U. S. DEPARTMENT OF THE INTERIOR

Geological Survey

Preliminary Report On Water-Power Resources of Power Creek near Cordova, Alaska.

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Table of Contents

Illustrations

Tables

SUMMARY

Power Creek has a heavy runoff, a favorable reservoir site, and a concentration of fall immediately downstream from the reservoir site, which factors combine to make the development of water-power attractive. Although the runoff is high it is unevenly distributed throughout the year so that storage is necessary for a feasible power development. Complete regulation of the flow by storage does not seem possible as so doing would require a storage capacity in the magnitude of 75,000 acre-feet whereas it appears that feasible storage capacity will be around 50,000 acre-feet. The available stream flow records for use in this report cover only one complete water year. Assuming this to be a fairly typical year, 6,000 k.w. of power could be developed continuously and about 8,000 k.w. for 50 percent of the time. This could be developed as a single project or as two separate projects. The latter method is believed to be preferable even though it would require an additional power house and an additional mile of transmission line.

The geologic conditions in the vicinity of the dam site are somewhat uncertain and must be fully investigated, as these conditions will, to a large extent, determine the feasibility of the project. Additional stream flow data is essential in order to make a more reliable estimate of the potential power. The power estimates as shown in this report may vary somewhat when more information on stream flow has been obtained, but indicate that the development of Power Creek would well fit in with the needs of Cordova and immediate vicinity.

INTRODUCTION

Purpose and Scope: The purpose of this report is to present a brief analysis of the water-power possibilities of Power Creek, so far as can be done with the data available at this time, and to determine what effect possible developments would have on public lands adjoining the stream and thus classify them as to their power value. The estimates of power available must be considered as preliminary at this time as there is only one complete year's record of stream flow data available on which to base estimates.

The present report uses this one year's record along with a map resulting from a survey made during the 1948 field season to determine the potential power value of the stream and discusses the various factors relating thereto.

Acknowledgments: The City officials of Cordova showed a very keen interest in the field work carried on during the 1948 season and furnished the field party with a truck for its use while the survey was in progress as well as miscellaneous tools and equipment. The Geological Survey is indebted to Ira H. Rothwell, Mayor; John Le Fever, Councilman; and Dan Fitzpatric, Chief of Police, for the helpful interest shown and assistance rendered. Acknowledgment is due Mr. Don Miller of the Geological Survey, who is stationed at Cordova, for preliminary arrangements he had made prior to the arrival of the field party. Especial acknowledgment is due Mr. E. M. Jacobson, Supervisor, Chugach National Forest, who arranged for a trail crew to clear out an old trail allowing access to the upper part of Power Creek. Without this trail it would have been virtually impossible for the field crew to have completed its work without taking time from mapping and resorting to trail

clearing. Credit must also be given to Messrs. R. K. Collins, O. S. Johnson and C. B. Shaw, field assistants, who worked long hours under very difficult field conditions in order to complete the mapping assignment within a reasonable period of time.

<u>Previous investigations and reports</u>: As far as known the only previous investigation of the water-power value of Power Creek was made by Messrs. Ellsworth and Davenport.[1] A gaging station

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[1] Ellsworth, C. E. and Davenport, R. W., A Water-power reconnaissance in South-Central Alaska: U. S. Geol. Survey Water-Supply Paper 372, pp. 69-71, 1913 [1915].

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was established by the U. S. Geological Survey on Power Creek in August, 1947, and has been in continuous operation since then. (See Plate I)

A geologist from the Bureau of Reclamation made a reconnaissance of the dam site area in August, 1948.

As far as known no investigations have been made by other agencies.

<u>Maps, surveys, and aerial photographs</u>: In order to obtain the required information on location and characteristics of possible dam sites, location and capacity of reservoir sites, stream gradient and fall capable of development, conduit routes, etc., Power Creek was mapped from the mouth upstream 8 miles. The mapping was on a scale of 1:24,000 (1 inch = 2,000 ft.) with a 20 foot contour interval. The datum used was mean sea level as determined from U. S. Coast & Geodetic Survey tidal bench marks at Cordova. The elevation of Eyak Lake was determined from these bench marks and

Gaging station on Power Creek one mile upstream from mouth. There was originally a vehicle bridge at this point leading to the American Legion camp just out of view on left bank. The present footbridge utilizes the abutments of the original bridge and serves as the measuring bridge for high water measurements. (Photo J-48-7) this elevation used in starting the survey at the mouth of Power Creek. The section of the stream containing a possible dam site location, about one half mile in length, was mapped on a scale of 1:9,600 (1 inch = 800 feet) with a 20 foot contour interval. The resulting map will be published as a regular stream survey in 3 colors. For use in this report, and until the regularly published map becomes available, a tracing was made from the field sheets, and prints obtained therefrom. One of these prints is included as Plate VI in this report. A profile of the stream was drawn and is included as Plate VII.

The only general maps available including Power Creek and adjoining areas are as follows:

U. S. Forest Service
Chugach National Forest
Scale 1 inch = 8 miles
1936 Edition

U. S. Geological Survey
Reconnaissance Map of
Chitina Quadrangle
Scale 1:250,000
Contour Interval 200 feet
Surveyed 1898-1913

The foregoing map does not actually show Power Creek but does show some of the topography of the ridges enclosing the basin.

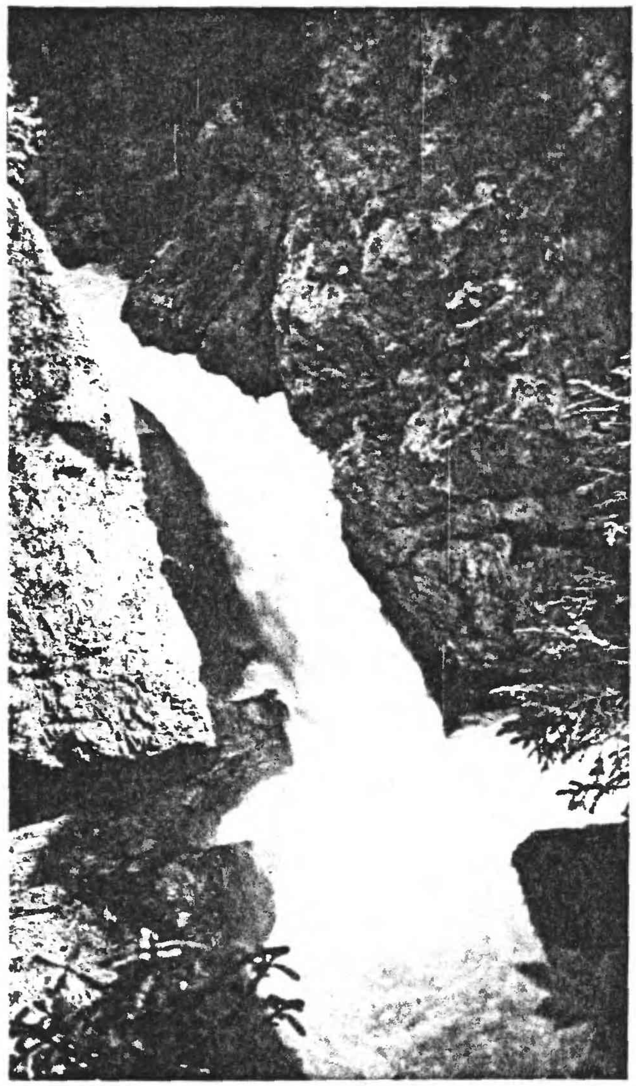
World Aeronautical Chart No. 137
Gulf of Alaska
Scale 1:1,000,000
1948 Edition

Aerial pictures were obtained in this region by the U. S. Army in 1941. Power Creek and adjacent areas are shown on the pictures designated as follows: Project 41, Alaska; Roll 1, Strip 4-D, pictures 238-244. Picture 4-D-L-242 shows the entire Power Creek basin.

GEOGRAPHY

The basin of Power Creek is not completely covered by maps and consequently cannot be too clearly described. The available information shows that Power Creek heads in the Shepherd Glacier, flows in a southwesterly direction for 7 or 8 miles and empties into Eyak Lake. The entire length of the basin from Eyak Lake to the head of the Shepherd Glacier is about 10 miles. It is bordered on either side by steep, rugged mountains, varying in elevation from 2500 to 5000 feet. It does not exceed 3 miles in width at the widest part. The area, based on certain work sheets used in the preparation of the World Aeronautical Charts, is 18 square miles above the gaging station which is located 1 mile above the mouth of the stream. A reference to the map, Plate VI, indicates the general features of the basin immediately adjacent to the stream. In the first half mile upstream from Eyak Lake the creek flows through a marshy area and has a complex mesh of braided channels. For about the next mile upstream the valley is rather narrow. At Ohman Falls, located at mile 2.5, the stream has a vertical drop of 52 feet. (See Plates II and III) The profile of the stream is shown on Plate VII. Upstream from the falls the gradient is very steep for 0.4 mile above which it flattens considerably. For 1/4 mile upstream and downstream from the falls the creek flows through a narrow canyon. Any likely dam site on the stream would be in the canyon section upstream from the falls. At the upper end of this canyon section the valley widens out into what is locally referred to as the Power Creek Basin. As seen from Plate VI this extends for about 4 miles, varying in width from 1/4 to 1/2 mile.

Ohman Falls as seen from point on trail 600 feet downstream therefrom. (Photo J-48-15)



Ohman Falls as seen from observation point on top of cliff on right bank. (Photo J-48-14)

The flat bottom and rugged character of the surrounding mountains is shown in Plate IV.

Cordova, with a population of 1,500 is the only town in the vicinity of Power Creek and is the main commercial center in the Prince William Sound region. It is 1600 miles via steamer from Seattle, has a well sheltered harbor protected from severe storms and free of ice throughout the year. Its main activity is related to the fishing industry. At present it is accessible only by water and air. There is a movement now on foot to construct a road to Chitina and thus become connected with the Alaska highway system. This proposed road would utilize the grade of the abandoned Copper River and Northwestern Railroad. The distance from Cordova to Chitina, using the old railroad grade, would be 131 miles; to Anchorage, 384 miles; to Fairbanks 447 miles; and to Tok Junction, which is on the Alaska Highway to the States, 344 miles.

GEOLOGY

The general geology of the Cordova area is described by Grant and Higgins.[1] As far as known, there is no report dealing specific-

[1] Grant, U. S., and Higgins, D. F., Reconnaissance of the geology and mineral resources of Prince William Sound, Alaska: U. S. Geol. Survey Bull. 443, 1910.

ally with the geology along Power Creek. Ellsworth and Davenport[2]

[2] Ellsworth, C. E., and Davenport, R. W., A Water-power reconnaissance in South-Central Alaska: U. S. Geol. Survey Water-Supply Paper 372, p. 70, 1913 (1915)

in describing a tunnel which had been started as part of a proposed

View of Power Creek valley looking upstream. Note flatness of valley bottom, terminating abruptly in the steep slopes of the encircling mountains. (Photo J-48-16) power development, refer to the geologic conditions at that point as follows:

> "On September 10, 1913, about 60 feet of 4 x 6 foot tunnel had been driven. The formation was of soft rock which could be broken down with a pick without the assistance of explosives. The rock disintegrated rapidly on exposure to the air and it was found necessary to timber the tunnel as work progressed. This work had been accomplished almost entirely by the efforts of one man."

Mr. Don Miller, geologist, U. S. Geological Survey, stationed at Cordova, in a letter to the author dated December 14, 1948, stated as follows:

> "I went up Power Creek as far as the head of the canyon in the Fall of 1947. As I recall, the rock exposed where the trail cuts the end of the ridge you mentioned is much shattered. This unfavorable feature is offset, to some extent at least, by the fact that the strike of the bedding is across Power Creek and the dip, at most places, is upstream."

The prominent depression on the upstream side of the ridge cutting across the valley may have some significance. This depression is approximately 300 feet across and 75 feet deep, bottom elevation being 498. It was noted during the mapping (June 30, 1948) that the bottom of the depression was covered by large, angular boulders. There were still small patches of snow in the bottom of the depression but there was no indication of water having ever stood therein although this area is covered by heavy snowfalls. Water could be heard running underneath the boulders, none of which was coming down the sides of the depression. Although the day was warm the air in the bottom of the depression was very cool.

It is believed that the point of geologic weakness in considering a dam for storage purposes on Power Creek would more likely be in the narrow ridge forming the right abutment than the immediate site of the dam itself in the canyon. At the narrowest part this ridge is only 600 feet through at the 450 foot contour.

Any satisfactory power development on Power Creek will require storage which in turn will necessitate the construction of a dam in the canyon section upstream from Ohman Falls. A geologic examination of the dam site and adjoining area is necessary before the power potentialities can be fully evaluated.

WATER SUPPLY

Climatological data: Weather records were started at Cordova in 1909 and are fairly complete through 1941 excepting the years 1915 and 1916 for which no records are available. The location of the station, as shown in the Annual Weather Summaries, was apparently moved several times during the above period but the record is shown as being continuous. Most of these moves were in the immediate vicinity of Cordova. However, during the period 1929-1932 the record was obtained at the Naval radio station located seven miles from Cordova. There was no record during 1942 and 1943. A station, still designated as Cordova but located at the airport 13 miles from town, was established in 1944. Records at this station are not comparable with those previously obtained and must be considered as a different station. The differences between the airport station and the station at Cordova are not surprising when the marked differences in the adjacent topography are considered. Unfortunately records at the present station do not lend themselves readily to coordination with the runoff record at the gaging station on Power Creek. The former is located on a flat, tidal lowland 13 miles southeast of Cordova whereas the latter is in a deep, narrow canyon

7 miles northeast of Cordova.

Records are available at Seward starting in 1908 and at Valdez starting in 1909. There does not appear to be any definite relationship between records at these stations and the one at Cordova so that any reliable estimate for periods of no record at Cordova cannot be made from a study of the Seward or Valdez records. This conclusion was arrived at from the following analysis. Prior to 1942 complete records at all three stations are available for ten different years. Indices of wetness and means for these years were computed and are shown in the table below.

Index of Wetness

Year	Cordova	Valdez	Seward
1913	0.84	0.96	0.81
1919	0.81	0.67	0.86
1920	0.97	0.87	0.72
1921	0.87	0.87	0.88
1922	1.13	0.83	0.91
1923	1.16	1.12	1.24
1930	0.88	1.29	0.96
1931	0.98	1.27	1.23
1936	1.20	1.12	1.04
1940	1.17	0.99	1.33
Mean annual precipitation_/	137.69"	58.10"	69.15"

_/ Based on the ten years indicated.

