From Circuit Notebook 2, Aug 6, 1935, "San Juan National Forest"

J.E.C.- 2 8/1/35

Our range situation is characteristic. We have the national forests in Nevada administering the summer ranges of sheep and cattle. Then we have the Taylor Grazing Act providing for the administration of all the rest of the public grazing country. Now we have the Soil Erosion Service entering the field to prevent destruction of the soil which makes the range pasturage possible. It is hard to shape a comprehensive administrative program which will be carried out through many years when there are three administrative organizations working more or less independently of one another in forming plans and in carrying them out.

I am going to leave the whole matter of the date of your return to you. It seems desirable of course that you should be here when school opens; I don't quite like the idea of causing somebody else to organize your classes. However, you know far more about that side of the matter than I do and you also know how important the remainder of the trip will be to your whole plan. The expense must be given some consideration; for even after your return we must square ourselves with Carl in the matter of his car. On the other hand, I am hoping that Mr. McLaughlin will feel inclined to put a little more money into the venture. If he does, then the matter of expense need be given no serious consideration. In any case I want you both to live well and to eat and sleep and travel in real comfort, and safety.× If necessary we may be able to supplement this trip with another one; perhaps next summer, perhaps even later.

As things stand I do not want to be like the man in his office who tells the general in the field how to fight the battle. The general knows far more about it himself. So just use your very best judgment, and I will back any move that you decide to make.

With all kinds of good wishes from Laura and myself and with my very best to Carl, I am

Sincerely yours,

S. B. Doten G.J.

S. B. Doten, Director

SBD:GJ

P.S- Hello Boys! Mr. Doten is in Fallon so I took advantage and couldn't resist underlining safety. Still wish I were a "stowaway". Having fun reading the diary - a check-up. Bestest - Just - Gola

× safety

WELCOME TO DILLON

We are glad to have you visit our city and trust that your stay will be a pleasant one.
Dillon, like all cities, has traffic ordinances which we believe are for the good of all concerned.
Unknowingly you have violated the following ordinance:

No parking on pavement between 4 and 7 A. M. ☒

Parking within white lines only ☐

We ask your cooperation.

Car was here before the sign.

Police Department, City of Dillon


DENNISON MFG. CO. U.S.A.
EC

Circuit Trip
To Study Western Watersheds
No. 3

Stenographic Notes

No.

DATE

From ~~August 5,~~ [Yampa, Colo.] 1935.

To August 21 [Helena, Mont.] 1935.

No. G426

Yampa, Colo., Aug. 5. (7885 ft.)

A delightfully cool and moist night under extra blankets. A country town with the fields in close view.

→ Little rain this summer at Grand Junction, but much at Yampa. Yesterday the rain was steady and the roads slippery. A welcome rain except that it was melting the lettuce crop too much.

Luck Continues.

We were caught here mainly by the rain. It gave us a delightful morning (6137) in which to ride but also a second thought to climb over the Park Range and to see the Colorado near its source.

The trip down stream to Glenwood Springs gave us the chance to look down into the Colorado bed from several vantage points which we could not have done so understandingly if we had followed it up.

D. & S. L. Ry.

As we circled the joint source of the Yampa and the White we found our route paralled by the railroad. It also turned with us into the Park Range, but swung to the south to Kremmling which also was our destination. Here was the solution of our problem

of reaching the snow courses in winter. Pity that the auto maps do not also contain the railroads. I always want to know where and whither.

Ideal Snow Survey Sites

Immediately south of Tabónas (8353 ft.), on the bordering range was a good site. But up Gore Pass to the east is a succession of ideal sites, glades circled by tall, heavy forests, and also far below the summit. Just right for the Yampa and the White. The timberline is approximately 10,500 ft. elevation. This is far below.

And still farther over Gore Pass are a succession of parks and forests, all ideal, lying at the source of a considerable feeder of the upper Colorado.

These could all be reached by team from Steamboat Springs ~~via~~ or Yampa via Tabónas and a shelter cabin at Gore Pass.

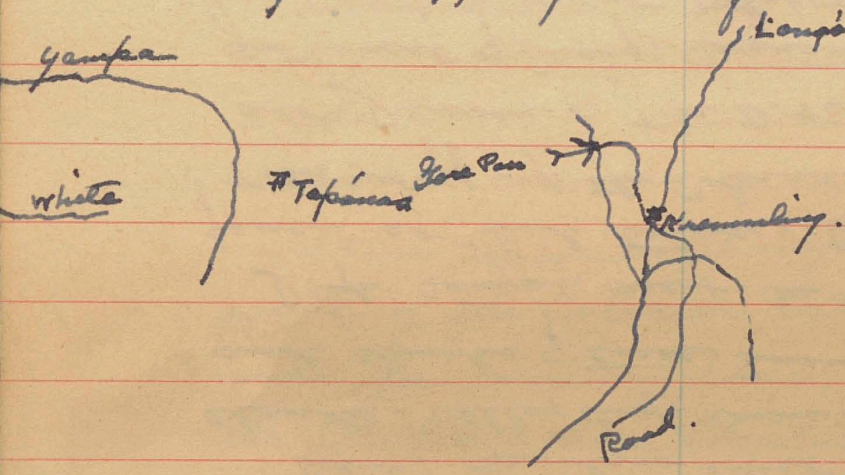
The top course would serve the Colorado, the lower course the Yampa and White, while the low level course at Yampa (7985 ft.) or Steamboat Springs (6772 ft.) would serve all.

