

Twin CK 5,100 - 26.3

~~Front CK~~
Sunset 5,500 - 26.3

Sackbut 5,250 - 28.6

Roland 5,200 - 38.4

Woods Pk. 6,200 - 43.2

Cedar Crossing 6,900 - 45.9

Huckleberry Mt. 5,000 18.5

Burns Summit 3,100 7.6

Sherwin 3,000 10.2

THE WASHINGTON WATER POWER COMPANY

EDISON ELECTRIC LIGHT & POWER SYSTEM.

SPOKANE STREET RAILWAY SYSTEM.

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

JOHN B. FISKEN, CONSULTING ENGINEER

SPOKANE, WASH.

September 7, 1921.

Dr. J. E. Church, Jr.,
University of Nevada,
Reno, Nevada.

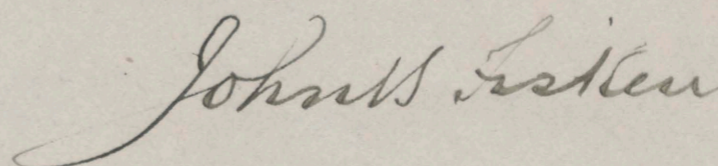
Dear Mr. Church:

I have your letter of August 30th with reference to the working up of some data sent you last autumn by Mr. Stevens. I have discussed this matter with Mr. Huntington and would state that owing to business conditions he is unwilling at the present time to incur any additional expense.

I am sending you a copy of my report of the snow survey for last winter, which I have had on my desk to send you for some time. I would state that Mr. Huntington has approved my recommendation that course at Cedar Crossing be abandoned.

If you desire to offer any criticisms on this report I should be very glad to receive them.

Yours very truly,



Consulting Engineer.

JBFLC
Encl:

REPORT OF SNOW SURVEY

FOR YEAR 1920-21

TO-GETHER WITH NOTES OF OTHER WORK CONNECTED THEREWITH
SNOW COURSES.

In Mr. J. C. Stevens' report dated September 18th 1920, it was recommended that eight snow courses be established as follows:

- | | |
|----------------|-------------------|
| 1. Cabinet | 5. Cedar Crossing |
| 2. Trout Creek | 6. Sherwin |
| 3. Lolo Pass | 7. Medimont |
| 4. Ward's Peak | 8. Mica. |

I spent a considerable amount of time during the winter interviewing various persons who were acquainted with the conditions at these various locations, and as a result suggested certain changes to Mr. Stevens which he approved.

I ascertained that the summit of the Bitter Root Range which could be reached both from Cabinet and from Trout Creek was bare as a result of the 1910 fire but that there was a considerable body of standing green timber in the range at the head of Twin Creek at an elevation of about 5000 feet which could be reached from Clark's Fork, and that the only other body of green timber near there was several miles south west at a lower elevation and harder to get at. It was decided to substitute Twin Creek Pass for Cabinet. As a substitute for Trout Creek, suggested a course near Sunset Peak and after a personal examination Mr. Stevens approved the change. Owing to the great advantage of accessibility of a snow course near Lookout Station over one at Lolo Pass (Coeur D'Alene Pass) I investigated the situation when there was a snow depth of two to three feet and found a suitable location on Lookout Mountain within about half a mile of Lookout Station and my recommendation that this substitution be made was approved. From inquiries made of Forest Service Men I concluded that suitable locations could be found at or near Ward's Peak and Cedar Crossing and these original locations were retained.

On a visit to Sherwin prior to any snow accumulation a suitable course was laid out by Mr. Stevens. Owing to the fact that a snow course north of Medimont would have been rather difficult to reach whereas an equally good one was available at Burns Summit, this change was approved. The preliminary investigation developed the fact that the high point designated "Mica Peak" on the U. S. G. S. map is "Signal Point," that Mica Peak is the high point about $6\frac{1}{2}$ miles southwest, and that between the two is Huckleberry Mountain, all three being about the same elevation. As Huckleberry Mountain is the easiest to reach I decided to try and find a suitable location on it and was successful. On our way home from Cedar Crossing we decided to investigate the possibilities of a good location above Roland and were successful.

In all nine courses were surveyed as follows:

- | | |
|-------------------|-------------------------|
| 1. Twin Creek | 6. Sherwin |
| 2. Sunset | 7. Burns Summit |
| 3. Lookout | 8. Huckleberry Mountain |
| 4. Ward's Peak | 9. Roland. |
| 5. Cedar Crossing | |

The attached map shows the locations of the courses proposed by Mr. Stevens and those finally adopted.

SNOW SURVEY TRIPS.

A schedule of Snow Survey Trips was prepared (see Appendix A) and was very closely adhered to.

BURNS SUMMIT. The party consisted of E. Logan and myself with some assistance from Lee Bergman and E. R. Wright.

We left Spokane by automobile Feb. 21st, 1921 at 7:45 A. M. and arrived at Thomson's 11:15 A. M. A considerable portion of the afternoon was spent exploring the mountains to the north east of Burns Summit but no suitable location was found in that direction. The rest of that day and the forenoon of the next was spent surveying a course along the old Mallan Road which was quite satisfactory. We left Thomson's at 2:45 P. M. Feb. 22nd, 1921 and arrived at the office at 6:25 P. M.

SHERWIN. The party consisted of Grant D. Godfrey and myself.

We left Spokane on C. M. & St. P. at 7:20 A. M. Feb. 24th 1921 and arrived at Sherwin Station 12:50 P. M. As this course had already been decided upon there was no delay in getting the survey started. There was only sufficient time between trains to survey 31 stations and as there was no place to spend the night and the 31 measurements showed very close uniformity I decided to accept them as the average for the course. We left Sherwin at 4:20 P. M. and arrived at Spokane about midnight.

HUCKLEBERRY MOUNTAIN. The party consisted of Grant D. Godfrey, Lee Bergman and myself.

We left Spokane by automobile at 7:15 A. M. Feb. 26th 1921 and arrived at Johnston's Ranch near mile post 82 Washington-Idaho State line, at 8:30 A. M. After a walk of about a mile and a half we reached the snow line at elevation about 4000 ft. and from there snow shod to the summit. Returning we left Johnston's at 5:50 P.M. and reached the office at 7:30 P. M.

SUNSET. The party consisted of J. C. Stevens, G. L. Richardson (who joined us at Wallace) and myself.

We left Spokane Feb. 28th 1921 for Wallace. We left Wallace March 1st 1921 at 7:30 A. M. by wagon, transferred to a sleigh at Rex Mill, and arrived at Tamarack Custer Store at 10 A. M. From there we snow shod about two miles to the Guelph Cabin near the summit of the divide between Nine Mile and Cedar Creeks and near the beginning of the Course. We finished the work and started for Wallace 4:40 P. M. arriving there about 8 P. M.

LOOKOUT. The party was the same as at Sunset.

We left Wallace March 2nd 1921 by N. P. Train at 9:10 A. M. arriving at Lookout Station at 10:05 A. M. and on the course at 10:35 A. M. We finished the survey with plenty of time to catch the N. P. train from Lookout at 4:31 P. M. and arrived at Wallace 5:30 P. M. Mr. Stevens and I returned to Spokane the next day.

TWIN CREEK. The party consisted of J. C. Stevens, Harold Knapp and myself.

Mr. Stevens and I left Spokane March 4th 1921 by N. P. train at 7 A. M. Arrived at Clark's Fork 10 A. M. and were met there by Mr. Knapp. After lunch we started by wagon for the Knapp Ranch on Twin Creek where we arrived at 3 P. M. March 5th we left the Knapp ranch by sleigh at 6:30 A. M. and arrived at Burkes Camp a distance of about 2 miles at 7:45 A. M. We left the horses here and started for the summit on snow shoes. After a very stiff climb of about a mile we reached the summit at 10:25 A. M. and went west about one mile to the Course. After lunch we surveyed the course and started for home at 5:20 P. M. reaching Burkes Camp at 6:30 P. M. and Knapps ranch 7:45 P. M. We left Knapps ranch the next morning at 8:30 A. M. arriving at Durite, a siding on the N. P. at 9:40 A. M. and Spokane at 1:55 P. M.

WARD'S PEAK. The party consisted of J. C. Stevens, A. M. Donally, Clyde Smith and myself.

Mr. Stevens and I left Spokane March 7th 1921 at 7:20 A. M. on C. M. & St. P. and arrived at Haugen 3:10 P. M. We were joined at Haugen by A. M. Donally and Clyde Smith and went with them to Savanac Ranger Station where we spent the night. Donally and Smith reported that as had been arranged they had made a trip to the ranger's cabin at Ward's Peak, had packed in some supplies, had dug the snow away from the cabin sufficiently for an entrance and found wood and other supplies sufficient for a stay of several days. They reported having had a very hard and dangerous trip as they were caught in a blizzard when returning from the Peak. Notwithstanding the blizzard they felt sure that the trail which they had broken would be found to be good, as it was. We laid in a few additional supplies and prepared for an early start the next day. We left Savanac March 8th 1921, by sleigh at 7:55 A. M., drove to the Gold Crome Mine about 4 miles and snow shod to the Placer Camp, an old deserted camp, $2\frac{1}{2}$ miles further arriving there at 10 A. M. From here to the Ranger's Cabin on Ward's Peak a distance of $6\frac{1}{2}$ miles was all covered on snow shoes except a short distance before reaching the summit of the range where the side hill was so steep that snow shoeing was hardly safe and about a mile along the range where the snow was packed and walking without snow shoes was easier than with them. After leaving the Placer Camp we reached the Compressor about $1\frac{1}{2}$ miles at 11 A. M., the summit at 3:15 P. M. and the Ranger's Cabin at 4:30 P. M. On arriving at the Cabin we discovered that someone had been there after Donally and Smith had left and had stolen a considerable quantity of our supplies, and had it been necessary for us to spend several days there which fortunately it was not we would have been compelled to go on short rations. We made no attempt to trace the thieves although their snow shoe tracks were visible leading off to the south east.

Next day March 9th 1921 we started the survey at 7:40 A. M. and were finished by 11:30 A. M. We left the cabin on our return at 1:05 P. M., arrived at the Placer Camp at 4:50 P. M. and spent the night there. We were fortunate in having good weather, unusual at that time of the year, as otherwise it would have been impossible to have made the trip in the short time it took us. Our original plan was to follow the range from Ward's Peak to Cedar Crossing but the snow drifts and other conditions caused us to abandon the plan as involving too much risk.

The next day March 10th 1921, we left the Placer Camp at 7:45 A. M., were met by the sleigh at the Gold Crome Mine and arrived at Savanac at 10:55 A. M. We left Haugen C. M. & St. P. Ry. at 3:13 P. M. and arrived at Superior at 4:20 P. M. We purchased our supplies and arranged for a sleigh for the next day to take us to the Amador Mine.

During the night it started to snow and this condition continued all day March 11th and most of the day March 12th. Contrary to the advice of several old timers, miners and trappers, who assured us we could never get over the summit till the storm had ceased and the snow settled, we decided to start out and go as far as we could.

CEDAR CROSSING. The party was the same as at Ward's Peak except as hereafter noted.

