western-central portion of the Basin just south of the private lands which comprise the community of Mammoth Lakes. The total study area encompasses approximately 4.7 square miles and is topographically tributary to Mammoth Creek which flows easterly approximately one mile northeasterly of the project limits. The Ski Area drainage boundaries are defined by the Sherwin Creek watershed to the east and the Lakes Basin drainage system divide to the south and west. There are no perennial surface streams within the project area; consequently, the only apparent hydrologic continuity with adjacent drainages is via subsurface groundwater flow.

The limits of the Sherwin Ski Area watershed are shown topographically on Figure 3. For convenience of evaluation, the watershed has been subdivided into five drainage subareas, labelled I through V. Additionally, a further division has been made within Subarea II to define a drainage area of special interest at the Canyon Lodge location.

Drainage Subareas. The drainage subareas are essentially defined by natural topographic boundaries. A summary of the drainage areas included within each subarea and descriptions of the features to which they are tributary is presented in Table 1.

Table 1. Drainage Subareas

Drainage Subarea	Area, Acres	Percent of Total Watershed	Tributary Point
I	258	8.61	Seasonal spring 500 feet west of Sherwin Creek. Tributary to Sherwin Creek.
II	1,262	42.15	Drainage confinement (sump) near Motocross Base Lodge. Tributary to Sherwin Creek 1/4 mile east.
(IIA)	(430)	(14.36)	Drainage confinement near Canyon Lodge.
III	626	20.90	Natural drainage confluence near Sherwin Road. Tributary to Mammoth Creek 1/2 mile northeast.
IV	373	12.45	Small valley near Snowcreek Base Lodge with sump at lower end. Tributary to Mammoth Creek 3/4 mile to north.
V	476	15.89	Old Mammoth meadow area, Bodle Ditch and Hidden Lake. Tributary to Mammoth Creek 1 mile northeast.
Totals	2,995	100.00	

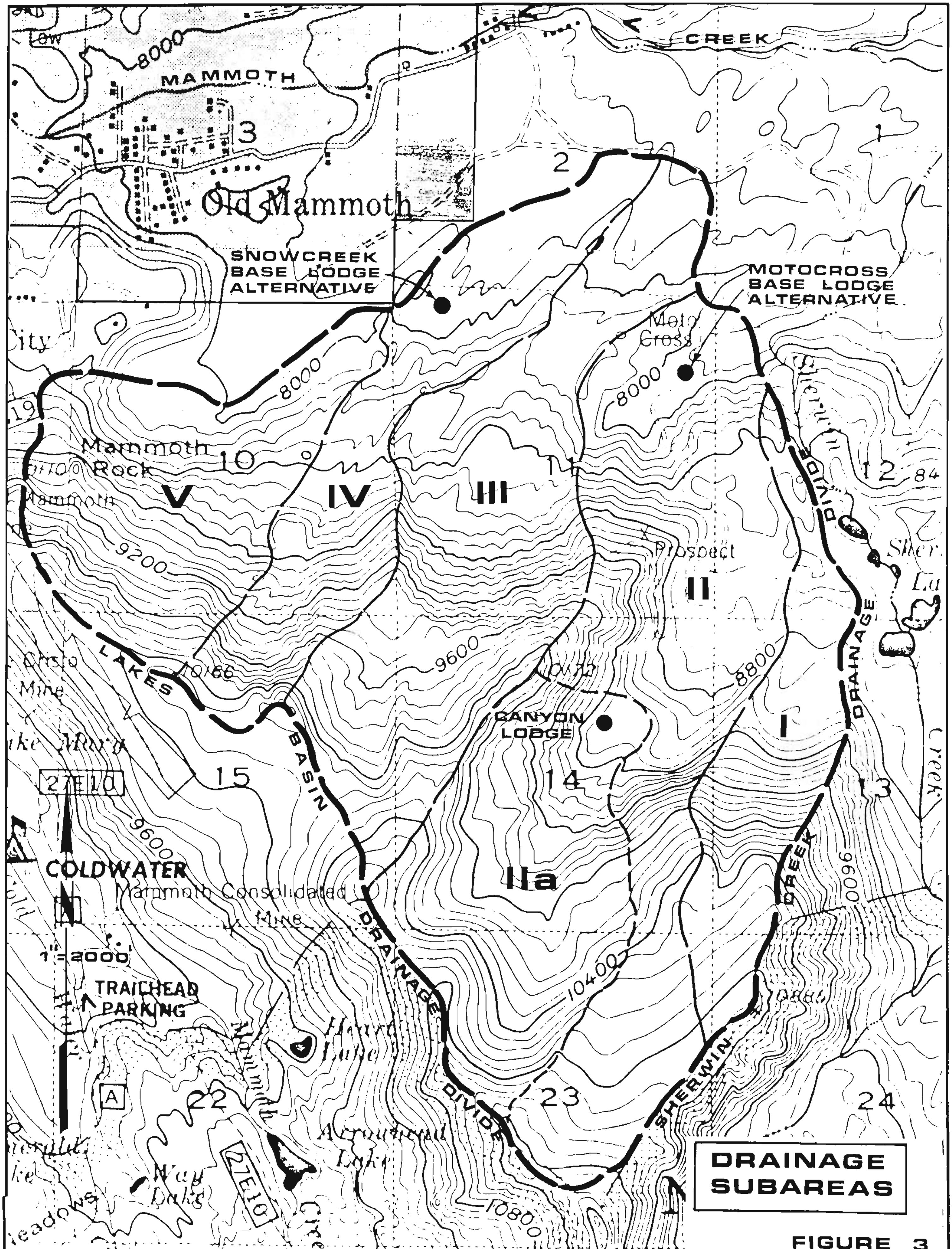

MAMMOTH
CREEK
Old Mammoth
SNOWCREEK BASE LODGE ALTERNATIVE
MOTOCROSS BASE LODGE ALTERNATIVE
Moto Cross
Mammoth Rock
V
IV
III
II
I
IIa
Prospect
CANYON LODGE
LAKES BASIN DRAINAGE DIVIDE
SHERWIN CREEK DRAINAGE DIVIDE
COLDWATER
Mammoth Consolidated Mine
1" = 2000'
TRAILHEAD PARKING
27E10
8000
9200
9600
8800
10400
DRAINAGE SUBAREAS

FIGURE 3

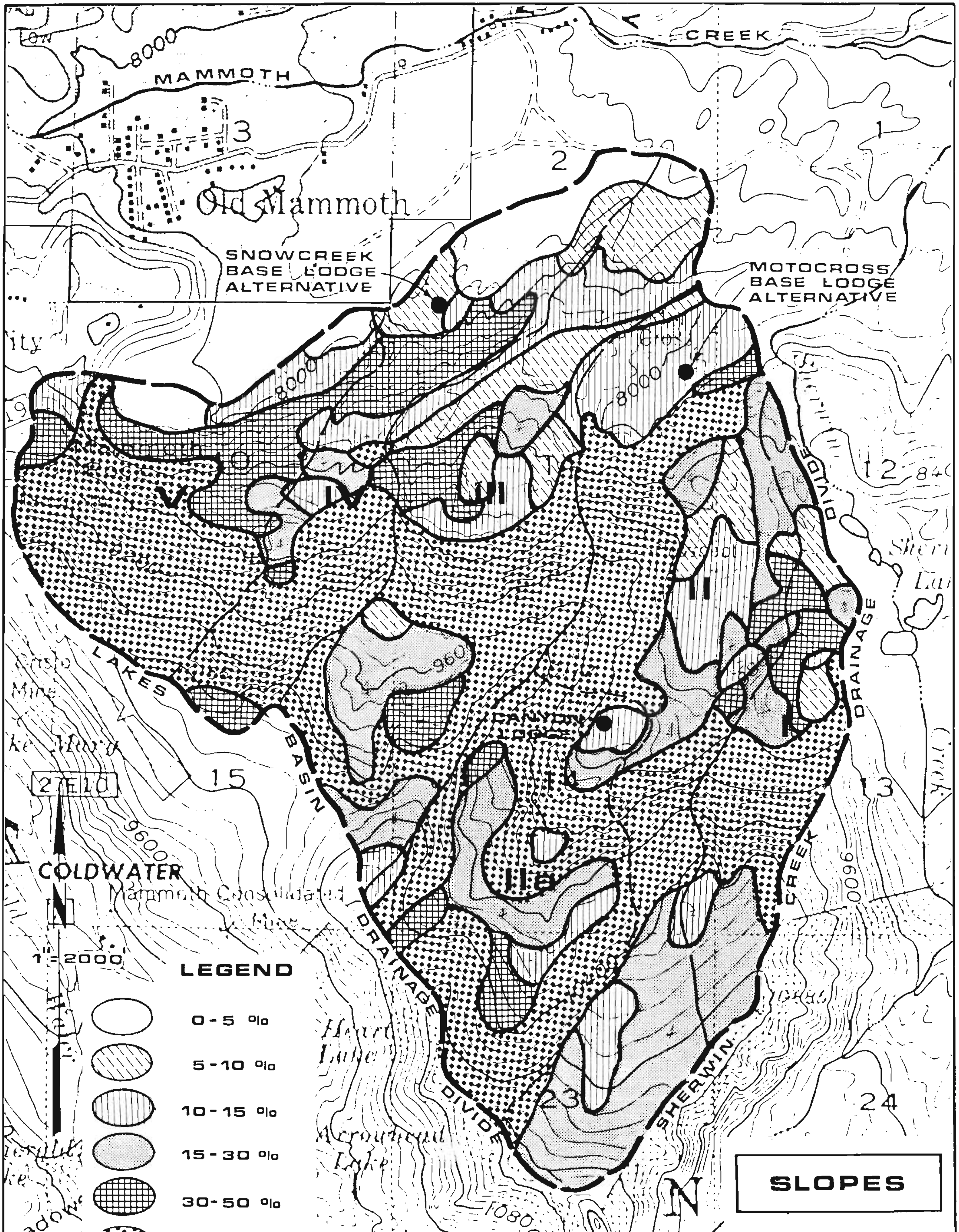
Precipitation. Mean annual precipitation ranges from 18 inches at the lower elevations to 40 inches at the highest peaks within the ski area watershed. Precipitation from year to year is highly variable, however, and departures from the historical mean range as high as 50%. Mean annual precipitation and total production for the watershed subareas are summarized in Table 2. Precipitation figures were derived from area-weighted averages of the 50-year mean isohyetals shown in Figure 2.

Table 2. Mean Annual Precipitation

Drainage Subarea	Area, acres	Mean Annual Precipitation, inches	Mean Annual Water Production, AF/year
I	258	31.2	671
II	1,262	34.2	3,595
(IIA)	(430)	(38.4)	(1,376)
III	626	30.5	1,591
IV	373	26.4	821
V	476	30.0	1,190
Total:	2,995	Average: 31.5	Total: 7,868

The pattern of annual precipitation is distinctly cyclical in the Mammoth Basin. Winter snowfall is heavy and frequent because storms are generally associated with large scale, long duration frontal movements. Average winter accumulations of snowfall range from 49 inches in the Town of Mammoth Lakes (elevation 8,300) to 106 inches at Mammoth Pass (elevation 9,500). During the remainder of the year, rainfall occurs primarily as the result of local convective thunderstorms. These storms are characteristically of short duration with peak rainfall intensities of less than 1.5 inches per hour.

Topography. The ski area watershed drains northerly from the crest of a series of unnamed peaks, commonly known as the Sherwin Ridge, to the floor of the Mammoth Basin. Elevations rise precipitously from 7,850 feet to over 11,500 feet at the southerly extremity of the watershed. The western portion of the drainage is uniformly steep with average slopes of 35-50%. The eastern portion includes a narrow valley known as Solitude Canyon but still is dominated by moderately steep slopes of 25-40%. A graphic representative of the watershed slopes is presented in Figure 4, and a slope analysis for each



MAMMOTH
CREEK
Old Mammoth
SNOWCREEK
BASE LODGE
ALTERNATIVE
MOTOCROSS
BASE LODGE
ALTERNATIVE
LAKES
BASIN
DRAINAGE
DIVIDE
SHERWIN
CREEK
DRAINAGE
DIVIDE
CANYON
LODGE
COLDWATER
1"=2000'
LEGEND
0-5 %
5-10 %
10-15 %
15-30 %
30-50 %
> 50 %
SLOPES

FIGURE 4

subarea is tabulated in Table 3. General physical characteristics of the drainage subareas are summarized in Table 4.

Table 3. Slope Analysis

Drainage Subarea	Total Acres	0-5% Acres	0-5% %	5-10% Acres	5-10% %	10-15% Acres	10-15% %	15-30% Acres	15-30% %	30-50% Acres	30-50% %	> 50% Acres	> 50% %
I	258	--	--	10	3.9	21	8.1	91	35.3	39	15.1	97	37.6
II	1,262	--	--	48	3.8	218	17.3	327	25.9	76	6.0	593	47.0
(II-A)	(430)	--	--	--	--	(42)	(9.8)	(77)	(17.9)	(57)	(13.3)	(254)	(59.1)
III	626	--	--	112	17.9	102	16.3	142	22.7	76	12.1	194	31.0
IV	373	24	6.4	23	6.2	64	17.2	24	6.4	80	21.4	158	42.4
V	476	--	--	20	4.2	33	7.0	17	3.6	121	25.4	285	59.9
Totals	2,995	24	0.8	213	7.1	438	14.6	601	20.1	392	13.1	1,327	44.3

Table 4. Physical Characteristics

Drainage Subarea	Acres	Elevation High	Elevation Low	Basin Length Feet	Basin Slope Percent
I	258	10,900	8,250	10,600	25.0
II	1,262	11,500	7,910	14,700	24.4
(IIA)	(430)	(11,200)	(9,080)	(7,200)	(29.4)
III	626	10,700	7,850	14,600	19.5
IV	373	10,150	7,850	9,600	24.0
V	476	10,150	8,000	4,400	48.9

Geology/Landforms. The entire Mammoth Basin has a complex geologic history, and the geomorphology of the region is varied and unusual. Pre-Tertiary metamorphic and granitic rocks form the backbone of the Sierra Nevada, but Tertiary volcanic rock, Quaternary glacial and lake deposits, and recent alluvial and volcanic materials are all interbedded throughout the Basin area. The valley floor of much of the Basin has been formed by subsidence of an enormous collapsed caldera centered in the Long Valley area. The floor has been filled alternately with volcanic rock, glacial deposits, lake deposits, and alluvial outwash from the Sierra Nevada. A unique feature of the ski area watershed are the rock glaciers located throughout the Solitude Basin area.

General landforms and surficial geologic features of the Sherwin Ski Area watershed are depicted in Figure 5 and summarized in Table 5.

Table 5. Geologic Features*

Drainage Subarea	Total Acres	GR Acres	GR %	MR Acres	MR %	GT Acres	GT %	RG Acres	RG %	M Acres	M %	A Acres	A %	T Acres	T %
I	258	115	44.6	--	--	108	41.9	6	2.3	--	--	--	--	29	11.2
II	1,262	471	37.3	77	6.1	343	27.2	7	0.6	69	5.5	18	1.4	277	21.9
(IIA)	(430)	(135)	(31.4)	(29)	(6.7)	(60)	(14.0)	--	--	--	--	--	--	(206)	(47.5)
III	626	279	44.6	13	2.1	89	14.2	--	--	132	21.1	53	8.5	60	9.5
IV	373	60	16.1	26	7.0	75	20.1	31	8.3	114	30.5	44	11.8	23	6.2
V	476	55	11.6	153	32.1	48	10.1	--	--	5	1.0	--	--	215	45.2
Totals	2,995	980	32.7	269	9.0	663	22.1	44	1.5	320	10.7	115	3.8	604	20.2

*Legend

GR Granitic Rock
MR Metamorphic Rock
GT Glacial Till and Old Rock Glaciers
RG Active Rock Glacier
M Glacial Moraine
A Alluvium
T Talus Deposit

Soils. Surficial soils throughout the Mammoth Basin reflect parent rock materials and are generally coarse grained and non-cohesive. In the Sherwin Ski Area watershed, soils consist predominantly of silty sands of decomposed granitic origin. Gravel, cobble, and boulder fractions are variable but typically significant throughout the study area. Soils are classified generally as inorganic, but pockets of meadow deposits are randomly distributed along the lower slopes and particularly within the Solitude Canyon area.

Previous studies of the Mammoth Basin have classified soil types on the basis of erosion and runoff potential. The classification system is based on four soil characteristics: runoff potential, soil depth, erodability, and potential vegetative productivity. Surficial soil types for the Sherwin Ski Area watershed are mapped on Figure 6 and summarized in Table 6. In general, the potential for significant erosion hazards within the watershed is low to moderate due to the high permeability of surface soils and the lack of distinct surface runoff concentrations.

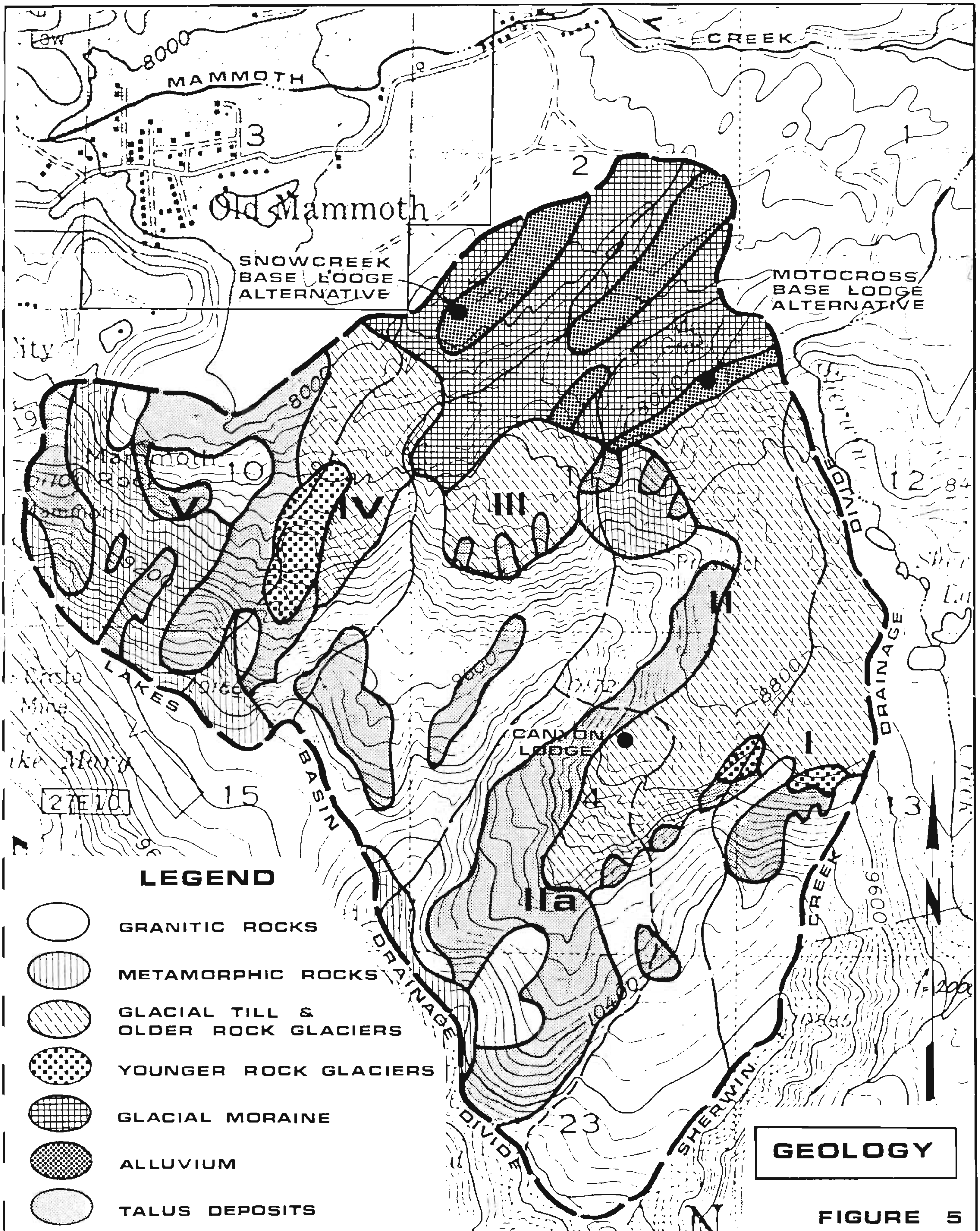

MAMMOTH
CREEK
8000
3
2
1
Old Mammoth
SNOWCREEK
BASE LODGE
ALTERNATIVE
MOTOCROSS
BASE LODGE
ALTERNATIVE
10
V
IV
III
II
I
IIa
12
LAKES
BASIN
DRAINAGE
DIVIDE
SHERWIN
CREEK
CANYON
LODGE
15
14
13
23
27E10
LEGEND
GRANITIC ROCKS
METAMORPHIC ROCKS
GLACIAL TILL &
OLDER ROCK GLACIERS
YOUNGER ROCK GLACIERS
GLACIAL MORAINE
ALLUVIUM
TALUS DEPOSITS
GEOLOGY

FIGURE 5

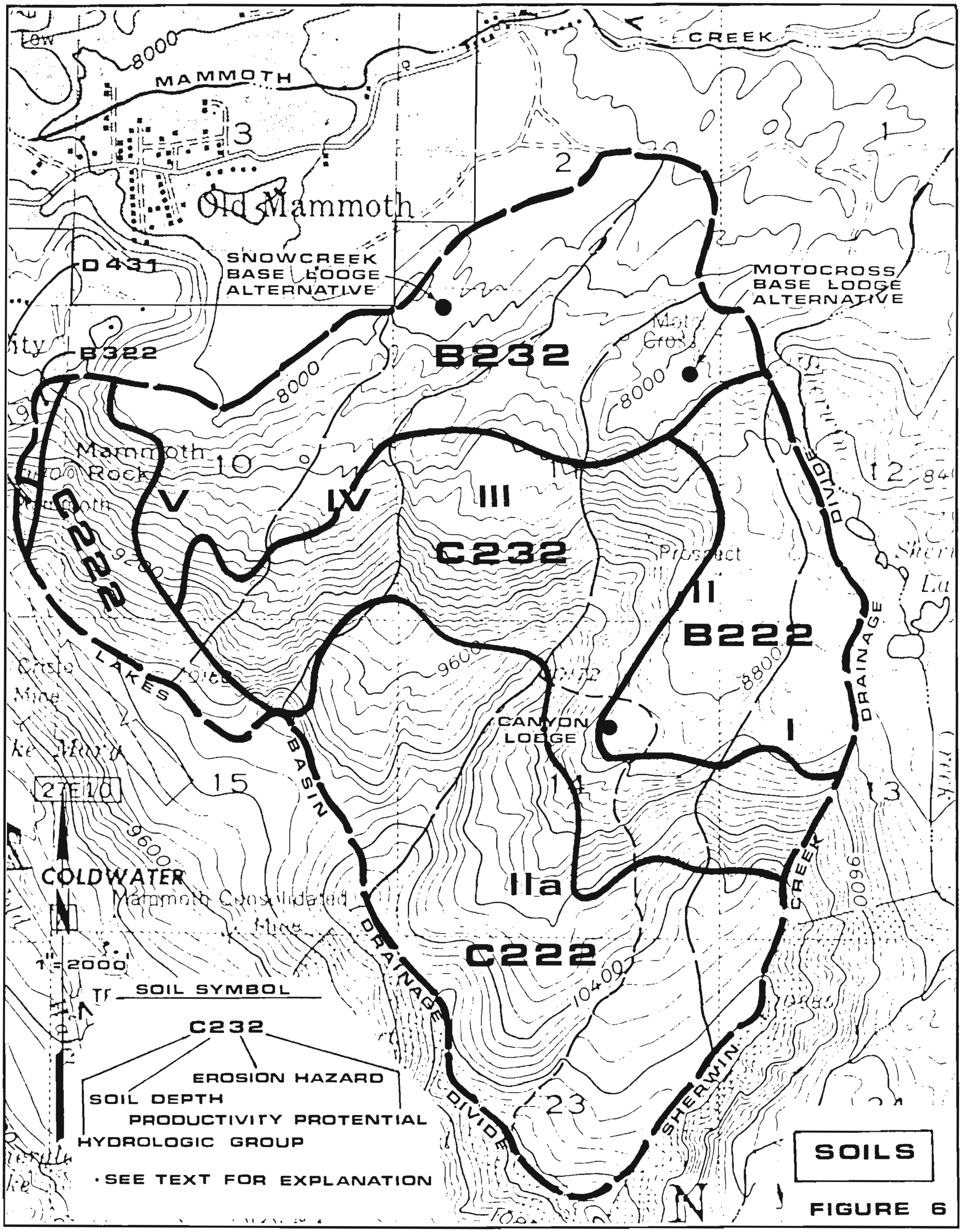

MAMMOTH
CREEK
8000
Old Mammoth
D431
B322
SNOWCREEK BASE LODGE ALTERNATIVE
MOTOCROSS BASE LODGE ALTERNATIVE
B232
Mammoth Rock
V
IV
III
C232
II
B222
C222
LAKES
BASIN
DRAINAGE
DIVIDE
CANYON LODGE
I
IIa
C222
SHERWIN
CREEK
DIVIDE
DRAINAGE
27E10
COLDWATER
Mammoth Consolidated Mine
1"=2000'
SOIL SYMBOL
C232
EROSION HAZARD
SOIL DEPTH
PRODUCTIVITY PROTENTIAL
HYDROLOGIC GROUP
•SEE TEXT FOR EXPLANATION
SOILS

FIGURE 6

Table 6. Soils Type Distribution*

Drainage Subarea	Total Acres	B222		B232		C222		C232		D431	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I	258	73	28.3	--	--	88	34.1	97	37.6	--	--
II	1,262	236	18.7	54	4.3	625	49.5	347	27.5	--	--
(IIA)	(430)	(12)	(2.8)	--	--	(373)	(86.5)	(46)	(10.7)	--	--
III	626	--	--	188	30.0	242	38.7	196	31.3	--	--
IV	373	--	--	183	49.0	--	--	190	51.0	--	--
V	476	--	--	199	41.8	213	44.8	42	8.8	22	4.6
Totals	2,995	309	10.4	624	20.8	1,168	39.0	872	29.1	22	0.7

SOIL TYPE CODE*

C 1 3 1

Runoff Potential	Soil Depth	Erosion Potential	Vegetative Productivity
A Very Low	1 0 to 20 in.	1 Low hazard	1 Low potential
B Low	2 20 to 36 in.	2 Moderate hazard	2 Medium potential
C Moderate	3 Over 36 in.	3 High hazard	3 High potential
D High	4 Variable conditions		

Vegetation. Plant communities found in the watershed are typical of the Eastern Sierra region and include representatives of the Upper Sonoran, Transition, Canadian, and Hudsonian life zones. The principal plant communities consist of mixed conifer forest, white bark pine forest, montane scrub, riparian woodland, and sagebrush scrub/chaparral in a complex and diverse mosaic which depends on slope, elevation, and soil conditions. Ground cover ranges from less than 10% in the upper forested areas to over 70% in the sagebrush scrub/chaparral communities on the lower slopes.

Plant communities are mapped on Figure 7 and a tabular breakdown of vegetative distribution is presented in Table 7.

Table 7. Vegetation Distribution*

Drainage Subarea	Total Acres	WP		MC		L		RIP		QA		BR		GR		BA	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
I	258	147	57.0	79	30.6	--	--	--	--	--	--	7	2.7	--	--	25	9.7
II	1,262	514	40.7	285	22.6	14	1.1	--	--	35	2.8	206	16.3	--	--	208	16.5
(IIA)	(430)	(275)	63.9)	--	--	(5)	(1.2)	--	--	(9)	(2.1)	(32)	(7.4)	--	--	(109)	(25.4)
III	626	215	34.3	197	31.5	--	--	--	--	--	--	171	27.3	--	--	43	6.9
IV	373	49	13.1	131	35.1	--	--	--	--	--	--	135	36.2	--	--	58	15.6
V	476	60	12.6	155	32.6	--	--	30	6.3	46	9.7	74	15.5	15	3.1	96	20.2
Totals	2,995	985	32.9	847	28.3	14	0.5	30	1.0	81	2.7	593	19.8	15	0.5	430	14.3

*Legend

WP Whitebark Pine Forest
MC Mixed Conifer Forest
L Lodgepole Pine Forest
RIP Riparian Meadow
QA Riparian Woodland
BR Mixed Brush and Chaparral
GR Grassland and Pasture
BA Barren Areas

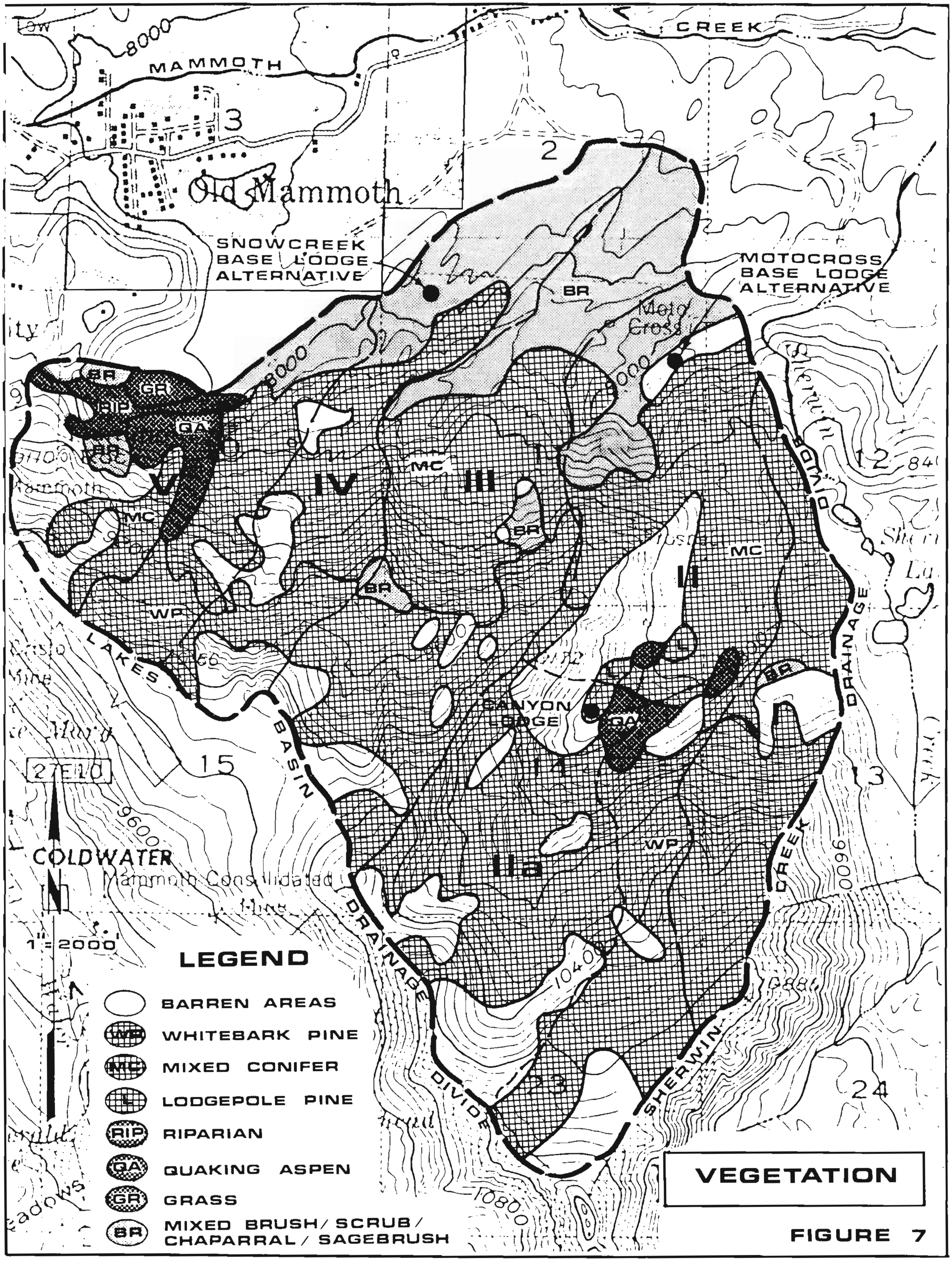

MAMMOTH
CREEK
8000
3
2
1
Old Mammoth
SNOWCREEK
BASE LODGE
ALTERNATIVE
MOTOCROSS
BASE LODGE
ALTERNATIVE
BR
GR
RIP
QA
MC
WP
L
IV
III
V
II
IIa
12
15
24
CANYON
LODGE
LAKES
BASIN
DRAINAGE
DIVIDE
SHERWIN
CREEK
27E10
9600
10400
10800
COLDWATER
Mammoth Consolidated
Mine
1"=2000'
LEGEND
BARREN AREAS
WHITEBARK PINE
MIXED CONIFER
LODGEPOLE PINE
RIPARIAN
QUAKING ASPEN
GRASS
MIXED BRUSH/SCRUB/
CHAPARRAL/SAGEBRUSH
VEGETATION

FIGURE 7

Watershed Hydrology

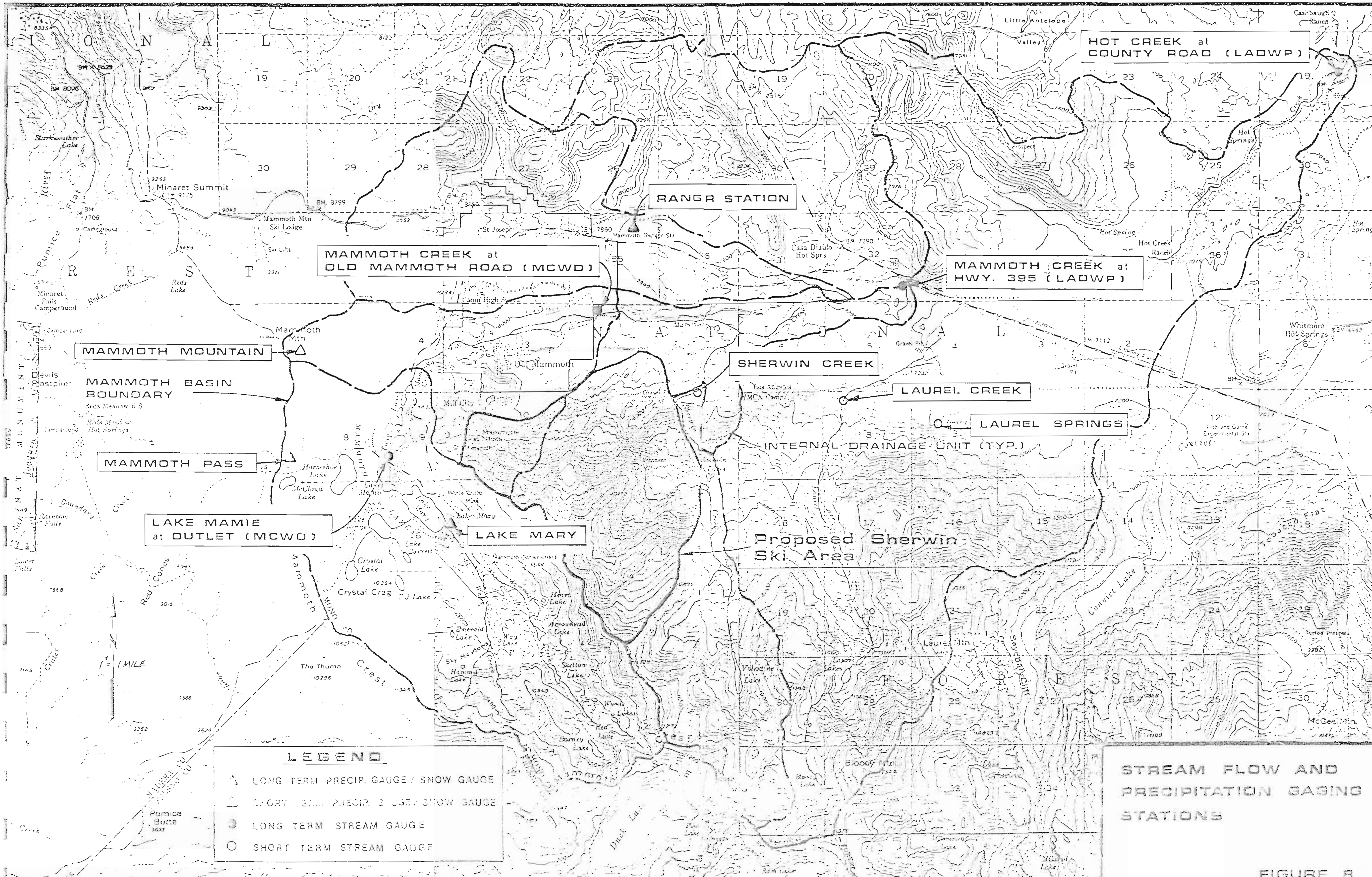
Hydrologic Data and Records. The locations of long-term and short-term precipitation and streamflow gauging stations within the Mammoth Basin are shown on Figure 8. There are no stations specifically located within the Sherwin Ski Area watershed, but short-term streamflow records are available for Sherwin Creek at a location approximately 3/4 mile northeasterly of the watershed boundary. Long-term precipitation and streamflow data for the Basin are presented in Appendix A. Also included is a plot of the historical streamflow hydrograph for Mammoth Creek at Highway 395 and the short-term flow records for Sherwin Creek from 1979 to 1982.

