Model for Evaluating the Effects of Dikes on the Water and Salt Balance of Great Salt Lake, Utah

by

K. M. Waddell and F. K. Fields

Prepared by
The United States Geological Survey
in cooperation with
The Utah Geological and Mineral Survey

UTAH GEOLOGICAL AND MINERAL SURVEY
a division of the
UTAH DEPARTMENT OF NATURAL RESOURCES

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Most numbers are given in this report in English units followed by metric units. The conversion factors used are shown to four significant figures. In the text, however, the metric equivalents are shown only to the number of significant figures consistent with the accuracy of the number in English units.

English			Metric	
Units (multiply)	Abbreviation	(by)	Units (to obtain)	Abbreviation
Acre-feet	acre-ft	0.001233	Cubic hectometres	hm^3
Cubic feet per second	ft^3/s	.02832	Cubic metres per second	m^3/s
Feet	ft	.3048	Metres	m
Inches	in	25.40	Millimetres	mm
Miles	mi	1.609	Kilometres	km
Tons		.9072	Metric tons	t

Water temperature is given in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by the following equation:

$$°F = 1.8\,(°C) + 32$$

MODEL FOR EVALUATING THE EFFECTS OF DIKES ON THE WATER AND SALT BALANCE OF GREAT SALT LAKE, UTAH

by
K. M. Waddell[1] *and F. K. Fields*[1]

ABSTRACT

A model was developed for predicting the water and salt budget for various diking options in Great Salt Lake.

The water budget was computed for 1-month intervals during a base period of 1931-73. The storage change (ΔS) during each month of the base period was computed from a budget of surface inflow (Is), ground-water inflow (Ig), precipitation on the lake surface (Ip), and outflow from evaporation (Oe), where $\Delta S = Is + Ip - Oe$.

By knowing the changes in storage, a prediction of altitude can be made from known altitude-volume relationships.

The total annual inflow to Great Salt Lake ranged from about 1.5 to 5 million acre-feet (1,849.5 to 6,165.0 cubic hectometres). The Bear River contributes the largest percentage of the measured surface inflow.

The total annual outflow from the lake (evaporation) ranged from about 2.2 to 4.0 million acre-feet (2,712.6 to 4,932.0 cubic hectometres) during 1931-73. The average annual evaporation was 2.98 million acre-feet (3,674.3 cubic hectometres) or 45 inches (1,143 millimetres) per year.

The model provides for nine diking options. These include combinations of eight areas east of a line joining Antelope Island, Fremont Island, and the Promontory Mountains. Another option includes the part of Great Salt Lake that lies north of the Southern Pacific Transportation Co. causeway, which divides the main body of the lake into north and south parts.

The model treats the salt balance of the diked areas from the standpoint of an inflow-outflow balance with complete mixing, and no allowances are made for any stratification or chemical changes due to interaction with the sediments or solution of entrapped brines or residual salts. Because the degree of inaccuracy created by these assumptions is not known, the concentrations predicted by the model should be regarded not as absolute but as relative indexes by which to compare various diking alternatives.

INTRODUCTION

The concept of diking parts of Great Salt Lake, Utah, has long been considered as a means of controlling the salinity of the lake for more efficient salt production, of providing freshwater for recreation and other uses, and of controlling the annual fluctuation of lake levels in order to prevent flooding and inundation of evaporation ponds adjacent to the lake. The State of Utah has considered alternatives for the development of the resources of Great Salt Lake, and diking was one of the alternatives considered. The purpose of this study was to develop a digital-computer model which could be used to evaluate various diking proposals for their effect on the water and salt balance of Great Salt Lake.

Evaluation of diking proposals for the lake required a knowledge of the parameters controlling the lake hydrology as well as the tool (the model) to facilitate the computations necessary for relating these parameters to the lake dynamics. During 1971, the U. S. Geological Survey in cooperation with the Division of Water Resources, Utah Department of Natural Resources, began a 7-year study to monitor the principal parameters controlling the water balance, these parameters being surface inflow (quantity and quality) and evaporation.

A model study was originally planned as the last stage of the 7-year study, but the urgent needs of State planners indicated a requirement for earlier development of a working model. Thus in 1973, a second study was initiated to develop a model of the water and salt balance of the lake, with provisions for determining the effects of diking off various combinations of the three major inflowing streams. This model study, which was carried out in cooperation with the Utah Geological and Mineral Survey, was begun with the knowledge that the results would be preliminary until such time as sufficient data were available to provide a satisfactory data base.

The model uses a simple water- and salt-budget approach for a closed lake. The monthly inflow and outflow (evaporation) of water and of salt load to Great Salt Lake were estimated for a base period of 1931-73. After calibration of the model with existing data, provisions were made in the model to evaluate the effects that diking of various combinations of bay

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[1] Hydrologist, U. S. Geological Survey.

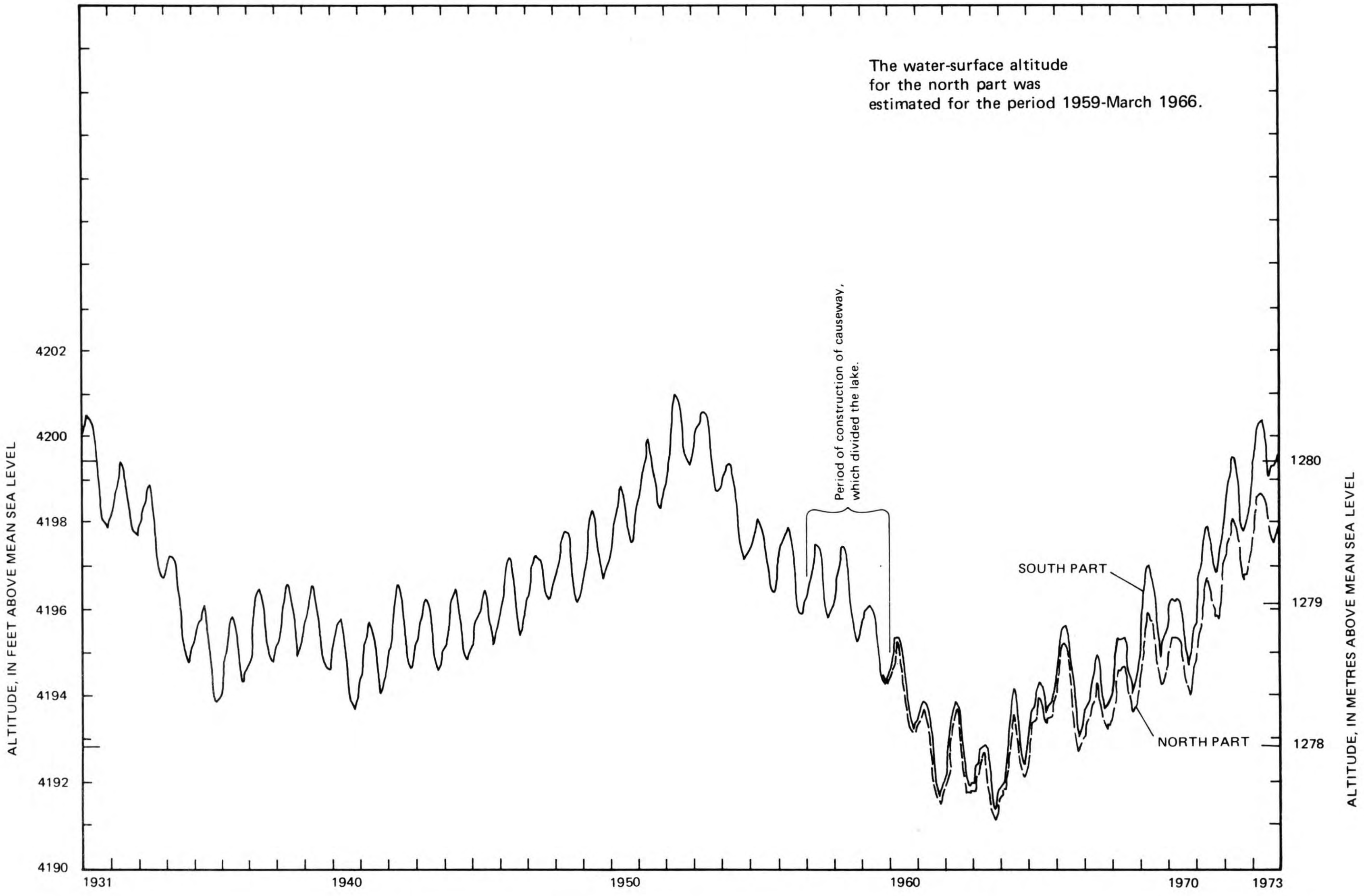


Figure 1. Hydrograph of Great Salt Lake, 1931-73.

areas would have on the water and salt balance existing during the 1931-73 base period.

Hydrology of the Lake

An understanding of prior changes in the water and salt balance of Great Salt Lake is important for an understanding of the current hydrology of the lake and of the model. Madison (1970, p. 9-19) described the hydrology of the lake through the 1969 water year and Waddell and Bolke (1973, p. 2-6) described changes during 1970-72. The synopsis that follows is taken from these previous reports, updated for trends since 1972.

The hydrologic characteristics of Great Salt Lake are typical of a closed lake. The water surface rises and falls in response to the balance between evaporation and the amount of water contributed to the lake by surface runoff, ground-water inflow, and precipitation on the surface. The annual peak water-surface altitude generally is in the late spring, and the minimum water-surface altitude generally is in the early fall. Also, the general trend of the water-surface altitude may rise or fall for several years (fig. 1) as part of a long-term cycle.

The causeway was constructed in 1957-59 by the Southern Pacific Transportation Co. for its railroad track across Great Salt Lake. It extends between Promontory Point and Lakeside, where the lake is about 18 mi (29 km) wide (fig. 5), and it divides the lake into north and south parts. A little more than one-third of the lake lies north of the causeway. The causeway is permeable and is breached by two open culverts, each 15 ft (4.6 m) wide. Although few data are available to substantiate the chemical characteristics of the lake prior to construction of the causeway, the restricted circulation effected by the causeway resulted in significant changes in the salt balance during the following years. According to Madison (1970, p. 7):

> "Prior to construction of the causeway, the dissolved-solids content and the chemical composition of the lake brine were controlled primarily by volume changes resulting from inflow and evaporation. The causeway created two separate but interconnected lakes with different water-surface elevations and densities. As a result, brine flows in both directions through the causeway, with less dense brine from the south part moving northward through the upper part of the causeway and more dense brine from the north

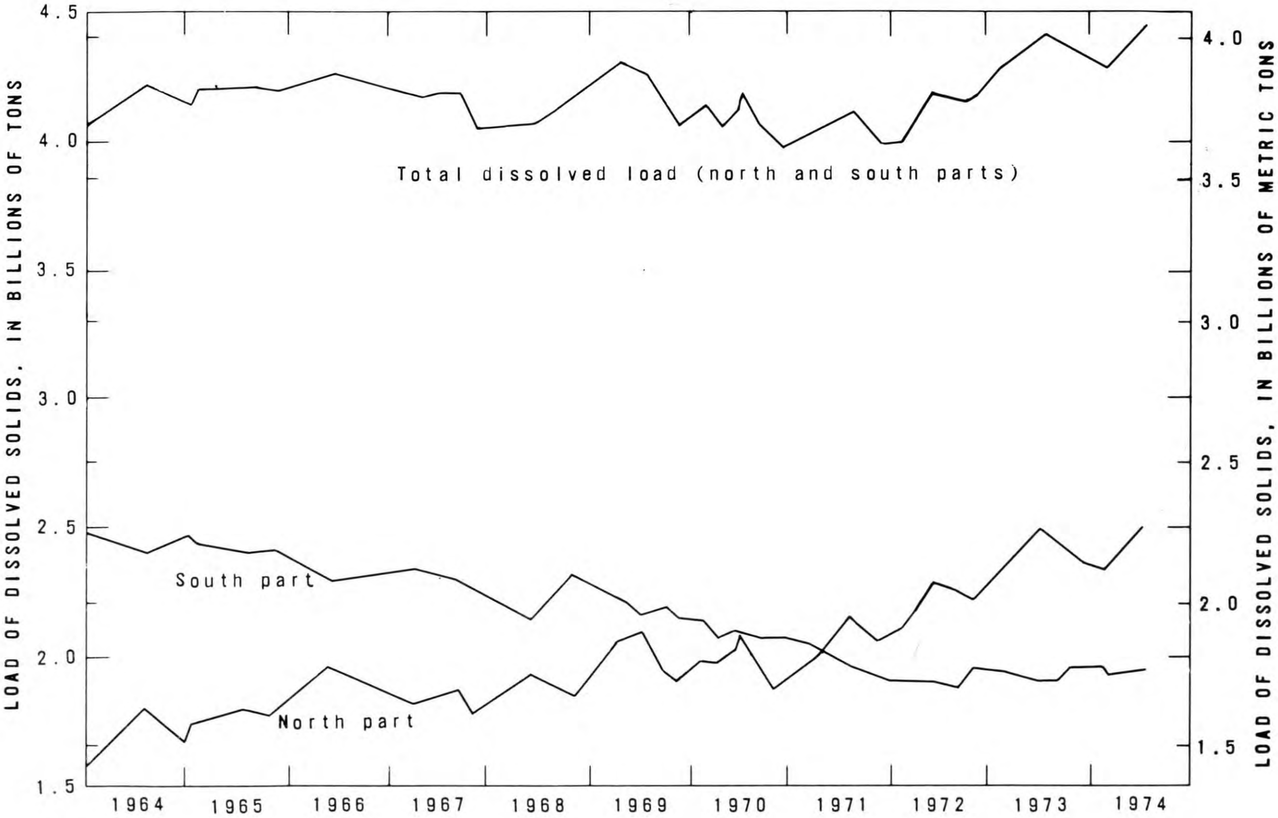


Figure 2. Graph showing variation of load of dissolved solids in Great Salt Lake, 1964-74.

part moving southward through the lower part of the causeway. The chemistry of the lake is now controlled by the interchange of dissolved-solids load through the causeway, as well as by changes in the salt crust and by volume changes."

In 1963, shortly after construction of the causeway, when the lake declined to its lowest recorded stage, both the north and south parts were probably saturated with respect to sodium chloride and a salt crust probably formed on the lakebed north and south of the causeway (Madison, 1970, p. 12). As the lake rose during the following years, the south part began to freshen with the increasing lake volume and because of dissolved-load loss to the north part. The net dissolved-load movement to the north part, which probably was already saturated due to the low lake altitude, may have resulted in additional deposits of sodium chloride in the north part. The concentration of dissolved solids in the north part remained at or near saturation (355 grams per litre) through 1973.

The dissolved-load loss from the south to the north part continued until about 1972, when the loss was only about 0.01 billion tons (0.009 billion t). Waddell and Bolke (1973, p. 2) indicated that the salt balance between the two parts of the lake was near equilibrium for inflow conditions like those of 1972. During 1973-74, inflow conditions were similar to those of 1972, and dissolved-load computations based on water-quality data confirmed that dissolved-load losses to the north had ceased. This is indicated by the graph shown for the south part in figure 2.

The dissolved load in the north part continued a general trend upward in 1972, even though the south part showed little or no change. This indicates that the salt crust in the north part was dissolving as the volume of the north part increased and freshened as the lake rose. In October 1974, the total dissolved load in the north and south parts was about 4.5 billion tons (4.1 billion t), representing a net increase of about 0.5 billion tons (0.45 billion t) since the low point near the end of 1971.

During the fall of 1970 and 1972, the Utah Geological and Mineral Survey cored the bottom of the north part of the lake, and J. H. Goodwin (written commun., 1973) estimated the salt crust at 1.14 and 1.33 billion tons (1.03 and 1.21 billion t), respectively. Also, the dissolved-solids load in the fall of 1972 was about 4.2 billion tons (3.8 billion t). On the basis of the 1972 estimates, the total dissolved plus precipitated salt load for the entire lake would be about 5.5 billion tons (4.99 billion t). Therefore, about 1 billion tons of salt crust (0.91 billion t) remained in the north part in October 1974.

In 1965, a lower layer of brine was observed in the south part of the lake (Hahl and Handy, 1969, fig. 1). This lower layer had chemical characteristics similar to the brine in the north part. Madison (1970, p. 12) and Waddell and Bolke (1973, p. 35) also observed this layer and stated that its volume remained relatively constant. Additional data collected by the U. S. Geological Survey and the Utah Geological and Mineral Survey during 1973-74 indicated that the volume of this lower layer and the altitude of the interface with the overlying brine was essentially unchanged, even though the lake altitude had increased by several feet. Madison (1970, p. 12) surmised that the apparent stability of the volume of the lower layer was due to equilibrium between the amount of brine moving south through the causeway and the amount of mixing taking place at the interface. Data prior to 1957 are insufficient to indicate whether density stratification was prevalent in the lake prior to construction of the causeway.

WATER BUDGET

The water budget for Great Salt Lake can be expressed in the following equation:

$$\Delta S = Is + Ig + Ip - Oe \qquad (1)$$

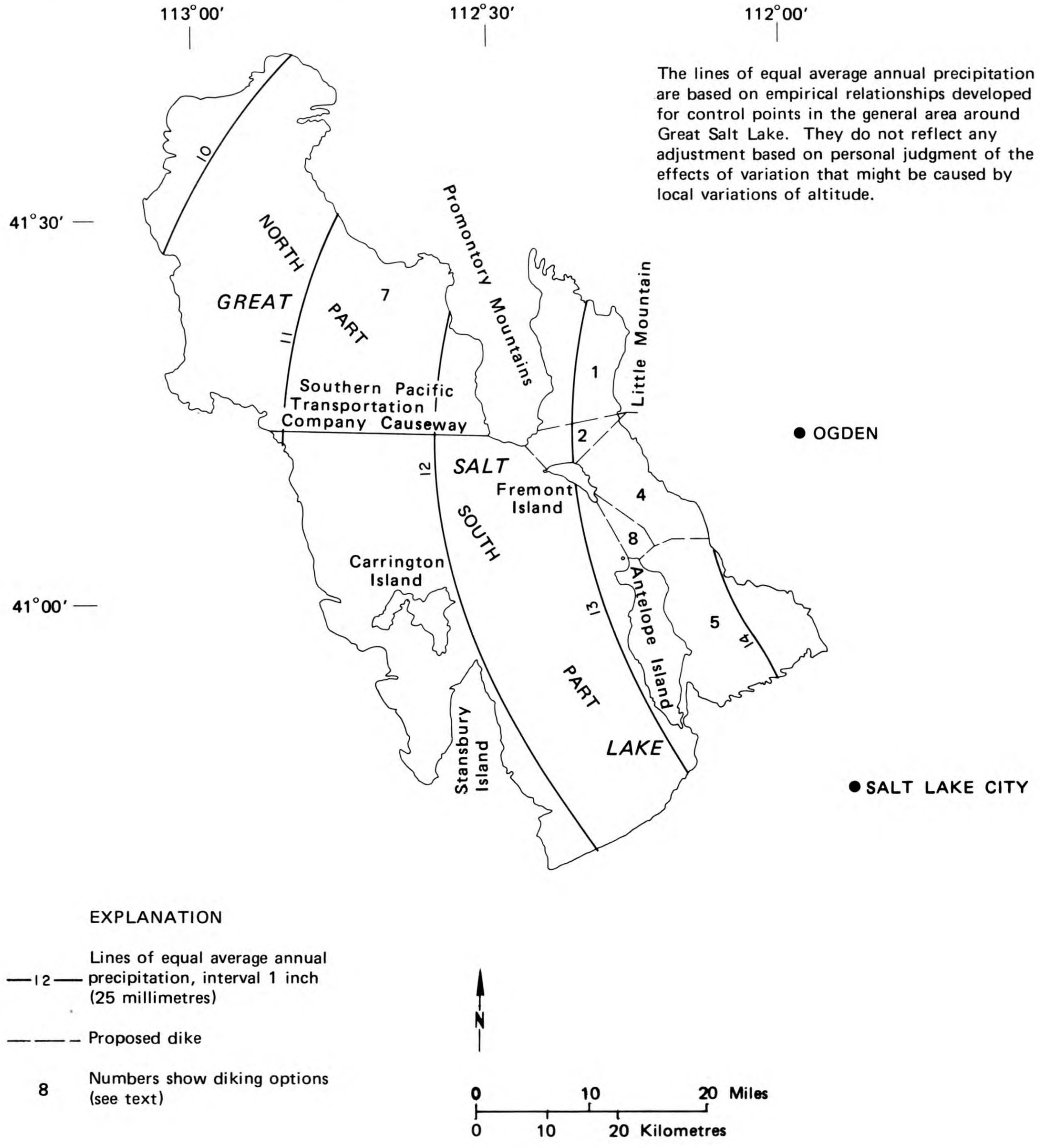
where ΔS is change of storage, Is is surface inflow, Ig is ground-water inflow, Ip is precipitation directly on the lake surface, and Oe is evaporation from the lake surface.

Now, let V (t - 1) represent the volume at the beginning of time step (t) and V (t) represent the volume after the time step. Then

$$V\ (t) = V\ (t - 1) + \Delta S. \qquad (2)$$

Altitude, area, and volume relationships are known for the lake (see appendix); therefore, volume (V) and area (A) can be expressed as functions of altitude (Al). Thus, by knowing the volume or changes in volume with time, a prediction of altitude can be made. Equations (1) and (2) are the basic equations used in the model in this study for computing the water budget for separate parts of the lake. This budget or mass balance technique is simple, but it requires knowledge of all parameters in the budget equation.

In order to predict the effects of various diking proposals on the water and salt budget of Great Salt Lake, it is necessary to have a data base for the parameters in the budget through a pre-selected base period. A base period is necessary in order to observe the response of the lake to climatic changes that affect


The lines of equal average annual precipitation are based on empirical relationships developed for control points in the general area around Great Salt Lake. They do not reflect any adjustment based on personal judgment of the effects of variation that might be caused by local variations of altitude.

Base from U.S. Geological Survey state base map, scale 1:500,000, 1959

Figure 3. Map showing average annual precipitation on Great Salt Lake, 1931-73.

the parameters in the water budget. By adopting a period from the past for which the parameters can be estimated, a data base was developed for use in the model.

A data base for 1931-73 was developed for the model. This was the longest period for which adequate data were available upon which to estimate the parameters within the budget equation. The period also covers two long-term cycles in which the water surface either rose or fell for several years (fig. 1). A time period (T) of 1 month was adopted, which means that all parameters in the water budget had to be estimated for each month of the period 1931-73.

Table 1. Average annual precipitation and freshwater evaporation for various lake altitudes and diked areas.

Area (figs. 3 and 5)	Altitude above mean sea level (ft)	Precipitation (Pa) (in)	Evaporation (in)
South part	4,205	12.98	55.98
	4,199	13.46	56.25
	4,196	13.70	56.39
	4,195	13.74	56.41
7	4,205	10.66	62.72
	4,199	10.80	62.09
	4,196	11.08	61.48
	4,195	11.13	61.32
1	4,205	13.09	52.56
	4,199	12.93	52.56
	4,196	12.95	54.18
2	4,205	12.89	54.42
	4,199	12.89	54.35
	4,196	12.89	54.47
4	4,205	13.42	52.88
	4,199	13.38	53.26
	4,196	13.34	53.44
5	4,205	13.86	51.42
	4,199	13.81	51.50
	4,196	13.71	51.94
2 + 4 + 8	4,205	13.34	53.36
	4,199	13.81	53.52
	4,196	13.71	53.84
Average for diked areas		13.33	53.25

Precipitation

The inflow to Great Salt Lake from precipitation on the water surface (Ip) was calculated in the following manner. The average annual precipitation (Pa) during 1931-73 was computed for 68 sites in a large area surrounding the lake. A multiple-regression analysis of the data was made to derive an equation describing mean annual precipitation as a function of latitude, longitude, and altitude. Using the equation, lines of equal average annual precipitation during 1931-73 were drawn for the area around the lake for a water-surface altitude of 4,200 ft (1,280.2 m) (fig. 3).

The surface area of the lake varies with water-surface altitude, and because precipitation varies areally across the lake, the average precipitation on any part of the lake is dependent upon the area inundated at a given water-surface altitude. Thus the lake was separated into seven different areas—the north and south parts separated by the Southern Pacific Transportation Co. causeway and the bay areas east of a line joining the Promontory Mountains, Fremont Island, and Antelope Island (fig. 3). Average precipitation values were computed for inundated areas at water-surface altitudes of 4,195, 4,196, 4,199, and 4,205 ft (1,278.6, 1,278.9, 1,279.8, and 1,281.7 m) (table 1). Thus, by knowing Pa for various altitudes, the average precipitation for any lake altitude can be interpolated. For example, if the lake altitude of concern is 4,200 ft (1,280.2 m), then average annual precipitation would be

$$Pa_{4200} = [(4200 - 4199)/(4205 - 4199)] \cdot (Pa_{4205} - Pa_{4199}) + Pa_{4199}$$

The ratio of annual precipitation for individual years to the 1931-73 average (Pa) ranges from 0.67 to 1.43 (Aj) (table 10).[1] To compensate for this variation, the 1931-73 average was adjusted by the factor Aj. So, the adjusted annual precipitation is now Pad = (Pa)(Aj), where Aj is the annual correction factor for any year, j.

The next step was to compute the monthly distribution of precipitation for each month of each

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[1] The ratio Aj was determined by obtaining the ratio of annual precipitation of 10 stations near Great Salt Lake to the 1931-73 average for the same 10 stations.

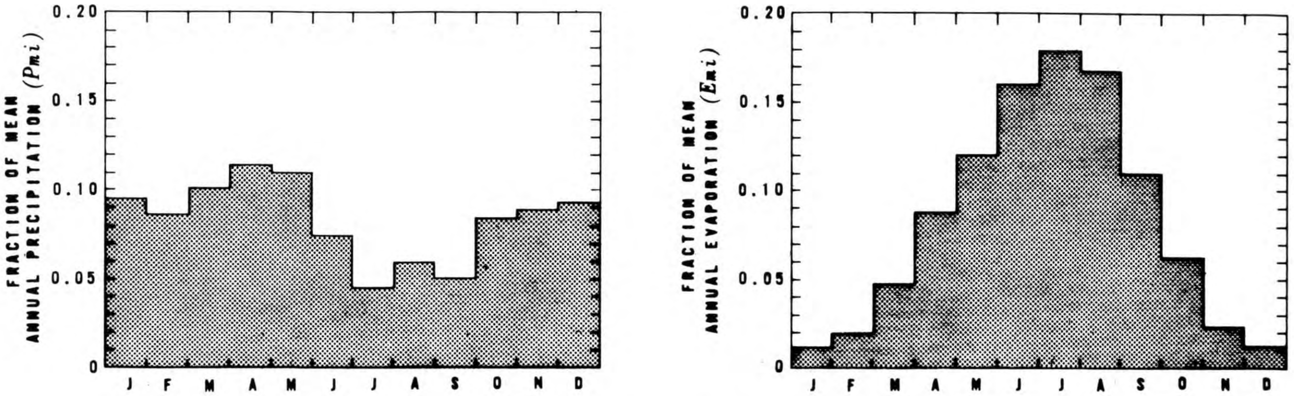

Figure 4. Graph showing average monthly distribution of precipitation and evaporation on Great Salt Lake, 1951-60.

year during 1931-73. This monthly distribution was computed as a percentage (Pmi)(100) of the annual total. The monthly distribution had only a small variation from year to year during a selected test period (1951-60) for 11 sites in the vicinity of Great Salt Lake. So an average monthly distribution was computed for the test period and assumed to be the same for each year of 1931-73 (fig. 4 and table 11). Thus, the average monthly precipitation for a given lake altitude becomes

$$Pm = (Pad)\ (Pmi)$$

The average annual inflow from precipitation on the lake surface during 1931-73 was estimated to be 966,000 acre-ft (1,190 hm^3) per year and ranged from 680,000 to 1,260,000 acre-ft (840 to 1,550 hm^3) per year.

In addition to precipitation on the surface of Great Salt Lake, precipitation on the wetland areas between long-term surface-inflow stations (fig. 6) and the shoreline of the lake was computed. This was done in order to extrapolate surface-inflow data observed at the long-term stations downstream to those applicable at the shoreline at an altitude of 4,200 ft (1,280.2 m) (table 2). The variance of precipitation (and evaporation) for these areas was small, so a mean value of 13.81 in (351 mm) per year was used for all areas. The annual distribution factor (Aj) and monthly distribution factor (Pmi) computed for Great Salt Lake were also used for the wetland areas.

Evaporation

Evaporation from Great Salt Lake (Oe) was developed as a function of latitude, longitude, water-surface altitude, pan coefficients, and salt content. To do this several intermediate steps were necessary.

The first step involved the extension of short-term class A pan records at 49 sites to the period 1931-70.[1] Most of the stations have records only during June-September, so the June-September evaporation data for all the short-term stations were extended to 1931-70 ($Est_{1931\text{-}70}$). This was done by using the ratio of the short-term data (Est) to the concurrent record at a long-term site (Elt), as a factor times the 1931-70 data at the long-term site ($Elt_{1931\text{-}70}$) (table 12).

$$Est_{\text{June-Sept. }1931\text{-}70} = (Est/Elt)\ (Elt_{1931\text{-}70})$$

The record at Utah Lake Lehi is complete for 1931-70 and was used as the long-term site.