We left Superior by sleigh March 13th at 8 A. M. and reached the Amador Mine about 13 miles at noon. After dinner as the storm had ceased and the snow conditions were not as bad as we anticipated we decided to take the sleigh as far as we could. We left the Amador Mine at 1:20 P. M. Arrived at the Power House, about 3 miles, at 2:35 P. M. and at Mayville, (an old Placer Camp) about $2\frac{1}{2}$ miles further, at 4:30 P. M. For the last mile or thereabouts the horses had all they could do to pull the sleigh with our packs, but as we were able to travel light, that was great help. On arriving at Mayville we met a miner, John Geronimo who had just come down from the Fuller Cabin. He told us that he was familiar with the conditions along the range, and that on account of the excessive combing it would be impossible for us to get over Cedar Crossing, and that there was only one short stretch of several hundred feet where we could cross the range. I arranged with him to go with us as a guide. We spent the night at Mayville and started the next morning March 14th at 8:30 A. M. and arrived at the Fuller Cabin about $2\frac{1}{2}$ miles at 11:20 A. M. As we had climbed about 1400 ft. the last quarter mile being very steep and the snow shoeing had been heavy we decided not to attempt crossing the range till the next day. We left the Fuller Cabin March 15th at 8 A. M. The weather was clear and we had no difficulty in getting over the summit, elevation about 7200 feet. We arrived at the snow course about 2 miles at 9:20 A. M. worked for one hour and ten minutes, during which time we took eleven measurements, and then started back as storm could be seen approaching and we were in a rather dangerous situation. The storm struck us while we were on our way but by staying close together and following our guide, our outgoing tracks were all obliterated, we arrived safely at Fuller Cabin at noon.

8. Mass curves beginning Mar. 15, 1921, in second foot days of, (a) the measured inflow, (b) the measured out-flow at Post Falls, (c) the out-flow minus the inflow, (d) the storage in Coeur D'Alene Lake.
9. Mass curves beginning Mar. 15, 1921, in second foot days of, (a) the sum of the measured out-flow at Spokane, plus evaporation from Coeur D'Alene lake, plus water pumped by the city of Spokane, (b) the sum of the measured inflow and lake storage.
10. To be decided upon later.

In the FIELD the clearing and permanent marking of the courses except Cedar Crossing will be taken up in the latter part of the summer.

I would recommend that the course of Cedar Crossing be abandoned for the following reasons:- It is a particularly hard location to reach in winter; with considerable risk involved; and it is at an elevation of almost 7000 ft. and is indicative of a very small area, the total area of the watershed above 7000 ft. being only 0.62 square miles. (see Appendix C) If however it is considered advisable to make another survey of this course next winter or to continue it permanently, the course should be cleared and marked this summer.

The courses of Burns Summit and Sherwin are in my opinion of little value. my only reasons for hesitating to recommend their abandonment are that they are easily reached and the expense of the survey is not great. I consider that it would be advisable to survey these courses next winter and to be guided as to their future retention or abandonment by the results obtained.

I have no recommendation at this time as to the abandonment of any other of the courses although we will undoubtedly decide to abandon some of them at a later date.

The results of last winters survey indicates that the water content of the snow blanket increases from the north to the south which leads me to believe that a very large part in proportion to the area of the discharge of the St. Joe River is due to the snow blanket south of the St. Joe. The elevation of ^{no} snow courses surveyed last winter lies between 3100 and 5000 feet and the area between these elevations is a very large part of the whole. (See Appendix C). I would therefore recommend that a course be established at an elevation between 4000 and 4500 feet at the head of Fishhook Creek about nine or ten miles south of Avery. This I expect to investigate this summer. It may later be found advisable to establish another similar course further west; any course east of Avery would be extremely hard to reach in winter.

CABINS OR SHELTERS

It was not considered advisable to build any cabins for last winter's survey, and if equally favorable conditions prevail in the future no cabins would be necessary.

As we can hardly hope for such favorable weather conditions every year it is probable that a cabin near the end of the wagon road and the beginning of the trail on the way to Ward's Peak may be found necessary. This cabin could be reached in severe weather and with a supply of provisions it would be practicable to wait there for favorable conditions

when the ascent to the course, a distance of about five miles, the survey, and the return to the cabin could be made in one day. There is an unused cabin in fair condition at the point above described, formerly used by the attendant at the compressor, which could probably be purchased for a small amount, any communication regarding it should be with W. B. Meneely, c/o Meneely Bell Co., 177 Broadway, New York. I do not however recommend the purchase of this cabin at this time.

It may be necessary in the event of establishing a course on Fishhook Creek to build a cabin either at the course or on the way to it, this will have to be determined by investigation.

CONTAINERS FOR SUPPLIES

Mountain etiquette forbids the locking up of cabins and any wayfarer coming to a cabin and finding it locked is justified in breaking his way in. Further such a wayfarer may help himself to any food which he may find in a cabin in a quantity sufficient to last him to the next place where food is obtainable. Violations of these unwritten laws are rare but as happened to us at Ward's Peak they do occasionally occur and I believe it is necessary that any supplies which we may put in in autumn should be there when we go in in winter. Protection also is advisable against raids by mice, pack rats or other animals. I am of opinion that containers can be made of iron that will be effective. These should be about 2 ft. x 3 ft. by $1\frac{1}{2}$ ft. to 2 ft. deep, made of sheet iron $\frac{3}{16}$ in. to $\frac{1}{4}$ in. thick, with angle irons at the corners, the fastenings to be stove bolts with counter sunk heads and having the nuts inside, and a lock with its face set back in a recess or countersink. This construction will I believe be proof against any onslaught as no one traveling on snow shoes is likely to have any tool sufficiently heavy to break open such a box.

METEOROLOGICAL STATIONS

Stations have been established at Mullan Junction and Roland (C. M. & St. P. tunnel) and have been in operation since March 15th 1921.

GAGING STATIONS.

The gaging stations recommended in the report of Mr. J. C. Stevens, with a few changes approved by him, have all been established and have been in working order since March 15th 1921, though some additional work which had to be postponed until low water period, together with some repairs of damage by high water still remain to be done.

Respectfully submitted,

J. B. Fisker

July 1st, 1921.

CONSULTING ENGINEER.

SNOW COURSES

LEGEND

PROPOSED

ADOPTED



Twin Creek
Cabinet

Trout Creek

Huckleberry Mt.
Burns Summit

Medimont

Sunset

Mica

Lolo Pass

Look Out

Roland

Wards Peak

Cedar Crossing

Sherwin



APPENDIX A
SCHEDULE FOR SNOW SURVEY TRIPS

	<u>Date</u>	<u>Course</u>	<u>Conveyance</u>	<u>Distination</u>
Feb.	21	Burns Summit & Wolf Lodge	Auto & Sleigh	Thomsons'
	22	" " " " "	" " "	Spokane
	23	Mica Peak	Auto	?
	24	Sherwin	C.M.& St.P. #18	Sherwin
	25	-----	-----	Spokane
	26	-----	O.W.R.& N. #9	Wallace
	27	Sunset Peak	Sleigh	Tamarack C. Mine
	28	" "	"	Wallace
March	1	Look Out Pass	N.P. #264	Look Out
	2	Coeur d'Alene Pass	"	Pottsville
	3	-----	O.W.R.& N. #21	Spokane
	4	-----	N.P. #42	Clarks Fork
	5	Twin Creek Pass	Partly wagon or sleigh	Twin Creek Pass
	6	-----	N.P. #305	Spokane
	7	-----	C.M.& St.P. #18	Haugen
	8	-----	Partly wagon or sleigh	Ward's Peak
	9	Ward's Peak	-----	-----
	10	-----	Snow shoes	---? --Cabin
	11	-----	" "	Fuller's Cabin
	12	Cedar Crossing	-----	-----
	13	-----	Snow shoes	End of Cedar Cr. road
	14	-----	Wagon or sleigh	Superior
	15	-----	C.M.& St.P. #17	Roland
	16	Roland	-----	-----
	17	-----	C.M.& St.P. #17	Spokane

APPENDIX B.

SUMMARY OF SNOW SURVEYS 1921.

Course	Elev.	Date	Depth of Snow In.	Core Inches	Water Content Inches	Density Per Cent	Corrections to Mar. 15, 1921 Water content Inches	Total Water Content Mar. 15 1921 Inches.
BURNS SUMMIT	3100	Feb. 22, 1921	29.3	27.0	7.6	25.9	4.1	11.7
SHERWIN	3000	Feb. 24, 1921	38.0	33.0	10.2	26.6	2.1	12.3
HUCKLEBERRY	5000	Feb. 26, 1921	56.0	50.0	18.5	33.0	3.7	22.2
SUNSET	5500	Mar. 1, 1921	78.9	71.2	26.3	33.4	3.8	30.1
LOOKOUT	5250	Mar. 2, 1921	79.1	75.6	28.6	36.2	1.5	30.1
TWIN CREEK	5100	Mar. 5, 1921	77.0	70.4	26.3	34.2	2.5	26.8
WARD'S PEAK	6200	Mar. 9, 1921	112.0	106.0	43.2	38.6	6.5	43.7
CEDAR CROSSING	6900	Mar. 15, 1921	131.0	124.0	45.9	35.0	0.0	45.9
ROLAND	5200	Mar. 17, 1921	118.0	112.0	38.4	32.5	0.0	38.4

COURSE-----Burns Summit
 AVERAGE ELEVATION-----3100 Feet.
 LOCATION-----Sta. 16; S.W. side of old Mullan road ft. N.W. from B.M. on summit.
 CHARACTER OF FORESTATION--In clearing of old road dense jungle growth to S.W. Fairly
 open on the N.E.
 NATURE OF SOIL-----Considerable gravel, some clay, some humus.

DESCRIPTION OF COURSE		MEASUREMENTS			
Sta.	Dist.	Remarks	Depth	Water Core Content	Remarks.
WESTERLY COURSE					
1		50' from monument west in line with tel. pole & 10" or 11" south of our guystab	28"	24 $\frac{1}{2}$	6 $\frac{3}{4}$
2	50	Δ R. abt. 15° to point B.T. 14'S.W. blazed	28	24	7 $\frac{1}{2}$
3	50	Δ R. abt. 10° to point B.T. 12'6" S	26	25	7
4	50		29 $\frac{1}{2}$	26	7 $\frac{1}{2}$
5	50		27	25 $\frac{1}{2}$	7 $\frac{1}{2}$
6	50	Δ L. abt. 2° to point B.T.W. 16'3"	28	25	7 $\frac{1}{2}$
7	50	B.T.S.W. 16'6" (Blazed with ski pole)	28 $\frac{1}{2}$	24 $\frac{1}{2}$	7 $\frac{1}{2}$
8	50		26	24	6 $\frac{3}{4}$
9	50	Δ L. abt. 2° to point. B.T. 13'6" S.W.	26 $\frac{1}{2}$	25	7
10	50		26	24 $\frac{1}{2}$	7
11	50	B.T.W. 17'3" (Blazed with ski pole)	25 $\frac{1}{2}$	24 $\frac{1}{2}$	6
12	50		23	22	5
13	50		23 $\frac{1}{2}$	23 $\frac{1}{2}$	7
14	50		27	26	6 $\frac{1}{2}$
15	50		28 $\frac{1}{2}$	27	7 $\frac{1}{2}$
EASTERLY COURSE					
1		At monument sample taken 14' S. at right angle to westerly course	29 $\frac{1}{2}$	28	7 $\frac{1}{2}$
2	50	thence from monument east in line with first telephone pole.	27 $\frac{1}{2}$	26	7 $\frac{1}{2}$
3	50		30 $\frac{1}{2}$	28	8
4	50	Δ R. to second tel. pole	30 $\frac{1}{2}$	29 $\frac{1}{2}$	8
5	50		33	32 $\frac{1}{2}$	9 $\frac{3}{4}$
6	50	6' W. of pole	32	31 $\frac{1}{2}$	8 $\frac{1}{2}$
7	50	Δ R. abt. 10°	31	30	7 $\frac{1}{2}$
8	50		38	29	9 $\frac{1}{2}$
9	50		27	25 $\frac{1}{2}$	6 $\frac{1}{2}$
10	50	B. 9' S. to pole $\frac{14}{24}$	26	25 $\frac{1}{2}$	7
11	50	Δ L. 45° to B. 12' W. pole $\frac{14}{25}$	30	20 $\frac{1}{2}$	7 $\frac{3}{4}$
12	50	Δ L. 30° to B. 15' L. pole $\frac{14}{27}$	27 $\frac{1}{2}$	26	7 $\frac{3}{4}$