As seen from Tables 1 and 2, pp. 14 - 17, Cordova is in an area of heavy rainfall and snowfall. The mean annual precipitation, 1909-1941, is 148.59 inches, an appreciable amount of which falls as snow. The annual precipitation varied from a maximum of 208.37 inches in 1938 to a minimum of 99.75 inches in 1932. Monthly values varied from a maximum of 49.63 inches in September, 1912, to a

Table 1 Monthly and Annual precipitation in inches at Cordova.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Calendar Year
1909	-	-	-	-	6.09	14.63	4.95	8.86	19.17	9.04	1.69	19.22	-
1910	8.89	7.50	16.18	5.34	6.21	5.82	7.51	6.39	12.61	19.70	6.37	9.33	111.85
1911	4.91	13.69	8.07	14.79	8.42	8.74	4.37	-	11.27	15.90	9.80	21.47	-
1912	10.00	12.21	16.79	4.02	20.29	5.66	4.99	23.16	49.63	24.88	5.73	13.47	190.83
1913	2.68	7.58	3.98	7.72	3.86	0.74	12.77	8.46	19.08	15.09	17.19	16.02	115.17
1914	2.72	7.76	8.56	7.63	6.86	11.24	6.82	13.63	-	-	-	-	-
1915	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	2.25	6.26	4.64	9.31	14.73	30.85	11.24	12.92	2.12	-
1918	5.34	3.44	-	-	-	-	-	12.32	42.51	19.89	19.97	23.85	-
1919	10.45	6.68	2.29	13.53	4.57	5.03	3.16	19.43	13.37	6.12	9.57	16.97	111.17
1920	11.28	18.64	4.22	1.61	1.07	4.07	7.46	24.35	9.93	24.67	16.30	9.88	133.48
1921	8.12	17.77	4.10	9.69	6.77	2.09	8.85	4.79	16.21	19.45	5.63	16.35	119.82
1922	13.83	4.73	5.78	17.55	4.72	3.47	20.08	20.29	6.28	28.27	26.79	4.08	155.87
1923	3.46	7.54	5.54	12.50	3.21	6.81	12.55	2.69	34.19	37.04	27.09	6.46	159.08
1924	18.63	15.71	18.95	13.82	1.17	4.08	10.11	8.40	22.49	26.97	18.11	3.56	168.00
1925	3.85	3.65	2.83	8.13	11.49	5.23	4.54	12.31	19.43	44.17	23.03	9.96	148.62
1926	19.69	8.39	31.49	16.23	8.50	1.45	9.63	12.70	5.67	31.84	9.45	14.42	169.46
1927	6.18	18.04	11.40	7.84	4.46	9.08	11.00	24.29	15.03	16.50	4.49	8.94	137.25
1928	10.40	25.52	8.35	5.61	9.96	5.54	10.59	12.72	28.91	26.14	30.14	27.21	201.09
1929	11.39	18.75	7.69	8.93	13.13	4.38	7.79	8.08	19.64	22.39	15.44	3.56	141.17
1930	1.48	6.91	11.84	8.11	8.77	2.00	11.08	7.97	16.02	7.10	21.49	18.79	121.56
1931	20.36	11.17	6.85	8.58	11.02	5.79	11.47	6.69	10.18	19.95	15.90	6.23	134.19
1932	5.99	3.97	2.46	3.73	6.92	6.25	4.31	28.48	12.48	16.27	5.36	3.53	99.75
1933	6.36	3.38	5.14	5.95	3.54	9.81	3.96	19.58	18.48	18.26	24.18	.04	118.68
1934	11.14	14.74	6.48	13.18	16.38	1.48	2.64	12.80	9.68	28.20	7.62	30.92	155.26
1935	12.06	18.22	2.66	6.74	11.58	1.04	7.00	15.66	16.38	20.48	15.10	17.50	144.42

Table 1 Monthly and Annual precipitation in inches at Cordova.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Calendar Year
1936	18.14	1.77	6.00	3.14	20.56	.94	10.72	6.94	9.95	45.13	32.33	9.66	165.28
1937	6.00	5.64	7.46	8.05	12.60	15.77	15.96	18.55	27.51	30.53	17.35	12.64	178.06
1938	13.30	14.75	7.22	11.31	20.90	17.03	6.03	3.26	41.86	34.06	19.83	18.82	208.37
1939	5.77	8.88	8.13	4.39	7.37	3.72	15.92	32.35	22.12	18.48	16.97	20.66	164.76
1940	12.97	7.91	12.16	6.45	12.60	5.79	3.35	15.74	29.21	25.81	13.09	16.50	161.58
1941	12.46	12.75	26.90	37.00	6.99	8.35	18.69	4.26	7.28	13.18	8.55	-	-
No. of Values	29	29	28	29	30	30	30	30	30	30	30	29	25
Mean	9.58	10.61	9.27	9.44	8.87	6.02	8.92	13.66	19.91	22.56	15.25	13.18	148.59
Max.	20.36	25.52	31.49	37.00	20.90	17.03	20.08	32.35	49.63	45.13	32.33	30.92	208.37
Min.	1.48	1.77	2.29	1.61	1.07	0.74	2.64	3.26	5.67	6.12	1.69	0.04	99.75

Table 2 Monthly, annual, and seasonal snowfall in inches at Cordova

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Seas.[a/]
1909	-	-	-	-	0	0	0	0	T	2.0	-	-	-	-
1910	96.5	61.0	26.0	43.0	0	0	0	0	0	T	3.5	29.0	259.0	-
1911	14.0	48.5	48.0	21.5	1.5	0	0	0	0	0	-	43.5	-	166.0
1912	14.5	3.0	17.5	10.0	0	0	0	0	0	1.5	17.0	59.2	122.7	-
1913	13.5	27.0	8.0	40.0	0	0	0	0	0	T	25.8	37.9	152.2	166.2
1914	12.8	10.2	18.6	5.5	-	0	0	0	-	-	-	-	-	110.8
1915	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	T	T	0	0	0	0	2.0	27.0	9.3	-	-
1918	31.0	22.0	-	-	-	0	0	0	0	1.0	47.2	34.2	-	-
1919	50.2	22.0	15.0	0.5	0	0	0	0	0	2.2	13.0	30.0	132.9	170.1
1920	9.5	17.0	31.2	8.2	T	0	0	0	0	14.5	10.8	27.5	118.7	111.1
1921	29.2	20.0	23.0	10.0	0	0	0	0	0	1.0	0.5	44.5	128.2	135.0
1922	38.0	16.0	39.8	16.2	0	0	0	0	0	15.0	27.0	6.2	158.2	156.0
1923	35.5	6.7	38.5	3.2	0	0	0	0	0	0	0.2	25.7	109.8	132.1
1924	30.1	18.7	10.2	27.8	0	0	0	0	0	17.0	T	13.8	117.6	112.7
1925	40.0	50.0	25.2	29.1	T	0	0	0	0	0	21.0	30.0	195.3	175.1
1926	4.5	32.8	5.8	0	0	0	0	0	0	14.0	T	25.8	82.9	94.1
1927	29.0	20.0	57.5	9.7	T	0	0	0	0	10.8	8.2	20.5	155.7	156.0
1928	32.0	20.5	50.0	9.2	0	0	0	0	0	2.0	23.5	15.2	152.4	151.2
1929	5.8	18.2	39.7	11.0	0	0	0	0	0	T	T	10.3	85.0	115.4
1930	3.0	65.0	75.2	40.7	3.0	0	0	0	0	5.0	2.0	21.3	215.2	197.2
1931	30.3	38.8	2.2	0	0	0	0	0	0	3.0	8.0	44.5	126.8	99.6
1932	51.0	40.4	3.0	0	0	0	0	0	0	T	16.0	17.5	127.9	149.9
1933	52.4	26.0	14.0	15.6	0	0	0	0	0	2.5	3.5	1.5	115.5	141.5
1934	47.9	3.0	13.2	10.0	0	0	0	0	0	T	T	10.7	84.8	81.6
1935	22.0	25.0	3.0	T	T	0	0	0	0	4.0	T	10.7	64.7	60.7

Table 2 (Con't.) Monthly, annual, and seasonal snowfall in inches at Cordova

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Seas. a/
1936	37.5	20.5	25.2	17.0	T	0	0	0	0	0	3.9	51.4	155.5	-
1937	10.6	57.9	4.3	2.0	0	0	0	0	0	0	1.0	19.5	95.3	130.1
1938	9.0	2.0	38.5	T	1.0	0	0	0	0	T	T	8.7	59.2	71.0
1939	-	6.7	36.6	-	0	0	0	0	0	0	-	46.5	-	-
1940	8.2	4.5	26.0	0	0	0	0	0	0	T	.7	6.0	45.4	-
No. of Values	27	28	27	27	28	30	30	30	29	29	26	28	24	22
Mean	28.1	25.1	25.7	12.2	20	0.0	0.0	0.0	0.0	3.4	10.0	25.0	127.5	131.06
Max.	96.5	65.0	75.2	43.0	3.0	0.0	0.0	0.0	T	17.0	47.2	59.2	259.0	197.2
Min.	3.0	2.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T	1.5	45.4	60.7

a/ Seasonal, July 1 to June 30

minimum of 0.04 inches in December, 1933. Using the monthly means shown in Table 1 it is noted that there is considerable variation in the monthly distribution throughout the year. October has the greatest value and accounts for 15 percent of the annual total with September and November next in order with values of 13 and 10 precent respectively. June has the lowest value, with 4 percent of the annual total. It is also noted that individual monthly values vary widely from year to year.

The mean seasonal (July 1 to June 30) snowfall, 1909-1940, is 131.1 inches. The four month period December through March accounts for 79 percent of the total, each month accounting for about 20 percent. April and November contribute about 9 percent and 8 percent respectively and October about 3 percent. May snowfall is infrequent and there has been no snowfall recorded during the 4 month period June through September. For the most part, the snowfall accumulates during the winter months and melts rapidly during June and July. During the water year, October 1, 1947 to September 30, 1948, the runoff at the gaging station during the four month period December through March was only 7 percent of the annual total. The mean precipitation for this four month period is 29 percent of the annual mean, indicating that a large amount of the precipitation is stored as snow.

As seen from Table 3, pp 19-20, the annual mean temperature is 41.0, varying from a maximum of 44.4° to a minimum of 38.4°. The monthly means for the year vary from 55.0° for July to 27.7° for January. During the period of record the monthly means have varied from a maximum of 59.2° in July, 1940 to a minimum of 14.6° in

Table 3 Mean monthly and annual temperature (^{o}F) at Cordova

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Calendar Year
1909	-	-	-	-	45.8	50.4	56.6	54.8	47.0	39.1	26.8	29.7	-
1910	25.5	27.8	32.4	36.0	46.2	48.6	53.7	56.6	51.4	41.3	35.0	30.3	40.4
1911	30.4	30.0	29.6	30.8	41.4	49.0	55.2	-	51.5	44.0	34.0	30.3	-
1912	33.1	36.1	36.0	40.8	45.6	50.2	54.4	51.2	47.8	41.2	37.0	31.6	42.1
1913	24.6	36.3	36.0	39.0	44.9	53.6	54.8	55.7	50.8	44.8	35.4	33.1	42.4
1914	31.5	34.6	35.8	41.2	45.4	51.6	54.0	53.4	-	-	-	-	-
1915	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-
1917	-	-	-	36.8	44.0	49.8	52.2	53.4	47.2	38.7	27.9	14.6	-
1918	24.6	22.0	-	-	-	-	-	52.2	47.4	40.2	31.9	28.1	-
1919	25.3	29.8	27.8	37.0	43.6	49.6	54.6	52.2	49.3	39.4	30.4	27.8	38.9
1920	18.8	33.8	28.4	33.0	43.4	51.0	55.4	51.8	47.9	39.6	35.2	30.8	39.1
1921	22.0	27.9	32.8	38.1	45.1	52.9	53.6	55.3	49.8	40.9	31.4	30.1	40.0
1922	28.8	26.2	25.0	35.8	42.7	49.2	53.6	52.4	47.2	42.6	33.8	27.4	38.7
1923	23.0	32.2	31.2	37.4	45.0	52.1	57.3	58.1	50.1	45.8	38.1	27.4	41.5
1924	29.7	29.5	35.7	34.6	45.0	54.4	54.6	54.2	47.5	39.6	36.9	24.9	40.6
1925	17.4	23.8	31.7	36.8	43.6	50.0	54.9	54.4	51.7	45.6	38.0	32.5	40.0
1926	38.3	30.6	39.0	41.6	47.2	57.1	56.3	56.7	52.6	45.1	36.8	32.0	44.4
1927	27.2	34.2	33.0	32.4	44.4	51.0	55.9	54.1	49.4	39.0	24.9	27.0	39.4
1928	30.6	34.1	30.2	37.8	43.4	52.2	53.9	52.6	46.4	40.6	34.8	33.3	40.8
1929	30.2	33.8	32.2	36.2	44.3	52.1	55.1	56.0	52.4	44.7	37.6	25.6	41.7
1930	19.4	22.3	30.0	36.8	44.8	51.8	54.8	57.0	49.6	39.5	34.2	38.2	39.9
1931	37.0	35.0	30.8	42.6	45.3	51.8	54.4	55.2	50.1	41.4	33.8	26.8	42.0
1932	18.9	18.0	33.8	39.4	45.0	49.6	54.4	52.9	48.2	44.1	28.1	28.6	38.4
1933	19.5	24.7	29.4	37.2	46.0	51.8	55.0	54.0	50.8	39.4	36.5	20.3	38.7
1934	26.4	37.0	34.4	39.6	44.6	50.8	56.1	55.6	51.8	44.0	37.8	32.0	42.5
1935	28.3	36.5	32.9	40.4	45.0	52.6	54.8	54.8	50.2	39.4	35.0	32.0	41.8

Table 3 (Con't.) Mean monthly and annual temperature (°F) at Cordova

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Calendar Year
1936	33.9	28.0	31.6	39.2	43.6	56.5	58.8	59.0	50.2	45.8	39.8	29.0	43.0
1937	32.0	28.2	35.4	39.2	44.3	51.6	54.2	53.6	51.4	46.4	36.6	30.4	41.9
1938	30.8	28.8	34.7	41.2	43.9	49.0	51.3	55.2	51.0	44.2	35.4	31.0	41.4
1939	29.8	30.9	32.2	38.8	44.8	52.2	55.4	52.0	51.1	40.0	35.4	34.4	41.4
1940	33.0	35.3	34.5	44.6	48.2	54.8	59.2	55.6	50.8	43.8	35.7	35.6	44.2
1941	32.3	35.0	38.4	40.4	47.2	54.2	55.4	59.1	52.2	41.8	32.2	-	-
No. of Values	29	29	28	29	30	30	30	30	30	30	30	29	25
Mean	27.7	30.4	32.7	38.1	44.8	51.7	55	54.6	49.8	42.1	34.2	29.5	41.0
Max	38.3	37.0	39.0	44.6	48.2	57.1	59.2	59.1	52.6	46.4	39.8	38.2	44.4
Min	17.4	18.0	25.0	30.8	41.4	48.6	51.3	51.2	46.4	39.0	24.9	14.6	38.4

December, 1917. Using the mean of all the monthly mean values it is seen that the monthly means are below freezing for December, January and February with March just barely above freezing. The annual minimums with date of occurrence are listed below.