The long-term records indicate that annual precipitation is highly variable within the Basin with significant departures from the mean occurring randomly from year to year. Although the relative quantity of streamflow is also variable, the runoff hydrograph exhibits a consistent seasonal pattern. The pattern consists of large peak flows in the spring and early summer snowmelt months (April through July), mean flow volumes through the late summer and autumn, and minimum flows during the winter months. Typical peak spring flow volumes are 10 times as large as minimum winter flows, reflecting the rapid snowmelt pattern of the Eastern Sierra region.

Mammoth Basin Hydrology. The California Department of Water Resources (DWR) completed extensive hydrologic studies of the Mammoth Basin in 1973. These studies included correlations of streamflow data, precipitation records, estimates of vegetative water consumption, surface water evaporation, groundwater, and subsurface flows within the Basin. The analyses and studies conducted by DWR were summarized in a generalized hydrologic balance for the Mammoth Basin which is schematically presented in Figure 9. The relationship of the Sherwin Ski Area watershed to the overall hydrologic balance is indicated on this figure.

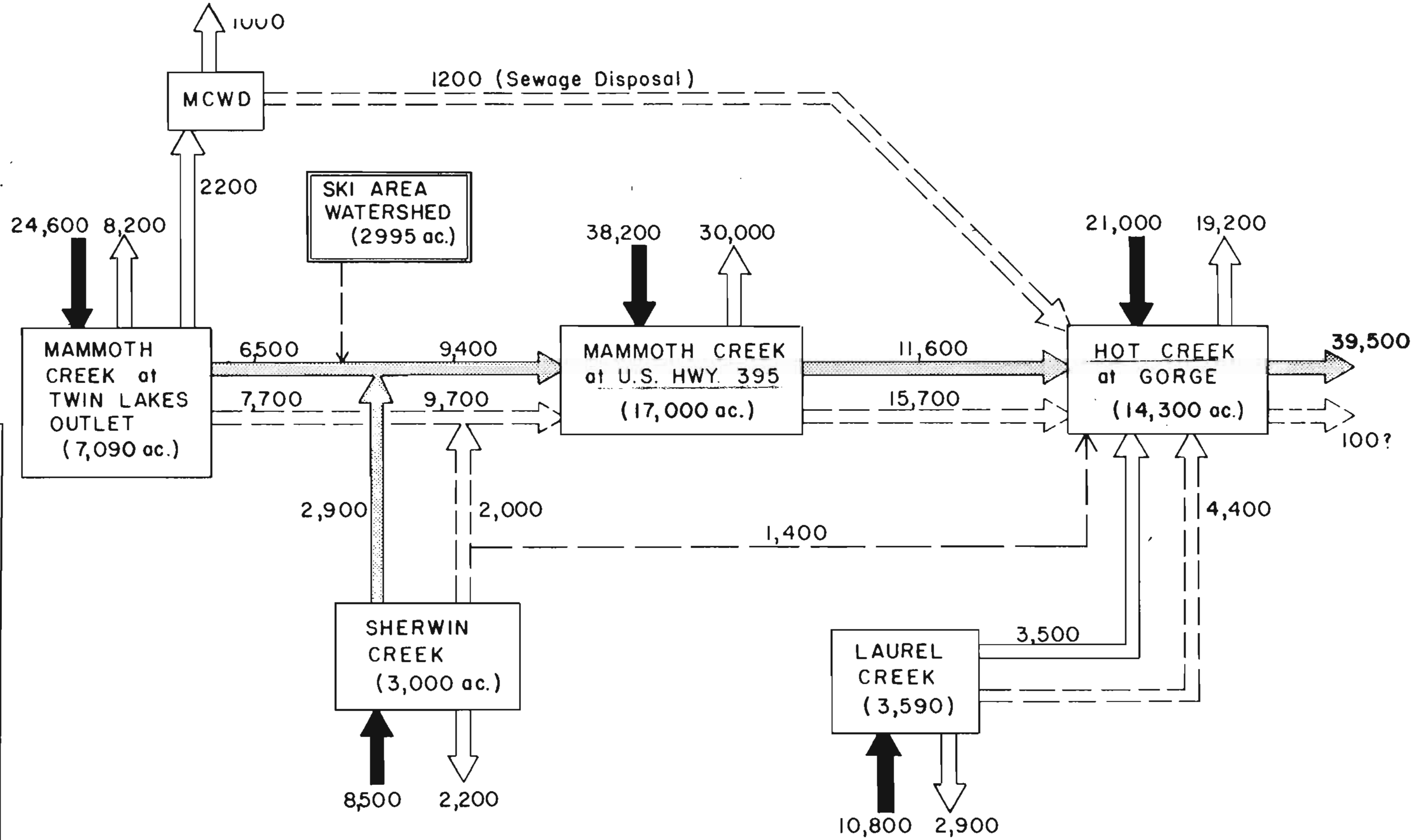
A hydrologic balance is basically a conceptual representation of the steady-state path of water within a particular basin or watershed. It is a useful tool for determining the potential long-term availability of surface and groundwater resources. Significant hydrologic characteristics of the Mammoth Basin are summarized below:

- Mean annual water production (derived from precipitation) is in excess of 103,000 acre-feet.



STREAM FLOW AND PRECIPITATION GAGING STATIONS

FIGURE 8



LEGEND

21,000 — PRECIPITATION, A.F./year

19,200 — CONSUMPTION, EVAPOTRANSPIRATION AND OTHER LOSSES, A.F./year

9,400 — SURFACE FLOW, A.F./year

9,700 — GROUNDWATER FLOW, A.F./year

1,400 — DEEP PERCOLATION, A.F./year

SUMMARY

TOTAL PRECIPITATION : 103,100 A.F./year

TOTAL CONSUMPTION AND DIRECT LOSSES : 63,500 A.F./year

TOTAL SURFACE OUTFLOW : 39,500 A.F./year

TOTAL SUBSURFACE OUTFLOW : 100 A.F./year

MAMMOTH BASIN HYDROLOGIC BALANCE
MEAN PRECIPITATION YEAR

FIGURE 9

- Approximately 60% of the annual water production is lost through evaporation and vegetative consumption (evapotranspiration).

- The remaining balance of water (40,000 acre-feet per year) leaves the basin as surface flow in Hot Creek at the Gorge.

- Hydrologic continuity between the internal drainage areas of the basin is maintained by a combination of surface and subsurface flows. The internal balances indicate that the magnitude of subsurface flow is equivalent to, and frequently greater than, measured surface stream flows.

Although localized groundwater basins are known to exist, the Mammoth Basin does not appear to contain a large continuous groundwater reservoir. Subsurface hydrologic continuity is thought to be maintained primarily by underflows through fractures, fissures, and localized underground channels. That significant underflows exist is verified by the fact that the surface outflow at the Hot Creek Gorge is substantially greater than the surface stream inflow.

Surface Runoff. The Sherwin Ski Area watershed is topographically tributary to Mammoth Creek and Sherwin Creek, but there are no apparent direct surface flow connections. Accordingly, it is assumed that direct surface outflow from the watershed only occurs under two conditions:

1. Short-term peak storm events during the summer months.

2. Peak snowmelt runoff during the spring with frozen or saturated soil conditions.

The maximum 6-hour summer precipitation for various recurrence intervals (as determined by studies conducted for the Mammoth Lakes Master Storm Drain Plan) and corresponding average 6-hour runoff rates are presented in Table 8.

Table 8. Summer Storm Runoff

Recurrence Interval, years	6-Hour Rainfall, inches	Runoff, cfs						
		I	II	(IIA)	III	IV	V	Total
2	1.0	0.49	2.15	(0.88)	1.12	0.59	0.91	5.26
5	1.6	1.19	5.26	(2.14)	2.73	1.45	2.23	12.86
10	2.0	1.93	8.48	(3.46)	4.41	2.34	3.60	20.76
20	2.4	2.85	12.55	(5.11)	6.52	3.46	5.32	30.70
50	3.0	4.48	19.72	(8.03)	10.24	5.43	8.36	48.23
100	3.5	5.97	26.29	(10.71)	13.66	7.24	11.14	64.30

For purposes of watershed analysis, it is assumed that the 2-year recurrence interval (50% probability of occurrence) represents average runoff conditions. Review of the synthetic hydrographs prepared for the Master Storm Drain Plan indicates that a 6-hour storm event at a 2-year recurrence interval yields approximately 24 hours of total runoff. Incorporating these factors, total average annual surface runoff due to summer storms for the ski area watershed is presented in Table 9.

Table 9. Annual Surface Outflow--Summer Storm

Drainage Subarea	Average Runoff, cfs	Duration hours	Surface Flow Volume, AF/yr.
I	0.49	24	1
II	2.15	24	4
(IIA)	(0.88)	(24)	(2)
III	1.12	24	2
IV	0.59	24	1
V	0.91	24	2
Total	5.26		10

While runoff from snowmelt usually occurs over long periods of time, under certain conditions peak surface flows can be generated. These conditions include the occurrence of unusually high daily temperatures when the ground surface is still frozen and the occurrence of rainfall while significant snow depths are present. A procedure for calculating peak runoff volumes for these conditions was developed in the Storm Drain Master Plan. Based on this method, the calculated average annual surface runoff associated with peak snowmelt conditions is summarized in Table 10.

Table 10. Annual Surface Outflow-Snowmelt

Drainage Subarea	Calculated Peak Snowmelt, cfs	Estimated Average Duration, days	Surface Flow Volume, AF/yr.
I	3	7	42
II	12	7	167
(IIA)	(7)	(7)	(97)
III	5	7	70
IV	2	7	28
V	3	7	42
Total	25		349

Evapotranspiration. Evapotranspiration includes water absorbed, consumed, and transpired to the atmosphere by vegetation as well as water evaporated directly from soil surfaces. Evapotranspiration factors for the vegetative communities found within the watershed area are summarized in Table 11.

Table 11. Evapotranspiration Factors

Vegetative Community	Evapotranspiration feet/year
Whitebark Pine Forest (WP)	1.9
Mixed Conifer Forest (MC)	2.1
Lodgepole Pine Forest (L)	1.7
Riparian Meadow (RIP)	2.5
Riparian Woodland (QA)	3.0
Mixed Brush (BR)	1.1
Grass/Pasture (GR)	2.0
Barren Areas (BA)	0.5

Total evapotranspiration water losses for each watershed subarea are obtained by multiplication of the above factors by the vegetative acreages presented previously in Table 7. Estimated total annual evapotranspiration losses are summarized in Table 12 below.

Table 12. Watershed Evapotranspiration Loss

Drainage Subarea	Total Area, acs.	Average Evapotranspiration feet/year	Total Evapotranspiration AF/year
I	258	1.80	465
II	1,262	1.61	2,035
(IIA)	(430)	(1.50)	(647)
III	626	1.65	1,032
IV	373	1.46	546
V	476	1.71	813
Totals	2,995	1.63	4,891

There are no natural surface water impoundments or diversions of water for domestic use within the ski area watershed, and, therefore, evapotranspiration represents the total consumptive use within the drainage area.

Groundwater Outflow. The DWR studies of the Mammoth Basin divided groundwater outflow into two components: (1) shallow underflow in alluvial, glacial, and sedimentary deposits; and (2) "deep" percolation into fractures of underlying basalt formations. The volumes associated with shallow underflows are of considerable magnitude and represent a significant hydrologic feature of the Basin. Although deep percolation flows are not as significant, they cannot be ignored entirely.

The studies suggest that the deep percolating water does not resurface until it reaches the outlet of the Basin at the Hot Creek Gorge and is essentially "lost" as a potential water resource. Although the DWR studies concluded that the volume of water lost to deep percolation was essentially indeterminate, the Sherwin Creek drainage was designated as a probable area of deep percolation due to its surface geology. Inspection of the DWR hydrologic balance (see Figure 9) indicates that the assigned value of deep percolation for the Sherwin Creek drainage represents 41% of the potential groundwater flow. There are significant differences between the surface geology and topography of the ski area watershed and the Sherwin Creek drainage, however. The method used by DWR for determining deep percolation and shallow groundwater flow volumes was not explained, but the Sherwin Creek drainage is the only area where such figures were provided.

Assuming that the basic hydraulic conductivity (or transmissivity) of saturated sediments is the same for the two drainage areas, but incorporating differences in hydraulic gradient and depth of saturated sediment, the potential shallow groundwater outflow for the ski area watershed is approximately 178% of the value for the Sherwin Creek drainage. Further assuming that the amount of water lost through deep percolation is inversely proportional to the volume of shallow outflow, the estimated value for the ski area watershed is approximately 23% of total available groundwater. Considering that no deep percolation losses were assigned to drainage areas within the Mammoth Basin other than Sherwin Creek, the use of this factor is probably conservative.

Deep percolation from interior Subarea IIA is assumed to be negligible due to its elevation and the shallow depth of the underlying granitic bedrock. In any event, the subarea is tributary to the lower reaches of Subarea II, and water volumes lost to deep percolation are included in the overall hydrologic analysis.

Watershed Hydrologic Balance. As noted previously, a hydrologic balance is basically an analytical method of determining available water resources. Although the basic equation of the balance is that inflow equals outflow, there can be many complex components involved. Analysis of the Sherwin Ski Area watershed is simplified by the following assumptions and factors:

1. There is no apparent surface or groundwater inflow from other drainage areas.

2. Consumptive use equals evapotranspiration because there are no domestic or agricultural diversions and no surface bodies of water.

3. There is no surface storage volume within the watershed.

Accordingly, the basic equàtion of the hydrologic balance for the ski area watershed can be reduced to:

$$P = ET + SO + GO$$

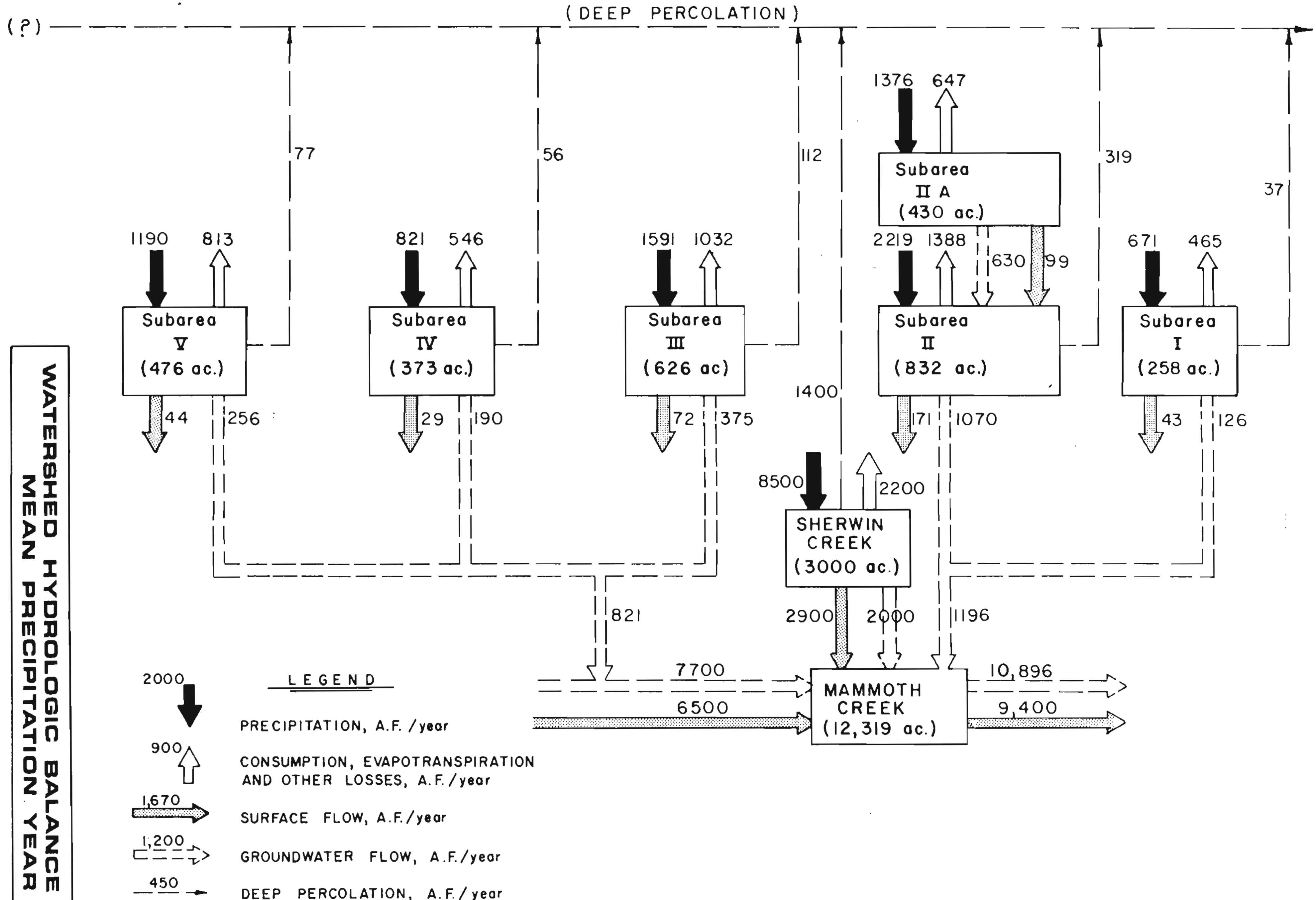
where:

P = precipitation
ET = evapotranspiration
SO = surface outflow (includes summer and snowmelt runoff)
GO = groundwater outflow (includes shallow and deep flow components)

Incorporating the previous determinations of the above elements, the hydrologic balance of the drainage subareas of the ski area watershed is presented tabularly in Table 13 and graphically in Figure 10. The hydrologic balance represents steady-state conditions during a mean precipitation year. As indicated in the balance, all of the major drainage subareas are essentially hydrologically independent within the area of interest except for Subarea IIA which has been specifically isolated.

Table 13. Watershed Hydrologic Balance
(Mean Precipitation Year)

	Drainage Subarea I	II	(IIA)	III	IV	V	Total
Area, acres	258	1,262	(430)	626	373	476	2,995
Inflow, AF/year							
Precipitation	671	3,595	(1,376)	1,591	821	1,190	7,868
Outflow, AF/year							
Surface Outflow							
Rainfall	1	4	(2)	2	1	2	10
Snowmelt	42	167	(97)	70	28	42	349
Subtotal:	43	171	(99)	72	29	44	359
Evapotranspiration	465	2,035	(647)	1,032	546	813	4,891
Groundwater Outflow							
Shallow	126	1,070	(630)	375	190	256	2,017
Deep	37	319	(0)	112	56	77	601
Subtotal:	163	1,389	(630)	487	246	333	2,618



WATERSHED HYDROLOGIC BALANCE
MEAN PRECIPITATION YEAR

FIGURE 10

Drainage Subareas I and II are physically tributary to Sherwin Creek just above its confluence with Mammoth Creek. In terms of the DWR Mammoth Basin hydrologic balance, however, the subareas are not included within the designated watershed of Sherwin Creek because they are situated just west of the drainage divide. All other areas of the ski area watershed (subareas III, IV and V) are indirectly tributary to Mammoth Creek.

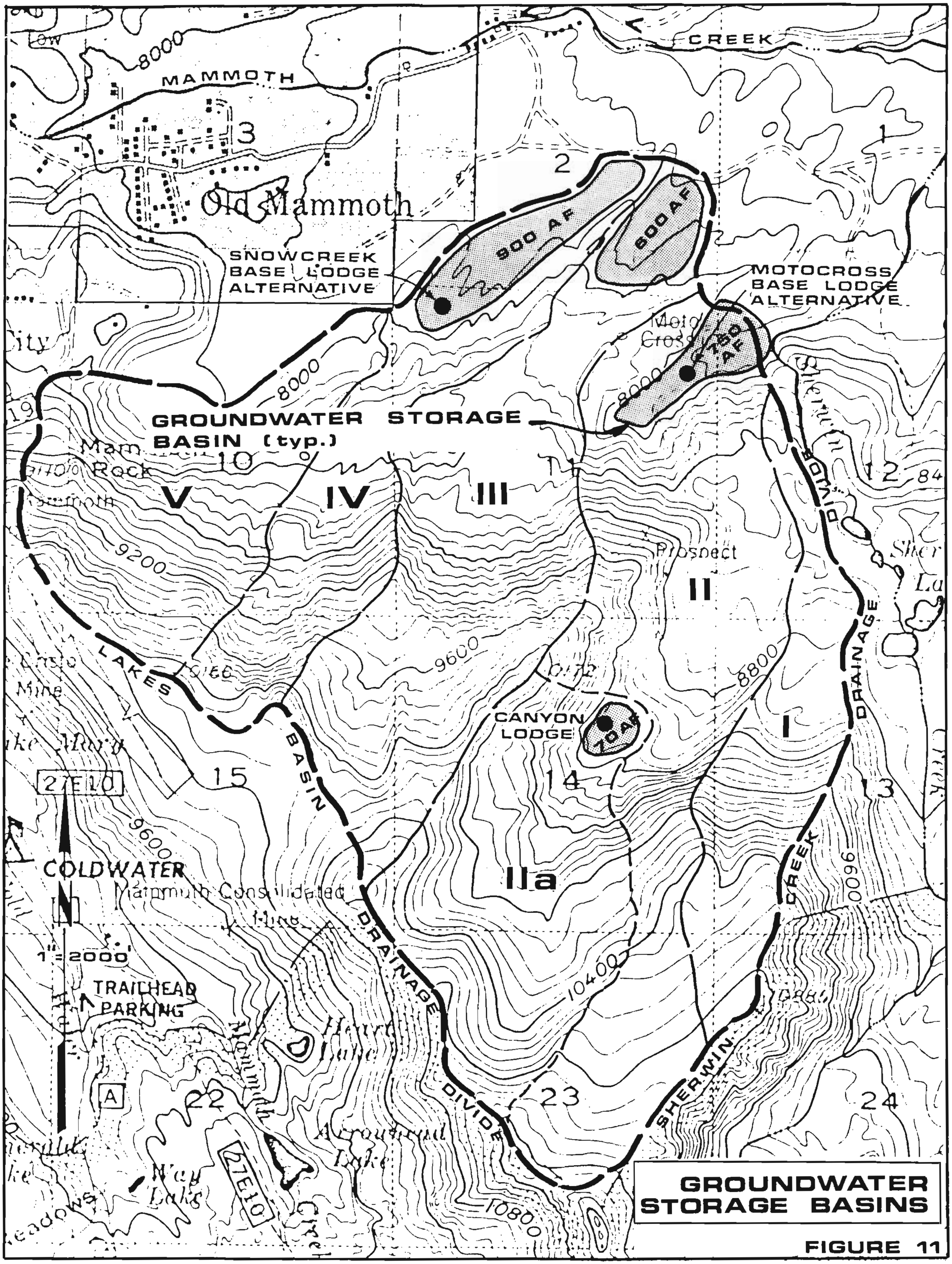
Groundwater Storage. Examination of the topographical features and surface geology of the ski area watershed indicates that there is a high probability that localized groundwater basins exist. The most promising locations for such basins are at the lower elevations of drainage subareas II, III and IV. As shown previously on Figure 5, the geology in these areas consist of alluvial "valleys" confined by lateral and terminal glacial moraines. Confirmation of the existence of such groundwater basins is provided by the log of an MCWD test well drilled in 1984 at the motocross site (Subarea II). The well log indicates that unconsolidated sand, gravel, and boulders were encountered to a depth of 425 feet. Static water level in the test well was at 216 feet below ground surface, and the estimated capacity of a production well at this site was 500 gpm (800 AF/year).

There is also a potential groundwater storage basin in the general area of Canyon Lodge, at the downstream end of Drainage Subarea IIA. Although not as extensive as the lower basins, surface vegetation and soils conditions indicate that groundwater levels are much shallower at this site.

The characteristics and estimated groundwater storage capacities of the major identified subsurface basins are summarized in Table 14. Locations of the basins are shown on Figure 11.

Table 14. Groundwater Storage Basins

Description	Tributary Subarea	Saturated Thickness, feet	Estimated Volume, acre-feet	Specific Yield, %	Estimated Storage Capacity, acre-feet
Motocross Site	II	200	3,000	25	750
Canyon Lodge	IIA	50	350	20	70
Local Depression	III	150	3,000	20	600
Old Borrow Pit	IV	150	4,500	20	900



GROUNDWATER STORAGE BASINS

FIGURE 11

Maximum Drought Conditions. The long-term precipitation data for the Mammoth Basin indicates that the lowest annual precipitation of record occurred during the drought of 1976-77. Total precipitation at the Lake Mary Store gauge station was only 44.74% of the long-term mean, and this year is generally considered to represent a 100-year event (i.e., there is a 1% probability of occurrence). During such a drought event, there are significant changes in the hydrologic balance of a given watershed.

During severe drought conditions, the surface runoff outflow is assumed to be negligible. Deep groundwater outflow is considered to be constant, however, with a corresponding reduction in shallow groundwater outflow or subsurface storage.

Significant changes occur in the mechanisms of vegetative consumption during drought periods. Plants prefer to derive necessary water directly from precipitation and near-surface soil moisture, but the availability of such water sources is reduced during drought conditions. Accordingly, a significant portion of vegetative demand must be withdrawn from deeper soil layers. Previous studies have estimated that total evapotranspiration during drought years is approximately 70% of mean precipitation year values. Unfortunately, the total evapotranspiration has not been broken down into direct precipitation loss and soil moisture depletion components. For the purposes of this analysis, soil moisture depletion values of between 4 and 6 inches have been assumed, modified for the surficial soil types for the drainage subareas. The resulting breakdown of the components of total drought year evapotranspiration is presented in Table 15.

Table 15. Evapotranspiration Components
(Maximum Drought Year)

	Drainage Subarea						
	I	II	(IIA)	III	IV	V	Total
Area, acres	258	1,262	(430)	626	373	476	2,995
Total Evapotranspiration, acre-feet/year[1]	326	1,425	(453)	722	382	569	3,424
Soil Moisture Depletion[2]							
Depth, inches	5.5	4.9	(4.5)	5.0	4.4	5.2	
Volume, acre-feet/year	118	515	(163)	260	138	206	1,237
Direct Precipitation Loss	208	910	(290)	462	244	363	2,187

[1]Assumed at 70% of total evapotranspiration for mean precipitation year.
[2]Depth estimated at 20% of total soil depth for subarea.

The analysis of evapotranspiration components indicates that during maximum drought conditions, approximately 64% of vegetative consumption is derived from direct precipitation. This is considered reasonable considering that less than 45% of the normal precipitation is actually available.

Incorporating the above factors, the hydrologic balance of the ski area watershed under maximum drought conditions (100-year event) is presented in Table 16.

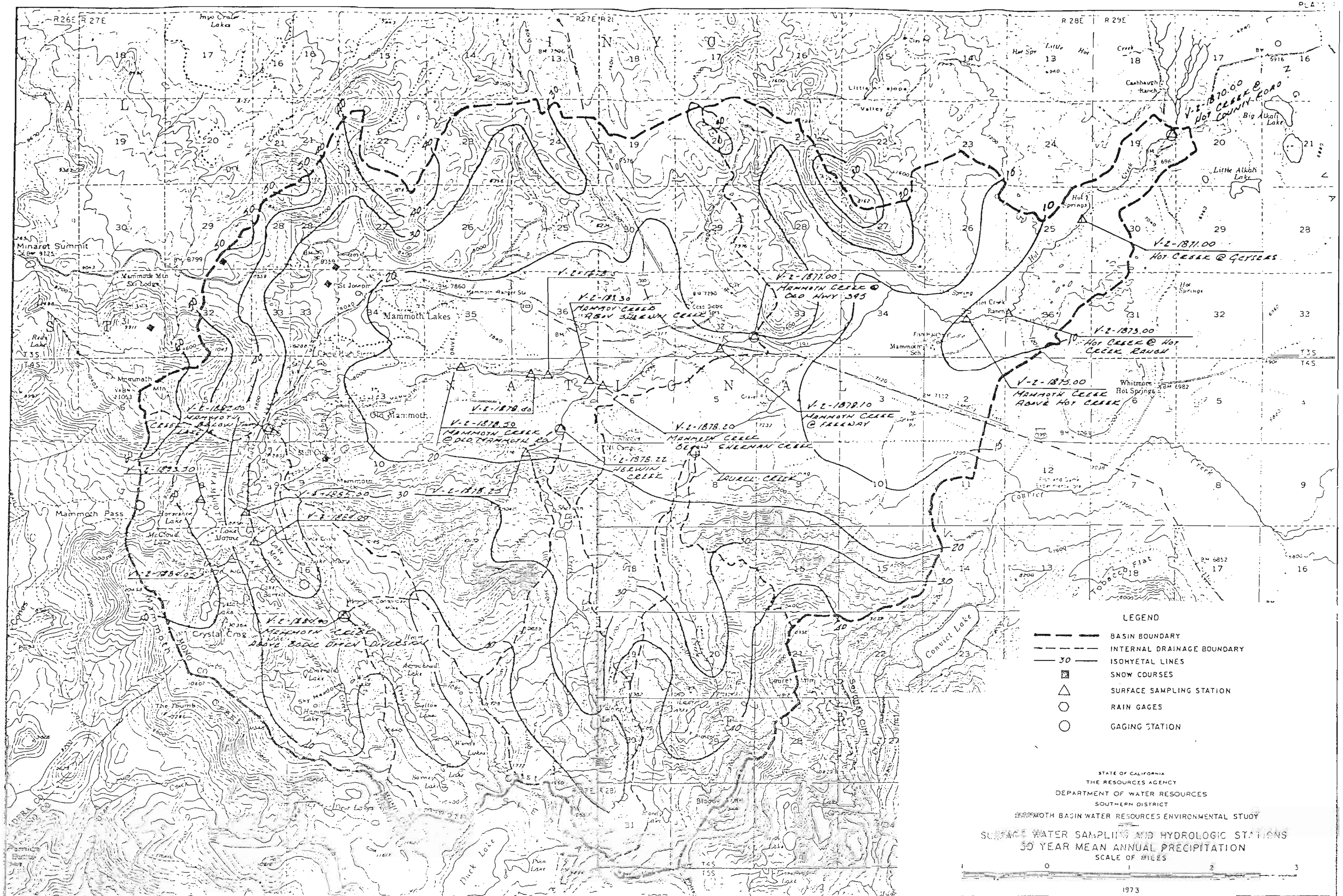
Table 16. Watershed Hydrologic Balance
(Maximum Drought Year)

	Drainage Subarea I	II	(IIA)	III	IV	V	Total
Area, acres	258	1,262	(430)	626	373	476	2,995
Inflow, AF year							
Precipitation	300	1,608	(616)	712	367	532	3,519
Outflow, AF/year							
Surface Outflow	0	0	(0)	0	0	0	
Evapotranspiration	208	910	(290)	462	244	393	2,187
Groundwater Outflow							
Shallow	55	379	(326)	138	67	92	731
Deep	37	319	(0)	112	56	77	601

Comparison of Table 16 with Table 13 indicates that the estimated shallow groundwater outflow during maximum drought conditions is approximately 36% of the mean year outflow. Of particular significance is the conclusion that shallow groundwater storage is relatively unaffected by drought conditions even assuming that deep percolation losses remain constant.