DESCRIPTION OF COURSE

MEASUREMENTS

Sta.	Dist.	Remarks	Depth	Core	Water Contents	Remarks.	
13	50		31	30	8		
14	50		33 $\frac{1}{2}$	31 $\frac{1}{2}$	8		
15	50	Δ R.25° to pole $\frac{14}{29}$ N.W. pole $\frac{14}{27}$ 33'	30 $\frac{1}{2}$	29	8		
16	50		36	24	9		
17	50		32	31	8		
18	50		32 $\frac{1}{2}$	31	8		
19	50		27	24 $\frac{1}{2}$	6 $\frac{1}{2}$		
20	50	Δ R.20° to pole $\frac{14}{31}$ S.W.B.T. tall tam.18'9"	31	26	7 $\frac{1}{2}$		
21	50		30 $\frac{1}{2}$	29	8		
22	50		28 $\frac{1}{2}$	28	7		
23	50		28 $\frac{1}{2}$	26 $\frac{1}{2}$	7 $\frac{1}{2}$		
24	50		34	32 $\frac{1}{2}$	9 $\frac{1}{2}$		
25	50		32 $\frac{1}{2}$	30 $\frac{1}{2}$	8 $\frac{1}{2}$		
26	50	26'W.of pole $\frac{14}{31}$ & 45' N.W. of 4th of July tree.	32	31	8		
			41	1203.0	1107.5	311.5	TOTALS
				29.3	27.0	7.6	AVERAGES.

$$\text{Average Density } \frac{7.6}{29.3} = 26.9\%$$

TIME-----Feb. 21, 1921 Began, 4:00 P. M. Finished 5:00 P. M. (Westerly Course)

-----Feb. 22, 1921 " 9:00 A. M. " 12:00 M. (Easterly Course)

WEATHER-----Feb. 21, 1921 Clear. Feb. 22, 1921 Snowing more or less.

TEMPERATURE-----

CHARACTER OF SNOW-----6" loose snow on top, frozen underneath.

CONDITION OF SOIL-----Soft. No frozen ground encountered.

COURSE -----Sherwin
 AVERAGE ELEVATION -----3000 feet.
 LOCATION -----About 1/4 mile east of section house
 CHARACTER OF FORESTATION -----
 NATURE OF SOIL -----Humus.

DESCRIPTION OF COURSE			MEASUREMENTS			
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks.
1	13	Started at White Pine, old blaze chopped across & Blue thence 2'5" to the R. of white fir blazed and blue	35	20	7½	
2	50		41½	40½	10	
3	43		39½	35	11	3" of dirt
4	70		39	33½	10½	
5	50		33	26	7½	
6	13	Above mentioned white fir				
6	50		31	27	9¼	1/2" of dirt
7	46		39½	37	11	
		Passes near small blazed cedar				
8	75		36½	33½	9½	
9	58		45½	36	13	
10	48		42	35½	10½	
11	50		35½	31	9½	
12	50	Sample taken 6" west	38	34½	12½	
13	50		33½	30	8	
14	50	L. 85° R.T. 3'L. of line 37' beyond Sta. 14	40½	37½	11	
15	50		38	36½	10½	
16	50		36	28	10	1/2" of dirt
		Passes 6" from tree blazed & blue				
17	50		36	32	10	1/2" of dirt
18	50		40½	35½	11½	
19	50		42½	39	11	
20	50	R. 90° B.T. 26' W. marked R.P.	39½	36	10½	
21	50	thence 1 Ft. to right of Big tree blazed in bark	37½	32½	10	
22	50		37	33½	10¼	
23	50		42	40	12½	
24	50		37	26	8½	
25	50		36½	35½	10½	1" of dirt

DESCRIPTION OF COURSE		MEASUREMENTS					
Sta.	Dist.	Remarks	Depth	Water Core Content	Remarks.		
26	50		42	34½	111		
27	50		38½	38	10½		
28	50		32	28	9		
		Passes 2' from tree old blaze marked Blue X					
29	43		36	34½	9½		
30	50		40½	33	10½		
31	50	R.F. center of line 5' distant blazed and marked R.P. in blue	35½	24	8½		
			31	1177.0	1024.5	314.0	TOTALS
				38.0	38.0	10.1	AVERAGES

Average density $\frac{10.1}{38.0} = 26.5\%$

TIME -----Feb. 24, 1931. Began 1:15 P. M. Finished 3:50 P. M.
 WEATHER-----Bright sunshine all day.
 TEMPERATURE-----Very warm.
 CHARACTER OF SNOW---Very wet. Had difficulty holding core in tube.
 CONDITION OF SOIL---Soft. No frozen ground encountered.

COURSE-----Huckleberry Mountain.
 AVERAGE ELEVATION-----5000 Feet.
 LOCATION-----T. 49 N., R. 5 W.B.M., About one mile south from the
 head of Liberty creek.
 CHARACTER OF FORESTATION-----
 NATURE OF SOIL-----

DESCRIPTION OF COURSE		MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Core Content	Water	Remarks
1		White Fir abt. 25' tall 600' to 700' S.40°E. of Cabin, Blazed and marked X in blue	64"	56"	19 $\frac{3}{4}$	
2	50'		53 $\frac{1}{2}$	49 $\frac{1}{2}$	18 $\frac{1}{2}$	
3	50		63	42 $\frac{3}{4}$	16	
		Passes 3'3" from small white fir (Blazed & marked blue.				
4	50		62	57 $\frac{1}{2}$	20 $\frac{1}{2}$	
5	50		50	46	16 $\frac{1}{2}$	
		28'4" ΔR.55°R. P. Dead snag 7'6" (marked xblue)				
6	44'		43	38	15 $\frac{1}{2}$	
7	50		37 $\frac{1}{2}$	34 $\frac{1}{2}$	13 $\frac{1}{2}$	1 $\frac{1}{2}$ " of dirt
8	50		56 $\frac{1}{2}$	48 $\frac{1}{2}$	18 $\frac{1}{2}$	Wood ?
9	50		42 $\frac{1}{2}$	41 $\frac{1}{2}$	15 $\frac{1}{2}$	1" of dirt
10	50		46	45	18	
		B.T.63'6" ahead B.T.L.26° (Blazed & Blue)				
11	50		61	48 $\frac{1}{2}$	18 $\frac{1}{2}$	1/2" of dirt
12	50		64	59 $\frac{1}{2}$	21	
13	50		45	42 $\frac{1}{2}$	16	
14	48	B.T.N.45°E. 2' (Blazed & Blue)	55 $\frac{1}{2}$	54	19	
15	50		49	42 $\frac{1}{2}$	17 $\frac{1}{2}$	
16	50		48	46	18 $\frac{1}{4}$	1/2" of dirt
17	50	B.T.N.90°E. 24' Red Fir (Blazed & Blue)	40	38	15 $\frac{1}{2}$	
		B.T.N.15°E 10' Dead Tree " "				
18	50		64	44	17 $\frac{1}{4}$	
19	50		65 $\frac{1}{2}$	55	20	
20	50		57	43	16	
21	50	Sample taken 3' west of line	66 $\frac{1}{2}$	62 $\frac{1}{2}$	23 $\frac{1}{2}$	
22	50		49	55 $\frac{1}{2}$	17 $\frac{1}{2}$	
23	50		42	38	16 $\frac{3}{4}$	
24	50		45	41	17 $\frac{1}{4}$	
		Bet. 2 Trees 1 R.4'6" (Blazed on back) 1 L. 5'4" (Blazed & blue)				
25	65					
26	50	Sample taken 2' South of line	49 $\frac{1}{2}$	43	19	1 $\frac{1}{2}$ " of dirt
27	50		44 $\frac{1}{2}$	43	16	1" of dirt
28	50		53 $\frac{1}{2}$	51 $\frac{1}{2}$	20 $\frac{1}{4}$	
29	50		46	42 $\frac{1}{2}$	16	1 $\frac{3}{4}$ " of dirt
30	51	ΔL.40° B.T.15°R.47'7" (Blazed & Blue)	41	39	14 $\frac{1}{2}$	On log ?
		B.T.130° L.21'3" (dead snag blazed & blue)	56 $\frac{1}{2}$	55	20 $\frac{1}{4}$	1" of dirt.

DESCRIPTION OF COURSE			MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks	
31	50		50 $\frac{1}{2}$	48	17 $\frac{1}{2}$		
32	50		77	76	27 $\frac{1}{2}$	1/2" of dirt	
33	50		67	64	24 $\frac{1}{2}$		
34	50	50° R. 30° B. T. R. 105° 8' 6" B. T. L. 45° 12' 8" (Blazed & Blue)	62	60 $\frac{1}{2}$	20 $\frac{1}{2}$	1/2" of dirt	
35	50		69	62 $\frac{1}{2}$	21		
36	51		75 $\frac{1}{2}$	51 $\frac{1}{2}$	17 $\frac{1}{2}$		
37	50		73 $\frac{1}{2}$	46	15	1" of dirt	
38	50		43 $\frac{1}{2}$	46 $\frac{1}{2}$	17		
39	50	No Stake, dropped branch marked	55 $\frac{1}{2}$	55 $\frac{1}{2}$	19 $\frac{1}{2}$	1" of dirt	
40	50	B. T. 35° R. 8' B. T. 15' on line	65 $\frac{1}{2}$	56 $\frac{1}{2}$	19 $\frac{1}{2}$		
			40	2239.5	2009.5	740.5	TOTALS
				56.	50.2	18.5	AVERAGES

$$\text{Average Density } \frac{18.5}{56.0} = 33.0\%$$

TIME ----- Feb. 26, 1921, Began 12:00 M. Finished 4:30 P.M.

WEATHER ----- Bright sunshine with occasional fog. Dense fog at lower elevation almost all day.

TEMPERATURE -----

CHARACTER OF SNOW ---- Very wet at most stations. Dry and frozen at a few.

CONDITION OF SOIL ---- No frozen ground. Almost all over course, soft and damp.

COURSE-----Sunset.
 AVERAGE ELEVATION-----5500 Feet.
 LOCATION-----About one mile southeast of Sunset Park.
 CHARACTER OF FORESTATION-----Stations one to seventeen in Guelph pole line clearing.
 Balance in light green timber.
 NATURE OF SOIL.