Minimum temperature (°F) and dates of occurrence
at Cordova

Year	Minimum Temp. (°F)	Date	Year	Minimum Temp. (°F)	Date
1918	1	Feb. 27	1931	- 2	Mar. 15
19	- 7	Jan. 30	32	- 19	Feb. 23
1920	- 4	Jan. 30	33	- 11	Jan. 29
21	0	Jan. 15	34	- 1	Jan. 22
22	- 2	Mar. 16	1935	7	Dec. 12
23	2	Jan. 1	36	7	Dec. 20
24	- 2	Jan. 23	37	6	Feb. 13
1925	- 5	Jan. 24	38	4	Feb. 5
26	4	Feb. 27	39	4	Feb. 7
27	- 2	Nov. 29	1940	10	Jan. 15
28	4	Mar. 9			
29	- 8	Dec. 31			
1930	- 14	Feb. 14			

A review of the above tabulation shows that of the 23 values listed, the minimum occurred 9 times in January, 7 times in February, 3 times in March, 3 times in December and once in November. In general, the minimum temperatures are most apt to occur in January or February.

With the monthly mean temperatures being below freezing for three months in the average year a certain amount of difficulty due to ice conditions can be expected in the operation of any hydraulic structures.

Runoff: The runoff from Power Creek is very closely related to climatic conditions. Daily variation in runoff follow almost directly daily variations in rainfall. During the winter months, when most of the precipitation comes as snow, the stream flow is low. Due to the rugged topography of the basin, much of which is barren, there is very little ground or bank storage. There are no lakes in the basin to provide natural storage. The snow accumulation during the winter months, however, serves as a natural reservoir, releasing the water with the warmer temperatures of early summer.

The available records of stream flow on Power Creek are as follow:

July 25 - November 15, 1913, fragmentary record at gaging station 1½ miles upstream from Eyak Lake.

August, 1947, fragmentary record at above gaging station.

Sept. 1, 1947 to Sept. 30, 1948, continuous record at gaging station 1 mile above mouth.

The last record listed is the only one that can be of use in a stream flow analysis and is the one used in the following discussion. This record is at a point about 7 miles northeast from Cordova, in a narrow mountain valley. The present weather station is at a point 13 miles southeast from Cordova, in comparatively flat and open delta terrain. Any correlation between the runoff records and the precipitation records must therefore be taken with extreme caution.

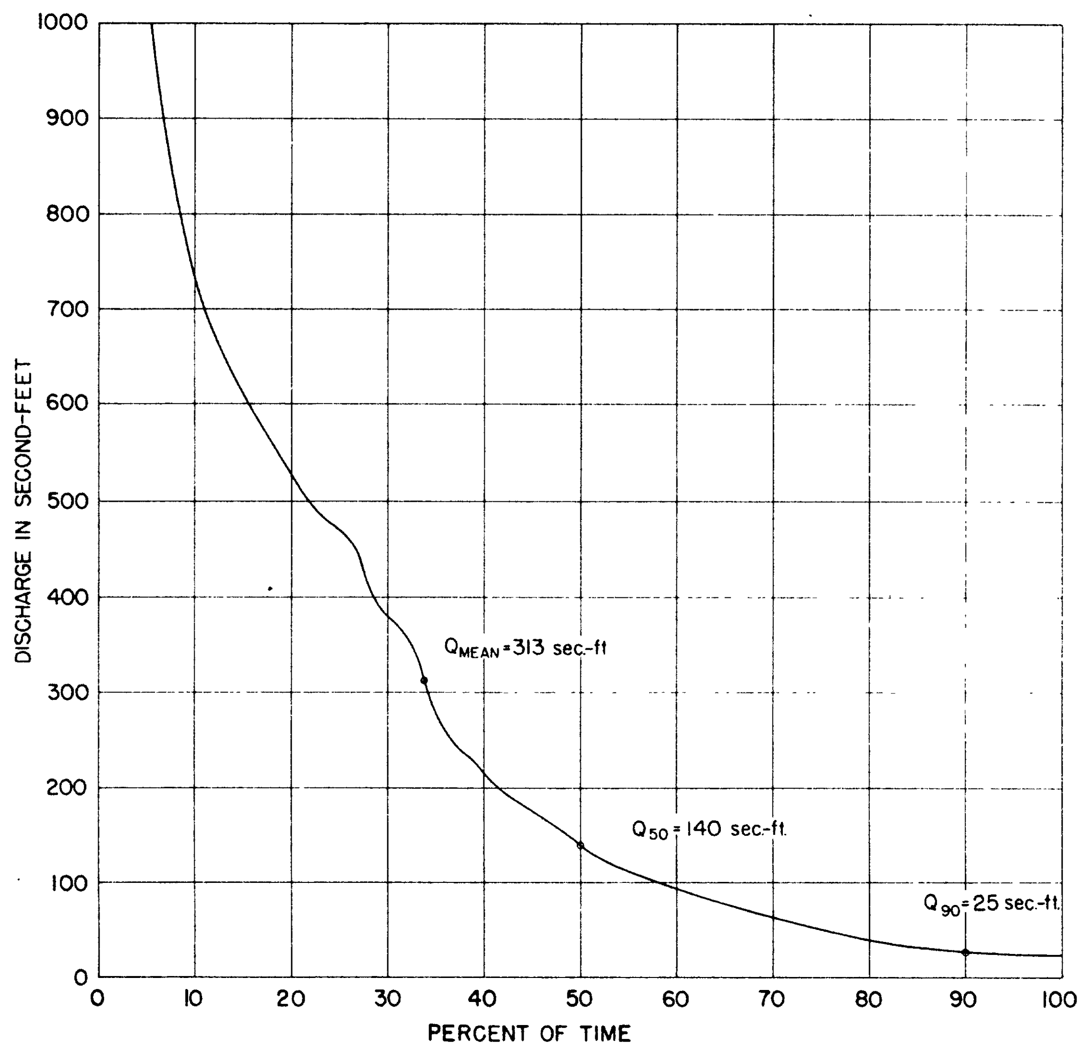
A review of the runoff record for the year ending September 30, 1948, Table 4, p. 23, shows that the flow varies through wide limits. The daily means varied from a maximum of 3010 to a minimum of 23 second-feet. The monthly means varied from a maximum of 741 to a minimum of 23[9] second-feet. The annual mean was 313 second-feet. The distribution of flow with respect to time is shown by the

Table 4 Daily and monthly mean discharge in second-feet.
Power Creek near Cordova. October 1, 1947 to Sept. 30, 1948

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,010	100	181	60	95	37	23	31	363	499	759	189
2	978	95	149	58	90	37	23	33	355	1,110	616	189
3	794	89	173	57	80	36	23	36	324	892	518	197
4	489	86	245	57	75	33	23	38	347	680	428	206
5	363	86	189	56	80	31	23	38	324	627	616	189
6	290	80	155	54	75	31	23	42	1,670	713	575	676
7	240	80	129	54	65	32	23	45	1,390	669	480	2,160
8	201	105	124	53	60	31	23	48	638	616	842	1,420
9	173	146	120	50	55	31	23	53	566	527	606	2,990
10	161	113	108	50	60	31	23	69	537	724	508	1,370
11	208	113	106	48	65	30	24	115	537	585	463	556
12	185	165	100	45	60	29	24	146	556	489	463	402
13	173	124	95	44	52	29	24	169	585	446	480	310
14	165	117	89	45	47	29	25	228	648	489	547	256
15	149	102	87	54	44	28	27	240	627	518	648	218
16	155	93	82	50	41	28	26	256	616	527	794	1,410
17	131	87	77	120	39	31	24	276	690	527	830	1,560
18	120	82	74	379	38	28	23	355	748	627	556	1,060
19	113	77	72	162	37	26	23	472	842	868	463	428
20	106	455	72	120	39	25	23	363	669	585	454	290
21	106	1,070	80	108	38	24	23	270	547	489	419	223
22	248	2,680	74	98	37	24	23	228	463	446	394	185
23	364	871	74	82	39	28	23	228	386	518	355	177
24	173	761	72	75	42	26	23	256	363	759	270	1,040
25	146	363	69	97	43	24	23	347	386	585	228	1,170
26	137	932	66	126	41	23	23	463	854	1,330	212	363
27	143	1,000	64	131	39	23	24	566	802	1,960	201	228
28	131	518	64	108	38	24	26	454	537	805	193	185
29	131	310	64	86	37	23	28	371	463	680	189	460
30	115	218	64	72		24	29	297	472	1,040	185	2,130
31	104		62	90		23		276		1,370	181	
Mean	322	371	103	86.7	53.5	28.4	23.9	220	610	732	467	741
Max.	3,010	2,680	245	379	95	37	29	566	1,670	1,960	842	2,990
Min.	104	77	62	44	37	23	23	31	324	446	181	177

Annual mean = 313 sec. ft.

DAILY FLOW DURATION CURVE
POWER CREEK NEAR CORDOVA, ALASKA
OCTOBER 1, 1947 TO SEPTEMBER 30, 1948



flow-duration curve in Figure 1, page 24. This graph shows that the flow for various time percentages are as follows:

Q 95 = 24 second-feet   Q 50 = 140 second-feet
Q 90 = 25 second-feet   Q Mean (34) = 313 second-feet

The runoff distribution throughout the year is shown by the following tabulation:

Month	Percent of annual runoff	Accumulated percentage of annual runoff
Oct. 1947	8.7	8.7
Nov.	9.7	18.4
Dec.	2.8	21.2
Jan. 1948	2.3	23.5
Feb.	1.4	24.9
Mar.	0.7	25.6
Apr.	0.7	26.3
May	5.9	32.2
June	16.0	48.2
July	19.8	68.0
Aug.	12.5	80.5
Sept.	19.5	100.0

From the above it is seen that half the annual runoff occurs during the three month period of July, August and September and only about one seventh during the 6 month period December through May. Only 3 percent occurred during the three month period of February, March and April. It must be remembered that the above relates only to the runoff for the water year October 1, 1947 to September 30, 1948 and that considerable variation can be expected as more records become available. However, the foregoing is believed to give a good indication of the general pattern of the runoff distribution throughout the year. The heaviest runoff occurs during the period June through September, about two thirds of the runoff occurring during one third of the year; runoff during October and November is moderate and low during the six month period December through May; the three month period of February, March and April is the critical low flow period.

The foregoing records are at a point 1.0 mile from the mouth of Power Creek and the dam site is located 1.5 miles farther upstream. As previously stated the approximate area at the gaging station is 18 square miles and using the same map material the approximate area at the dam site is 16 square miles or roughly 10 percent less than at the gaging station. If the runoff was directly proportioned to the drainage area it would follow that the runoff at the dam site would be about 10 percent less than that recorded at the gaging station. In general, however, a drainage basin in a mountainous region has a greater intensity of runoff in the upper parts of the basin than in the lower and the difference in runoff between the dam site and gaging station would probably be less than the ratio of the drainage areas would indicate. In the present study, therefore, the flow at the proposed dam site is considered the same as at the gaging station.

The only factual data available on the difference in stream flow along the stream is the result of two measurements made on September 10, 1913,[/] at points approximating the present gaging

[/] Ellsworth, C. E. and Davenport, R. W., A Water-power reconnaissance in South-Central Alaska: U. S. Geol. Survey Water-Supply Paper 372, p. 71, 1913 (1915).

station location and somewhat upstream from the dam site. These two measurements showed a discharge of 137 and 109 second-feet respectively. It was noted that the true difference may not be as great as the measurements indicate as the bed of the stream at the point of the upper measurement was rather porous, thus affording an opportunity for underground flow. Another factor that could have contributed to the above difference is the possible diurnal fluctuation in flow due to the glacial drainage. If temperature conditions were such as to cause diurnal fluctuation the results of the two measurements could easily be effected in such a way that the difference indicated would be misleading.

The relationship of the stream flow for the water year October 1, 1947 to September 30, 1948 to a long time period is difficult to evaluate in view of the lack of other records for comparison. As previously pointed out, the Cordova weather station was moved to the airport, 13 miles from town, in 1944 and the records at the new location do not appear comparable to the record obtained prior to 1942. The precipitation record from January 1944, through October, 1948 gives five values for each month except August, October and November for which there were four values. The sum of the monthly means of these values gives an annual value of 92.78 inches. The precipitation for the period October 1, 1947 to September 30, 1948, was 90.99 inches. On this basis the precipitation for the year mentioned would therefore be about the average for the period 1944-1948. For lack of other information, the stream flow data available is considered to represent an average year.

With only one year's record very little can be said about flood magnitudes or frequencies. The momentary peak discharge during the year was 5,100 second-feet and the highest daily mean was 3,010 second-feet. No doubt much greater peaks have occurred in previous years. There is no flood problem as there are no developments along the creek that would be effected by high water. Flood periods, no doubt, tend to raise the level of Eyak Lake but here again the high stage would cause no particular damage. Higher discharges apparently result from the heavy rain storms than from the melting of snow in Spring or early Summer. During months of heavy rainfall such as September, 1912, 49.63 inches; or October, 1936, 45.13 inches; there would likely be certain days with concentrated rainfall. For instance, October 22, 1936 recorded 8.76 inches for a 24 hour period. Assuming this same figure applied to the entire basin of Power Creek the 24 hour rainfall would have been equivalent to 8,400 acre-feet or a 24 hour mean flow of 4,300 second-feet. As uniform distribution throughout the 24 hour period would not be likely the peak discharge would be considerably greater than the 24 hour mean. On October 1, 1947, the 24 hour mean was 3,010 second-feet whereas the peak discharge was 5,100 second-feet or 1-2/3 times as great. Peak flows in the magnitude of 10,000 second-feet or more would probably have to be considered in spillway designs. As the length of the stream flow record increases and some correlation established between rainfall and runoff more reliable estimates of probable flood discharges can be made.

As previously pointed out the monthly mean temperatures for December, January and February are below freezing and March just on the border line. Consequently ice conditions would result and would have to be considered in the design and operation of a project.