Water Quality

Surface Water. The lakes and streams of the Mammoth Basin are of excellent quality and consequently are suitable for a wide variety of beneficial uses. The most extensive water quality sampling program of the Mammoth Basin was performed by DWR in the period 1970-1972. Data from that sampling program is presented in Appendix B, and the location of water quality sampling points is shown on Figure 12. In general, the surface waters of the Basin are low in total dissolved solids (TDS) and mineral content, are soft to moderately hard, and have low alkalinities.



V-2-1870.00 Hot Creek @ County Road
V-2-1871.00 Hot Creek @ Geysers
V-2-1877.00 Mammoth Creek @ Old Hwy 395
V-2-1873.00 Hot Creek @ Hot Creek Ranch
V-2-1875.00 Mammoth Creek Above Hot Creek
V-2-1878.10 Mammoth Creek @ Freeway
V-2-1878.20 Mammoth Creek Below Sherwin Creek
V-2-1878.50 Mammoth Creek @ Old Mammoth Rd
Laurel Creek
Sherwin Creek
V-2-1884.00 Mammoth Creek Above Edison Diversion
Minaret Summit
Mammoth Lakes
Old Mammoth
Mammoth Pass
Crystal Crag
Convict Lake
Big Alkali Lake
Little Alkali Lake
Whitmore Hot Springs
Duck Lake
I N Y O
A L P I N E
M A T L O N C A L
LEGEND
BASIN BOUNDARY
INTERNAL DRAINAGE BOUNDARY
ISOHYETAL LINES
SNOW COURSES
SURFACE SAMPLING STATION
RAIN GAGES
GAGING STATION
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT
MAMMOTH BASIN WATER RESOURCES ENVIRONMENTAL STUDY
SURFACE WATER SAMPLING AND HYDROLOGIC STATIONS
50 YEAR MEAN ANNUAL PRECIPITATION
SCALE OF MILES
1973

FIGURE 12

The mineral content of Mammoth Creek (the primary surface stream of the Basin) varies seasonally and is typically lowest during the spring and early summer snowmelt months and highest during fall and winter low flow periods. The mineral content and chemical composition of surface waters also changes with location. Mineral content increases at the lower reaches of Mammoth Creek, and the character changes from a calcium bicarbonate type to a sodium bicarbonate type. The noted variations are not significant enough to affect the excellent quality of surface waters, however, and maximum TDS values are generally less than 200 mg/l.

Surface water quality analyses for Mammoth Creek above and below Sherwin Creek and for Sherwin Creek itself are summarized in Table 17. Although the analyses are based on limited sampling and some data is missing, the results are representative of the water quality characteristics of the surface streams.

Table 17. Surface Water Quality

Constituent	Unit	Mammoth Creek Above Sherwin Creek		Mammoth Creek Below Sherwin Creek		Sherwin Creek Above Campground	
		March	June	March	June	March	June
Dissolved Oxygen	mg/l	10.7	8.8	10.5	8.8	10.6	8.7
Temperature	^{o}F	37	48	37	48	34	46
pH	--	7.8	7.3	7.8	7.3	7.6	7.4
EC	umhos	180	80	195	80	42	35
Ca	mg/l	12	7	12	7	--	--
Mg	mg/l	7	2	8	2	--	--
Na	mg/l	12	3	13	3	6	3
K	mg/l	2	1	3	1	--	--
CO_3	mg/l	0	0	0	0	--	--
HCO_3	mg/l	90	33	99	33	18	14
SO_4	mg/l	7	3	7	4	--	--
Cl	mg/l	2	1	1	1	1	0
NO_3	mg/l	0.3	0.2	0.3	0.2	0.6	0.5
B	mg/l	.01	0	.01	0	--	--
F	mg/l	0.2	0	0.2	0	--	--
TDS	mg/l	108	40	106	37	--	--
Total Hardness	mg/l CA CO_3	59	26	63	26	--	17
Turbidity	JTU	--	--	--	--	3	2

Water Quality Problems. The most significant water quality problem in the Mammoth Creek watershed is the discharge of sediment and silt during peak runoff periods. Surficial soils of the area are generally fine grained and cohesionless, and the natural pattern of runoff (with large peak flows for short periods of time) is conducive to sediment transport. There is considerable evidence that inadequately controlled runoff from developed urban areas, as well as from disturbed natural areas, contributes significantly to silt and sediment discharges, however. In recognition of the problem, the USFS began monitoring suspended sediment and turbidity levels in the Mammoth Basin area in 1979. A summary of sampling results collected from 1979 through 1982 is presented in Table 18.

Table 18. Suspended Sediment and Turbidity

Sampling Location	Suspended Sediment, mg/l			Turbidity, NTU		
	Max.	Min.	Mean	Max.	Min.	Mean
Mammoth Creek						
Above Lake Mary	18	0.7	5	1	0.2	0.6
Old Mammoth	312	1	27	224	0.6	15
East of Community	98	20	60	67	12	35
Above Murphy Gulch	184	3	44	131	3	23
Below Murphy Gulch	957	8	141	735	5	86
At Highway 395	218	0.5	19	140	0.5	10
Above Fish Hatchery	63	1	16	33	3	10
Sherwin Creek						
At Sherwin Road	94	0.5	8	14	0.3	2
Mammoth Mountain						
Above Warming Hut II	78,920	195	8,250	27,000	13	2,570
At Canyon Blvd.	17,600	328	5,030	8,900	95	1,350
Chairlift 9 watershed	8,150	27	822	3,380	7	306
Town of Mammoth Lakes						
Below Minaret Village	420	22	154	406	69	190
Murphy Gulch at Visitor Ctr.	11,940	0.3	2,170	3,500	4	737
Murphy Gulch at Mammoth Creek	5,690	5	715	2,790	5	434

The sensitivity of natural soils to disturbance is clearly indicated by the sediment levels measured in the runoff from Mammoth Mountain. The impact of runoff from urban development is also reflected in the increased sediment and turbidity levels in Mammoth Creek as it flows through the developed areas of the community. In response to the evidence of significant sediment discharges, the Lahontan Regional Water Quality Control Board (RWQCB) adopted specific erosion control requirements for the Mammoth Creek watershed in 1983. The guidelines established waste discharge requirements for urban runoff and include mandatory erosion control measures for all development within the watershed.

Natural (background) levels of sediment discharge are somewhat difficult to determine accurately due to a lack of corresponding suspended sediment data and flow measurements. In 1981-82, however the USFS measured instantaneous discharge flows and suspended sediment concentrations at the Mammoth Creek at Highway 395 gauging station over a 12-month period from October, 1981 through September, 1982. In this particular year, the annual flow volume of Mammoth Creek was 177% of the 50-year mean (see Appendix A). The daily sediment discharge ranged from a maximum of 140 tons/day during July to .02 tons/day in November. Total annual sediment discharge for Mammoth Creek at Highway 395 was 5,100 tons, or approximately 0.20 tons/acre of watershed above this point.

Short-term sediment discharge measurements are available for Sherwin Creek, but the data is essentially random and cannot be extrapolated to produce annual sediment load estimates (see Appendix C). Inspection of the available measurements and review of Table 17 indicates that the sediment production rate of the Sherwin Creek watershed is significantly less than that for Mammoth Creek. The Sherwin Creek watershed contains several lakes and natural topographic impoundments, however, and the lower sediment production rate undoubtedly reflects this feature. For the purpose of analysis, the 0.20 tons/acre production rate is assumed to be representative of the natural sediment yield from runoff throughout the ski area watershed.

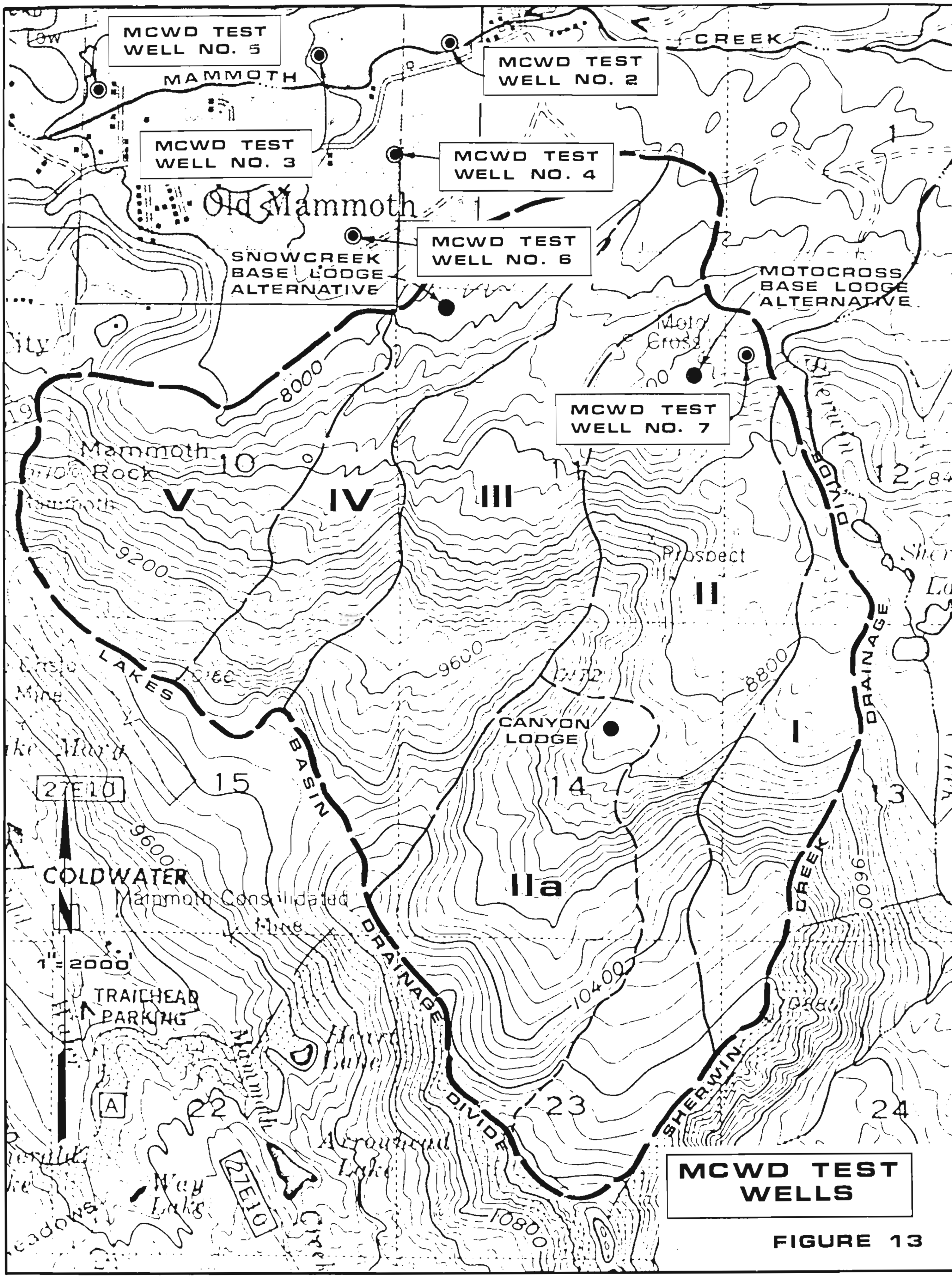
Groundwater. The quality of groundwater in the Mammoth Basin varies with location, source depth, and temperature. DWR summaries of well locations, groundwater quality analyses, and water temperatures are included in Appendix D. Although the quality of groundwaters with temperatures below 80°F is generally excellent, certain chemical constituents (particularly metallic elements) sometimes occur in significant concentrations which exceed Public Health Drinking Water Standards. Problem elements include iron (Fe), manganese

(Mn), arsenic (As), and mercury (Hg). The occurrence of these elements in significant concentrations appears to be a function of depth and subsurface geology rather than location. In general, groundwaters extracted from shallow depths (less than 200 feet) exhibit lower concentrations of metallic elements than those with deeper sources.

In 1984, the Mammoth County Water District (MCWD) drilled several exploratory test wells in the vicinity of the Mammoth Lakes community. As shown on Figure 13, three of the test wells (Nos. 4, 6, and 7) were located adjacent to the lower slopes of the ski area watershed. A summary of chemical analyses for these wells is presented in Table 19.

Table 19. Groundwater Quality

Chemical Constituent	Maximum Level (Drinking Water Standards)	Test Well No. 4		Test Well No. 6		Test Well No. 7
		@260'	@518'	@135'	@407'	@425'
Arsenic	.05 mg/l	.03	.03	.053	.04	.001
Barium	1.0 mg/l	.10	.02	.10	.03	.11
Cadmium	.010 mg/l	.006	0	.006	.006	.004
Chromium	.05 mg/l	.002	0	.002	0	.001
Fluoride	1.4-2.4 mg/l	.41	.3	.22	.3	.10
Lead	.05 mg/l	.04	0	.04	0	.004
Mercury	.002 mg/l	0	0	0	0	.005
Nitrate (NO_3)	45 mg/l	1.1	2.8	4.9	.59	10
Selenium	.01 mg/l	.006	.006	.006	.006	.006
Silver	.05 mg/l	--	--	--	--	--
Copper	1.0 mg/l*	.013	.011	.005	.011	.01
Zinc	5 mg/l*	.19	.05	.019	.11	.08
Manganese	.05 mg/l*	.04	.12	.48	.44	.05
Iron	.30 mg/l*	.09	.04	.09	.04	.06
Chloride	250-600 mg/l*	1.9	1.6	.94	.75	.85
Sulfate	250-600 mg/l*	50	18	33	35	12
Bicarbonate	--	170	175	160	180	140
Carbonate	--	0	0	0	0	0
Calcium	--	35	32	23	25	30
Magnesium	--	15	13	23	20	.71
Potassium	--	7.2	6.7	6.7	1.0	3.2
Sodium	--	16	11	20	21	20



MCWD TEST WELLS

FIGURE 13

Table 19. (cont.)

Chemical Constituent	Maximum Level (Drinking Water Standards)	Test Well No. 4 @260'	Test Well No. 4 @518'	Test Well No. 6 @135'	Test Well No. 6 @407'	Test Well No. 7 @425'
Alkalinity	--	140	145	130	150	115
Total Hardness	--	145	135	150	140	78
pH	6.5-8.8*	7.9	7.8	8.1	7.8	7.6
EC	900-2,200 umhos*	350	340	370	370	320
TDS	500-1,500 mg/l*	230	220	210	260	

*Indicates recommended level only.

The variability of metallic element concentrations is demonstrated in the summary. Samples collected from Test Wells No. 4 and 6 indicate significantly different manganese concentrations even though they are in close proximity to each other. Both deep and shallow samples from Test Well No. 6 show manganese concentrations in excess of drinking water standards, but shallow samples from Test Well No. 4 are within the standards.

Of particular interest is Test Well No. 7 which is located at the Mammoth Motocross site at the lower end of Drainage Subarea II. Manganese concentrations at this site are marginally acceptable, which might be expected from the sample results at the other two sites. The most surprising feature of Test Well No. 7 is the significant concentration of mercury (.005 mg/l) which exceeds drinking water standards by 250%. Mercury is a toxic substance not generally found in the groundwaters of the Mammoth Basin (see Appendix D). It has been postulated by the MCWD that the presence of mercury is related to magmatic vapors rising along the Sierra Nevada fault in the vicinity of the test well. Unfortunately, only one deep sample was collected and analyzed at the test well site. It is possible that mercury concentrations vary in response to seismic activity, that mercury concentrations are much lower (or even nonexistent) at shallower depths, or that the sample merely reflected a long-term accumulation of the vapor near the well site. Without additional analyses, however, it is impossible to determine the significance of the test results. It should be noted that other than mercury and manganese concentrations, the groundwater quality at the Test Well No. 7 location was excellent in terms of all other constituents.

Water Rights

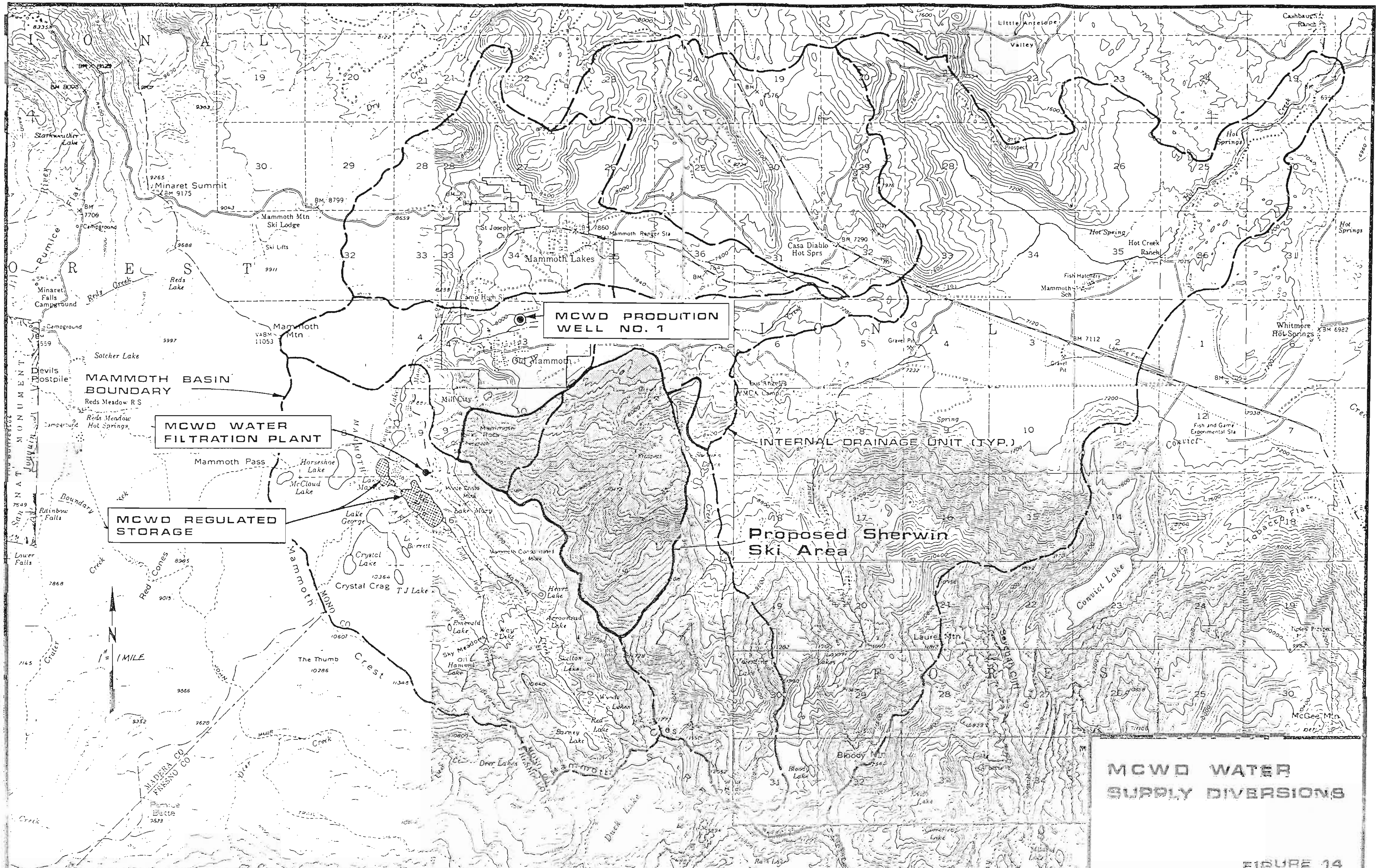
General. Historically, there has been considerable competition for surface water rights within the Mammoth Basin between agricultural, mining, and domestic users. With the establishment of Mammoth Lakes as a major destination resort in the last 10 years, however, the Mammoth County Water

District has gradually acquired and consolidated most of the important surface water rights for domestic consumption. The primary point of MCWD surface diversion is at Lake Mary in the Lakes Basin watershed of Mammoth Creek. Due to the unique features of the hydrologic cycle of the Mammoth Basin, which includes heavy winter snowfall, rapid spring snowmelt, and highly variable annual precipitation, the availability of surface water resources is limited. An important condition imposed on the MCWD for the consolidation of water rights was the implementation of a comprehensive surface water resource management plan which includes storage regulation and maintenance of minimum downstream surface flows. During drought conditions, the MCWD is currently unable to satisfy the domestic demands of the Mammoth Lakes community solely by surface water diversions under the constraints of the management plan.

Accordingly, the MCWD has embarked on a groundwater development program. Currently there is only one full production well within the District's system, but another well is nearing completion. Long-range District plans forecast the development of at least three more deep well sources.

The ski area watershed is situated southeast of the Mammoth Lakes community and considerably downstream of the primary MCWD surface diversions and storage impoundments along Mammoth Creek (see Figure 14). Any surface waters diverted within the ski area watershed for irrigation or snowmaking will not affect the MCWD diversions. In addition, surface waters diverted for such purposes would be returned to the hydrologic system of the Basin (less vegetative consumption and evaporative losses) at the lower reaches of the watershed.

Groundwater Extraction. Deep well supply sources are not subject to water right permits or appropriation limitations. Consideration must be given, however, to the availability of groundwater resources and the potential for interferences with MCWD domestic supply wells. At the present time, the MCWD has abandoned the idea of well development in the motocross area and is concentrating its efforts in the Snowcreek meadow area. Drainage Subarea V, and possibly a portion of Subarea IV, are tributary to the MCWD well development field. Development of deep well supplies downstream of this area (Subareas I, II, III, and portion of IV) will not have any effect on groundwater resources to be developed by the MCWD. This conclusion is reached by analysis of the overall groundwater hydraulic gradient and consideration of subsurface geologic conditions.



MCWD WATER SUPPLY DIVERSIONS

FIGURE 14

Sherwin Creek. There are three diversions of record for the Sherwin Creek surface stream, as summarized in Table 20 below. Locations of the diversions are shown on Figure 15.

Table 20. Sherwin Creek Water Rights

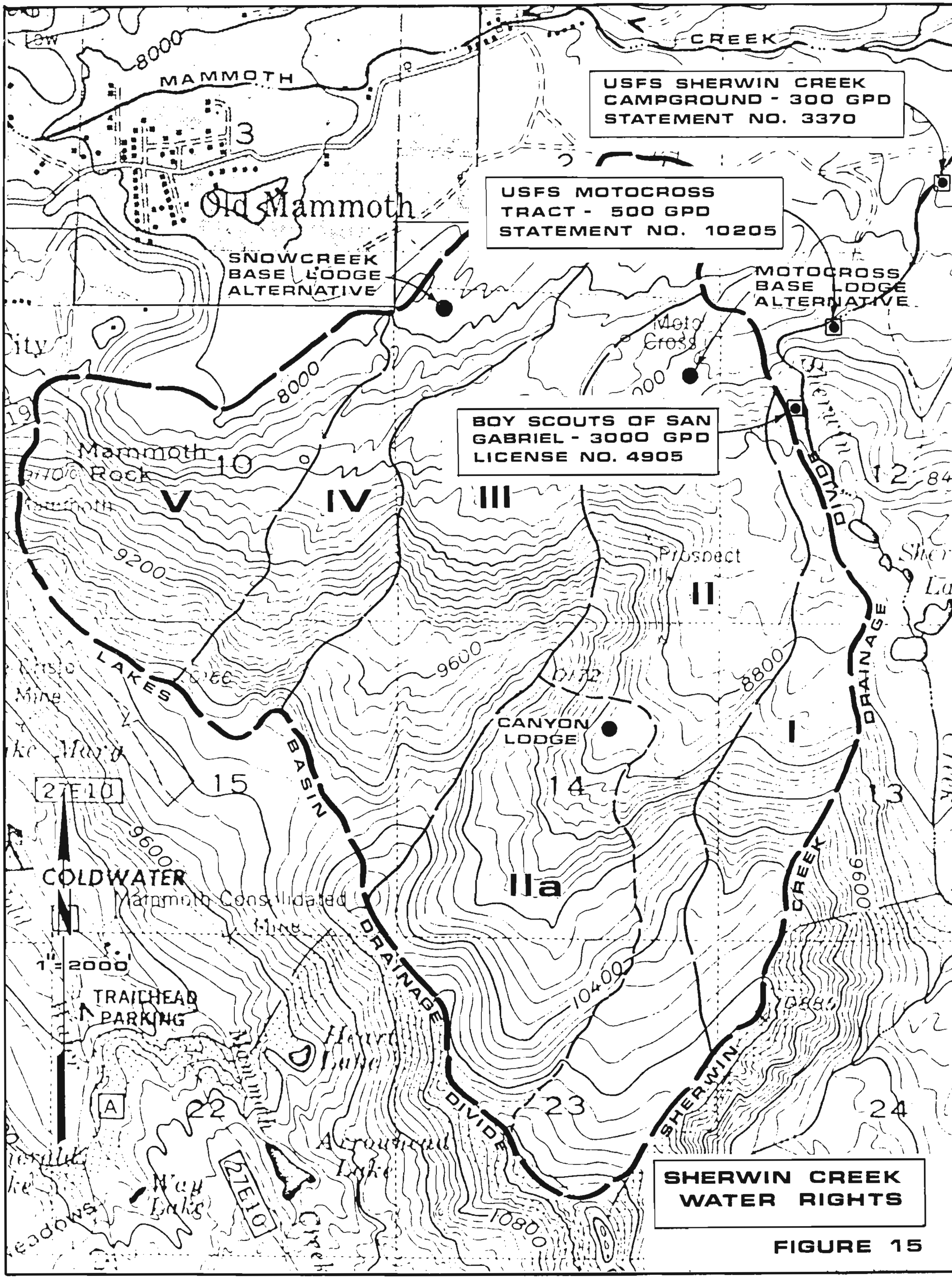
Name of Holder	Permit or Statement No.	Source	Diversion Amount, gpd.		Annual Volume, AF/year
Boys Club of San Gabriel	4905	Stream	3,000		1.28
U.S. Forest Service Sherwin Creek Campground	3370	Stream	130		.10
U.S. Forest Service Motocross Track	10205	Stream	500		.15
				Total:	1.53

Although the ski area watershed is not directly tributary to the Sherwin Creek stream flow, there is a potential conflict with the USFS motocross diversion. This diversion occurs in the vicinity of the drainage divide between the two watersheds. The short-term use of this diversion (3 to 4 weeks per year) and the relatively small volume of water involved indicates that there is no significant conflict with potential ski area water resource development.

Water Resource Development Potential

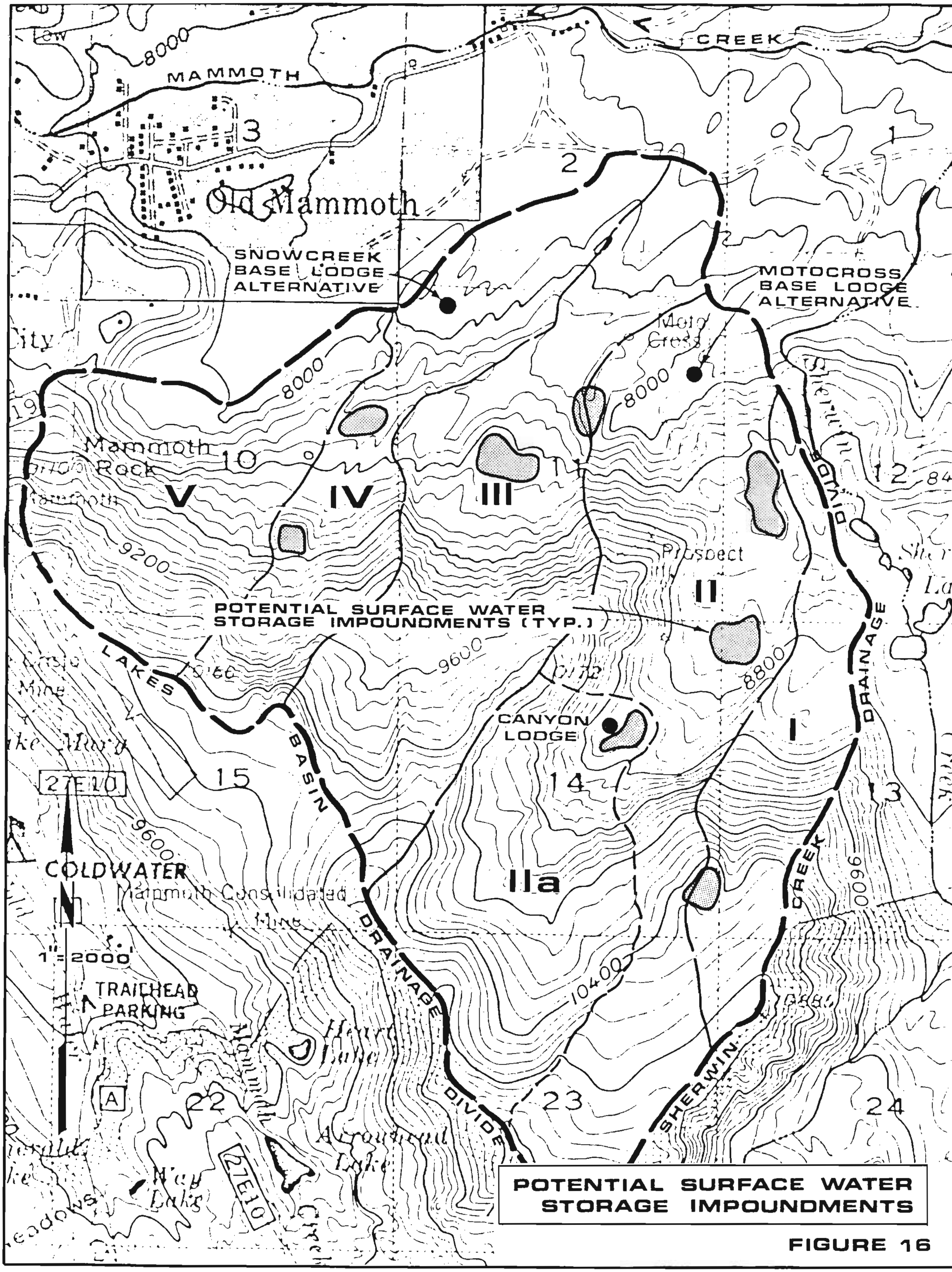
Surface Water Resources. The Sherwin Ski Area watershed does not contain any perennial surface streams or water courses. Although seasonal springs are known to exist, they appear only for short durations during the spring snowmelt months. The mean precipitation year hydrologic balance for the ski area watershed indicates that total surface outflow volumes are approximately 360 acre-feet annually. However, this surface flow is not concentrated at specific locations and only occurs for short durations. During low precipitation years or drought conditions, no surface outflow at all is anticipated from the watershed. Consequently, the potential for development of reliable water supplies from the surface water resources of the watershed is considered to be extremely limited.

The topography of Drainage Subareas II, III, and IV includes numerous natural depressions and "sump" areas. These natural topographic impoundments are ideal locations for surface water storage facilities such as lakes or ponds. The potential storage capacity of the surface water impoundments shown on Figure 16 is in excess of 200 acre-feet (70,300,000



SHERWIN CREEK WATER RIGHTS

FIGURE 15



POTENTIAL SURFACE WATER STORAGE IMPOUNDMENTS

FIGURE 16

gallons) at moderate depths of 5 to 6 feet. Due to the highly permeable nature of surficial soils, it will be necessary to line all surface storage facilities with impervious material and the actual size of the artificial impoundments will probably be limited by economic considerations. Judicious selection of surface storage sites at locations with favorable natural topography would minimize other construction and earthwork costs, however.

Groundwater Resources. The hydrologic analyses of the Sherwin Ski Area watershed show that there is a significant potential for the development of groundwater resources. The steady-state hydrologic balance indicates that the total estimated groundwater outflow from Drainage Subareas II, III, and IV is approximately 2,119 acre-feet per year. During maximum drought year conditions, the outflow is reduced to about 584 acre-feet for these subareas, but this is still a significant resource. In addition, the potential groundwater storage basins associated with these subareas have an estimated total storage capacity of approximately 2,250 acre-feet of water. This volume is roughly equal to the steady-state annual groundwater outflow and indicates that deep well sources can be expected to produce reliable water supplies on a long-term basis.