The second step involved the extension of the June-September data to the entire year. The ratio of June-September data to that for the entire year was computed for those few sites where complete annual records were available. It was found that these ratios varied as a function of latitude. Using the multiple-regression technique, an equation describing the annual correction factor (Acf) as a function of latitude was developed. This equation was then used to extend the June-September evaporation data to the entire year for the complete data set (table 12). Very little evaporation occurs from November to February; thus, the extension of June-September evaporation to January-December evaporation essentially adds the months of March, April, May, and October. For each site, therefore, the January-December evaporation ($Est_{\text{Jan.-Dec. }1931\text{-}70}$) is obtained by dividing the June-September estimates ($Est_{\text{June-Sept. }1931\text{-}70}$) by the annual correction factor (Acf) associated with a particular latitude (table 12):

$$E = E_{\text{Jan.-Dec. }1931\text{-}70} = E_{\text{June-Sept. }1931\text{-}70}/Acf$$

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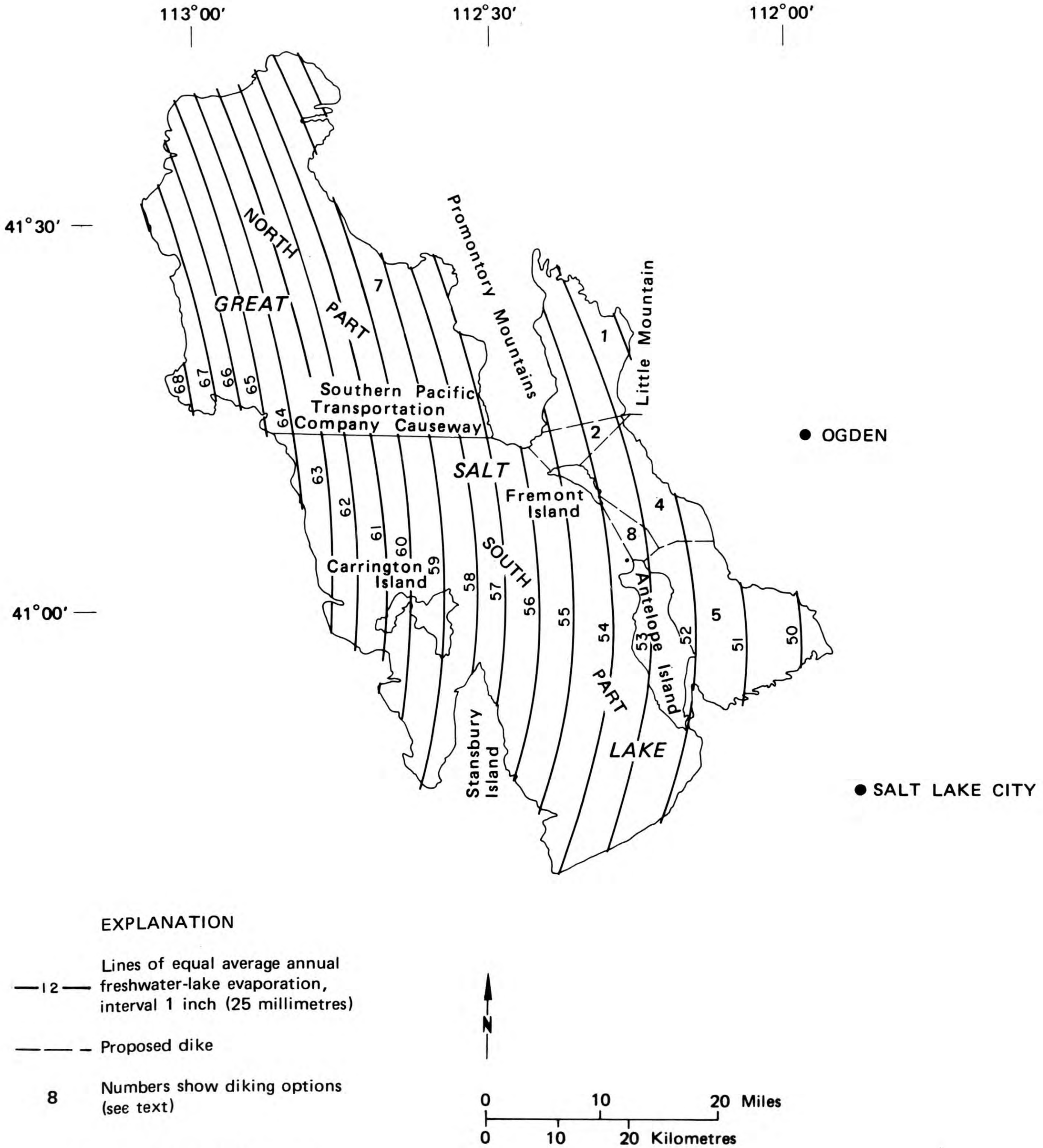
[1] The period 1931-70 was used because the records for 1971-73 were not yet available. The small annual variance during this period indicated that a 1931-70 base period for evaporation would be adequate even though 1931-73 was the base period for the model.



Base from U.S. Geological Survey state base map, scale 1:500,000, 1959

Figure 5. Map showing average annual freshwater-lake evaporation for Great Salt Lake, 1931-70.

The third step was to compute the pan coefficients in order to convert pan evaporation to freshwater-lake evaporation. The pan coefficients (Pcf) shown in table 12 were interpolated from the U. S. Department of Commerce (1959, pl. 3). The annual freshwater-lake evaporation (Efw) was then computed for each station as follows (table 12):

$$\mathrm{Efw} = (\mathrm{E})(\mathrm{Pcf})$$

The fourth step was to develop an equation describing freshwater-lake evaporation (Efw) as a function of latitude, longitude, and water-surface altitude. This equation was developed by multiple-regression technique using the data input from the 49 sites in table 12. Then, lines of equal freshwater-lake evaporation were drawn for Great Salt Lake using data generated by the equation (fig. 5).

Like precipitation, the mean evaporation is variable over the lake surface; and because the lake-surface area varies with the lake altitude, it was necessary to compute mean values for different areas inundated at various altitudes for the several proposed areas of the lake. The lake surface was broken down in the same way as described for precipitation and the mean evaporation values were computed for areas inundated at water-surface altitudes of 4,205, 4,199, 4,196, and 4,195 ft (1,281.7, 1,279.8, 1,278.9, and 1,278.6 m) (table 1). Then by interpolation, the freshwater-lake evaporation can be computed for the inundated area occurring at any altitude.

The pan-evaporation data at Utah Lake Lehi were tested for annual variations by computing the ratio of the annual pan-evaporation values to the 1931-70 mean. The ratio ranged from 0.84 to 1.19. These ratios were used initially to correct the 1931-70 means for the evaporation of an individual year. During calibration of the model, however, it was found that these annual variations created a larger error in the mass balance than did a factor of 1.0. So the correction factor for the individual year evaporation was discarded and the mean value for 1931-70 was used without correction. The annual variations are probably within the range of sampling error and are not indicative of annual fluctuations of evaporation rates.

The monthly distribution of evaporation for 1931-73 was computed similarly to that of precipitation. The monthly distribution was computed as a percentage (Emi)(100) of the annual total (fig. 4). The monthly distribution had only a small variation from year to year during a selected test period (1951-60). An average monthly distribution was computed for the test period and assumed to be the same for each year of 1931-73. Thus:

$$\text{Monthly freshwater-lake evaporation} = (\mathrm{Efw})(\mathrm{Emi}).$$

Table 2. Average annual precipitation and freshwater evaporation from Willard Reservoir and wetland areas between long-term surface-inflow stations and the 4,200-foot shoreline of Great Salt Lake.

	Precipitation (in)	Evaporation (in)
Bear River Migratory Bird Refuge	13.25	49.4
Willard Reservoir	14.10	49.1
Farmington Bay Waterfowl Management Area	14.08	50.2
Average	13.81	49.6

The next step was to correct freshwater-lake evaporation (Efw) for the effect of salt content. The following equations, which were developed during a prior study of Great Salt Lake (Waddell and Bolke, 1973, p. 33), were adapted for this study:

$$\mathrm{SCE} = (1 - 0.778\ \mathrm{CS}/\rho\mathrm{S})$$

$$\mathrm{SCEN} = (1 - 0.778\ \mathrm{CN}/\rho\mathrm{N})$$

The equations were then verified with field data obtained from the Morton Salt Co. These data were for brines whose specific gravity indicated that they were near saturation with respect to sodium chloride (table 3). Saturation in the north part of Great Salt Lake is attained at a specific gravity of approximately 1.225 at a temperature of 20°C (68°F). The average specific gravity of the brines observed by the Morton Salt Co. was 1.218 at an average temperature of 24.9°C (76.8°F). This adjusts to 1.219 at 20°C (68°F). The average ratio of the brine to freshwater, adjusted to 20°C (68°F), thus was 0.75. This compares to a ratio of 0.78 which was computed by the equations of Waddell and Bolke (1973, p. 33).

Thus, the evaporation rate from Great Salt Lake, in inches, was computed by applying the salinity correction factor (SCE or SCEN) to the freshwater-lake evaporation rate (Efw) for the concentration (CS or CN) existing in the lake for each month of the 1931-73 base period. Then total evaporation, in acre-feet, was computed for each month by applying the rate to the total area as shown in the following equations:

$$\text{Monthly evaporation from south part} = (\mathrm{Efw}/12)(\mathrm{Emi})(\mathrm{SCE})(\mathrm{A})$$

$$\text{Monthly evaporation from north part} = (\mathrm{Efw}/12)(\mathrm{Emi})(\mathrm{SCEN})(\mathrm{A})$$

The annual evaporation from Great Salt Lake ranged from about 2.2 to 4.0 million acre-ft (2,712.6 to 4,932.0 hm^3) during 1931-73. The average annual

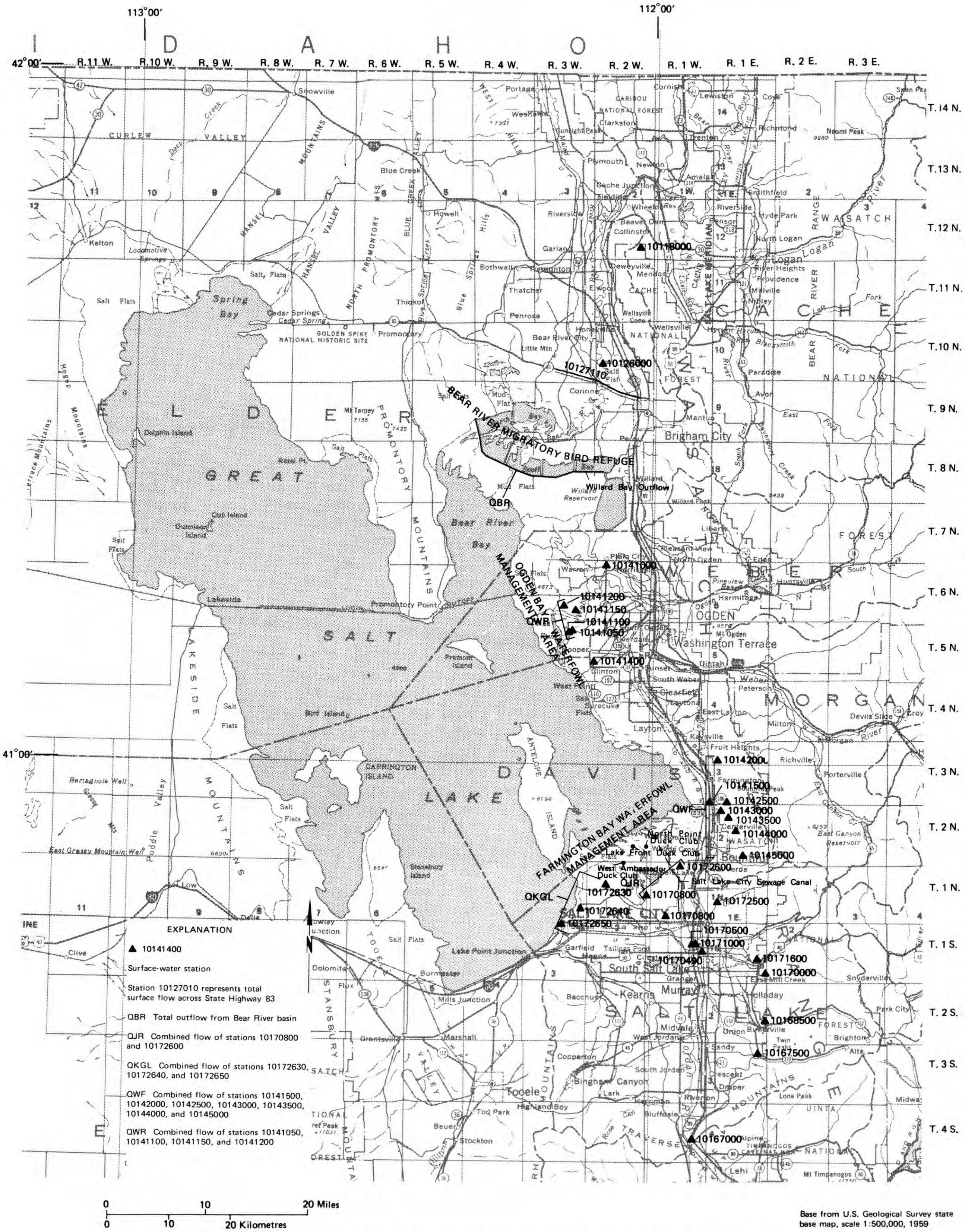


Figure 6. Map showing location of gaging sites used for estimating surface inflow to Great Salt Lake.

Table 3. Compilation of evaporation data for brines and freshwater.
[courtesy of Morton Salt Co.]

Date	Brine			Freshwater evaporation (in)	Ratio of brine to freshwater evaporation
	Evaporation (in)	Specific gravity	Temperature (°F)		
June 1958	9.95	1.225	74.6	14.27	.70
July	10.51	1.230	75.0	15.21	.69
Aug.	8.96	1.235	78.7	13.09	.68
June 1959	8.76	1.220	72.9	11.64	.75
Aug.	9.52	1.210	74.9	12.21	.78
Aug. 1960	10.76	1.210	–	13.10	.82
May 1961	8.23	1.214	–	10.60	.78
June	12.41	1.220	–	14.87	.83
July	11.77	1.217	81.5	13.85	.85
Aug.	9.05	1.238	77.6	12.57	.72
Aug. 1963	10.69	1.206	76.4	13.30	.80
May 1966	7.68	1.203	–	11.08	.69
July	11.08	1.215	–	15.42	.72
Aug.	10.21	1.200	–	13.47	.76
July 1968	11.23	1.210	80.6	15.17	.74
May 1969	9.08	1.217	68.3	12.16	.75
July	9.88	1.218	80.7	12.76	.77
Aug.	9.93	1.218	78.6	13.83	.72
June 1970	7.21	1.212	72.7	10.24	.70
July	9.02	1.216	79.6	12.83	.70
Aug.	8.70	1.247	79.4	12.98	.67
July 1971	10.43	1.214	79.2	13.71	.76
May 1972	8.60	1.215	64.7	10.33	.83
July	12.16	1.219	81.2	16.51	.74
Aug.	9.55	1.218	77.8	12.36	.77
June 1973	9.46	1.218	75.2	11.72	.81
July	9.24	1.206	81.1	11.92	.78
Aug.	9.46	1.226	79.6	12.26	.77
Average		1.218	76.8		.75

evaporation was 2.98 million acre-ft (3,674.3 hm^3) or 45 in (1,143 mm) per year.

Surface Inflow

Surface inflow to Great Salt Lake (Is) was estimated for 1931-73 by correlation of short-term records obtained at stream-gaging sites near the lakeshore with long-term records obtained at sites upstream. On some streams, several correlations were necessary to extend the record to sites nearest the shore of the lake. The site locations are shown in figure 6, and the period of record is shown in table 6. Some of the 1931-73 estimates are based on data collected only during 1971-73. The estimates for these sites are subject to considerable error, and they can be improved only with the collection of additional data.

Statistical summaries for all correlations are shown in table 7. The standard error of estimate ranged from 5.1 to 27 percent of the average. Monthly estimates of surface inflow to Great Salt Lake at individual gaging sites are shown in table 16, and total estimated annual surface- and ground-water inflow to the lake is shown in table 17.

The inflow boundary to Great Salt Lake was selected as the shoreline for a water-surface altitude of approximately 4,200 ft (1,280.2 m). This shoreline is near the dike outlets of bird refuges on the Bear, Weber, and Jordan Rivers, which are the main contributors of surface inflow to the lake.

Bear River

The records of inflow of the Bear River and its tributaries to Great Salt Lake were extended to the dike of the Bear River Migratory Bird Refuge, and the dike was assumed to be the inflow point for the 1931-73 base period.

The gaging station on the Bear River near Collinston (site 10118000) is the closest site to the inflow point of the Bear River with a record that

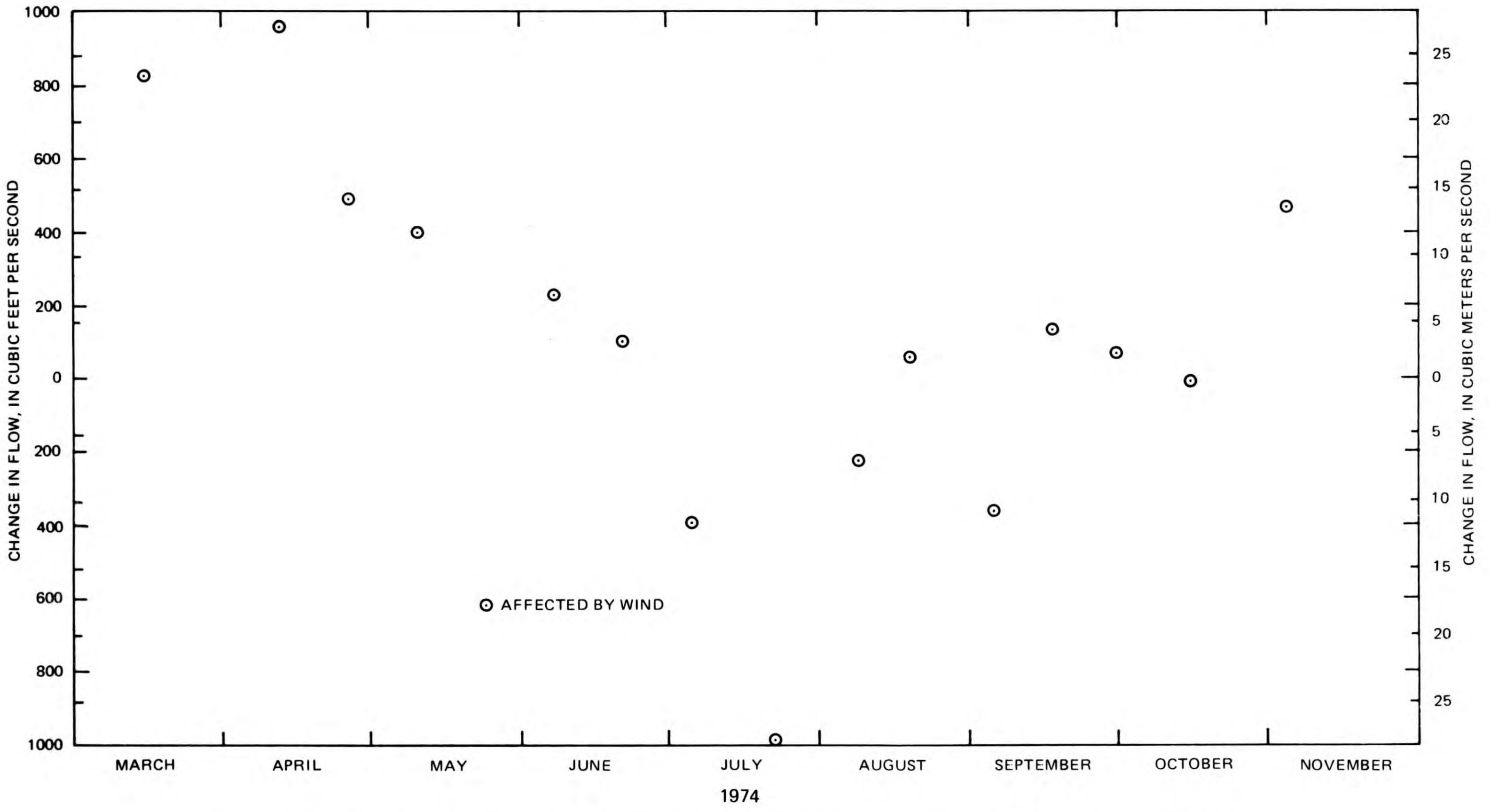


Figure 7. Graph showing net change of flow from State Highway 83 to the dike of the Bear River Migratory Bird Refuge.

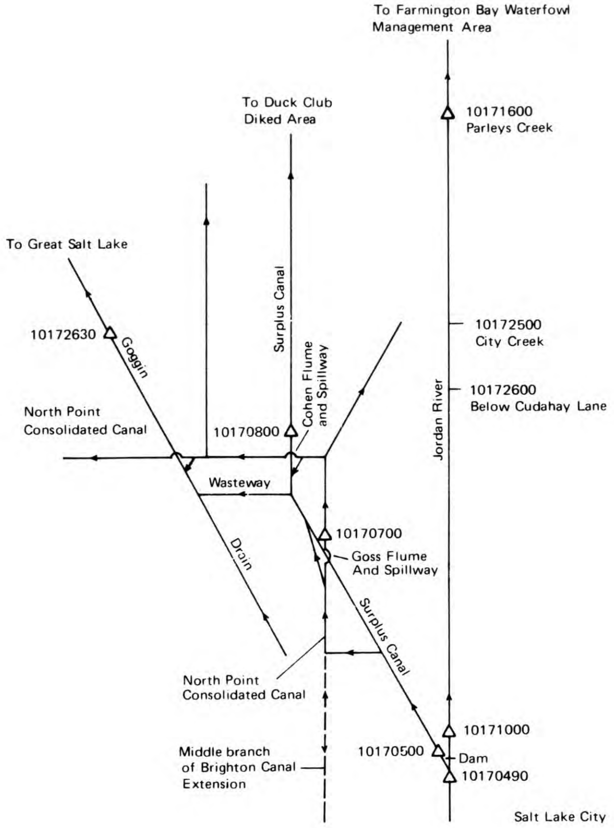


Figure 8. Schematic diagram showing relation of flows in lower Jordan River basin.

includes the entire 1931-73 base period (table 6). Records for site 10118000 were used to extend the record near Corinne (site 10126000) to the 1931-73 base period. Other canals and drainage tributary to the Bear River that cross State Highway 83 (site 10127110) were measured during the 1972-74 water years.[1] This flow was then added to the flow of the Bear River near Corinne, giving the total flow across State Highway 83 (table 13). The percentage of the total flow across State Highway 83 that was contributed by the tributaries and canals was computed for each month during the 1972-74 water years and was found to average about 10 percent of the flow of the Bear River near Corinne. The 10-percent gain was then applied to the 1931-71 estimates to provide a 1931-73 estimate of the total flow across State Highway 83.

To extend the record from State Highway 83 to the outflow point at the Bear River Migratory Bird Refuge dike, measurements were made during 1974 of flow changes from State Highway 83 to the dike (table 4 and fig. 7). Figure 7 shows the net change of flow from State Highway 83 to the dike of the Bear River Migratory Bird Refuge. Of the 16 measurements made during 1974, 6 indicated net losses. Most of these losses occurred during the warmer months when evaporation was high; conversely, gains generally occurred during the months when evaporation was low. These measurements are representative of 1974, but it is not known how well they relate to 1931-73. In view of these uncertainties, an alternative method was used to estimate the net change from State Highway 83 to the refuge dike.

Table 4. Compilation of data showing net change of flow, in cubic feet per second, from State Highway 83 to the dike of the Bear River Migratory Bird Refuge.

Date	Total flow across State Highway 83	Two-day average (rounded)	Refuge dike	Net gain(+) or loss(-)
3-14-74	4,530			
3-15	4,470	4,500	5,330	+830
4-11	3,050			
4-12	3,210	3,130	4,090	+960
4-25	3,610			
4-26	3,670	3,640	4,130	+490
5- 9	3,960			
5-10	4,200	4,080	4,480	+400
5-23	3,450			
5-24	3,400	3,420	2,800	-620
6- 6	3,260			
6- 7	3,370	3,320	3,550	+230
6-20	2,530			
6-21	1,940	2,240	2,340	+100
7- 4	1,030			
7- 5	1,000	1,020	626	-394
7-21	1,130			
7-22	1,090	1,110	122	-988
8- 7	733			
8- 8	926	830	598	-232
8-18	723			
8-19	451	587	644	+58
9- 4	1,030			
9- 5	794	912	549	-363
9-16	1,600			
9-17	1,690	1,640	1,770	+130
9-29	919			
9-30	911	915	984	+69
10-14-74	1,630			
10-15	1,500	1,560	1,550	-10
11- 3	1,630			
11- 4	1,670	1,650	2,120	+470

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[1] A water year is the 12-month period from October 1 through September 30, and it is designated by the calendar year in which it ends. Thus, the water year ending September 30, 1974, is called the "1974 water year."

Table 5. Net change of flow, in cubic feet per second, between the Jordan River (2100 South) and the outlets from duck clubs and Farmington Bay Waterfowl Management Area.
[see fig. 6 for location of sites]

Date	Site 10172630	Two-day average	Site 10170500 plus 10171000	Two-day average	Site 10170500 plus 10171000 minus 10172630	Farmington Bay Waterfowl Management Area plus duck clubs	Net gain(+) or loss(-)
12-18-73	29		713				
12-19-73	29	29	696	705	676	634	-42
1-23-74	375		911				
1-24-74	377	376	907	909	533	666	+133
2-27-74	361		980				
2-28-74	370	366	994	987	622	538	-84
3-28-74	434		900				
3-29-74	430		906				
3-30-74	423		960				
3-31-74	423		953				
4- 1-74	400	422	932	930[1]	508	538	+30
5- 2-74	425		688				
5- 3-74	381	403	638	663	260	819	+559
5-30-74	533		1,102				
5-31-74	475	504	1,079	1,091	587	769	+182
6-25-74	36		662				
6-26-74	42	39	640	651	612	296	-316
8-26-74	18		522				
8-27-74	23	21	516	519	498	239	-259
10- 2-74	24		414				
10- 3-74	23	24	458	436	412	244	-168

[1] Five-day average.

The net change of flow from State Highway 83 to the dike during 1931-73 was estimated by determining the net change due to precipitation and evaporation within the intervening area and then adding or subtracting any other gain or loss as determined by the calibration of the model. (The precipitation and evaporation rates used are shown in table 2.) This is discussed in a later section under "Calibration of model."

Weber River

The gaging station on the Weber River near Plain City (site 10141000) is the site nearest Great Salt Lake with a record that incorporates the entire 1931-73 base period. Records for site 10141000 were used to extend the record of four short-term stations (QWR in table 7 and fig. 6), which monitored the total flow of the Weber River during 1971-73 as the water either entered or bypassed the Ogden Bay Waterfowl Management Area (fig. 6). Monthly gains were recorded during 1971-73 between the long- and short-term sites, the flow at the sites correlated well, and the average monthly gains for 1971-73 were used to extend the short-term records for the 1931-73 base period. The dike of the Ogden Bay Waterfowl Management Area was assumed to be the inflow point to Great Salt Lake, and the gain or loss from precipitation and evaporation on the management area was computed from data given in table 2. Any unmeasured change in flow in the management area was incorporated as part of the unmeasured inflow computed as part of the model calibration discussed in a later section under "Calibration of model."

Jordan River Basin

The discharge of the Jordan River to Great Salt Lake was obtained by extension of the flow in the river to the outlets of the Farmington Bay Waterfowl Management Area and the duck club outlets west of the management area. Several correlations from upstream stations with various intervals of record were required for extension through the 1931-73 base period.