Another condition peculiar to this stream that must be given consideration in the location, design, and operation of a project is the regular occurrence of snow slides on the left bank in the canyon section. These slides fill the bottom of the canyon to considerable depth and remain there until well into the summer. This condition is shown by the picture in Plate V, which was taken on June 28, 1948. Much of this ice and snow remained in the gorge until the latter part of July in 1948.

WATER UTILIZATION PLAN

Present Use: At present there are no developments using the water in Power Creek. As reported by Ellsworth and Davenport [1] a power development was started in 1913 but was never completed. It is not known whether or not any rights are now being held for development on this stream.

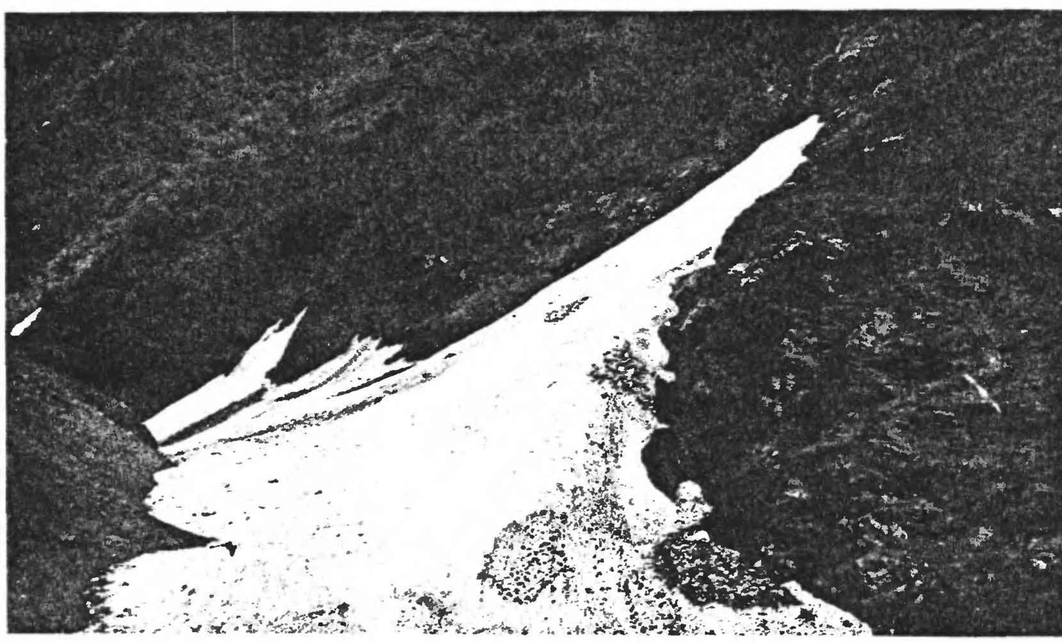
[1] Ellsworth, C. E., and Davenport, R. W., A Water-power reconnaissance in South-Central Alaska: U. S. Geol. Survey Water-Supply Paper 372, p. 70, 1913 (1915)

Future Use: The development of power appears to be the only use for which Power Creek would be considered. The heavy rainfall in the area makes irrigation unnecessary and furthermore there is very little, if any land that would be susceptible to irrigation from Power Creek even if it were necessary.

STREAM REGULATION

Natural Storage: There is no developed storage in the basin.

Undeveloped Storage: There is only one potential storage site in the basin. This would be developed by the construction of a dam in the



View looking upstream from point on trail showing how gorge upstream from Ohman Falls becomes filled with snow slides from left bank (right side of picture). Picture taken June 28, 1948. Snow stayed in gorge until latter part of July. (Photo J-48-9) canyon about 1/4 mile above Ohman Falls. The Area and Capacity curves, as well as tables, are shown in Figure 2. Although the curves and tables go up to altitude 600 it is very doubtful if a dam to this height would be feasible. It is believed that an altitude of 550 is probably the maximum height of flow line that can be considered. For this report a maximum flow line of 540 has been assumed.

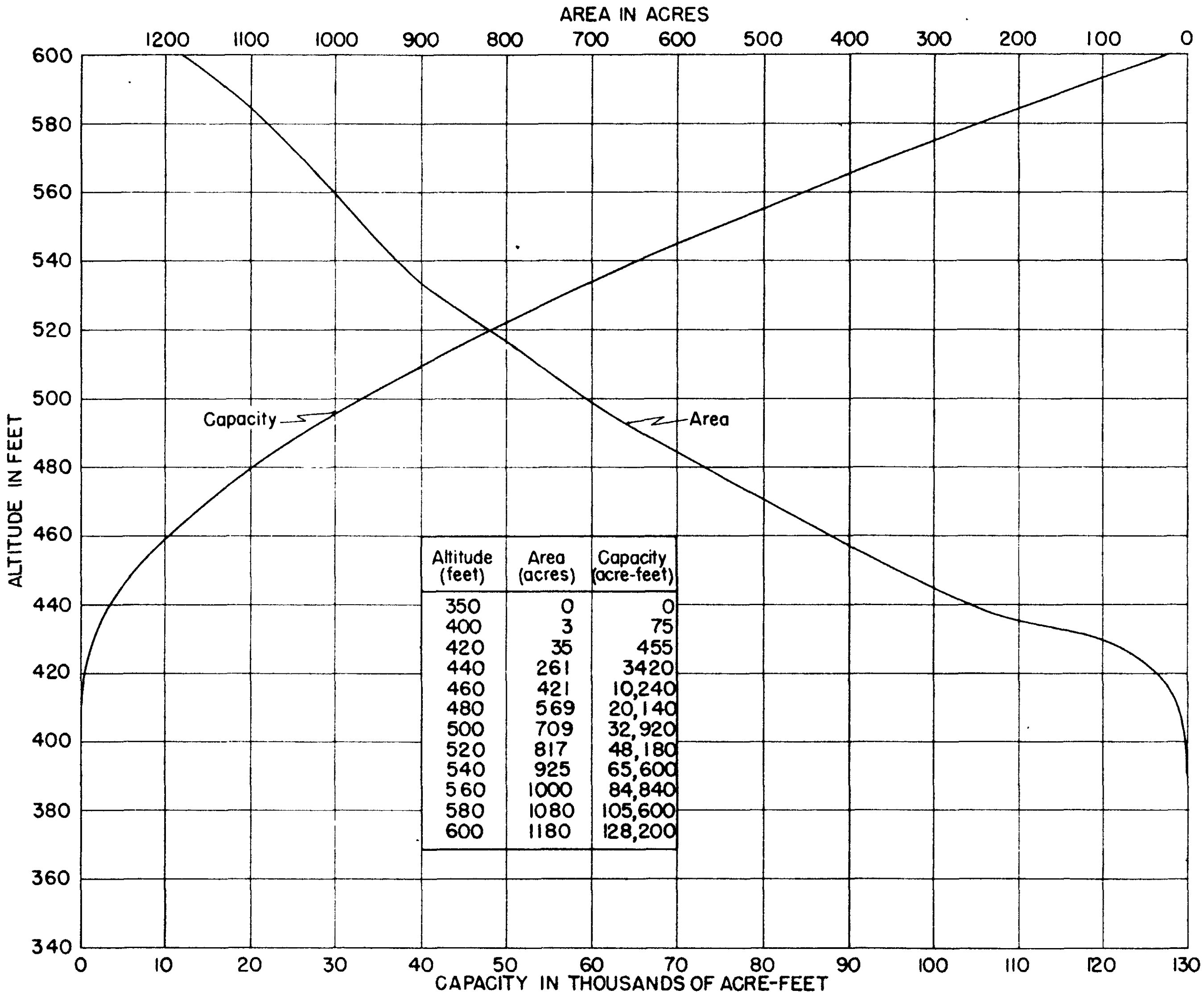
Development of the foregoing storage site would be very desirable, in fact necessary, for any dependable power installation. The capacity of this site is not great enough to permit complete regulation of the stream but can substantially increase the flow through the usual low flow periods. The flow possible with storage will depend on the maximum height of reservoir flow line and the lower limits of draw down considered feasible. For this report a maximum flow line of 540 and a draw down to 470 has been assumed. Through this 70 foot range in stage there will be 50,000 acre-feet of usable storage. Complete regulation would have required a capacity of 75,000 acre-feet. Usable capacity in this amount is not considered feasible. The amount of storage required to provide various rates of flow is shown below.

Flow (Second-feet)	Storage required (Acre-feet)
100	13,000
125	21,000
150	29,000
175	37,000
200	45,000
225	53,000
250	60,000
275	68,000
300	77,000

Fifty thousand acre-feet has been arbitrarily assumed as the

AREA AND CAPACITY

POWER CREEK RESERVOIR SITE NEAR CORDOVA, ALASKA



Altitude (feet)	Area (acres)	Capacity (acre-feet)
350	0	0
400	3	75
420	35	455
440	261	3420
460	421	10,240
480	569	20,140
500	709	32,920
520	817	48,180
540	925	65,600
560	1000	84,840
580	1080	105,600
600	1180	128,200

FIGURE 2

maximum feasible storage that could be developed.

The availability of 50,000 acre-feet of storage during the period October 1, 1947 to September 30, 1948, would have produced the following results, assuming a full reservoir on October 1. The period started with the heaviest stream flow of the season and a certain amount of water would have been spilled the first few days. From October 6 to November 30 a flow of 275 second-feet could have been maintained by drawing 10,000 acre-feet from storage. This draft would have occurred between October 6 and November 20 and the reservoir would have refilled between November 20 and November 30. From December 1 to May 31 a flow of 215 second-feet could have been maintained by drawing 50,000 acre-feet from storage, this maximum draw down occurring about May 10, after which date the stream flow started to increase. From June 1 to September 30 a flow of 430 second-feet could have been maintained and the reservoir refilled by the latter date. Summarizing, 50,000 acre-feet of storage would have provided a flow of 215 second-feet for six months of the year, a flow of 275 second-feet for two months, and a flow of 430 second-feet for four months. Using a flow of 275 second-feet for the four month period June through September would have resulted in spilling about 40,000 acre-feet. For this report it has been assumed that a flow of 215 second-feet could be obtained continuously and a flow of 275 second-feet for 50 percent of the time. The results above outlined are shown graphically in Figure 3.

WATER POWER

<u>Developed power</u>: There are no developed power sites on Power Creek.

<u>Undeveloped power</u>: Any power development on this stream will come

U.S. GEOLOGICAL SURVEY

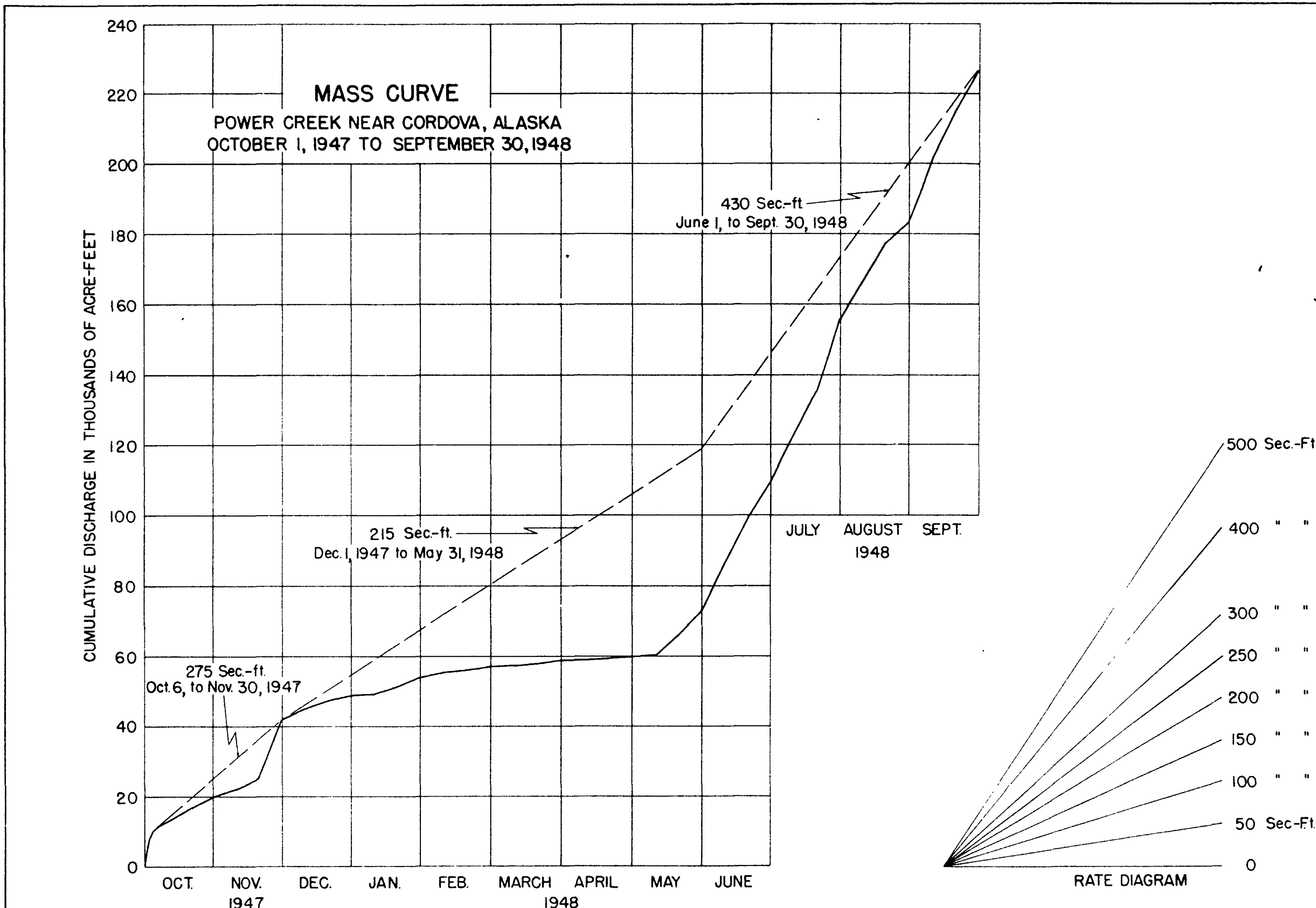


FIGURE 3

within the first three miles from the mouth to utilize the concentration of fall, 400 feet, in that distance. (See Plate VII) Possible methods of development will come under one of two general schemes, with regulated flow resulting from storage, or with natural flow only. The former plan is the most desirable but the potential power under the latter is also considered to serve as a basis of comparison and also if geologic conditions should make storage development impracticable.