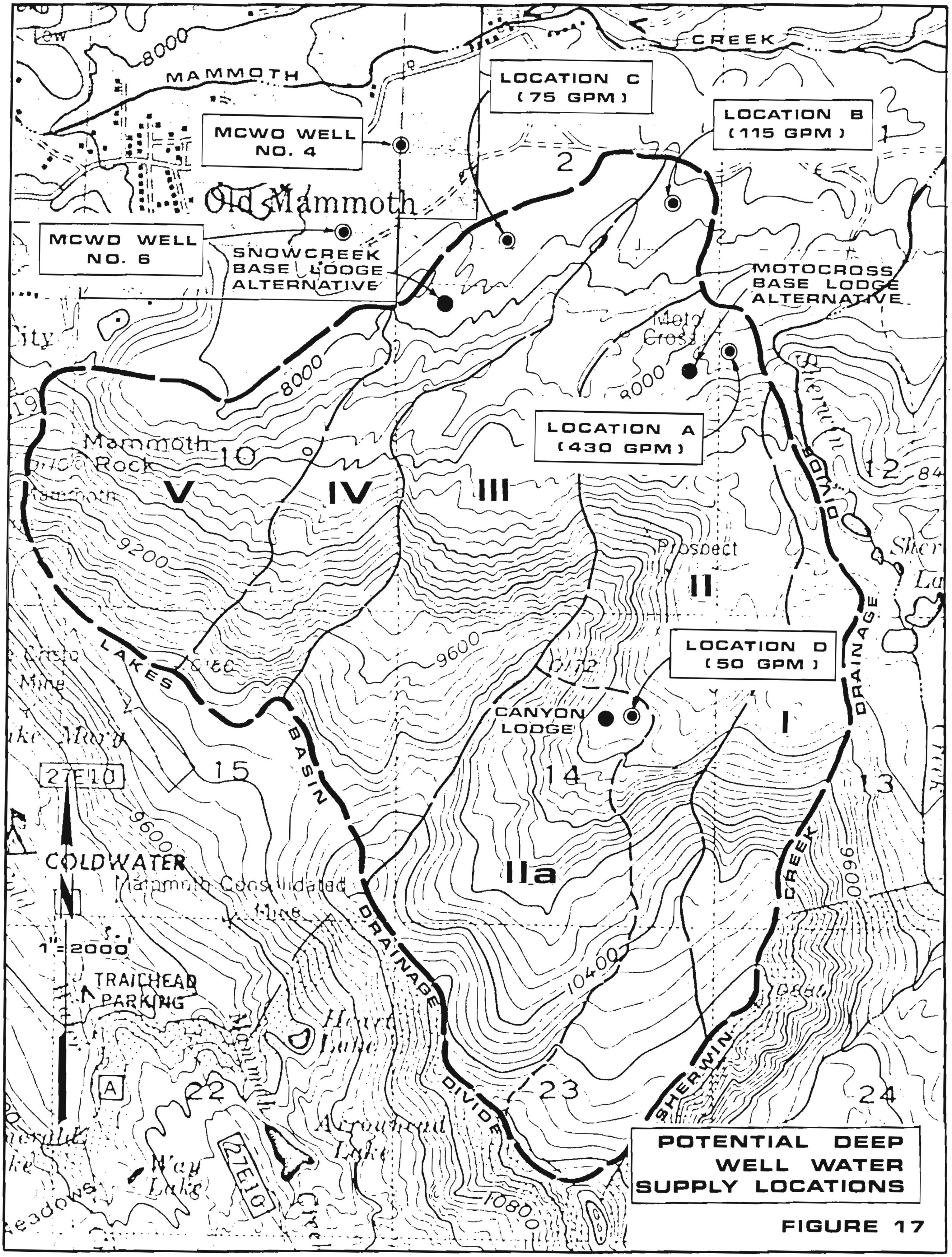
Based on geologic considerations, the most favorable locations for the development of deep well water supplies are shown on Figure 17. Conditions are favorable for multiple deep well installations at all locations except for location D. Due to the relatively small size and shallow depth of the associated groundwater storage basin, it is probable that only one supply source could be developed at this location.

Detailed geohydrologic studies of each site are necessary to accurately determine the potential yields from individual deep well installations. However, approximations of potential supply capacities can be made from available geologic and hydrologic information. Rough, conservative estimates of the potential yields for the designated well locations are summarized in Table 21.

Table 21. Potential Well Yields

Well Location	Tributary Subarea	Total Depth, feet	Depth to Water Level feet	Mean Annual Groundwater Recharge, AF/year	Potential Yield, AF/year	Potential Yield, gpm
A	II	400	200	1,389*	695	430
B	III	400	250	373	186	115
C	IV	400	250	245	123	75
D	IIA	100	50	631	80	50

*Recharge reduced by groundwater extracted at Location D if wells are developed at both locations.



POTENTIAL DEEP WELL WATER SUPPLY LOCATIONS

FIGURE 17

Although the development of deep well water supplies appears to be entirely feasible, there is a concern regarding the quality of the water obtained from such sources. The MCWD test well analyses indicate that significant concentrations of mercury, iron, and manganese may be encountered. Since only one water quality sample was analyzed, it is not certain that the results are representative of the character of groundwater resources in the area. It may be that groundwater extracted from different depths, or even slightly different horizontal locations, will not evidence the same concentrations of these metallic elements. In any event, mercury was the only constituent which specifically exceeded the toxic concentration limits of the Public Health Drinking Water Standards. The recommended limits for manganese and iron concentrations are primarily based on aesthetic and water system maintenance considerations. Neither substance is toxic, but high levels of these constituents produce objectionable colors and stains and tend to produce deposits in water pipelines. Mercury, on the other hand, is extremely toxic, and water contaminated with high levels is not suitable for human consumption. Mercury concentrations measured in the MCWD test well only marginally exceed the drinking water standards, however, and the groundwater could still be used for other purposes such as irrigation or snowmaking.

Summary and Conclusions

The information and analyses presented in the previous sections of this report are summarized in the following conclusions:

1. The proposed Sherwin Ski Area watershed encompasses 4.7 square miles (2,995 acres) and is hydrologically tributary to Mammoth Creek and Sherwin Creek. There are no direct surface flow connections linking the watershed with downstream surface waters, however.

2. Mean annual water production of the ski area watershed is approximately 7,868 acre-feet but is subject to variations of up to 50% within any given year.

3. The topography of the watershed is variable with significant elevation differences and is generally dominated by slopes in excess of 30%. Due to the permeability of surficial soils and surface geologic features, the natural erosion rate from the watershed is low to moderate.

4. A variety of plant communities occupy the watershed, basically stratified with respect to elevation. Alpine forest communities are predominate with relatively sparse understory ground cover.

5. The most significant components of the mean annual hydrologic balance are evapotranspiration and groundwater outflow. Evapotranspiration represents 62% of the available water production. Shallow groundwater outflow is estimated at 26% of total precipitation.

6. The watershed can be subdivided into five drainage subareas, each of which is isolated by topographic drainage divides. There is no apparent surface or groundwater continuity between the drainage subareas, and they are considered to be hydrologically independent.

7. The lower reaches of each of the drainage subareas contain topographic and geologic features which indicate the presence of groundwater storage basins. The existence of such basins is generally confirmed by test well drilling in the area.

8. The hydrologic balance for the watershed during the maximum drought period (100-year minimum precipitation event) indicates that shallow groundwater outflow is significantly reduced (36% of mean outflow), but that groundwater storage is not depleted.

9. General quality of surface waters in the area (Mammoth Creek and Sherwin Creek) is excellent but subject to seasonal variations. The most significant surface water quality problem in the Mammoth Basin is the discharge of silt and sediment from urban development and disturbed areas. Sediment yields for the watershed under natural conditions are low and are estimated at 0.20 tons/acre annually.

10. Groundwater quality varies considerably with location, temperature, and depth of extraction. Problem constituents include mercury, manganese, and iron. Insufficient data exists to predict whether or not these constituents represent significant concern for the ski area watershed.

11. Urban consumption imposes significant demands on the surface water resources of the Mammoth Basin. The ski area watershed is located considerably downstream of existing points of diversion, however, and there is no significant natural surface outflow.

12. A portion of the ski area watershed (Drainage Subarea V) is directly tributary to the proposed MCWD domestic well field. The remaining drainage subareas are significantly down-gradient of the well field and considered to be hydrologically independent.

13. The potential for development of surface water resources within the ski area watershed is minimal.

14. There is a significant potential for the development of groundwater resources in the lower reaches of the watershed. Considerable water supply capacity (over 1,000 AF/year) is available from deep well sources.

APPENDIX A

Mammoth Basin Historical
Precipitation and Streamflow Data

ANNUAL PRECIPITATION AT LAKE MARY STORE

Season	Seasonal Precipitation Inches	Cumulative Precipitation Inches	Cumulative Mean Precipitation Inches	Percent of Seasonal Mean	Departure from Mean Percent	Accumulated Departure from Mean Percent
1946-47	24.65	24.65	24.65	83.36	-16.64	- 16.64
1947-48	24.20	48.85	24.43	81.84	-18.16	- 34.80
1948-49	23.89	72.74	24.25	80.79	-19.21	- 54.01
1949-50	24.35	97.09	24.27	82.35	-17.65	- 71.66
1950-51	35.99	133.08	26.62	121.71	+21.71	- 49.95
1951-52	40.15	173.23	28.87	135.78	+35.78	- 14.17
1952-53	26.50	199.73	28.53	89.62	-10.38	- 24.55
1953-54	27.52	227.25	28.41	93.07	- 6.93	- 31.48
1954-55	23.50	250.75	27.86	79.47	-20.53	- 52.01
1955-56	44.15	294.90	29.49	149.31	+49.31	- 2.70
1956-57	28.00	322.90	29.35	94.61	- 5.39	- 8.09
1957-58	34.25	357.15	29.76	115.83	+15.83	+ 7.74
1958-59	22.40	379.55	29.20	75.75	-24.25	- 16.51
1959-60	18.10	397.65	28.40	61.21	-38.79	- 55.30
1960-61	24.65	422.30	28.15	83.36	-16.64	- 71.94
1961-62	31.40	453.70	28.36	106.19	+ 6.19	- 65.75
1962-63	33.40	487.10	28.65	112.95	+12.95	- 52.80
1963-64	22.03	509.13	28.84	74.50	-25.50	- 78.30
1964-65	37.21	546.34	28.75	125.84	+25.84	- 52.46
1965-66	20.30	566.64	28.33	68.65	-31.35	- 83.81
1966-67	43.40	610.04	29.05	146.77	+46.77	- 37.04
1967-68	19.15	629.19	28.60	64.76	-35.24	- 72.28
1968-69	43.65	672.84	29.25	157.76	+57.76	- 14.52
1969-70	23.25	696.09	29.00	78.63	-21.37	- 35.89
1970-71	25.20	721.29	28.85	85.22	-14.78	- 50.67
1971-72	23.40	744.69	28.64	79.13	-20.87	- 71.54
1972-73	28.05	772.74	28.62	94.86	- 5.14	- 76.68
1973-74	31.90	804.64	28.74	107.88	+ 7.88	- 68.80
1974-75	28.45	833.09	28.73	96.21	- 3.79	- 72.59

ANNUAL PRECIPITATION AT LAKE MARY STORE

Season	Seasonal Precipitation Inches	Cumulative Precipitation Inches	Cumulative Mean Precipitation Inches	Percent of Seasonal Mean	Departure from Mean Percent	Accumulated Departure from Mean Percent
1975-76	22.58	855.67	28.52	76.36	-23.64	- 96.23
1976-77	13.23	868.90	28.03	44.74	-55.26	-151.49
1977-78	41.63	910.53	28.45	140.78	+40.78	-110.71
1978-79	25.03	935.56	28.35	84.65	-15.35	-126.06
1979-80	36.90	972.46	28.60	124.79	+24.79	-101.27
1980-81	19.41	991.87	28.34	65.64	-34.36	-135.63
1981-82	52.58	1,044.45	29.01	177.82	-77.82	- 57.81
1982-83	48.60	1,093.05	29.54	164.36	+64.36	+ 6.55
1983-84	30.70	1,123.75	29.57	103.82	+ 3.82	+ 10.37

38-Year Mean = 29.57 Inches

ANNUAL PRECIPITATION AT MAMMOTH PASS STATION

Season	Seasonal Precipitation Inches	Cumulative Precipitation Inches	Cumulative Mean Precipitation Inches	Percent of Seasonal Mean	Departure from Mean Percent	Accumulated Departure from Mean Percent
1949-50	46.2	46.2	46.2	77.70	-22.30	-22.30
1950-51	61.9	108.1	54.05	104.10	+ 4.10	-18.20
1951-52	82.1	190.2	63.4	138.08	+38.08	+19.88
1952-53	52.1	242.3	60.58	87.62	-12.38	+ 7.50
1953-54	48.1	290.4	58.08	80.89	-19.11	-11.61
1954-55	48.6	339.0	56.5	81.74	-18.26	-29.87
1955-56	85.8	424.8	60.69	144.30	+44.30	+14.43
1956-57	51.1	475.9	59.49	85.94	-14.06	+ 0.37
1957-58	70.3	546.2	60.69	118.23	+18.23	+18.60
1958-59	65.7	611.9	61.19	110.49	+10.49	+29.09
1959-60	33.9	645.8	58.71	57.01	-42.99	-13.90
1960-61	44.3	690.1	57.51	74.50	-25.50	-39.40
1961-62	59.4	749.5	57.65	99.90	- 0.10	-39.50
1962-63	61.5	811.0	57.93	103.43	+ 3.43	-36.07
1963-64	57.3	868.3	57.89	96.37	- 3.63	-39.70
1964-65	84.9	953.2	59.58	142.79	+42.79	+ 3.09
1965-66	74.6	1027.8	60.46	125.46	+25.46	+28.55
1966-67	67.9	1095.7	60.87	114.19	+14.19	+42.74
1967-68	40.1	1135.8	59.78	67.44	-32.56	+10.18
1968-69	68.0	1203.8	60.19	114.36	+14.36	+24.54
1969-70	49.6	1253.4	59.69	83.42	-16.58	+ 7.96
1970-71	54.8	1308.2	59.46	92.16	- 7.84	+ 0.12

22-Year Mean = 59.46 Inches/Year
50-Year Mean (Projected) = 56.3 Inches/Year

HOT CREEK (MAMMOTH CREEK) AT HIGHWAY ACRE-FEET HYDROGRAPHIC YEARS 1934-35 TO 1983-84 ID - HXOA2

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	OCT-MAR TOTAL	% NORM	APR	MAY	JUN	JUL	AUG	SEP	APR-SEP TOTAL	% NORM	TOTAL	% NORM	REL POS
MEAN	602	564	569	505	424	460	3123		794	2916	4983	3147	1318	743	13901		17024		
CFS	10	9	9	8	8	7	9		13	47	84	51	21	12	38		23		
MAX.	2554	2000	2160	1218	1048	782	8266		1595	8572	13280	11027	5556	3110	37559		45825		
MIN.	83	77	64	68	46	169	507		192	299	904	287	95	86	1975		3153		
1983-84	1813	1466	1162	1218	631	758	7048	226	1093	4829	5179	3496	1640	795	17032	123	24080	141	9
1982-83	2554	2000	1318	857	755	782	8266	265	668	4476	13280	11027	5556	2552	37559	270	45825	269	1
1981-82	393	483	415	155	346	297	2089	67	1553	4979	7985	6934	3447	3110	28008	201	30097	177	5
1980-81	811	469	372	380	393	361	2786	89	649	2145	2679	750	301	259	6783	49	9569	56	41
1979-80	421	352	312	782	517	463	2847	91	970	3771	8175	7894	2918	1300	25036	180	27883	164	6
1978-79	1138	768	457	728	537	607	4235	136	1047	4064	4367	1948	947	655	13028	94	17263	101	22
1977-78	83	77	64	68	46	169	507	16	423	3019	8896	6288	2770	2720	24116	173	24623	145	8
1976-77	272	195	127	139	220	225	1178	38	261	299	904	287	117	107	1975	14	3153	19	50
1975-76	1017	572	460	400	396	468	3313	106	420	1805	928	382	326	215	4076	29	7389	43	47
1974-75	516	336	362	366	392	340	2312	74	477	2700	7111	3119	1059	694	15160	109	17472	103	21
1973-74	523	1049	562	593	396	527	3650	117	802	4347	7106	3007	1313	606	17181	124	20831	122	16
1972-73	520	361	458	430	514	340	2623	84	518	4800	6307	2314	997	491	15427	111	18050	106	20
1971-72	495	516	419	416	295	399	2540	81	586	1584	2769	701	190	664	6494	47	9034	53	45
1970-71	452	590	520	425	332	496	2815	90	593	1811	4301	2099	751	402	9957	72	12772	75	31
1969-70	1367	879	698	851	665	779	5269	169	909	2549	4342	2152	751	484	11187	80	16456	97	24
1968-69	231	368	322	277	105	245	1548	50	981	8572	11637	8808	3691	1466	35155	253	36703	216	2
1967-68	1123	818	592	598	600	532	4263	137	567	1639	1994	753	375	131	5459	39	9722	57	40
1966-67	340	303	858	469	475	610	3055	98	519	3233	8413	10197	3307	1903	27732	199	30787	181	4
1965-66	841	778	587	556	470	565	3797	122	1014	3231	2321	990	459	344	8359	60	12156	71	33
1964-65	153	347	1317	938	348	521	3624	116	836	2025	5120	4440	3368	1469	17258	124	20882	123	15
1963-64	639	853	636	424	307	470	3329	107	600	1492	2272	723	408	286	5781	42	9110	54	44
1962-63	542	393	427	335	1048	422	3167	101	590	2197	6234	4334	1581	874	15800	114	18967	111	18
1961-62	137	148	226	231	358	348	1448	46	1094	2092	5550	3360	1209	605	13910	100	15358	90	28
1960-61	135	144	179	188	145	219	1010	32	192	603	969	332	201	175	2472	18	3482	20	49
1959-60	347	222	240	356	369	412	1946	62	599	863	1372	301	95	86	3316	24	5262	31	48
1958-59	644	522	430	438	371	503	2908	93	828	1447	1900	585	226	366	5352	39	8260	49	46
1957-58	473	382	389	308	341	439	2332	75	854	4663	6960	4634	2419	1265	20795	150	23127	136	11
1956-57	1023	764	576	565	569	532	4029	129	700	1642	6345	2471	808	413	12379	89	16408	96	25
1955-56	279	273	1556	808	445	439	3800	122	944	3324	8528	5872	2279	1186	22133	159	25933	152	7
1954-55	145	336	294	323	222	271	1591	51	498	1217	4239	1354	462	198	7968	57	9559	56	42
1953-54	306	295	251	212	278	520	1862	60	1089	3124	2501	1221	390	260	8585	62	10447	61	36
1952-53	747	424	536	651	354	410	3122	100	820	1021	2980	2726	616	295	8458	61	11580	68	34
1951-52	438	340	647	607	480	373	2885	92	708	3789	6159	5725	2579	1147	20107	145	22992	135	12
1950-51	252	1659	2160	770	575	505	5921	190	743	2356	3400	1854	993	475	9821	71	15742	92	26
1949-50	243	291	254	364	300	314	1766	57	736	2240	2968	1384	393	325	8046	58	9812	58	39
1948-49	286	183	266	209	162	197	1303	42	744	2134	3377	1234	507	162	8158	59	9461	56	43
1947-48	306	284	224	321	204	261	1600	51	689	1867	3370	1774	527	155	8382	60	9982	59	38
1946-47	535	564	462	274	204	459	2578	83	784	3550	2408	1263	385	242	8632	62	11210	66	35
1945-46	861	1133	770	553	389	527	4233	136	1521	3746	3784	2158	920	444	12573	90	16806	99	23
1944-45	320	547	473	367	401	403	2511	80	685	3281	6352	4602	2097	1106	18403	132	20914	123	14
1943-44	635	569	587	556	561	561	3469	111	603	2056	2898	2260	695	333	8845	64	12314	72	32
1942-43	808	849	798	629	604	707	4394	141	1595	3816	4738	3227	1464	756	15596	112	19990	117	17
1941-42	751	903	851	797	609	606	4517	145	1012	2833	7548	5114	1725	1124	19356	139	23873	140	10

HOT CREEK (MAMMOTH CREEK) AT HIGHWAY ACRE-FEET HYDROGRAPHIC YEARS 1934-35 TO 1983-84 ID - HXOA2

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	OCT-MAR TOTAL	% NORM	APR	MAY	JUN	JUL	AUG	SEP	APR-SEP TOTAL	% NORM	TOTAL	% NORM	REL POS
MEAN	602	564	569	505	424	460	3123		794	2916	4983	3147	1318	743	13901		17024		
CFS	10	9	9	8	8	7	9		13	47	84	51	21	12	38		23		
MAX.	2554	2000	2160	1218	1048	782	8266		1595	8572	13280	11027	5556	3110	37559		45825		
MIN.	83	77	64	68	46	169	507		192	299	904	287	95	86	1975		3153		
1940-41	524	480	507	589	499	517	3116	100	692	4251	6971	4100	1673	852	18539	133	21655	127	13
1939-40	519	382	355	594	441	526	2817	90	1106	4067	4573	1922	687	456	12811	92	15628	92	27
1938-39	1177	904	823	846	660	636	5046	162	942	1662	1411	573	289	270	5147	37	10193	60	37
1937-38	460	519	1159	763	754	762	4417	141	924	4807	10212	7595	3191	1398	28127	202	32544	191	3
1936-37	546	387	450	742	444	447	3016	97	694	4353	5941	2797	838	430	15053	108	18069	106	19
1935-36	652	415	262	340	311	330	2310	74	991	3296	4039	2152	893	444	11015	85	14125	83	29
1934-35	285	293	282	409	278	378	1925	62	643	2140	5358	2033	962	509	11725	84	13650	80	30

HOT CREEK(MAMMOTH CREEK) AT THE HIGHWAY STATION NO. 2640

	OCT 81 TO MAR 82	APR 82 TO SEP 82	HYDRO YEAR 1981-82	CALENDAR YEAR 1982
MEAN CFS	5.8	77.2	41.6	47.9
ACRE-FEET	2089	28008	30097	34678
MAXIMUM CFS			217.7	217.7
MINIMUM CFS			1.2	1.2

LONG TERM MEAN FOR 51 COMPLETE CALENDAR YEARS 22.1 CFS

DAILY DISCHARGES IN CUBIC FEET PER SECOND

	1981			1982											
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.2	6.5	6.5	2.4	4.1	6.7	3.4	56.5	116.0	155.7	99.7	45.3	58.2	42.6	27.1
2	5.5	6.3	7.8	1.5	3.9	4.1	4.1	60.6	85.6	120.6	80.9	44.2	44.2	44.2	29.8
3	6.2	6.1	8.2	1.4	4.4	3.5	3.9	68.6	80.2	96.8	63.6	40.0	40.0	52.4	30.3
4	5.9	5.8	8.4	1.3	4.3	6.9	4.7	75.6	78.9	94.7	49.1	36.0	37.5	41.6	30.7
5	5.5	5.8	8.6	1.2	4.3	5.1	5.5	75.0	82.2	93.9	62.4	34.5	35.5	36.5	27.6
6	5.5	5.8	8.4	1.2	4.1	4.7	5.5	71.1	86.3	89.7	89.1	33.1	36.0	34.5	28.0
7	7.2	5.6	7.8	1.3	3.9	6.0	5.5	71.8	83.6	76.3	75.0	30.7	35.5	33.1	25.8
8	6.7	5.4	7.2	1.6	3.8	5.4	5.5	60.0	81.6	75.0	57.1	30.3	36.5	36.5	24.9
9	5.3	5.4	7.4	1.9	3.6	5.1	5.5	66.1	81.6	100.4	52.4	29.8	35.5	34.1	24.1
10	7.2	5.4	6.9	2.0	3.5	6.9	7.8	57.1	82.9	131.7	50.8	29.4	35.0	29.8	23.2
11	8.4	5.3	5.8	2.1	3.5	7.2	70.5	49.6	94.7	154.0	49.6	28.9	33.6	28.9	22.4
12	6.7	5.6	5.6	2.1	3.5	6.1	51.9	43.7	120.5	134.9	48.0	29.4	33.6	32.1	22.0
13	6.1	16.0	5.6	2.4	3.8	5.6	41.6	40.5	137.3	121.4	47.4	28.9	33.1	32.6	21.6
14	6.7	20.0	5.1	2.8	4.1	5.8	30.7	40.5	134.1	118.3	46.9	28.9	32.6	33.6	21.6
15	7.2	13.4	4.7	2.9	6.0	4.6	22.8	40.5	130.1	121.4	46.3	28.0	32.1	34.1	21.6
16	7.1	10.1	4.6	2.9	12.0	3.6	24.5	42.6	123.8	126.1	45.8	27.6	31.7	33.6	21.2
17	6.9	12.7	4.7	2.9	11.2	4.3	24.9	49.1	127.7	126.1	44.7	27.6	31.2	29.4	21.6
18	6.7	12.4	5.6	3.2	10.9	4.6	27.1	57.6	148.1	122.2	43.7	29.4	30.3	34.1	20.8
19	6.5	9.2	7.1	2.9	8.6	4.4	32.6	63.6	210.9	113.0	46.9	28.4	30.3	35.0	20.8
20	6.3	8.2	13.2	3.2	8.2	4.9	31.2	68.6	217.7	100.4	45.8	27.6	29.8	33.6	20.8
21	6.3	7.4	9.9	3.0	8.2	4.7	23.7	75.6	200.5	89.1	43.7	26.2	30.7	33.1	16.5
22	6.1	7.4	8.4	3.0	8.8	4.6	26.7	86.3	186.6	90.4	45.3	23.7	35.5	32.6	16.5
23	6.3	8.2	7.4	3.0	8.4	4.7	30.7	99.7	169.6	101.8	61.2	22.0	30.7	32.6	16.5
24	6.3	12.3	6.3	3.3	8.2	4.5	33.6	108.5	159.1	115.2	75.6	48.5	30.3	32.1	16.5
25	6.1	12.6	6.0	3.3	8.0	4.5	34.1	119.9	156.5	118.3	69.2	84.9	75.6	30.7	16.5
26	6.0	4.6	6.0	3.0	7.2	4.7	39.5	148.9	148.1	115.2	52.4	208.1	130.1	30.3	16.5
27	5.4	4.1	5.6	2.8	7.2	4.7	40.5	177.6	151.4	123.8	49.6	205.2	42.6	29.8	16.5
28	8.0	5.1	5.4	3.0	6.9	3.6	46.3	169.6	161.7	124.5	51.9	119.1	38.0	28.9	15.6
29	7.6	5.4	4.6	3.3		2.9	49.1	110.0	189.4	119.9	50.8	101.8	38.5	28.0	15.6
30	5.1	5.4	5.1	3.6		2.5	49.6	123.0	191.2	116.0	47.4	90.4	76.9	17.7	15.3
31	6.3		5.1	3.8		2.9		124.5		109.2	45.8		46.3		16.6
MEAN CFS	6.4	8.1	6.7	2.5	6.2	4.8	26.1	81.0	134.2	112.0	56.1	52.3	41.5	33.6	21.4
ACRE-FEET	393	483	415	155	346	297	1553	4979	7985	6934	3447	3110	2554	2000	1318
MAX. CFS	8.4	20.0	13.2	3.8	12.0	7.2	70.5	177.6	217.7	155.7	99.7	208.1	130.1	52.4	30.7
MIN. CFS	5.1	4.1	4.6	1.2	3.5	2.5	3.4	40.5	78.9	75.0	43.7	22.0	29.8	17.7	15.3
LONG TERM MEAN				7.8	7.3	7.2	13.0	44.4	79.1	47.9	19.8	11.6	9.2	9.1	9.0

MAMMOTH BASIN RUNOFF*

STATION HOT CREEK -- GORGE (COUNTY ROAD)

Quantities in acre-feet

Year	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean Sec. Ft.	Acre Feet
1923-24	3,290	3,140	2,950	3,120	2,610	2,690	2,520	2,530	2,340	2,180	2,080	2,010	43.3	31,460
1924-25	2,590	(2,610)	(2,830)	2,660	2,340	2,180	2,220	3,370	4,670	4,160	2,760	2,530	48.2	34,920
1925-26	2,710	2,530	2,580	2,470	2,190	2,730	2,890	4,704	4,250	2,830	2,280	2,150	47.4	34,314
1926-27	2,470	2,330	2,030	1,935	2,090	2,945	2,592	5,019	9,334	6,131	3,889	3,381	61.1	44,146
1927-28	3,082	3.090	2,822	2,723	2,324	2,483	2,505	4,599	4,706	3,010	2,441	2,209	49.6	35,994
1928-29	2,372	2,221	2,247	2,353	2,086	2,196	2,206	2,992	3,826	3,319	2,378	2,249	42.1	30,445
1929-30	2,198	2,128	2,092	2,121	1,972	2,382	2,223	2,405	4,180	2,837	2,462	2,280	40.5	29,280
1930-31	2,346	2,034	2,176	2,114	1,864	2,154	1,800	2,242	1,986	1,741	1,596	1,604	32.7	23,657
1931-32	1,663	1,676	1,750	1,779	1,811	2,202	2,159	3,598	7,234	6,769	3,717	2,766	51.1	37,124
1932-33	2,396	2,444	2,360	2,468	2,163	2,236	2,295	2,158	5,334	3,882	2,414	1,958	44.4	32,108
1933-34	1,980	2,011	2,076	2,072	1,694	2,185	2,097	2,754	2,541	1,937	1,726	1,680	34.2	24,753
1934-35	1,769	1,776	1,820	1,935	1,771	2,155	2,524	3,540	6,830	4,234	2,991	2,512	46.8	33,857
1935-36	2,431	2,292	2,206	2,235	2,070	2,178	3,123	5,289	5,871	4,771	3,063	2,472	52.4	38,001
1936-37	2,438	2,097	2,060	2,332	2,306	2,680	3,306	6,186	8,651	6,025	3,450	2,842	61.3	44,373
.937-38	2,778	2,753	3,660	2,777	2,574	2,817	4,003	8,515	12,894	11,366	6,862	4,983	91.2	65,982

From LADWP

MAMMOTH BASIN RUNOFF*

STATION HOT CREEK -- GORGE (COUNTY ROAD)

Quantities in acre-feet

Year	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean Sec. Ft.	Acre Feet
1938-39	4,467	3,886	3,662	3,673	3,041	3,301	3,354	3,559	3,752	2,969	2,723	2,534	56.5	40,921
1939-40	2,764	2,494	2,461	2,738	2,534	2,959	3,112	6,090	7,215	4,650	3,177	2,899	59.2	43,003
1940-41	2,805	2,558	2,706	2,912	2,470	2,942	3,491	7,194	9,328	7,548	4,810	3,884	72.7	52,648
1941-42	3,820	3,589	3,473	3,949	3,203	3,135	3,725	4,562	9,782	8,401	4,817	3,936	77.9	56,392
1942-43	3,406	3,278	3,234	2,994	2,841	3,317	4,033	6,059	7,933	5,761	3,919	3,406	69.3	50,181
1943-44	3,322	2,982	2,922	3,066	2,883	2,883	2,787	4,075	5,446	4,442	3,034	2,663	55.8	40,505
1944-45	2,727	3,109	2,925	2,721	2,358	2,692	3,593	5,875	8,858	8,336	4,388	3,647	70.8	51.229
1945-46	3,481	3,769	3,262	2,961	2,700	2,953	3,406	6,268	6,435	4,526	3,394	3,152	64.0	46,307
1946-47	3,022	2,776	3,101	2,622	2,492	2,705	2,669	4,133	4,184	3,271	2,738	2,600	50.2	36,313
1947-48	2,627	2,505	2,437	2,371	2,143	2,371	2,263	3,457	5,213	3,604	2,465	2,110	46.2	33,566
1948-49	2,314	2,129	2,166	2,006	1,901	2,107	2,556	3,949	5,009	2,745	2,459	2,116	43.5	31,455
1949-50	2,158	1,986	1,952	2,131	2,013	2,234	2,408	3,264	5,126	3,233	2,454	2,246	43.1	31,205
1950-51	2,233	3,433	3,913	2,679	2,353	2,412	2,257	3,617	5,191	3,638	2,747	2,442	51.0	36,915
1951-52	2,402	2,177	2,412	2,548	2,229	2,378	3,306	6,624	9,781	8,453	5,268	3,913	70.9	51,491
1952-53	3,449	2,893	2,900	3,031	2,410	2,663	2,878	2,937	4,826	5,494	2,955	2,522	53.8	38,958

* From LADWP

MAMMOTH BASIN RUNOFF*

STATION HOT CREEK -- GORGE (COUNTY ROAD)

Quantities in acre-feet

Year	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean Sec. Ft.	Acre Feet
1953-54	2,472	2,382	2,310	2,275	2,172	2,765	3,081	4,962	4,725	3,975	2,653	2,400	50.0	36,180
1954-55	2,345	2,277	2,362	2,376	2,111	2,496	2,434	3,167	5,962	3,539	2,673	2,326	46.8	33,868
1955-56	2,320	2,287	3,713	3,222	2,634	2,842	3,292	4,994	9,665	8,608	4,932	3,809	72.0	52,246
1956-57	3,744	3,321	3,111	2,966	2,795	3,001	2,969	3,431	7,772	4,718	3,111	2,916	60.6	43,850
1957-58	2,959	2,752	2,657	2,489	2,380	2,721	3,798	6,733	8,455	7,052	5,020	3,955	70.4	50,971
1958-59	3,402	3,111	2,961	2,906	2,475	3,016	3,022	3,150	3,630	2,720	2,513	2,540	49.0	35,454
1959-60	2,438	2,371	2,438	2,472	2,366	2,533	2,482	2,380	3,026	2,378	2,192	2,145	40.3	29,221
1960-61	2,118	2,048	2,090	2,080	1,979	2,259	2,073	2,172	2,386	2,156	2,026	2,050	35.1	25,437
1961-62	2,171	2,094	2,182	2,164	2,102	2,392	3,576	3,845	7,020	5,372	3,276	2,926	54.0	39,080
1962-63	2,959	2,584	2,586	2,351	3,530	2,676	2,769	4,153	8,314	6,513	3,895	3,429	63.2	45,759
1963-64	3,237	3,186	2,811	2,571	2,354	2,556	2,579	3,022	3,995	2,569	2,378	2,273	46.2	33,531
1964-65	2,309	2,272	2,989	2,825	2,319	2,623	2,869	3,535	7,098	7,171	5,817	4,115	63.5	45,941
1965-66	3,573	3,343	3,098	3,019	2,493	2,973	3,074	4,624	4,210	2,973	2,599	2,503	53.2	38,482
1966-67	2,582	2,397	3,156	2,597	2,434	3,188	3,251	5,109	9,862	12,526	6,644	5,270	81.5	59,016
1967-68	4,283	3,655	3,439	3,264	3,043	2,978	2,835	3,350	3,730	2,791	2,567	2,379	52.8	38,313