Streamflow records of the Jordan River at Salt Lake City (2100 South) (site 10170490) are available for 1942-73. These records were extended through 1931-73 on the basis of correlations with upstream

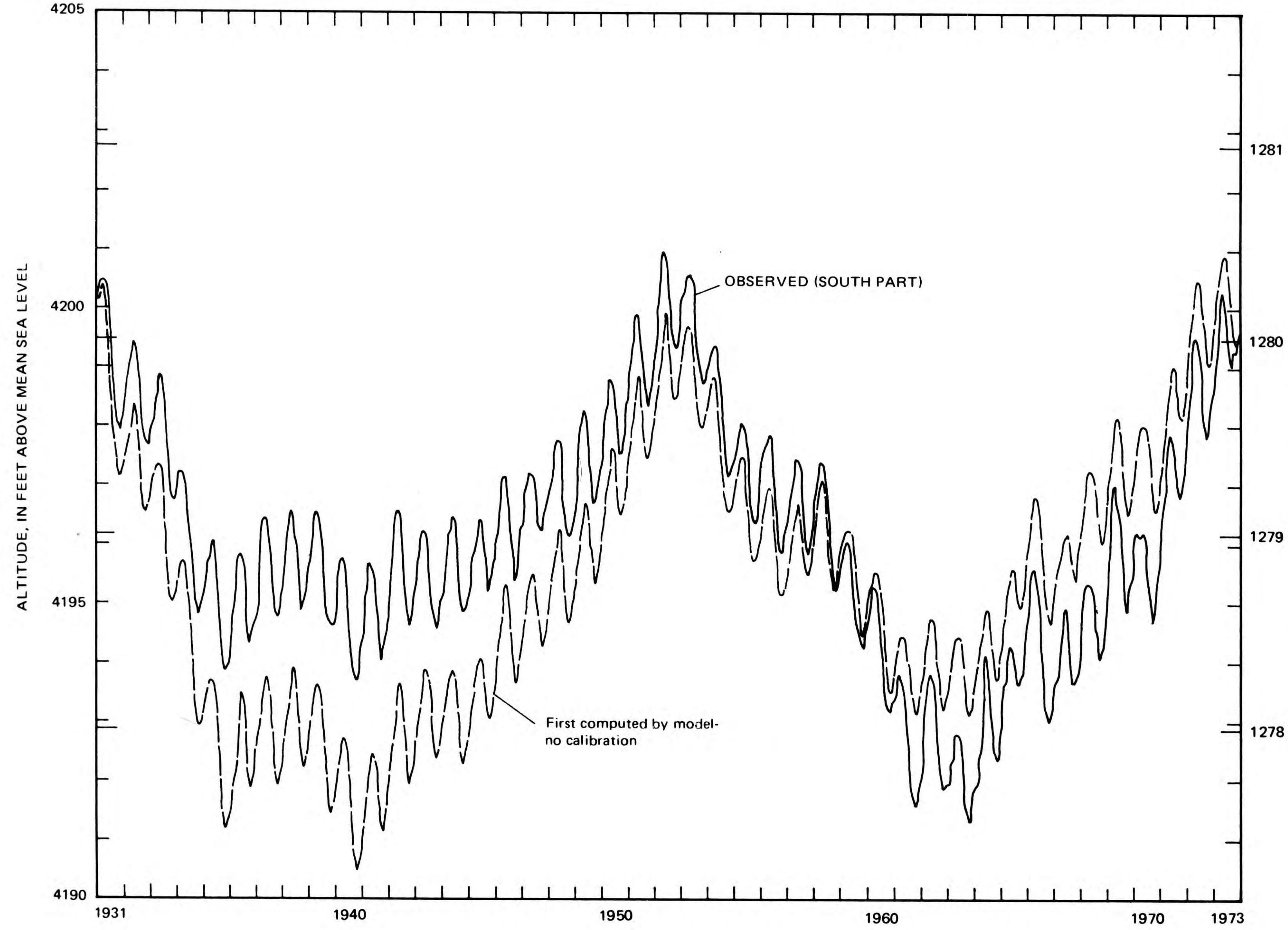


Figure 9. Graph showing comparison of observed and computed lake altitudes during calibration of the model.

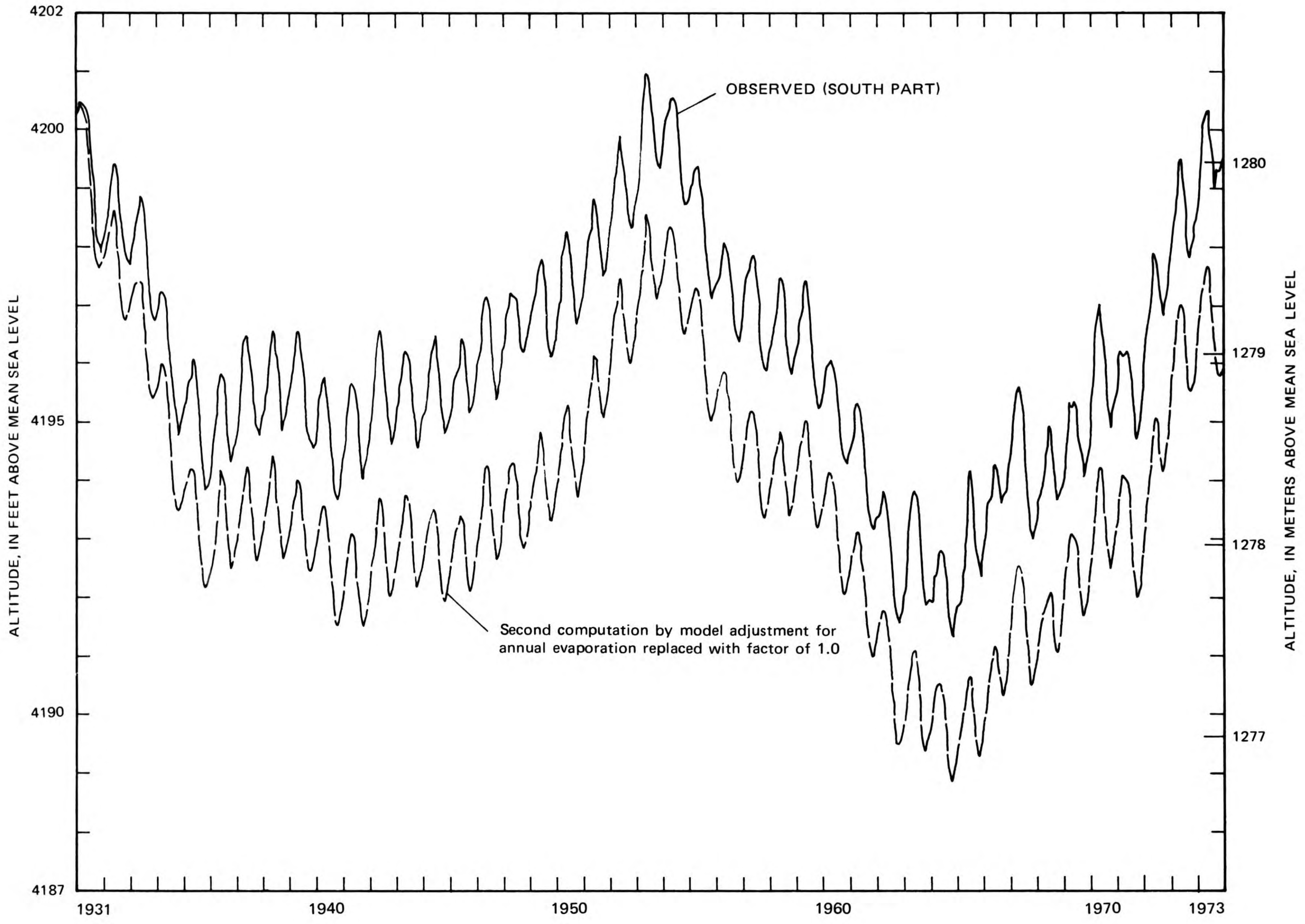


Figure 9. *continued*

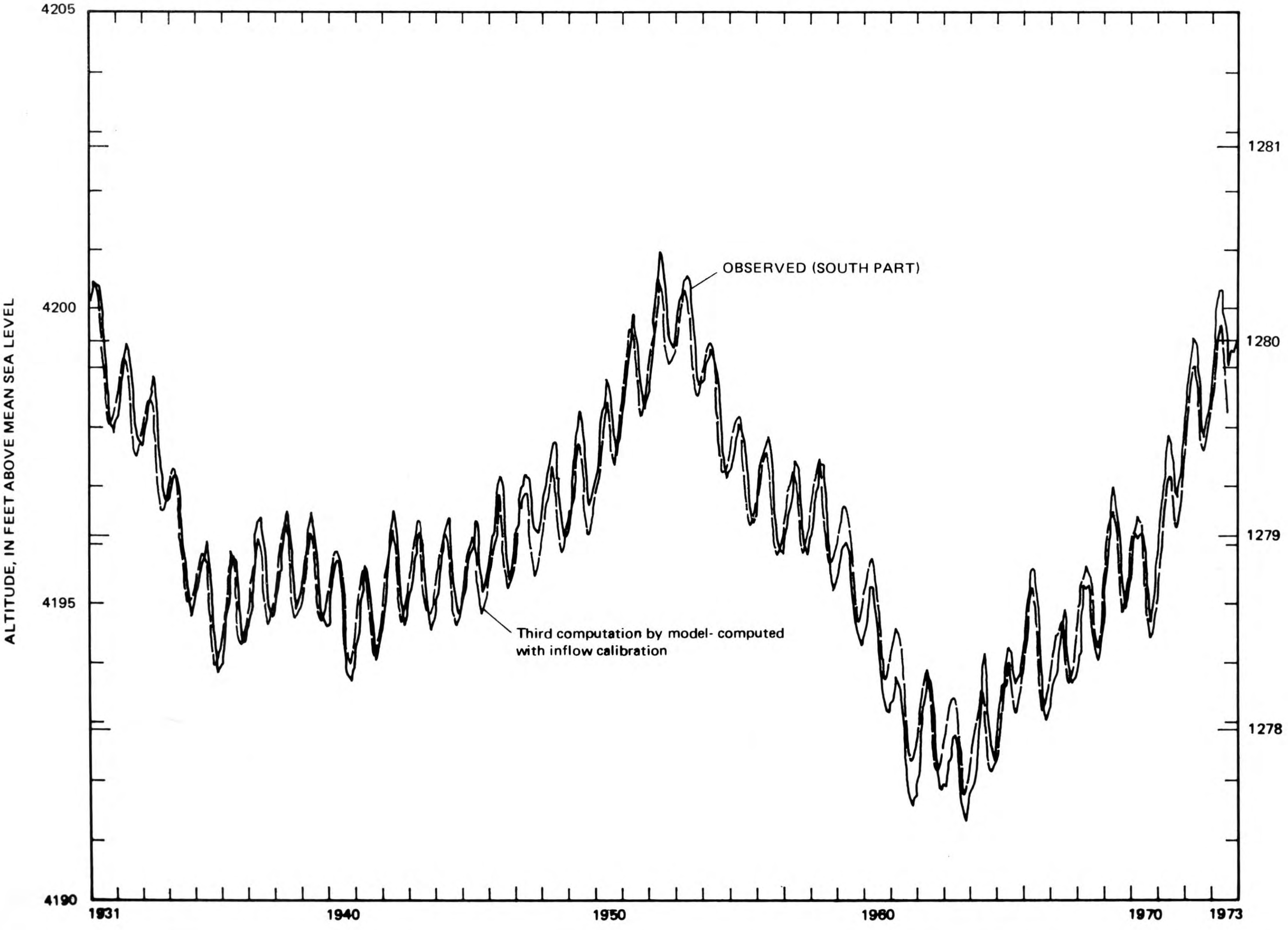


Figure 9. *continued*

Table 6. Bar chart of gaging-site records, 1931-73.

10118000	Bear River near Collinston, Utah
10126000	Bear River near Corinne, Utah
10127110	Bear River Basin outflow across State Highway 83 near Corinne, Utah
10141000	Weber River near Plain City, Utah
10141050	South Fork Weber Canal near Hooper, Utah
10141100	South Fork Weber River near Hooper, Utah
10141150	Middle Fork Weber River near Hooper, Utah
10141200	North Fork Weber River near Hooper, Utah
10141400	Howard Slough at Hooper, Utah
10141500	Holmes Creek near Kaysville, Utah
10142000	Farmington Creek above diversions, near Farmington, Utah
10142500	Ricks Creek above diversions, near Centerville, Utah
10143000	Parrish Creek above diversions, near Centerville, Utah
10143500	Centerville Creek above diversions, near Centerville, Utah
10144000	Stone Creek above diversions, near Bountiful, Utah
10145000	Mill Creek at Mueller Park, near Bountiful, Utah
10167000	Jordan River at narrows, near Lehi, Utah
10167500	Little Cottonwood Creek near Salt Lake City, Utah
10168500	Big Cottonwood Creek near Salt Lake City, Utah
10170000	Mill Creek near Salt Lake City, Utah
10170500	Surplus Canal at Salt Lake City, Utah
10170700	North Point Consolidated Canal below Goss flume, at Salt Lake City, Utah
10170800	Surplus Canal at Cohen flume, near Salt Lake City, Utah
10171000	Jordan River at Salt Lake City, Utah
10171600	Parley Creek at Suicide Rock, near Salt Lake City, Utah
10172500	City Creek near Salt Lake City, Utah
10172600	Jordan River below Cudahy Lane, near Salt Lake City, Utah
10172630	Goggin Drain near Magna, Utah
10172640	Lee Creek near Magna, Utah
10172650	Kennecott Drain near Magna, Utah
	Salt Lake City sewage canal

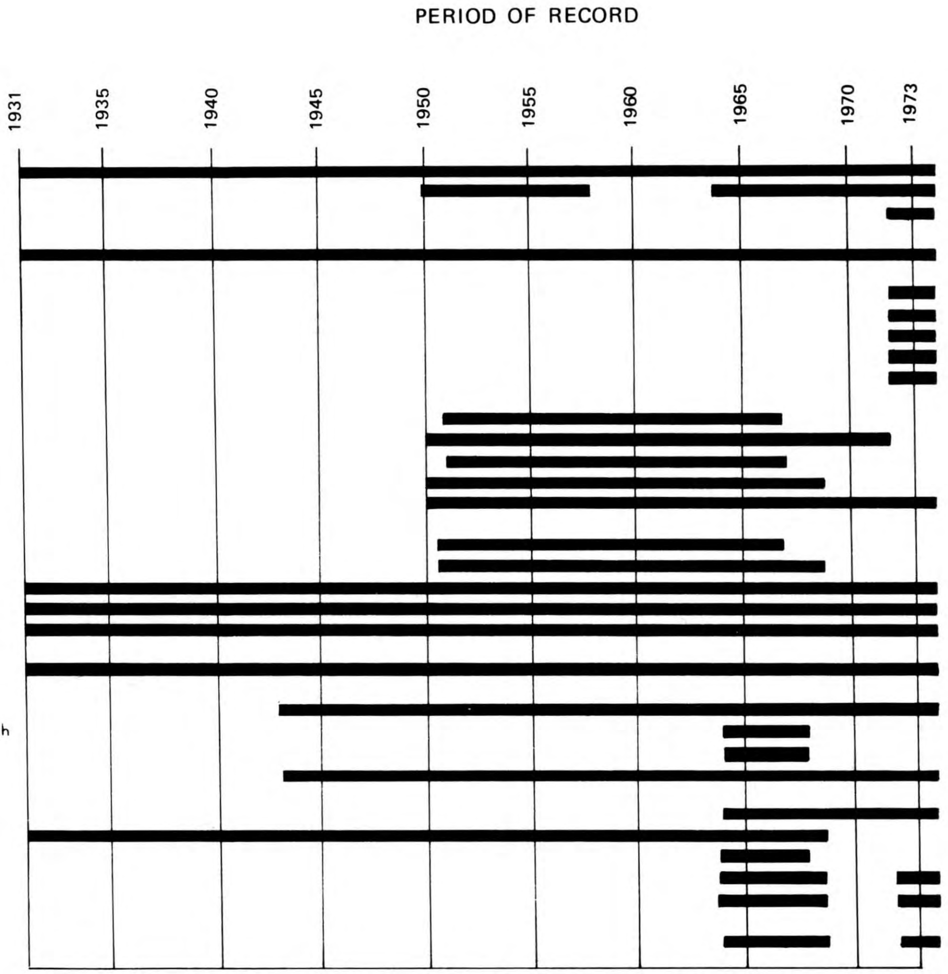


Table 7. Statistical summary of estimates of monthly surface inflow to Great Salt Lake.

Site being estimated (dependent variable)	Site(s) used for correlation analysis (independent variable)	Number of months used for correlation	Period being estimated (months and water years)	Correlation coefficient	Average of dependent variable (acre-ft)	Standard error of estimate expressed as:	
						Acre-ft	Percentage of the average of the dependent variable
			Bear River Basin				
10126000	10118000	180	1931-49, 1958-63	0.994	103,700	5,290	5.1
10127110	10126000	36	1931-70	–	(1)	–	–
			Weber River Basin				
QWR[2]	10141000	18	1931-71	.998	46,700	2,380	5.1
	Tributaries between Weber River and Farmington Bay Waterfowl Management Area						
QWF[3]	10172500	48	Nov.-Feb.; 1931-49, 1962-73	.578	616	86	14
		48	Mar.-June; 1931-49, 1962-73	.92	3,740	1,010	27
		48	July-Oct.; 1931-49, 1962-73	.90	733	150	20
			Jordan River Basin				
10170490	10167000 +	12	Oct., 1931-42	.915	19,900	1,939	9.7
(Monthly total)	10167500 +	12	Nov., 1931-42	.964	18,230	2,370	13
	10168500 +	12	Dec., 1931-42	.992	19,760	1,610	8.2
	10170000	12	Jan., 1931-42	.996	20,090	1,500	7.5
		12	Feb., 1931-42	.988	20,120	2,050	10
		12	Mar., 1931-42	.954	25,700	1,670	6.5
		13	Apr., 1931-42	.915	22,740	4,200	18
		14	May, 1931-42	.845	26,130	5,070	19
		16	June, 1931-42	.887	27,060	3,100	11
10170490 (Annual total)	10167000	11[4]	1931-42	.926	262,700	31,920	12
10170490 (July total)	10170490 (Annual total)	10	July, 1931-42	.226	17,170	2,440	14
10170490 (August total)	10170490 (Annual total)	10	Aug., 1931-42	.190	17,300	2,680	15
10170490 (September total)	10170490 (Annual total)	10	Sept., 1931-42	.334	18,560	1,990	11
10170500	10170490	154	1931-42	.975	12,040	1,690	14
10172600	10171000 + 10171600 + 10172500	60	1931-63, 1969-73	.922	9,270	742	8.6
10170800 + 10172630 + 10170700	10170500	60	1931-63, 1969-73	.993	12,940	717	5.5
10170800 (Oct. Nov.)	10170500	10	1931-63, 1969-73	.913	6,730	832	12
10170800 (Dec., Jan., Feb.)	10170500	15	1931-63, 1969-73	.976	7,090	531	7.5
10170800 (Mar., Apr., May, June, July)	10170500	25	1931-63, 1969-73	.916	8,740	1,650	19
10170800 (Aug. Sept.)	10170500	10	1931-63, 1969-73	.475	7,320	1,740	24

[1] Average ratio of monthly discharge at site 10126000 to that of site 10127110 during 1971-73 was 0.90. This ratio was used to estimate the 1931-70 discharge at site 10127110.

[2] Combined discharge of stations 10141050, 10141100, 10141150, and 10141200.

[3] Combined discharge of station 10141500, 10142000, 10142500, 10143000, 10143500, 10144000, and 10145000.

[4] Number of years used for correlation.

Table 8. Estimates of ground-water inflow to Great Salt Lake, in acre-feet.

	Farmington Bay (area 5, fig. 3)				Bear River Bay (area 1, fig. 3)			Bear River Bay-Syracuse (areas 2 and 4, fig. 3)	South part	North part	Total
	Antelope Island	Jordan Valley	East shore	Subtotal	Promontory	East shore	Subtotal				
Monthly inflow	125	165	2,000	2,300	250	1,000	1,250	1,000	870	830	6,250
Total annual: 6,250 x 12 = 75,000											

stations and inflowing tributaries (table 7). Just below site 10170490, the Surplus Canal diverts from the Jordan River and the flow path to the Great Salt Lake becomes quite complicated (fig. 8).

The record of the Jordan River at site 10171000 was estimated for 1931-41 from correlations with records at site 10170500 on the Surplus Canal and site 10170490 on the Jordan River. This record was then extended to site 10172600 on the Jordan River below Cudahy Lane on the basis of correlations of data collected at site 10172600 with that of data at site 10171000 and tributary sites 10171600 (Parleys Creek) and 10172500 (City Creek). Attempts were made to extend the record at site 10172600 to the dike outlets on the basis of monthly measurements made of outflow from the Farmington Bay Waterfowl Management Area during 1974 (table 5). The results of table 5 are as inconclusive as that of table 4 for extension through the 1931-73 base period.

Therefore, the flow estimated for site 10172600 was combined with the flow estimated for site 10170800 (QJR in fig. 6) and extended to the outlets of the waterfowl management area and duck clubs in a manner similar to that used for the lower reaches of the Bear and Weber Rivers.

Part of the water diverted into the Surplus Canal eventually ends up within the duck club diked areas and some is diverted to Goggin Drain, most of which drains into the south part of Great Salt Lake. Most of the water that flows into the duck club diked areas is water that passes site 10170800 (fig. 8). The flow at site 10170800 was measured during 1964-68, and the record was extended to 1931-73 on the basis of correlations of flows at site 10170800 with flows at site 10170500.

The water diverted from the Surplus Canal to the Goggin Drain was estimated by subtracting the flow passing site 10170800 from the total originating at site 10170500 and correlating with the combined flows of Goggin Drain and the North Point Consolidated Canal at sites 10172630 and 10170700.

Miscellaneous Inflow

Seven tributaries (QWF in table 7 and fig. 6) between the Weber River and the Farmington Bay Waterfowl Management Area had short-term records, which were correlated with the flow of City Creek (site 10172500 in fig. 6) for the entire 1931-73 base period. Although the seven short-term sites were along the slopes of the Wasatch Range and far removed from the lakeshore, they were the only means available for estimating inflows from tributaries along this part of the shoreline. Intermittent measurements were made at points on these tributaries near the shore of the lake during 1971-73, but additional measurements will be needed in order to extend the records of the upstream sites to the sites nearer the lakeshore.

Kennecott Drain and Lee Creek also drain directly into the south part of Great Salt Lake. Efforts to correlate short-term records at sites 10172640 on Lee Creek and 10172650 on Kennecott Drain were not successful. The average monthly flow at both sites was computed for the records at both sites (1963-68, 1971-73) and used for the remaining part of the 1931-73 base period.

Records of inflow were compiled for five sewage plants, all of which discharge their effluents directly into Farmington Bay. The largest of these plants is the Salt Lake City sewage plant. The total monthly discharge from these plants during 1959-73 is shown in table 16.

Ground-Water Inflow

Ground-water inflow to Great Salt Lake (Ig) is difficult to distinguish from other sources of inflow because of fluctuations of the shoreline during the 1931-73 base period. The base altitude used for estimates of ground-water inflow to the lake was 4,200 ft (1,280.2 m). The lowest altitude recorded during the base period (1931-73) was 4,191.35 ft (1,277.5 m) in 1963. The shoreline in many parts of the lake at that time was several miles downstream from its position when the lake was at an altitude of 4,200 ft (1,280.2 m). The flow of some streams increased due to

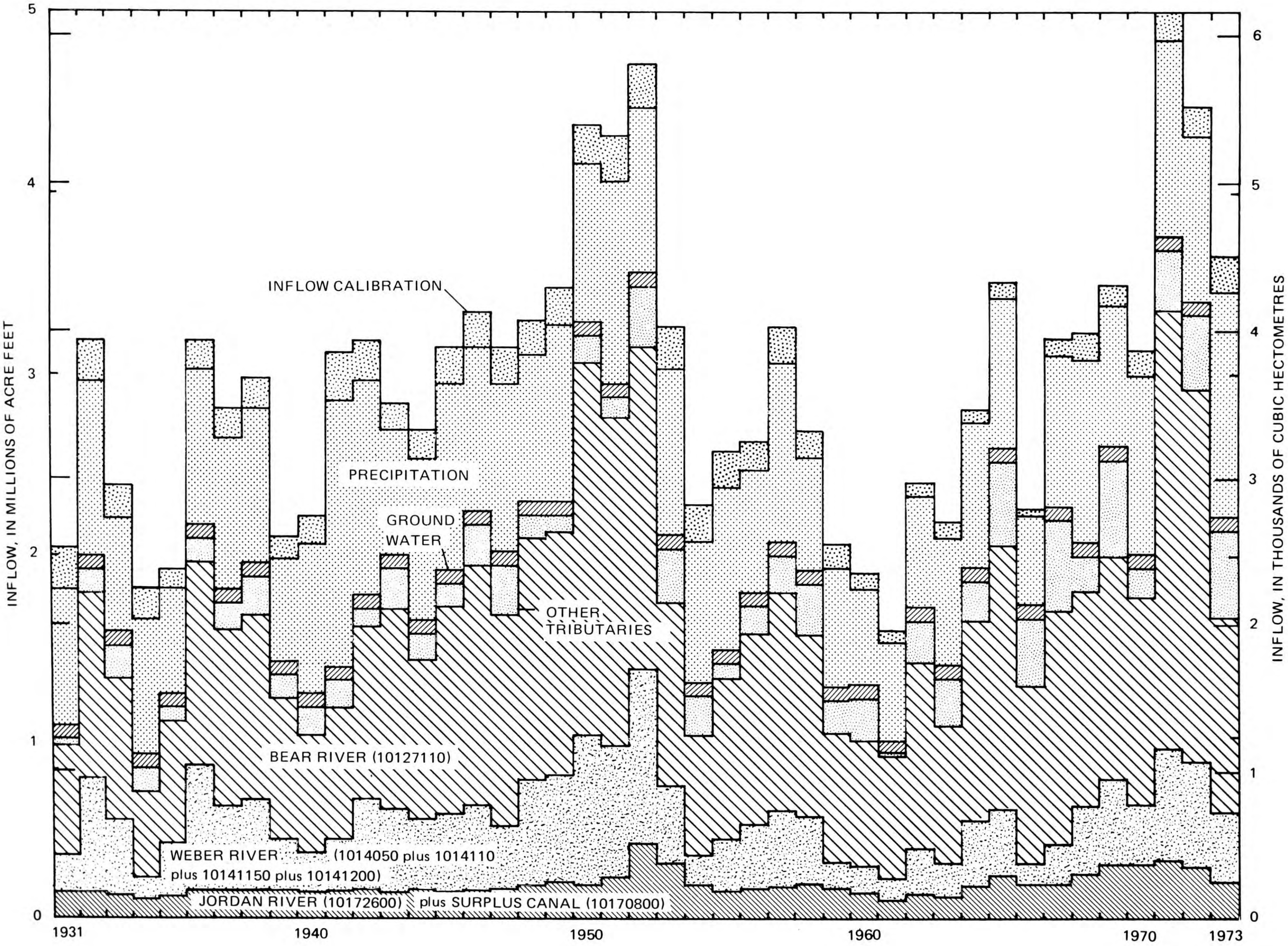


Figure 10. Graph showing annual inflow to Great Salt Lake from all sources, 1931-73.

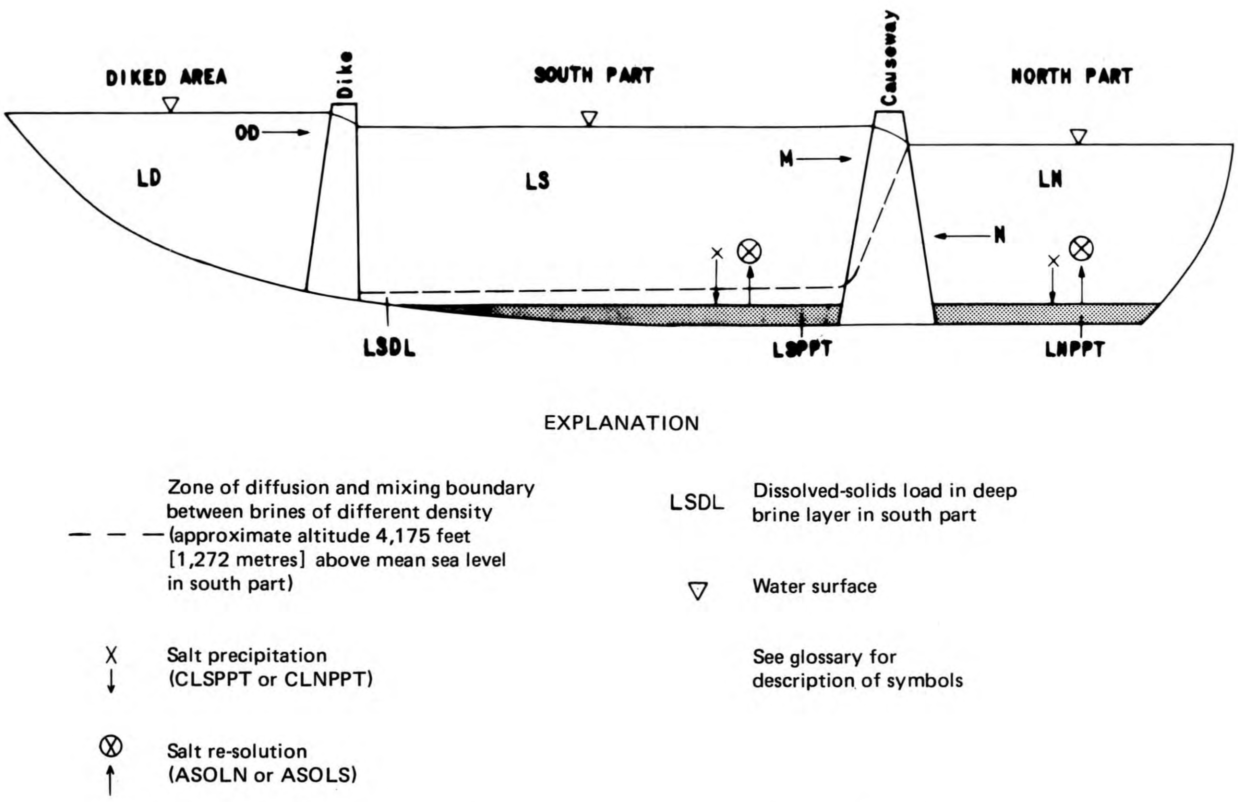


Figure 11. Schematic diagram showing salt balance for proposed diking option.

ground-water inflow between the 4,200-ft (1,280.2 m) shoreline and the position of any lower shoreline. Thus as the stream entered the lake at a shoreline lower than 4,200 ft (1,280.2 m), some of the surface inflow would be what was computed as ground-water inflow at a shoreline of 4,200 ft (1,280.2 m).