In arriving at the potential power with regulated flow the following assumptions have been made. A dam would be built in the canyon, at about mile 2.65, with a maximum flow line at 540 and 50,000 acre-feet of storage capacity would be used, making the minimum draw down elevation 470 and the mean reservoir elevation 510. Water would be diverted from the reservoir by a short tunnel through the narrow ridge on the right side of the valley and connect with a penstock leading to a power house located near mile 2 with a tailrace elevation of 240. The tunnel would be at elevation 450 and thus be under a maximum static head of 90 feet. The stream would again be diverted just below the aforementioned power house, at elevation 230, to a conduit following along the right bank, or possibly a tunnel, and connecting to a penstock leading to a power house located near mile 0.8, with a tailrace elevation of 20. The water supply would be the same for both power houses and has been taken as the amounts set forth in the preceding section on storage, viz., 215 second-feet continuous and 275 second-feet for 50 percent of the time. Following the above assumptions the potential power would be as tabulated on the following page.

Undeveloped power site 14-CA-1

Head(H) (feet)	Regulated Flow (Q) (second-feet) Continuous	50 percent of time	Horsepower a/ Continuous	50 percent of time	Kilowatts Continuous	50 percent of time
			Power House No. 1			
270	215	275	4640	5940	3460	4430
			Power House No. 2			
210	215	275	3610	4620	2700	3450
Totals						
480			8250	10560	6160	7880

a/ Horsepower (70 percent efficiency) = (0.08)(Q)(H)

In theory, at least, it would be possible to develop the potential power of the above site in only one stage. This, however, would require a conduit over a mile in length under a maximum static head of 90 feet which has been considered an objectionable feature. The two stage development has been considered preferable even though it does require a second power house and an additional mile of transmission line. A two stage development might also fit in better with the economic needs and development plans of the region this power would serve.

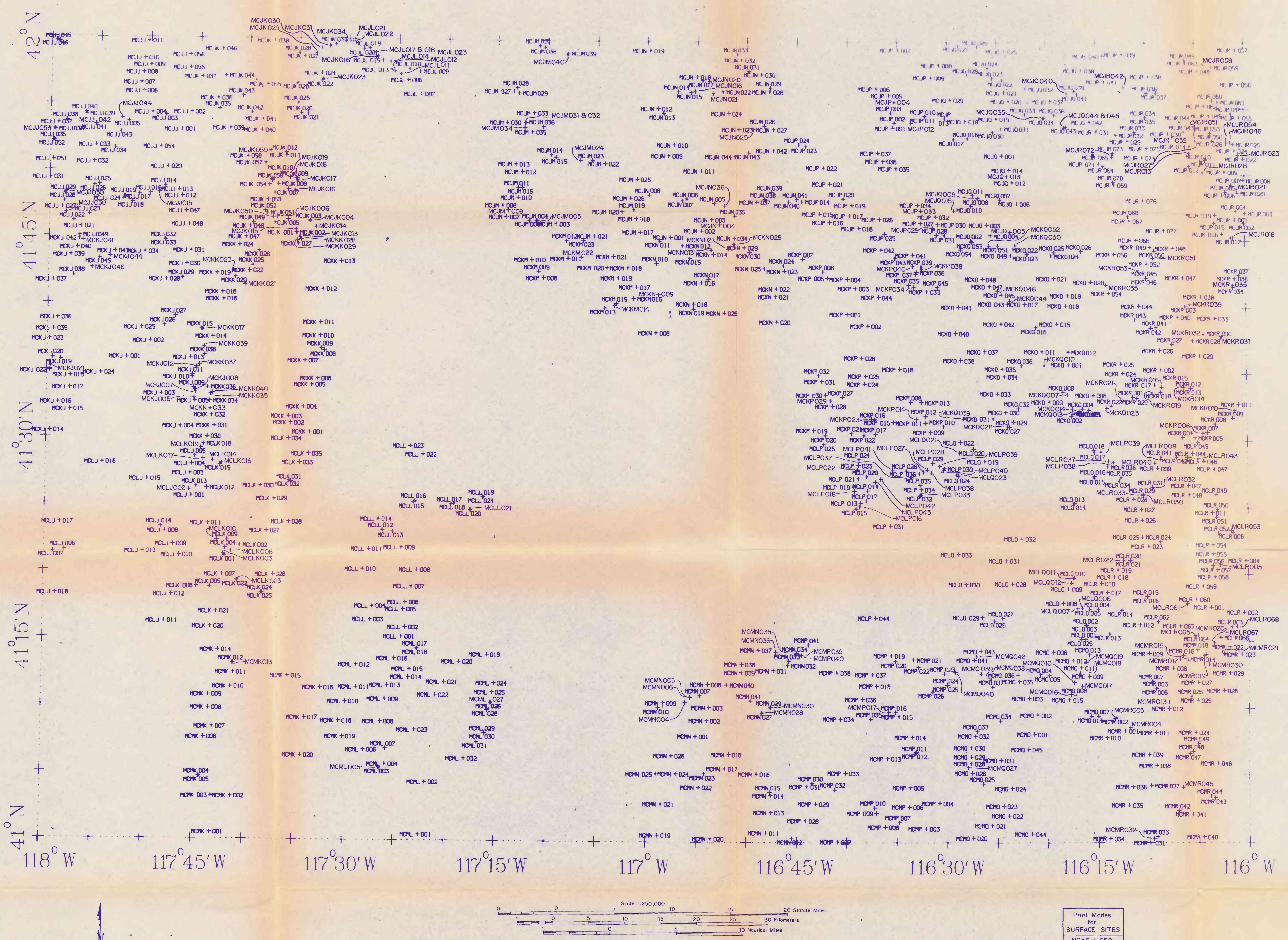
To outline the potential power using natural flow only the following assumptions have been made. There would be a dam near the head of the canyon, at about mile 2.75, with a flow line at elevation 440, a diversion tunnel about 600 feet long and at elevation 430 through the narrow ridge on the right side of the valley, connecting with a conduit which would follow along the right bank for about 1 mile, connecting with a penstock leading to a power house, located at about mile 1.0, which would have a tailrace elevation of 40 feet. The available stream flow is assumed to be the same as at the gaging station, viz., 25 second-feet for 90 percent of the time and 140 second-feet for 50 percent of the time. Under these assumptions the potential power is as shown below.

Undeveloped power site 14 CA-1 (Alternate plan)

	Natural Flow (Q) (second-feet)		Horsepower a/		Kilowatts	
Head (H) (feet)	90 percent of time	50 percent of time	90 percent of time	50 percent of time	90 percent of time	50 percent of time
400	25	140	800	4480	597	3340

a/ Horsepower (70 percent efficiency) = 0.08 (Q)(H)

As previously mentioned, more stream flow data is necessary and a geologic examination of the sites to be occupied by the various hydraulic structures must be made before a final evaluation can be made of the potential power of this stream. However, it is believed that this report gives a reasonable idea as to the power potentialities and focuses attention on those considerations where more information is needed.



MCJL003 & MCJL001
MCJL004 & MCJL002

Print Modes for SURFACE SITES

NCAS + 058
+ NCAS 058
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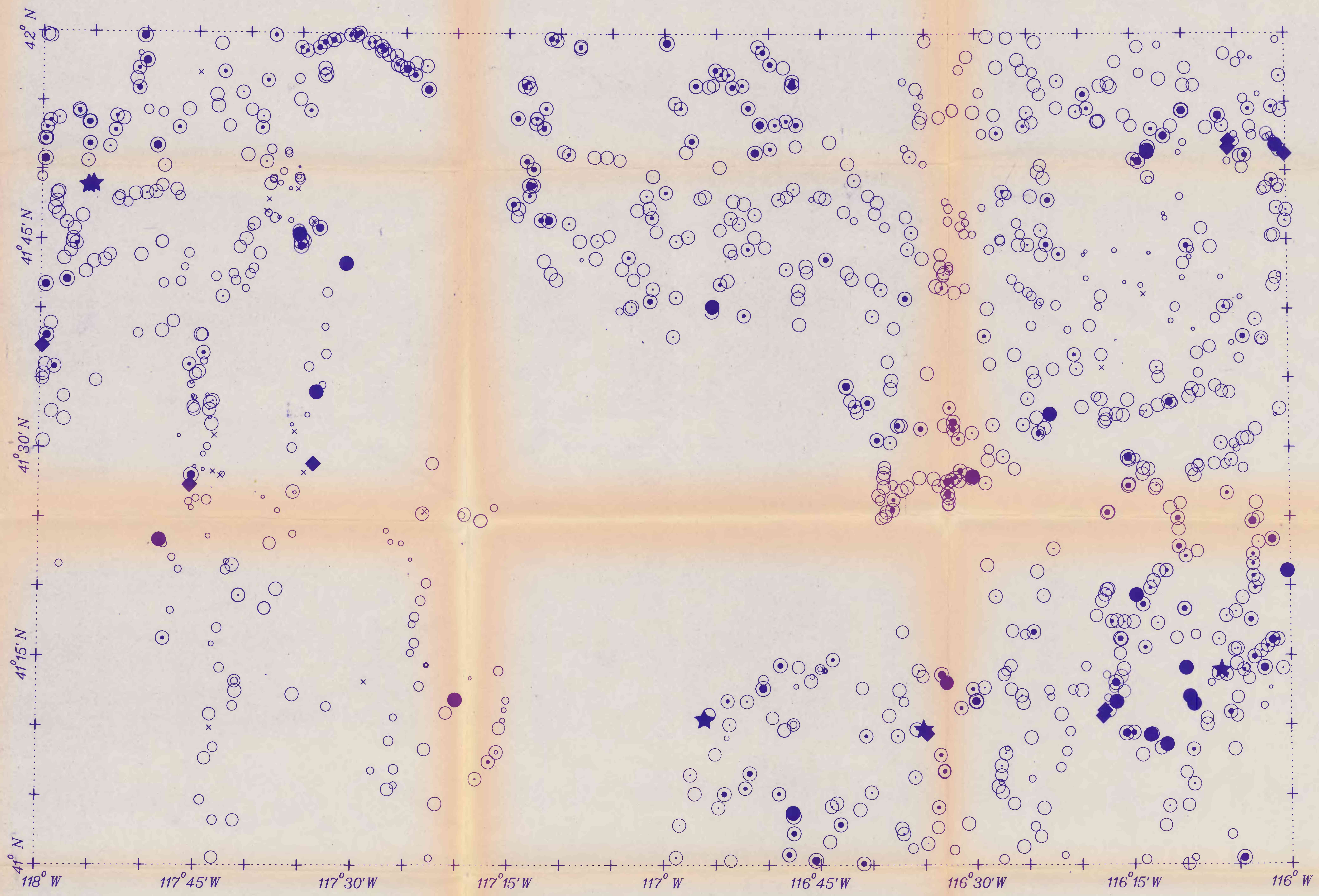
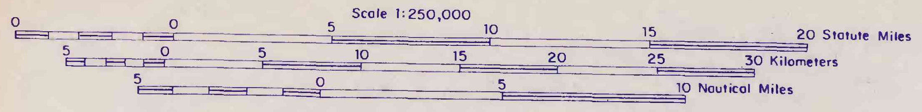
+ (Site Location)