Over Gore Pass to Kremmling (7322 ft.)

Wisps of clouds in the treetops from yesterday's rain. No avalanches here. Snowfences in the glades. Is the road kept open in winter?

The glades and forests reminded me of Sardine Valley, cool and fragrant in the

early morning. Except that we could look to the side down a deepening gorge. We were at in the very pass made by the upper forders of the Colorado.



Down, ~~into~~ down hairpin curves into fog. Forests, flowers. The main Colorado lay in a broad the semi-barren valley beyond.

I had worried last night for lack of camera sites and because I could not comprehend how the Yampa could possibly flow 1,000,000 acres. "Now I feel a week earlier", I meant "a week younger" and felt repaid for my second thought of crossing the pass. We could now listen on without the feeling of dissatisfaction and uncertainty.

What we had discovered would be applicable elsewhere.

Ground squirrels were in the road everywhere. Getting warm? One little fellow was taken so unaware that he stood on his hind legs after the car straddled over him to see what had happened.

snow trips, they can hire substitutes tho still supervise the work.

3. There are no avalanches in the White Forest.

4. Gave us state map of National Forests and marked all "Winter Stations" in the Forests i.e. where Rangers lived permanently.

He also marked such snowstake sites as he knew. He is a recent transfer from Wyoming(?). More supervisors have been changed since 1934 than remain unchanged.

No density measurements of snow are made; merely estimates. However, careful directions were given on the Report blanks for estimating the density by eye observation. → Obtain one of these blanks from Weather Bureau.

Send → 5. Suggests reprints for Rangers also; or better 2 sets of reprints, one set for office, the other to be routed, as are magazines, to the Rangers in turn. Furnished us also the personnel of the two forests.

Glenwood Springs to Salida { The Roaring Fork and Arkansas.

Glenwood 5780 ft. — Independence Pass 12,226 ft. — Salida 7,050 ft.

Left 1:30 pm. just 7,000 miles out of Reno. We abandoned the direct route to Gunnison because we wished to traverse the Roaring Fork also. It took us over the highest pass in Colorado and around the flanks of its two highest peaks:

Mt. Massive 14,404 ft and Mt Elbert 14,420 ft.

The Roaring Fork descended noisily but uniformly all its route from Aspen.

→ a spur track of the D&R.G. evidently ran to Aspen, possibly built originally because of mining there. Farm lands all the way.

→ Erosion in the red palisades and rim rock was noticably cut down or prevented by the forest cover.

Courses for Roaring Fork and Arkansas River.

Aspen (7850 ft.) was evidently named for its forest of aspens and should have been named "Aspens". There is an all-year ranger station here and

→ ideal opportunity for a set of snow courses. This is plainly a mining town gone idle, but it still survives. The mountains here are forest clad.

This would be a low-level course possibly, but the road up the pass leads to higher course sites. There may possibly be evidence of avalanches along the canyon. Whole slopes of fallen fir, white as skeletons. But higher still, white trees were standing. Forest fires? And higher, a whole slope moved down by axes. Need of timber for the mines at Aspen?

So the doubt regarding avalanches grows stronger. ✱

Somewhat below timber line, here apparently 11,000 - 11,500 ft.; is an ideal site for a snow course, but it would require a shelter cabin.

Independence Pass did not seem high or fearsome. The auto took the grade in second and did not boil. The presence of fir nearly to the pass made one doubt its height, but the sign read 12,226 ft., with Mt Massive and Mt Elbert guarding 2,000 ft above. "How tiny Mt Pass would appear from here", said Carl. And in ~~bed~~ rich, green pasture and sagebrush, lambs were browsing contentedly in their range above the forests. But further on, the mountain tops were forbiddingly gray and barren.

Twin Lakes Project.

Down the Arkansas slope - not far it seemed - was a large camp in the forest labeled

"East Portal - Twin Lakes Project."

So this was the tunnel being driven beneath the Continental Divide to bring the waters of the Colorado to the Arkansas.

Mts Harvard, Yale, Princeton - Trail at Main along the way. 2 descent Tennessee Saliba - Harvard | dominant, Yale, modest, Princeton prominent.

But was not this from the Roaring Fork rather than the Gunnison? Twin Lakes lay farther downstream.

→ Here was the ideal opportunity for a high-level snow course that could serve both the Arkansas and the Roaring Fork. Keepers would be maintained here permanently at the mouth of the tunnel, and probably on the west slope also.

It would even be possible for the snow surveyor here to climb over to the other side of the pass and make the survey at the head of Roaring Fork.

As we descended, we found a village at Twin Lakes (8940 ft. approx.) and good sites for lower-level snow survey courses. And finally that a Forester was resident at Buena Vista (7,800 ft.), a larger town about 25 miles below.