DESCRIPTION OF COURSE		MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Water Core Content	Remarks.	
1		4'E of cor. pole of Guelph, blazed Θ	74	66	27	2" of dirt
2	50'	thence	75	72	27	
3	50'		65	52	19 $\frac{1}{2}$	1" of dirt
4	50'		62	53 $\frac{1}{2}$	22 $\frac{1}{2}$	
5	50'		68	66 $\frac{1}{2}$	23	
6	50'		84	72 $\frac{1}{2}$	29	3 $\frac{1}{2}$ " of dirt
7	50'		78	70 $\frac{1}{2}$	27	2 $\frac{1}{2}$ " of dirt
8	50'		81	70	26	
9	50'		78 $\frac{1}{2}$	68 $\frac{1}{2}$	24	
10	50'		81	77	28	1 $\frac{1}{2}$ " of dirt
11	50'		80	70 $\frac{1}{2}$	24	
12	50'		82 $\frac{1}{2}$	67	26 $\frac{1}{2}$	
		Passes 4th pole N of cor. blazed 3'10"				
13	45'		90	81	29	1" of dirt
14	50'		71 $\frac{1}{2}$	65 $\frac{1}{2}$	24	
15	50'		77	73	25	
16	35'		84	79 $\frac{1}{2}$	30	
		22' Δ R.115°3'3" E. of 5th pole N of cor.				
17	50'	Thence	80	77	29	
18	49'		53 $\frac{1}{2}$	49	17	
19	50'		62	77	28	2" of dirt
20	50'		100	83	30	
21	50'		84 $\frac{1}{2}$	75 $\frac{1}{2}$	28	
22	50'		91 $\frac{1}{2}$	88	32	
		Passes 2'5" L of large hemlock				
23	50'	Δ R.85°E.21'S" about 5' L. old snag	95	88	29 $\frac{1}{2}$	
24	50'	Thence	87 $\frac{1}{2}$	77 $\frac{1}{2}$	35	
25	50'		79	75 $\frac{1}{2}$	28	
26	50'		87	77	29	3 $\frac{1}{2}$ " of dirt
27	50'		89	78	26	
28	50'		77	74	27	
29	50'		65	57	23	1" of dirt
30	50'		82 $\frac{1}{2}$	72	25	

DESCRIPTION OF COURSE		MEASUREMENTS			Remarks.	
Sta.	Dist.	Depth	Core	Water Content		
31	60'	50 $\frac{1}{2}$	39 $\frac{1}{2}$	13		
32	50'	82 $\frac{1}{2}$	81	28	1" of dirt	
33	50'	73	51	22	2" of dirt	
34	50'	92 $\frac{1}{2}$	79	30		
35	50'	71 $\frac{1}{2}$	68	24		
36	50'	128	123 $\frac{1}{2}$	49	drift	
37	50'	63 $\frac{1}{2}$	62 $\frac{1}{2}$	25	2 $\frac{1}{2}$ " of dirt	
38	Passes 1'10" from blazed tree 50' B.T.L. 198° 16 feet		50	45	17	
		38	2994.5	2708.0	1006.0	TOTALS
			78.9	71.2	26.3	AVERAGES

Average density $\frac{26.3}{78.9} = 33.4\%$

TIME-----March 1, 1921 Began 1:00 P. M. Finished 4:40 P. M.
 WEATHER-----Cloudy; some sunshine, some snow.
 TEMPERATURE-----About freezing.
 CHARACTER OF SNOW--Fairly dry
 CONDITION OF SOIL--Soft; no frozen ground.

COURSE-----Look-out
 AVERAGE ELEVATION-----5250 Feet.
 LOCATION-----1/2 mile E 60° W from Look-out station.
 CHARACTER OF FORESTATION-- Open. Largely fire killed timber, some green timber.
 NATURE OF SOIL-----

DESCRIPTION OF COURSE		MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Gore	Water Content	Remarks
1.		B.T.N.N.E. 18'9" B.T.N.16'2"	68"	66"	23 1/2"	
2	50'	Thence S. 55° W.	63	62	24	
3	50'		64	61	32	2" of dirt
4	50'		77 1/2	77 1/2	30	1 1/2" of dirt
5	50'		63	61	24	
6	50'		72	70	28	
7	50'		66	65	25 1/2	
8	50'		77 1/2	69 1/2	26 1/2	5 1/2" of dirt
9	50'		74	72	30	
10	50'		76	69	28	dirt frozen (?)
11	50'		85	82	31	2" of dirt
12	50'		80	75	31	4" of dirt
13	50'	B.T.S.25° W 34' B.T.S.90° W 19'	83 1/2	79	30	
14	50'		80 1/2	78	29 1/2	
15	50'		82	77	29	
16	50'		81 1/2	80	32	1" of dirt
17	50'		80	79	30	
18	50'		80 1/2	76 1/2	30	2 1/2" of dirt
19	50'		75	66	25	
20	50'	△ 90° L.B.T. S.40° W. 22' B.T.N.70° W.19'5"	74	72	27	
21	50'	Thence S. 30° E.	74	72	26	2" of dirt
22	50'		87	83	32	
23	50'		72	69	35	
24	50'		81	74	29	1" of dirt
25	50'		80	75	27	
26	50'		78	73	26	
27	50'		67	65	23	Fog ?
28	50'		84	83	30	2" of dirt
29	50'		85	84	27	1" of dirt
30	50'		86	83	30	2" of dry dirt
31	50'		80	74	29	
32	50'	B.T.N.65° W.10'10" B.T.S.80° E. 12'.	111	91	34	1" of dirt
33	50'		78	78	31	
34	50'		77	76	30	
35	50'		82	81	30	

6		DESCRIPTION OF COURSE	MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks	
36	50'		86	80	30	1" of dirt	
37	50'		90 $\frac{1}{8}$	82 $\frac{1}{2}$	30	4 $\frac{1}{2}$ " of dirt	
38	50'		74	74	27	dirt frozen(?)	
		Passes 1/2" from blazed dead snag					
39	50'		80	80	30	1/2" of frozen dirt	
40	50'		89	86	32 $\frac{1}{2}$		
			40	3165.5	3022.0	1144.5	TOTALS
				79.1	75.6	28.5	AVERAGES

Average density $\frac{29.6}{79.1} = 36.2\%$

TIME-----March 2, 1921 Began 10:35 A.M. Finished 2:35 P. M.
 WEATHER-----Day cloudy. Wind light. Inclined to snow.
 TEMPERATURE-----A little below 32° F.
 CHARACTER OF SNOW---New snow, rather damp. Packed under snow-shoes.
 CONDITION OF SOIL---Unfrozen except at a few places, which are doubtful.

COURSE-----Twin Creek
 AVERAGE ELEVATION-----5100 Feet.
 LOCATION-----One mile westerly from pass.
 CHARACTER OF FORESTATION-----
 NATURE OF SOIL-----

DESCRIPTION OF COURSE			MEASUREMENTS			
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks
1		1 1/8 mile W. of summit of twin Creek pass B.T.B.45°E. B.T.N. 30°W.	82	80	29	2" of dirt
2	50	thence N. 80° E.	59	50	21 1/2	
3	50		88	86	30	
4	50		75	73	26 1/2	
5	50		75	73	27	
6	50	△ R.70° B.T.L.15'2" B.T.R.4'10"	77	71	26	
7	53	thence S. 30° E.	82	80	28	
8	50		82	79	28 1/2	
9	50		74	68	23	
10	50	△ L.55° B.T.L.5'9" B.T.R.28'2"	84	75	29	dirt
11	50	thence S. 85° E.	75	70	27	2" of dirt
12	50		62 1/2	57 1/2	23	1 1/2" of dirt
13	50	△ R.10° B.T.L.30' B.T.R.13'8"	65	84	31	Photo
14	50	thence S. 75° E.	84	82 1/2	31	1" of dirt.
15	50		86	80	30 1/2	1" of dirt
16	50		85	63 1/2	31	
17	50		70	68	24	
18	50	△ R.60° B.T.L.3'10" B.T.R. 15'2"	59	58	23 1/2	
19	50	thence S. 15° E.	74	70 1/2	27	
20	50		94 1/2	93	30	1 1/2" of dirt
21	50		75	70	25	1" of dirt
22	50		77	71	28	
23	50	△ L.95° B.T.L.8'3" (4" fir) B.T.R.5'9" (3" fir)	76	69	28	
24	50	thence N. 70° E.	63	57	21	1" of dirt.
25	50		56 1/2	55	21	1 1/2" of dirt.
26	50		73	66	22	
27	50	△ R.35° B.T.L.6'4" B.T.R.25'0"	82	75	29	
28	50	thence S. 65° E.	84	73	26	1" of dirt.
29	50		53	49	30 1/2	

DESCRIPTION OF COURSE		MEASUREMENTS					
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks	
30	50		79	67	26 $\frac{1}{2}$		
31	50	Δ L. 75° B.T.L. 1'7" B.T.R. 5'0"	70	46	22	1" of dirt.	
32	50	thence N. 29° E.	73	69	26		
33	50		65	57	22		
34	50		78	71	27	1" of dirt.	
35	50		84	76	28		
36	50	Δ L. 30° B.T.L. 14'2" B.T.R. 29'8"	87	84	27 $\frac{1}{2}$	1" of dirt.	
37	50	thence N. 60° W	73	69 $\frac{1}{2}$	27		
38	50		70	60	23	2" of dirt.	
39	50	B.T.L. 5'0" B.T.R. 14'2"	81	73	27 $\frac{1}{2}$	2" of dirt.	
			39	2957.5	2739.5	1027.0	TOTALS
				77.0	70.4	26.3	AVERAGES

$$\text{Average density} = \frac{26.3}{77.0} = 34.2\%$$

TIME-----March 5, 1931, Began 1:30 P. M. Finished 5:30 P. M.
 WEATHER-----Clear all day. Slight wind on sunset.
 TEMPERATURE-----Below 32° F. all day.
 CHARACTER OF SNOW-----Fairly dry.
 CONDITION OF SOIL-----Soft; none frozen.

COURSE-----Fard's Park
 AVERAGE ELEVATION-----6550 Feet
 LOCATION-----About 700' Southeast of Forest Service cabin.
 CHARACTER OF FORESTATION-----1st half, few scattering trees; 2nd half, some timber.
 NATURE OF SOIL-----Soft loam.

DESCRIPTION OF COURSE		MEASUREMENTS			Remarks.	
Sta.	Dist.	Remarks	depth	Core		Water Content
1		1 B.T.L.24' (Large balsam blazed)				
		1 B.T.L.31'8" (Small balsam blazed)	119	116	44	
2	50	thence S. 90° E	121	116	45	
3	50		117	107	42	
4	50		102	100	39	
5	50		132	130	50	1" of dirt
6	50		109½	100½	45	1½" of dirt
7	50		125½	124½	47	1½" of dirt
8	50		105½	101½	41	1½" of dirt
9	50		103½	96½	42	2½" of dirt
10	50		147	146	57	
11	50		129½	122½	51	1½" of dirt
12	50		115	113	46	
13	50	B.T.R.4'8" B.T.L.2'	101	69	35	2" of dirt
14	50		114	106	44	
15	50		102	94	39	
16	50		111½	110½	46	1½" of dirt
17	50		134	127	55	
18	50		120	119	52	
19	50	B.T.R.19'7" B.T.L.14'5"	97	97	39	1" of dirt
20	50		99½	95½	40	
21	50		91	88½	34	Rock S
22	50		124	123	51	
23	50		107	101	45	2" of dirt
24	50	Δ R.25° B.T.R.21' B.T.L.34'5"	96	93	39	
25	50	thence S. 55° E.	97½	92	37½	1½" of dirt & grass
26	50		112	111	42	
27	50		124	116	45	
28	50		130	129	50	
29	50		118	106½	41	
30	50	Δ L.50° B.T.R.18' B.T.L.30'9" (small tree beside 2 large ones)	119	112½	47	2" of dirt
31	50		122	114	45	

DESCRIPTION OF COURSE			MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks	
32	50		85	74	34	2" of dirt	
33	50		126 $\frac{1}{8}$	122	47		
34	50		113	102	44	2" of dirt	
35	50		109	107	41		
36	50		120	111	46		
37	50		94	85	33	on rocks	
38	50		123	118	47 $\frac{1}{2}$	on rocks	
		Touch Blazed tree on south side	—				
39	50		56	41	20	3" of dirt	
40	50	B.T.R. 15'10" B.T.L. 15'6"	105	103	42		
			40	4477.5	4245.0	1728	TOTALS
				112	106	43.2	AVERAGES

$$\text{AVERAGE DENSITY } \frac{43.2}{112.0} = 38.6\%$$

TIME - - - - - March 9, 1921, Began 7:40 A.M. Finished 11:30 A.M.
 WEATHER - - - - - Bright sunshine, strong wind.
 TEMPERATURE - - - - - Abt. 30° to 32° F.
 CHARACTER OF SNOW - - - - - Dry on top, wet below.
 CONDITION OF SOIL - - - - - Soft.