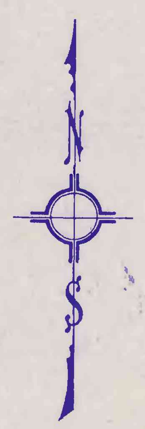
SURFACE SAMPLE SITE LOCATIONS IN THE *MCDERMITT* QUADRANGLE

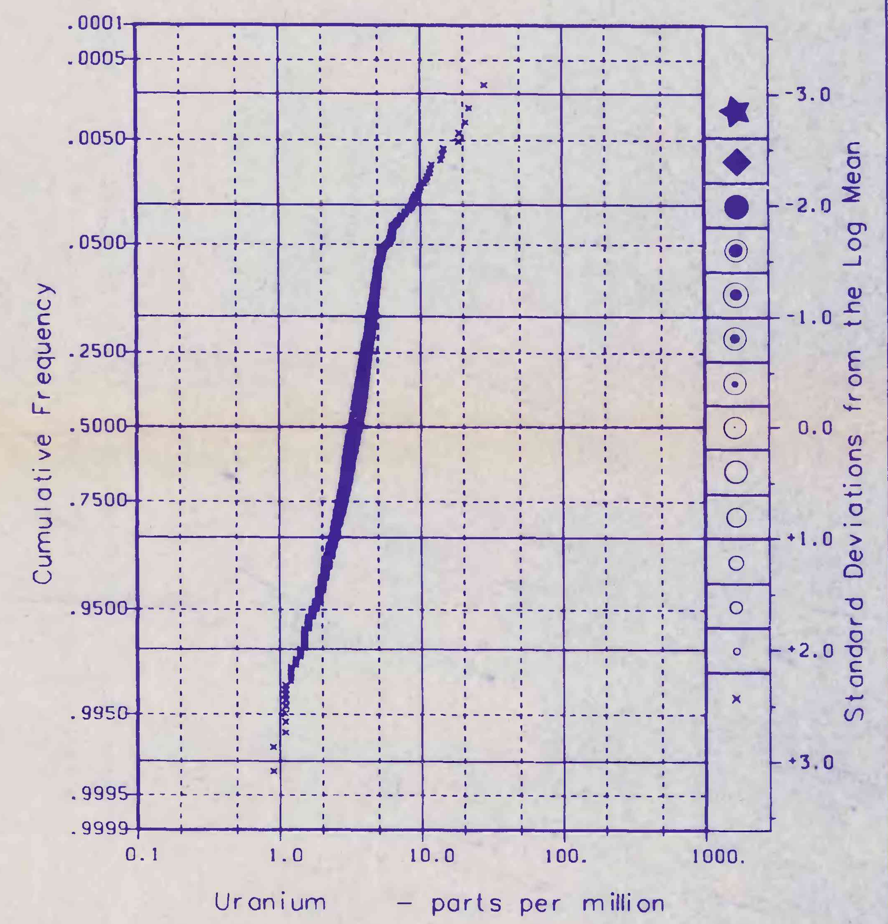
PLATE 1

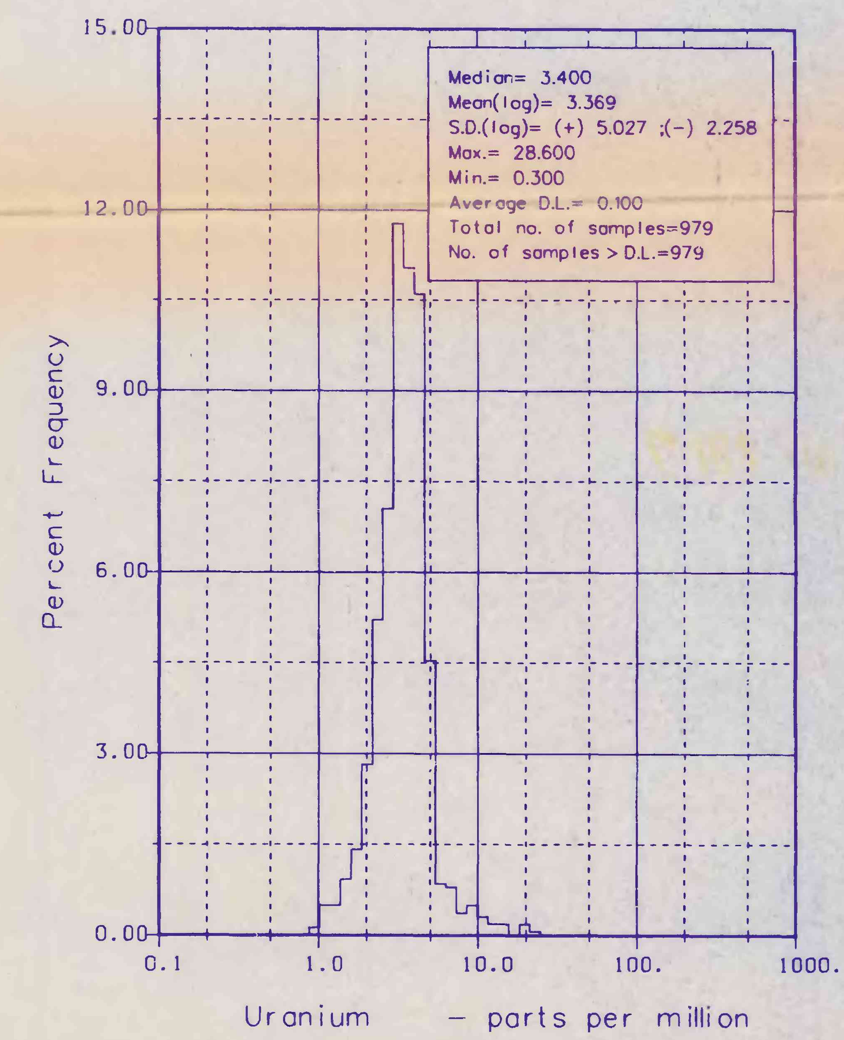
GJBX-117(80)
PLATE 1











Uranium - parts per million

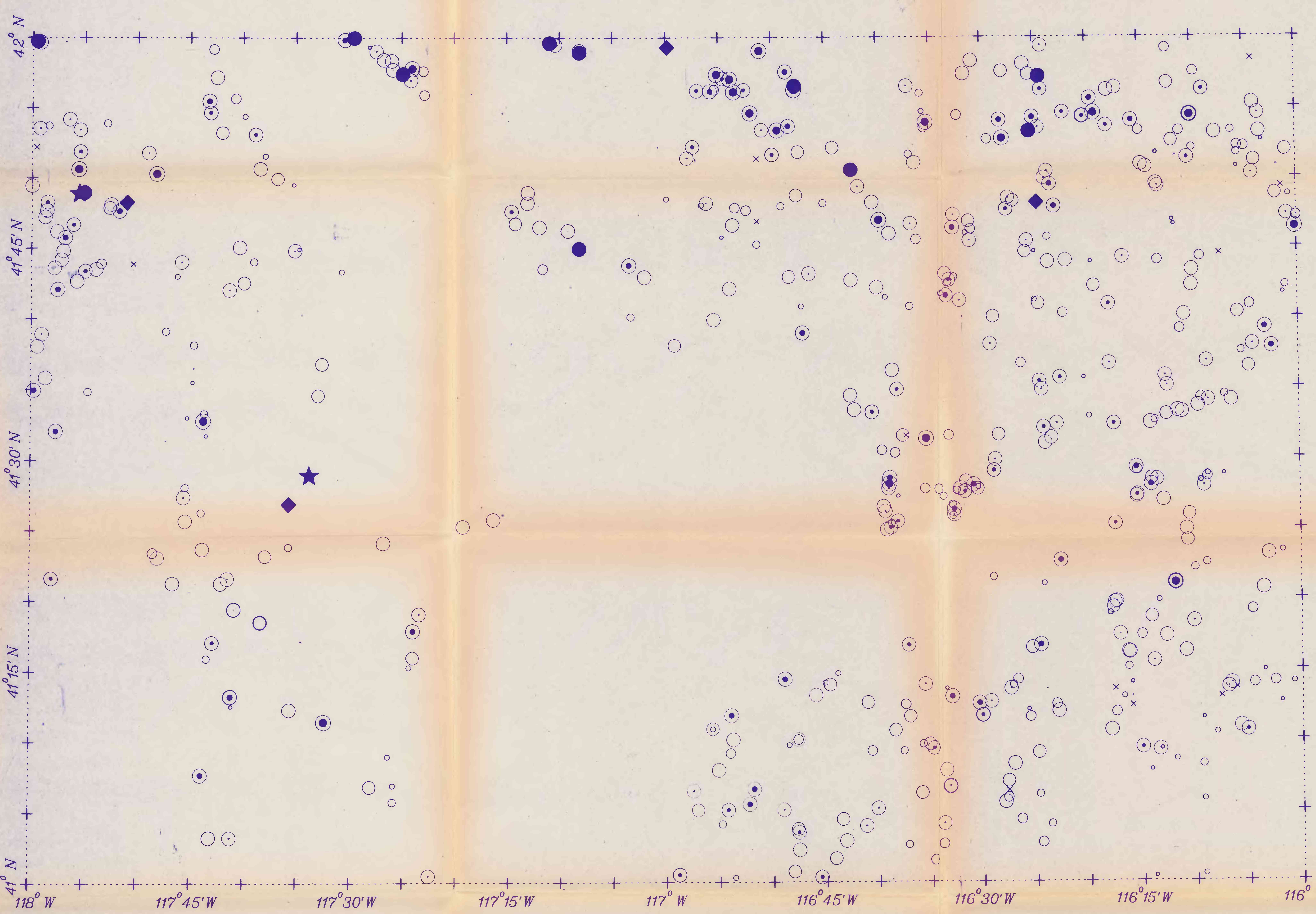
+ < D.L.	∘ 1.600- 2.000	○ 2.800- 3.200	⊙ 4.100- 4.500	● 6.400- 10.100
× < 1.200	○ 2.000- 2.400	○ 3.200- 3.700	⊙ 4.500- 5.000	◆ 10.100- 14.600
∘ 1.200- 1.600	○ 2.400- 2.800	⊙ 3.700- 4.100	⊙ 5.000- 6.400	★ > 14.600

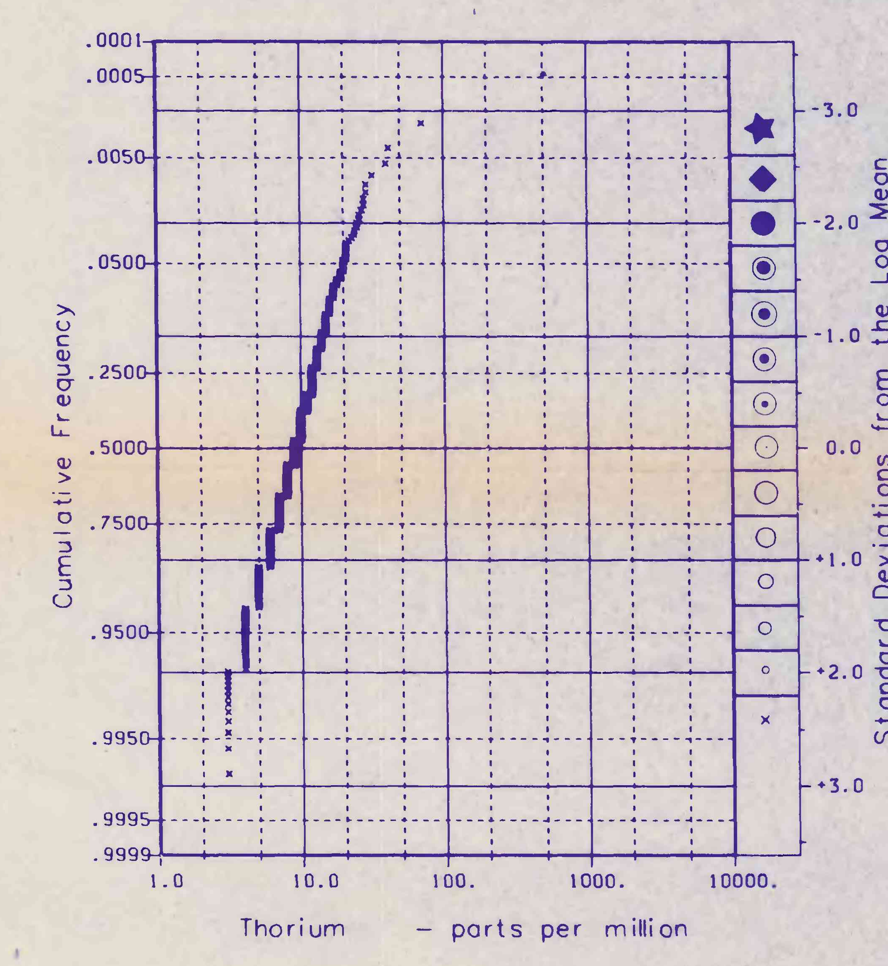
URANIUM DISTRIBUTION IN THE SEDIMENTS OF THE *MCDERMITT* QUADRANGLE

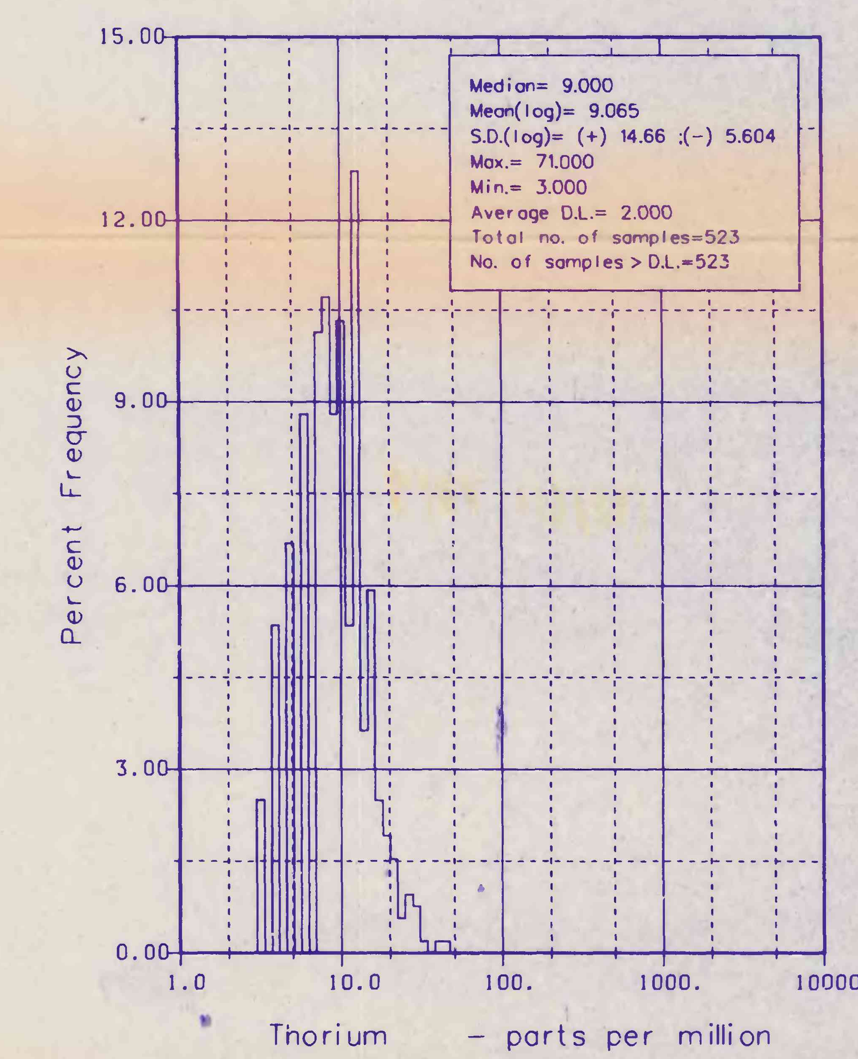
PLATE 2

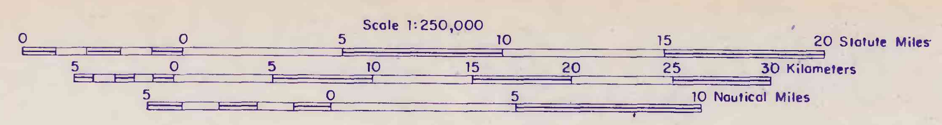
GJBX-119(80)