Twin Lakes themselves will doubtless be developed into a large reservoir and a winter access maintained; → a snowshoe trip from Twin Lakes to the Portal and possibly over the Pass would thus be feasible.

Salida.

A flat tire above Twin Lakes and delay at Buena Vista caused

also we dispensed the D & R.G. from Leadville to Buena Vista and Salida was passing. Also a flying station below Twin Lakes at Lenita(?). Recent U.S. Nat'l Water Supply Paper 744 (1933).

us to decide to plunge no more and spend the night at Salida. Carl had driven 276 ~~260~~ miles this day.

Sunrays at Intervals along the Continental Divide

During the day it occurred to us that snow sunray stations could even be arranged at intervals along the Continental Divide. The Twin Lakes Tunnel, Tennessee Pass or Tunnel, Moffat Tunnel, Rocky Mountain National Park might furnish 4 sunray centers.

Mr. Seymour of the Routt forest believed that the Snake (Colorado stream) furnished as much to the Green as the Yampa.

The general system can possibly be worked out.

Obviously the snow stakes (240) are too numerous to serve as the initial points of snow courses.

We stopped to consult with the Supervisor of the Cochetopa forest at Salida. But only the janitor was in. It was 6 p.m. Since Mr. Pearce was a new comer, transferred since June from Wyoming, we decided to consult with his predecessor who had been in the Forest for ten years. However, she gave us many circulars of other forests.

Moffat Tunnel is in Routt forest.

→ Send synopsis to Wallace Pearce, Supervisor Cochetopa National Forest, Salida.

Charles B. Mack, the predecessor, is with Colonel Peck in Denver office.

Saliday - Durango, Aug. 6.

Salida.

Salida deserves mention like Tucson for a park set on a conical hill with a spiral road leading to a view from the top. A Chinaman might think it a shrine of Buddha but an American would think of fair mines. Except for the road and view, the hill is bare.

Suggested by the Canyon Rim Drive from Canyon City.

And baby chrysanthemums on all the cafe tables recalled exquisite but large sweet peas in a country cafe at Kremmling - house grown too.

And the waitress, like Gould's wife, Pearl, in suggestion. I: "Fifteen hours?" She: "Not quite. Sometimes more".

Salida (7050 ft.) - Monarch Pass (11,386 ft.) - Gunnison (7683 ft.)

Thru into the Gunnison. Up-down.

Rain here yesterday. Treacherous roads on the road.

D & R. G. (narrow gage). In 1892 I had longed to come West via Marshall Pass. Now my wish is to be gratified by

following that tiny road and seeing Marshall Pass from the pass next north. Marshall has always been too small for anything larger than a narrowgage runde. So an auto road is barred.

The one railroad gateway to southwest Colorado. They should run a narrowgage down Bright Angel Trail – or possibly an Austin service.

→ Monarch. Mining town with narrowgage spur. Possibly auto road may be kept open in the winter. Snow canvas possible here. Fine forest just above town. Good site.

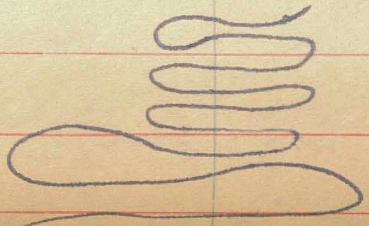
Monarch Pass. 11386 ft.

Timberline even to top of pass. Fallen timber as at Aspen but area too broad to have been caused by avalanches.

Few unforested crests in Gunnison Basin. Only a few peaks, as viewed from this point. Here grass range also above timberline. But far down to next forests cease.

"Keep to the Right". Often and still again. But will humans ever learn to keep on the outside of a curve?

Engineering! Down the steep face. Hairpin curves



to the head of the Gunnison Valley below on Tomichi Creek.

→ Fox Farm. Here at foot of pass is a site for a snow course. The pass itself is too difficult of ascent.

Sargent 8477 ft.

Here we found our narrow gage again. We had gone over; it had gone round. and thru at Marshall Pass at 10856 ~~8477~~ ft. We were ahead of the train tho it had left Salida an hour ahead. Marshall Pass was only 16½ mi. up.

Sites for snow survey courses near Sargent and sites at Marshall Pass and the train in winter to take one. Evidently a stopping point at the pass, for the pass was scheduled.

Gunnison "Thank you. Come again".

Gunnison National Forest.

Much help and understanding from

→ Supervisor J.V. Leighou, who is as genial and approachable as Mr. Clarke, our host at Los Angeles, and resembles him closely.

His old stamping ground was the Continental Divide and Gunnison Forest touches it for considerable distances. He mapped the all winter stations there. Course feasible. Cooperation with other

→ See map.

agencies also possible: Rocky Mountain National Park, U.S. Reclamation Service, Grand Lake Project, Denver Water Co.(?), U.S. Forest Service, Twin Lakes Project,

→ Also Taylor Reservoir Project on the upper Gunnison and a Ranger at Crested Butte would provide for the two main feeders of the Gunnison which heads at Altamont. The Reservoir would be permanent. Planned to furnish late water for the Uncompahgre Project on the lower stream. Little chance of generating power for Denver. "Not probable." Water is seasonal in its use.