* From LADWP

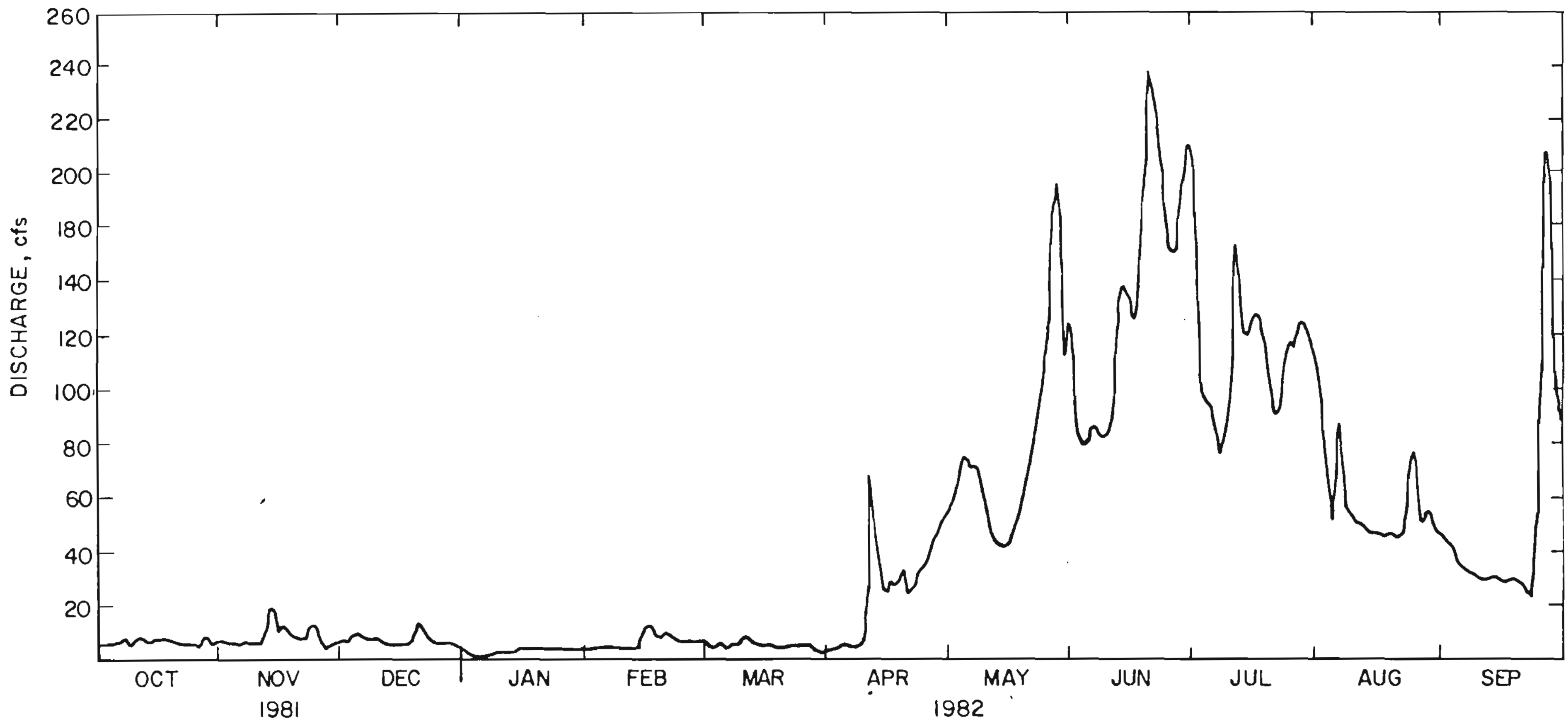
MAMMOTH BASIN RUNOFF*

STATION HOT CREEK -- GORGE (COUNTY ROAD)

Quantities in acre-feet

Year	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean Sec. Ft.	Acre Feet
1968-69	2,457	2,526	2,499	2,498	2,300	2,891	4,215	11,515	16,155	12,688	7,365	5,019	99.6	72,128
1969-70	4,791	3,865	3,663	3,719	3,260	3,575	3,528	4,687	6,759	5,190	3,457	3,164	68.6	49,658
1970-71	3,150	3,193	3,236	3,067	2,722	2,924	2,682	4,190	6,058	4,300	3,090	2,710	57.1	41,322
1971-72	2,939	2,925	2,685	2,694	2,473	2,787	2,504	3,120	4,566	2,655	2,283	2,798	47.4	34,429
1972-73	2,801	2,619	2,698	2,710	2,512	2,657	3,565	7,174	8,706					

* From LADWP



Hydrograph for Mammoth Creek at Old Hwy 395

MAMMOTH BASIN RUNOFF*

Station SHERWIN CREEK AT BASE OF MOUNTAINS

Date	Discharge cfs	Date	Discharge cfs
5-11-70	1.5±	11-24-70	3.0±
5-21-70	2.5±	4-22-71	1.5±
6- 9-70	4.0±	4-29-71	2.0±
6-16-70	7.0±	5- 6-71	2.0±
6-18-70	7.5±	5-13-71	2.0±
6-25-70	8.0±	5-20-71	3.5±
7- 1-70	6.5±	5-27-71	3.5±
7- 8-70	7.5±	6- 3-71	4.0±
7-15-70	6.5±	6-11-71	5.0±
7-23-70	6.5±	6-17-71	8.0±
7-30-70	6.0±	6-24-71	8.0±
8- 7-70	6.0±	7- 1-71	7.0±
8-20-70	5.0±	7- 8-71	6.0±
8-28-70	4.5±	7-15-71	5.5±
9- 4-70	4.0±	7-22-71	6.0±
9-10-70	3.5±	7-29-71	5.0±
9-21-70	3.0±	8- 5-71	4.0±
9-30-70	3.0±	8-10-71	4.0±
10- 7-70	3.0±	8-19-71	3.5±
10-19-70	3.0±	8-26-71	3.5±
11- 2-70	3.0±	9- 2-71	3.5±
11-10-70	3.0±	9- 9-71	3.5±
11-18-70	3.0±	9-16-71	3.0±

* From LADWP

MAMMOTH BASIN RUNOFF*

Station SHERWIN CREEK AT BASE OF MOUNTAINS

Date	Discharge cfs	Date	Discharge cfs
9-23-71	3.0±	7-13-72	4.0±
9-30-71	3.0±	7-20-72	3.0±
10- 7-71	3.0±	7-27-72	3.0±
10-14-71	3.0±	8- 3-72	2.0±
10-21-71	3.0±	8-10-72	2.10
10-28-71	3.0±	8-17-72	1.68
11- 4-71	3.5±	8-24-72	1.49
11-11-71	4.0±	8-31-72	1.79
11-18-71	3.5±	9- 7-72	2.79
11-29-71	5.0±	9-14-72	3.28
12- 2-71	3.0±	9-28-72	2.10
12- 9-71	3.0±	10- 5-72	2.55
12-16-71	3.0±	10-12-72	2.00
4-20-72	3.0±	10-19-72	2.21
4-27-72	3.0±	10-26-72	1.68
5- 4-72	3.0±	11- 2-72	1.30
5-11-72	3.5±	11- 9-72	2.10
5-18-72	5.0±	5-24-73	20±
6- 1-72	6.0±	5-31-73	22±
6- 8-72	8.0±	6- 7-73	20±
6-15-72	8.0±	6-14-73	20±
6-22-72	6.0±	6-21-73	15±
7- 6-72	5.0±	6-28-73	20±

* From LADWP

MAMMOTH BASIN RUNOFF*

Station SHERWIN CREEK AT BASE OF MOUNTAINS (continued)

Date	Discharge cfs	Date	Discharge cfs
7- 5-73	12±		

* From LADWP

APPENDIX B

Mammoth Basin Surface Water Quality Data

MINERAL ANALYSES OF SURFACE WATER
An explanation of column headings follows:

GH – The instantaneous gage height in feet above an established datum.
Q – The instantaneous discharge in cubic feet per second (cfs). "E" indicates the value has been estimated.
DO – The dissolved oxygen content in milligrams per liter.
SAT – The percent saturation of dissolved oxygen.
LABORATORY
EC – Laboratory determination of the electrical conductance in micromhos at 25° Celsius.
FIELD
EC – Field determination of the electrical conductance in micromhos at temperature when sampled.
LABORATORY AND FIELD
pH – Measure of acidity or alkalinity of water, field or laboratory determination.
TDS – Gravimetric determination of total dissolved solids at 180° Celsius (or 105° Celsius).
SUM – Total dissolved solids determined by addition of analyzed constituents minus 1/2 of bicarbonate.
TH – Total hardness.
NCH – Noncarbonate hardness.
TIME – Pacific Standard Time on a 24-hour clock.
TEMP – Water temperature in degrees Fahrenheit at the time of field sampling.
SAR – Sodium Absorption Ratio.
TURB – E = Jackson Candle Units (JCU) – Hellige
A = Jackson Turbidity Units (JTU) – Hach

REM (remarks) as follow:

- T – Total Dissolved Solids and the calculated SUM of constituents are not within 20 percent of each other
- E – Total Dissolved Solids (TDS) value is not within the range of 0.35 to 0.70 of the electrical conductivity.
- S – The anion sum and cation sum for a complete analysis is not within the prescribed tolerance of ±5%.
- C – The electrical conductivity divided by the EC–EPM factor (or if absent, 100) is not within 20% of the average of the cation sum and anion sum for complete analyses.
- X – The field EC and the lab EC are not within 20% of each other
- Z – The value of the constituent is greater than the field limit; in which case all 9's will appear.
- N – This analysis has been reported under a different station number.

The MINERAL CONSTITUENTS are as follows:

B – Boron
CA – Calcium
CL – Chloride
CO_3 – Carbonate
F – Fluoride
HCO_3 – Bicarbonate
K – Potassium
MG – Magnesium
NA – Sodium
NO_3 – Nitrate
SIO_2 – Silica
SO_4 – Sulfate

The LAB and SAMPLER agency codes are as follow:

1200 – Los Angeles Department of Water and Power
4740 – Southern California Edison Company
5010 – U. S. Geological Survey
5050 – Department of Water Resources
5086 – CRWQCB, Lahontan Region
5091 – California Department of Public Health
5788 – U. S. Agriculture Consultants
5999 – Unknown

MINERAL ANALYSES OF SURFACE WATER

INDEX OF SAMPLING STATIONS

Station Number	Station Name
V2 1870.00	Hot Creek at the County Road
V2 1871.00	Hot Creek at the Geysers
V2 1875.00	Mammoth Creek Above Hot Creek
V2 1877.00	Mammoth Creek at old Hwy 395
V2 1878.10	Mammoth Creek at Freeway
V2 1878.20	Mammoth Creek Below Sherwin
V2 1878.22	Sherwin Creek at Voohis Camp
V2 1878.30	Mammoth Creek Above Sherwin Creek
V2 1878.35	Mammoth Creek Below Upper USFS Campground
V2 1878.40	Mammoth Creek at Upper USFS Campground
V2 1878.50	Mammoth Creek at old Mammoth Road
V2 1882.40	Mammoth Creek Below Twin Lakes Bridge
V2 1882.50	Twin Lakes at Outlet Below Dam, Station No. 3
V2 1882.60	Twin Lakes at Pedestrian Bridge, Station No. 1

INDEX OF SAMPLING STATIONS

Station Number	Station Name
V2 1882.70	Twin Lakes at Upper Auto Bridge, Station No. 2
V2 1883.00	Lake Mamie at Outlet Above Dam
V2 1883.10	Lake Mamie Station No. 1
V2 1883.55	Horseshoe Lake Station No. 2
V2 1884.00	Lake Mary at Outlet Below Dam
V2 1884.05	Lake George at End of Boat Dock
V2 1884.10	Lake George Overflow Near Lake Mary
V2 1884.15	Lake Mary Station No. 5
V2 1884.20	Lake Mary Station No. 6
V2 1884.25	Lake Mary Station No. 2
V2 1884.30	Lake Mary Station No. 1
V2 1884.32	Lake Mary at Mary's Store Boat Dock
V2 1884.45	Lake Mary Station No. 8
V2 1884.50	Lake Mary Station No. 3
V2 1884.55	Lake Mary Station No. 7
V2 1884.60	Lake Mary Station No. 4

MINERAL ANALYSES OF SURFACE WATER

DATE TIME	SAMPLER LAB	G.H. Q DEPTH	DO SAT	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	TURB SAR	REM
							MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER					
V2 1870.00				HOT CREEK AT THE COUNTY ROAD								CONTINUED									
08/21/69	1200			69.8F	7.8		8.8	5.4	40	4.3	--	111	19	18	.9	--	.9		40	5E	
	1200			21.0C	7.4	279	.44	.44	1.74	.11		1.82	.40	.51	.01		38.0			2.6	
							16	16	64	4											
09/16/69	1200			72.5F	7.7		11	5.1	56	5.1	--	139	19	26	1.7	--	1.2		48	2E	
	1200			22.5C	7.8	362	.55	.42	2.44	.13		2.28	.40	.73	.03		46.0			3.5	
							16	12	69	4											
10/23/69	1200			65.3F	7.7		12	4.9	56	58	--	138	23	28	1.1	1.00	1.5		49	2E	
	1200			18.5C	7.5	374	.60	.40	2.44	1.48		2.26	.48	.79	.02		56.0			3.4	
							12	8	50	30											
11/20/69	1200			68.9F	7.7		11	7.3	80	7.0	--	181	30	38	1.8	--	1.7		58	5E	
	1200			20.5C	7.5	460	.55	.60	3.48	.18		2.97	.62	1.07	.02		52.0			4.6	
							11	12	72	4											
12/18/69	1200			72.5F	7.9		12	5.6	83	5.6	--	185	26	41	1.3	--	2.1		52	4E	
	1280			22.5C	7.1	490	.60	.46	3.61	.14		3.03	.54	1.16	.02		55.0			5.0	
							12	10	75	3											
03/18/70	1290			70 F	7.8		13	5.0	79	7.1	--	183	23	39	.9	--	1.4		52	2E	
	1200			21 C	8.0	482	.65	.41	3.44	.18		3.00	.48	1.10	.01		55.0			4.7	
							14	9	74	4											
04/23/70	1200			70.7F	7.9		13	5.1	79	6.5	--	181	30	39	.7	1.70	1.9		52	3E	
	1200			21.5C	8.1	474	.65	.42	3.44	.17		2.97	.62	1.10	.01		35.0			4.7	
							14	9	74	4											
05/21/70	1200			74.3F	7.6		12	5.2	64	6.0	--	161	21	32	.5	1.70	1.5		51	5E	
	1200			23.5C	7.6	404	.60	.43	2.78	.15		2.64	.44	.90	.01		45.0			3.9	
							15	11	70	4											
06/18/70	1200			70.7F	7.9		11	3.8	47	4.3	--	123	15	23	.4	1.00	1.2		43	4E	
	1200			21.5C	7.6	313	.55	.31	2.04	.11		2.02	.31	.65	.01		35.0			3.1	
							18	10	68	4											
07/23/70	1200			83.3F	7.5		12	5.0	72	6.9	--	171	23	36	.7	1.20	1.7		50	1E	
	1200			28.5C	7.5	434	.60	.41	3.13	.18		2.80	.48	1.02	.01		38.0			4.4	
							14	9	72	4											
08/20/70	1200			79 F	8.3		11	5.2	85	8.0	--	194	27	43	.8	1.70	2.0		50	7E	
	1200			26 C	7.2	502	.55	.43	3.70	.20		3.18	.56	1.21	.01		64.0			5.3	
							11	9	76	4											
09/24/70	1200			79 F	8.1		12	5.2	87	7.1	--	185	33	42	.2	1.00	1.0		52	7E	
	1200			26 C	8.1	485	.60	.43	3.78	.18		3.03	.69	1.18	.00		48.0			5.3	
							12	9	76	4											
10/28/70	1200			76.1F	8.3		12	5.2	86	6.9	--	185	27	42	.8	1.90	2.0		51	7E	
	1200			24.5C	8.3	493	.60	.43	3.74	.18		3.03	.56	1.18	.01		57.0			5.2	
							12	9	76	4											
11/19/70	1200			77.0F	8.0		13	5.0	88	7.4	--	195	30	45	.5	2.30	2.0		52	1E	
	1200			25.0C	8.0	510	.65	.41	3.83	.19		3.20	.62	1.27	.01		60.0			5.3	
							13	8	75	4											
03/16/71	1200			74.3F			13	4.9	89	7.5	--	198	28	44	1.3	1.00	2.0		52	3E	
	1200			23.5C	8.1	530	.65	.40	3.87	.19		3.25	.58	1.24	.02		60.0			5.3	
							13	8	76	4											
04/20/71	1200			79 F	8.4		12	5.4	100	7.6	--	207	30	49	.7	2.50	2.6		52	1E	
	1200			26 C	8.3	556	.60	.44	4.35	.19		3.39	.62	1.38	.01		61.0			6.0	
							11	8	78	3											
05/20/71	1200			74.3F	8.4		12	4.9	68	6.4	--	166	23	35	.7	1.80	1.5		50	2E	
	1200			23.5C	8.2	434	.60	.40	2.96	.16		2.72	.48	.99	.01		46.0			4.2	
							15	10	72	4											
06/22/71	1200			68.9F	7.7		9.6	3.4	42	4.1	--	106	17	21	.5	.91	.9		38	6E	
	1200			20.5C	7.7	279	.48	.28	1.83	.10		1.74	.35	.59	.01		32.0			3.0	
							18	10	68	4											
07/22/71	1200			79.7F	7.7		10	4.6	60	5.3	--	144	24	25	1.3	1.30	1.4		45	2E	
	1200			26.5C	7.6	374	.50	.38	2.61	.14		2.36	.50	.71	.02		42.0			3.9	
							14	10	72	4											
08/19/71	1200			86.9F	7.9		12	4.9	88	7.6	--	194	28	43	.4	2.00	2.1		49	3E	
	1200			30.5C	7.9	520	.60	.40	3.83	.19		3.18	.58	1.21	.01		57.0			5.4	
							12	8	76	4											
09/26/71	1200			79 F	7.9		12	5.1	90	7.6	--	198	28	45	.4	--	2.1		50	13E	
	1200			26 C	8.2	521	.60	.42	3.92	.19		3.25	.58	1.27	.01		54.0			5.5	
							12	8	76	4											
10/21/71	1200		8.1	72 F	8.4		12	4.9	85	7.1	--	193	26	43	.6	1.90	2.0		50	3E	
	1200		92	22 C	8.0	504	.60	.40	3.70	.18		3.16	.54	1.21	.01		54.0			5.2	
							12	8	76	4											
V2 1871.00				HOT CREEK AT THE GEYSERS																	
05/20/71	5050			68 F	6.9	220	8.6	3.1	30	3.5	.0	83	11	17	1.0	--	.8	136	34		
1645	5050			20 C	7.5	214	.43	.25	1.31	.09	.00	1.36	.23	.48	.02		--	115	0	2.2	
							21	12	63	4		65	11	23	1						
V2 1875.00				MAMMOTH CREEK ABOVE HOT CREEK																	
03/27/63	1200						11	6.0	16	3.5	--	85	2.2	7.0	.3	.20	.3		52		
	1200				7.9	173	.55	.49	.70	.09		1.39	.05	.20	.00		29.0			1.0	
							30	27	38	5											
04/16/63	1200			68 F			13	5.9	14	2.0	--	89	12	5.0	.5	.16	.3		56		
	1200			20 C	7.8	167	.65	.49	.61	.07		1.46	.25	.14	.01		--			0.0	
							36	27	34	4											
05/01/63	1200						14	4.6	17	2.3	--	79	27	2.8	.0	.15	.1		54		
	1200					140	.70	.38	.75	.06		1.29	.56	.08	.00		--			1.0	
							37	20	40	3											

MINERAL ANALYSES OF SURFACE WATER

DATE TIME	SAMPLER LAB	G.H. DEPTH	DO SAT	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	TURB SAR	PER
	V2	1077.00		MAMMOTH CREEK AT OLD HWY 395										CONTINUED							
12/19/38	1200		10.3				11	5.0	18	--	--	70	8.0	10	--	.38	.5		47	3E	
	1200				7.8	177	.55	.41	.78			1.20	.17	.28			30.0			1.1	
02/13/39	1200		11.1				10	7.0	21	--	--	81	12	11	--	.43	.5		54	4E	
	1200				8.0	199	.50	.58	.91			1.33	.25	.31			25.0			1.2	
04/19/39	1200		9.5				12	6.0	7.0	--	--	67	5.0	2.0	--	.04	.1		55	8E	
	1200				7.8	116	.60	.49	.30			1.10	.10	.06			26.0			0.4	
06/22/39	1200						10	4.0	6.0	--	--	46	4.0	1.0	--	.00	.2		41	5E	
	1200				7.7	83	.50	.33	.26			.75	.08	.03			12.0			0.4	
07/19/39	1200		7.8				8.0	6.0	4.0	--	--	41	4.0	4.0	--	--	.0		45	11E	
	1200				7.7	77	.40	.49	.17			.67	.08	.11			15.0			0.3	
08/16/39	1200		6.9				7.0	4.0	8.0	--	--	52	4.0	1.0	--	--	.2		34	2E	
	1200				7.7	83	.35	.33	.35			.85	.08	.03			15.0			0.6	
09/20/39	1200		7.8				8.0	5.0	9.0	--	--	71	6.0	.4	--	--	.0		40	3E	
	1200				8.4	109	.40	.41	.39			1.16	.12	.01			20.0			0.0	
10/18/39	1200		8.4				12	5.0	6.0	--	--	73	5.0	.0	--	--	.0		51	3E	
	1200				7.7	114	.60	.41	.26			1.20	.10	.00			28.0			0.4	
11/15/39	1200		10.3				10	5.0	8.0	--	--	67	6.0	1.0	--	--	.0		46	3E	
	1200				8.4	117	.50	.41	.35			1.10	.12	.03			23.0			0.5	
12/20/39	1200		10.4				15	6.0	8.0	--	--	79	5.0	.0	--	--	.0		62	2E	
	1200				8.2	150	.75	.49	.35			1.29	.10	.00			30.0			0.4	
01/17/40	1200		11.0				13	5.0	7.0	--	--	67	6.0	.0	--	--	.0		52	2E	
	1200				7.9	120	.65	.41	.30			1.10	.12	.00			27.0			0.4	
03/20/40	1200		10.5				13	8.0	10	--	--	79	9.0	1.0	--	--	.0		63	2E	
	1200				8.1	145	.65	.66	.44			1.29	.19	.03			25.0			0.5	
04/17/40	1200		10.0				17	6.0	6.0	--	--	87	8.0	2.0	--	--	.0		76	3E	
	1200				8.1	163	.85	.49	.26			1.43	.17	.06			25.0			0.3	
05/15/40	1200		8.4				10	3.0	2.0	--	--	37	3.0	1.0	--	--	.0		36	7E	
	1200				7.9	75	.50	.25	.09			.61	.06	.03			12.0			0.1	
06/19/40	1200		7.7				6.0	3.0	3.0	--	--	28	5.0	1.0	--	--	.2		25	5E	
	1200				7.6	48	.30	.25	.13			.46	.10	.03			18.0			0.3	
07/17/40	1200		8.4				7.0	4.0	9.0	--	--	37	4.0	1.0	--	--	.0		34	2E	
	1200				8.1	57	.35	.33	.39			.61	.08	.03			10.0			0.7	
08/21/40	1200		7.6				7.0	3.0	6.0	--	--	40	5.0	1.0	--	--	.0		30	3E	
	1200				8.0	70	.35	.25	.28			.66	.10	.03			15.0			0.5	
09/18/40	1200		7.2				10	5.0	5.0	--	--	57	2.0	1.0	--	--	.0		47	3E	
	1200				7.9	94	.50	.41	.22			.93	.04	.03			10.0			0.3	
10/16/40	1200		9.3				10	5.0	5.0	--	--	67	6.0	1.0	--	--	.0		47	1E	
	1200				7.8	110	.50	.41	.22			1.10	.12	.03			15.0			0.3	
11/27/40	1200		11.0				12	7.0	8.0	--	--	72	3.0	1.0	--	--	.0		59	5E	
	1200				8.1	124	.60	.58	.35			1.18	.06	.03			10.0			0.5	
01/15/41	1200		11.2				11	5.0	7.0	--	--	73	8.0	2.0	--	--	.2		50	3E	
	1200				8.1	126	.55	.41	.30			1.20	.17	.06			20.0			0.4	
02/19/41	1200		10.9				11	6.0	6.0	--	--	73	8.0	4.0	--	--	--		54	7E	
	1200				8.1	128	.55	.49	.26			1.20	.17	.11			20.0			0.4	
03/19/41	1200		10.6				11	8.0	13	--	--	77	13	4.0	--	--	.0		61	2E	
	1200				8.1	140	.55	.66	.57			1.26	.27	.11			20.0			0.7	
04/16/41	1200		10.7				14	7.0	11	--	--	77	9.0	1.0	--	--	.0		62	5E	
	1200				8.0	141	.70	.58	.48			1.26	.19	.03			30.0			0.6	
07/18/49	1200			64 F			7.0	2.3	9.0	1.0	--	55	3.0	1.4	--	.05	.0		27		
	1200			18 C	7.4	141	.35	.19	.39	.03		.90	.06	.04			15.0			0.8	
							36	20	41	3											
10/31/62	1200			45.5F	8.2		9.0	2.9	7.3	1.7	--	49	7.0	1.0	.5	.00	.2		34	1E<	
	1200			7.5C	8.0	90	.45	.24	.32	.04		.80	.15	.03	.01		16.0			0.5	
							43	23	30	4											
11/07/62	1200						--	--	--	--	--	--	--	--	--	.00	.1				
	1200					123											--				

V2 1878.10 MAMMOTH CREEK AT FREEWAY CONTINUED

DATE / TIME	SAMPLER / LAB	G.H. / D / DEPTH	DO / SAT	TEMP	PH (FIELD / LABORATORY)	EC (FIELD / LABORATORY)	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F / SIO2	TDS / SUM	TH / NCH	TURB / SAR	REM
05/27/70	1200		9.3	46.4F	8.0		--	--	6.1	--	--	--	--	.7	.4	--	--			5E	
	1200		102	8.0C	7.7	60			.27					.02	.01		--				
06/24/70	1200		8.8	55.4F	8.0		--	--	.5	--	--	--	--	.7	.2	--	--			6E	
	1200		99	13.0C	7.9	61			.02					.02	.00		--				
07/05/70	1200		7.5	59.0F			--	--	4.5	--	--	--	--	.7	.5	--	--			2E	
	1200		97	15.0C	8.0	68			.20					.02	.01		--				
07/29/70	1200		7.7	60.1F	8.2		--	--	5.0	--	--	--	--	.4	.2	--	--			1E	
	1200		101	15.6C	8.0	71			.22					.01	.00		--				
08/10/70	1200		8.1	59.9F			--	--	6.0	--	--	39	--	.4	.5	--	--			2E	
	1200		106	15.5C	8.0	79			.26			.64		.01	.01		--				
08/26/70	1200		8.2	58.1F	8.6		--	--	5.8	--	--	44	--	.7	.9	--	--			2E	
	1200		105	14.5C	8.0	84			.25			.72		.02	.01		--				
09/14/70	1200		8.8	50.9F			--	--	7.0	--	--	60	--	.7	.4	--	--			2E	
	1200		103	10.5C	8.2	112			.30			.98		.02	.01		--				
09/30/70	1200		9.7	45.5F	8.5		--	--	10	--	--	--	--	1.4	.0	--	--			1E	
	1200		105	7.5C	7.8	122			.44					.04	.00		--				
10/15/70	1200		8.8	39.2F			--	--	7.7	--	--	63	--	1.4	.3	--	--			1E	
	1200		87	4.0C	7.7	118			.33			1.03		.04	.00		--				
10/28/70	1200		11.5	32.0F	8.4		--	--	7.5	--	--	71	--	1.4	.6	--	--			5E	
	1200		102	0.0C	7.8	132			.33			1.16		.04	.01		--				
11/25/70	1200		10.2	40.1F	8.5		--	--	7.0	--	--	72	--	1.1	.4	--	--			1E<	
	1200		102	4.5C	7.9	131			.30			1.18		.03	.01		--				
12/16/70	1200		11.1	32.9F	8.6		--	--	8.4	--	--	--	--	.7	.6	--	--			1E	
	1200		100	0.5C	7.8	126			.37					.02	.01		--				
02/24/71	1200		11.2	32.0F	8.2		--	--	--	--	--	84	--	1.4	.7	--	--			3E	
	1200		99	0.0C		159						1.38		.04	.01		--				
03/24/71	1200		10.2	41.0F			--	--	9.5	--	--	85	--	.7	.7	--	--			3E	
	1200		104	5.0C	8.1	160			.41			1.39		.02	.01		--				
03/30/71	5050		10.5	37 F	7.8	205	13	9.0	12	3.0	.0	102	10	2.0	.3	.01	.2	118	70		
1100	5050	15	77	3 C	8.1	184	.65	.74	.52	.08	.00	1.67	.21	.06	.00		--	99	0	0.6	
							33	37	26	4		86	11	3							
04/28/71	1200		11.1	39.2F	8.4		--	--	9.8	--	--	87	--	.4	.1	--	--			3E	
	1200		110	4.0C	8.2	161			.43			1.43		.01	.00		--				
05/20/71	5050		8.9	50 F	7.3	80	7.0	2.0	3.0	1.0	.0	33	3.0	1.0	.2	.00	.0	37	26		X
1415	5050	130	79	10 C	7.1	63	.35	.16	.13	.03	.00	.54	.06	.03	.00		--	33	0	0.3	
							52	24	19	4		86	10	5							S
05/26/71	1200		8.9	32.0F	8.1		--	--	6.5	--	--	46	--	1.1	.7	--	--			2E	
	1200		79	0.8C	7.9	97			.28			.75		.03	.01		--				
06/30/71	1200		8.3	54.5F	7.7		--	--	3.4	--	--	24	--	--	--	--	--			3E	
	1200		101	12.5C		56			.15			.39					--				
07/27/71	1200		7.8	61.7F	7.9		--	--	4.7	--	--	33	--	.5	.8	--	--			3E	
	1200		104	16.5C		67			.20			.54		.01	.01		--				
08/25/71	1200				7.9		--	--	5.0	--	--	--	--	.4	1.4	--	--			1E	
	1200				8.1	90			.22					.01	.02		--				

V2 1878.20 MAMMOTH CREEK BELOW SHERWIN CREEK

DATE / TIME	SAMPLER / LAB	G.H. / D / DEPTH	DO / SAT	TEMP	PH (FIELD / LABORATORY)	EC (FIELD / LABORATORY)	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F / SIO2	TDS / SUM	TH / NCH	TURB / SAR	REM
03/30/71	5050		10.5	37 F	7.8	195	12	8.0	13	3.0	.0	99	7.0	1.0	.3	.01	.2	106	63		
1030	5050	15	77	3 C	8.2	173	.60	.66	.57	.08	.00	1.62	.15	.03	.08		--	93	0	0.7	
							31	35	30	4		90	8	2							S
05/20/71	5050		8.8	48 F	7.3	88	7.0	2.0	3.0	1.0	.0	33	4.0	1.0	.2	.00	.0	37	26		X
1430	5050		76	9 C	7.2	64	.35	.16	.13	.03	.00	.54	.08	.03	.00		--	34	0	0.3	
							52	24	19	4		83	12	5							

V2 1878.22 SHERWIN CREEK AT VOOHIS CAMP

DATE / TIME	SAMPLER / LAB	G.H. / D / DEPTH	DO / SAT	TEMP	PH (FIELD / LABORATORY)	EC (FIELD / LABORATORY)	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F / SIO2	TDS / SUM	TH / NCH	TURB / SAR	REM
04/29/70	1200			32.9F			--	--	5.8	--	--	17	--	.7	.6	--	--			3E	
	1200			8.5C		42			.25			.28		.02	.01		--				
05/27/70	1200		8.9	49.3F			--	--	4.5	--	--	--	--	.4	.3	--	--			5E	
	1200		105	9.6C	7.4	30			.20					.01	.00		--				
06/24/70	1200		8.1				--	--	2.0	--	--	20	--	.7	.3	--	--			3E	
	1200				7.5	42			.09			.33		.02	.00		--				