The total ground-water inflow to the lake was estimated to be 75,000 acre-ft (92.5 hm^3) per year, and monthly estimates are shown in table 8 (T. Arnow and J. C. Stephens, written commun., Apr. 22, 1974). The total estimate is subdivided for the north and south parts of the lake, Farmington Bay, Bear River Bay, and the shoreline extending from Bear River Bay to Syracuse. The entries in table 8 represent the estimates of average ground-water inflow to Great Salt Lake during 1931-73. Any error in these estimates would be incorporated with the calibration factor (Ium) discussed in a later section.

Calibration of the Model

After compilation of the inflow estimates for 1931-73, the data were tested in the model of the water budget discussed earlier in this report. The monthly lake altitudes were computed by the model for the 1931-73 base period and then compared with observed lake altitudes.

The observed and computed lake altitudes for the first computation by the model indicated that the net inflow estimate (or volume change, ΔS) was too low during the early part of the base period and too high during the latter part. This is indicated by the skewed contrast between the observed and computed lake altitudes in figure 9. The skewed contrast was removed in a second computation when the annual evaporation was assumed to be constant instead of variable from 1931 to 1973. Although the lake altitude computed with this assumption falls below that of the observed lake altitude, the relation is consistent throughout the base period.

The annual evaporation correction factors, which were based on data of one station (as discussed previously), were probably a result of sampling error and are not indicative of actual trends of evaporation rates. However, there were 3 years in which the evaporation rates had to be adjusted to prevent a large divergence between the observed and computed lake altitudes. During 1937, 1939, and 1970, the annual evaporation was corrected by the factors of 0.9, 0.8, and 1.15, respectively.

Comparison of the computed (second model computation) and observed hydrographs indicates a deficiency in the estimated net inflows, as computed

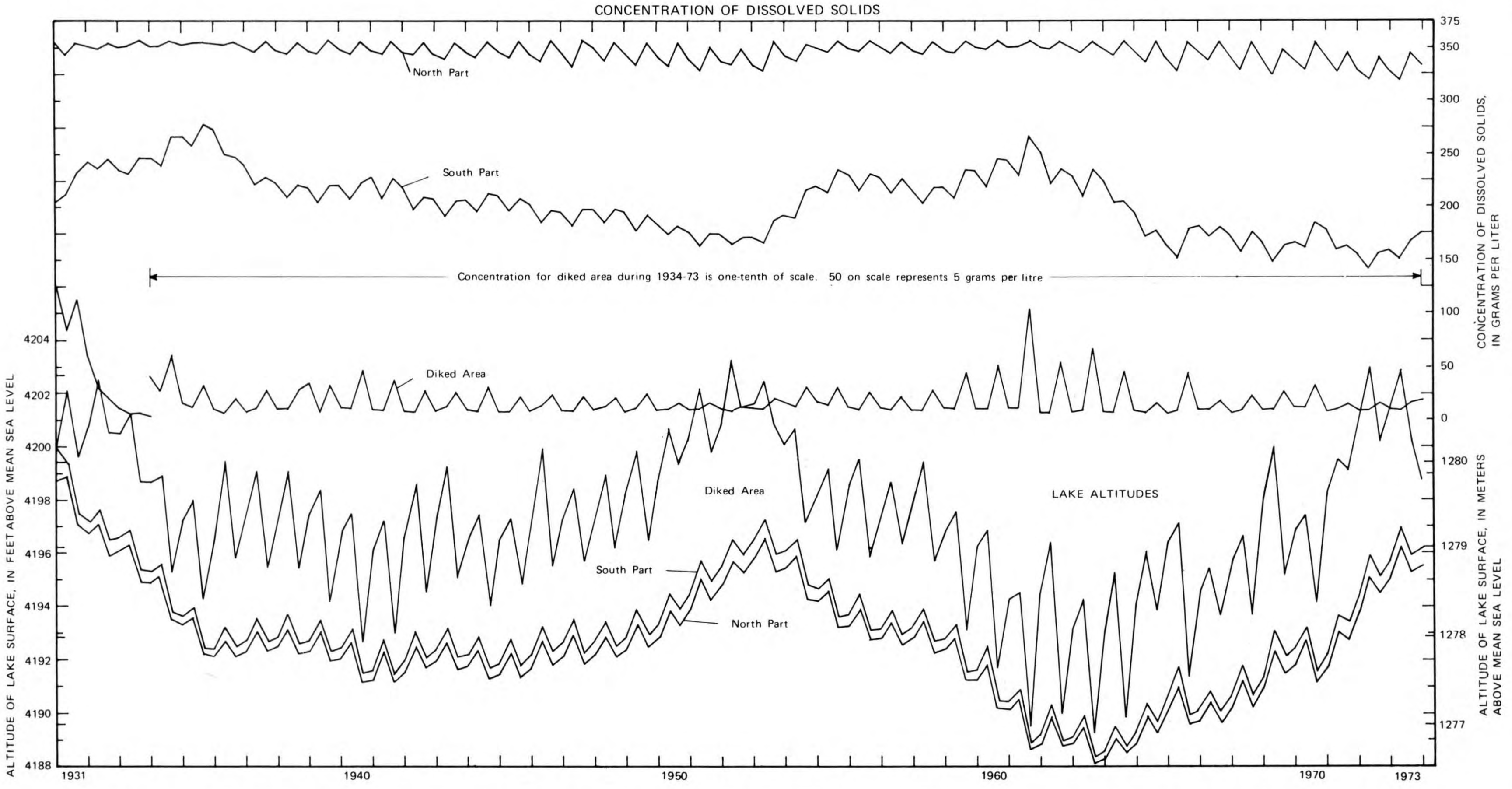


Figure 12. Graph showing lake altitude and concentration of dissolved solids for diking option 20.

by the budget equation (1) Letting ΔS, as computed by the model, be (ΔS) m and that of the observed lake altitudes be (ΔS) o, the net deficit can be represented by Ium = (ΔS) o - (ΔS) m.

The deficits in net inflow (total inflow less evaporation) indicated by the second model computation cannot be precisely attributed to any parameters in the water-budget equation. The deficits, however, generally became larger during periods of falling stages and smaller during periods of rising lake stages.

The deficit (Ium) was tested as a function of the observed lake altitude, Sl, or Ium = (Sl - 4190) c, where 4190 is the lake altitude at which the deficit (Ium) was approximately zero and c was a constant representing the slope of the relationship between (Sl - 4190) and Ium. The value of c was determined by repeated runs of the model and selection of the best fit between the observed and computed lake altitudes.

All unmeasured inflows plus errors in the estimate of the other parameters can be incorporated into the factor Ium. The computed monthly values of Ium were then added to the inflow estimates for the base period and the budget equation for the 1931-73 base period became:

$$\Delta S = Is + Ig + Ip + Ium - Oe \qquad (3)$$

Figure 9 shows that in the third model computation using the net inflows as computed by equation (3), the computed lake altitudes converge near the observed altitudes.

The annual inflow to Great Salt Lake from the three major tributaries and other parameters within the budget equation is shown in figure 10. The total annual inflow (Is + Ip + Ig + Ium) during 1931-73 ranged from about 1.5 to 5 million acre-ft (1,849.5 to 6,165.0 hm^3). The Bear River contributes the largest percentage of the measured surface inflow.

DIKING OPTIONS

The options provided in the model for diking include combinations of eight areas east of a line joining Antelope Island, Fremont Island, and the Promontory Mountains, and the part of Great Salt Lake that lies north of the Southern Pacific Transportation Co. causeway (fig. 3). The dikes would extend from the Promontory Mountains to Fremont Island and from Fremont Island to Little Mountain.

Except for the Southern Pacific Transportation Co. causeway, all dikes are assumed to have only one outlet to the south part of Great Salt Lake, with the width of the outlets being optional. The outflow is considered to be a function of the positive head difference from the diked part to the south part. The dikes are assumed to be impervious to seepage, and the outlet structures are to be operated to prevent density flows from entering the diked part from the south part.

Areas evaluated for diking

Diking option	Area (from fig. 3)
1	1
3	1+2
4	4
5	5
6	4+2
7	7
12	4+8
14	4+2+8
20	1+2+4+5+8

Only one diking option can be simulated during each run of the model. Once a diking option is chosen, the remainder of the areas are included with the south part.

The Southern Pacific Transportation Co. causeway can be treated in two ways by the model. It can be treated as an impervious dike, similar to the other dikes with an outlet providing for flows from the south to north parts. Or it can be treated as a permeable structure with culverts as they now exist or with modified culvert widths as discussed by Waddell and Bolke (1973).

SALT BALANCE

The total load of salt in the north and south parts of Great Salt Lake consists of the dissolved load and the undissolved load. The annual inflow load to the lake is small compared to the total load in the lake. Thus, the inflowing load can be ignored in computations of the salt balance for the north and south parts. For any diked area being considered, however, it is necessary to know the inflowing load in order to compute the concentrations within the diked area.

The salt balance for the Great Salt Lake with a diking option is depicted in figure 11. The dissolved load in the diked area (LD) is dependent upon the selected diking option (D), the time step within the base period (t), and the outflow from the diked area (OD).

The dissolved load (LD) contributed by the Bear, Weber, and Jordan Rivers was developed as a function of stream discharge. These relationships were developed at site 10126000 on the Bear River, site 10141000 on the Weber River, and site 10170490 on the Jordan River. Efforts were made to extend these relationships to the refuge outlets on the Jordan and Bear River systems, but the data-collection period was inadequate. A summary of the data collected at the refuge outlets is given in tables 14 and 15. The dissolved load within the diked area at any time step (t) can be estimated as follows:

Dissolved load = initial load + inflow load - outflow load

$$\mathrm{LD}(t) = \mathrm{LD}(t-1) + (\mathrm{ID}(t))(\mathrm{CI}) - (\mathrm{OD}(t))(\mathrm{LD}(t-1)/\mathrm{VD}(t-1))$$

where ID (t) is the inflow to the diked area, CI is the concentration of the inflow, OD (t) is the outflow from the dike, and (LD (t - 1)/VD (t - 1)) is the concentration of dissolved solids of water within the diked area. VD (t - 1) is the volume within the diked area at the end of the previous time step (t - 1).

Due to the limitations of the available water-quality data, the load of dissolved solids or the concentration of dissolved solids in the diked area cannot be estimated precisely. The model treats the salt balance of the diked area from the standpoint of an inflow-outflow balance with complete mixing, and no allowance is made for any stratification or chemical changes due to interaction with the sediments or solution of entrapped brines or residual salts. Because the degree of inaccuracy created by the assumptions is not known, the concentrations predicted by the model should be regarded not as absolute but as relative indexes by which to compare various diking alternatives. A particular diking alternative can be evaluated from the standpoint of dissolved-solids content by comparing the concentrations predicted by the various diking alternatives.

The salt balance for the north and south parts of Great Salt Lake is complicated because of the two-directional flows through the causeway, precipitation of sodium chloride and re-solution of sodium chloride deposits, and the presence of two layers of brine with different chemical characteristics in the south part. The total dissolved plus precipitated salt load in the north and south parts (TL) can be described by the following equation:

$$\mathrm{TL} = \mathrm{LS} + \mathrm{LSDL} + \mathrm{CLSPPT} + \mathrm{LN} + \mathrm{CLNPPT} + \mathrm{LD}$$

where LSDL is the load of dissolved solids in the deep layer of the south part, CLSPPT and CLNPPT are the precipitated salt loads in the south and north parts, respectively, and LS, LN, and LD are the dissolved-solids loads in the south, north, and diked parts, respectively. Now TL can be estimated by the above equation when all the parameters on the right side of the equation are known.

In the fall of 1972, as previously discussed on page 4, the total dissolved plus precipitated load (TL) in Great Salt Lake was about 5.5 billion tons (4.99 billion t). The dissolved-salt load in the deep layer of the south part (LSDL) has been computed as 0.3 billion tons (0.27 billion t), and it has been essentially constant since it was first observed (Waddell and Bolke, 1973, p. 35). Now the equation can be rearranged so that

$$\mathrm{LS} + \mathrm{CLSPPT} = 5.2 - \mathrm{LN} - \mathrm{CLNPPT} - \mathrm{LD}$$

For the south part, the dissolved-salt load (LS) can be estimated from the following equation:

New dissolved load = initial load + inflow load from diked part - outflow load from south part + inflow load from north part + salt re-solution in south part - precipitated salt load in south part

$$\mathrm{LS}(t) = \mathrm{LS}(t-1) + (\mathrm{OD}(t))(\mathrm{LD}(t-1))/\mathrm{VD}(t-1) - (\mathrm{M}) \cdot (\mathrm{LS}(t-1))/\mathrm{VS}(t-1) + (\mathrm{N})(\mathrm{LN}(t-1))/\mathrm{VN}(t-1) + \mathrm{ASOLS}(t) - \mathrm{LSPPT}(t)$$

For the north part, the dissolved-salt load can be estimated from the following equation:

New dissolved load = initial dissolved plus precipitated load - new dissolved-solids load in south part + salt re-solution in north part - precipitated salt load in north part

$$\mathrm{LN}(t) = \mathrm{LN}(t-1) + (\mathrm{M})(\mathrm{LS}(t-1))/(\mathrm{VS}(t-1)) - \mathrm{N}((\mathrm{LN}(t-1))/\mathrm{VN}(t-1) + \mathrm{ASOLN}(t) - \mathrm{LNPPT}(t)$$

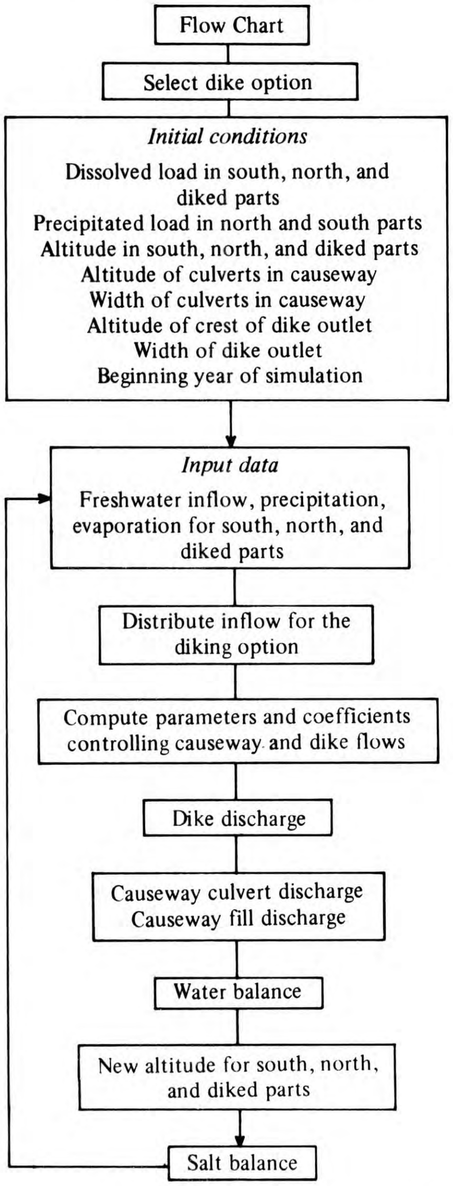
Now, ASOLN (t) and LNPPT (t) must be computed using the equations developed by Waddell and Bolke (1973, p. 34). ASOLN (t) and LNPPT (t) can be assumed to be negligible to initially estimate LN (t). Then LN (t) can be tested to determine if the total load in the north part exceeds the limiting salt load necessary for saturation. The limiting salt load necessary for saturation at a given lake volume was determined by Waddell and Bolke (1973, p. 34) to be $483 \cdot \mathrm{VN}$ for the north part and $483 \cdot \mathrm{VS}$ for the south part. If it exceeds $483 \cdot \mathrm{VN}$, then precipitation will occur and ASOLN (t) will become zero. The amount of precipitation (LNPPT) must then be subtracted from the first estimate of LN (t). This procedure is repeated until the iterative values converge to a solution.

If the quantity (LN (t)) is less than $483 \cdot \mathrm{VN}$, then the brine is under saturated and re-solution of the salt crust will occur if a deposit exists. The amount of re-solution can be computed by the following equation revised from Waddell and Bolke (1973, p. 34):

$$\mathrm{ASOLN} = \mathrm{T}[(483)\,(\mathrm{VN}) - \mathrm{LN}\,(t)]\ (0.00525)$$

where 0.00525 is an empirical constant for re-solution rate per day. Then after this computation, LN (t) must again be computed using the value given for ASOLN. This procedure must then be repeated until the iterative values converge to a soltuion.

A generalized flow chart showing the approach used in the model to compute the water and salt balance for various diking proposals follows:



A complete listing of the computer program is given in table 18.

EXAMPLE OF MODEL SIMULATION

The outcome of various diking proposals depends to a large degree upon the way the dike outlets are operated. The quantity of flow leaving the dike affects the salt balance of each separate part of the lake.

Since operation of the control structure of a dike outlet could be arbitrary, a standard weir equation was used with a fixed crest altitude and length. By utilizing this equation, various diking proposals can be evaluated with consistent dike outlet operation.

The standard formula used was $Q = (Cw)\,(L)\,(h^{3/2})\,(1.983)$, where Q is the discharge, Cw is a coefficient characteristic of flow conditions over a weir, L is the length of the weir crest, h is the height of water surface above the weir crest, and 1.983 is a factor for converting from cubic feet per second to acre-feet per day.

The type of diking proposal to select depends upon the desire of the person using the program. Many combinations of parameters, including dike outlet, causeway-culvert width, initial lake altitude and salt precipitate, and area to be diked may be selected by the operator. All these parameters may significantly alter the results of the model.

For example, if it were desired to have a large diked area for freshwater storage, then option 20 would be the proper selection to test. If it were also desirable that some of the salt load in the north part migrate to the south part, then wider culverts in the causeway would be necessary. An example of the model output for option 20 with the following parameter values is shown in figure 12:

Diking option 20		
Dike-crest-outlet width	200 ft	(61.0 m)
Dike-crest altitude	4,200 ft	(1,280.16 m)
Initial lake altitude-south part	4,200.1 ft	(1,280.19 m)
Initial lake altitude-north part	4,198.7 ft	(1,279.76 m)
Causeway-culvert width (east)	15 ft	(4.57 m)
Causeway-culvert width (west)	15 ft	(4.57 m)

The computer program is listed in table 18. This FORTRAN IV program may not be compatible with some computers or compilers. Compatibility should be tested with a trial run. A trial run with the same initial conditions should generate output that will be similar to the output shown in table 19.

Table 19. Example of computer-program output.

```
                                  LAKE ALTITUDES (FEET)                 LAKE CONCENTRATIONS (GRAMS PER LITRE)
YEAR     MONTH             NORTH           SOUTH            DIKE           NORTH           SOUTH            DIKE
1931         1           4199.16         4199.70         4200.93         337.649         204.770         124.763
1931         2           4199.20         4199.72         4201.53         337.578         205.856         104.213
1931         3           4199.15         4199.69         4201.95         339.511         207.485          89.522
1931         4           4198.96         4199.53         4201.96         344.558         210.247          82.333
1931         5           4198.66         4199.24         4201.59         351.479         214.419          81.659
1931         6           4198.19         4198.76         4200.94         356.279         220.969          86.376
1931         7           4197.64         4198.15         4200.15         356.468         229.154          95.634
1931         8           4197.14         4197.60         4199.44         356.385         236.784         105.295
1931         9           4196.84         4197.26         4199.07         355.896         241.930         106.840
1931        10           4196.74         4197.16         4199.30         355.337         243.907          91.317
1931        11           4196.82         4197.24         4199.69         353.604         242.964          72.704
1931        12           4196.96         4197.41         4200.52         351.414         240.274          51.574
1932         1           4197.15         4197.62         4200.65         348.713         236.587          42.409
1932         2           4197.31         4197.77         4200.80         346.997         233.717          35.456
1932         3           4197.38         4197.88         4201.28         347.499         231.560          27.801
1932         4           4197.34         4197.89         4202.05         350.663         230.267          20.600
1932         5           4197.25         4197.87         4202.95         355.244         228.827          14.692
1932         6           4197.03         4197.64         4202.27         355.725         229.127          13.497
1932         7           4196.67         4197.21         4200.93         356.094         232.509          14.699
1932         8           4196.30         4196.78         4199.78         356.076         237.159          16.390
1932         9           4196.10         4196.54         4199.16         355.619         240.082          16.602
1932        10           4196.07         4196.50         4199.23         355.244         240.353          14.087
1932        11           4196.22         4196.66         4199.47         352.764         237.839          11.330
1932        12           4196.41         4196.88         4200.02         349.632         234.274           8.462
```

RECOMMENDATIONS FOR FUTURE STUDY

The model developed during this study was based to a large extent on data collected during the short timespan of 1971-74. Most of these data were collected to extend records from long-term upstream stations to downstream points nearer the lakeshore. Because the lakeshore may fluctuate for many miles, the change of flow between the long-term stations and the lakeshore may have a high variability.

If the model is to be refined, the following program should be carried out:

1. Compute evaporation using a different method than that used for this report. The energy budget or mass transfer techniques would provide an independent check of computations made for this report.

2. Verify quantity and quality of ground-water discharge.

3. Monitor stream discharge and water quality as near the shoreline as possible, in conjunction with long-term monitoring stations upstream.

4. Monitor storage changes in waterfowl management and refuge areas between shoreline gaging stations and long-term gaging stations upstream.

5. Monitor lake-surface altitudes and salinity in the north and south parts.

6. Monitor discharge and specific gravities in the east and west culverts of the causeway of the Southern Pacific Transportation Co.

7. Recalibrate the model using refined estimates of the parameters in the water budget.

8. Improve the salt-balance predictions for the diked areas by refinement of the water-quality relationships in the model.

CONCLUSIONS

The inflow from precipitation on the surface of Great Salt Lake during 1931-73 ranged from 680,000 to 1,260,000 acre-ft (840 to 1,550 hm^3) per year and averaged 966,000 acre-ft (1,190 hm^3) per year.

The total ground-water inflow to the lake was estimated to be 75,000 acre-ft (92.5 hm^3) per year.

The total annual inflow during 1931-73 ranged from about 1.5 to 5 million acre-ft (1,849.5 to 6,165.0 hm^3).

The Bear River contributes the largest percentage of the measured surface inflow.

The total annual outflow from the lake (evaporation) ranged from about 2.2 to 4.0 million acre-ft (2,712.6 to 4,932.0 hm^3) during 1931-73 and averaged 2.98 million acre-ft (3,674.3 hm^3) per year.

Short-term stations near the shoreline of Great Salt Lake were extended to the 1931-73 base period by correlation with long-term stations upstream. The standard error of estimate for these correlations ranged from 5.1 to 27 percent of the average.

The model treats the salt balance of the diked area from the standpoint of an inflow-outflow balance with complete mixing and no allowance for stratification or chemical changes due to interaction with the sediments or solution of entrapped brines or residual salts. Because of the model limitations, the predicted concentrations of dissolved solids for the diked areas should be regarded as relative indexes by which to compare various diking alternatives.

SELECTED REFERENCES

Hahl, D. C., 1968, Dissolved-mineral inflow to Great Salt Lake and chemical characteristics of the salt lake brine, Summary for water years 1960, 1961, and 1964: Utah Geol. and Mineralog. Survey Water-Resources Bull. 10.

Hahl, D. C., and Handy, A. H., 1969, Great Salt Lake, Utah: Chemical and physical variations of the brine, 1963-1966: Utah Geol. and Mineralog. Survey Water-Resources Bull. 12.

Hely, A. G., Mower, R. W., and Horr, C. A., 1967-69, Hydrologic and climatologic data, 1966-68, Salt Lake County, Utah: U. S. Geol. Survey open-file repts. (duplicated as Utah Basic-Data Releases 13, 15, and 17).

Iorns, W. V., Mower, R. W., and Horr, C. A., 1966, Hydrologic and climatologic data, 1964-65, Salt Lake County, Utah: U. S. Geol. Survey open-file repts. (duplicated as Utah Basic-Data Releases 11 and 12).

Kohler, M. A., Nordenson, T. J., and Baker, D. R., 1959, Evaporation maps for the United States: U. S. Weather Bur. Tech. Paper 37.

Madison, R. J., 1970, Effects of a causeway on the chemistry of the brine in Great Salt Lake, Utah: Utah Geol. and Mineralog. Survey Water-Resources Bull. 14.

Peck, E. L., and Dickson, D. R., 1965, Evaporation and ground water, Great Salt Lake, *in* Evaporation studies, Great Salt Lake: Utah Geol. and Mineralog. Survey Water-Resources Bull. 6, p. 4-13.

U. S. Department of Commerce, 1959, Evaporation maps for the United States: U. S. Dept. Commerce Tech. Paper 37, pl. 3.

U. S. Geological Survey, 1960, Compilation of records of surface waters of the United States through September 1950, Part 10, The Great Basin: U. S. Geol. Survey Water-Supply Paper 1314.

______1961-64, Surface-water records of Utah: Water Resources Div., annual series.

______1965-73, Water resources for Utah, Part 1, Surface water records, Part 2, Water quality records: Water Resources Div., annual series.

U. S. Weather Bureau, 1957, Climatic summary of the United States–Supplement for 1931 through 1952, Utah: Climatography of the United States 11-37.

______1965, Climatic summary of the United States–Supplement for 1951 through 1960, Utah: Climatography of the United States 86-37.

Waddell, K. M. and Bolke, E. L., 1973, The effects of restricted circulation on the salt balance of Great Salt Lake, Utah: Utah Geol. and Mineral Survey Water-Resources Bull. 18.

Whelan, J. A., 1973, Great Salt Lake, Utah: Chemical and physical variations of the brine, 1966-72: Utah Geol. and Mineral Survey Water-Resources Bull. 17.

APPENDIX

Glossary

Symbol or value		Description	Units
Text	Computer program (table 18)		
A		Area	Acres
Acf		Ratio of June-September evaporation to annual pan evaporation (E)	–
AD	L3	Area of diked part	Acres
Aj	P (K)	Ratio of annual precipitation for year j (or (K)) to the 1931-73 average precipitation	–
Al	S1, N1, L1	Altitude above mean sea level	Feet
ASOLN	H4	Redissolved salt in north part	Tons
ASOLS	H5	Redissolved salt in south part	Tons
CI	C4	Concentration of dissolved solids in water flowing into diked area	Tons/acre-foot
CLNPPT	N9	Cumulative precipitated salt load in north part	Tons
CLSPPT	S9	Cumulative precipitated salt load in south part	Tons
CN		Dissolved-solids concentration in north part	Grams/millilitre
CS		Dissolved-solids concentration in south part	Grams/millilitre
Cw	3.5	Coefficient characteristic of flow over a weir	–
D	Z	Diking option	–
E		Annual pan evaporation	Inches
Efw		Annual freshwater-lake evaporation	Inches
Elt		June-September pan evaporation at a long-term site	Inches
Emi		Fraction of mean annual evaporation for month (i)	–
Est		June-September pan evaporation at a short-term site	Inches
h	QQQ	Head above dike-outlet crest	Feet
i	I	Month	–
ID	Q (K, I)	Inflow to diked part	Acre-feet
Ig		Inflow from ground water	Acre-feet
Ip		Inflow from precipitation on water surface	Acre-feet
Is	QT (II, KK)	Surface inflow	Acre-feet
Ium		Calibration parameter for deficient inflows	Acre-feet
j	K	Year within base period, 1931-73	–
L	CL	Length of dike-outlet crest	Feet
LD	L6	Dissolved-salt load in diked part	Tons
LN	N6	Dissolved-salt load in north part	Tons
LNPPT	H2	Precipitated-salt load in north part	Tons
LS	S6	Dissolved-solids load in south part	Tons
LSDL		Dissolved-solids load in deep brine layer in south part	Tons

Glossary–*continued*

Symbol or value		Description	Units
Text	Computer program (table 18)		
LSPPT	H2	Precipitated-salt load in south part	Tons
M	M1	Discharge from south to north through causeway	Acre-feet/day
N	M2	Discharge from north to south through causeway	Acre-feet/day
OD	D6	Outflow from the diked part	Acre-feet
Oe		Outflow from evaporation	Acre-feet
Pa		Average annual precipitation	Inches
Pad		Adjusted annual precipitation	Inches
Pcf		Pan coefficient for freshwater evaporation	–
Pm		Average monthly precipitation	Inches
Pmi	F(I)	Fraction of mean annual precipitation for month i (or (I))	–
Q		Discharge	Acre-feet/day
Sl		Altitude of water surface in south part	Feet
SCE		Effect of salinity on evaporation rate in south part	–
SCEN		Effect of salinity on evaporation rate in north part	–
t	(K, I)	Time step	–
T	Tl	Time period (or increment)	Days
TL	TXS	Total dissolved plus precipitated load	Tons
V		Volume	Acre-feet
VD	L4	Volume of diked part	Acre-feet
VN	N4	Volume of north part	Acre-feet
VS	S4	Volume of south part, excluding diked part	Acre-feet
ΔS		Volume change	Acre-feet
(ΔS) o		Observed volume change	Acre-feet
(ΔS) m		Computed volume change	Acre-feet
ρ S		Density of brine in south part at any temperature	Grams/millilitre
ρ N		Density of brine in north part at any temperature	Grams/millilitre

Altitude, Area, and Volume Relationships of the Lake

It is necessary to know the altitude, area, and volume relationships of the lake in order to predict changes in the water and salt balance of the north, south, and diked parts of Great Salt Lake. These relationships were developed largely from an advanced copy (scale 1:99,000) of a map of Great Salt Lake and vicinity under preparation by the Topographic Division of the U. S. Geological Survey. The advanced map delineates shorelines at 1-ft (0.3 m) intervals for altitudes ranging from 4,193 to 4,200 ft (1,278.0 to 1,280.2 m). The bay area bottoms lie at altitudes generally above 4,193 ft (1,278.0 m); thus, the altitude-area-volume relationships for the potential diked areas are based almost entirely upon the new map.