→ Two sources of heavy snow: the Continental Divide and the Uncompahgre Range. The latter blankets the heart of the Gunnison and causes the snow to be shallow here. So Cachetopa Pass (10032 ft). is traversable all winter.

→ The snow deep on Uncompahgre Mesa, and a snowmobile there very desirable, rangers are with drawn. But possibly the mesa can be penetrated from Montrose or Delta.

→ Upper snow does not melt before May, but lower snow on valley floor at Gunnison will start melting by April 1.

Plan of house appeals. Skiing long distances no pleasure.

About 8 skiers in Gunnison Forest. at one the water content is determined by melting.

The Meeker Ranch.

→ Well known. about 20 mi. S the south toward Cachetopa Pass. I wish that we could have gone out, but we must reach Durango, still 180 mi. distant.

Twin Lakes Project is taking water from Roaring Fork rather than from Gunnison.

Gunnison (7683 ft.) - Red Mountain Pass 11,018 ft - Durango (6,505 ft)

Down the Gunnison. Snow fences along the highway. Railway parallels river & Montrose. Broadgage from Montrose to Grand Junction. Water grass dark green and cane, as written by Meeker

Abella creek is brown-yellow with silt from yesterday's P.) rain. Pouring into fairly clean Gunnison like Missouri into Mississippi. The dividing line clearly seen on the curve into the main stream.

Probably mixed thoroughly soon. Both flow in gorges here. The railway in bottom of gorge; auto road on top.

We are passing down into rimrock and mesa country.

To pass from Gunnison to its southern feeder, the Uncompahgre, the auto road climbs high over the mesa. Snowfences

Montrose 5811 ft.

Broad farm land. Is this the site of the Uncompahgre Project? Good hay and crops here to compare with Gunnison.

→ The Uncompahgre Mesa seems low. If the snow is deep, a long trek on skis would be worth while. Enquire by letter from Forest Headquarters at Delta.

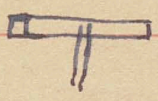
Begin here

Up the Uncompahgre.

Farm lands up the narrowing valley.

→ The Uncompahgre also thick with silt. Rains? Rugged mountains ahead — as rugged as the Green Mts and Tetons.

The auto road seems to twist around the railroad. "8 times in a mile" — Carl



"Railway Crossing."

So tiny the road, so beseeching the sign, We were tempted to suggest: "Don't bump the train."

The railway climbs to Ouray but no further.

Like Zion Canyon verdure is graying over talus in red rimrock Canyon.

To Silverton.

Ouray and up: 7800 to 11018 ft.

The Uncompahgre alps and Colorado

River Canyon. "Church Ranch - chicken" Did like to live here. Up a box canyon. Here the "Million Dollar Highway" from Montrose to Durango.

→ Pass! Cliff pass. Here 1000 feet above Away at foot of cliffs is a site for a snow course.

Below us Away is now the Bavarian Partenkirchen. Snow in clefts. a tunnel. Three times wilder than Donner.

Steep slate on edge. Road built by Pathfinder "Otto Mears in 1921." Bear Creek falls under bridge 227 ft. Next after La Sal in our glen. "A Million Dollar Highway?" It should be.

→ Poor site for snow survey. Too rugged, too slanting.

Bear Falls a Multimal Falls, almost a Bridal Veil. Best thing in days. B.M. 10110 ft. Double height snow fence.

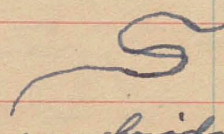
Red silt in stream. Red mountains Red pyramid peak. Lemons and vermillions far more vivid than Bryce.

People live here all winter? Ranch house.

→ Good sites here for 2 camps. Abandoned mines. No one here.

Fallen timber. Burned. The black still shows. So not avalanches but mining.

Real S- curves



10955 ft. on bridge. "Red Mountain Pass" 11,018 ft.

↖ Once a toll road. Timberline still higher. Geiger Grade 0 by side of this. Mines in both cases.

Silverton 9322 ft. to Durango 6520 ft.

On the Silverton side water clear. Verdure.

Then below at a junction of valleys is Silverton, looking like a checkerboard, sitting cozily on a flat. And a railway! ▦ Later we learned that it climbed up the Animas River canyon from Durango.

→ Lucky again to have climbed up this way. A narrow-gauge course site close by. Safer. No climbing.

The ridges have been moved of their timber for the mines and been devastated by fire. The forests are slowly

regrowing. Silverton City Mountain Park.
"Free fishing". Colorful boats on lake. Scenic.

→ Near by is a site for a snow course.

Out of the headwaters over a shoulder
→ into the lower Animas. Good sites up here
on divide for snow surveys. Flowers,
range grass. We are lucky indeed, for
we are in the wildest mountains of
Colorado and find an avalanche-dread
fade before us.

But how does the railway get thru?

Down canyon. Aspens thick. Grass
and flowers.

Near mouth of canyon 8731 ft.