MINERAL ANALYSES OF SURFACE WATER

DATE TIME	SAMPLER LAB	G.H. Q DEPTH	DO SAT	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	TURB SAR	REM
							MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER					
V2 1878.22		SHERWIN CREEK AT VOOHIS CAMP												CONTINUED							
07/05/70	1200			57.2F			--	--	3.5	--	--	15	--	.4	.5	--	--			3E	
	1200			14.0C	7.7	33			.15			.25		.01	.01		--				
07/27/70	1200		8.0	55.4F			--	--	3.5	--	--	--	--	.4	.1	--	--			1E	
	1200		102	13.0C	7.6	32			.15					.01	.00		--				
08/12/70	1200		8.1	58.1F			--	--	3.5	--	--	13	--	.4	.6	--	--			2E	
	1200		107	14.5C	7.5	31			.15			.21		.01	.01		--				
09/16/70	1200		8.4	50.0F			--	--	1.7	--	--	15	--	.7	.4	--	--			1E	
	1200		100	10.0C	7.7	36			.07			.25		.02	.01		--				
10/15/70	1200		9.1	46.4F			--	--	3.0	--	--	15	--	.4	.3	--	--			4E	
	1200		103	8.0C	7.4	37			.13			.25		.01	.00		--				
10/28/70	1200		11.4	34.7F			--	--	3.0	--	--	15	--	.4	.3	--	--			2E	
	1200		108	1.5C	7.5	38			.13			.25		.01	.00		--				
11/25/70	1200		9.9	39.2F			--	--	2.2	--	--	17	--	.7	.6	--	--			1E	
	1200		101	4.0C	7.3	37			.10			.28		.02	.01		--				
04/28/71	1200		10.6	33.8F			--	--	3.0	--	--	18	--	.0	.1	--	--			1E	
	1200		99	1.0C	7.6	42			.13			.30		.00	.00		--				
05/26/71	1200		8.7	46.4F			--	--	3.0	--	--	14	--	.4	.3	--	--			2E	
	1200		98	8.0C	7.4	35			.13			.23		.01	.00		--				
06/30/71	1200						--	--	2.9	--	--	12	--	.1	.5	--	--			1E	
	1200					30			.13			.20		.00	.01		--				
08/25/71	1200						--	--	2.0	--	--	14	--	.0	.5	--	--			2E	
	1200				7.6	36			.09			.23		.00	.01		--				
V2 1878.30		MAMMOTH CREEK ABOVE SHERWIN CREEK																			
03/30/71	5050		10.7	37 F	7.8	180	12	7.0	12	2.0	.0	90	7.0	2.0	.3	.01	.2	108	59		
1000	5050	20	79	3 C	8.1	163	.60	.58	.52	.05	.00	1.48	.15	.06	.00		--	87	0	0.7	
							34	33	30	3		88	9	4							
05/20/71	5050		8.8	48 F	7.3	80	7.0	2.0	3.0	1.0	.0	33	3.0	1.0	.2	.00	.0	40	26		X
1300	5050		76	9 C	7.1	64	.35	.16	.13	.03	.00	.54	.06	.03	.00		--	33	0	0.3	
							52	24	19	4		86	10	5							S
V2 1878.35		MAMMOTH CREEK BELOW UPPER USFS CAMPGROUND																			
03/30/71	5050		10.5	37 F	7.8	180	11	7.0	11	2.0	.0	87	5.0	1.0	.2	.00	.2	100	57		
0930	5050	25	77	3 C	8.1	154	.55	.58	.48	.05	.00	1.43	.10	.03	.00		--	80	0	0.6	
							33	35	29	3		92	6	2							S
05/20/71	5050		9.1	47 F	7.3	80	7.0	2.0	3.0	1.0	.0	33	3.0	1.0	.2	.00	.0	40	26		X
1330	5050		77	8 C	7.2	65	.35	.16	.13	.03	.00	.54	.06	.03	.00		--	33	0	0.3	
							52	24	19	4		86	10	5							S
V2 1878.40		MAMMOTH CREEK AT UPPER USFS CAMPGROUND																			
03/27/63	1200						11	5.0	8.5	2.1	--	72	6.5	1.0	.2	.04	.2		50		
	1200				7.8	135	.55	.41	.37	.05		1.18	.14	.03	.08		25.0			0.5	
							40	30	27	4											
11/19/63	1200						8.8	2.9	7.4	1.8	--	50	4.1	3.0	.5	.02	.2		34		
	1200				7.7	99	.44	.24	.32	.05		.82	.09	.08	.01		15.0			0.6	
							42	23	30	5											
12/31/63	1200						10	3.9	8.6	1.9	--	67	7.0	.4	.6	--	.2		42		
	1200				8.2		.50	.32	.37	.05		1.10	.15	.01	.01		23.0			0.6	
							40	26	30	4											
05/12/64	1200						10	4.0	8.0	2.1	--	67	6.0	3.0	.5	.07	.2		40		
	1200				8.0	120	.50	.33	.35	.05		1.10	.12	.08	.01		21.0			0.5	
							41	27	28	4											
V2 1878.50		MAMMOTH CREEK AT OLD MAMMOTH ROAD																			
03/04/70	1200		11.5	40.1F	8.2		--	--	17	--	--	98	--	1.1	.0	--	--				
	1200		118	4.5C	8.1	170			.74			1.61		.03	.00		--				
03/24/70	1200		8.7	44.6F	8.5		--	--	4.5	--	--	89	--	.7	.3	--	--			9E	
	1200		96	7.0C		168			.20			1.46		.02	.00		--				
04/25/70	1200		11.2	32.0F	8.2		--	--	12	--	--	83	--	1.1	.5	--	--			5E	
	1200		102	0.0C		75			.52			1.36		.03	.01		--				
04/28/70	1200		11.2	32.0F	8.2		--	--	12	--	--	83	--	1.1	.5	--	--			5E	
	1200		102	0.0C		75			.52			1.36		.03	.01		--				
05/26/70	1200		8.8	48.2F	8.0		--	--	6.5	--	--	--	--	.4	.3	--	--			9E	
	1200		102	9.0C	7.6	75			.28					.01	.00		--				
06/23/70	1200		8.1	58.1F	8.0		--	--	.5	--	--	--	--	.7	.4	--	--			6E	
	1200		106	14.5C	7.7	65			.02					.02	.01		--				

DATE TIME	SAMPLER LAB	G.H. Q DEPTH	DO SAT	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	TURB SAR	REM
							MINERAL CONSTITUENTS IN		MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE							MILLIGRAMS PER LITER					
V2 1882.40	MAMMOTH CREEK BELOW TWIN LAKES BRIDGE													CONTINUED							
09/16/70	1200		9.3				--	--	5.0	--	--	81	--	1.4	.3	--	--			2E	
	1200				8.7	130			.22			1.33		.04	.00		--				
10/15/70	1200		9.5	44.6F			--	--	5.0	--	--	41	--	.7	.2	--	--			1E<	
	1200		108	7.0C	8.1	129			.22			.67		.02	.00		--				
10/20/70	1200		11.1	32.9F			--	--	6.0	--	--	68	--	.7	.4	--	--			1E	
	1200		105	0.5C	8.0	145			.26			1.11		.02	.01		--				
11/25/70	1200		10.2	39.2F			--	--	4.5	--	--	68	--	.7	.4	--	--			1E	
	1200		107	4.0C	7.6	124			.20			1.11		.02	.01		--				
04/20/71	1200		7.0	35.6F			--	--	6.2	--	--	85	--	.4	.3	--	--			2E	
	1200		77	2.0C	7.2	153			.27			1.39		.01	.00		--				
05/26/71	1200		9.0	42.8F			--	--	3.0	--	--	34	--	.7	.4	--	--			2E	
	1200		100	6.0C	7.3	74			.13			.56		.02	.01		--				
06/30/71	1200						--	--	2.4	--	--	23	--	.4	.6	--	--			1E	
	1200					51			.10			.38		.01	.01		--				
08/25/71	1200						--	--	3.5	--	--	49	--	.4	.8	--	--			1E	
	1200				8.8	91			.15			.80		.01	.01		--				
09/28/71	1200			40.1F			--	--	5.2	--	--	--	--	.0	.0	--	--			1E	
	1200			4.5C	8.6	105			.23					.00	.00		--				
V2 1882.50	TWIN LAKES AT OUTLET BELOW DAM, STATION NO. 3																				
08/03/71	5050		8.3	66 F	8.4	65	6.5	1.7	2.4	.4	.0	32	2.9	1.0	.5	.00	.1	30	23		E
1620			89	19 C	7.0	60	.32	.14	.10	.01	.00	.52	.06	.03	.01		--	31	0	0.2	
							56	25	18	2		84	10	5	2						S
10/20/71	5050		11.1	102 F	7.7	150	12	4.3	5.0	2.0	.0	70	2.9	1.0	.1	.00	.1	61	49		EX
1115			107	39 C	7.4	116	.63	.35	.22	.05	.00	1.15	.06	.03	.00		--	62	0	0.3	
							50	28	18	4		93	5	2							
05/24/72			9.6	44.0F	6.7		6.8	1.8	2.0	.6	.0	30	1.9	1.0	.6	.02	.2	29	24		E
0815			78	6.7C	6.0	91	.34	.15	.09	.02	.00	.49	.04	.03	.01		--	29	0	0.2	C
							57	25	15	3		86	7	5	2						S
10/11/72	5050		10.3	42 F	7.7		11	3.8	4.5	1.6	.0	59	2.4	.5	.1	.03	.1	66	44	1 A	
1045	5050	7.5	82	6 C	6.5	103	.56	.31	.20	.04	.00	.97	.05	.01	.00		--	53	0	0.3	
		0					50	28	18	4		94	5	1							S
V2 1882.60	TWIN LAKES AT PEDESTRIAN BRIDGE, STATION NO. 1																				
09/17/70	5050		12.5	55.6F	8.5		--	--	5.0	--	--	--	--	.7	1.4	--	--				
	1200		118	13.1C	9.2	130			.22					.02	.02		--				
09/17/70	5050		12.5	55.5F	8.5	150	13	4.0	6.0	2.0	.0	74	3.0	1.0	.2	.02	.1	62	49		EX
1630	1200		118	13.0C	7.0	123	.65	.33	.26	.05	.00	1.21	.06	.03	.00		--	66	0	0.4	
							50	26	20	4		93	5	2							
10/08/70	5050		11.7	46.9F	8.1		--	--	4.5	--	--	--	--	.7	.2	--	--				
	1200		99	8.3C	7.8	124			.20					.02	.00		--				
03/30/71	5050		4.7	36 F	6.0	165	13	6.0	6.0	2.0	.0	80	2.0	1.0	.5	.00	.1	74	57	25E<	E
1400	5050		34	2 C	6.8	138	.65	.49	.26	.05	.00	1.31	.04	.03	.01		--	70	0	0.3	
							45	34	18	3		94	3	2	1						
05/20/71	5050		10.3	41 F	7.0		7.0	1.0	2.0	1.0	.0	26	2.0	1.0	.0	.00	.0	28	22		
1330	5050		80	5 C	7.1	50	.35	.08	.09	.03	.00	.43	.04	.03	.00		--	27	0	0.2	
							64	15	16	5		86	8	6							S
V2 1882.78	TWIN LAKES AT UPPER AUTO BRIDGE, STATION NO. 2																				
03/30/71	5050				6.8	155	14	4.0	5.0	2.0	.0	75	2.0	1.0	.3	.00	.1	60	52	25E<	EX
1330	5050				6.9	127	.70	.33	.22	.05	.00	1.23	.04	.03	.00		--	65	0	0.3	
							54	25	17	4		95	3	2							
05/20/71	5050			50 F	7.8	60	5.0	1.0	2.0	1.0	.0	24	2.0	1.0	.2	.00	.0	29	17		X
1300	5050			10 C	7.0	49	.25	.08	.09	.03	.00	.39	.04	.03	.00		--	24	0	0.2	
							56	18	20	7		85	9	7							
10/20/71	5050		11.4	43 F	6.9	140	11	3.5	4.4	2.0	.0	62	3.8	1.0	.0	.00	.1	50	44		X
1035	5050		92	6 C	7.2	104	.58	.29	.19	.05	.00	1.02	.08	.03	.00		--	57	0	0.3	
							52	26	17	5		90	7	3							
V2 1883.00	LAKE MAMIE AT OUTLET ABOVE DAM																				
10/08/70	5050		9.0	49.5F	7.2		--	--	1.0	--	--	--	--	.7	.2	--	--				
	1200		79	9.7C	7.4	45			.04					.02	.00		--				
08/04/71	5050		7.7	65 F	7.2		2.9	1.3	1.2	.3	.0	15	3.4	1.0	.0	.00	.1	18	13		
1500	5050		81	18 C	6.7	32	.14	.11	.05	.01	.00	.25	.07	.03	.00		--	17	0	0.1	
							45	35	16	3		71	20	9							S
10/20/71	5050		9.2	61 F	7.8	60	5.3	.8	2.0	.4	.0	20	3.8	1.0	.0	.00	.1	16	17		EX
1000			72	5 C	6.6	40	.26	.07	.09	.01	.00	.33	.08	.03	.00		--	23	0	0.2	T
							60	16	21	2		75	18	7							
05/24/72	5050		9.0		6.7		4.9	1.2	1.4	.4	.0	20	1.9	.5	.4	.01	.2	24	17		
0930					6.6	40	.24	.10	.06	.01	.00	.33	.04	.01	.01		--	21	1	0.1	
							59	24	15	2		85	10	3	3						S

MINERAL ANALYSES OF SURFACE WATER

DATE TIME	SAMPLER LAB	G.H. D DEPTH	DO SAT	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	TURB SAR	REM
							MINERAL CONSTITUENTS IN MILLIGRAMS PER LITER	MILLIEQUIVALENTS PER LITER	PERCENT REACTANCE VALUE							MILLIGRAMS PER LITER					
V2 1803.00	LAKE MAMIE AT OUTLET ABOVE DAM												CONTINUED								
10/11/72	5050		9.0	44 F	6.9		3.9	1.5	1.5	.4	.0	10	3.4	.5	.1	.01	.1	24	16	0 A	
1015		5.5	73	7 C	5.7	40	.19	.12	.07	.01	.00	.30	.07	.01	.00		--	20	1	0.2	
		0					49	31	10	3		79	10	3							
V2 1803.10	LAKE MAMIE STATION NO. 1																				
09/17/70	5050		8.4	55.9F	7.3		--	--	1.1	--	--	--	--	.7	.0	--	--				
	1200		80	13.3C	7.0	44			.05					.02	.00		--				
V2 1803.55	HORSESHOE LAKE STATION NO. 2																				
10/08/70	5050		8.2	54.0F	7.2		--	--	1.0	--	--	--	--	.7	.0	--	--				
	1200		76	12.2C	7.3	24			.04					.02	.00		--				
V2 1804.00	LAKE MARY AT OUTLET BELOW DAM																				
08/04/71	5050		8.4	65 F	7.2	40	2.9	1.3	1.2	.3	.0	16	2.4	1.0	.0	.00	.1	16	13		EX
1540	5050		89	18 C	6.6	32	.14	.11	.05	.01	.00	.26	.05	.03	.00		--	17	0	0.1	
							45	35	16	3		76	15	9							S
10/20/71	5050		9.2	45 F	7.2	60	5.6	.7	2.0	.3	.0	20	3.4	1.0	.0	.00	.1	20	17		EX
0900			76	7 C	6.7	42	.28	.06	.09	.01	.00	.33	.07	.03	.00		--	23	1	0.2	
							64	14	20	2		77	16	7							
05/23/72	5050		8.7	38.5F	6.7		5.9	.9	1.4	.3	.0	20	4.3	.5	.2	.01	.1	25	10		
1700			65	3.6C	6.5	41	.29	.07	.06	.01	.00	.33	.09	.01	.00		--	23	2	0.1	
							67	16	14	2		77	21	2							
10/10/72	5050		8.4	46 F	7.0		5.4	.4	1.5	.5	.0	10	3.0	.5	.0	.02	.1	27	15	0 A	
1435		1.5	70	8 C	5.0	40	.27	.03	.07	.01	.00	.30	.08	.01	.00		--	21	0	0.2	T
		0					71	8	18	3		77	21	3							
V2 1804.05	LAKE GEORGE AT END OF BOAT DOCK																				
09/17/70	5050		8.5	61.0F	7.2		--	--	1.0	--	--	--	--	.7	.2	--	--				
	1200		86	16.1C	7.5	29			.04					.02	.00		--				
10/08/70	5050		9.0	53.1F	7.2		--	--	.9	--	--	--	--	.7	.0	--	--				
	1200		83	11.7C	7.3	29			.04					.02	.00		--				
06/25/71	5050		8.5	52.0F	6.9	25	1.3	.8	1.2	.3	.0	10	1.4	1.0	.1	.00	.1	8	7		EX
0945	5050		77	11.1C	6.2	19	.06	.07	.05	.01	.00	.16	.03	.03	.00		--	11	0	0.2	T
							32	37	26	5		73	14	14							S
08/04/71	5050		8.5	65 F	7.0	25	1.3	.9	1.2	.3	--	9	1.0	1.0	.0	.00	.1	10	7		X
1615	5050		90	18 C	6.4	10	.06	.07	.05	.01		.15	.02	.03	.00		--			0.2	
							32	37	26	5											
10/20/71	5050		9.0	48 F	6.9	40	2.5	.5	2.0	.4	.0	12	2.4	1.0	.0	.00	.1	9	8		EX
1230			77	9 C	6.4	25	.12	.04	.09	.01	.00	.20	.05	.03	.00		--	15	0	0.3	T
							46	15	35	4		71	18	11							S
05/23/72	5050		8.5	37.0F	6.7		2.9	.6	1.2	.3	.0	12	.5	.5	.5	.05	.1	10	10		E
1600			63	2.8C	6.2	23	.14	.05	.05	.01	.00	.20	.01	.01	.01		--	12	0	0.2	T
							56	20	20	4		87	4	4	4						S
10/10/72	5050		8.4	48 F	7.0		2.0	1.1	1.3	.4	.0	12	2.4	.5	.2	.01	.1	19	10	0 A	E
1410			72	9 C	5.6	25	.10	.09	.06	.01	.00	.20	.05	.01	.00		--	14	0	0.2	T
							38	35	23	4		77	19	4							
V2 1804.10	LAKE GEORGE OVERFLOW NEAR LAKE MARY																				
10/20/71	5050		9.0	46 F	6.9	60	4.9	.9	2.0	.6	.0	19	3.4	1.0	.0	.00	.1	19	16		EX
1300	5050		75	8 C	8.7	39	.24	.07	.09	.02	.00	.31	.07	.03	.00		--	22	0	0.2	
							57	17	21	5		76	17	7							
05/23/72			9.1	42.0F	6.7		3.9	1.2	1.4	.4	.0	10	1.4	.5	.4	.01	.2	17	15		E
1730			72	5.6C	6.6	32	.19	.10	.06	.01	.00	.30	.03	.01	.01		--	18	0	0.2	
							53	28	17	3		86	9	3	3						
10/10/72	5050		8.5	45 F	7.0		5.1	.5	1.5	.4	.0	17	4.3	.5	.0	.03	.1	20	15	0 A	E
1500		1.5	70	7 C	6.2	38	.25	.04	.07	.01	.00	.28	.09	.01	.00		--	21	1	0.2	
		0					60	11	19	3		74	24	3							
V2 1804.15	LAKE MARY STATION NO. 5																				
06/25/71	5050		8.3	53.0F	7.1	40	4.2	.5	1.2	.4	--	15	2.0	1.0	.2	.00	.1	19	13		X
0745	5050		76	11.7C	6.6	31	.21	.04	.05	.01		.25	.04	.03	.00		--			0.1	
							68	13	16	3											
V2 1804.20	LAKE MARY STATION NO. 6																				
06/25/71	5050		8.4	52.0F	6.9	35	2.9	.5	1.0	.3	.0	12	1.0	1.0	.0	.00	.1	15	10		EX
0800	5050		76	11.1C	6.5	29	.14	.04	.04	.01	.00	.20	.02	.03	.00		--	13	0	0.1	
							61	17	17	4		80	8	12							S
V2 1804.25	LAKE MARY STATION NO. 2																				
06/25/71	5050		8.3	54.0F	7.0	40	4.2	.5	1.2	.4	.0	15	2.0	1.0	.0	.00	.1	17	13		EX
0845	5050		77	12.2C	6.6	32	.21	.04	.05	.01	.00	.25	.04	.03	.00		--	17	0	0.1	
							68	13	16	3		70	13	9							
V2 1804.30	LAKE MARY STATION NO. 1																				
06/25/71	5050		8.4	54.0F	7.2	40	3.5	.9	2.0	.4	.0	15	3.8	1.0	.1	.00	.1	17	12		EX
0915	5050		78	12.2C	6.5	33	.17	.07	.09	.01	.00	.25	.08	.03	.00		--	19	0	0.2	
							58	21	26	3		69	22	8							S

MINERAL ANALYSES OF SURFACE WATER

DATE TIME	SAMPLER LAB	G.H. Q DEPTH	DO SAT	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	TURB SAR	REM
							MINERAL CONSTITUENTS IN: MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE									MILLIGRAMS PER LITER					
V2 1884.32	LAKE MARY AT MARYS STORE BOAT DOCK																				
05/20/71	5050		8.8	33 F	6.8	40	3.0	1.0	1.0	.8	.0	12	2.0	1.0	.0	.00	.0	17	12		X
1200	5050		61	1 C	6.5	26	.15	.08	.04	.00	.00	.20	.04	.03	.00		--	14	2	0.1	
							56	30	15			74	15	11							
V2 1884.35	COLD WATER CREEK AT LAKE MARY																				
05/24/72	5050		10.8	37.2F	6.7		6.8	.6	1.4	.3	.0	23	2.9	.5	.3	.02	.1	28	19		
1000			74	2.9C	6.8	41	.34	.05	.06	.01	.00	.38	.06	.01	.00		--	24	1	0.1	
							74	11	13	2		84	13	2							
10/10/72	5050		9.5	40 F	7.0		6.8	1.8	1.5	.4	.0	28	3.4	.5	.1	.03	.1	33	25	0 A	
1525		1.5	73	4 C	6.2	55	.34	.15	.07	.01	.00	.46	.07	.01	.00		--	28	2	0.1	
		8					60	26	12	2		85	13	2							S
V2 1884.40	MAMMOTH CREEK AT LAKE MARY																				
05/24/72	5050		10.8	37.5F	6.7		4.9	.6	1.2	.3	.8	17	3.4	.5	.4	.02	.8	25	15		
1045			74	3.1C	6.5	39	.24	.05	.05	.01	.00	.28	.07	.01	.01		--	20	1	0.1	
							69	14	14	3		76	19	3	3						S
10/10/72	5850		9.0	41 F	6.9		5.9	1.2	1.7	.4	.8	20	5.8	.5	.0	.03	.1	28	20	0 A	
1545		.5	70	5 C	5.7	49	.29	.10	.07	.01	.00	.33	.12	.01	.00		--	25	3	0.2	
		0					62	21	15	2		72	26	2							
V2 1884.45	LAKE MARY STATION NO. 8																				
06/25/71	5050		9.6	45.0F	6.9	40	4.2	.4	1.0	.3	.8	15	2.0	1.0	.2	.00	.1	17	12		X
0900	5050		79	7.2C	6.6	28	.21	.03	.04	.01	.00	.25	.04	.03	.00		--	16	0	0.1	
							72	10	14	3		70	13	9							S
V2 1884.50	LAKE MARY STATION NO. 3																				
09/17/70	5050		8.0	56.5F	7.3		--	--	1.0	--	--	--	--	.7	1.0	--	--				
	1200		77	13.6C	7.7	44			.04					.02	.02		--				
10/08/70	5050		8.8	52.0F	7.2		--	--	1.0	--	--	--	--	.4	.1	--	--				
	1200		80	11.1C	7.4	45			.04					.01	.00		--				
V2 1884.55	LAKE MARY STATION NO. 7																				
06/25/71	5050		8.6	53.0F	7.0	40	4.6	.3	1.2	.3	.0	13	2.0	1.0	.2	.00	.1	20	13		X
0815	5050		79	11.7C	6.6	32	.23	.02	.05	.01	.00	.21	.04	.03	.00		--	16	2	0.1	
							74	6	16	3		75	14	11							S
V2 1884.60	LAKE MARY STATION NO. 4																				
06/25/71	5050		7.1	53.0F	7.2	40	3.4	1.0	1.2	.4	.0	15	2.0	1.0	.1	.00	.1	18	13		X
0730	5050		65	11.7C	6.6	32	.17	.08	.05	.01	.00	.25	.04	.03	.00		--	16	0	0.1	
							55	26	16	3		78	13	9							

MINOR ELEMENT ANALYSES OF SURFACE WATER

The **CONSTITUENTS** are as follows:

AS – Arsenic	CR Hex – Chromium Hexavalent	HG – Mercury
AL – Aluminum	CR – Chromium	NI – Nickel
SB – Anitomony	CU – Copper	PB – Lead
BA – Barium	FE – Iron	SE – Selenium
BE – Beryllium	GA – Gallium	SR – Strontium
BI – Bismuth	MN – Manganese	AG – Silver
CD – Cadmium	LI – Lithium	TI – Titanium
CO – Cobalt	MO – Molybdenum	V – Vanadium

The **LAB** and **SAMPLER** codes are as follows:

1200 – Los Angeles Department of Water and Power
5010 – United States Geological Survey
5050 – Department of Water Resources
5086 – California Regional Water Quality Control Board, Lahontan Region
5788 – United States Agriculture Consultants
5999 – Unknown

Explanation of **NUMBER** used to indicate the **AMOUNT** of **CONSTITUENT** in sample:

EXAMPLE:

6 5A = 6×10^{-5} grams per liter analyzed by Atomic Absorption

10 5C = 10×10^{-5} grams per liter analyzed by Colorimetric

22 6S = 22×10^{-6} grams per liter analyzed by Spectrographic

MINOR ELEMENT ANALYSIS OF SURFACE WATER

CONSTITUENTS IN GRAMS/LITER AND NEGATIVE EXPONENT DISSOLVED/TOTAL

DATE DISCH	TIME PH	TEMP EC	SAMP LAB	ARSENIC	BARIUM	CADMIUM	CR ALL	CR HEX	COPPER	IRON	LEAD	MANGAN.	MERCURY	SELEN.	SILVER	ZINC	REM
		V2	1070.00	HOT CREEK AT THE COUNTY ROAD													
5/21/71	0830	50 F 234	5050 5050	6 5C	0 4C	0 5C	0 5C		0 5C	14 5C	2 5C	25 5C	3 7C	0 5C		1 5C	
		V2	1071.00	HOT CREEK AT THE GEYSERS													
5/20/71	1645 6.9	60 F 220	5050 5050	6 5C	0 4C	0 5C	0 5C		0 5C	14 5C	2 5C	25 5C	3 4C	0 5C		1 5C	
		V2	1082.50	TWIN LAKES AT OUTLET BELOW DAM, STATION NO. 3													
5/24/72	0015 6.7	44.0F	5050 5010	165 8S		65 8S	35 8S	165 8S	650 8S	35 8S		35 8S	35 8S		65 8S	35 8S	
10/11/72 7 E	1045 7.7	42 F	5050 5050	0 5C		0 5A			0 5A	73 5A	0 5A	5 5A				0 5A	
		V2	1083.00	LAKE MAMIE AT OUTLET ABOVE DAM													
5/24/72	0930 6.7		5050 5010	165 8S		65 8S	35 8S	165 8S	650 8S	35 8S		35 8S	35 8S		65 8S	35 8S	
10/11/72 5 E	1015 6.9	44 F	5050 5050	0 5C		0 5A			0 5A	42 5A	1 5A	11 5A				2 5A	
		V2	1084.00	LAKE MARY AT OUTLET BELOW DAM													
5/23/72	1700 6.7	38.5F	5050 5010	165 8S		65 8S	35 8S	165 8S	650 8S	35 8S		35 8S	35 8S		65 8S	35 8S	
10/10/72 1.5	1435 7.0	46 F	5050 5050	0 5C		0 5A			3 5A	34 5A	0 5A	15 5A				1 5A	
		V2	1084.05	LAKE GEORGE AT END OF BOAT DOCK													
5/23/72	1600 6.7	3.0C	5050 5010	165 8S		65 8S	35 8S	165 8S	650 8S	35 8S		550 8S	35 8S		65 8S	35 8S	
10/10/72	1410 7.0	40 F	5050 5050	0 5C		0 5A			2 5A	16 5A	1 5A	5 5A				6 5A	
		V2	1084.10	LAKE GEORGE OVERFLOW NEAR LAKE MARY													
5/23/72	1730 6.7	42.0F	5050 5010	165 8S		65 8S	35 8S	165 8S	650 8S	35 8S		35 8S	35 8S		510 8S	35 8S	
10/10/72 1 E	1500 7.0	45 F	5050 5050	0 5C		0 5A			3 5A	23 5A	0 5A	9 5A				4 5A	
		V2	1084.35	COLD WATER CREEK AT LAKE MARY													
10/10/72 '1 E	1525 7.0	40 F	5050 5050	0 5C		0 5A			2 5A	19 5A	10 5A	1 5A				10 5A	
		V2	1084.40	MAMMOTH CREEK AT LAKE MARY													
10/10/72 0.5	1545 6.9	41 F	5050 5050	0 5C		0 5A			2 5A	28 5A	0 5A	1 5A				2 5A	

END OF 294-M1

APPENDIX C

Sherwin Creek Sediment and Turbidity Data

SHERWIN CREEK ABOVE SHERWIN CREEK CAMPGROUND

(1979)

Location: SW 1/4, SW 1/4, SE 1/4 of Section 1, Township 4 South Range 27 East, M.D.B.& M., approximately 3 miles SE of Mammoth Lakes, CA. (Ranger Station) and 40 miles NW of Bishop, CA.

Drainage Area: 5.9 sq. mi.

Elevation: 7840 ft.

Remarks: Measurements are taken at the bridge on the road to Voorhis Viking Camp.

Date	Time	Instantaneous Discharge (cfs)	PH (units)	Temperature (Deg C)	Dissolved Oxygen (mg/l)	Alkalinity ($CaCO_3$) (mg/l)
Jun 5	0900	25	7.0	10.0	9	17
Jun 12	1030	20	7.0	10.0	9	34
Jun 21	1325	16	6.9	12.0	8	17
Jun 26	1135	13	6.9	12.0	8	17
Jul 3	1230	15	6.9	12.0	8	17
Jul 10	1100	14	6.9	12.0	8	17
Jul 17	0915	14	6.8	13.0	8	17
Jul 31	1120	14	6.8	13.0	8	17
Aug 7	0835	13	6.8	13.0	8	17
Aug 20	1420	10	7.0	14.0	9	17
Sep 14	1535	5.7	7.1	13.5	9	17
Sep 25	1110	5.6	7.0	10.5	9	17
Oct 12	1145	4.5	7.0	9.0	9	17
Oct 17	1015	4.5	7.0	9.0	9	17
Average		-	6.9	11.5	8.5	18

Sherwin Creek above Sherwin Creek Campground - Cont'd (1979)

Date	Hardness ($CaCO_3$) (mg/l)	Specific Conductance (micromhos)	Turbidity (NTU)	Non-filterable Residue (mg/l)	Total Coliform (colonies per 100 ml)
Jun 5	17	20	0.5	10	3
Jun 12	17	20	0.5	7	-
Jun 21	17	20	0.4	-	-
Jun 26	17	25	0.6	1	2
Jul 3	17	20	0.3	0.5	-
Jul 10	17	25	0.8	-	8
Jul 17	17	25	0.7	0.4	-
Jul 31	17	25	0.8	0.4	-
Aug 7	17	20	0.7	-	-
Aug 20	17	25	0.9	-	-
Sep 14	17	25	0.7	14	-
Sep 25	17	30	2.0	8	-
Oct 12	17	25	0.8	3	-
Oct 17	17	30	1.9	1	-
Average	17	25	.8	5	-

SHERWIN CREEK AT SHERWIN CREEK CAMPGROUND

(1980)

Location: SE 1/4, NE 1/4, of Section 1, Township 4 South Range 27 East, M.D.B.& M., approximately 3 miles SE of Mammoth Lakes (Ranger Station), CA. and 40 miles NW of Bishop, CA.

Drainage Area: 5.9 sq. mi.

Elevation: 7840 ft.

Remarks: Measurements taken at Campsite #77 in Sherwin Creek Campground.

Date	Time	Instantaneous Discharge (cfs)	Non-filterable Residue (mg/l)	Turbidity (NTU)	Fecal Coliforms (Colonies/100ml)
Jun 2	1200	12	13	14	<1
Jun 16	1000	24	4	7.0	<1
Jun 23	1000	46	7	13	<1
Jun 30	1130	57	12	6.0	8
Jul 5	1330	38	--	3.7	1
Jul 13	1020	30	--	2.8	3
Jul 27	1315	31	94	5.3	4
Aug 2	1315	27	7	2.0	7
Aug 10	0950	23	9	.8	5
Aug 17	1100	20	3	2.5	8
Aug 24	1100	17	5	5.0	6
Sep 6	1310	12	9	1.7	3
Sep 8	1030	13	3	.8	4
Average		--	15	5.0	4

SHERWIN CREEK ABOVE SHERWIN CREEK CAMPGROUND

(1981)

Location: SE 1/4, NE 1/4, SE 1/4, of Section 1, Township 4 South, Range 27 East M.D.B.& M., approximately 3 miles south east of Mammoth Lakes (Ranger Station), CA.

Drainage Area: 5.9 sq. mi.

Elevation: 7840 ft.

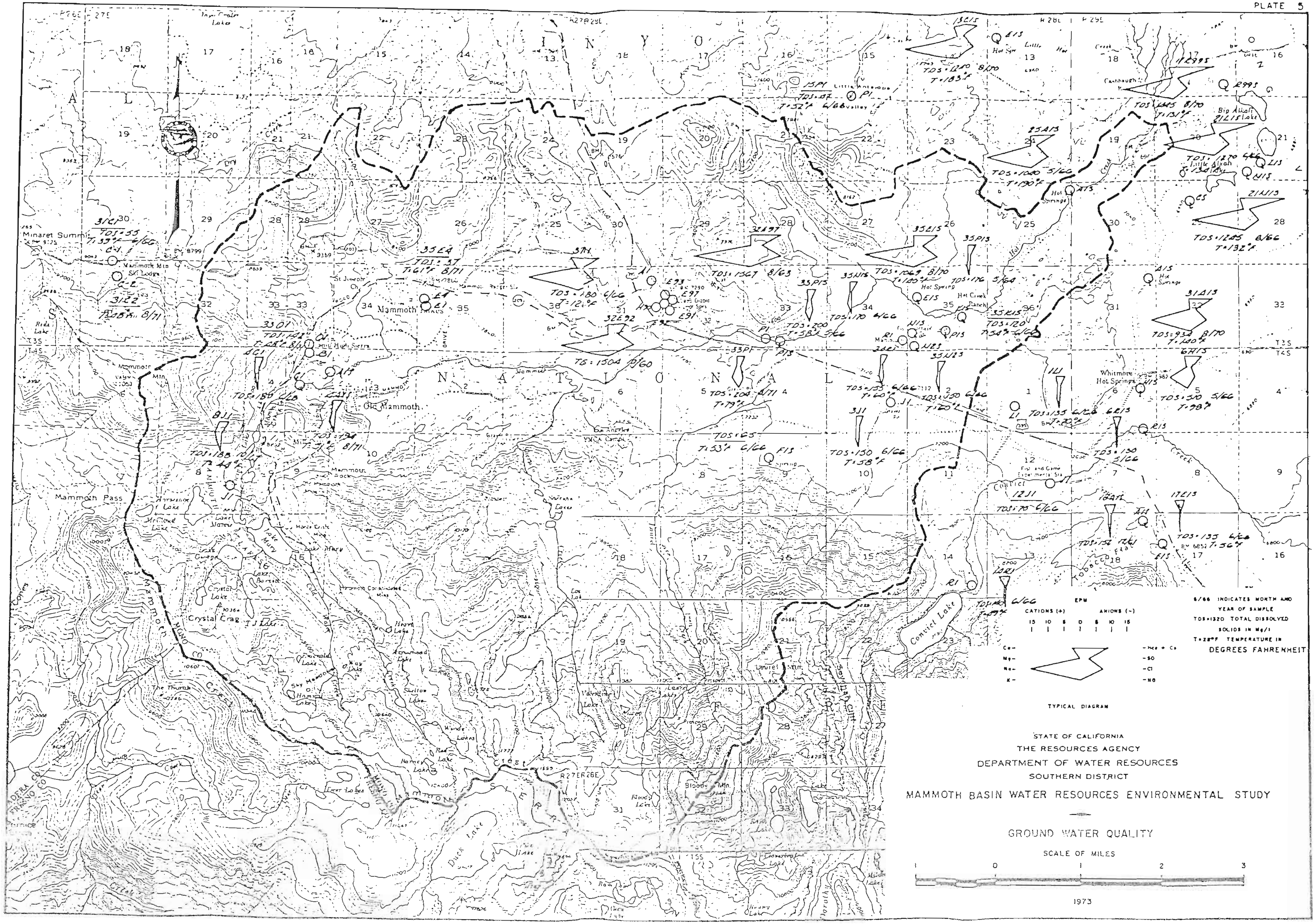
Remarks: Samples taken 100 ft. upstream of the wood vehicle bridge, near the Sherwin Creek Campground picnic area.