In the bay areas, it was assumed for purposes of the model that present industries, waterfowl-management and refuge areas, and residential areas at altitudes above 4,205 ft (1,281.7 m) would be protected from inundation by either raising existing dikes or construction of new dikes. Thus, the areas for all diking options except number 7 are constant at altitudes above 4,205 ft (1,281.7 m).

Altitude, area, and volume relationships were also developed for the south part to include all the bay areas. Thus, when a particular diking option (D) is chosen, its area (AD) and volume (VD) can be subtracted from the total, and the remainder is considered the area and volume of the south part. The altitude, area, and volume relationships for the diked areas and the north and south parts are shown in table 9.

The area in the south part incorporated by evaporating ponds belonging to the National Lead Corp. has been omitted from the south part altitude, area, and volume relationships.

Tables 9-18

Table 9. Altitude, area, and volume relationships for various diking options [see pages 24 and 30 of text for explanation of diking options.]

	DIKE OPT NO. 1		DIKE OPT NO. 3		DIKE OPT NO. 4		DIKE OPT NO. 5			DIKE OPT NO. 6	
ALTITUDE (FT)	AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)	ALTITUDE (FT)	AREA (ACRES)	VOLUME (AC-FT)
4170.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4170.0	0.00	0.00
4171.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4171.0	0.00	0.00
4172.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4172.0	0.00	0.00
4173.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4173.0	0.00	0.00
4174.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4174.0	0.00	0.00
4175.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4175.0	0.00	0.00
4176.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4176.0	0.00	0.00
4177.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4177.0	0.00	0.00
4178.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4178.0	0.00	0.00
4179.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4179.0	0.00	0.00
4180.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4180.0	0.00	0.00
4181.0	0.00	0.00	326.40	163.20	0.00	0.00	0.00	0.00	4181.0	326.00	163.00
4182.0	0.00	0.00	652.80	652.80	0.00	0.00	0.00	0.00	4182.0	653.00	652.50
4183.0	0.00	0.00	976.00	1467.20	0.00	0.00	0.00	0.00	4183.0	1000.00	1479.00
4184.0	0.00	0.00	1299.20	2604.80	0.00	0.00	0.00	0.00	4184.0	1325.00	2641.50
4185.0	0.00	0.00	1673.60	4091.20	0.00	0.00	0.00	0.00	4185.0	1600.00	4104.00
4186.0	0.00	0.00	2048.00	5952.00	0.00	0.00	0.00	0.00	4186.0	2048.00	5928.00
4187.0	0.00	0.00	2400.00	8176.00	0.00	0.00	0.00	0.00	4187.0	2500.00	8202.00
4188.0	0.00	0.00	2938.00	10845.00	0.00	0.00	0.00	0.00	4188.0	2938.00	10921.00
4189.0	0.00	0.00	3600.00	14114.00	0.00	0.00	0.00	0.00	4189.0	4500.00	14640.00
4190.0	0.00	0.00	5082.00	18455.00	1133.00	100.00	0.00	0.00	4190.0	6214.00	19997.00
4190.5	0.00	0.00	5541.00	21225.00	1619.00	860.00	200.00	50.00	4190.5	7107.00	23550.50
4191.0	0.00	0.00	6000.00	23996.00	2105.00	1619.00	396.00	199.00	4191.0	8000.00	27104.00
4191.5	0.00	0.00	6462.00	27227.00	2591.00	2914.00	600.00	448.00	4191.5	9001.50	31605.00
4192.0	0.00	0.00	6925.00	30458.50	3078.00	4210.50	1293.00	921.00	4192.0	10003.00	36106.00
4192.5	218.80	109.40	7516.00	34216.00	3529.00	5975.00	2500.00	1869.70	4192.5	10826.00	41518.70
4193.0	437.76	218.88	8107.00	37974.00	3980.00	7739.50	3932.00	3477.70	4193.0	11649.00	46931.50
4193.5	900.00	553.32	9000.00	42251.00	4200.00	9784.50	6000.00	5960.70	4193.5	12522.50	53192.70
4194.0	1418.88	1133.04	9903.00	46977.00	4912.00	12062.50	9828.00	9917.70	4194.0	13396.00	59454.00
4194.5	2100.00	2012.76	10900.00	52177.80	7400.00	15140.50	14500.00	16000.00	4194.5	16717.00	67812.50
4195.0	3025.92	3294.24	12511.00	58030.00	10554.00	19629.00	19892.00	24598.00	4195.0	20038.00	76171.00
4195.5	4100.00	5075.72	14800.00	64858.00	13600.00	25667.50	26000.00	36071.00	4195.5	23711.00	88026.50
4196.0	5953.28	7589.04	16773.00	72752.00	16564.00	33208.50	32823.00	50776.00	4196.0	27384.00	99882.00
4196.5	9000.00	11327.30	20800.00	82144.80	19000.00	42100.00	38700.00	68657.00	4196.5	30340.00	115052.00
4197.0	12614.00	16731.00	24545.00	93481.00	21365.00	52190.00	43900.00	89307.00	4197.0	33296.00	130222.00
4197.5	16500.00	24010.00	29000.00	106867.00	23000.00	63282.00	50000.00	112782.00	4197.5	35043.00	147743.00
4198.0	21592.00	33533.00	33870.00	122584.00	24513.00	75160.00	55732.00	139215.00	4198.0	36790.00	165265.00
4198.5	26000.00	45431.00	39000.00	140802.00	26400.00	87888.00	61000.00	168398.00	4198.5	38756.00	184643.00
4199.0	31782.00	59877.00	44360.00	161642.00	28145.00	101525.00	66055.00	200162.00	4199.0	40722.00	204021.00
4199.5	38500.00	77447.00	52000.00	185732.00	30500.00	116186.00	71000.00	234426.00	4199.5	43044.00	225543.00
4200.0	45606.00	98474.00	58455.00	213345.00	32517.00	131940.00	76724.00	271357.00	4200.0	45366.00	247065.00
4200.5	52500.00	123000.00	66000.00	244459.00	34200.00	148619.0	80600.00	310688.00	4200.5	47000.00	268000.00
4201.0	60000.00	151125.00	75000.00	279710.00	35600.00	166070.0	84000.00	351838.00	4201.0	48700.00	293000.00
4201.5	66600.00	182775.00	82500.00	319085.00	37000.00	184220.0	86200.00	394388.00	4201.5	50000.00	318590.00
4202.0	73000.00	217675.00	89000.00	361960.00	38000.00	202970.0	88500.00	438063.00	4202.0	51000.00	340000.00
4202.5	78500.00	255550.00	93500.00	407585.00	38900.00	222194.0	90500.00	482813.00	4202.5	52000.00	365000.00
4203.0	83000.00	295925.00	98000.00	455460.00	39500.00	241800.0	92500.00	528563.00	4203.0	52800.00	395000.00
4203.5	87000.00	338425.00	102000.00	505460.00	40100.00	261690.0	94500.00	575313.00	4203.5	53500.00	425000.00
4204.0	90600.00	382825.00	105000.00	557210.00	40600.00	281870.0	96800.00	623138.00	4204.0	54000.00	450000.00
4204.5	93500.00	428850.00	107000.00	610210.00	41000.00	302270.0	98000.00	671838.00	4204.5	54500.00	480000.00
4205.0	95578.00	476119.00	108503.00	664086.00	41651.00	322930.0	99908.00	721315.00	4205.0	54577.00	503365.00
4205.5	95578.00	523908.00	108503.00	718337.00	41651.00	343755.0	99908.00	771269.00	4205.5	54577.00	530653.00
4206.0	95578.00	571697.00	108503.00	772588.00	41651.00	364580.0	99908.00	821223.00	4206.0	54577.00	557941.00
4206.5	95578.00	619486.00	108503.00	826839.00	41651.00	385405.0	99908.00	871177.00	4206.5	54577.00	585229.00
4207.0	95578.00	667275.00	108503.00	881090.00	41651.00	406230.0	99908.00	921131.00	4207.0	54577.00	612517.00
4207.5	95578.00	715064.00	108503.00	935341.00	41651.00	427055.0	99908.00	971085.00	4207.5	54577.00	639805.00
4208.0	95578.00	762853.00	108503.00	989592.00	41651.00	447880.0	99908.00	1021030.00	4208.0	54577.00	667093.00
4208.5	95578.00	810642.00	108503.00	1043840.00	41651.00	468705.0	99908.00	1070980.00	4208.5	54577.00	694381.00
4209.0	95578.00	858431.00	108503.00	1098090.00	41651.00	489530.0	99908.00	1120930.00	4209.0	54577.00	721669.00
4209.5	95578.00	906220.00	108503.00	1152340.00	41651.00	510355.0	99908.00	1170880.00	4209.5	54577.00	748957.00
4210.0	95578.00	954009.00	108503.00	1206590.00	41651.00	531180.0	99908.00	1220830.00	4210.0	54577.00	776245.00

Table 10. Annual distribution of precipitation ratios during 1931-73.

Year	Park Valley	Brigham City	Corinne	Farmington	Logan Utah State University	Ogden sugar factory	Midvale	Tooele	Utah Lake Lehi	Salt Lake City	Average ratio of annual to 1931-73 average (Aj)
1931	0.62	0.73	0.71	0.71	0.73	0.81	0.71	0.75	0.70	0.63	0.71
1932	1.30	1.09	1.05	.99	.97	.99	.85	.95	1.01	.92	1.01
1933	.75	.67	.65	.70	.70	.69	.77	.87	.57	.67	1.70
1934	.74	.72	.79	.86	.69	.93	.79	.79	.90	.76	.80
1935	.68	.73	.82	.76	.79	.86	.80	.74	.69	.69	.76
1936	1.10	.99	1.11	1.21	1.08	1.36	1.19	1.06	1.20	1.08	1.14
1937	1.19	1.01	1.24	.99	1.20	1.10	1.04	1.04	1.09	.87	1.08
1938	1.26	1.00	1.12	1.07	1.05	1.28	1.01	1.20	.98	.87	1.08
1939	.74	.62	.65	.71	.73	1.00	.74	.63	.78	.62	.72
1940	1.30	.99	.99	1.14	1.00	1.29	1.00	1.13	.96	.99	1.08
1941	1.69	1.30	1.61	1.38	1.15	1.55	1.54	1.33	1.47	1.25	1.43
1942	1.09	.96	.99	1.10	1.06	1.10	.87	1.07	.89	.88	1.00
1943	.69	.92	.84	.82	1.07	.94	.90	.77	.91	.73	.86
1944	1.00	1.10	.94	1.09	1.11	1.04	1.29	1.23	1.19	1.23	1.12
1945	1.38	1.37	1.31	1.22	1.45	1.40	1.13	1.27	1.21	1.18	1.29
1946	.94	1.10	1.23	1.03	1.21	1.07	1.12	1.12	1.29	1.03	1.11
1947	1.84	.97	1.03	1.15	1.11	1.15	1.25	1.35	1.11	1.13	1.11
1948	.88	1.15	.93	.97	1.02	1.01	.93	.86	.84	.96	.96
1949	1.20	1.12	1.03	1.15	1.16	1.31	1.01	1.10	1.04	1.11	1.12
1950	1.00	1.06	1.22	.90	1.17	.93	.88	.79	.76	.90	.96
1951	.95	1.12	1.19	1.12	1.11	1.13	1.20	1.08	1.45	1.17	1.15
1952	.87	.78	.70	1.04	.76	.76	.98	.82	1.01	1.01	.87

and the north and south parts of Great Salt Lake.

DIKE OPT NO.		JTH PART EXCLUDING BAY AREAS		DIKE OPT NO. 12			DIKE OPT NO. 14		DIKE OPT NO. 20		SOUTH PART INCLUDING BAY AREAS	
AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)	ALTITUDE (FT)	AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)	AREA (ACRES)	VOLUME (AC-FT)
36344.00	77000.00	81656.00	173000.00	0.00	0.00	4170.0	0.00	0.00	0.00	0.00	81656.00	173000.00
55000.00	122672.00	95000.00	261328.00	0.00	0.00	4171.0	0.00	0.00	0.00	0.00	95000.00	261328.00
70000.00	185172.00	110000.00	363828.00	0.00	0.00	4172.0	0.00	0.00	0.00	0.00	110000.00	363828.00
86000.00	263172.00	127000.00	481828.00	0.00	0.00	4173.0	0.00	0.00	0.00	0.00	127000.00	481828.00
98000.00	355172.00	146000.00	618828.00	0.00	0.00	4174.0	0.00	0.00	0.00	0.00	146000.00	618828.00
112475.00	460410.00	162525.00	773090.00	0.00	0.00	4175.0	0.00	0.00	0.00	0.00	162525.00	773090.00
115000.00	574148.00	189000.00	948852.00	0.00	0.00	4176.0	0.00	0.00	0.00	0.00	189000.00	948852.00
129000.00	696148.00	202000.00	1144350.00	0.00	0.00	4177.0	0.00	0.00	0.00	0.00	202000.00	1144350.00
138000.00	829648.00	220000.00	1355350.00	0.00	0.00	4178.0	0.00	0.00	0.00	0.00	220000.00	1355350.00
146000.00	971648.00	237000.00	1583850.00	0.00	0.00	4179.0	0.00	0.00	0.00	0.00	237000.00	1583850.00
152625.00	1120960.00	254375.00	1829540.00	0.00	0.00	4180.0	0.00	0.00	0.00	0.00	254375.00	1829540.00
160000.00	1277270.00	266744.00	2090090.00	0.00	0.00	4181.0	326.00	163.00	256.00	128.00	267000.00	2090210.00
166000.00	1440270.00	279347.00	2363140.00	0.00	0.00	4182.0	653.00	652.50	653.00	582.50	280000.00	2363720.00
172000.00	1609270.00	291838.00	2648730.00	185.60	92.80	4183.0	1162.00	1560.00	1162.00	1490.00	293000.00	2650220.00
179000.00	1784770.00	301330.00	2945320.00	371.00	371.10	4184.0	1670.00	2976.00	1670.00	2906.00	303000.00	2948220.00
187624.00	1968080.00	306000.00	3248980.00	678.00	895.60	4185.0	2500.00	5061.00	2500.00	4991.00	308500.00	3253970.00
193000.00	2158390.00	313000.00	3558480.00	986.00	1727.60	4186.0	3034.00	7828.00	3034.00	7758.00	316034.00	3566230.00
198000.00	2353890.00	320000.00	3874980.00	1400.00	2920.60	4187.0	4300.00	11495.00	4000.00	11275.00	324000.00	3886250.00
203000.00	2554390.00	327000.00	4198480.00	2118.00	4679.60	4188.0	5056.00	16173.00	5056.00	15803.00	332056.00	4214280.00
207000.00	2759390.00	336000.00	4529980.00	3100.00	7288.60	4189.0	7000.00	22201.00	7000.00	21831.00	343000.00	4551810.00
212954.00	2969370.00	342000.00	4868980.00	4160.00	10918.60	4190.0	9242.00	30322.00	9242.00	29952.00	351242.00	4898930.00
214973.00	3076860.00	346500.00	5042230.00	4780.00	13308.60	4190.5	10421.00	35532.50	10621.00	35262.00	357121.00	5077490.00
217000.00	3184350.00	351000.00	5215480.00	5400.00	15698.60	4191.0	11600.00	40743.00	12000.00	40573.00	363000.00	5256050.00
220000.00	3293600.00	356000.00	5392230.00	6021.50	18709.30	4191.5	12584.00	47035.00	13400.00	46923.00	369400.00	5439150.00
227000.00	3405350.00	360000.00	5571230.00	6643.00	21720.10	4192.0	13568.00	53327.00	14861.00	53988.00	374861.00	5625210.00
233000.00	3520350.00	363000.00	5751980.00	7375.50	25407.80	4192.5	14672.50	60663.50	17500.00	62078.00	380500.00	5814050.00
246730.00	3640280.00	365800.00	5934180.00	8108.00	29095.60	4193.0	15777.00	68000.00	20146.00	71490.00	385946.00	6005670.00
252000.00	3764960.00	379000.00	6120380.00	8807.50	33499.30	4193.5	16884.00	76442.00	24000.00	82526.00	403000.00	6202900.00
261300.00	3893290.00	387350.00	6311970.00	9507.00	37903.10	4194.0	17991.00	84884.00	29238.00	95836.00	416588.00	6407800.00
270000.00	4026110.00	392000.00	6506810.00	12839.50	44322.80	4194.5	21823.50	95795.50	41000.00	113396.00	433000.00	6620200.00
276360.00	4162700.00	395030.00	6703560.00	16172.00	50742.60	4195.0	25656.00	106707.00	48574.00	135789.00	443604.00	6839340.00
287000.00	4303540.00	400900.00	6902550.00	19334.50	60409.80	4195.5	29486.50	121450.00	61000.00	163182.00	461900.00	7065730.00
298580.00	4449940.00	402280.00	7103340.00	22497.00	70077.10	4196.0	33317.00	136194.00	72104.00	196458.00	474384.00	7299790.00
310000.00	4602080.00	413000.00	7307160.00	25090.50	82622.50	4196.5	36466.00	154427.00	84000.00	235484.00	497000.00	7542640.00
326100.00	4761110.00	417580.00	7514810.00	27684.00	95168.00	4197.0	39615.00	172660.00	96129.00	280516.00	513709.00	7795320.00
335000.00	4926380.00	421000.00	7724450.00	29474.50	109905.00	4197.5	41578.50	193449.00	110000.00	332048.00	531000.00	8056490.00
343720.00	5096060.00	425460.00	7936070.00	31265.00	124642.00	4198.0	43542.00	214238.00	120867.00	389765.00	546327.00	8325830.00
360000.00	5271990.00	432000.00	8150430.00	33145.00	141214.00	4198.5	45572.00	237024.00	134000.00	453482.00	566000.00	8603910.00
382220.00	5457800.00	442290.00	8369000.00	35025.00	157787.00	4199.0	47602.00	259810.00	145439.00	523341.00	587729.00	8892340.00
390000.00	5651100.00	465000.00	8595830.00	37217.50	176396.00	4199.5	49930.50	284775.00	160000.00	599701.00	625000.00	9195530.00
405000.00	5849850.00	499670.00	8836990.00	39410.00	195005.00	4200.0	52259.00	309740.00	174589.00	683348.00	674259.00	9520330.00
415000.00	6054850.00	510000.00	9089410.00	41000.00	215000.00	4200.5	53000.00	337000.00	188000.00	773996.00	698000.00	9863400.00
425000.00	6264850.00	515000.00	9345660.00	42500.00	235000.00	4201.0	54500.00	364000.00	200000.00	870996.00	715000.00	10216600.00
435000.00	6479850.00	516000.00	9603410.00	44000.00	257560.00	4201.5	56000.00	390934.00	210000.00	973496.00	726000.00	10576900.00
440000.00	6698600.00	517000.00	9861660.00	45000.00	280000.00	4202.0	56500.00	420000.00	218000.00	1080500.00	735000.00	10942100.00
445000.00	6919850.00	518000.00	10120400.00	46000.00	300000.00	4202.5	57500.00	445000.00	225000.00	1191240.00	743000.00	11311600.00
450000.00	7143600.00	519000.00	10379600.00	47000.00	325000.00	4203.0	58500.00	475000.00	232000.00	1305500.00	751000.00	11685100.00
455000.00	7369850.00	520000.00	10639400.00	47500.00	345000.00	4203.5	59500.00	505000.00	237000.00	1422750.00	757000.00	12062100.00
460000.00	7598600.00	521000.00	10899600.00	48000.00	370000.00	4204.0	60000.00	535000.00	242000.00	1542500.00	763000.00	12442100.00
465000.00	7829850.00	523000.00	11160600.00	48400.00	400000.00	4204.5	60700.00	560000.00	247000.00	1664740.00	770000.00	12825400.00
470000.00	8063600.00	523500.00	11422900.00	48557.00	421312.00	4205.0	61482.00	597081.00	256968.00	1790700.00	780468.00	13212000.00
472272.00	8306550.00	525132.00	11690300.00	48557.00	445590.00	4205.5	61482.00	627822.00	256968.00	1919180.00	780468.00	13602200.00
474544.00	8549500.00	526764.00	11957700.00	48557.00	469868.00	4206.0	61482.00	658563.00	256968.00	2047660.00	780468.00	13992400.00
476816.00	8792450.00	528396.00	12225100.00	48557.00	494146.00	4206.5	61482.00	689304.00	256968.00	2176140.00	780468.00	14382700.00
479088.00	9035400.00	530028.00	12492500.00	48557.00	518424.00	4207.0	61482.00	720045.00	256968.00	2304620.00	780468.00	14772900.00
481360.00	9278350.00	531660.00	12759900.00	48557.00	542702.00	4207.5	61482.00	750786.00	256968.00	2433100.00	780468.00	15163100.00
483632.00	9521300.00	533292.00	13027300.00	48557.00	566980.00	4208.0	61482.00	781527.00	256968.00	2561580.00	780468.00	15553400.00
485904.00	9764250.00	534924.00	13294700.00	48557.00	591258.00	4208.5	61482.00	812268.00	256968.00	2690060.00	780468.00	15943600.00
488176.00	10007200.00	536556.00	13562100.00	48557.00	615536.00	4209.0	61482.00	843009.00	256968.00	2818540.00	780468.00	16333800.00
490448.00	10250100.00	538188.00	13829500.00	48557.00	639814.00	4209.5	61482.00	873750.00	256968.00	2947020.00	780468.00	16724100.00
492720.00	10493000.00	539820.00	14096900.00	48557.00	664092.00	4210.0	61482.00	904491.00	256968.00	3075500.00	780468.00	17114300.00

Table 10. *continued*

Year	Park Valley	Brigham City	Corinne	Farmington	Logan Utah State University	Ogden sugar factory	Midvale	Tooele	Utah Lake Lehi	Salt Lake City	Average ratio of annual to 1931-73 average (Aj)
1953	.88	.94	.87	1.08	.82	.87	.96	.77	.81	.82	.88
1954	.67	.91	.82	.78	.73	.77	.90	1.16	.66	.83	.82
1955	1.11	1.03	1.19	1.05	1.19	.88	1.03	.92	.90	.91	1.02
1956	.88	.83	.77	.77	.69	.83	.85	.80	.62	.82	.79
1957	1.05	1.20	1.27	1.29	1.05	1.16	1.15	1.18	1.22	1.23	1.18
1958	.97	.73	.70	.79	.79	.52	.79	.78	.65	.71	.74
1959	1.15	.90	.85	.94	.96	.76	.92	.94	.88	.92	.92
1960	.71	.84	.83	.78	.84	.83	.76	.80	.81	.82	.80
1961	.94	.96	.92	.84	.87	.90	.72	.86	.92	.78	.87
1962	.76	.93	.89	.87	.89	.90	.95	.92	.97	.99	.91
1963	1.36	1.25	1.03	1.22	1.16	1.15	1.23	.96	1.35	.94	1.16
1964	1.23	1.15	1.07	1.14	1.12	1.09	1.36	1.21	1.42	1.19	1.20
1965	1.10	1.23	1.10	1.18	1.17	1.18	1.29	1.16	1.14	1.23	1.18
1966	.49	.69	.84	.60	.62	.51	.67	.67	.97	.60	.67
1967	1.20	1.28	1.13	1.00	1.24	1.03	.92	1.11	1.17	1.10	1.12
1968	1.27	1.37	1.29	1.24	1.32	1.14	1.30	1.37	1.31	1.41	1.31
1969	.76	1.05	.99	.98	.99	.71	.98	1.17	1.02	1.06	.97
1970	.99	1.20	1.27	1.39	1.23	1.24	1.22	1.28	1.12	1.32	1.22
1971	–	1.46	1.37	1.30	1.32	1.12	1.16	1.34	1.12	1.25	1.27
1972	1.08	.98	.90	.97	.92	.77	–	1.13	.81	1.05	.96
1973	.96	1.54	1.29	1.37	1.26	1.25	–	1.19	1.11	1.36	1.26

Table 11. Monthly distribution

	January		February		March		April		May		June	
	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches
Corinne	10.5	1.57	9.1	1.36	10.3	1.54	11.5	1.72	11.9	1.78	7.0	1.04
Farmington	11.8	2.25	9.7	1.86	10.7	2.05	12.2	2.33	9.8	1.88	6.8	1.30
Logan Utah State University	10.0	1.67	8.4	1.39	10.9	1.81	12.7	2.11	11.2	1.86	7.6	1.26
Midvale	8.7	1.22	9.2	1.29	11.6	1.62	11.4	1.60	10.1	1.41	6.6	.93
Ogden sugar factory	10.1	1.66	8.8	1.44	9.4	1.54	12.9	2.12	10.1	1.66	7.5	1.23
Park Valley	10.2	1.05	8.4	.87	7.1	.73	9.1	.94	10.7	1.11	8.2	.85
Salt Lake City	9.7	1.35	8.5	1.18	11.2	1.56	12.7	1.76	10.1	1.40	7.1	.98
Snowville	10.1	1.18	7.5	.88	10.5	1.23	10.6	1.24	13.6	1.60	7.5	.88
Tooele	8.5	1.31	9.8	1.51	11.4	1.76	12.0	1.85	9.7	1.50	6.6	1.02
Utah Lake Lehi	8.5	.84	8.6	.85	9.2	.91	9.6	.95	9.6	.95	7.1	.70
Wendover WBAP	6.9	.32	6.4	.30	8.4	.39	10.9	.51	14.1	.66	9.9	.46
Average percent of annual (PMi) (100)	9.5		8.6		10.1		11.4		11.0		7.4	

of precipitation during 1951-60.

July		August		September		October		November		December		Total annual inches
Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	Percent of annual	Inches	
2.9	0.44	3.1	0.47	5.3	0.79	7.6	1.14	9.8	1.46	11.0	1.65	14.96
2.1	.41	5.3	1.02	3.8	.72	8.3	1.58	9.4	1.79	10.1	1.93	19.12
2.3	.39	4.4	.74	5.3	.89	8.5	1.41	9.4	1.56	9.3	1.55	16.64
4.6	.64	6.6	.92	3.9	.54	8.6	1.20	9.9	1.39	9.0	1.26	14.02
3.2	.53	4.4	.73	5.0	.82	9.2	1.51	9.2	1.52	10.2	1.68	16.44
8.8	.91	7.9	.82	6.1	.63	6.0	.62	7.9	.82	9.6	.99	10.34
4.2	.58	6.3	.87	3.8	.53	8.3	1.15	9.4	1.30	8.9	1.24	13.90
4.1	.48	4.7	.55	6.0	.71	8.4	.99	7.9	.93	9.1	1.07	11.74
4.9	.76	5.7	.89	4.0	.62	8.2	1.27	10.2	1.58	9.1	1.41	15.48
6.3	.62	9.2	.91	4.7	.46	9.3	.92	8.1	.80	9.9	.98	9.89
6.6	.31	7.7	.36	6.9	.32	9.9	.46	6.2	.29	6.2	.29	4.67
4.5		5.9		5.0		8.4		8.9		9.3		

Table 12. Compilation of data for estimating annual freshwater evaporation, 1931-70. All sites are in Utah unless indicated otherwise.