"Western Colorado Power Co. Siphon.
24000 cu. ft. per minute"

→ Snow plots on the bank. All kinds of
snow survey sites. Where is the dam
and reservoir? Snow survey there also.
This was found to be Electra Lake below.

"La Plata Co." and of course La Plata Mountains

2,000 ft. drop for Durango is 6500 ft.

→ "San Juan National Forest Ranger Station". Good.
With station and snow plot we should
be able to penetrate far up.

Bryce and Zion rimrock on west side of valley. Heavy forest even on top of rimrock. Lake or reservoir below us. Irrigation and fruit.

Durango (6520 ft.)

"a mile high and still growing". Auto court wanted $4.00, Earl found a large corner room the The Savay Hotel for $2.50 Quiet, spacious, good furniture, cool, a place to rest. Our motto: "Seek a declining but respectable hotel" - something like our old home in Bend. The private bath on shower have been abandoned.

A tiny city - with one-day laundry service - encircled by mountains. From our beds we could see the red bars of sunrise.

Mail plentiful and long-awaiting. We had been long overdue. Ware at Denver.

San Juan National Forest.

Supervisor Hutton saw the point at once. "Two roads were open or were to be opened thru the Forest:-

1. The William Jolley Highway to Silverton, Ouray and Montrose which would open up all the snow survey courses selected as our trip down, & the Animas and 2. The Wolf Creek Pass

2nd pg of letter from S.B. Dotter to Church, 8/1/35 - in Soldier

From Durango to the San Juan Mountains in fairly

highway which led east in the Rio Grande Basin and would give access to the various elevations on the San Juan and Rio Grande." The plan of snow surveys was scientific." Drew a map for me.

Both highway and railway were available.

The Western Colorado Power Co. would probably cooperate at their intake as well as at Electra Lake in the valley.

Called at office but officials out. "Always abundant storage for their needs" though the clerk.

Write and send reprints:

Mr. J. A. Clay
Vice Pres. and Gen. Mngr.

Mr P. C. Schools
Gen. Supt

Durango, Colo.

(Margin: The railway runs to Silverton and)

Montezuma National Forest, Mancos.

W. L. Schipull, Supervisor both young (very young?) and eager. Has 5 rangers. Roads open. Needs records for study of floods. Offh to bonus. "Will select only willing and able men from whole group. Would make snow surveys parallel Divide regular setup and provide a program for them." Men go timber cruising in sum[mer] to [illegible] ofter allowed from above.

(Margin: Sufficiency and willingness [illegible] desired.)

a similar task". less snowshoes + ski rather than ski. "Forest trees abundant in most. So good sites".

Telluride open upstream Avalanches if you seek them, but ~~they can be avoided~~ you do not need to meet. Especially prevalent at Telluride and Rico.

→ Possible to have always on joint watershed of Mancos and Dolores.

Sees large possibilities in careful records in coordinating upstream storm and downstream runoff. Snows and floods.

→ [illegible] coordinating upstream storm and downstream runoff - snows + floods. Rapier. young.

Mesa Verde -

A platform of rimrock high uplifted to the north. with the platform green and the rimrock red and the sloping base green.

A country of pinyon and cypress - Green now because of summer thunder storms.

The Dream Table must have fascinated the early Spaniards for it was a Pikes Peak in its monumental character.

...Car Task": less snowshoes + side
...oki. "Forest trees abundant in rock.
...tion

...ubstream Avalanches
...you do not need to meet
~~...they can be avoided~~
...ta and Rico.
...on joint watershed
...d.
...ties in careful seconds
...ubstream storms and downstream
...and floods.
...ual".

→

On the mesa rim
in sight of his lodge
homes he built his
own temple — his Notre Dame.

Shelter and food and
range on the mesa,
where the low cedars
made a jungle for him.

Did he climb the canyons
from below or did he
climb down from above?

We entered from
the uptilted end by a
series of curves cut
in the rim rock.

Green valleys below us
of modern man.
Outlaws over four states
The whole country is a

San Luis: Use snowshoes + skis

skis. "Forest trees abundant in most

trees

Avalanches
you do not need to worry
~~they can be avoided~~

and Rico.

on joint watershed

ies in careful seconds
stream above and downstream
nd floods.

nual."

→ ness reaching into the
far distance but cleft
by a labyrinth of gorges
being eroded into a
Here the silt of the
San Juan, ~~that~~
finds its source.

→ canyon being marked
by broad openings.

rises
Beyond Shiprock, a
really, truly, sail speeding
eastward.

Four states! You couldn't
tell what topography belonged
to which. And La Sal
mountains within portable
vision. How we travel
in circles.

...ar task". Use snowshoes + ski.

...ski. "Forest trees abundant...

...trees

...bstream Avalanches
...You do not need to meet
~~...they can be avoided~~
...a and Rico.

...on joint watershed
...d.

...ties in careful seasonals
...stream shows and downstream
...and floods.

...nual".

But to stand on
Sun Temple and see
the delicate fairy "palace"
& towers — in the
sheltering pocket of the
opposite cliff town are
to Mayfield Parrish.

approach to the fairy city?
Down a rock chimney by
a ladder.