Date	Time	Instantaneous Discharge (cfs)	Non-filterable Residue (mg/l)	Turbidity (NTU)
Jun 22	1150	8.9	13	0.7
Jun 30	1210	8.8	16	0.4
Jul 9	1150	7.4	2	1.6
Jul 13	1150	6.5	0.7	2.0
Jul 15	1225	6.4	6	1.3
Jul 21	1200	5.7	2	1.4
Jul 23	1200	5.6	3	1.7
Jul 28	1300	4.6	2	2.7
Jul 30	1100	5.0	0.5	0.7
Aug 4	1130	3.6	1	0.6
Aug 10	1225	3.6	9	2.0
Aug 17	1320	3.5	0.8	1.8
Aug 20	1220	3.4	--	2.0
Aug 25	1040	3.4	--	1.5
Sep 2	1155	4.0	8	1.1
Sep 9	1355	3.3	3	0.4
Minimum:		3.3	0.5	0.4
Maximum:		8.9	16	2.7
Mean:		5.2	5	1.4

APPENDIX D

Mammoth Basin Groundwater Quality Data

PLATE 5


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT
MAMMOTH BASIN WATER RESOURCES ENVIRONMENTAL STUDY
GROUND WATER QUALITY
SCALE OF MILES
1 0 1 2 3
1973
TYPICAL DIAGRAM
CATIONS (+)
EPM
ANIONS (-)
15 10 5 0 5 10 15
6/66 INDICATES MONTH AND YEAR OF SAMPLE
TDS=1320 TOTAL DISSOLVED SOLIDS IN Mg/l
T=28°F TEMPERATURE IN DEGREES FAHRENHEIT
INYO
NATIONAL
Minaret Summit
Mammoth Mtn Ski Lodge
Mammoth Pass
Old Mammoth
Mammoth
Crystal Crag
Convict Lake
Whitmore Hot Springs
Hot Creek Ranch
Little Antelope Valley
Big Alkali Lake
Duck Lake

MINOR ELEMENT ANALYSES OF GROUND WATER

The CONSTITUENTS are as follows:

AS – Arsenic	CR Hex – Chromium Hexavalent	HG – Mercury
AL – Aluminum	CR – Chromium	NI – Nickel
SB – Anitomony	CU – Copper	PB – Lead
BA – Barium	FE – Iron	SE – Selenium
BE – Beryllium	GA – Gallium	SR – Strontium
BI – Bismuth	MN – Manganese	AG – Silver
CD – Cadmium	LI – Lithium	TI – Titanium
CO – Cobalt	MO – Molybdenum	V – Vanadium

The LAB and SAMPLER codes are as follows:

1200 – Los Angeles Department of Water and Power
5010 – United States Geological Survey
5050 – Department of Water Resources
5086 – California Regional Water Quality Control Board, Lahontan Region
5788 – United States Agriculture Consultants
5999 – Unknown

Explanation of NUMBER used to indicate the AMOUNT of CONSTITUENT in sample:

EXAMPLE:

6 5A = 6×10^{-5} grams per liter analyzed by Atomic Absorption

10 5C = 10×10^{-5} grams per liter analyzed by Colorimetric

22 6S = 22×10^{-6} grams per liter analyzed by Spectrographic

MINOR ELEMENT ANALYSIS OF GROUND WATER

CONSTITUENTS IN GRAMS/LITER AND NEGATIVE EXPONENT DISSOLVED/TOTAL

DATE DISCH	TIME PH	TEMP EC	SAMP LAB	ARSENIC	BARIUM	CADMIUM	CR ALL	CR HEX	COPPER	IRON	LEAD	MANGAN.	MERCURY	SELEN.	SILVER	ZINC	REM
		03S/27E-31C01 M															
2/15/64																	
			5999	1 5C													
6/22/64	1030	39.0F	5050	0 5S					12 6S	6 6S	1 6S	55 7S	2 4S		2 6S	16 6S	
			5010														
		03S/27E-33C01M M															
0/25/71				1 5C													
			5050														
		03S/28E-13E01S M															
6/16/66	1030	100.0F	5050	11 4S	25 5S	12 6S	1 6S		33 7S	55 6S	5 7S	57 5S	4 4S		2 6S	12 5S	
			5010														
9/20/66	1300	100 F				36 8S	36 8S		36 0S	29 6S	36 8S	278 6S				14 7S	
			5010														
5/16/67	1045	100 F		56 5C													
			5050														
9/01/70		103 F															
			5999	112 5C													
		03S/28E-15P01 M															
6/20/64	1530	52.0F		0 5C													
			5050														
		03S/28E-25A01S M															
5/17/57		93.0C		10 4C					0 5C	4 5C	0 4C	0 4S				1 5C	
	8.3	1620	5999														
5/12/66	1600	190.0F	5050	11 4S	24 5S	5 6S	5 7S		5 6S	14 6S	35 6S	17 6S	1 4S	14 6S	1 6S	17 6S	
			5010														
9/20/66	1000	180 F				36 8S	36 8S		36 0S	10 6S	36 8S	74 6S					
			5010														
5/16/67	0900	184 F		60 5C													
			5050														
		03S/28E-31A01 M															
6/20/64	1200	128 F		185 5C													
			5050														
9/21/64	0900	130 F				36 8S	36 8S		36 8S	32 6S	70 7S	147 6S				145 0S	
			5010														
		03S/28E-31H90 M															
9/17/41																	
			5999	146 5C						1 3C							
7/01/42																	
			5999	256 5C						32 4C							
		03S/28E-31H93 M															
8/31/60																	
			5091							0 5C		0 5C					
9/27/60		275.0F															
			5999							2 5C		0 5C					
		03S/28E-32E01 M															
7/15/64			5050	4 8S	1 5S	25 7S	5 7S		3 6S	1 4S	37 7S	85 7S	2 6S		2 6S	12 6S	
			5010														
		03S/28E-32E02 M															
7/11/66		105.0F	5050	8 5S	24 8S	25 7S	5 7S		15 6S	1 4S	27 7S	185 7S	2 4S		2 6S	8 5S	
			5010														
		03S/28E-32E90 M															
3/26/63			5050	200 5C						20 5C							
	7.6	1930	5050														
5/07/63			1200														
		1600	1200	2 3S													
11/26/63	0830		5050														
	7.8	1800	5788	82 5C													
		03S/28E-32E95 M															
7/24/63																	
			5999	16 4C						12 5C							
6/24/64	1000	124 F		0 5C													
			5050														
		03S/28E-32E97 M															
7/01/63																	
			5999	97 5C						104 5C							
0/08/63																	
			5999	3 3C						15 5C							

MINOR ELEMENT ANALYSIS OF GROUND WATER

DATE DISCH	TIME PH	TEMP EC	SAMP LAB	ARSENIC	BARIUM	CADMIUM	CR ALL	CR HEX	COPPER	IRON	LEAD	MANGAN.	MERCURY	SELEN.	SILVER	ZINC	REM
				CONSTITUENTS IN GRAMS/LITER AND NEGATIVE EXPONENT DISSOLVED/TOTAL													
03S/28E-33P01 M																	
3/26/63		91 F	5050	5 5C						44 3C							
5/21/63	0040	89 F	5050	1 5C													
5/21/63	0040	83 F	5010			1 6S	1 6S		1 6S	17 6S	1 6S	71 6S				4 6S	
9/15/63	1500		5700	0 5C													
11/04/63			5700	12 6C													
5/13/66	0930		5050 5010	4 5S	9 4S	5 6S	5 7S		2 3S	6 5S	05 7S	26 6S	1 4S		1 6S	32 5S	
5/13/66	0930		5050	4 5C	9 4C	5 6C	5 7C		2 3C	6 5C	05 7C	26 6C	1 4C		1 6C	32 5C	
03S/28E-33P01S M																	
5/13/66		50.0F	5050 5010	4 5S	80 5S	25 7S	5 7S		10 7S	9 6S	6 7S	36 7S	1 4S		1 6S	1 5S	
03S/28E-33P02 M																	
3/12/63	0945	61 F	5050							1 4C							
5/13/66	1000	58 F	5050	6 5C													
03S/28E-33P02S M																	
5/21/63	0850	64 F	5050	1 4C													
03S/28E-34R01 M																	
3/12/63	1231	61 F	5050							14 5C		0 5C					
3/26/63	1302	64 F	5050	4 5C													
5/21/63	0930	62 F	5010			1 6S	1 6S		1 6S	45 7S	1 6S	20 6S				4 6S	
6/20/66		60.0F	5050 5010	4 5S	1 5S	25 7S	5 7S		20 7S	6 6S	7 7S	11 7S	2 4S		2 6S	4 6S	
6/20/66	0930	60.0F	5050 5050	5 5C													
03S/28E-34R02 M																	
8/21/71	1600		5050	4 5C													
03S/28E-35C01S M																	
6/14/66		165.0F	5050 5010	12 4S	6 4S	5 6S	5 7S		2 6S	35 7S	5 7S	22 7S	2 4S		2 6S	5 7S	
6/14/66	1700	165 F	5050	2 3C													
5/14/67	1500	163 F	5050	12 4C													
9/01/70		140 F	5999	146 5C													
03S/28E-35K01S M																	
6/24/55	7.5	54.0F 164	5999						1 4C	2 5C 3 5C		0 5S	0 5C				
5/14/63	0945 7.3	53 F 160	5050 5050	4 5C													
7/08/63	7.3	56 F 174	5050 5050	4 5C													
11/26/63	0929 7.4	240	5006 5700	44 6C													
5/11/64	7.5	165	5006 5700	25 6C													
6/14/66		54.0F	5050 5010	2 4S	1 5S	25 7S	0 7S		[illegible]	50 7S	20 7S	12 7S	2 4S		2 6S	5 6S	
6/14/66	1000	54 F	5050	2 5C													
03S/28E-35N01S M																	
6/24/55	7.4	61.5F 243	5999						1 4C	4 5C 7 5C		0 5C					
5/14/63	7.3	61 F 227	5050 5050	4 5C													
7/08/63	1145 7.3	60 F 219	5050 5050	5 5C													
7/11/63	0935 7.2	60 F 241	5050 5050	8 5C													

MINOR ELEMENT ANALYSIS OF GROUND WATER

CONSTITUENTS IN GRAMS/LITER AND NEGATIVE EXPONENT DISSOLVED/TOTAL

DATE DISCH	TIME PH	TEMP EC	SAMP LAB	ARSENIC	BARIUM	CADMIUM	CR ALL	CR HEX	COPPER	IRON	LEAD	MANGAN.	MERCURY	SELEN.	SILVER	ZINC	REM
		03S/28E-35H01S M								CONTINUED							
9/16/63	1600		5050														
	7.3	375	5700	5 5C													
10/21/63	1350		5050														
	7.0	226	5700	40 6C													
11/04/63			5050	44 6C													
	7.3	220	5050														
11/26/63	0955		5050														
	7.1	267	5700	72 6C													
12/10/63	1100		5050														
	7.3	230	5700	40 6C													
12/31/63	0945		5050														
	7.1	237	5700	20 6C													
1/13/64	1400		5050														
	7.1	207	5700	40 6C													
2/18/64	1040		5050														
	8.0	222	5700	40 6C													
3/29/64	1320		5050														
	8.0	220	5700	50 6C													
4/25/64	1045		5050														
	7.3	245	5700	52 6C													
6/14/66	1640			5 5C													
			5050														
		03S/28E-35H02S M															
4/24/55		61.5F							1 4C	2 5C		0 5C					
			5999							5 5C							
5/14/63	0920	61 F	5050	6 5C													
	7.3	223	5050														
7/08/63	1155	60 F	5050	7 5C													
	7.3	209	5050														
7/11/63	0930	60 F	5050	4 5C													
	7.9	222	5050														
9/16/63	1600		5050														
	7.1	360	5700	6 5C													
10/21/63	1400		5050														
	7.1	230	5700	40 6C													
11/04/63	0955		5050														
	7.0	210	5700	32 6C													
11/19/63	0820		5050														
	7.9	243	5700	40 6C													
12/10/63	1110		5050														
	0.0	220	5700	32 6C													
12/31/63																	
	7.2	215	5700	32 6C													
3/10/64	0910																
	7.6	212	5700	12 6C													
4/13/64	1050		5050														
	7.7	225	5700	40 6C													
5/11/64			5006														
	7.9	210	5700	43 6C													
6/14/66		60.0F	5050	4 5S	1 5S	25 7S	5 7S		1 6S	65 7S	5 7S	12 7S	2 4S		2 6S	1 5S	
			5010														
6/14/66	1640	60 F		5 5C													
			5050														
		03S/28E-35P02S M															
5/14/63	0935	55 F	5050	5 5C													
	7.4	194	5050														
7/08/63	1215	60 F	5050	6 5C													
	7.3	200	5050														
11/26/63	0920		5050														
	7.4	197	5700	80 6C													
5/11/64			5006														
	7.6	195	5700	31 6C													
6/14/66	1700	54 F		4 5C													
			5050														
		03S/29E-17R99S M															
9/01/70		131 F															
			5999	67 5C													
		03S/29E-21L01S M															
6/11/66		120.0F	5050	24 5S	144 6S	25 7S	5 7S		38 7S	1 4S	13 7S	33 6S	2 4S		2 6S	25 7S	
			5010														
6/11/66	1610	120 F		52 5C													
			5050														
9/26/66	1530	138 F				34 8S	36 8S		36 8S	21 6S	36 8S	157 6S				145 8S	
			5010														

MINOR ELEMENT ANALYSIS OF GROUND WATER

CONSTITUENTS IN GRAMS/LITER AND NEGATIVE EXPONENT DISSOLVED/TOTAL

DATE DISCH	TIME PH	TEMP EC	SAMP LAB	ARSENIC	BARIUM	CADMIUM	CR ALL	CR HEX	COPPER	IRON	LEAD	MANGAN.	MERCURY	SELEN.	SILVER	ZINC	REM
03S/29E-21L01S M											CONTINUED						
5/14/67	1330	134 F	5050	32 5C													
03S/29E-23H01S M																	
6/22/66	1500	132 F	5050	4 5C													
03S/29E-29R01S M																	
9/01/70		172 F	5999	7 4C													
03S/29E-31A01S M																	
5/13/66		142 F	5050	11 4C	69 5C	5 6C	5 7C		46 7C	0 6C	25 7C	2 6C	1 4C		1 6C	6 5C	
9/01/70		140 F	5999	121 5C													
04S/27E-04Q01M M																	
9/16/60			5091							0 5C		0 5C					
04S/27E-08J01M M																	
1/03/60		44 F	5091							3 5C		25 6C					
04S/28E-01L01 M																	
6/15/66	1420		5050	0 5C													
04S/28E-03J01 M																	
6/20/66	1045	58 F	5050	9 5C													
04S/28E-09F01S M																	
6/19/66		53.0F	5050 5010	4 5S	1 5S	25 7S	1 6S		5 6S	15 6S	7 7S	13 7S	2 4S		2 6S	25 6S	
6/19/66	1030	53 F	5050	1 5C													
04S/28E-12J01 M																	
6/21/66	1600		5050	0 5C													
04S/28E-14R01 M																	
6/24/66	1600	49 F	5050	0 5C													
04S/29E-06H01S M																	
8/28/41		940	1200							0 5C							
1/08/46		715	1200							1 4C							
2/28/56	7.7	733	1200							5 6C							
12/12/61		772	1200							5 6C							
5/12/66		98.0F	5050 5010	2 4S	16 5S	5 6S	5 7S		39 7S	10 6S	14 6S	21 7S	1 4S		2 6S	25 6S	
5/12/66	1000	98 F	5050	66 5C													
04S/29E-06R01S M																	
2/28/56	8.1	212	1200							5 6C							
12/12/61	8.0	221	1200							5 6C							
5/12/66	1030		5050	0 5C													
04S/29E-17E01S M																	
6/24/66		56.0F	5050 5010	4 5S	1 5S	25 7S	1 6S		4 6S	75 7S	75 7S	15 7S	2 4S		2 6S	25 6S	
6/24/66	1520	56 F	5050	2 5C													
04S/29E-18A01S M																	
3/20/56	7.6	227	1200							4 6C							
12/12/61	7.8	250	1200							5 6C							

MINERAL ANALYSES OF GROUND WATER
An explanation of column headings follows:

TDS – Gravimetric determination of total dissolved solids at 180° Celsius (or *105° C).
SUM – Total dissolved solids determined by addition of analyzed constituents. ≠ – Difference between total anions and total cations of over 5 percent.
EC – The electrical conductance in micromhos at 25° Celsius.
pH – Measure of acidity or alkalinity of water.
TH – Total hardness.
NCH – Noncarbonate hardness.
TIME – Pacific Standard Time on a 24-hour clock.
TEMP – Water temperature in degrees Fahrenheit at the time of field sampling.
SAR – Sodium Adsorption Ratio.
REM (REMARKS) as follow:

- T – Total Dissolved Solids (TDS) and the calculated SUM of constituents are not within 20 percent of each other.
- E – Total Dissolved Solids value is not within the range of 0.35 to 0.70 of the electrical conductivity.
- S – The anion sum and cation sum for a complete analysis is not within the prescribed tolerance of ±5 percent.
- C – The electrical conductivity divided by the EC–EMP factor (or if absent, 100) is not within 20 percent of the average of the cation sum and anion sum for complete analyses.
- X – The field EC and the lab EC are not within 20 percent of each other.
- Z – The value of the constituent is greater than the field limit; in which case all 9's will appear.
- N – This analysis has been reported under a different station number.

The MINERAL CONSTITUENTS are as follows:

B	– Boron	K	– Potassium
CA	– Calcium	MG	– Magnesium
CL	– Chloride	NA	– Sodium
CO_3	– Carbonate	NO_3	– Nitrate
F	– Fluoride	SIO_2	– Silica
HCO_3	– Bicarbonate	SO_4	– Sulfate

The LAB and SAMPLER agency codes are as follows:

1200 – Los Angeles Department of Water and Power
4740 – Southern California Edison Company
5010 – U. S. Geological Survey
5050 – Department of Water Resources
5086 – California Regional Water Quality Control Board, Lahontan Region
5091 – State Department of Public Health, Bureau of Sanitary Engineering
5788 – United States Agriculture Consultants
5999 – Unknown

MINERAL ANALYSES OF GROUND WATER

DATE / TIME	SAMPLER / LAB	TEMP		FIELD / LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F / SIO2	TDS / SUM	TH / NCH	SAR	REM
						MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER					
03S/27E-31C01 M																				
06/22/66		39	F			3.0	2.0	8.0	4.0	.0	46	.0	.0	.0	.00	.1	55	16		
1030	5050	4	C	5.9	79	.15	.16	.35	.10	.00	.75	.00	.00	.00		--	40	0	0.9	T
						20	21	46	13		100									
08/27/71	5050	39	F	5.7	100	--	--	--	--	--	--	--	--	--	--	--				
1200	5050	4	C													--				
03S/27E-31C02 M																				
08/27/71	5050	38	F	5.7	120	7.0	4.0	7.0	2.0	.0	57	2.0	2.0	3.8	.01	.0	74	34		E
1047	5050	3	C	6.7	101	.35	.33	.30	.05	.00	.93	.04	.06	.06		--	56	0	0.5	T
						34	32	29	5		85	4	6	6						S
03S/27E-33001H M																				
08/25/71	5050	48	F	5.3	205	8.0	9.0	17	3.0	.0	98	14	2.0	.0	.00	.2	142	57		E
1810	5050	9	C	6.5	190	.40	.74	.74	.08	.00	1.61	.29	.06	.00		--	101	0	1.0	T
						20	38	38	4		82	15	3							
03S/27E-35E01 M																				
08/25/71	5050	60	F		75	--	--	--	--	--	--	--	--	--	--	--				
1500	5050 -	16	C													--				
03S/27E-35E02 M																				
08/25/71	5050	57	F		80	--	--	--	--	--	--	--	--	--	--	--				
1440	5050	14	C													--				
03S/27E-35E03 M																				
08/25/71	5050	60	F	6.7	65	--	--	--	--	--	--	--	--	--	--	--				
	5050	16	C													--				
03S/27E-35E04 M																				
08/25/71	5050	61	F		95	5.0	2.0	3.0	2.0	.0	31	2.0	3.0	.0	.00	.0	37	21		X
1545	5050	16	C	6.8	64	.25	.16	.13	.05	.00	.51	.04	.08	.00		--	32	0	0.3	
						42	27	22	8		81	6	13							S
03S/28E-13E01S M																				
06/16/66	5050	180	F	7.5		25	.0	400	30	.0	727	90	204	.8	9.40	8.6	1240	63		
1030	5050	82	C	7.1	1908	1.25	.00	17.40	.77	.00	11.92	1.87	5.75	.01		--	1117	0	22.0	
						6		90	4		61	10	29							
05/14/67		180	F			--	--	--	--	.0	--	--	203	--	--	--				
1045	5050	82	C	7.1	1900					.00			5.72			--				
08/13/70		183	F			23	1.2	413	41	62	610	95	208	.0	8.71	6.5		62		
	5999	84	C	8.6	1880	1.15	.10	17.98	1.06	2.08	10.00	1.98	5.88	.00		85.0	1239	0	22.8	
						6		89	5	10	50	10	29							
03S/28E-15P01 M																				
06/20/66	5050	52	F			3.0	.0	9.0	5.0	.0	34	5.0	1.0	.0	.00	.3	47	8		
1530	5050	11	C	7.2	70	.15	.00	.39	.13	.00	.56	.10	.03	.00		--	40	0	1.4	
						22		58	19		81	14	4							
03S/28E-25A01S M																				
05/17/57	5010	199	F			4.4	.2	350	20	8.0	497	90	200	.0	10.0	10.0	1110	12		
	5010	93	C	8.3	1620	.22	.02	15.23	.51	.27	8.15	1.87	5.64	.00		99.9	1027	0	44.3	
						1		95	3	2	51	12	35							Z
05/12/66	5050	190	F			3.0	1.0	325	22	.0	481	84	190	1.2	9.20	8.6	1040	12		
1600	5050	88	C	8.2	1542	.15	.08	14.14	.56	.00	7.88	1.75	5.36	.02		--	872	0	41.5	
						1	1	95	4		52	12	36							
05/14/67		184	F			--	--	--	--	.0	--	--	190	--	--	--				
900	5050	84	C	7.5	1572					.00			5.36			--				
03S/28E-31A01 M																				
06/20/66	5050	128	F			51	.0	360	38	.0	549	120	258	.8	11.0	11.0	1380	127		E
1200	5050	53	C	6.8	1890	2.54	.00	15.66	.97	.00	9.00	2.50	7.28	.01		--	1109	0	13.9	
						13		82	5		48	13	39							
03S/28E-31H90 M																				
10/16/40	5999					6.0	22	481	--	--	415	170	360	--	--	12.0		107		
	5999				2226	.30	1.81	20.92			6.80	3.54	10.15			40.0			20.4	
12/17/41	5999					4.0	3.0	--	--	--	348	--	337	--	--	14.0		23		
	5999			8.8	2250	.20	.25				5.70		9.50			99.9				
																				Z

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	SAR	REM
					MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER					
03S/28E-32E90 M																			
03/14/63	5050		7.1	1970	11 .55 3	2.0 .16 1	420 18.27 92	34 .87 4	.0 .00	527 8.64 45	140 2.91 15	264 7.50 39	1.0 .02	14.0	11.0 40.0	1390 1107	36 0	30.6	E
03/26/63	5050 5050	130 F 94 C	7.6	1938	6.3 .31 2	1.1 .09	420 18.27 93	35 .90 5	.0 .00	476 7.80 42	139 2.89 16	274 7.73 42	1.0 .02	12.0	10.0 99.9	1370 1222	19 0	40.6	E ZS
10/21/63 1245	5780		7.3	1740	12 .60 3	1.0 .08	410 17.84 92	32 .82 4	.0 .00	458 7.51 41	132 2.75 15	288 8.12 44	.0 .00	13.4	20.0 91.0	1450 1205	34 0	38.6	E S
11/26/63 838	5780		7.0	1800	6.0 .30 2	1.0 .08	405 17.62 94	30 .77 4	.0 .00	459 7.52 41	134 2.79 15	291 8.21 44	.0 .00	12.9	5.0 88.0	1400 1194	19 0	40.3	E
03S/28E-32E92 M																			
09/27/60	5010 5010		9.1	1870	--	--	375 16.31	37 .95	--	--	--	278 7.84	--	11.0	-- --				
10/20/60	5780		9.2	2015	3.0 .15 1	.0 .00	408 17.75 98	9.0 .23 1	90 3.00 17	166 2.72 16	147 3.06 18	301 8.49 49	.0 .00	5.00	14.0 48.0	1504 1093	9 0	64.9	E NT
12/06/60	5999 1200		9.5	2016	4.0 .20 1	.0 .00	450 19.58 94	40 1.02 5	--	--	167 3.48	312 8.80	2.5 .04	15.0	12.0 99.9		10	62.0	Z
03S/28E-32E93 M																			
08/31/60	5091		8.9		.4 .02	.7 .06	415 18.05 94	44 1.13 6	37 1.23 6	423 6.93 36	120 2.64 14	293 8.26 43	.0 .00	--	13.0 --	1490 1126	4 0	91.7	NT
09/27/60	5010 5010	*275 F 135 C	9.2	1940	1.6 .08	.0 .00	400 17.40 95	36 .92 5	120 4.00 21	232 3.80 20	130 2.71 14	293 8.26 44	6.2 .10 1	13.0	13.5 99.9	1440 1214	4 0	87.1	E N Z
03S/28E-32E95 M																			
07/24/63	5999		9.3		1.0 .05	2.0 .16 1	475 20.66 95	30 .77 4	139 4.63 22	340 5.57 27	96 2.00 10	310 8.74 42	1.2 .02	13.0	21.0 98.0	1555 1332	11 0	63.1	
03S/28E-32E97 M																			
08/08/63			9.3		.0 .00	.6 .05	430 18.71 94	48 1.23 6	120 4.27 19	330 5.41 24	170 3.54 16	330 9.31 41	3.0 .06	1.50	11.0 99.9	1567 1374	4 0	119.1	ZS
03S/28E-33P01 M																			
03/12/63 930	5050		7.0	398	15 .75 20	9.0 .74 20	48 2.09 56	7.0 .18 5	.0 .00	142 2.33 62	16 .33 9	39 1.10 29	.5 .01	1.40	.4 98.0	300 296	75 0	2.4	E
03/26/63	5050 5050	91 F 33 C	6.7	350	13 .65 19	8.5 .70 21	42 1.83 54	7.6 .19 6	.0 .00	117 1.92 58	16 .33 10	37 1.04 32	.5 .01	1.20	.4 99.9	265 283	68 0	2.2	E
04/02/63	5780	89 F 32 C	6.5	330	15 .75 22	8.0 .66 19	43 1.87 54	7.0 .18 5	.0 .00	116 1.90 57	17 .35 11	38 1.07 32	.0 .00	1.38	.4 9.0	284 195	71 0	2.2	E T
05/21/63 840	5050	89 F 32 C	6.7	357	9.0 .45 13	12 .99 28	43 1.87 54	7.0 .18 5	.0 .00	122 2.00 58	18 .37 11	38 1.07 31	.5 .01	1.40	.4 98.0	208 207	72 0	2.2	E
06/25/63	5050 1200		7.7	263	7.2 .36 16	5.4 .44 20	30 1.31 59	4.8 .12 5	--	--	12 .25	21 .59	1.0 .02	1.10	.3 66.0		40	2.1	
06/25/63 915	5050	77 F 25 C	6.6	235	8.0 .40 17	5.0 .41 17	32 1.39 59	6.0 .15 6	.0 .00	90 1.48 63	12 .25 11	21 .59 25	1.2 .02 1	.96	.4 75.0	198 205	41 0	2.2	E
06/26/63	5999		7.7	263	7.0 .35 16	5.0 .41 19	30 1.31 60	5.0 .13 6	.0 .00	--	12 .25	21 .59	1.0 .02	1.10	.3 66.0		38	2.1	
06/26/63 1	5999 5999		7.0	208	8.8 .44 22	3.9 .32 16	26 1.13 56	5.0 .13 6	.0 .00	97 1.59 44	70 1.46 40	19 .54 15	1.1 .02 1	.88	.5 .8	216 183	38 0	1.8	E N C S
08/08/63	5999		7.1	135	9.0 .45 21	5.0 .41 19	26 1.13 53	6.0 .15 7	.0 .00	92 1.51 58	12 .25 10	28 .79 30	3.8 .06 2	.70	.1 68.0	224 204	43 0	1.7	E C S
09/15/63 1500	5780		7.8	262	13 .65 25	5.0 .41 15	33 1.44 54	6.0 .15 6	.0 .00	105 1.72 66	8.0 .17 7	25 .71 27	.0 .00	1.06	.2 54.0	220 197	53 0	2.0	E
10/21/63 1310	5780		6.5	320	20 1.00 31	4.0 .33 10	40 1.74 54	7.0 .18 6	.0 .00	117 1.92 60	17 .35 11	33 .93 29	.0 .00	1.66	.2 60.0	262 240	67 0	2.1	E
11/04/63	5780		7.3	350	15 .75 22	8.0 .66 20	41 1.78 53	7.0 .18 5	.0 .00	120 1.97 59	16 .33 10	36 1.02 31	.0 .00	1.43	.2 61.0	256 244	71 0	2.1	E
12/10/63 1045	5780		7.3	360	17 .85 23	8.0 .66 18	44 1.91 53	8.0 .20 6	.0 .00	124 2.03 59	19 .40 12	37 1.04 30	.0 .00	1.48	.2 65.0	276 260	76 0	2.2	E
01/13/64 1320	5780		7.3	330	16 .80 23	7.0 .58 16	45 1.96 56	7.0 .18 5	.0 .00	128 2.10 59	16 .33 9	40 1.13 32	.0 .00	1.53	.2 71.0	270 264	60 0	2.4	E

*Reported as 42 psi pressure; not included in statistical summary.