Station	Latitude		Longitude		Latitude -34° Min	Longitude -104° Min	Altitude above mean sea level (ft)	June-Sept. evaporation (in)	Annual evaporation (in)	Pan coefficient (Pcf)	Annual evaporation from freshwater lakes (Efw) (in)
	Deg	Min	Deg	Min							
Bear River Refuge	41	28	112	16	448	496	4,208	37.62	63.67	0.715	45.52
Draper	40	31	111	49	391	469	4,515	37.92	65.30	.708	46.23
Ferron	39	06	111	08	306	428	6,000	23.50	41.67	.689	28.71
Fish Springs Refuge	39	51	113	24	351	564	4,335	59.33	103.54	.700	72.48
Flaming Gorge	40	56	109	25	416	325	6,270	36.25	61.94	.707	43.79
Fort Duchesne	40	17	109	52	377	352	4,990	30.45	52.68	.698	36.77
Green River	39	00	110	09	300	369	4,071	34.64	61.56	.687	42.29
Gunnison	39	09	111	49	309	469	5,145	38.42	68.05	.690	46.95
Hite	37	49	110	26	229	386	3,470	51.24	93.69	.670	62.77
Lakeside	41	13	112	52	433	532	4,260	56.58	96.18	.715	68.77
Logan Utah State University	41	46	111	49	466	469	4,608	30.61	51.53	.715	36.84
Manila	41	00	109	43	420	343	6,420	37.12	63.35	.708	44.85
Mexican Hat	37	09	109	52	189	352	4,270	56.72	105.60	.680	71.81
Midlake	41	12	112	39	433	519	4,235	49.53	84.22	.715	60.22
Milford	38	26	113	01	266	541	5,028	56.20	101.20	.687	69.52
Moab 4NW	38	26	109	36	276	336	3,965	46.13	82.74	.685	56.68
Morgan	41	02	111	41	422	461	5,070	30.60	52.19	.711	37.11
Myton	40	12	110	04	372	364	5,030	28.65	49.65	.700	34.76
National Lead Ind.	40	54	112	42	414	522	4,230	50.03	85.54	.710	60.73
Piute Dam	38	19	112	11	259	491	5,900	37.40	67.54	.685	46.26
Provo Radio-KOVO	40	13	111	40	373	460	4,470	30.03	52.02	.700	36.41
Promontory Point	41	16	112	30	436	510	4,202	49.59	84.22	.715	60.22
Riverton	40	31	111	59	391	479	4,655	41.61	71.66	.705	50.52
Saltair	40	46	112	06	406	486	4,210	53.80	92.21	.710	65.47
Salt Lake Airport	40	46	111	58	406	478	4,220	44.50	77.47	.709	54.93
Sevier Bridge Dam	39	23	112	02	323	482	4,980	42.96	75.71	.694	52.54
Scofield Dam	39	47	111	07	347	427	7,630	29.01	50.69	.697	35.33
Silver Sands	40	44	112	12	404	492	4,205	40.65	69.72	.708	49.36
Strawberry Reservoir East Portal	40	10	111	11	370	431	7,606	29.21	50.65	.700	35.46
Utah Lake Lehi	40	22	111	54	382	474	4,497	36.32	62.73	.703	44.10

Table 12. *continued*

Station	Latitude		Longitude		Latitude -34° Min	Longitude -104° Min	Altitude above mean sea level (ft)	June-Sept. evaporation (in)	Annual evaporation (in)	Pan coefficient (Pcf)	Annual evaporation from freshwater lakes (Efw) (in)
	Deg	Min	Deg	Min							
Vernal	40	27	109	31	387	331	5,280	24.94	43.01	.700	30.11
Wanship Dam	40	48	111	24	408	444	5,950	28.82	49.37	.709	35.00
Boulder City, Nev.	35	59	114	51	119	651	2,525	63.62	122.78	.650	79.81
Caliente, Nev.	37	37	114	31	217	631	4,402	41.87	76.96	.680	52.33
Ruby Lake, Nev.	40	12	115	30	372	690	6,012	33.37	57.82	.713	41.23
Green River, Wyo.	41	32	109	29	452	329	6,089	45.81	77.44	.710	54.98
Twin Falls, Idaho	42	33	114	21	513	621	3,960	40.85	67.88	.725	49.21
Grand Junction, Colo.	39	03	108	27	303	267	4,710	45.57	80.90	.688	55.66
Gai Lake, Colo.	40	16	105	50	376	110	8,680	31.67	54.81	.710	38.92
Gr. Mtn. Dam, Colo.	39	53	106	20	353	140	7,740	26.26	445.79	.710	32.51
Meredith, Colo.	29	22	106	45	322	165	7,825	33.02	58.21	.710	41.33
Montrose, Colo.	38	29	107	53	269	233	5,830	34.24	61.58	.689	42.43
Vallecito, Colo.	37	22	107	35	202	215	7,650	24.83	45.95	.690	31.71
Dan's Dam, Ariz.	35	12	112	20	72	500	6,000	81.72	162.25	.700	113.58
Fort Valley, Ariz.	35	16	111	44	76	464	7,347	23.99	47.51	.700	33.26
Many Farms, Ariz.	36	22	109	37	142	337	5,305	49.58	94.50	.690	65.20
Wahweap, Ariz.	36	59	111	29	179	449	3,728	69.78	130.53	.680	88.76

Table 13. Surface flow from Bear River basin across State Highway 83, 1972-74 water years.

Date	1 Bear River near Corinne (acre-ft)	2 Tributaries and canals (acre-ft)	3 Total surface flow across State Highway 83 (acre-ft)	4 Ratio (column 2 divided by column 3)
Oct. 1971	176,600	15,900	192,500	0.08
Nov.	172,700	13,400	186,100	.07
Dec.	182,000	13,300	195,300	.07
Jan. 1972	198,000	13,900	211,900	.07
Feb.	166,200	11,100	177,300	.06
Mar.	226,200	10,900	237,100	.05
Apr.	247,800	8,100	255,900	.03
May	251,600	13,700	265,300	.05
June	181,700	15,700	197,400	.08
July	97,680	16,420	114,100	.14
Aug.	54,110	15,130	69,240	.22
Sept.	116,000	19,000	135,000	.14
Total for water year (rounded)	2,071,000	167,000	2,237,000	.07
Oct. 1972	129,700	16,900	146,600	.12
Nov.	149,000	12,200	161,200	.08
Dec.	146,100	10,000	156,100	.06
Jan. 1973	154,100	11,000	165,100	.07
Feb.	140,000	10,400	150,400	.07
Mar.	201,300	25,900	227,200	.11
Apr.	194,100	11,400	205,500	.06
May	185,700	16,400	202,100	.08
June	54,020	17,440	71,460	.24
July	38,740	17,750	56,490	.31
Aug.	7,900	16,850	24,750	.68
Sept.	84,470	21,930	106,400	.21
Total for water year (rounded)	1,485,000	188,000	1,673,000	.11
Oct. 1973	106,600	14,900	121,500	.12
Nov.	96,990	12,410	109,400	.11
Dec.	116,900	11,200	128,100	.09
Jan. 1974	138,200	11,300	149,500	.08
Feb.	126,000	12,300	138,300	.09
Mar.	218,700	17,500	236,200	.07
Apr.	194,400	10,100	204,500	.05
May	207,200	15,500	222,700	.09
June	149,100	14,500	163,600	.09
July	43,830	15,300	59,130	.26
Aug.	44,600	15,880	60,480	.26
Sept.	62,230	16,220	78,450	.21
Total for water year (rounded)	1,505,000	167,000	1,672,000	.10

Table 14. Discharge and specific-conductance data for outflow from the Bear River Migratory Bird Refuge near Brigham City.

Date	Discharge (ft^3/s)	Specific conductance (micromhos/cm at 25°C)	
		Discharge-weighted average	Average
3- -74	5,330	1,240	3,040
4-12	4,090	1,370	2,110
4-26	4,130	1,040	1,220
4-30			990
5- 3			1,520
5- 9			1,550
5-10	4,480	775	1,180
5-17			699
5-24	2,800	1,010	1,480
5-30			1,530
6- 3			1,970
6- 7	3,550	897	2,170
6-11			2,020
6-17			1,920
6-21	2,340	823	1,240
6-24			1,350
6-27			1,470
7- 2			1,590
7- 5	626	1,260	2,040
7-22	122	1,930	1,870
7-26			2,320
8- 2			2,350
8- 8	598	1,750	2,300
8-19	644	2,030	2,300
9- 5	549	1,980	2,310
9-17	1,770	1,660	2,170
9-30	984	2,250	2,390
10-15	1,550	2,090	2,470
11- 4	2,120	2,410	2,380
11-17,18	1,660	2,740	3,150
12- 2	1,810	1,920	2,350

Table 15. Discharge and specific-conductance data for outflow from the Farmington Bay Waterfowl Management Area, duck clubs, and Salt Lake City Sewage Canal.

Date	Total flow (ft^3/s)	Specific conductance (micromhos/cm at 25°C)	
		Discharge-weighted average	Average
Farmington Bay Waterfowl Management Area			
12-19-73	304	1,860	1,830
1-24-74	333	1,770	1,870
2-28-74	217	2,010	2,030
3-29-74–4-1-74	337	2,320	2,450
5- 3-74	498	2,860	3,100
5-31-74	523	2,230	4,350
6-26-74	184	1,530	2,570
8-27-74	121	1,670	2,011
10- 3-74	171	2,450	2,780
10-30-74	268	2,610	2,780
11-29-74	212	1,990	2,090
1- 6-75	163	1,820	1,770
Salt Lake Sewage Canal			
12-19-73	93.5	–	3,600[1]
1-24-74	151	–	3,700[1]
2-27-74	145	–	3,710[1]
4- 1-74	128	–	3,050[1]
5- 3-74	206	–	2,110[1]
5-31-74	99	–	5,400[1]
6-26-74	120	–	4,400[1]
10- 3-74	76	–	3,900[1]
10-30-74	86	–	3,200[1]
11-29-74	57	–	4,000[1]
1- 6-75	67	–	3,600[1]
North Point Duck Club			
12-19-73	201	1,700	1,800
1-24-74	199	2,120	2,210
2-28-74	183	2,310	2,540
4- 1-74	155	1,850	2,150
5- 2-74	183	1,760	2,400
5-31-74	150	1,160	1,230
6-26-74	92	1,460	1,480
8-27-74	88	1,670	1,660
10- 3-74	26	2,060	2,230
10-31-74	64	1,990	2,390
11-29-74	47	1,940	2,040
1- 6-75	48	2,120	2,200
Lake Front Duck Club			
12-12-73	106	1,910	1,870
1-25-74	114	2,040	2,000
2-28-74	120	2,010	2,000
4- 1-74	87	1,600	1,600
5- 2-74	125	1,620	1,580
5-31-74	66	1,260	1,280
6-26-74	20	1,640	1,580
8-27-74	30	2,040	2,020
10- 3-74	33	2,420	2,410
10-31-74	33	2,370	2,290
11-29-74	30	2,060	2,100
1- 6-75	27	2,080	2,220
West Ambassador Duck Club			
12-20-73	23	2,500	2,500
1-25-74	20	2,490	2,490
2-28-74	18	2,820	2,820
4- 1-74	6.9	6,940	6,500
5- 2-74	13	4,440	4,840
10- 3-74	14	4,370	4,600
10-31-74	54	3,540	3,950
11-29-74	15	3,370	3,600
1- 6-75	21	2,820	3,050

[1] Represents measurement of single discharge point.

Table 16. Monthly estimates of surface inflow to Great Salt Lake, 1931-73.

Total surface flow across State Highway 83, excluding Bear River, near Corinne (10126000)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1932	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1933	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1934	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1935	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1936	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1937	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1938	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1939	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1940	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1941	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1942	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1943	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1944	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1945	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1946	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1947	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1948	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1949	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1950	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1951	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1952	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1953	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1954	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1955	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1956	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1957	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1958	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1959	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1960	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1961	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1962	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1963	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1964	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1965	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1966	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1967	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1968	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1969	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1970	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1971	16390.0	12770.0	11650.0	12400.0	10740.0	10900.0	9734.0	12000.0	16560.0	17060.0	15980.0	20450.0
1972	15900.0	13400.0	13300.0	13900.0	11100.0	10900.0	8100.0	7700.0	15700.0	16420.0	15130.0	19000.0
1973	16880.0	12140.0	9999.0	10900.0	10380.0	25720.0	11370.0	16310.0	17420.0	17700.0	16830.0	21890.0

10126000 Bear River near Corinne

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	67640.0	74930.0	72010.0	72010.0	73260.0	85460.0	61490.0	17920.0	9050.0	8980.0	8940.0	8920.0
1932	20110.0	43350.0	53670.0	53360.0	60860.0	128200.0	181400.0	215700.0	96610.0	16900.0	9890.0	20520.0
1933	39180.0	53570.0	62420.0	61590.0	60970.0	100300.0	127200.0	150100.0	55960.0	9430.0	9330.0	9300.0
1934	28230.0	53000.0	70150.0	66810.0	57990.0	58050.0	37370.0	9040.0	8750.0	8710.0	8540.0	14160.0
1935	27060.0	51890.0	52220.0	45030.0	60250.0	78140.0	82670.0	88560.0	46370.0	8650.0	8570.0	8450.0
1936	29390.0	48570.0	47690.0	60510.0	76550.0	90810.0	223600.0	251200.0	89820.0	8630.0	8620.0	13620.0
1937	54200.0	74600.0	71110.0	65430.0	69150.0	145800.0	147400.0	172600.0	49300.0	13940.0	8410.0	10640.0
1938	61070.0	61270.0	80740.0	68530.0	81990.0	123800.0	172400.0	187000.0	41560.0	28590.0	8420.0	13260.0
1939	63160.0	96660.0	92920.0	69490.0	71610.0	141400.0	117100.0	61420.0	10360.0	8630.0	8550.0	33860.0
1940	54190.0	48730.0	57840.0	63620.0	75940.0	96880.0	83590.0	23740.0	9440.0	8590.0	8550.0	23320.0
1941	46250.0	57380.0	61780.0	56850.0	83840.0	95140.0	99070.0	62880.0	14280.0	8700.0	11800.0	16920.0
1942	57240.0	60130.0	71580.0	67720.0	71200.0	111400.0	173000.0	145700.0	28580.0	9560.0	8630.0	14430.0
1943	45350.0	64970.0	76860.0	89790.0	90020.0	125100.0	222100.0	138800.0	131400.0	16760.0	14500.0	21560.0
1944	66590.0	77700.0	74950.0	65940.0	67470.0	97560.0	114500.0	130400.0	88470.0	9350.0	8920.0	9160.0
1945	35970.0	62620.0	56180.0	58880.0	103200.0	103600.0	103100.0	150700.0	176800.0	13250.0	30720.0	49560.0
1946	57270.0	94230.0	96970.0	97570.0	76140.0	165100.0	277100.0	173400.0	74570.0	15800.0	43960.0	51270.0
1947	85970.0	110800.0	120100.0	100800.0	105200.0	122700.0	128000.0	142300.0	97770.0	22540.0	60570.0	70480.0
1948	92190.0	106100.0	110500.0	89640.0	104700.0	99600.0	174400.0	230000.0	116300.0	26370.0	37010.0	47330.0
1949	91130.0	96490.0	108300.0	113100.0	113000.0	163400.0	173100.0	169300.0	61990.0	15550.0	26140.0	44630.0
1950	105300.0	96300.0	99130.0	133700.0	144100.0	161100.0	228500.0	288900.0	220400.0	128400.0	87750.0	102000.0
1951	146800.0	150200.0	166500.0	164100.0	194800.0	188300.0	226700.0	243200.0	99570.0	56240.0	89450.0	85600.0
1952	119000.0	123900.0	133100.0	149000.0	138400.0	160100.0	339000.0	299400.0	121000.0	58120.0	62240.0	71600.0
1953	90860.0	105200.0	121500.0	137900.0	113000.0	116700.0	126400.0	104900.0	118400.0	10920.0	15860.0	15120.0
1954	43690.0	67130.0	69100.0	73220.0	72490.0	92750.0	104200.0	31040.0	21140.0	7540.0	6970.0	20510.0
1955	44010.0	55270.0	55520.0	63970.0	56910.0	96400.0	127700.0	97970.0	55870.0	7280.0	10380.0	16490.0
1956	45820.0	68370.0	111100.0	130500.0	79540.0	124500.0	165600.0	162500.0	44720.0	7690.0	14000.0	15150.0
1957	46820.0	64750.0	76990.0	74880.0	90840.0	124900.0	132500.0	221300.0	145000.0	13270.0	29620.0	42810.0
1958	90100.0	91900.0	84890.0	84900.0	113400.0	110100.0	174000.0	149100.0	24690.0	11640.0	31230.0	42130.0
1959	51030.0	72840.0	80470.0	76290.0	81890.0	83290.0	111300.0	32990.0	11540.0	9560.0	8860.0	26370.0
1960	56550.0	54250.0	56700.0	60990.0	63640.0	123500.0	128800.0	57820.0	8680.0	8460.0	8790.0	11790.0
1961	31210.0	60120.0	56610.0	49000.0	68130.0	80010.0	67620.0	10050.0	8770.0	8900.0	8850.0	17300.0
1962	41680.0	52810.0	55980.0	53740.0	171900.0	108800.0	196700.0	161700.0	57830.0	11640.0	8680.0	8640.0
1963	38360.0	56430.0	56440.0	56600.0	104800.0	67620.0	106500.0	91650.0	66450.0	8510.0	8520.0	26440.0
1964	39080.0	74290.0	58510.0	61390.0	61290.0	71210.0	181500.0	183100.0	179400.0	13940.0	4900.0	7450.0
1965	36980.0	59510.0	109900.0	105500.0	118400.0	90320.0	160100.0	165600.0	122800.0	40170.0	68890.0	104200.0
1966	126200.0	145500.0	145300.0	149900.0	134300.0	179400.0	158700.0	86940.0	7190.0	6900.0	5450.0	8570.0
1967	30110.0	48540.0	60460.0	65220.0	62060.0	97470.0	133300.0	181600.0	205800.0	48990.0	53650.0	66850.0
1968	106800.0	120400.0	115700.0	117100.0	93360.0	146900.0	119800.0	63640.0	107500.0	6960.0	41630.0	19350.0
1969	70200.0	111400.0	113500.0	160100.0	117400.0	172700.0	253400.0	125500.0	42660.0	27010.0	7710.0	13790.0
1970	61890.0	84640.0	101400.0	121100.0	84400.0	84130.0	79740.0	125400.0	96110.0	6650.0	6270.0	24060.0
1971	68500.0	69800.0	121100.0	164900.0	151100.0	178500.0	256000.0	334700.0	362500.0	152400.0	71750.0	136500.0
1972	176600.0	172700.0	182000.0	198000.0	166200.0	226200.0	247800.0	251600.0	181700.0	97680.0	54110.0	116000.0
1973	129400.0	148700.0	145900.0	153900.0	139800.0	201200.0	193700.0	185400.0	53920.0	38670.0	7880.0	84320.0

Table 16. *continued*

Combined flow of South Fork Weber Canal (10141050) and South (10141100), North (10141200), and Middle Forks (10141150)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	19420.0	19230.0	19230.0	18550.0	21280.0	25960.0	21760.0	9650.0	3950.0	2650.0	2660.0	3030.0
1932	4600.0	9820.0	15130.0	18060.0	25770.0	53280.0	138100.0	226900.0	68010.0	6750.0	4760.0	4720.0
1933	6830.0	15130.0	15330.0	20590.0	20400.0	37570.0	79620.0	128300.0	67430.0	5020.0	3270.0	3370.0
1934	4470.0	7510.0	12730.0	14650.0	15220.0	15190.0	5670.0	2930.0	2650.0	2550.0	2560.0	3230.0
1935	3710.0	5590.0	14740.0	13330.0	15350.0	27020.0	53840.0	57510.0	47060.0	3140.0	2780.0	3150.0
1936	5230.0	9170.0	12830.0	13950.0	19910.0	41940.0	219100.0	234100.0	52080.0	4540.0	3900.0	3860.0
1937	10390.0	23570.0	20570.0	20290.0	25410.0	49260.0	117100.0	117000.0	33150.0	5780.0	3520.0	4070.0
1938	10330.0	19090.0	27020.0	20360.0	19370.0	43590.0	118200.0	145000.0	34240.0	4830.0	3940.0	4650.0
1939	12880.0	30590.0	28690.0	26770.0	17420.0	51480.0	59060.0	32650.0	6530.0	3590.0	3420.0	4840.0
1940	8550.0	9280.0	14300.0	25290.0	22350.0	34700.0	37590.0	8460.0	4640.0	3410.0	3150.0	4300.0
1941	9630.0	16340.0	20960.0	21990.0	23600.0	29790.0	39370.0	39430.0	18050.0	5380.0	5320.0	6460.0
1942	14930.0	20550.0	30210.0	29910.0	31040.0	39020.0	111800.0	111100.0	44820.0	5680.0	4220.0	5520.0
1943	9900.0	18130.0	29940.0	28310.0	30580.0	49760.0	139300.0	58550.0	63210.0	6900.0	5390.0	5210.0
1944	11570.0	19750.0	25990.0	21180.0	23550.0	29240.0	41030.0	96160.0	78780.0	6940.0	4530.0	4940.0
1945	11830.0	23430.0	20090.0	21530.0	31510.0	33180.0	39460.0	88260.0	71370.0	6500.0	9860.0	9060.0
1946	23210.0	24650.0	29220.0	32590.0	30990.0	51440.0	157900.0	76840.0	15220.0	5320.0	4880.0	5040.0
1947	17780.0	16580.0	27100.0	24090.0	26540.0	38050.0	50090.0	81260.0	26340.0	4980.0	6500.0	9410.0
1948	15300.0	29800.0	22060.0	25750.0	27960.0	26760.0	119300.0	196200.0	47260.0	5760.0	4400.0	5670.0
1949	8690.0	17920.0	28780.0	25430.0	24180.0	69410.0	116200.0	133200.0	71720.0	6490.0	5340.0	5770.0
1950	21510.0	25990.0	29760.0	36610.0	38180.0	61710.0	143800.0	227200.0	123000.0	14350.0	5410.0	7670.0
1951	18630.0	28870.0	41880.0	38160.0	49840.0	67210.0	155900.0	191700.0	53800.0	7420.0	12670.0	7270.0
1952	26040.0	25540.0	33460.0	35640.0	37800.0	65530.0	203600.0	374500.0	108400.0	13730.0	8200.0	7080.0
1953	9430.0	22390.0	26840.0	33930.0	27180.0	37630.0	52460.0	87710.0	99500.0	6190.0	5590.0	6420.0
1954	10850.0	16540.0	15160.0	18060.0	21490.0	25550.0	24510.0	4530.0	4410.0	4260.0	3520.0	4340.0
1955	9060.0	14590.0	12530.0	11920.0	13450.0	26830.0	33630.0	32250.0	12650.0	5580.0	4860.0	5630.0
1956	9510.0	16910.0	32180.0	35090.0	34430.0	68160.0	47100.0	65330.0	22450.0	4750.0	3800.0	4040.0
1957	13370.0	16840.0	16150.0	13590.0	25710.0	32650.0	51030.0	115400.0	54230.0	6500.0	5280.0	6740.0
1958	11810.0	17150.0	30870.0	25870.0	32070.0	53780.0	105800.0	90680.0	5210.0	4540.0	4680.0	5510.0
1959	7220.0	15580.0	15000.0	14920.0	12560.0	14770.0	19230.0	8630.0	4680.0	3710.0	3420.0	8460.0
1960	11820.0	9920.0	8940.0	9680.0	11890.0	33490.0	33270.0	12150.0	4710.0	3590.0	4990.0	5570.0
1961	11610.0	13090.0	9400.0	9070.0	9580.0	11650.0	7810.0	3350.0	3040.0	2820.0	2630.0	4430.0
1962	4370.0	3650.0	8360.0	8690.0	30480.0	31200.0	74050.0	48280.0	11220.0	6230.0	3410.0	4570.0
1963	8470.0	14660.0	10910.0	9600.0	15560.0	12030.0	24270.0	44070.0	15060.0	4300.0	3840.0	9020.0
1964	8520.0	11420.0	14240.0	14360.0	18370.0	22120.0	42870.0	89850.0	94110.0	6900.0	5110.0	6120.0
1965	8310.0	10020.0	18360.0	9720.0	19930.0	26980.0	55880.0	91800.0	66330.0	15020.0	10220.0	26110.0
1966	23350.0	18090.0	16690.0	13070.0	8060.0	23800.0	8540.0	10050.0	5700.0	4350.0	4440.0	5810.0
1967	9210.0	9150.0	9770.0	9040.0	8980.0	11070.0	9810.0	32260.0	79210.0	8970.0	5070.0	7510.0
1968	20970.0	20490.0	24440.0	20420.0	9060.0	12690.0	14630.0	28950.0	52800.0	7320.0	13310.0	10230.0
1969	21850.0	27300.0	31490.0	41090.0	41400.0	122000.0	90900.0	83730.0	24860.0	10780.0	6720.0	7660.0
1970	20500.0	25200.0	13890.0	19060.0	9050.0	10810.0	16800.0	50410.0	46150.0	7060.0	6530.0	31720.0
1971	27850.0	24640.0	27240.0	35360.0	34080.0	56990.0	117600.0	103000.0	50770.0	8350.0	8630.0	19610.0
1972	29230.0	26780.0	25920.0	36980.0	42960.0	102900.0	128600.0	84370.0	34520.0	7150.0	8260.0	11260.0
1973	26180.0	25250.0	28040.0	34080.0	35910.0	55710.0	60600.0	120400.0	38970.0	10400.0	7630.0	17820.0

Willard Bay outflow

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1932	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1933	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1934	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1935	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1936	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1937	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	5300.0	0.0	0.0	0.0	3900.0	28800.0	33200.0	39600.0
1966	17200.0	500.0	8200.0	10200.0	12900.0	0.0	0.0	0.0	5500.0	7800.0	7700.0	13300.0
1967	48000.0	16300.0	1500.0	600.0	100.0	100.0	100.0	7800.0	26500.0	9100.0	22200.0	13800.0
1968	18400.0	13600.0	8400.0	6200.0	100.0	200.0	600.0	5300.0	21700.0	8600.0	6500.0	14100.0
1969	0.0	20900.0	12500.0	200.0	2300.0	13850.0	9900.0	7510.0	3600.0	5400.0	6100.0	19200.0
1970	41400.0	32600.0	100.0	200.0	200.0	200.0	100.0	5200.0	800.0	7900.0	5400.0	1600.0
1971	6800.0	3300.0	7600.0	2900.0	2800.0	5900.0	4400.0	6100.0	5100.0	9600.0	6300.0	5500.0
1972	0.0	800.0	1000.0	3200.0	8400.0	21200.0	24000.0	17000.0	9400.0	8000.0	7000.0	4500.0
1973	2000.0	1400.0	500.0	0.0	200.0	0.0	23800.0	13000.0	10400.0	5300.0	8500.0	1900.0

Table 16. *continued*

10141400 Howard Slough at Hooper

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1932	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1933	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1934	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1935	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1936	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1937	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1938	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1939	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1940	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1941	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1942	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1943	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1913.0	1320.0	1180.0	2140.0
1944	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1945	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1946	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1947	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1948	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1949	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1950	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1951	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1952	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1953	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1954	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1955	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1956	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1957	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1958	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1959	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1960	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1961	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1962	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1963	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1964	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1965	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1966	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1967	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1968	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1969	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1970	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1971	1570.0	1510.0	1860.0	1610.0	1980.0	2490.0	1540.0	1740.0	1910.0	1320.0	1180.0	2140.0
1972	1820.0	1700.0	2270.0	2110.0	1560.0	1200.0	1750.0	1530.0	1440.0	1010.0	1090.0	2400.0
1973	1320.0	1310.0	1440.0	1100.0	2400.0	3770.0	1320.0	1950.0	2370.0	1620.0	1260.0	1890.0

Combined flow of tributaries 10141500, 1042000, 10142500, 1014300, 10143500, 10144000, and 10145000