Then to Cedar Tree House
to live the life from spring
& city towers built to the
overhanging rock.

Openings finer than the Ezrins
use. Fire? your smoke
stained overhanging rock.

And a climb up the cliff
by ladder among mesa
and trees.

and if we could, to live up from the fairy city of the Cliff Temple, standing ...dly dominant.

...ax task. Use snowshoes to ride
...ski. "Forest trees abundant near.
...tion

...stream Avalanches
...you do not need to meet
~~...they can be avoided~~
...a and Rico.

...ge on joint watershed
...d.

...ties in careful seconds
...stream storm and downstream
...nd floods.

...al".

...ated driving. Much
prefer the Hans Egede.
Can almost shriek
at thought snow,
yet 3 to 4 in yet
ahead today.

East to Wolf Creek Pass - 10,850 ft.

Into the San Juan. Roads too rough for our speed. Flowers.

Rolling forest-covered mesas. Oaks, pinyon creep down on all sides to farm lands.

Two thunderstorms in eastern sky. Summer rains merely local? "No lows connected with them". But the summer rains add little to the rivers - at least in July-August.

Study April-June rains and effect; also July-August.

Los Pinos River. Broad farming valley south to San Juan River.

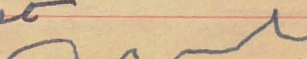
Roads show spotted showers. Many precipitation stations necessary to record them. Rains valuable for verdure, cut down evaporation, supply shallow roots, make summer delightful and green. An asset.

In San Juan National Forest again and in low mountains covered with sage-scrub and some trees.

Erosion, like piece cut from conical cake.

Sandstone, sand, gravel.

Rugged mountain barrier to north and east



Continental Divide and San Juan Mountains.

abandoned lumber railroads and large area of nearly cut-over land.

10,850 ft.

Pagosa Springs 7100 ft. to Wolf Creek Pass.

And the San Juan itself. Wolf Creek Pass 24 mi. 10,050 ft. upstream and 3000 ft. to climb.

San Juan and Animas much alike in gradient. Ranger Station on river above town.

→ Good forests and snow survey sites at bottom of Wolf Creek Pass. Pass steep but forested. Halfway up a home and good site for camp. Good stream of water.

→ Ideal sites farther up the road. Even small meadows and plenty of flats.

→ 2 mi. below top of pass is best site. Easy ascent, Timberline above pass (10,850 ft.) the meadows there.

Forecast in San Juan Basin easy.

Animas 1/3

San Juan 2/3

Both after joining gain little and fully lose some.

Silt of San Juan from sandstone canyons in mesa. Like the Little Colorado.

Rio Grande Basin.

1 mi. east of Wolf Creek Pass a meadow called Alberta Park. Wide road under construction.

a pedestrian! a two-person ferryboat hippopotamus needed.

→ 9 4mi. from summit good sites in large rolling meadows. Road camp here now.

15 mi. down in range and pasture benchland is a third site. CCC Camp here 5 mi. above South Fork.

Into rain.

Three mountain stations available:

1. Wolf Creek Pass 2. Wagon Wheel Gap

3. Cachetopa Pass.

South Fork 7890ft.

Small town. Railway!

→ Wagon Wheel Gap 14 mi. north. We had not realized it. We surely should visit it but passed by.

Snowfences. Broad farm lands.

Del Norte,

Like Gunnison in size. Has conical hill with road and scenic outlook as at Salida. Broad valley lands.

Summer storms still with us. Paved road!

Peaceful. Valley widening ~~gently~~ greatly — a semi-Sacramento Valley. Snowfences.

Monte Vista

a very homelike town.

Rio Grande National Forest. at Monte Vista.

a. F. Hoffman Supervisor.

No avalanches of consequence. Reservoirs and Ranger Stations near Continental Divide.

→ Another pass (Cumbres Pass) to south of Wolf Creek Pass, on railroad. Open roads and railroads for use.

Snow boards ("scats") only twice a year.

Snow courses would take more time, but let the higher-ups decide. If overworked will need more help. I: "Speak up if you do". Easy to overload".

→ Reprints.

→ Rio Grande Forest contains bulk of waterbearing area.

→ Write New Mexico for Forest Maps. any further Continental Divide on which to place snow courses?

Two tributaries of Rio Grande (also in Forest) furnishing a fair flow into Rio Grande below.

→ Seek stream measurements from State if not in U.S.G.S. Water Supply Papers.

Wagon Wheel Gap. abandoned and dismantled 9 years ago. Any chance of restarting snow surveys there? Has the deforested area regrown its trees? Ask Monte Vista Forest Service office.

→ Practically no precipitation stations in Forest.

Mountains rise less high toward southeast and east but of full height to north.

a Sacramento Valley full width east of Monte Vista but considerable of it sagebrush.

Forest Service men appear alert and familiar with their areas.

Alamosa.

Rio Grande a flood stream even here upstream.

Blanca 7985ft.

Large pools along the road just west. Heavy rain here yesterday.

Ft. Garland 7996ft.

Nearly all buildings adobe but covered with stucco.

Up La Veta Pass 9382ft.