PLATE 2









Thorium - parts per million

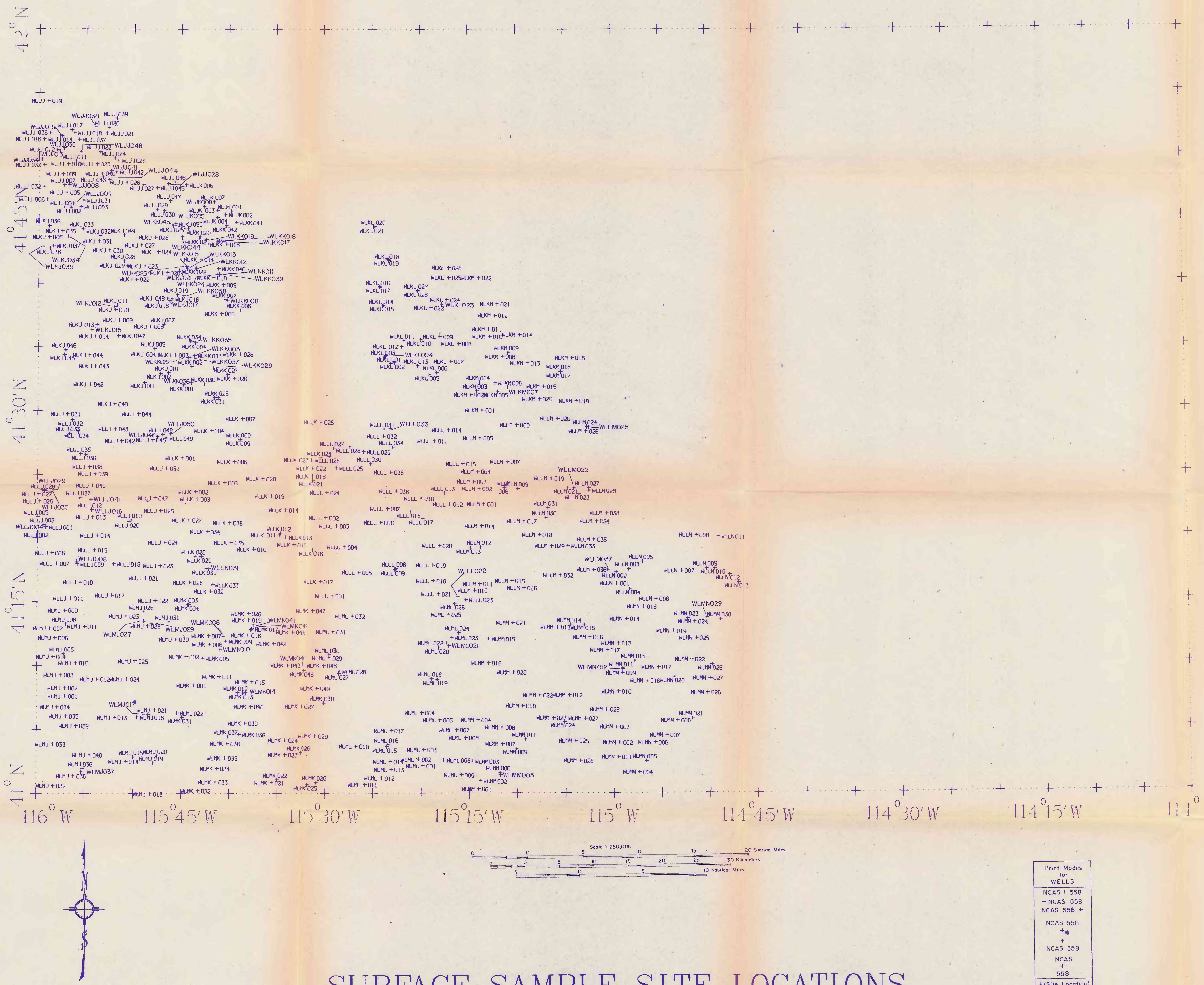
+ < D.L.	∘ 4.0- 5.0	○ 7.0- 8.0	⊙ 12.0- 14.0	● 21.0- 28.0
× < 3.0	∘ 5.0- 6.0	○ 8.0- 10.0	⊙ 14.0- 17.0	◆ 28.0- 40.0
∘ 3.0- 4.0	○ 6.0- 7.0	⊙ 10.0- 12.0	⊙ 17.0- 21.0	★ > 40.0

THORIUM DISTRIBUTION IN THE SEDIMENTS OF THE *MCDERMITT* QUADRANGLE

PLATE 3

GJBX-117(80)

PLATE 3

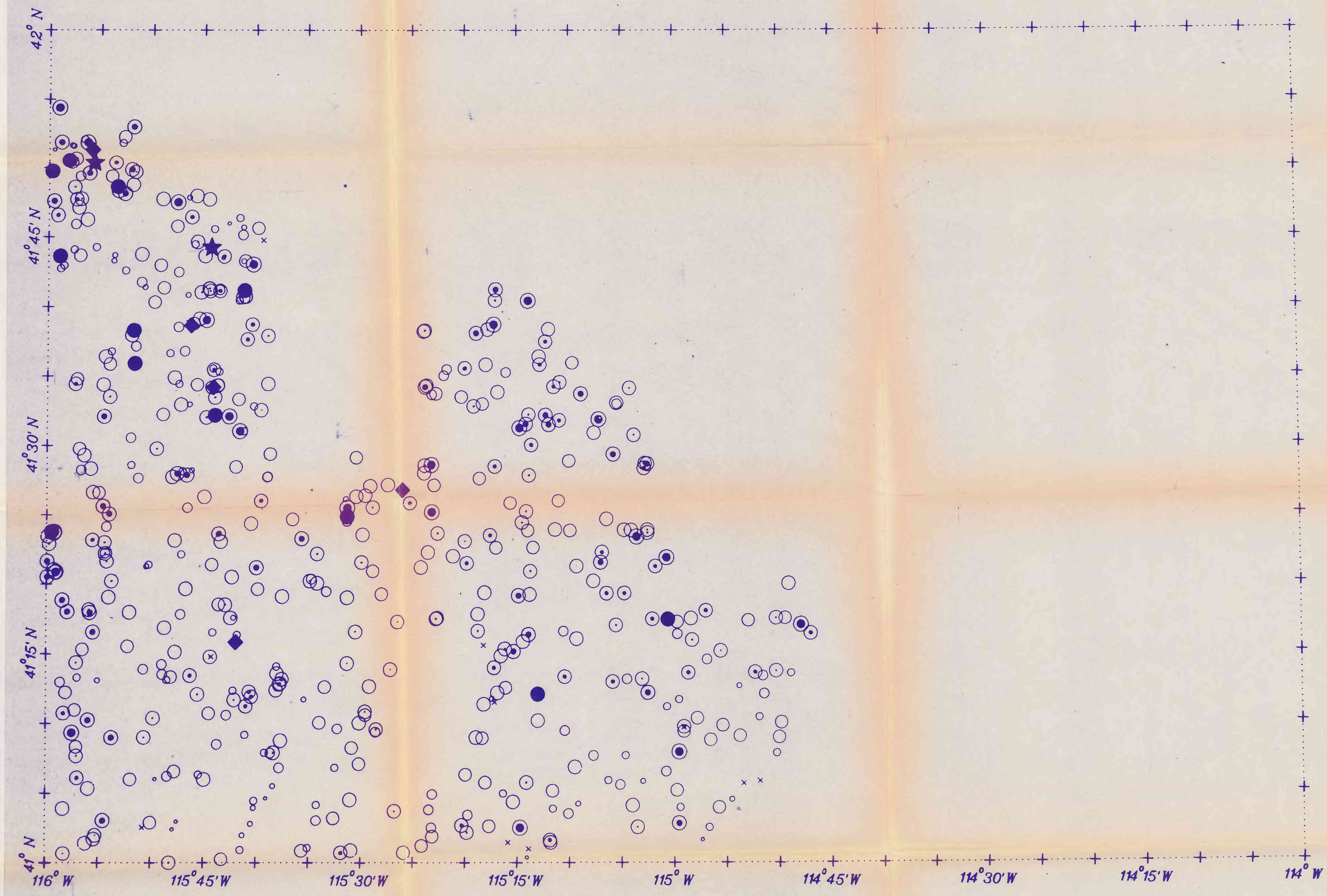


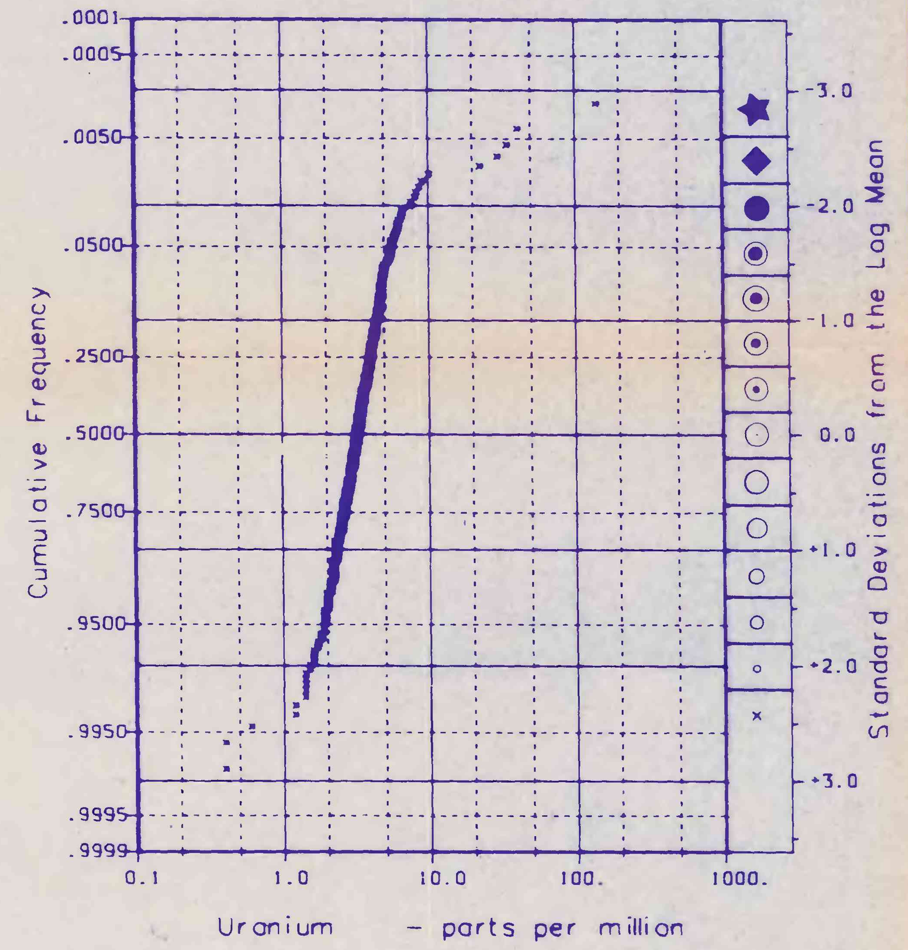
SURFACE SAMPLE SITE LOCATIONS IN THE *WELLS* QUADRANGLE

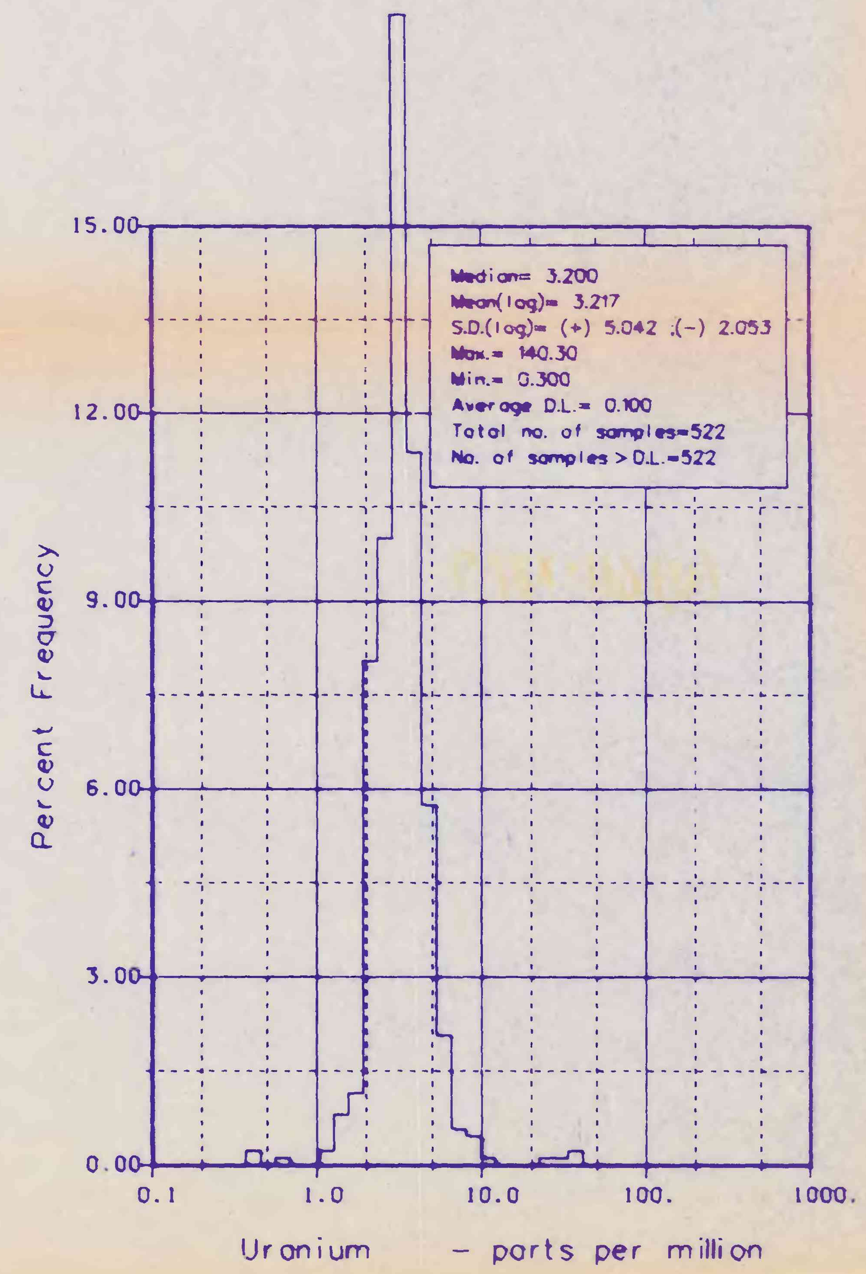
PLATE 1

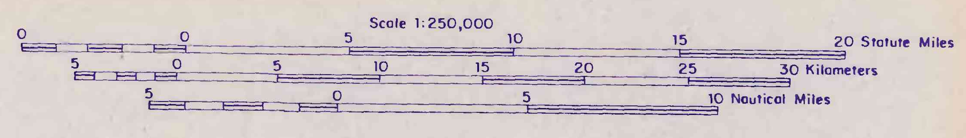
GJBX-117(80)