COURSE-----Cedar Crossing.
 AVERAGE ELEVATION-----46900 Feet.
 LOCATION-----Southeast from Forest service cabin.
 CHARACTER OF FORESTATION--Fairly wooded course; large trees.
 NATURE OF SOIL-----Humus.

DESCRIPTION OF COURSE			MEASUREMENTS				
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks.	
1	50'	B.T.R. 11'7" B.T.L. 13'1"	114	112	42		
2	50'	Fence N 45° W	138	133	50		
3	50'		137	135	47		
4	50'		127	122	46	3" of dirt	
5	50'		138	104	40		
6	50'		128	123	45		
7	50'		128	126	45		
8	50'		130	127	45		
9	50'		137	135	51		
10	50'		129	127	49	1" of dirt	
11	50'	S.E. corner tool house R28'11" at F.S. cabin xx Blue B.T.L. 20'11"	144	117	45		
			11	1440.0	1359.0	505.	TOTALS
				131	124	45.9	AVERAGES

$$\text{Average density } \frac{45.9}{131.0} = 35.0\%$$

TIME-----March 15, 1921. Began 9:20 A.M. Finished 10:30 A.M.
 WEATHER-----Clear & cold at start. Storm & high wind came up. Unable to proceed.
 TEMPERATURE-----About 15° F.
 CHARACTER OF SNOW--Dry fresh snow about two feet. Frozen below.
 CONDITION OF SOIL--Unfrozen.

COURSE-----Roland.
 AVERAGE ELEVATION-----5200 Feet
 LOCATION-----Near Summit of Bitter Root Range at the head of Cliff
 creek N. of Taft tunnel.
 CHARACTER OF FORESTATION--Stations one and two in C.M. & St. P. clearing
 Stations three to twelve in old burn porcupine
 timber. Balance of course in fairly heavy timber.
 NATURE OF SOIL-----Humus.

DESCRIPTION OF COURSE			MEASUREMENTS			
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks
1		Midway bet. two H. frame- poles of C.M. & St.P.Ry.on Summit	72"	58"	20"	
2	50'	Thence N. 60°W	54	53	14	
3	50'		122	120	58	
4	50'		115	111	40	2" of dirt
5	50'		97	95	32	
6	50'		120	118	42	1" of grass
7	50'		111½	107½	35	2½" of dirt
8	50'		108	105	34	
9	50'		124	123	41	
10	50'		124½	122½	40	1½" of dirt
11	50'		119	115	40	
		Passes about 1' from blazed tree				
12	50'		125	120	43	1½" of dirt
13	50'		99	96	35	1" of dirt
14	50'		136½	133½	44	1½" of dirt
15	50'		140	133	45	
16	50'	AR. 40° B.T. 14' 8" B.T.L. 6"	123	119	40	1" of dirt
17	50'	Thence N 20°W	124	121	40	
18	50'		126	123	42	1" of dirt
19	50'		129	123	41	
20	50'		119	110	38	
		Passes bet.blazed trees 18" apart				
21	50'		109	84	30	1" of dirt
22	50'		110½	107½	32	2½" of dirt
23	50'		139½	126½	42	1½" of bear gra.
24	50'	AR. 80° B.T.R. 5' B.T.L. 6' 9"	134	125	41	
25	50'	Thence N 60°E	138	135	45	
26	50'		138½	120½	40	1½" of bear gra.
27	50'		134	129	44	2" of dirt
28	50'	AR. 100° B.T.R. 9' 4" B.T.L. 11' 5" Thence S 20° E	110	79	33	
29	50'		117	109	33	
30	50'		133	131	44	1" of bear grass
31	50'		114½	106½	37	2½" of dirt
32	50'		109	98	31	3" of dirt
33	50'		99	92	34	3" of dirt

DESCRIPTION OF COURSE			MEASUREMENTS			
Sta.	Dist.	Remarks	Depth	Core	Water Content	Remarks
34	50'		131	124	41	1" of dirt & grass
35	50'	Passes about 8" L. of blazed tree	117½	116½	41	1½" of dirt
36	50'		140	136	47	2" of dirt
37	50'		130	134	44	
38	50'		124	119	40	3" of dirt
39	50'		118½	108½	39	2½" of dirt
40	50'	B.T.R. 6'4" B.T.L. 22'5" about 32' to intersection of course	(99	77	33	3" of dirt
			40 (4732.5	4464.5	1535	TOTALS
			(
			118.3	111.6	38.4	AVERAGES
			Average Density $\frac{38.4}{118.3} = 32.5\%$			

TIME ----- March 17, 1921 -- Began at 12:15 P.M. Finished at 3:05 P.M.
 WEATHER ----- Raining & Snowing. A little wind.
 TEMPERATURE ----- About 35° F.
 CHARACTER OF SNOW ----- Very wet on top 2' to 3' below frozen crusts.
 CONDITION OF SOIL ----- Unfrozen.

DRAINAGE AREA OF THE COEUR D'ALENE LAKE WATERSHED-IN SQ. MILES.

	-ELEVATION-						TOTALS
	2000 to 3000	3000 to 4000	4000 to 5000	5000 to 6000	6000 to 7000	Above 7000	
Coeur d'Alene River-							
Above Cataldo	166.75	502.25	402.00	126.50	17.00		1214.50
Above the mouth	310.50	612.00	426.50	131.75	17.00		1497.75
St. Joe River-							
Above Calder	52.08	245.72	396.81	334.18	55.71	.82	1085.32
*Above the mouth	369.02	604.84	524.05	346.85	56.73	.82	1902.31
*Includes St. Maries							
St. Maries River-							
Above Lotus	86.10	223.75	102.20	7.95			420.00
*Above the mouth	112.02	257.76	102.20	7.95			479.93
*Included in St. Joe							
TOTAL AREAS							
Above Gaging Stas.	304.93	971.72	901.01	468.63	72.71	.82	2719.82
Above the mouths	679.52	1216.84	950.55	478.60	73.73	.82	3400.06
Total Area of Watershed	974.60	1312.40	971.73	479.42	73.73	.82	3812.70
Per Cent of Total	25.56%	34.42%	25.49%	12.57%	1.94%	0.02%	

The normal annual and monthly run-off with the percentage relationship of the monthly to the annual is given in the following table:

Table — Normal Monthly and Annual Run-off of Bend Breille River at Newport, Washington.

Based on years 1903-04 to 1920-21 inclusive and corrected for natural storage in Lake Bend Breille.

Months	acre-feet	Per Cent of Annual
October	649,000	3.38
November	796,000	4.15
December	646,000	3.37
January	689,000	3.59
February	613,000	3.19
March	932,000	4.86
April	1,809,000	9.43
May	3,721,000	19.40
June	4,755,000	24.79
July	2,685,000	14.00
August	1,174,000	6.12
September	710,000	3.70
<u>Annual</u>	<u>19,180,000</u>	100.0
April-July	<u>12,970,000</u>	67.62

upon it, furnishes the bulk of the run-off.

Willamette
[10,341,304 A.F.]

Columbia
Valley

Dec	2.6
Nov	8.4
Oct	13.5
Sept	16.6
Aug	13.9
July	13.0
June	10.1
May	8.0
Apr	5.7
Mar	3.6
Feb	2.2
Jan	2.1

Dec-Mar 56.99

Apr-July 27.39

Monthly Percentage of Normal

Burlington	Riparia	Av.
	3.51	3.71
Oct	3.90	4.36
Nov	4.75	4.46
Dec	4.17	4.86
Jan	5.42	5.25
Feb	5.51	9.26
Mar	8.26	14.01
Apr	13.52	20.24
May	20.42	20.41
June	21.10	7.91
July	8.11	2.90
Aug	7.71	2.65
Sep.	2.94	2.65
	<u>2.70</u>	<u>2.65</u>
	99.97	100.02
Major		
Mar-June	64.52	63.30
Apr-July		62.57

Monthly discharge of COLORADO River at YUMA, ARIZ
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
1902				
October				229 164
November				219 650
December				301
January				229 164
February				219 650
March				301 474
April				367 676
May				2211 156
June				2530 115
July				770 255
August				257 203
September				227 246
The year period				7,110,000
1902-3				
October				264 335
November				249 144
December				332 771
January				189 935
February				187 271
March				376 120
April				852 456
May				2074 284
June				3162 526
July				2304 494
August				668 309
September				403 795
The year period				11,100,000

Note:

Monthly discharge of COLORADO River ^{at} ~~near~~ YUMA, ARIZ.
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<u>1903-4</u>				
October				521 538
November				321 263
December				267 041
January				223 507
February				218 406
March				367 573
April				479 484
May				1703 022
June				2607 114
July				1417 105
August				1054 143
September				691 497
The year <u>period</u>				9870 000 ✓
<u>1904-5</u>				
October				715 839
November				366 009
December				275 305
January				499 900
February				1561 000
March				3108 000
April				2251 000
May				2593 000
June				4550 000
July				1864 000
August				744 000
September				386 500
The year <u>period</u>				18,900 000 ✓

NOTE:

Monthly discharge of COLORADO River ^{at} YUMA, ARIZ.
for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<u>1905-6</u>				
October				494 200
November				714 000
December				946 900
January				422 000
February				531 000
March				1 560 000
April				1 930 000
May				3 330 000
June				5 010 000
July				2 400 000
August				1 180 000
September				696 000
The year period				19 200 000
<u>1906-7</u>				
October				719 000
November				578 000
December				1 130 000
January				1 320 000
February				1 040 000
March				1 480 000
April				2 100 000
May				2 380 000
June				5 640 000
July				5 930 000
August				2 310 000
September				1 380 000
The year period				26 000 000

NOTE:

Monthly discharge of COLORADO River at YUMA, ARIZ
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
1907-8				
October				836 000
November				643 000
December				458 000
January				389 000
February				817 000
March				990 000
April				1 060 000
May				1 670 000
June				2 550 000
July				2 000 000
August				1 490 000
September				678 000
The year period				13 600 000
1908-9				
October				585 000
November				481 000
December				978 000
January				615 000
February				772 000
March				978 000
April				1 800 000
May				3 330 000
June				6 250 000
July				4 890 000
August				2 510 000
September				2 890 000
The year period				26 100 000

Note:

Monthly discharge of COLORADO River ^{at} YUMA, ARIZ
_{near}
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<u>1909-10</u>				
October				861 000
November				562 000
December				517 000
January				1 160 000
February				509 000
March				1 500 000
April				1 710 000
May				3 470 000
June				2 800 000
July				904 000
August				592 000
September				367 000
The year period				15 000 000
<u>1910-11</u>				
October				429 000
November				467 000
December				427 000
January				541 487
February				742 610
March				1 067 700
April				1 213 685
May				2 764 960
June				3 818 576
July				3 083 549
August				1 131 983
September				530 388
The year period				16 200 000

NOTE:

Monthly discharge of COLORADO River at YUMA, ARIZ
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
1911-12				
October				1 756 786
November				722 391
December				465 130
January				331 000
February				424 000
March				518 000
April				1 260 000
May				2 510 000
June				6 430 000
July				2 870 000
August				1 400 000
September				582 000
The year period				19 600 000
1912-13				
October				676 000
November				702 000
December				403 000
January				238 000
February				337 000
March				558 000
April				1 520 000
May				2 360 000
June				2 830 000
July				1 300 000
August				580 000
September				525 000
The year period				12 000 000