15 mi. to La Veta Pass an easy climb.

→ Snow fence. Broad aspen forest with glades 1 mi. below summit.

La Veta Pass 9382ft. Easy grade. Slopes forested far above pass to 11,000ft.

→ Continuous dense forest of aspens and firs to east. Road open. But a glade 5 mi. below summit at hairpin curve. Road parallels south feeders of Arkansas. See San Isabel Forest at Pueblo.

La Veta (town) 7024ft. Mountain valley to Arkansas.

Walsenburg 6200 ft.

Streams are washes here. Pueblo snowfences. Beginning of prairie uplands.

51 mi. to Pueblo. Sunflowers. Tiny corn. Drought area of 1934 and flood of 1935. Sagebrush tiny and sparse. Frequent snowfences.

Huerfano River. a bit of water. Snowfences.

Pass and Repass.

8th. car a Dodge. An same Carl passes Dodge. An straight ~~stretches~~ roads Dodge goes 70 mi. and passes Carl. Later he does up a side road and disappears.

Rain to north and here.

Pueblo - 5 pm. Flood dive thru center of town - very high. Depot directly beneath. Expensive hotel. Examine hotel menu.

Saw assistant supervisor, San Isabel Forest.

San Isabel National Forest. Pueblo

→ Snow fences faulty but percent system appreciated by water users. However, more surveying will be more scientific. We shall be glad to cooperate.

→ Maps prepared. Send reprints.

Letters

For me! Carl insisted on getting here in time for mail. 2 for Carl. Woman fortunate we inquired all way good. We go north. Emily's article and editorial work

that attached rag and was on fence when did.

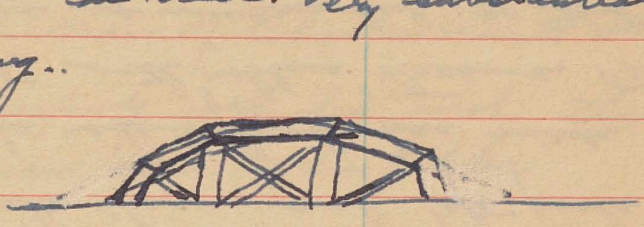
are completely satisfying. I can leave it all to her.

Heavy Thunderstorms

Loose soil shimmering with water just ready to flow from surface. Result of drought and blowing away of topsoil?

Sun again. On way 43 mi. to Colorado Springs for greasing.

Steel highway bridges in Colorado after one pattern in steel. Very substantial but very pleasing..



Who designed them? The concrete abutments in Utah look as if the ends of their parapets were crushed down.

→ The Alamo Hotel - have eaten at a big downtown hotel.

Ethel.

Saw Ethel, our grey three oldest, Has grown in face and character Spending her happiest years with her babies. K. is devoted & his family His life is colored here. He toils in thought of their care.

→ Crystal Creek Project on Pike's Peak. Will take 10 years to fill the reservoir. Streams are so small and preempted by earlier rights. Ethel's husband K. is among the holes for granting the foundation.

→ Better look this over to see opportunity for more surveying.

Colorado Springs streams show much sediment from yellow of last June.

↑ Ethel's address: "Tanglewood" 1 mile south of Alamo Hotel

8875 ft

August 9 - Colorado Springs 6070 ft. to South Park.

Pike National Forest.

Mr Kaethley, Supervisor.

28 snow scales. Colorado Springs 30,000. Region 55,000. Summer 150,000. Tourist town in origin. Denver 300,000 (?).

Water comes only from Pikes Peak region, all South Platte goes to Denver.

→ Pikes National Forest supplies 28 or 41 (?) towns with water.

Storms uneven over area. Canteen is light in snow. Last snow causes floods.

Two floods: one in 1901 washed river full of silt but high-level snows scoured the channel clean and left pools for fish.

The recent flood has made broad washes of silt with ribbon streams. But the high-snow water is impounded so that there is no longer clear flood water to scour the channels again. Balance of nature interrupted. Fish are destroyed, Neither holes nor fish food for fish. ["424 bridges carried out in Colorado."]

Snow scales read by Rangers or residents cooperating. a few quite remote are difficult to reach in soft snow.

→ Prefer not to read scales.

Doubt accuracy of snow scales. "Your work

Water all Mississippi. Clouds stay up. Trouble with farmers.

is worth while".

There are open roads, resident Rangers, powerline patrolmen.

→ Gave us a permit to use Toll Road up Pikes Peak free. "Pass for making preliminary investigation for a snow survey."

Garden of the Gods.

" Drive to Colorado Springs

By Children of Charles Elliott Powers (?) in keeping with his wish that it be forever open to the public".

"Something different" - Cut. Red erosion, Canty. "Gateway". "Balanced Rock". Fins, pedestals,

Up Pikes Peak.

"Sheepskin coats for rent". Overcast.

"Most cars are from outside Colorado". Cut. yes, South Rim again.

1½ mi. from Tollgate 8,000 ft.

3-4 mi. " " - Higher, Continuous forest tho mostly on slopes.

5 mi. Slopes gentle. Growth young but will be better.