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP		FIELD LABORATORY PH	EC	MINERAL CONSTITUENTS IN CA	MG	NA	K	CO3	MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE HCO3	SO4	CL	NO3	MILLIGRAMS PER LITER B	F SIO2	TDS SUM	TH NCH	SAR	REM
035/20E-33P01 M													CONTINUED							
02/03/64						16	6.0	46	7.0	.0	121	23	37	.0	1.45	.2	250	65		E
1400	5700			6.0	340	.80	.49	2.00	.18	.00	1.98	.48	1.04	.00		72.0	260	0	2.5	
						23	14	50	5		57	14	30							
03/29/64						14	7.0	40	6.0	.0	117	18	34	.0	1.44	.1	236	64		E
1305	5700			7.0	315	.70	.58	1.74	.15	.00	1.92	.37	.96	.00		63.0	241	0	2.2	
						22	18	55	5		59	11	30							
04/25/64						31	9.0	40	8.0	.0	175	19	36	.0	1.44	.1	300	115		E
1040	5700			7.1	400	1.55	.74	1.74	.20	.00	2.87	.40	1.02	.00		62.0	292	0	1.6	
						37	17	41	5		67	9	24							
05/11/64						27	8.0	41	7.0	.0	153	19	39	.0	1.28	.2	256	101		E
	5700			8.0	350	1.35	.66	1.78	.18	.00	2.51	.40	1.10	.00		--	218	0	1.8	
						34	17	45	5		63	10	27							
05/13/64						13	9.0	58	7.0	.0	173	17	33	.0	1.46	.4	310	70		E
930	5050			7.5	409	.65	.74	2.52	.18	.00	2.84	.35	.93	.00		--	224	0	3.0	T
						16	18	62	4		69	8	23							
04/28/71	5050	79	F	6.2	280	10	7.0	33	6.0	.0	106	15	22	.5	.92	.2	204	54		E
1004	5050	26	C	7.1	266	.50	.58	1.44	.15	.00	1.74	.31	.62	.01		--	147	0	2.0	T
						19	22	54	6		65	12	23							
035/20E-33P01S M																				
03/12/63		61	F			19	7.8	47	7.0	.0	110	24	45	1.5	1.80	.3	250	76		
945	5050	16	C	7.0	373	.95	.58	2.04	.18	.00	1.80	.50	1.27	.02		60.0	266	0	2.3	
						25	15	54	5		50	14	35	1						
03/26/63		62	F			23	7.0	50	8.0	.0	117	28	55	1.5	1.85	.4	255	87		
1223	5050	17	C	7.4	420	1.15	.58	2.18	.20	.00	1.92	.58	1.55	.02		54.0	286	0	2.3	
						28	14	53	5		47	14	38							
04/02/63		63	F			28	4.0	52	7.0	.0	115	29	53	.0	1.04	.2	282	87		
1000	5700	17	C	7.0	410	1.40	.33	2.26	.18	.00	1.88	.60	1.49	.00		42.0	273	0	2.4	
						34	8	54	4		47	15	38							S
04/30/63		64	F			21	10	50	8.0	.0	122	31	55	.0	1.64	.2	294	94		
910	5700	18	C	6.9	450	1.05	.82	2.18	.20	.00	2.00	.65	1.55	.00		46.0	283	0	2.2	
						25	19	51	5		48	15	37							
05/21/63		64	F			16	10	51	8.0	.0	124	27	46	.5	1.70	.3	270	81		
850	5050	18	C	7.1	407	.80	.82	2.22	.20	.00	2.03	.56	1.30	.01		57.0	278	0	2.5	
						20	20	55	5		52	14	33							
07/02/63						10	4.0	18	5.0	.0	83	18	10	2.0	.58	.5	228	42		E
	5999			7.3	160	.50	.33	.78	.13	.00	1.36	.37	.28	.03		43.0	151	0	1.2	T
						29	19	45	7		67	18	14	1						S
08/00/63						10	3.0	22	5.0	.0	86	13	18	4.0	.50	.1	254	38		E
	5999			7.2	110	.50	.25	.96	.13	.00	1.41	.27	.51	.06		49.0	167	0	1.6	TC
						27	14	52	7		63	12	23	3						S
01/13/64						29	3.0	38	6.0	.0	111	19	45	.0	1.60	.2	224	85		
1330	5700			7.6	350	1.45	.25	1.65	.15	.00	1.82	.40	1.27	.00		30.0	234	0	1.8	
						41	7	47	4		52	11	36							
02/03/64	5050					24	8.3	41	6.7	.0	114	25	57	.0	1.90	.2	240	95		
1410	5700			7.3	380	1.20	.68	1.78	.17	.00	1.87	.52	1.61	.00		38.0	250	1	1.8	
						31	18	46	4		47	13	40							
02/18/64						25	10	43	7.0	.0	124	31	52	.0	1.97	.1	270	104		E
925	5700			7.6	390	1.25	.82	1.87	.18	.00	2.03	.65	1.47	.00		39.0	270	2	1.8	
						30	20	45	4		49	16	35							
03/10/64	5050					26	11	46	7.4	.0	129	34	59	.0	2.16	.1	276	107		
0900	5700			8.1	435	1.30	.90	2.00	.19	.00	2.11	.71	1.66	.00		39.0	280	5	1.9	
						30	21	46	4		47	16	37							
03/29/64						25	10	48	7.0	.0	132	28	60	.0	2.12	.1	262	104		
1310	5700			8.0	430	1.25	.82	2.09	.18	.00	2.16	.58	1.69	.00		40.0	285	0	2.1	
						29	19	48	4		49	13	38							
04/25/64						25	9.0	48	7.0	.0	131	35	54	.0	1.86	.1	266	100		
1040	5700			7.1	410	1.25	.74	2.09	.18	.00	2.15	.73	1.52	.00		39.0	283	0	2.1	
						29	17	49	4		49	17	35							
05/11/64						24	7.0	51	8.0	.0	115	31	62	.0	2.30	.2	290	89		E
	5700			8.1	400	1.20	.58	2.22	.20	.00	1.88	.65	1.75	.00		--	242	0	2.4	
						29	14	53	5		44	15	41							
05/13/64		58	F			18	7.8	33	6.0	.0	105	21	31	.5	1.46	.3	200	74		
1000	5050	14	C	7.5	313	.90	.58	1.44	.15	.00	1.72	.44	.87	.01		--	170	0	1.7	
						29	19	47	5		57	14	29							
035/20E-34R01 M																				
03/12/63		61	F			10	9.0	26	5.0	.0	122	11	6.0	1.0	.28	.4	180	62		E
1231	5050	16	C	7.3	233	.50	.74	1.13	.13	.00	2.00	.23	.17	.02		67.0	195	0	1.4	
						20	30	45	5		83	10	7	1						
03/26/63		64	F			10	9.0	25	5.0	.0	120	5.0	6.0	1.0	.32	.4	160	62		E
1302	5050	18	C	7.6	227	.50	.74	1.09	.13	.00	1.97	.10	.17	.02		[illegible]	180	0	1.4	
						20	30	44	5		87	4	8	1						S
04/02/63						11	9.0	25	5.0	.0	122	13	5.0	.0	.28	.4	184	65		E
1035	5700			7.3	230	.55	.74	1.09	.13	.00	2.00	.27	.14	.00		45.0	173	0	1.4	
						22	29	43	5		83	11	6							
05/21/63		62	F			13	8.0	28	4.0	.0	122	10	10	.5	.40	.3	180	66		E
930	5050	17	C	7.5	267	.65	.66	1.22	.10	.00	2.00	.21	.28	.01		60.0	196	0	1.5	
						25	25	46	4		80	8	11							S
06/25/63	5999					11	8.3	24	4.8	--	--	11	11	1.1	.42	.4		62		
	1200			7.6	264	.55	.68	1.04	.12			.23	.31	.02		54.0			1.3	
						23	28	44	5											

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH	EC	MINERAL CONSTITUENTS IN MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE: CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	MILLIGRAMS PER LITER: B	F / SIO2	TDS SUM	TH NCH	SAR	REM
03S/28E-34R01 M												CONTINUED							
06/25/63		61 F			8.0	10	26	5.0	.0	115	12	12	1.9	.44	.3	165	61		
945	5050	16 C	7.1	240	.40	.82	1.13	.13	.00	1.88	.25	.34	.03		60.0	192	0	1.4	
					16	33	44	5		75	10	14	1						
07/03/63					11	8.0	24	5.0	.0	94	11	11	1.1	.42	.4		60		
	5999		7.6	264	.55	.66	1.04	.13	.00	1.54	.23	.31	.02		56.0	174	0	1.3	
					23	28	44	5		73	11	15	1						S
09/16/63					12	5.0	23	5.0	.0	111	10	4.8	.0	.34	.2	164	51		E
1550	5700		7.0	234	.60	.41	1.00	.13	.00	1.82	.21	.11	.00		48.0	162	0	1.4	
					28	19	47	6		85	10	5							
10/21/63					13	5.0	23	5.0	.0	110	10	5.0	.0	.31	.2	166	53		E
1345	5700		7.7	205	.65	.41	1.00	.13	.00	1.80	.21	.14	.00		46.0	161	0	1.4	
					30	19	46	6		84	10	7							
11/04/63					11	7.0	23	5.0	.0	114	8.0	5.8	.0	.24	.2	166	57		E
	5700		8.1	210	.55	.58	1.00	.13	.00	1.87	.17	.14	.00		—	115	0	1.3	T
					24	26	44	6		86	8	6							
11/19/63					10	8.0	23	5.0	.0	117	9.0	4.0	.0	.26	.2	166	50		E
823	5700		7.0	220	.50	.66	1.00	.13	.00	1.92	.19	.11	.00		—	117	0	1.3	T
					22	29	44	6		86	9	5							
12/10/63					11	7.0	23	5.0	.0	118	7.0	4.0	.0	.26	.2	178	57		E
1053	5700		7.2	215	.55	.58	1.00	.13	.00	1.93	.15	.11	.00			160	0	1.3	
					24	26	44	6		88	7	5							
01/13/64					12	5.0	23	5.0	.0	116	6.0	4.0	.0	.27	.4	148	51		
1343	5700		7.2	210	.60	.41	1.00	.13	.00	1.90	.12	.11	.00		47.0	159	0	1.4	
					28	19	47	6		89	6	5							
02/03/64					20	4.0	24	5.0	.0	129	8.0	5.0	.0	.33	.2	162	67		E
1425	5700		7.6	220	1.00	.33	1.04	.13	.00	2.11	.17	.14	.00		47.0	177	0	1.3	
					40	13	42	5		87	7	6							
03/29/64					12	7.0	23	4.0	.0	126	7.0	5.0	.0	.33	.1	138	59		
1315	5700		7.9	224	.60	.58	1.00	.10	.00	2.07	.15	.14	.00		43.0	163	0	1.3	
					26	25	44	4		88	6	6							
05/11/64					13	7.0	24	5.0	.0	111	12	11	.0	.33	.2	144	62		
	5700		7.7	225	.65	.58	1.04	.13	.00	1.82	.25	.31	.00		--	127	0	1.3	
					27	24	43	5		76	11	13							
06/20/64		60 F			10	8.0	22	5.0	.0	110	7.0	7.0	.7	.20	.3	155	50		E
930	5050	16 C	7.2	216	.50	.66	.96	.13	.00	1.80	.15	.20	.01		—	114	0	1.3	T
					22	29	43	6		83	7	9							
03S/28E-34R02 M																			
08/27/71	5050		6.8	235	10	9.0	21	4.0	.0	117	10	4.0	.0	.21	.3	153	62		E
1600	5050		7.6	213	.50	.74	.91	.10	.00	1.92	.21	.11	.01		--	117	0	1.2	T
					22	33	40	4		85	9	5							
03S/28E-35E01S M																			
12/29/60	5050				7.0	1.0	341	22	.0	409	134	245	1.9	10.4	10.0	1216	22		E
	5050		7.4	1710	.35	.08	15.70	.56	.00	6.70	2.79	6.91	.03		99.9	1083	0	33.8	
					2		94	3		41	17	42							Z
06/14/66	5050	165 F			7.0	2.0	372	23	.0	451	107	264	.5	11.0	11.0	1225	26		E
1700	5050	74 C	8.2	1745	.35	.16	16.10	.59	.00	7.39	2.23	7.44	.01		—	1008	0	31.9	
					2	1	94	3		43	13	44							
05/14/67		163 F			—	--	—	—	.0	--	--	249	—	—	--				
1500	5050	73 C	8.0	1726					.00			7.02			--				
08/13/70		140 F			6.6	3.2	374	36	37	395	120	255	.0	11.4	7.5		30		
		60 C	8.6	1751	.33	.26	16.30	.93	1.23	6.47	2.50	7.20	.00		30.5	1069	0	29.9	
					2	1	91	5	7	37	14	41							
03S/28E-35K01S M																			
04/24/55		54 F			12	5.3	14	3.0	.0	88	11	2.0	.2	.10	.1		52		
	5010	12 C	7.5	166	.60	.44	.61	.08	.00	1.44	.23	.06	.00		44.0	135	0	0.8	
					35	25	35	5		83	13	3							
05/14/63	5050	53 F			13	4.4	16	3.3	.0	90	8.2	2.0	1.0	.10	.2	130	51		E
0945	5050	12 C	7.3	168	.65	.36	.70	.08	.00	1.48	.17	.06	.02		27.0	119	0	1.0	
					36	20	39	4		86	10	3	1						
07/08/63		56 F			13	4.4	16	3.3	.0	90	8.2	3.0	1.5	.10	.3	130	51		E
	5050	13 C	7.3	174	.65	.36	.70	.08	.00	1.48	.17	.08	.02		25.0	119	0	1.0	
					36	20	39	4		85	10	5	1						
11/26/63	5050				25	3.8	15	3.7	.0	123	9.4	2.5	1.5	.17	.2	156	79		
0929	5700		7.4	240	1.25	.31	.65	.09	.00	2.02	.20	.07	.02		35.0	157	0	8.7	
					54	13	28	4		87	9	3	1						
05/11/64	5050				14	3.0	16	3.0	.0	86	10	3.0	.0	.13	.2	142	47		E
	5700		7.5	165	.70	.25	.70	.08	.00	1.41	.21	.08	.00		—	91	0	1.0	T
					40	14	40	5		83	12	5							
06/14/66		54 F			12	5.0	16	4.0	.0	91	8.0	3.0	.6	.08	.3	120	51		
1000	5050	12 C	7.3	173	.60	.41	.70	.10	.00	1.49	.17	.08	.01		--	93	0	1.0	T
					33	23	39	6		85	10	5	1						
03S/28E-35H01S M																			
04/24/55		61.5F			12	10	23	4.8	.0	130	11	6.5	.3	.32	.3		71		
	5010	16.4C	7.4	243	.60	.82	1.00	.12	.00	2.13	.23	.18	.00		67.0	199	0	1.2	
					24	32	39	5		84	9	7							
09/22/60	5999	61 F			15	7.3	27	—	.0	128	11	7.8	.3	--	--		68		
	5010	16 C	7.7	238	.75	.60	1.17		.00	2.10	.23	.22	.00		56.0	187	0	1.4	
										82	9	9							

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	SAR	REM
					MINERAL CONSTITUENTS IN	MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE								MILLIGRAMS PER LITER					
03S/28E-35N01S M												CONTINUED							
12/29/60					15	10	28	6.0	.0	128	5.0	18	2.5	.35	.3	202	79		
	5999		7.3	291	.75	.82	1.22	.15	.00	2.10	.10	.51	.04		56.0	204	0	1.4	
					26	20	41	5		76	4	19	1						S
05/14/63	5050	61 F			9.3	8.5	25	5.1	.0	120	8.6	6.0	1.0	.24	.3	170	58		E
	5050	16 C	7.3	227	.46	.70	1.09	.13	.00	1.97	.18	.17	.02		12.0	135	0	1.4	T
					19	29	46	5		84	8	7	1						
07/08/63	5050	60 F			9.3	8.2	24	4.9	.0	112	9.6	6.0	1.0	.28	.3	175	57		E
1145	5050	16 C	7.3	219	.46	.67	1.04	.13	.00	1.84	.20	.17	.02		13.0	131	0	1.4	T
					20	29	45	6		83	9	8	1						
07/11/63	5050	60 F			11	8.7	25	5.2	.0	122	9.1	8.0	1.5	.42	.3	185	64		E
0735	5050	16 C	7.2	241	.55	.72	1.09	.13	.00	2.00	.19	.23	.02		13.0	142	0	1.4	T
					22	29	44	5		82	8	9	1						
09/16/63	5050				14	4.9	22	4.1	.0	106	12	4.3	.8	.29	.2	158	56		E
1600	5780		7.3	375	.70	.40	.96	.10	.00	1.74	.25	.12	.00		45.0	159	0	1.3	C
					32	19	44	5		82	12	6							
10/14/63	5050				9.4	9.1	23	5.4	.0	115	8.2	8.0	1.0	.34	.4	185	61		E
	5050		7.2	215	.47	.75	1.00	.14	.00	1.88	.17	.23	.02		60.0	181	0	1.3	
					20	32	42	6		82	7	10	1						
10/21/63	5050				18	5.4	24	5.8	.0	125	10	7.1	.0	.40	.2	180	68		E
1350	5780		7.0	226	.90	.44	1.04	.13	.00	2.05	.21	.20	.00		46.0	177	0	1.3	
					36	18	41	5		83	9	8							
11/04/63	5050				11	7.1	23	4.7	.0	114	10	2.8	.0	.33	.2	170	56		E
	5780		7.3	220	.55	.58	1.00	.12	.00	1.87	.21	.08	.00		47.0	162	0	1.3	
					24	26	44	5		87	10	4							
11/26/63	5050				18	6.2	24	6.9	.0	126	12	5.3	4.1	.30	.4	200	70		E
0955	5780		7.1	267	.90	.51	1.04	.18	.00	2.07	.25	.15	.07		44.0	185	0	1.2	
					34	19	40	7		81	10	6	3						
12/10/63	5050				11	7.1	25	5.0	.0	121	6.7	[illegible]	1.0	.41	.2	192	56		E
1100	5780		7.3	230	.55	.58	1.09	.13	.00	1.98	.14	[illegible]	.02		46.0	168	0	1.4	
					23	25	46	6		85	6	8	1						
12/31/63	5050				12	6.8	24	5.2	.0	121	6.1	5.3	.0	.33	.2	192	56		E
0945	5780		7.1	237	.60	.56	1.04	.13	.00	1.98	.13	.15	.00		46.0	165	0	1.4	
					26	24	45	6		88	6	7							
01/13/64	5050				12	4.7	23	4.6	.0	116	4.3	2.1	.0	.23	.2	152	50		E
1400	5780		7.1	207	.60	.39	1.00	.12	.00	1.90	.09	.06	.00		44.0	152	0	1.4	
					28	18	47	6		93	4	3							
02/18/64					12	6.8	24	5.0	.0	119	9.1	7.4	.0	.42	.1	160	57		E
1040	5780		8.0	222	.60	.56	1.04	.13	.00	1.95	.19	.21	.00		44.0	167	0	1.4	
					26	24	45	6		83	8	9							
03/29/64	5050				14	6.3	25	5.3	.0	124	8.2	8.9	.0	.44	.1	160	61		E
1320	5780		8.0	220	.70	.52	1.09	.14	.00	2.03	.17	.25	.00		44.0	173	0	1.4	
					29	21	44	6		83	7	10							
04/25/64	5050				14	7.0	27	5.6	.0	126	7.7	9.2	.0	.42	.1	176	63		E
1045	5780		7.3	245	.70	.58	1.17	.14	.00	2.07	.16	.26	.00		45.0	170	0	1.5	
					27	22	45	5		83	6	10							
06/14/66					10	7.0	24	5.0	.0	115	8.0	9.0	.7	.34	.3	170	54		E
1640	5050		7.2	214	.50	.58	1.04	.13	.00	1.88	.17	.25	.01		--	121	0	1.4	T
					22	26	46	6		81	7	11							
03S/28E-35N02S M																			
04/24/55		61.5F			11	9.3	23	4.8	.0	128	12	4.8	.2	.20	.3		66		
	5010	16.4C	7.5	231	.55	.76	1.00	.12	.00	2.10	.25	.14	.00		63.0	191	0	1.2	
					23	31	41	5		84	10	6							
09/22/60	5999	62 F			14	7.3	27	--	.0	126	11	5.5	.3	--	--		64		
	5010	17 C	7.9	225	.70	.60	1.17		.00	2.07	.23	.16	.00		61.0	188	0	1.5	
										84	9	7							
05/14/63	5050	61 F			8.4	9.8	24	5.0	.0	122	8.2	5.0	1.0	.28	.3	185	62		E
0920	5050	16 C	7.3	223	.42	.81	1.04	.13	.00	2.00	.17	.14	.02		11.0	133	0	1.3	T
					18	34	43	5		86	7	6	1						
07/08/63		60 F			8.4	8.2	22	4.7	.0	107	9.1	5.0	1.0	.24	.3	175	55		E
1155	5050	16 C	7.3	209	.42	.67	.96	.12	.00	1.75	.19	.14	.02		11.0	122	0	1.3	T
					19	31	44	6		83	9	7	1						
07/11/63	5050	60 F			11	7.7	24	4.9	.0	117	7.7	7.0	1.0	.24	.4	170	59		E
0930	5050	16 C	7.9	222	.55	.63	1.04	.13	.00	1.92	.16	.20	.02		13.0	134	0	1.4	T
					23	27	44	6		83	7	9	1						
09/16/63	5050				15	4.4	21	5.5	.0	105	12	3.2	3.6	.23	.2	198	57		
1600	5780		7.1	360	.75	.36	.91	.14	.00	1.72	.25	.09	.06		44.0	161	0	1.2	C
					35	17	42	6		81	12	4	3						
10/14/63	5999				9.4	8.7	21	4.6	.0	115	10	5.0	.5	.22	.4	175	60		E
	5050		7.0	205	.47	.72	.91	.12	.00	1.88	.21	.14	.01		57.0	173	0	1.2	
					21	32	41	5		84	9	6							
10/21/63	5050				16	3.0	22	4.3	.0	108	10	3.5	.0	—	.2	150	53		
1400	5780		7.1	230	.80	.25	.96	.11	.00	1.77	.21	.10	.00		45.0	157	0	1.3	
					38	12	45	5		85	10	5							
11/04/63	5050				12	5.8	22	4.6	.0	114	7.7	2.8	.0	.21	.2	162	55		E
0955	5780		7.8	210	.60	.48	.96	.12	.00	1.87	.16	.08	.00		43.0	154	0	1.3	
					28	22	44	6		89	8	4							
11/19/63	5050				12	6.6	22	4.5	.0	113	10	3.5	1.0	.38	.2	166	56		
0820	5780		7.9	243	.60	.54	.96	.12	.00	1.85	.21	.10	.02		47.0	163	0	1.3	
					27	24	43	5		85	10	5	1						
12/10/63	5050				12	5.8	23	4.5	.0	116	5.8	4.3	1.0	.24	.2	164	54		E
1110	5780		8.0	220	.60	.48	1.00	.12	.00	1.90	.12	.12	.02		44.0	150	0	1.4	
					27	22	45	5		88	6	6	1						

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP		FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	SAR	REM
						MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER					
	04S/29E-06H01S M												CONTINUED							
05/12/66	5050	98	F			21	3.0	140	9.0	.0	276	41	74	.0	3.70	3.2	510	65		
1000	5050	37	C	8.2	759	1.05	.25	6.09	.23	.00	4.52	.85	2.09	.00		—	427	0	7.6	
						14	3	80	3		61	11	28							
	04S/29E-06R01S M																			
02/28/56						32	2.0	5.0	1.0	.0	97	24	1.0	.0	.03	.2		88		
	5999			8.1	212	1.60	.16	.22	.03	.00	1.59	.50	.03	.01		27.0	141	9	0.2	
						80	8	11	1		75	23	1							S
12/12/61						31	2.0	5.0	1.0	.0	99	11	6.8	1.2	.10	.0		84		
	5999			8.0	221	1.55	.16	.22	.03	.00	1.62	.23	.17	.02		35.0	141	5	0.2	
						79	8	11	2		79	11	8	1						
05/12/66						30	2.0	5.0	1.0	.0	90	12	2.0	.0	.00	.2	130	83		
1030	5050			8.2	191	1.50	.16	.22	.03	.00	1.61	.25	.06	.00		—	100	3	0.2	T
						79	8	12	2		84	13	3							
	04S/29E-17E01S M																			
04/24/66	5050	56	F	6.0		34	1.0	6.0	2.0	.0	93	23	2.0	.3	.00	.2	135	89		
1520	5050	13	C	7.6	208	1.70	.08	.26	.05	.00	1.52	.48	.06	.00		—	114	13	0.3	
						81	4	12	2		74	23	3							
	04S/29E-10A01S M																			
03/20/56						38	2.0	6.0	3.0	.0	110	20	5.0	.6	.03	.1		103		
	5999			7.6	227	1.90	.16	.26	.08	.00	1.80	.42	.14	.01		23.0	152	13	0.3	
						79	7	11	3		76	10	6							
12/12/61						37	2.0	6.0	2.0	.0	107	21	5.0	.8	.10	.0		101		
	5999			7.8	250	1.85	.16	.26	.05	.00	1.75	.44	.14	.01		24.0	151	13	0.3	
						80	7	11	2		75	19	6							

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	SAR	REM
					MINERAL CONSTITUENTS IN MILLIGRAMS PER LITER / MILLIEQUIVALENTS PER LITER / PERCENT REACTANCE VALUE									MILLIGRAMS PER LITER					
	03S/29E-31A01S M																		
04/25/40	5050				15	1.0	305	20	.0	482	77	101	4.3	0.00	7.0	964	40		
	5050		7.3	1445	.75	.08	13.27	.51	.00	7.90	1.60	5.10	.07		99.9	940	0	20.6	
					5	1	91	3		54	11	35							Z
05/13/66		142 F			16	1.0	315	21	.0	490	78	180	.0	0.00	6.0	960	44		
1430	5050	61 C	8.2	1487	.80	.08	13.70	.54	.00	8.16	1.62	5.08	.00		--	864	0	20.7	
					5	1	91	4		55	11	34							
05/14/67		141 F			--	--	--	--	.0	--	--	179	--	--	--				
1130	5050	60 C	8.0	1493					.00			5.05			--				
08/13/70	4740 *	140 F			15	1.0	299	30	37	415	62	177	.0	7.97	5.5		42		
	5999	60 C	8.5	1463	.76	.08	13.01	.78	1.23	6.80	1.30	5.00	.00		99.9	934	0	20.1	
					5	1	89	5	9	67	9	35							Z
	04S/27E-04A01S M																		
08/25/71	5050	51 F	6.0	255	7.0	7.0	35	4.0	.0	136	16	2.0	.0	.02	.3	194	47		E
1700	5050	11 C	7.3	246	.35	.58	1.52	.10	.00	2.23	.33	.06	.00		--	130	0	2.2	T
					14	23	60	4		85	13	2							
	04S/27E-04B01M M																		
08/25/71	5050	48 F	5.5	210	--	--	--	--	--	--	--	--	--	--	--				
1600		9 C													--				
	04S/27E-04G01M M																		
06/12/60	5999				14	11	10	3.0	.0	90	12	3.0	.0	--	.1	180*	80		
	5091		6.1		.70	.90	.44	.08	.00	1.48	.25	.08	.00		--	97	6	0.5	T
					33	42	21	4		82	14	4							S
08/24/71	5050	43 F	5.7	215	--	--	--	--	--	--	--	--	--	--	--				
1030		6 C													--				
	04S/27E-08J01M M																		
10/24/67		44 F			9.5	20	27	5.9	--	162	.7	1.5	.4	--	.2	180*	100		
	5091	7 C	7.0		.47	1.69	1.10	.15		2.66	.01	.04	.01		--			1.1	T
					13	40	34	4											
08/25/71	5050	44 F	6.7	375	--	--	--	--	--	--	--	--	--	--	--				
1220		7 C													--				
	04S/28E-01L01 M																		
06/15/66	5050				23	4.0	11	2.0	--	104	9.0	3.0	1.0	.06	.3	135	74		
1420	5050		8.1	194	1.15	.33	.48	.05		1.70	.19	.08	.02		--			0.6	T
					57	16	24	2		1									
08/27/71	5050	70 F	8.0	225	--	--	--	--	--	--	--	--	--	--	--				
1522		21 C													--				
	04S/28E-03J01 M																		
06/20/66	5050	58 F			11	6.0	21	5.0	.0	110	9.0	4.0	.5	.16	.4	150	52		E
1045	5050	14 C	7.4	204	.55	.49	.91	.13	.00	1.80	.19	.11	.01		--	111	0	1.3	T
					26	24	44	6		85	9	5							
08/27/71	5050	60 F	6.0	220	--	--	--	--	--	--	--	--	--	--	--				
1520		16 C													--				
	04S/28E-09F01S M																		
04/19/66		53 F			16	.0	5.0	1.0	.0	46	13	1.0	.0	.00	.2	65	40		
1030	5050	12 C	7.6	118	.80	.00	.22	.03	.00	.75	.27	.03	.00		--	59	3	0.3	
					76		21	3		71	26	3							
	04S/28E-12J01 M																		
06/21/66	5050				24	1.0	1.0	1.0	--	69	8.0	1.0	.0	.00	.1	70	64		E
1400	5050		7.3	134	1.20	.08	.04	.03		1.13	.17	.03	.00		--			0.1	
					89	6	3	2											
	04S/28E-14R01 M																		
06/24/66		49 F			38	1.0	3.0	2.0	.0	106	13	2.0	2.2	.00	.1	140	99		
1600	5050	9 C	7.6	206	1.90	.08	.13	.05	.00	1.74	.27	.06	.04		--	113	12	0.1	
					88	4	6	2		82	13	3	2						
	04S/29E-06H01S M																		
08/20/41					16	9.0	192	--	--	320	46	200	--	4.60	4.0		77		
	5999			940	.80	.74	8.35			5.24	.96	5.64			60.0			9.5	
01/08/44					22	2.0	132	7.0	--	263	36	71	.0	3.50	1.4		63		
	5999			715	1.10	.16	5.74	.18		4.31	.75	2.00	.00		15.0			7.2	
					15	2	80	3											
10/03/52					--	--	131	8.0	--	--	--	--	--	--	--	492			
	5999			774			5.70	.20							--				T
02/20/54					22	2.0	132	10	.0	263	48	72	.0	2.45	1.6		63		
	5999		7.7	733	1.10	.16	5.74	.26	.00	4.31	1.00	2.03	.00		32.0	450	0	7.2	
					15	2	79	4		59	14	28							
12/12/61					20	2.0	130	9.0	--	250	39	78	2.0	3.40	2.9		58		
	5999			772	1.00	.16	5.66	.23		4.10	.81	2.20	.03		94.0			7.4	
					14	2	80	3											

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH	EC	CA	MG	NA	K	CO3	HCO3	SO4	CL	NO3	B	F SIO2	TDS SUM	TH NCH	SAR	REM
					MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER					
03S/28E-35M02S M												CONTINUED							
12/31/63	5700		7.2		12 .60 27	6.4 .53 24	23 1.00 44	4.5 .12 5	.0 .00	115 1.88 85	10 .21 10	3.2 .09 4	1.0 .02 1	.24	.2 43.0	130 160	56 0	1.3	
02/03/64 1450	5050 5700		7.4	220	12 .60 27	5.7 .47 21	24 1.04 47	4.7 .12 5	.0 .00	113 1.85 84	5.0 .12 5	8.2 .23 10	.0 .00	.25	.2 44.0	166 160	55 0	1.4	E
03/10/64 0910	5700		7.6	212	12 .60 27	6.3 .52 23	23 1.00 45	4.5 .12 5	.0 .00	121 1.98 87	9.6 .20 9	3.5 .10 4	.0 .00	.33	.1 44.0	152 163	56 0	1.3	E
04/13/64 1050	5700		7.7	225	12 .60 26	7.3 .60 26	23 1.00 43	4.5 .12 5	.0 .00	123 2.02 87	9.1 .19 8	4.3 .12 5	.0 .00	.26	.1 45.0	150 166	59 0	1.3	
05/11/64	5086 5700		7.7	210	12 .60 26	7.0 .58 25	23 1.00 43	5.0 .13 6	.0 .00	120 1.97 84	11 .23 10	5.0 .14 6	.0 .00	.24	.2 —	180 122	60 0	1.3	E T
06/14/66 1640	5050	60 F 16 C	7.2	201	9.0 .45 21	7.0 .58 27	22 .96 45	5.0 .13 6	.0 .00	108 1.77 86	7.0 .15 7	5.0 .14 7	.7 .01	.17	.3 —	150 109	52 0	1.3	E T
03S/28E-35P01S M																			
05/14/63 930	5050	55 F 13 C	7.4	210	8.0 .40 18	9.0 .74 33	22 .96 43	5.8 .13 6	.0 .00	112 1.84 87	8.0 .17 8	3.0 .08 4	1.0 .02 1	.16	.4 14.0	170 125	57 0	1.3	E NT S
07/08/63 1205	5050	54 F 12 C	7.5	204	8.0 .40 18	9.0 .74 33	22 .96 43	5.0 .13 6	.0 .00	112 1.84 87	8.0 .17 8	3.0 .08 4	1.5 .02 1	.16	.4 14.0	175 126	57 0	1.3	E NT S
11/26/63 910	5700		7.3	225	12 .60 28	6.0 .49 22	22 .96 44	5.0 .13 6	.0 .00	112 1.84 86	10 .21 10	3.0 .08 4	1.0 .02 1	.19	.2 44.0	158 150	55 0	1.3	E N
05/11/64	5700		8.0	210	13 .65 29	6.0 .49 22	23 1.00 45	4.0 .10 4	.0 .00	116 1.90 86	11 .23 10	3.0 .08 4	.0 .00	.24	.2 —	176 117	57 0	1.3	E NT
03S/28E-35P02S M																			
05/14/63 935	5050	55 F 13 C	7.4	194	9.0 .45 23	7.0 .58 29	20 .87 44	4.0 .10 5	.0 .00	105 1.72 87	7.0 .15 8	3.0 .08 4	1.0 .02 1	.14	.3 17.0	150 120	52 0	1.2	E N
05/14/63 0935	5050	55 F 13 C	7.4	194	9.3 .46 23	6.6 .54 27	20 .87 44	4.3 .11 6	.0 .00	105 1.72 87	7.2 .15 8	3.0 .08 4	1.0 .02 1	.14	.3 17.0	150 120	50 0	1.2	E
07/08/63 1215	5050	60 F 16 C	7.3	200	9.3 .46 22	7.7 .63 30	20 .87 42	4.4 .11 5	.0 .00	107 1.75 86	7.7 .16 8	4.0 .11 5	1.0 .02 1	.14	.3 16.0	155 123	55 0	1.2	E T
11/26/63 920	5700		7.4	197	13 .65 32	5.0 .41 20	20 .87 43	4.0 .10 5	.0 .00	108 1.77 88	8.0 .17 8	2.0 .06 3	.9 .01	.17	.2 40.0	146 146	53 0	1.2	E N
11/26/63 0920	5700		7.4	197	13 .65 32	4.9 .40 20	20 .87 43	4.3 .11 5	.0 .00	108 1.77 89	7.8 .16 8	1.8 .05 3	.9 .01 1	.17	.2 40.0	146 146	52 0	1.2	E
05/11/64	5086 5700		7.6	195	11 .55 27	6.0 .49 24	21 .91 44	4.0 .10 5	.0 .00	106 1.74 83	9.0 .19 9	6.0 .17 8	.0 .00	.17	.2 --	150 109	51 0	1.3	E T
06/14/66 1700	5050	54 F 12 C	7.5	187	11 .55 28	6.0 .49 25	19 .83 42	5.0 .13 7	.0 .00	101 1.66 84	7.0 .15 8	4.0 .11 6	.0 .00	.13	.3 --	135 102	52 0	1.1	E T
03S/29E-17R99S M																			
08/13/70	4740 5999	131 F 55 C	8.5	2264	20 1.01 4	5.7 .47 2	486 21.18 88	51 1.32 6	52 1.76 7	905 14.83 62	77 1.62 7	197 5.58 23	.0 .00	7.64	5.0 99.9	1445	74 0	24.6	Z
03S/29E-21L01S M																			
06/11/66 1610	5050	128 F 53 C	7.3	1779	28 1.40 7	.0 .00	380 16.53 88	37 .95 5	.0 .00	791 12.96 69	60 1.25 7	160 4.51 24	.3 .00	31.0	4.9 --	1270 1085	70 0	19.0	E
05/14/67 1330	5050	134 F 57 C	7.1	1757	--	--	--	--	.0 .00	--	--	152 4.29	--	--	-- --				
03S/29E-21M01S M																			
06/22/66 1500	5050	132 F 56 C	7.0	1754	26 1.30 7	.0 .00	380 16.53 88	35 .90 5	.0 .00	781 12.80 69	60 1.25 7	158 4.46 24	.0 .00	31.0	4.8 --	1245 1074	65 0	20.5	E
03S/29E-29C01S M																			
08/13/70	4740 5999	172 F 78 C	8.7	1846	32 1.62 8	3.6 .30 1	405 17.64 86	34 .87 4	54 1.80 9	700 11.47 57	72 1.50 7	190 5.34 27	.0 .00	5.73	5.5 99.9	1241	96 0	18.0	Z