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	541.0	607.0	591.0	590.0	540.0	1060.0	1600.0	3060.0	2030.0	620.0	461.0	379.0
1932	387.0	532.0	534.0	521.0	528.0	1330.0	3450.0	9660.0	6670.0	1440.0	831.0	560.0
1933	530.0	632.0	625.0	618.0	557.0	1360.0	2070.0	5130.0	8240.0	1310.0	840.0	622.0
1934	576.0	660.0	669.0	637.0	557.0	1200.0	1220.0	1200.0	936.0	251.0	211.0	216.0
1935	258.0	489.0	528.0	504.0	522.0	1180.0	2290.0	6610.0	6760.0	1250.0	722.0	528.0
1936	506.0	648.0	620.0	612.0	591.0	2270.0	6050.0	12650.0	6880.0	1530.0	886.0	629.0
1937	591.0	667.0	651.0	597.0	593.0	1860.0	3180.0	10850.0	6230.0	1590.0	896.0	640.0
1938	626.0	657.0	658.0	626.0	568.0	1720.0	4690.0	9630.0	6020.0	1390.0	896.0	641.0
1939	620.0	704.0	696.0	667.0	597.0	1940.0	3240.0	5750.0	2850.0	858.0	635.0	513.0
1940	492.0	602.0	606.0	620.0	608.0	1990.0	3770.0	6700.0	3330.0	962.0	673.0	525.0
1941	559.0	670.0	645.0	615.0	650.0	1940.0	3240.0	8830.0	5960.0	1650.0	1020.0	779.0
1942	727.0	732.0	716.0	716.0	672.0	1940.0	6290.0	9130.0	9190.0	2230.0	1330.0	951.0
1943	896.0	805.0	830.0	819.0	765.0	2120.0	4630.0	5370.0	4810.0	1360.0	962.0	687.0
1944	550.0	674.0	665.0	618.0	592.0	1340.0	2580.0	8270.0	7150.0	1700.0	1050.0	733.0
1945	736.0	589.0	689.0	645.0	595.0	1290.0	1700.0	5160.0	5670.0	1450.0	1010.0	724.0
1946	646.0	682.0	644.0	626.0	562.0	1720.0	4220.0	5720.0	4270.0	1130.0	736.0	547.0
1947	547.0	652.0	671.0	638.0	682.0	1960.0	3030.0	8210.0	4480.0	1380.0	933.0	632.0
1948	623.0	711.0	686.0	621.0	505.0	1500.0	3620.0	9570.0	6200.0	1360.0	905.0	760.0
1949	647.0	714.0	672.0	613.0	566.0	1850.0	4810.0	10190.0	7920.0	1800.0	1060.0	724.0
1950	811.0	740.0	660.0	674.0	717.0	1920.0	4040.0	9510.0	8450.0	1940.0	1130.0	812.0
1951	780.0	766.0	720.0	696.0	671.0	1630.0	3000.0	8030.0	5580.0	1420.0	1080.0	663.0
1952	743.0	693.0	704.0	704.0	680.0	860.0	763.0	17140.0	7100.0	2100.0	1070.0	694.0
1953	668.0	658.0	702.0	893.0	686.0	1220.0	3140.0	7400.0	10320.0	2170.0	1020.0	506.0
1954	649.0	703.0	717.0	634.0	647.0	821.0	2490.0	2700.0	10780.0	525.0	350.0	295.0
1955	415.0	499.0	455.0	464.0	460.0	650.0	1960.0	6980.0	2890.0	904.0	507.0	397.0
1956	507.0	559.0	970.0	1070.0	707.0	1380.0	3640.0	6060.0	2540.0	873.0	515.0	413.0
1957	490.0	522.0	571.0	515.0	620.0	962.0	2090.0	9890.0	8120.0	2160.0	928.0	635.0
1958	725.0	675.0	709.0	638.0	784.0	1040.0	3440.0	15060.0	4170.0	1230.0	653.0	541.0
1959	575.0	641.0	622.0	573.0	539.0	8020.0	2070.0	3610.0	1970.0	635.0	428.0	452.0
1960	537.0	452.0	450.0	459.0	440.0	1360.0	3680.0	5380.0	1870.0	673.0	407.0	366.0
1961	447.0	523.0	488.0	447.0	460.0	705.0	1620.0	2730.0	908.0	320.0	247.0	293.0
1962	425.0	470.0	492.0	462.0	987.0	1140.0	7290.0	10630.0	4770.0	1590.0	829.0	633.0
1963	610.0	558.0	509.0	480.0	575.0	781.0	1840.0	7520.0	3430.0	959.0	482.0	461.0
1964	500.0	557.0	479.0	471.0	471.0	580.0	1690.0	12600.0	9000.0	2380.0	1020.0	667.0
1965	669.0	679.0	1010.0	851.0	911.0	1030.0	4140.0	10300.0	6660.0	2310.0	1180.0	926.0
1966	838.0	789.0	755.0	703.0	606.0	1920.0	3730.0	5800.0	3150.0	884.0	599.0	464.0
1967	481.0	572.0	495.0	543.0	505.0	1240.0	1970.0	6020.0	7210.0	1710.0	985.0	638.0
1968	593.0	646.0	624.0	604.0	597.0	1600.0	2660.0	7150.0	4520.0	1880.0	1240.0	829.0
1969	831.0	792.0	725.0	629.0	558.0	1370.0	2240.0	3850.0	3640.0	1350.0	899.0	620.0
1970	524.0	612.0	598.0	719.0	723.0	1520.0	1710.0	8480.0	9600.0	2050.0	1030.0	789.0
1971	672.0	749.0	758.0	783.0	893.0	2640.0	6100.0	10310.0	9250.0	2360.0	1320.0	945.0
1972	886.0	830.0	840.0	768.0	768.0	3970.0	5120.0	10530.0	4770.0	1660.0	1050.0	776.0
1973	731.0	748.0	713.0	691.0	653.0	1780.0	2880.0	10510.0	7980.0	1830.0	1100.0	863.0

Table 16. *continued*

10170800 Surplus Canal at Cohen Flume, near Salt Lake City

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	4740.0	7310.0	8590.0	8360.0	6060.0	3610.0	4180.0	7020.0	6750.0	2820.0	0.0	0.0
1932	5970.0	3620.0	4690.0	4430.0	3480.0	3610.0	4060.0	7050.0	6810.0	2560.0	0.0	0.0
1933	4960.0	2530.0	4950.0	4110.0	3160.0	3320.0	4060.0	3840.0	8280.0	2560.0	0.0	0.0
1934	3380.0	2780.0	4300.0	3820.0	3200.0	3490.0	7840.0	5080.0	2560.0	2560.0	0.0	0.0
1935	3670.0	2880.0	4620.0	4470.0	3740.0	3710.0	4020.0	4440.0	6740.0	2560.0	0.0	0.0
1936	1860.0	3230.0	4510.0	4400.0	3710.0	3700.0	4960.0	7500.0	6930.0	2560.0	0.0	0.0
1937	8280.0	3290.0	4850.0	4650.0	4040.0	4130.0	4050.0	7280.0	6700.0	3610.0	736.0	1260.0
1938	7590.0	3210.0	4690.0	4520.0	3750.0	3740.0	4740.0	7100.0	8710.0	3960.0	1410.0	1980.0
1939	10050.0	3630.0	5600.0	4680.0	3930.0	3770.0	6150.0	8280.0	6730.0	4500.0	2440.0	3090.0
1940	6020.0	3490.0	4900.0	4470.0	3730.0	3840.0	4720.0	8410.0	6700.0	3780.0	1060.0	1610.0
1941	4780.0	3450.0	4660.0	4470.0	3650.0	3760.0	4020.0	7130.0	6700.0	2960.0	0.0	0.0
1942	3680.0	3710.0	5460.0	4600.0	3530.0	3630.0	4500.0	6670.0	8030.0	3820.0	1140.0	1690.0
1943	9600.0	3890.0	4950.0	4000.0	3450.0	3650.0	5870.0	7040.0	6240.0	4420.0	2150.0	2390.0
1944	6340.0	2070.0	3320.0	3030.0	3820.0	4480.0	5300.0	8200.0	13030.0	6730.0	2810.0	3620.0
1945	5640.0	3070.0	4710.0	3790.0	3700.0	3820.0	3930.0	6020.0	8170.0	5300.0	4310.0	3560.0
1946	5430.0	3670.0	4820.0	4610.0	4110.0	3920.0	6580.0	6240.0	5260.0	4650.0	2510.0	2800.0
1947	8250.0	6690.0	6900.0	4730.0	5000.0	4360.0	6070.0	7710.0	8320.0	4830.0	4560.0	4020.0
1948	4480.0	6060.0	5490.0	4290.0	5300.0	4270.0	9820.0	10440.0	10530.0	5000.0	3370.0	4220.0
1949	5020.0	4270.0	5050.0	3030.0	6210.0	10060.0	7070.0	9870.0	8170.0	5190.0	3340.0	2260.0
1950	3550.0	4190.0	8010.0	7800.0	10990.0	6800.0	6700.0	7980.0	8140.0	5840.0	3800.0	4700.0
1951	5180.0	7600.0	6850.0	5120.0	5390.0	5430.0	4940.0	8690.0	7510.0	7160.0	7320.0	5090.0
1952	9670.0	6080.0	11290.0	19560.0	20090.0	14560.0	17410.0	30050.0	29010.0	14070.0	11080.0	7630.0
1953	19340.0	32030.0	39050.0	44420.0	40220.0	20660.0	19420.0	13790.0	14620.0	6830.0	7830.0	7350.0
1954	11580.0	8000.0	12430.0	13360.0	11630.0	9960.0	7720.0	6530.0	6770.0	5670.0	2850.0	4270.0
1955	6870.0	4450.0	5740.0	3940.0	3550.0	4840.0	4350.0	5860.0	7050.0	5430.0	4850.0	5580.0
1956	7740.0	3080.0	4160.0	2340.0	2530.0	4040.0	5200.0	8740.0	6660.0	4710.0	2610.0	5130.0
1957	9120.0	5660.0	5730.0	4700.0	4080.0	4240.0	4650.0	8650.0	13560.0	5890.0	4390.0	5770.0
1958	8930.0	4860.0	6010.0	6370.0	10370.0	8050.0	10590.0	13140.0	11610.0	4520.0	2830.0	6180.0
1959	6060.0	3140.0	5010.0	4610.0	5790.0	4610.0	4580.0	6380.0	7660.0	6470.0	6580.0	8140.0
1960	6740.0	2590.0	4560.0	4230.0	3630.0	4000.0	5090.0	6280.0	6080.0	5090.0	3330.0	3300.0
1961	4840.0	3750.0	5000.0	3810.0	3910.0	4050.0	3540.0	4250.0	3530.0	4130.0	839.0	1890.0
1962	2020.0	3050.0	3950.0	3450.0	4880.0	5540.0	6000.0	7870.0	8160.0	6420.0	4540.0	7280.0
1963	6040.0	4400.0	4580.0	2360.0	706.0	3920.0	4560.0	6160.0	8460.0	5320.0	5460.0	6820.0
1964	8520.0	7860.0	5930.0	4670.0	3310.0	3700.0	5030.0	16500.0	14970.0	5910.0	4930.0	7120.0
1965	5700.0	3510.0	9750.0	8640.0	8140.0	6790.0	8230.0	9470.0	14700.0	9760.0	8750.0	10800.0
1966	8410.0	4900.0	5220.0	7300.0	13330.0	5610.0	5090.0	10730.0	6610.0	5130.0	5390.0	10870.0
1967	8760.0	4260.0	6240.0	5130.0	5830.0	4020.0	4790.0	11760.0	16950.0	8090.0	4370.0	7520.0
1968	9000.0	6380.0	8160.0	7230.0	7500.0	3900.0	9630.0	8450.0	14900.0	7680.0	4030.0	5570.0
1969	11520.0	10110.0	15710.0	21400.0	26290.0	15590.0	17000.0	12530.0	13880.0	7130.0	6680.0	7000.0
1970	15710.0	13430.0	17900.0	25690.0	28120.0	14970.0	11250.0	14880.0	14670.0	7810.0	5890.0	10150.0
1971	13650.0	9860.0	16930.0	22950.0	25470.0	14960.0	13940.0	13400.0	15270.0	7520.0	9100.0	8960.0
1972	12470.0	14750.0	18570.0	24240.0	24480.0	14390.0	15560.0	11160.0	12650.0	7320.0	9480.0	10130.0
1973	12530.0	6370.0	7060.0	13480.0	21000.0	13290.0	14630.0	15360.0	12980.0	9430.0	8000.0	12210.0

10172600 Jordan River below Cudahy Lane, near Salt Lake City

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	8270.0	7640.0	7940.0	8040.0	7610.0	7270.0	7690.0	8910.0	8750.0	7900.0	7240.0	7150.0
1932	7510.0	7300.0	7240.0	7180.0	7110.0	7600.0	12680.0	14190.0	11330.0	7760.0	7200.0	7060.0
1933	7590.0	7300.0	7370.0	7690.0	7460.0	7290.0	8230.0	12030.0	12900.0	5430.0	4760.0	4970.0
1934	7440.0	7420.0	7430.0	7300.0	7180.0	7240.0	8210.0	7530.0	5240.0	828.0	827.0	998.0
1935	7240.0	7180.0	7310.0	7230.0	7160.0	7230.0	8030.0	11860.0	11000.0	642.0	142.0	35.0
1936	7280.0	7430.0	7320.0	7390.0	7640.0	8900.0	14560.0	16860.0	11410.0	6360.0	5770.0	6110.0
1937	8030.0	7830.0	7690.0	7410.0	7360.0	7750.0	10620.0	16770.0	11150.0	8730.0	7780.0	7580.0
1938	7950.0	7560.0	7750.0	7370.0	7230.0	8200.0	12970.0	15300.0	11500.0	8430.0	7990.0	7600.0
1939	9630.0	7790.0	7490.0	7370.0	7240.0	7650.0	9750.0	10780.0	8720.0	7780.0	7540.0	7490.0
1940	7650.0	7370.0	7360.0	7390.0	7360.0	7740.0	9810.0	11400.0	8750.0	7640.0	7370.0	7360.0
1941	7560.0	7480.0	7390.0	7320.0	7370.0	7980.0	10380.0	14350.0	10990.0	8070.0	7660.0	7430.0
1942	7730.0	8270.0	8810.0	8050.0	7960.0	8350.0	14450.0	14260.0	13370.0	8920.0	8120.0	7700.0
1943	8250.0	7300.0	6770.0	6350.0	7010.0	9120.0	5840.0	7090.0	10540.0	8980.0	8190.0	8520.0
1944	7560.0	6940.0	8040.0	7930.0	7890.0	8590.0	8050.0	14230.0	9970.0	5380.0	6360.0	7940.0
1945	9560.0	8470.0	7350.0	7280.0	6270.0	6830.0	5780.0	8260.0	9010.0	7100.0	9630.0	10570.0
1946	9880.0	8020.0	8110.0	7620.0	7300.0	9130.0	11300.0	10910.0	7950.0	8450.0	7790.0	8940.0
1947	9230.0	7510.0	7190.0	6890.0	7640.0	8430.0	6630.0	12520.0	10110.0	8020.0	9910.0	9280.0
1948	10100.0	8350.0	7780.0	8220.0	7380.0	8700.0	11010.0	10880.0	9360.0	8940.0	8610.0	10630.0
1949	10480.0	9250.0	9680.0	9540.0	9370.0	9850.0	9310.0	15650.0	11230.0	10200.0	10230.0	13480.0
1950	13610.0	9490.0	6000.0	6300.0	6650.0	7230.0	10670.0	15430.0	12410.0	10590.0	10010.0	12680.0
1951	11600.0	8200.0	8410.0	7690.0	6610.0	7110.0	7900.0	14310.0	9910.0	9120.0	8470.0	8310.0
1952	8430.0	6300.0	7720.0	7940.0	11620.0	16550.0	23290.0	21730.0	15590.0	10770.0	9540.0	8300.0
1953	12940.0	12470.0	9990.0	8370.0	4730.0	8080.0	8550.0	9260.0	9320.0	8210.0	6690.0	7970.0
1954	9770.0	8270.0	10430.0	9360.0	9610.0	12120.0	9560.0	8940.0	8690.0	8680.0	8810.0	8900.0
1955	8370.0	6970.0	8270.0	7460.0	7100.0	7030.0	6380.0	10050.0	10250.0	7810.0	7820.0	8150.0
1956	9490.0	9140.0	10760.0	10990.0	8610.0	6800.0	5370.0	12700.0	9520.0	11520.0	9850.0	10070.0
1957	9990.0	9050.0	8260.0	7570.0	6630.0	7880.0	8150.0	11360.0	10840.0	8990.0	8710.0	9160.0
1958	9120.0	7250.0	7180.0	6680.0	4450.0	3480.0	6820.0	8820.0	6520.0	12610.0	14000.0	13280.0
1959	11160.0	9810.0	11090.0	10700.0	7800.0	7330.0	7500.0	9680.0	9120.0	8310.0	8930.0	8930.0
1960	8550.0	7950.0	8370.0	8370.0	7050.0	9370.0	6800.0	8790.0	8680.0	7900.0	6920.0	7130.0
1961	7350.0	6880.0	7210.0	7170.0	6150.0	7140.0	6480.0	5170.0	4440.0	2840.0	3450.0	2680.0
1962	4120.0	4820.0	5500.0	4800.0	4390.0	3620.0	4690.0	8710.0	7170.0	6550.0	6290.0	5220.0
1963	5270.0	4590.0	5630.0	7460.0	8370.0	5690.0	6090.0	7070.0	4840.0	3700.0	2970.0	2450.0
1964	5350.0	5390.0	5680.0	6130.0	6470.0	8020.0	8230.0	13670.0	11040.0	6850.0	5630.0	7340.0
1965	7590.0	6960.0	8340.0	8460.0	7590.0	8720.0	12300.0	14490.0	15770.0	11230.0	10890.0	10360.0
1966	9800.0	9240.0	9260.0	8990.0	10060.0	11020.0	8890.0	10570.0	9810.0	9390.0	9520.0	9860.0
1967	10140.0	7800.0	7370.0	8570.0	7900.0	8820.0	9290.0	10000.0	10950.0	9010.0	9640.0	10420.0
1968	9520.0	7430.0	7810.0	7690.0	7860.0	9310.0	11980.0	10570.0	12530.0	10910.0	10930.0	10740.0
1969	8670.0	7800.0	8560.0	8790.0	9180.0	9260.0	10090.0	10360.0	8950.0	9570.0	9580.0	9500.0
1970	10390.0	9780.0	10960.0	10110.0	7000.0	7370.0	6620.0	10930.0	11090.0	9950.0	9310.0	10120.0
1971	7720.0	8320.0	9840.0	10680.0	9550.0	12080.0	11280.0	10820.0	12640.0	9670.0	9100.0	9680.0
1972	9840.0	8320.0	9120.0	9670.0	9090.0	12240.0	7050.0	14150.0	9790.0	8550.0	7930.0	9510.0
1973	8590.0	8640.0	7710.0	7090.0	6970.0	8710.0	8700.0	13610.0	15260.0	11310.0	9230.0	9960.0

Table 16. *continued*

10182630 Goggin Drain near Magna

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	1890.0	1580.0	984.0	939.0	502.0	0.0	684.0	5870.0	5380.0	0.0	1190.0	1810.0
1932	1750.0	2030.0	241.0	191.0	12.0	0.0	467.0	5920.0	5490.0	0.0	235.0	787.0
1933	1870.0	2160.0	291.0	130.0	0.0	0.0	471.0	66.0	8160.0	0.0	160.0	160.0
1934	2060.0	2130.0	166.0	76.0	0.0	0.0	7380.0	2330.0	0.0	0.0	160.0	160.0
1935	2020.0	2120.0	227.0	199.0	61.0	0.0	392.0	1160.0	5360.0	0.0	160.0	160.0
1936	2240.0	2080.0	207.0	187.0	55.0	0.0	2110.0	6760.0	5700.0	0.0	160.0	160.0
1937	1460.0	2070.0	271.0	233.0	118.0	603.0	441.0	6340.0	5280.0	0.0	2530.0	2780.0
1938	1550.0	2080.0	240.0	209.0	63.0	0.0	1710.0	6020.0	8970.0	291.0	2850.0	3120.0
1939	1250.0	2030.0	415.0	238.0	96.0	0.0	4270.0	8170.0	5340.0	1280.0	3340.0	3650.0
1940	1740.0	2050.0	281.0	199.0	59.0	66.0	1680.0	8420.0	5280.0	0.0	2680.0	2940.0
1941	1890.0	2050.0	235.0	199.0	43.0	0.0	399.0	6070.0	5290.0	0.0	1570.0	2130.0
1942	2020.0	2020.0	388.0	224.0	20.0	0.0	1260.0	5230.0	7720.0	34.0	2720.0	2980.0
1943	1370.0	2050.0	238.0	62.0	0.0	0.0	3480.0	5560.0	4130.0	912.0	3090.0	3200.0
1944	1760.0	2260.0	0.0	0.0	28.0	1020.0	2470.0	7630.0	16210.0	5010.0	3400.0	3770.0
1945	1840.0	2140.0	194.0	22.0	5.9	0.0	40.0	3750.0	7570.0	2470.0	4090.0	3740.0
1946	1860.0	2070.0	214.0	175.0	82.0	14.0	4740.0	4140.0	2390.0	1320.0	3260.0	3390.0
1947	1530.0	1710.0	599.0	197.0	246.0	801.0	3840.0	6760.0	7830.0	1630.0	4210.0	3960.0
1948	1980.0	1790.0	338.0	116.0	303.0	639.0	10500.0	11610.0	11760.0	1930.0	3660.0	4050.0
1949	1910.0	2000.0	256.0	0.0	470.0	10940.0	5610.0	10600.0	7560.0	2280.0	3640.0	3140.0
1950	2090.0	2010.0	804.0	766.0	1360.0	5140.0	4960.0	7230.0	7510.0	3440.0	3860.0	4270.0
1951	1890.0	1610.0	589.0	270.0	319.0	2700.0	1840.0	8500.0	6410.0	5770.0	5490.0	4450.0
1952	1360.0	1790.0	1410.0	2940.0	3040.0	18930.0	23990.0	46480.0	44620.0	18060.0	7230.0	5630.0
1953	222.0	0.0	6560.0	7550.0	6770.0	29780.0	27570.0	17560.0	19040.0	5200.0	5720.0	5500.0
1954	1140.0	1560.0	1620.0	1800.0	1480.0	10760.0	6780.0	4650.0	5080.0	3130.0	3410.0	4070.0
1955	1690.0	1980.0	384.0	50.0	0.0	1650.0	775.0	3460.0	5590.0	2700.0	4340.0	4680.0
1956	1590.0	2140.0	90.0	0.0	0.0	235.0	2300.0	8590.0	4900.0	1420.0	3300.0	4470.0
1957	1430.0	1840.0	381.0	192.0	76.0	580.0	1310.0	8420.0	17150.0	3520.0	4130.0	4770.0
1958	1450.0	1930.0	434.0	500.0	1240.0	7360.0	11870.0	16420.0	13700.0	1090.0	3410.0	4960.0
1959	1790.0	2130.0	249.0	175.0	392.0	1240.0	1190.0	4390.0	6670.0	4550.0	5140.0	5860.0
1960	1710.0	2200.0	165.0	105.0	0.0	157.0	2090.0	4210.0	3860.0	2100.0	3640.0	3620.0
1961	1930.0	2060.0	248.0	27.0	44.0	242.0	0.0	593.0	0.0	385.0	2480.0	2970.0
1962	2260.0	2140.0	52.0	0.0	224.0	2900.0	3700.0	7040.0	7560.0	4450.0	4200.0	5460.0
1963	1790.0	1980.0	170.0	0.0	0.0	14.0	1160.0	4000.0	8080.0	2500.0	4620.0	5250.0
1964	228.0	114.0	52.0	37.0	42.0	164.0	513.0	11830.0	17070.0	1140.0	4600.0	1460.0
1965	544.0	1030.0	494.0	331.0	339.0	129.0	2010.0	6650.0	16590.0	4560.0	5230.0	3360.0
1966	688.0	634.0	759.0	504.0	465.0	9780.0	442.0	3030.0	631.0	600.0	1120.0	559.0
1967	426.0	528.0	242.0	128.0	156.0	967.0	138.0	10090.0	21190.0	3900.0	2180.0	3960.0
1968	1190.0	573.0	125.0	53.0	568.0	12870.0	11530.0	11180.0	18100.0	2290.0	11380.0	6950.0
1969	1140.0	1310.0	2230.0	3280.0	4190.0	20760.0	23260.0	15320.0	17720.0	5720.0	5190.0	5340.0
1970	651.0	920.0	2640.0	4080.0	4530.0	19660.0	13050.0	19500.0	19120.0	6940.0	4820.0	6790.0
1971	894.0	1340.0	2460.0	3570.0	4040.0	19640.0	17820.0	16880.0	20190.0	6410.0	6310.0	6250.0
1972	1490.0	1290.0	4380.0	12120.0	13410.0	16230.0	20180.0	9750.0	13050.0	2290.0	6960.0	2830.0
1973	1710.0	1050.0	1410.0	5340.0	14940.0	19420.0	18760.0	18370.0	10830.0	3190.0	6640.0	3400.0

10172650 Kennecott Drain near Magna

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1931	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0	1080.0
1932	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0	1170.0
1933	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0
1934	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0	1360.0
1935	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0	1490.0
1936	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0	1580.0
1937	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0	1670.0
1938	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0	1750.0
1939	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0	1900.0
1940	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0	1990.0
1941	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0	2080.0
1942	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0	2170.0
1943	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0	2330.0
1944	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0	2410.0
1945	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0
1946	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0	2590.0
1947	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0	2730.0
1948	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0	2830.0
1949	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0	2980.0
1950	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0	3080.0
1951	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0	3170.0
1952	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0	3320.0
1953	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0	3430.0
1954	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0	3550.0
1955	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0	3660.0
1956	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0	3750.0
1957	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0	3880.0
1958	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0	4000.0
1959	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0	4160.0
1960	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0	4320.0
1961	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0	4480.0
1962	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0	4580.0
1963	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0	4690.0
1964	5240.0	4850.0	4510.0	3960.0	4090.0	5940.0	4190.0	4570.0	5710.0	4670.0	5080.0	5430.0
1965	4150.0	4640.0	5930.0	5470.0	4920.0	4310.0	4230.0	6090.0	5720.0	5570.0	6610.0	6770.0
1966	5850.0	4880.0	5350.0	4700.0	4610.0	4270.0	4950.0	4930.0	4740.0	5220.0	5830.0	6540.0
1967	7610.0	6660.0	5520.0	6120.0	5240.0	5950.0	7630.0	7940.0	9760.0	7250.0	7150.0	6550.0
1968	4180.0	4170.0	4000.0	3710.0	5030.0	4130.0	6490.0	7280.0	6710.0	6030.0	9710.0	7940.0
1969	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0	6030.0
1970	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0	6420.0
1971	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0	6920.0
1972	9590.0	9310.0	6210.0	6360.0	5100.0	4700.0	9920.0	8080.0	6420.0	7350.0	6710.0	9200.0
1973	9610.0	9200.0	5650.0	5800.0	7890.0	11370.0	7230.0	7770.0	7480.0	7800.0	9210.0	11760.0

Table 17. Total estimated surface- plus ground-water inflow to Great Salt Lake, 1931-73 water years.