NOTE:

Monthly discharge of COLORADO River at YUMA, ARIZ.
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<u>1913-14</u>				
October				633 000
November				472 000
December				393 000
January				462 000
February				644 000
March				922 000
April				1 360 000
May				3 310 000
June				6 600 000
July				3 170 000
August				1 350 000
September				591 000
The year period				19 900 000
<u>1914-15</u>				
October				842 000
November				613 000
December				818 000
January				564 000
February				1 510 000
March				953 000
April				1 790 000
May				2 940 000
June				2 890 000
July				1 890 000
August				682 000
September				270 000
The year period				15 800 000

NOTE:

Monthly discharge of COLORADO River at YUMA, ARIZ
 for the years ending Sept. 30, _____

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
1915-16				
October				442 000
November				356 000
December				354 000
January				2 820 000
February				1 630 000
March				2 200 000
April				2 120 000
May				3 360 000
June				3 540 000
July				2 260 000
August				1 670 000
September				738 000
The year period				21 500 000
1916-17				
October				1 640 000
November				708 000
December				454 000
January				562 000
February				440 000
March				603 000
April				1 560 000
May				3 030 000
June				5 350 000
July				5 770 000
August				1 440 000
September				536 000
The year period				22 100 000

NOTE:

Monthly discharge of COLORADO River at YUMA, ARIZ
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
1917-18				
October				465 000
November				422 000
December				420 000
January				405 000
February				323 000
March				1 010 000
April				768 000
May				1 790 000
June				3 680 000
July				2 660 000
August				713 000
September				406 000
The year period				13 100 000
1918-19				
October				473 000
November				479 000
December				451 000
January				231 000
February				398 000
March				544 000
April				1 230 000
May				2 220 000
June				2 040 000
July				1 240 000
August				658 000
September				307 000
The year period				10,300,000

NOTE:

MONTHLY WATER DIVERSIONS

From Colorado River.

Yuma Project

Years 1908- 1915.

(quantities in acre-feet)

MONTH	1908	1909	1910	1911	1912	1913	1914	1915
Jan.	695.7	1523.7	2288.6	3079.4	3187.0	3208	7567	9268
Feb.	1916.8	4526.7	3002.7	4392.2	6292.0	9588	5221	3555
Mar.	2503.7	3596.1	4100.8	5691.7	5576.0	11309	12569	25746
Apr.	2305.4	5968.3	5026.9	7361.5	6474.0	11781	11900	25367
May	2477.8	5210.4	5510.9	9560.2	8968.0	11400	21255	17591
June	2341.8	6753.2	4326.7	9052.4	9670.0	13949	22444	26893
July	2282.8	4869.3	3056.7	6731.6	12155.0 *	15862	26939	34733
Aug.	2391.8	3711.2	4943.1	8775.5	13086.0	16141	24963	29543
Sept.	2119.0	3102.5	3414.8	8109.5	12572.0	13073	26538	29672
Oct.	1601.4	3532.6	2507.0	5032.2	8851.0	8669	27120	20575
Nov.	975.6	1665.7	2614.6	3324.7	5827.0	6035	13199	18907
Dec.	372.5	1481.5	1525.9	1453.1	3751.0	5492	5492	6936 [2015]
Total	21983.7	45940.2	42318.7	72563.8	96409.0	127307	205207	246786

*Siphon water started.

Furnished by USRS

*Recd Tucson Aug 2/28/22
from Project Manager Yuma
letter dated 7/28/22*

Monthly Water Diversions from Colorado River at ^{at} ~~near~~ ^{near} for Yuma Project

Monthly discharge of
for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<i>1915-16</i>				
October				20 575
November				18 907
December				6 936
January				0 ^a
February				0 ^a
March				23 172
April				37 424
May				39 801
June				46 714
July				41 790
August				50 690
September				43 605
The year period				
<i>1916-17</i>				
October				41 253
November				37 160
December				15 942
January				14 806
February				36 500
March				48 777
April				42 436
May				42 825
June				51 001
July				45 980
August				46 768
September				41 877
The year period				

NOTE: Data furnished by U.S.R.S.
a no record given

Monthly discharge from

Monthly discharge of

Colorado

River ^{at} ~~near~~

for Yuma Project

for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<i>1917-18</i>				
October				37 123
November				24 084
December				19 383
January				15 074
February				17 826
March				41 902
April				48 060
May				52 044
June				51 880
July				61 233
August				59 602
September				51 975
The year period				
<i>1918-19</i>				
October				39 964
November				15 877
December				13 320
January				22 181
February				28 096
March				39 269
April				54 085
May				47 973
June				57 420
July				55 083
August				46 918
September				45 726
The year period				

NOTE:

Data furnished by U. S. R. S

Monthly discharges from
Colorado River ^{at} _{near} **for Yuma Project**

Monthly discharge of
 for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<i>1919-20</i>				
October				41 547
November				20 357
December				18 530
January				16 829
February				1 943
March				48 611
April				45 565
May				46 467
June				53 360
July				63 544
August				63 325
September				36 136
The year period				
<i>1920-21</i>				
October				42 167
November				26 909
December				24 012
January				24 945
February				32 496
March				48 681
April				51 354
May				46 550
June				46 806
July				52 989
August				45 141
September				45 727
The year period				

NOTE: *Data furnished by U.S.R.S.*

Monthly discharges from

Monthly discharge of

Colorado

River ^{at} _{near}

for Yuma Project

for the years ending Sept. 30,

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF IN ACRE- FEET.
	Maximum.	Minimum.	Mean.	
<i>1921-22</i>				
October				23 484
November				40 634
December				23 232
January				
February				
March				
April				
May				
June				
July				
August				
September				
The year period				
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
The year period				

NOTE:

Data furnished by U.S.R.S.

Errors in Means

Green River: - Made Dec. 30, 1922 -

Annual		April - July	
+15.1	-30.5	+16.7	-28.5
23.0	11.0	29.3	17.1
26.4	-25.3	0.3	4
25.2	-41.2	39.8	25.3
10.6		28.1	40.2
0.9	-108.0	14.9	<u>-111.1</u>
	100.3	9.8	
<u>+100.3</u>		+129.1	
	9) +61.8	111.1	
	-7.7	<u>+18.0</u>	
	-0.856%	10) <u>+1.80%</u>	
	-0.86%		

Grand River:-

Annual		April - July	
+15.1	-11.0	+45.1	-35.1
23.0		16.7	20.7
26.4		29.3	2.9
<u>+64.5</u>		0.3	28.5
-11.0		39.8	17.1
		+131.2	<u>-104.3</u>
4) <u>+53.5</u>		104.3	
+13.38%		10) <u>+26.9</u>	
		+2.69%	
		+2.69%	

Error in Means

San Juan:

Annual

$$\begin{array}{r} +23.0 \\ 26.4 \\ \hline \end{array} \quad \begin{array}{r} -11.0 \\ \hline \end{array}$$

$$\begin{array}{r} +49.4 \\ -11.0 \\ \hline \end{array}$$

$$\begin{array}{r} 3) +38.4 \\ \hline +12.80\% \end{array}$$

April-July

$$\begin{array}{r} +0.3 \\ 39.8 \\ \hline \end{array} \quad \begin{array}{r} -17.1 \\ \hline \end{array}$$

$$\begin{array}{r} +40.1 \\ -17.1 \\ \hline \end{array}$$

$$\begin{array}{r} 3) +23.0 \\ \hline +7.67\% \end{array}$$

Gila:

Annual

$$\begin{array}{r} +12.7 \\ 15.1 \\ 23.0 \\ 26.4 \\ \hline \end{array} \quad \begin{array}{r} -30.5 \\ 11.0 \\ ~~25.3~~ \\ ~~41.2~~ \\ \hline \end{array}$$

$$\begin{array}{r} +77.2 \\ \hline \end{array}$$

$$\begin{array}{r} ~~-108.0~~ \\ ~~77.2~~ \\ \hline ~~-30.8~~ \\ 8) \hline ~~-3.85\%~~ \end{array}$$

April-July

$$\begin{array}{r} +16.7 \\ 29.3 \\ 0.3 \\ 39.8 \\ \hline \end{array} \quad \begin{array}{r} -28.5 \\ 17.1 \\ ~~3.9~~ \\ ~~25.3~~ \\ ~~40.2~~ \\ \hline \end{array}$$

$$\begin{array}{r} +86.1 \\ \hline \end{array}$$

$$\begin{array}{r} ~~-111.1~~ \\ ~~86.1~~ \\ \hline ~~-25.0~~ \\ 8) \hline ~~-3.13\%~~ \end{array}$$

$$+77.2$$

$$-41.5$$

$$\begin{array}{r} +35.7 \\ \hline \end{array}$$

Annual $+5.95\%$

$$+86.1$$

$$-45.6$$

$$\begin{array}{r} +40.5 \\ \hline \end{array}$$

Apr-July $+6.75\%$

Divisor	Dividend	Quotient
.923	1,002,123	1,085,724
1,085,724	522,721	48.1%
	180,950	16.7
Annual	443,547	40.9
	2,950,200	271.7
	1,339,540	122.9
	589,780	53.5
Total	6,012,738	553.8
.9478	158,915	167,667
167,667	142,821	85.2
	34,320	20.5
Period	127,557	76.1
	455,200	271.5
	114,110	68.1
	79,480	47.4
Total	953,988	568.7

Gila River
at
Kelvin, Ariz.

Corrected Normals { 1,085,724 Ann.
167,667 Period.

.6867	3,096,667	4,509,490
4,509,490	2,710,000	60.1
Annual	3,240,000	71.8
	3,340,000	74.1
.653	2,093,333	3,205,717
3,205,717	2,048,000	63.9
	1,966,000	61.3
	2,266,000	70.7

San Juan River
near
Bluff, Utah

Corrected Normals { 4,509,490 Ann.
3,205,717 Period

Daily gage height, in feet, and discharge, in second-feet, of **COLORADO** River near **TOPOCK, ARIZ.** for the year ending Sept. 30, 1918

Stevens water-stage recorder near
G. M. Bobst [observer]

Used rating table dated 2-8-22 (Feb 1-June 20, 1918)
Indirect method June 21-Sept 30, 1920

NOTE: Insufficient measurements secured to define changes in stage-discharge relation Oct. 1, 1917 to Jan. 31, 1918. Monthly discharges for this period estimated 2,000 second-feet greater than shown for record of Colorado River at Yuma, Ariz. This amount allows for diversions between Topock and Yuma (Loguna Dam and Palo Verde). ACR 2-9-22

Table with columns for months (OCT to SEPT) and days (1-31). Each day entry includes Gage height and Discharge. Includes handwritten notes and corrections in the right margin.

Summary table with rows for TOTAL, Mean, Sec.-ft. per square mile, Run-off, Depth in inches, Maximum, Minimum, and Accuracy. Includes handwritten calculations and totals.

1918 recomputations
are

State of Arizona. Provisional, subject to
revision for publication.
Date collected in cooperation with the
U. S. Geological Survey
Tucson, Arizona, Box 102
University Station, Tucson, Arizona

Daily gage height, in feet, and discharge, in second-feet, of COLORADO

River TOPOCK, ARIZ. near Stevens Water-stage recorder, [observer]

for the year ending Sept. 30, 1919

File Number { Washington District

Table of area: Half tenths 5.19 sq. mi.
Used rating table dated July 8, 1918 Stevens

NOTE: No gage height record, discharge interpolated Dec. 29 to Jan. 2, Apr. 4-8, May 25 to June 2, June 12-17, July 23-27 Aug 9-15-17 Starts shifting control method used thruout year

Table with columns for months (OCT. to SEPT.), days, gage height, discharge, and quarterly/yearly totals. Includes handwritten annotations for data corrections and control shifts.