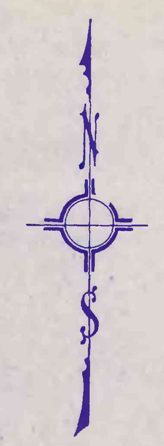
PLATE 4











Uranium - parts per million

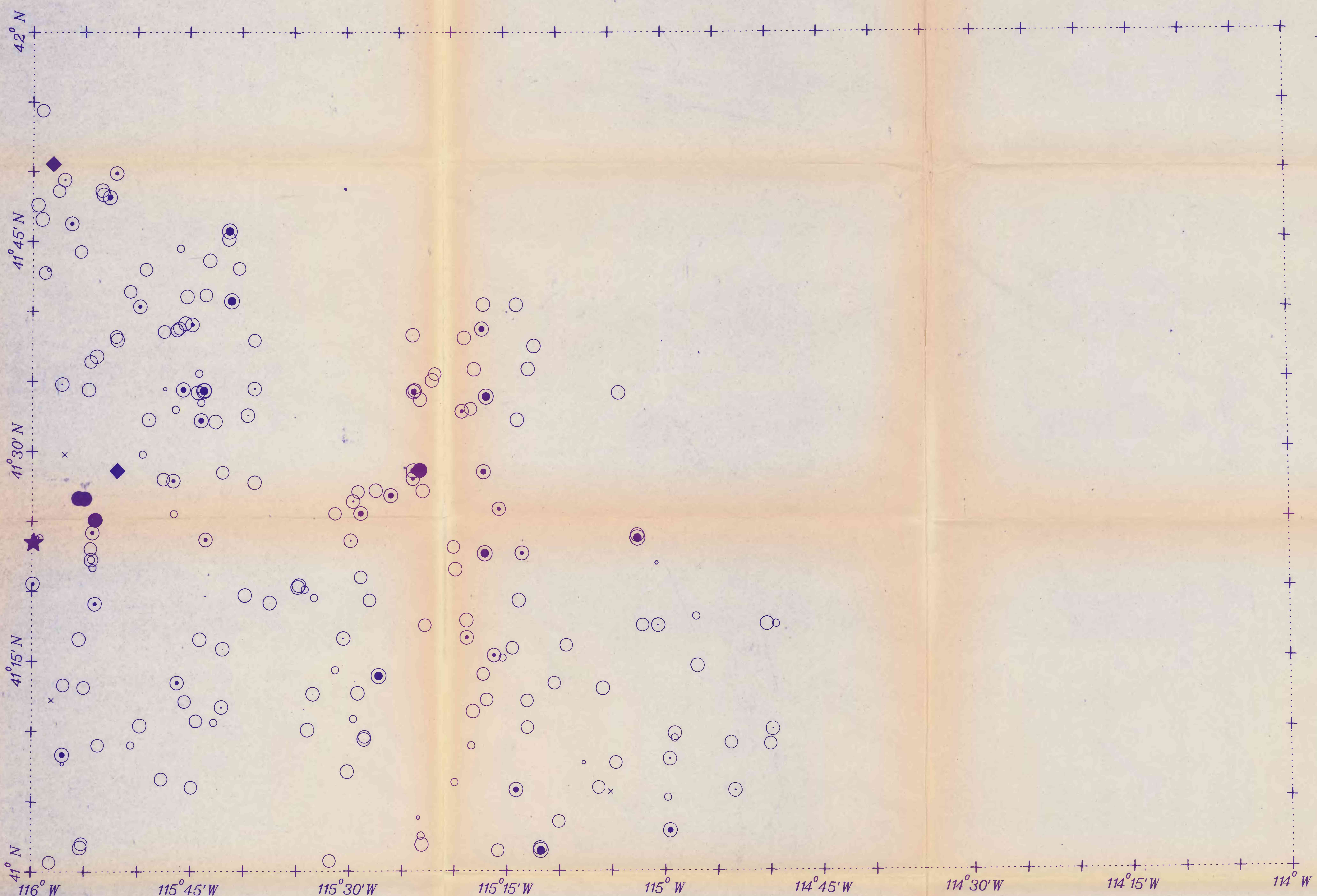
+ < D.L.	∘ 1.700- 2.000	○ 2.600- 3.000	⊙ 3.900- 4.300	● 6.000- 8.600
× < 1.400	○ 2.000- 2.300	○ 3.000- 3.400	⊙ 4.300- 4.800	◆ 8.600- 34.300
∘ 1.400- 1.700	○ 2.300- 2.600	⊙ 3.400- 3.900	⊙ 4.800- 6.000	★ > 34.300

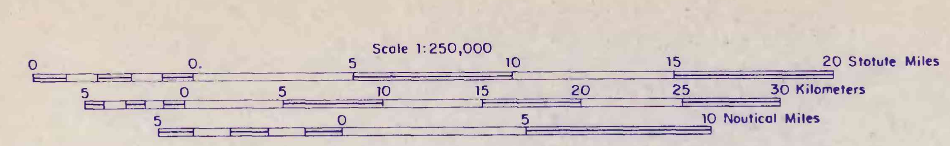
URANIUM DISTRIBUTION IN THE SEDIMENTS OF THE *WELLS* QUADRANGLE

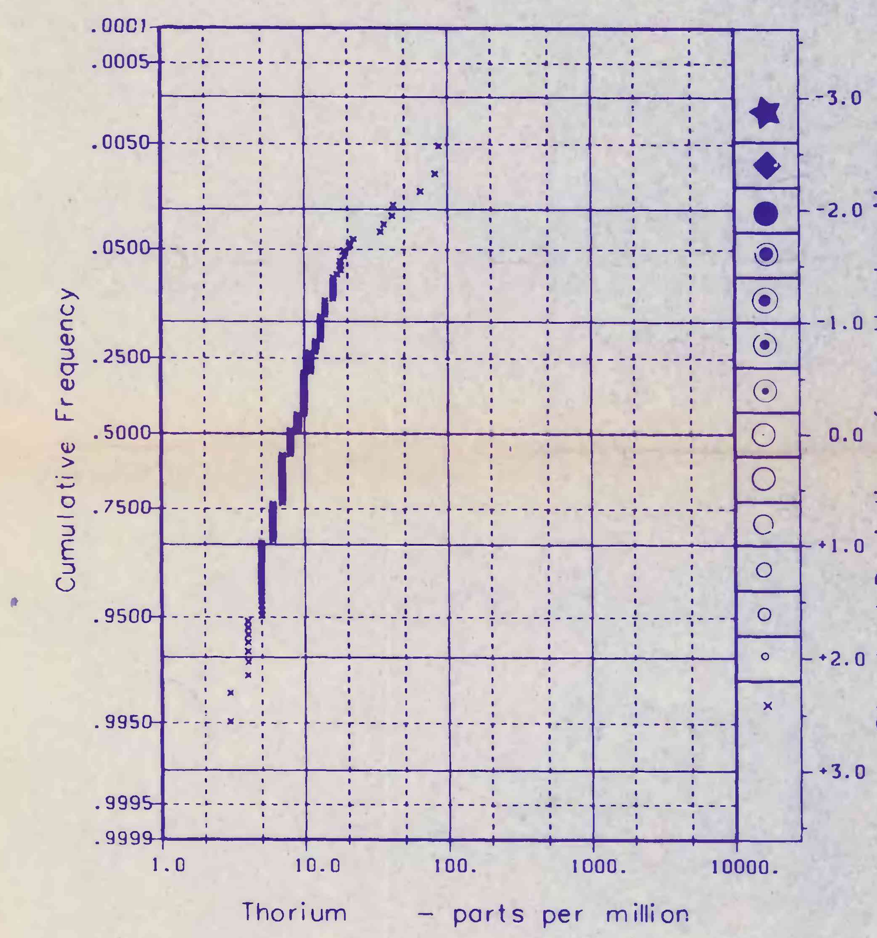
GJBX-117(80)

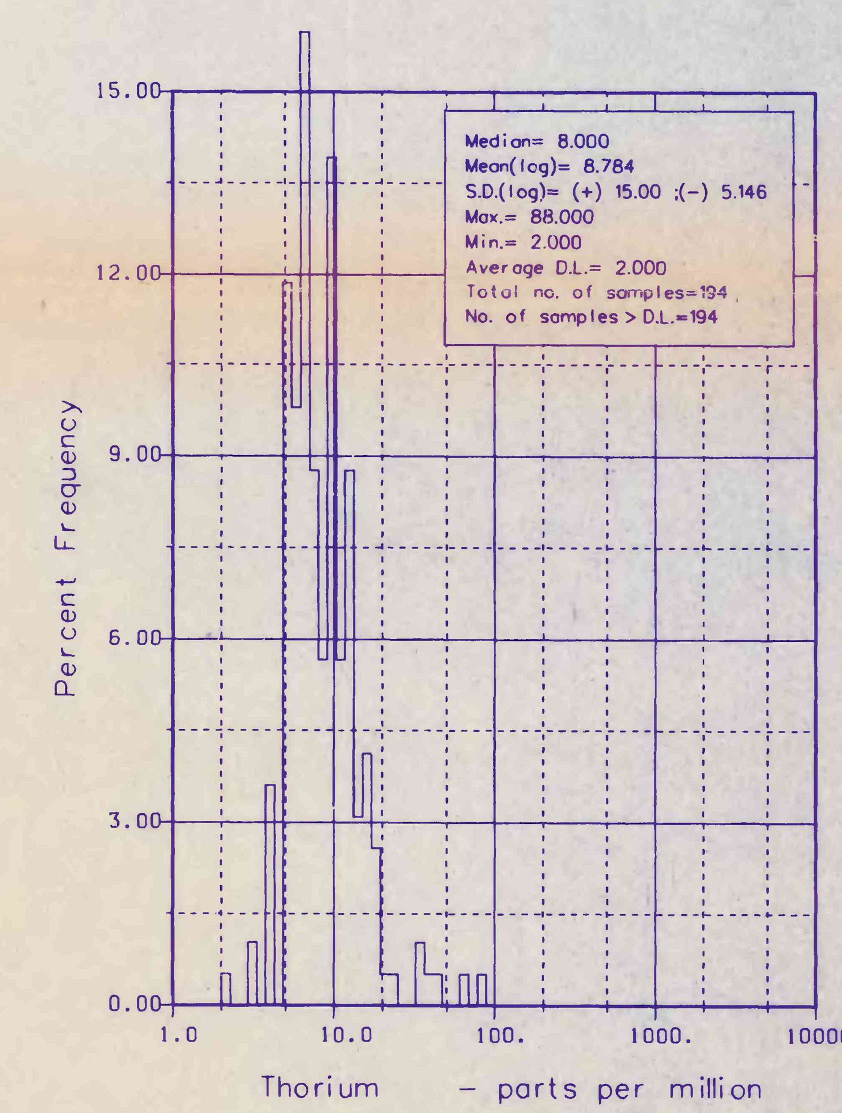
PLATE 5

PLATE 5









Thorium - parts per million

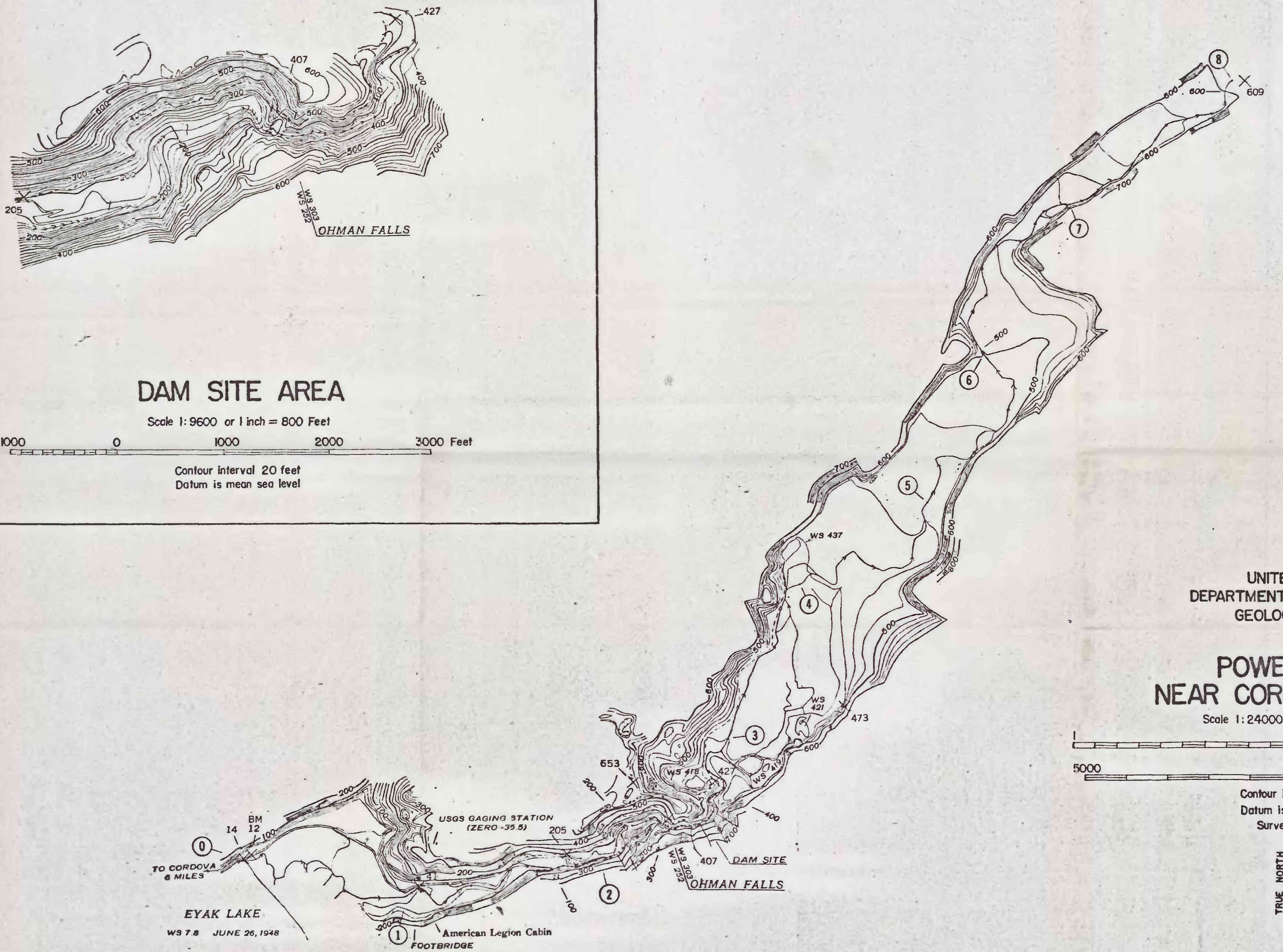
+ < D.L.	∘ 4.0- 5.0	○ 7.0- 7.0	⊙ 11.0- 13.0	● 22.0- 42.0
× < 3.0	∘ 5.0- 5.0	○ 7.0- 10.0	⊙ 13.0- 16.0	◆ 42.0- 82.0
∘ 3.0- 4.0	○ 5.0- 7.0	⊙ 10.0- 11.0	⊙ 16.0- 22.0	★ > 82.0

THORIUM DISTRIBUTION IN THE SEDIMENTS OF THE *WELLS* QUADRANGLE

PLATE 6

GJBX-117(80)

PLATE 6



DAM SITE AREA

Scale 1:9600 or 1 inch = 800 Feet

1000 0 1000 2000 3000 Feet

Contour interval 20 feet
Datum is mean sea level

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

POWER CREEK NEAR CORDOVA, ALASKA

Scale 1:24000 or 1 inch = 2000 feet

1 0 1 Mile

5000 0 5000 Feet

Contour interval 20 feet
Datum is mean sea level
Surveyed in 1948

49-13

PLATE VII

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

POWER CREEK NEAR CORDOVA, ALASKA

PROFILE

Horizontal scale 1: 24,000 or 1 inch = 2,000 feet
Vertical scale 1 inch = 100 feet