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1931	127800.0	133300.0	131100.0	130900.0	130500.0	145300.0	117100.0	74060.0	61630.0	48070.0	44420.0	50880.0	1195000.0
1932	65690.0	88780.0	103300.0	106200.0	119100.0	216000.0	359800.0	501100.0	220700.0	60590.0	46920.0	63340.0	1952000.0
1933	86480.0	103600.0	113000.0	117300.0	114000.0	172000.0	241500.0	321300.0	186900.0	49110.0	42520.0	48260.0	1596000.0
1934	71710.0	95810.0	117500.0	115900.0	105700.0	107400.0	87640.0	50010.0	46140.0	40280.0	36490.0	48630.0	923100.0
1935	69660.0	92580.0	101800.0	93530.0	108700.0	139600.0	171300.0	192200.0	149400.0	41760.0	36700.0	42340.0	1240000.0
1936	72300.0	93660.0	95430.0	109900.0	130200.0	170100.0	490600.0	551200.0	199000.0	49230.0	43750.0	54490.0	2060000.0
1937	108800.0	134600.0	127500.0	121600.0	128500.0	231900.0	303000.0	353000.0	138100.0	59340.0	48370.0	57150.0	1812000.0
1938	115100.0	116600.0	143500.0	124600.0	134900.0	203700.0	335000.0	392300.0	137400.0	73270.0	50080.0	61510.0	1888000.0
1939	123700.0	164300.0	158400.0	132400.0	122900.0	229000.0	220100.0	149500.0	67080.0	52560.0	50650.0	83850.0	1554000.0
1940	104800.0	94460.0	107900.0	124900.0	132200.0	168100.0	161800.0	89680.0	64780.0	50390.0	48310.0	70560.0	1218000.0
1941	96950.0	110400.0	118400.0	114800.0	141400.0	161600.0	177200.0	161300.0	88000.0	52870.0	52290.0	64320.0	1339000.0
1942	112700.0	118500.0	140000.0	134700.0	136700.0	187400.0	332100.0	314800.0	138500.0	56420.0	51160.0	63950.0	1787000.0
1943	101900.0	120400.0	142600.0	152900.0	154300.0	212900.0	402200.0	245300.0	247300.0	65690.0	59450.0	72400.0	1977000.0
1944	121000.0	132700.0	136000.0	122400.0	125900.0	165500.0	195000.0	287800.0	240700.0	61540.0	52320.0	61090.0	1702000.0
1945	92280.0	123800.0	112400.0	115900.0	168000.0	172000.0	175100.0	285200.0	305700.0	62600.0	84950.0	108200.0	1806000.0
1946	125100.0	156900.0	163200.0	167100.0	141900.0	254800.0	483000.0	300400.0	136900.0	63290.0	88560.0	103100.0	2184000.0
1947	150200.0	167700.0	185900.0	161400.0	168200.0	199900.0	219000.0	282000.0	182200.0	70120.0	112200.0	129000.0	2028000.0
1948	151700.0	176600.0	170300.0	152800.0	169100.0	165200.0	350100.0	492100.0	228900.0	76220.0	83610.0	104000.0	2321000.0
1949	145100.0	154600.0	176400.0	176000.0	176900.0	289400.0	337700.0	372300.0	196200.0	68510.0	75570.0	101500.0	2270000.0
1950	174100.0	162700.0	168100.0	210200.0	225200.0	267800.0	420400.0	579900.0	407700.0	191700.0	137900.0	163700.0	3109000.0
1951	212300.0	221400.0	248800.0	240500.0	280900.0	296400.0	422100.0	498200.0	210600.0	114300.0	150500.0	143100.0	3039000.0
1952	192800.0	188600.0	211700.0	240400.0	235100.0	300700.0	630000.0	813100.0	353700.0	144200.0	125500.0	132800.0	3568000.0
1953	161100.0	197100.0	228700.0	257800.0	216200.0	238400.0	259600.0	264600.0	299300.0	66970.0	68970.0	74810.0	2333000.0
1954	105400.0	126700.0	133700.0	141300.0	141000.0	176400.0	177400.0	82500.0	85060.0	57370.0	52300.0	74460.0	1354000.0
1955	98280.0	108400.0	107200.0	112700.0	105300.0	161900.0	197000.0	180800.0	122600.0	57380.0	59240.0	73100.0	1384000.0
1956	102600.0	124900.0	183700.0	205000.0	149700.0	229700.0	251600.0	288200.0	119200.0	58730.0	60670.0	71530.0	1846000.0
1957	109300.0	123500.0	132600.0	126600.0	152000.0	195900.0	222200.0	399500.0	277400.0	68230.0	79760.0	102300.0	1989000.0
1958	150300.0	148700.0	154800.0	150200.0	186400.0	208700.0	335000.0	317800.0	94540.0	63660.0	83640.0	105100.0	1999000.0
1959	106200.0	129200.0	137300.0	133100.0	133800.0	144700.0	169000.0	90900.0	70660.0	61960.0	60900.0	91420.0	1329000.0
1960	114900.0	103100.0	104600.0	109900.0	111600.0	197600.0	203100.0	119700.0	63150.0	56660.0	55550.0	65120.0	1305000.0
1961	86560.0	112300.0	104500.0	95700.0	113300.0	129600.0	110500.0	51630.0	50220.0	48350.0	46240.0	63000.0	1012000.0
1962	84080.0	92880.0	100100.0	97470.0	238000.0	179400.0	316100.0	269900.0	126600.0	66190.0	56230.0	65650.0	1693000.0
1963	90220.0	109000.0	104400.0	103200.0	155600.0	116400.0	168600.0	186800.0	136700.0	55110.0	54350.0	84640.0	1365000.0
1964	95330.0	128900.0	113600.0	115800.0	117700.0	136900.0	267200.0	358000.0	360700.0	70650.0	58760.0	68070.0	1891000.0
1965	92060.0	111000.0	178600.0	164600.0	189800.0	163100.0	269400.0	329100.0	281100.0	145600.0	171900.0	234600.0	2331000.0
1966	220300.0	208900.0	216200.0	220500.0	208800.0	260800.0	212600.0	156800.0	72130.0	68510.0	67590.0	89220.0	2002000.0
1967	142500.0	118100.0	115500.0	119900.0	114300.0	154000.0	188900.0	291900.0	406700.0	125600.0	132400.0	154700.0	2065000.0
1968	198600.0	198100.0	193500.0	187700.0	147700.0	216500.0	199900.0	167100.0	267600.0	80130.0	125700.0	108200.0	2091000.0
1969	148400.0	210500.0	215300.0	267000.0	232400.0	387400.0	435000.0	289400.0	150500.0	101600.0	76450.0	101900.0	2616000.0
1970	185700.0	198300.0	178500.0	212700.0	163900.0	169200.0	157500.0	265500.0	233100.0	83520.0	73210.0	124800.0	2046000.0
1971	161500.0	150200.0	218100.0	274500.0	259500.0	323000.0	457000.0	527300.0	511800.0	232100.0	147000.0	227100.0	3489000.0
1972	268700.0	261100.0	275500.0	319600.0	294500.0	425600.0	480400.0	427400.0	300400.0	168200.0	128600.0	196000.0	3546000.0
1973	219800.0	225900.0	220100.0	244600.0	253000.0	354700.0	355400.0	414700.0	189000.0	118300.0	87160.0	177000.0	2860000.0

Sewage inflow

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1959	0.0	0.0	0.0	437.0	514.0	459.0	431.0	506.0	226.0	532.0	548.0	539.0
1960	514.0	446.0	443.0	432.0	444.0	509.0	430.0	247.0	300.0	500.0	309.0	516.0
1961	501.0	419.0	422.0	412.0	373.0	459.0	413.0	477.0	414.0	457.0	435.0	449.0
1962	422.0	411.0	491.0	465.0	471.0	710.0	556.0	611.0	636.0	710.0	862.0	752.0
1963	792.0	758.0	761.0	736.0	760.0	828.0	931.0	1030.0	1040.0	1120.0	931.0	993.0
1964	3690.0	3430.0	3530.0	3540.0	3490.0	4290.0	4550.0	5320.0	4750.0	4830.0	4660.0	3960.0
1965	3890.0	3750.0	4150.0	4290.0	4160.0	3930.0	3940.0	4140.0	3980.0	4200.0	4120.0	3990.0
1966	3710.0	3470.0	3990.0	3870.0	4370.0	4100.0	3660.0	4220.0	4150.0	4220.0	4710.0	4730.0
1967	3550.0	3340.0	3230.0	3270.0	3420.0	3480.0	3300.0	3890.0	4490.0	4530.0	4320.0	3970.0
1968	3750.0	3510.0	3580.0	3360.0	3430.0	4060.0	4010.0	4070.0	4190.0	4440.0	4170.0	3980.0
1969	3900.0	3880.0	3860.0	4230.0	4920.0	5010.0	3560.0	4090.0	4520.0	4640.0	4720.0	4290.0
1970	4030.0	3750.0	3890.0	4010.0	3310.0	3220.0	3210.0	3730.0	4500.0	4720.0	4690.0	4640.0
1971	4330.0	4270.0	4600.0	5150.0	4530.0	4540.0	4420.0	4620.0	4510.0	4840.0	4690.0	4270.0
1972	4600.0	4630.0	4880.0	4980.0	4330.0	4560.0	4890.0	4820.0	4870.0	5120.0	5110.0	4590.0
1973	4540.0	4380.0	4460.0	4950.0	5040.0	5920.0	5100.0	5160.0	5110.0	5430.0	5290.0	4960.0

Table 18. Computer program to simulate the water and salt balance for selected diking options.

```
      REAL S(55,3),N(55,3),L(55,3),G(4,3),L4T,L5T
      REAL D(4,3),F(24),P(43),FJ(12)
      REAL Q(45,12),H(45,12),         X(45,12),LL(20,55,3),QT(45,12)
      REAL   N1,N2,N3,N4,N5,N6,L1,L2,L3,L4,L5,L6
      REAL N7,N8,N9,L7,L8
      REAL QB(45,12),QW(45,12),QJ(45,12),QU(45,12),QI(45,12),DU(45,12)
      INTEGER B(4),Z,W9,R3
      INTEGER O
      M=5
      O=10
      READ (M,101) K,Z,A,CE,CL,N1,S1,L1
      READ (M,102) N6,S6,L6,N9,S9,T1
  101 FORMAT (2I10,6F10.0)
  102 FORMAT (5F15.0,F5.0)
C      KOK PRESERVES K
      KOK=K
C     READ IN ELEV-AREA-VOL OF N,S,L
      READ  (O,301)((S(II,KK),KK=1,3),II=1,55)
      READ  (O,301)((N(II,KK),KK=1,3),II=1,55)
      DO 11 MM=1,9
      DO 11 II=1,55
   11 READ (O,301)(LL(MM,II,KK),KK=1,3)
  301 FORMAT (3F10.0)
      IF(Z.EQ.1)MZ=1
      IF(Z.EQ.3)MZ=2
      IF(Z.EQ.4)MZ=3
      IF (Z.EQ.5) MZ=4
      IF(Z.EQ.6)MZ=5
      IF(Z.EQ.8)MZ=6
      IF(Z.EQ.12)MZ=7
      IF(Z.EQ.14)MZ=8
      IF(Z.EQ.20)MZ=9
      DO 13 II=1,55
      DO 13 KK=1,3
   13 L(II,KK) = LL(MZ,II,KK)
C     READ IN STREAMFLOW DATA
      READ  (O,302)((QB(II,KK),KK=1,12),II=1,43)
      READ  (O,302)((QW(II,KK),KK=1,12),II=1,43)
      READ  (O,302)((QJ(II,KK),KK=1,12),II=1,43)
      READ  (O,302)((H(II,KK),KK=1,12),II=1,43)
      READ  (O,302)((X(II,KK),KK=1,12),II=1,43)
      READ  (O,302)((QU(II,KK),KK=1,12),II=1,43)
  302 FORMAT (6F10.0,20X)
C     STREAMFLOW ANALYSIS
      DO 205 I1=1,43
      DO 205 KK=1,12
  205 QT(II,KK)=QB(II,KK)  + QW(II,KK)+ QJ(II,KK)
      D6=41000.
      D8=0.0
      IF (K.GT.0 ) D8=10000.
      D6=D6+D8
```

Table 18. *continued*

```
      IF (Z.EQ.1.OR.Z.EQ.3) GO TO 210
      IF (Z.EQ.4.OR.Z.EQ.6.OR.Z.EQ.12.OR.Z.EQ.14) GO TO 220
      IF (Z.EQ.5) GO TO 230
      IF (Z.EQ.20) GO TO 240
  210 DO 211 II=1,43
      DO 211 KK=1,12
      QI(II,KK)=(375./675.)*(QU(II,KK))
  211 DU(II,KK)=QU(II,KK)-QI(II,KK)
      D1=20000.+D8
      DO 212 II=1,43
      DO 212 KK=1,12
  212 Q(II,KK)=QB(II,KK)
      GO TO 245
  220 DO 221 II=1,43
      DO 221 KK=1,12
      QI(II,KK)=(150./675.)*(QU(II,KK))
  221 DU(II,KK)=QU(II,KK)-QI(II,KK)
      D1=0.0
      DO 225 II=1,43
      DO 225 KK=1,12
  225 Q(II,KK)=QW(II,KK)
      GO TO 245
  230 DO 233 II=1,43
      DO 233 KK=1,12
      QI(II,KK)=(075./675.)*(QU(II,KK))
  233 DU(II,KK)=QU(II,KK)-QI(II,KK)
      D1=21000.
      DO 235 II=1,43
      DO 235 KK=1,12
  235 Q(II,KK)=QJ(II,KK)
      GO TO 245
  240 DO 241 II=1,43
      DO 241 KK=1,12
      QI(II,KK)=(600./675.)*(QU(II,KK))
  241 DU(II,KK)=QU(II,KK)-QI(II,KK)
      D1=41000+D8
      DO 243 II=1,43
      DO 243 KK=1,12
  243 Q(II,KK)=QT(II,KK)
  245 DO 244 II=1,43
      DO 244 KK=1,12
  244 H(II,KK)=QT(II,KK)-Q(II.KK)+H(II,KK)
  246 D7=D6-D1
         DATA F /.095,.086,.101,.114,.110,.074,.045,.059,.050,.084,.089,
     1.093,.012,.020,.047,.088,.120,.160,.179,.167,.109,.062,.023,.012/
      DATA P /0.71,1.01,0.7,0.9,0.76,1.14,1.08,1.08,.72,1.08,1.93,1.50,
     1.86,1.12,1.29,1.11,1.11,.96,1.12,.96,1.15,.87,.88,.82,1.02,.79,1.18
     1,.74,.82,.71,.77,.91,1.06,1.20,1.18,.67,1.12,1.31,.97,1.22,1.27,
     1.96,1.26/
      DATA FJ /2200.,2200.,2100.,2000.,1900.,1800.,2000.,2100.,2200.,
     12200.,2200.,2200. /
```

Table 18. *continued*

```
      JJ=48
       WRITE (6,310)
  310 FORMAT (1H1,///,30X,'USGS GSL SIMULATION INPUT DATA',//,10X,'K,Z,A
     1,CE,CL,N1,S1,L1')
      WRITE (6,311) K,Z,A,CE,CL,N1,S1,L1
  311 FORMAT (10X,2I10,2F15.2,4F15.2)
      WRITE (6,312)
  312 FORMAT (//,10X,'N6,S6,L6,N9,S9,T1')
      WRITE (6,313) N6,S6,L6,N9,S9 ,T1
  313 FORMAT (10X,5F15.0,F10.3)
      IF (Z.EQ.0) GO TO 681
      DO 630 I=1,55
      DO 630 J=2,3
  630 S(I,J)=S(I,J)-L(I,J)
  680 CONTINUE
  681 DO 740 J=1,4
  740 READ  (0,305)(D(J,K),K=1,3)
      DO 840 J=1,4
  840 READ  (0,305)(G(J,K),K=1,3)
  305 FORMAT (3F10.0)
      K=KOK
      DO 1250 J=1,50
      IF (N1.GT.N(J,1)) GO TO 1250
      B(1)=J
      GO TO 1260
 1250 CONTINUE
 1260 DO 1300 J=1,50
      IF (S1.GT.S(J,1)) GO TO 1300
      B(2)=J
      GO TO 1302
 1300 CONTINUE
 1302 IF (Z.EQ.0) GO TO 1341
      DO 1309 J=1,50
      IF (L1.GT.L(J,1)) GO TO 1309
      B(3)=J
      GO TO 1341
 1309 CONTINUE
 1341 D2=13.87
      D3=50.0
      L5 = 0.0
      I=1
      X7=0.0
      W9=0
      TXS=N6+S6+N9+S9+300000000.
      IIJ=0
 1185 W9=W9+1
      X7=X7+1.0
      FI=I
      FK=K
      X6= (FI-1.0)+X7*(T1/30.5)
      X5= X7*(T1/30.5)+(FK-1.0)*12.0 + FI - 1.0
      NN=B(1)-2
```

Table 18. *continued*

```
      DO 1270 J=NN,50
      IF (N(J,1).GE.N1) GO TO 1280
1270  CONTINUE
1280  N2=(N1-N(J-1,1))/(N(J,1)-N(J-1,1))
      N3=N2*(N(J,2)-N(J-1,2))+ N(J-1,2)
      N4= N2*(N(J,3)-N(J-1,3))+ N(J-1,3)
      NN=B(2)-2
      DO 1330 J=NN,50
      IF (S(J,1).GE.S1) GO TO 1340
1330  CONTINUE
1340  S2=(S1-S(J-1,1))/(S(J,1)-S(J-1,1))
      S3= S2*(S(J,2)-S(J-1,2))+S(J-1,2)
      S4= S2*(S(J,3)-S(J-1,3))+S(J-1,3)
      NN=B(3)-2
      DO 1364 J=NN,50
      IF (L(J,1).GE.L1) GO TO 1365
1364  CONTINUE
1365  L2=(L1-L(J-1,1))/(L(J,1)-L(J-1,1))
      L3= L2*(L(J,2)-L(J-1,2))+L(J-1,2)
      L4= L2*(L(J,3)-L(J-1,3))+L(J-1,3)
      L5T=L4
      IF(L4.LE.0.)L4=.1
      T2=12.5+12.*SIN(.262*(8.*15.21+X6*30.5)/15.21-3.53)
      P5=0.99823
      P6=(8.*T2-T2**2.0+132416.)/132432.
      P3=1.0 + 0.63*(N6*0.0007353)/N4
      P4=1.0 + 0.63*(S6*0.0007353)/(S4-620000.)
      P7=1.0 + 0.63*(L6*0.0007353)/L4
      IF(P7.GE.1.225)P7=1.225
      N7=(P3-1.0)/.63
      S7=(P4-1.0)/.63
      L7=(L6/L4)*.0007353
      P4=P4*P6/P5
      P3=(P3*P6/P5)*0.996
      P7=P7*P6/P5
      C1=4183.

C
C
 1644  V=0.0
       R3=0.0
 1939  R3=R3+1
       R=S1-N1
       IF (R.LE..15) R= .15
       Y8=S1-C1
       Y9=Y8-R
       R1=-6.3*Y9-5.84*(P3-P4)*Y8+7.09*Y8
       IF (R1.LE.0.0) R1=0.1
       R2=6.39*Y9+5.94*(P3-P4)*Y8-6.23*Y8
       IF (R2.LE.0.0) R2=0.1
       A4=3.55*(Y8-R1-R2)/(Y8-Y9)-1.02
```

Table 18. *continued*

```
     IF (A4.LE.0.0) A4=0.01
     A5=3.83*(Y8-R1-R2)/(Y8-Y9)-1.19
     IF (A5.LE.0.0) A5=0.01
     IF (A4.GT.3.0) A4=3.0
1930 IF (A5.GT.3.0) A5=3.0
     IF (W9.GT.1) GO TO 1940
     V2=0.6
1940 T8=A4*V2/(1.0+A4)
     W1=A*R1*(((Y8-R1-R2-A4*V2**2./64.4)*64.4/(1.0+A4)+T8**2.)**.5-T8)
     V1=W1/(A*R1)
     T9=A5*V1/(1.+A5)
     T7=((Y9-R2-R1*P4/P3-A5*V1**2./64.4)*64.4/(1.+A5)+T9**2.)
     IF (T7.LE.0.0) GO TO 2020
     X4=T7**0.5-T9
     IF (X4.LE.0.0) GO TO 2020
     W2=A*R2*(((Y9-R2-R1*P4/P3-A5*V1**2./64.4)*64.4/(1.+A5)+T9**2)**.5
    1-T9)
     E=W2/(A*R2)-V2
     A6=(0.05-ABS(E))
2000 IF (A6.GT.0.0) GO TO 2050
     A7=(V2+(W2)/(R2*A))/2.
     V2=A7
     GO TO 1940
2020 V2=0.0
     T8=A4*V2/(1.+A4)
     W1=A*R1*(((Y8-R1-R2-A4*V2**2./64.4)*64.4/(1.+A4)+T8**2.)**.5-T8)
     V1=W1/(A*R1)
     W2=0.0
2050 W1=W1
     W2=W2
     IF (R3.EQ.2) GO TO 2101
     C1=4183.
     A8=W1
     A9=W2
     W2=0.0
     W1=0.0
     IF(S1.LE.4188.)GO TO 2101
     V=0.0
     IF (R3.EQ.1) GO TO 1939
2101 W1=A8+W1
     W2=A9+W2
     IF (W2.LE.0.0) W2=1.0
     IF (W1.LE.0.0) W1=1.0
2121 B3=W1*1.983*30.5
     B5=W2*1.983*30.5
     Y=P3-P4
     B8=6.9835-1675.*Y+158.97*R+45535.*Y**2.-3373.3*Y*R+14.01*R**2.
    1-429070.*Y**3.+34904.*Y**2.*R-631.2*Y*R**2.+48.556*R**3.+1302000.
    2*Y**4-105270.*Y**3.*R-176.07*Y*R**3.-5.4593*R**4.+3352.1*Y**2*R**2
     B9=2.1629+1290.3*Y-113.24*R-19649.*Y**2-912.81*Y*R+186.17*R**2+
    1195100.*Y**3+20974.*Y**2*R-1861.6*Y*R**2-18.802*R**3-629690.*Y**4
    2-66502.*Y**3*R+308.06*Y*R**3-15.187*R**4+2865.3*Y**2*R**2
```

Table 18. *continued*

```
      IF (B8.LE.0.)GO TO 2173
      GO TO 2175
2173  B8=0.
2175  IF (B9.LE.0.)GO TO 2178
      GO TO 2181
2178  B9=0.
2181  IF (Y.LE..05.AND.R.GT.0.6)GO TO 2183
      GO TO 2235
2183  B9=0.
2235  X3=19.307+242.23*Y-35.429*R-4339.9*Y**2+407.5*Y*R+14.332*R**2+
     119021.*Y**3-1466.8*Y**2*R-45.647*Y*R**2-3.8069*R**3
      B9=(1.-((4199.5-S1)/X3)*1.312)*B9
      B8=B8*69.3936*1.983*30.5
      B9=B9*69.3936*1.983*30.5
      M1=(B3+B8)/30.5
      M2=(B5+B9)/30.5
      K7=QW(K,I)-1700.-1000.
      K8=(K7-2446.)/.9757
      K8=K8/60.48
      IF (K8.LE.0.) K8=0.0
      K6=(QB(K,I)-81000./12.-13880.-1300.)/60.48
      IF (K6.LE.0.) K6=100.
      C5=(523.-0.6563*K8+.00054494*K8**2-(.0000002005)*K8**3
     1     +(.00000000000027535)*K8**4)
      IF (K8.GT.3000.)C5=250.
      IF (K6.LT.109.) GO TO 2236
      C3=(321647./K6+965.)*0.6
2236  IF (K6.LE.110.) C3=3000.
      C4=C3*K6*60.48+81000.*C5/12.+13880.*2900.*.6+(375./675.)*QU(K,I)
     1*2600.*.6
      X8=21000.
      C4=C4/(K6*60.48+81000./12.+13880.+(375./675.)*QU(K,I)
     1+(X8*D2*F(I)-X8*D3*F(I+12))/12.)
      IF (C4.LE.0) C4=0.
      C6=(1.1*C5*K7+1700.*583.+1000.*500.+(75./675.)*QU(K,I)*500.)/(QW(K
     1,I)+(75./675.)*QU(K,I))
      C7=FJ(I)
      IF(Z.EQ.1.OR.Z.EQ.3)GO TO 940
      IF (Z.EQ.4.OR.Z.EQ.6.OR.Z.EQ.12.OR.Z.EQ.14)GO TO 900
      IF(Z.EQ.5)GO TO 920
      IF(Z.EQ.20)GO TO 930
      IF(Z.EQ.0)GO TO 940
 900  C4=C6
      GO TO 940
 920  C4=C7
      GO TO 940
 930  C4=(C4*(QB(K,I)+(375./675.)*QU(K,I))+C6*(QW(K,I)+(150./675.)*QU(K
     1,I))+C7*(QJ(K,I)+(75./675.)*QU(K,I)))/(QT(K,I)+(600./675.)*QU(K,I)
     2)
 940  CONTINUE
      CE= (L1-S1)*.5+S1
      QQQ = L1 - CE
```

Table 18. *continued*

```
      IF (QQQ.LT.0.0) QQQ=0.0
      D6 = (3.5*CL*QQQ**1.5)*60.48
      DO 1070 J=2,4
      IF (D(J,1).GE.S1)GO TO 1080
      IF (D(J-1,1).LT.S1)GO TO 1070
      C=0.
      GO TO 1090
1070  CONTINUE
1080  C=(S1-D(J-1,1))/(D(J,1)-D(J-1,1))
1090  P1=C*(D(J,2)-D(J-1,2))+D(J-1,2)
      E1=C*(D(J,3)-D(J-1,3))+D(J-1,3)
      DO 1160 J=2,4
      IF (G(J,1).GE.N1)GO TO 1170
      IF (G(J-1,1).LT.N1)GO TO 1160
      C=0.
      GO TO 1180
1160  CONTINUE
1170  C=(N1-(G(J-1,1)))/(G(J,1)-G(J-1,1))
1180  P2=C*(G(J,2)-G(J-1,2))+G(J-1,2)
      E2=C*(G(J,3)-G(J-1,3))+G(J-1,3)
      P3=D2
      E3=D3
1200  P1=P1*P(K)
      P2=P2*P(K)
      P3=P3*P(K)
      E=.98
      IF (K.EQ.7)E=.9
      IF (K.EQ.9)E=.8
      IF (K.EQ.40)E=1.15
      E1=E1*E
      E2=E2*E
      E3=E3*E
      N8=1.-(.778*N7)/(1.+N7*.63)
      S8=1.-(.778*S7)/(1.+S7*.63)
      L8=1.-(.778*L7)/(1.+L7*.63)
1428  N5=(((N3                  )*P2*F(I)-N3*E2*F(I+12)*N8)/12.+X(K,I)+B3
     1-B5+B8-B9)*T1/30.5
1429  S5=((S3                 )*P1*F(I)-S3*E1*F(I+12)*S8)/12.+H(K,I) +
     1D7*(D2*F(I)-D3*F(I+12))/12.+DU(K,I)-B3-B8+B5+B9+D6
      S5=(S5)*T1/30.5
      L5=(((L3                  )*P3*F(I)-L3*E3*F(I+12)*L8)/12.+Q(K,I)+QI
     1(K,I)          -D6+(D1*D2*F(I)-D1*D3*F(I+12))/12.)*T1/30.5
      L4T=L4+L5
      IF(IIJ.EQ.1)GO TO 1435
      IF(L4T.LE.0.)GO TO 1432
      GO TO 1435
1432  D6=0.
      IIJ=1
      GO TO 1429
1435  IF(L4T.LE.0.)L4T=0.1
      IIJ=0
      NN=B(1)-2
```

Table 18. *continued*

```
      DO 1490 J=NN,50
      IF (N(J,3).GE.N4+N5)GO TO 1500
1490  CONTINUE
1500  N1=((N4+N5-N(J-1,3))/(N(J,3)-N(J-1,3)))*(N(J,1)-N(J-1,1))+N(J-1,1)
      B(1)=J
      NN=B(2)-2
      DO 1540 J=NN,50
      IF (S(J,3).GE.S4+S5)GO TO 1550
1540  CONTINUE
1550  S1=((S4+S5-S(J-1,3)))/(S(J,3)-S(J-1,3))*(S(J,1)-S(J-1,1))+S(J-1,1)
      B(2)=J
      NN=B(3)-4
      DO 1570 J=NN,50
      IF (L(J,3).GE.L4T)GO TO 1575
1570  CONTINUE
1575  L1=((L4T   -L(J-1,3)))/(L(J,3)-L(J-1,3))*(L(J,1)-L(J-1,1))+L(J-1,1)
      B(3)=J
1576  G6=N6
      N6=T1*(M1*S6/(S4-620000.)-M2*N6/N4)+N6
      F2=N6/N4
      IF (F2.LE.483.)GO TO 1690
      H2=N6-483.*N4
      N9=H2+N9
      N6=N6-H2
      H4=0.
      GO TO 1800
1690  H2=0.
      H4=(.01/1.901)*T1*(483.*N4-N6)
      IF (H4.GT.N9)GO TO 1710
      GO TO 1715
1710  H4=N9
1715  N6=N6+H4
      N9=N9-H4
      IF (N9.LT.0.)GO TO 1735
      GO TO 1800
1735  N9=0.
1800  TLS=TXS-N6-N9-300000000.
      UFCS=(S4-620000.)*483.
      IF(TLS.LE.UFCS)GO TO 1840
      H1=TLS-483.*(S4-620000.)
      S9=S9+H1
      S6=TLS-S9
      H5=0.
      GO TO 1890
1840  H1=0.
      S6=TLS-S9
      H5=(0.01/1.901)*T1*(483.*(S4-620000.)-S6)
      IF (H5.GT.S9)H5=S9
      S9=S9-H5
      S6=S6+H5
      IF (S9.LT.0.)S9=0.
```

Table 18. *continued*

```
 1890 IF (L4.LE.0.) L4= .1
      DGL=L6/L4
      IF(DGL.GE.483.)DGL=483.
      L6=L6+T1*(C4*(QI(K,I)+Q(K,I)) *.00136-D6*DGL   )/30.5
      S6=S6+D6*(L6/L4)*T1/30.5
      KD=1930+K
      IF (X7*T1.GE.30.49) GO TO 2085
        GO TO 2900
 2085 JJ=JJ+1
      WN7 = 1000.*N7
      WS7 = 1000.*S7
      WL7 = 1000.*L7
      IF (WL7.GT.355.)WL7=355.
      IF (JJ.LE.48) GO TO 2086
      JJ=1
      WRITE (6,315)
  315 FORMAT (1H1,40X,'LAKE ELEVATIONS (FEET)',19X,'LAKE CONCENTRATIONS
     1(GRAMS/LITER)',/,16X,'YEAR',5X,'MONTH',10X,'NORTH',10X,'SOUTH',11X
     2,'DIKE',10X,'NORTH',10X,'SOUTH',11X,'DIKE')
 2086 IF(L5T.LT.100.)GO TO 2091
      WRITE (6,316) KD,I,N1,S1,L1,WN7,WS7,WL7
  316 FORMAT (10X,2I10,3F15.2,3F15.3)
      GO TO 2900
 2091 WRITE (6,317)KD,I,N1,S1,WN7,WS7
  317 FORMAT (10X,2I10,2F15.2,12X,3HDRY,2F15.3,12X,3HDRY)
 2900 IF (X7*T1.GE.30.49) GO TO 2920
      GO TO 2130
 2920 X7=0.
      I=I+1
 2130 IF (I.GT.12)GO TO 2150
      GO TO 2980
 2150 I=1
      K=K+1
 2980 IF (K.GT.42.AND.I.GT.9)GO TO 2200
      GO TO 1185
 2200 CONTINUE
      STOP
      END
```

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UTAH GEOLOGICAL AND MINERAL SURVEY

606 Black Hawk Way
Salt Lake City, Utah 84108

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