Vertical notes on the right side of the table, including 'T.G.B.', '7/19/19', and '7/11/19' with arrows pointing to specific rows.

Daily gage height, in feet, and discharge, in second-feet, of

COLORADO

River TOPOCK, ARIZ.

for the year ending Sept. 30, 1920.

Stevens Continuous Water Stage Recorder near G. M. Bobst

Table of use: Indirect method Standard curve used - table dated July 8, 1918 except for short periods May and June

Notes - a Gage height of measurement. b Observer's staff gage reading.

Main data table with columns for months (OCT to SEPT), gage height, discharge, and day. Includes summary rows for TOTAL, Mean, Maximum, and Minimum.

Vertical notes on the right side of the table, including 'Copied from 9-1920 May and June and July recomputed' and '2-14-22'.

Daily gage height, in feet, and discharge, in second-feet, of

COLORADO

River near

TOPOCK, ARIZ. for the year ending Sept. 30, 1921.

Table of use: Lengths ONLY

Used rating table dated

Drainage area square miles.

Stevens Continuous Water-Stage Recorder Gage read to 1/100th a day

NOTE - a Outside staff gage reading. Daily discharge June 26 to July 13, 1921 obtained by hydrograph comparison of records for Lees Ferry and Yuma.

Main data table with columns for months (OCT to SEPT), gage height, discharge, and day. Includes summary rows for totals, mean, maximum, and minimum.

Vertical notes on the right side of the table, including 'RECORD - GAGE CHAIN BROKEN', 'RECORD - NO RECORD', and 'RECORD - FLOAT CAUGHT'. Includes handwritten signatures and dates like '11-29-22' and '11-15-22'.

Year 1921

STATE OF COLORADO

ENGINEERING DEPT.

1000
Run off in/acre-feet of..... SAN JUAN
River at..... ARBOLES
Drainage area..... 1394 Sq. miles. Altitude..... 6001 feet above sea level

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1895						*106.0	39.7	25.9	13.1	12.7	11.7		
96				* 85.5	100.5	26.2	15.7	11.6	18.4	15.4	12.5		
97				115.3	208.6	137.5	42.1	18.6	36.1	62.6	23.6		
98				91.5	115.8	141.9	62.8	16.2	7.3	6.1	5.0		
99					56.4	32.7	32.2	23.7	12.9				
1910								*15.0	7.2	11.5	9.0	7.1	
11	7.5	8.4	88.0	117.7	193.7	217.9	174.2	53.1	46.1				
12	14.3	11.2	53.5	91.9	198.5	165.7	63.8	21.5	11.0	15.4	12.0		
13	°6.2	° 6.4	13.8	98.2	117.0	92.8	24.7	10.5	12.1	19.0	12.1	9.0	421.8
14	°8.6	°10.6	44.6	83.9	165.0	168.0	61.5	35.7	39.2	52.4	16.5		
15	°10.0	° 9.9	27.9	117.0	166.0	196.0	106.0	26.3	32.6	12.9	8.7	8.1	721.4
16	10.9	29.6	126.0	118.0	148.0	174.0	85.8	91.9	31.9	80.2	23.1	15.4	934.8
17	18.6	18.0	45.4	110.0	135.0	247.0	133.0	26.0	13.5	8.2	5.9	4.2	764.8
18	4.2	5.4	41.6	45.4	95.4	123.0	58.5	21.3	20.4	8.2	8.8	4.2	436.5
19	4.4	4.6	25.7	89.1	136.0	113.0	78.6	27.9	14.5	10.7	12.2	18.6	535.3
20	19.7	44.0	58.0	104.0	302.0	277.0	119.0	30.6	13.4	13.3	14.0		
Mean	10400	14800	52500	97500	152500	147900	73300	28500	20600	23500	12500	9500	643,500
Percent per square	1.6	2.3	8.2	15.1	23.7	23.	11.4	4.4	3.2	3.7	2.	1.5	100%

*Fractional record extended.

°Estimated.

Station located in Sec. 21, T. 32 N., R. 5 W. $\frac{1}{2}$ m. above mouth Piedra River.

STATE OF COLORADO

ENGINEERING DEPT.

Run off in acre-feet of ¹⁰⁰⁰ SAN JUAN River at ARBOLES
 Drainage area 1394 Sq. miles. Altitude 6001 feet above sea level

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL	
1895				°101.0	°124.0	*106.0	39.7	25.9	13.1	12.7	11.7		434.1	78
96				* 85.5	100.5	26.8	15.7	11.6	18.4	15.4	12.5		285.8	51
97				115.3	208.6	137.5	42.1	18.6	36.1	62.6	23.6		744.4	117
98				91.5	115.8	141.9	62.8	16.2	7.3	6.1	5.0		444.6	81
99				° 54.2	56.4	32.7	32.2	23.7	12.9	°13.5	° 7.4		233.0	42
1911				117.7	193.7	217.9	174.2	53.1	46.1	°24.5	°12.6		839.8	152
12				91.9	198.5	165.7	63.8	21.5	11.0	15.4	12.0		579.8	105
13				98.2	117.0	92.8	24.7	10.5	12.0	19.0	12.1		386.4	69
14				83.9	165.0	168.0	61.5	35.7	39.2	52.4	16.5		622.2	113
15				117.0	166.0	196.0	106.5	26.3	32.6	12.9	8.7		665.5	120
16				118.0	148.0	174.0	85.8	91.9	31.9	80.2	23.1		752.9	136
17				110.0	135.0	247.0	183.0	26.0	13.5	8.2	5.9		678.6	123
18				45.4	95.4	123.0	58.5	21.3	20.4	8.2	8.8		381.0	69
19				89.1	136.0	113.0	78.6	27.9	14.5	10.7	12.2		482.0	87
20				104.0	302.0	277.0	119.0	30.6	13.4	13.3	14.0		873.3	157
Total				1422.7	2261.9	2218.7	1097.6	440.8	322.5	355.1	186.1			
Mean				94.8	150.8	147.8	73.3	29.7	21.5	23.4	12.4		553.7	
Acre-ft. per sq. mife.														

*Fractional record extended.

°Estimated by comparative method.

STATE OF COLORADO

ENGINEERING DEPT.

Run off in acre-feet of PIEDRA

~~Creek~~

River at ARBOLES

Drainage area 6.50

Sq. miles. Altitude 6000

feet above sea level

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1895							21275	12298	6843	7686	5558		
96				*42700	64378	13626	6825	3603	20648	10760	7200		
97				86876	124512	70751	18200	6456	23564	51650	13983		
98				58195	60196	72060	35970	9162	5296	4304	2202		
99					19369	10056	8670	11068	2940				
1910									4879	7378	6664	5427	
11	11802	7371	44757	109482	118116	107466	84920	24684	20487	73525	21465	13501	638000
12	7518	5752	24659	66935	140140	89507	34963	14870	6590	8956	9158		
13	2460	3890	6820	60700	72600	52100	8550	5800	8150	10800	7080	5980	245000
14	4300	4720	32000	61300	96500	90400	46900	16400	15600	42500	13400	9900	434000
15	4890	7870	26700	112000	111000	111000	47000	13900	14400	10300	6590	5360	471000
16	°4610		89600	102000	40800	91400	50300	49200	15900	67100	15500	6020	
17	8190	7110	11100	88400	129000	152000	73800	13400	8020	5740	4400	2040	503000
18	1330	3110	19800	27400	54500	50000	16400	9270	12500	6090	5720	4640	211000
19	3420	4060	18200	86800	95600	65900	48700	31900	11800	8340	8070	13500	396000
20	12600	19200	32900	87300	208000	158000	80700	26900	7550	8060	10900		
Mean	6110	7010	30700	76200	95300	81000	38200	16600	11600	21500	13100	7370	405000
Acre-ft. per Sq. Mile	1.5	1.7	7.6	18.8	23.5	20.0	9.4	4.1	2.9	5.3	3.2	1.8	

*Fractional record extended

° Estimated from measurement

Station located in Sec. 16, T. 33 N., R. 5 W. at D.&.R.G. Bridge at Arboles.

STATE OF COLORADO

ENGINEERING DEPT.

Run off in acre-feet of..... ANIMAS River at..... DURANGO
 Drainage area..... 812 Sq. miles. Altitude..... 6550 feet above sea level

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1895							23857	31420	21600	19123	14638	*14100	
96				*69000	143020	52066	21459	12236	59742	29207	16304		
97	12185	10245	15651	160915	279981	200190	70841	34029	53929	87155	34070	23780	983000
98	24145	14436	19038	89851	108526	204159	83869	22443	15650	9961	9402		
99				34750	106374	106929	41135	42488	16423	17893	15584	13359	
1900	11028	7317	12234	19874	134227	118413	25148	11006	13745	15765	12206	13184	394000
01				50281									
02				26517	104453	70169	16685	16770	17792	15727			
03				92469	198813	245678	150408	34064	32273	21366			
04							*29100	55523	43914	103238	30407	*19800	
05				87174	239433	375174	112215	50174	31775	32097	17197	*15000	
10	22063	15719	57633	77076	148805	117300	37722	25401	16364	14767	11336	6764	556000
11	14396	9144	28642	102368	190396	236889	200909	55102	34285	*200000	37350	18903	1128000
12	17147	14152	17800	37531	223202	211924	107524	43426	21991	18724	16681		
13	*9220	9000	11900	46800	135000	123000	49600	23900	33400	29600	17300	13800	503000
14	12900	10300	29900	59500	195000	270000	132000	40300	22400	40100	20100	12400	845000
15	12300	9400	17800	71400	138000	204000	105000	33700	22200	20200	16000	13100	663000
16	12400	13600	51900	83400	181000	255000	114000	85800	27900	103000	32600	20000	981000
17	19500	16300	20000	55200	122000	348000	179000	46900	25700	22900	13400	8770	878000
18	12100	7200	18400	32500	116000	167000	55000	36200	45600	21700	16500	16600	545000
Given													
Acre-ft. per sq. mile													

* Fractional record extended.

Station located in Sec. 20, T. 35 N., R. 9 W. at foot bridge on 14th St. near San Juan

Water & Power Co. plant.

STATE OF COLORADO

ENGINEERING DEPT.

Run off in acre-feet of DOS PINOS ^{Creek} River at IGNACIO
 Drainage area 450 Sq. miles. Altitude 6480 feet above sea level

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1899					32404	27907	17770	21459	3660	7809	6129	*3440	
1900	5060	3388	5786										
01				26896	63087	45402	13896	12420	*10400				
02				18563	35494								
03				*40600	103577	134904	*49300	10048	17222	9037			
06				52185	149722	188152		15249	24575				
10									2559	7194	6307	5234	
11	7644	6540	26374	58052	112635	140658	79097	10725	16602				
12	8331	6922	13636	29314	70613	59656	34166	13514	2882	8035	12012		
13			* 5890	41200	75600	49200	6820	1160	9160	11400	7440	6950	
14	4990	6500	23800	43900	93500	138000	69500	8240	1330	26400	12200	6960	
15	3360	5050	15900	55400	80300	116000	45400	4470	6970	5500	4040	4520	756000
16	5830	7760	41700	60600	86000	93100	43500	61700	17800	74600	18800	6200	518000
17	7310	7800	7490	37900	68400	129000	66900	6120	3500	3790	1590	3570	343000
18	4120	3220	11900	15300	43300	40900	10500	1920	13500	710	2230	3940	152000
19	5390	4080	9200	43300	100000	65200	50600	20900	5180	4400	7440	10900	327000
20	11100	15100	23100	48600	125000	129000	64800	10500	1550	5520	9640		
Mean	6310	6640	16800	40900	82600	96900	42500	14200	9130	13700	7980	5750	343000
Accum. Def. surplus	1.8	1.9	4.9	11.9	24.1	28.3	12.4	4.1	2.7	4.0	2.3	1.7	

*Fractional record extended

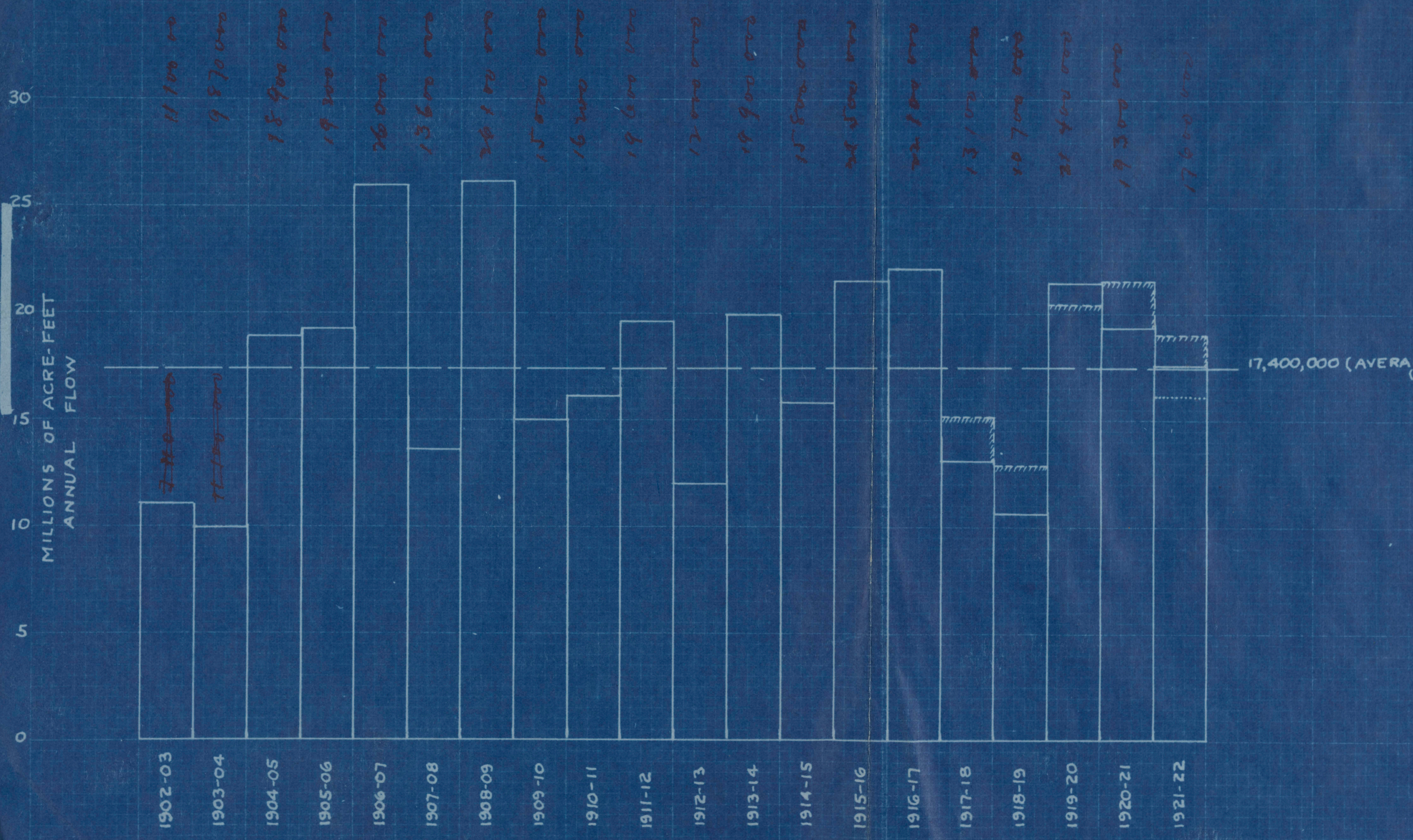
Station located in Sec. 8, T. 33 N., R. 7 W at Highway Bridge.

COLORADO RIVER DATA

AVERAGE ANNUAL FLOW IN ACRE- FEET

LEGEND

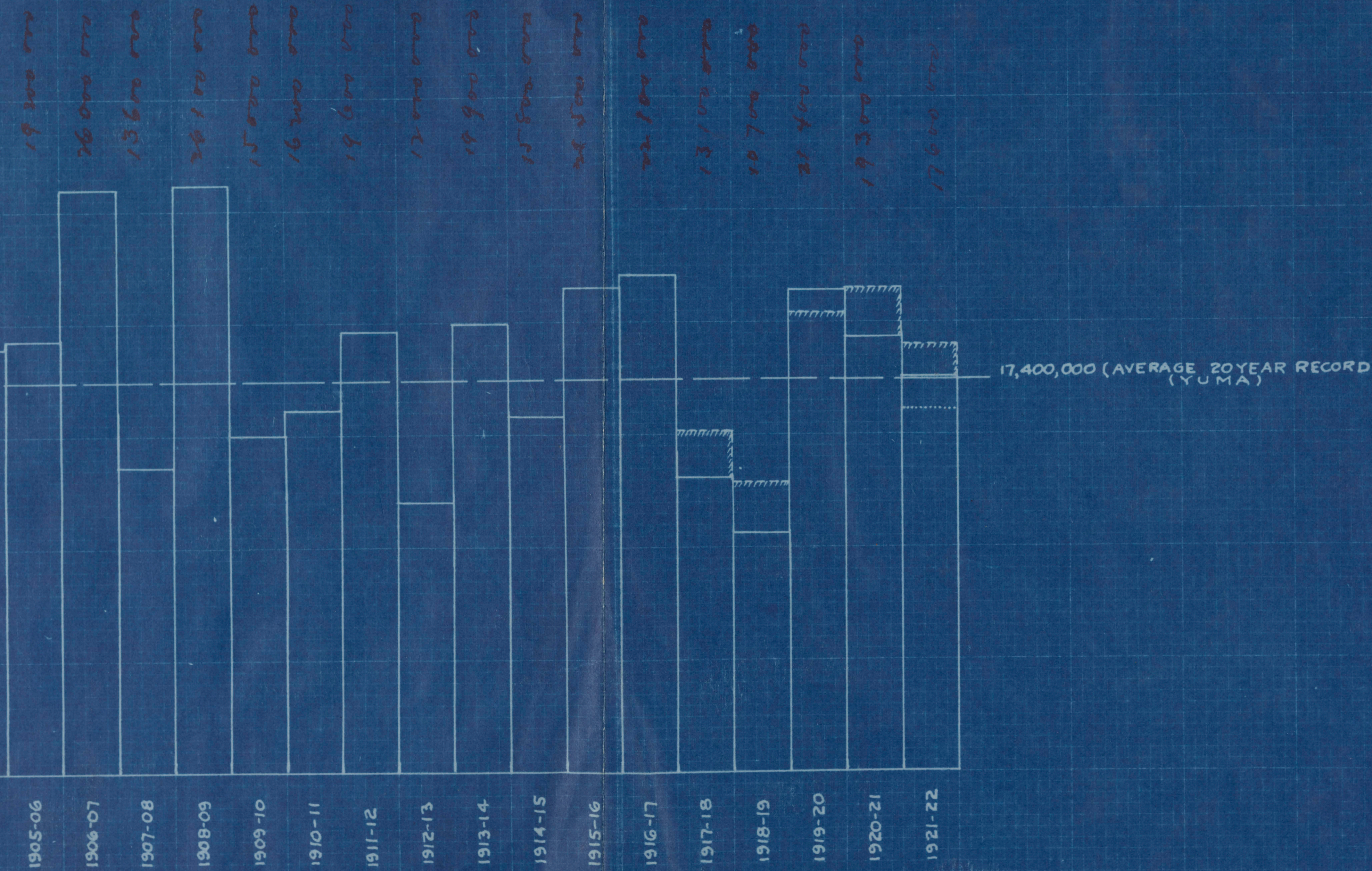
- YUMA
- ~~~~~ TOPOCK
- LEES FERRY



COLORADO RIVER DATA

AVERAGE ANNUAL FLOW IN ACRE - FEET

RY



Year	
Meas. Nos.	
Max. G. H.	
Min. G. H.	
Plotted by	
Checked by	

Office Engineer
District Engineer

CURVE APPROVED BY

Roguel Rice
12/1/21

DATE

Divisor	Dividend	Quotient
42.45	3.11	7.3390
	6.00	14.13
	7.21	16.98
	6.32	14.89
	4.96	11.68
	4.74	11.17
	2.94	6.93
	2.38	5.61
	1.77	4.17
	0.75	1.77
	0.58	1.37
	1.69	3.98
	100.01	

Precipitation

Portland

17.89	1.35	7.55
	2.17	12.13
	2.39	13.36
	1.89	10.56
	1.40	7.83
	1.19	6.65
	1.51	8.44
	1.50	8.38
	0.66	3.69
	0.54	3.02
	0.93	5.20
	[2.36	13.19]
	100.00	

Spokane

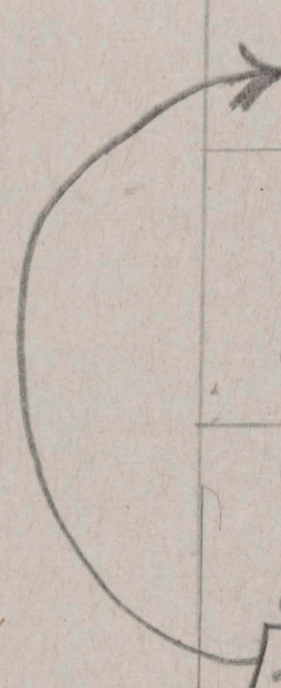


Table — Similarity in Relative Run-Off and
in Precipitation throughout Upper Columbia
Basin.

Months	Run-Off		Columbia		Precipitation		Spokane	
	Pen & Oreille Newport [1903-04 to 1920-21] Acre-Foot P.Ct of Annual		Dalles [1878-79 to 1920-21] A-F. P.Ct of Annual		Portland [1849-1908] In. P.Ct of Annual		In. P.Ct of Annual	
October	649,000	3.38	6,370,000	4.20	3.11	7.33	1.35	7.55
November	796,000	4.15	5,900,000	3.89	6.00	14.13	2.17	12.13
December	646,000	3.37	5,940,000	3.92	7.21	16.98	2.39	13.36
January	689,000	3.59	5,800,000	3.82	6.32	14.89	2.36	13.19 10.56
February	613,000	3.19	5,720,000	3.77	4.96	11.68	1.89	7.83
March	932,000	4.86	8,040,000	5.30	4.74	11.17	1.40	6.65
April	1,809,000	9.43	12,600,000	8.31	2.94	6.93	1.19	8.44
May	3,721,000	19.40	23,200,000	15.29	2.38	5.61	1.51	8.38
June	4,755,000	24.79	32,060,000	21.13	1.77	4.17	1.50	3.69
July	2,685,000	14.00	24,600,000	16.22	0.75	1.77	0.66	3.02
August	1,174,000	6.12	13,400,000	8.83	0.58	1.37	0.54	5.20
September	710,000	3.70	8,100,000	5.34	1.69	3.98	0.93	
Annual	19,180,000	100.0	151,710,000	100.0	42.45	100.0	17.89	100.0
April-July	12,970,000	67.62	92,460,000	60.95	7.84	18.47	4.86	27.16