5½ mi. Road to right to Crystal Creek Reservoir. Meadow but this will become a reservoir.

→ Sam K.— Wants cutting substitute for black diamonds. Suggested petrified wood. Write Director, National Forest Service.

"If you know of any diamond drilling write Mike (himself) want you?"

a fine piece of dam. Concrete foundation, steel apron with buckling or expansion joints all welded including rivets. Good storage. An emergency project.

→ Above reservoir easy slopes, abundant aspen and fir forests. Good sites for snow surveys all way to timber line.

Mount Cor? Pierce-Arrow Bus up Pike's Peak. Too much vertical climbing recently. But later we outstripped it.

→ 10 mi. just below Timberline and Glen Cove an excellent course in meadow interspersed with pines.

Rain of yesterday washed road out slightly. Patches of new snow in shade.

[later: about two days later, the peak was white with snow.]

Glen Cove 11,425 ft.

Water for autos. also gas and an opportunity to get your portrait in groups.

a good building, abundant shelter. But now closed in late autumn until following summer season

11 mi. Snow survey course ends here.

12 mi. Above timberline among rocks and range grass.

"A person coming up here without a point in view is a damn fool." Carl. But his viewpoint is his view out.

Rainbeamers all about.

Cloud sliding up over east face of Pike's Peak. New experience.

Old miner snores.

Base of Cone. "I'm not calling. Nice warm day. Not yet 30°F, but I may chatter later when I have drunk this air in." Carl.

"If a car loses 60 percent of its efficiency at 6,000 ft., what does it lose at 12,000 ft.? At last we are still going." Carl.

On Rock Pile. Cloud circling tops. One auto passenger had sheepline coat. We are in shirt sleeves. Air fresh.

The air is beginning to feel a little rarer! My chest feels hollow.

A 3 to 2 car-wide highway. Steep but safe. Granite sand over entire road, brought from lower down. Shows that a highway can be made up Mt Rose.

17 mi. Cloud vapor blowing past us.

Reservoirs down east front. Thin

forest on slope to south of them.

Cog railway.

"Western Union

Telegraph

← "

"Let yam friends know you're up".

18 mi. Flat top. "Summit Building. 1882"

Cog railway. Teeth cant come loose.

36° F. Possibly we are hardened. We do not shiver.

Rocks sheer to north.

Dizzy. Floor also dizzy. It says, "Floor rained 4 feet in one spot. Mountain settling. "Ice and rock," said old timer. Rather rock alone. Loose top.

Tebulon Pike (Lieutenant) at 36 years discovered Pike's Peak. Young men explorers.

Bought pictures so students need not come up.

Down.

"Use low gear instead of brake to bottomless pit".

Sunshine, cloud and shadow. Mountains, valleys, plains, dark green, light green, sunlit green.

Deferred Time - "Wrist watch very handy." Ad. yes, & put in water. But it is again slowly drying out and speeding up.

Heart action. Said ticket man at Glen Cove Heart beats fast and one grows dizzy because of going up or down too fast. He does not notice it when there for a few days. But when running trains, he notices it again.

So G. F. Monk after a long stay on Whitney suffered severely on coming down to sealevel too quickly after a long stay on top.

Snow Sunrays.

→ For Pike's Peak watershed, snow caresses possible on other planes of mountain. But avoid bare summit.

Speed.

30 mi. down 18 mi. Min. speed 30 mi, Sometimes 50 mi. Good road.

→ Write and thank Mr. Keithley for the pass and pleasure.

To South Park.

A dozen Olds. Too many to be given front names. Denver the focal point of the outbreak?

Open, rolling grasslands and groves of fir. In a gentle canyon to the south, a lake.

→ Many new faces. Snow caresses anywhere

toward divide east of Antero.

From divide a great valley ~~not mountainous~~ with islands of mountains and trees. South Park? Sunset colors: heliotrope background edged with gold. Clouds floating against it outlined in rose.

Wild grass land. Some hay stacks. Flowers. → Looks wet. Is it like Big Meadows on East Walker? What effect on runoff.

Hartzell 8875ft.

all year-round town. Wooded hills in antelope. Have spent the night at a ranch hotel with kerosene lamps. Swan survey here?

~~August 9~~ Junction only 19 mi. from Buena Vista. Traveling in circles. Forested hill and flats for surveys.

August 10.

Start at 4:30 a.m. A deer trots audibly overhead.

Coots. Vapor is rising from the meadows.

Antero Reservoir is very shallow and almost empty.

Low forested hills on the west edge of → South Park. Good for surveys.

* Survey also in pass toward Buena Vista. and Trout Lakes Project.

Flowers by the road. Forests toward the north continuous. Meadows above 9,000ft.

→ Snow bases at timberline and also above. High country. Snow fences.

Fairplay 9964 ft. Mining town. Name its name Heard a "decent canary". Mining curios of old days on display. Placer mining: a gravel ravine at the edge of town.

Cold bracing wind even with your coat on. Carl out getting gas from a shivering woman, rung out of bed. He'd jumped back into car to get warm.

→ # Forest within a mile. Ideal for snow in summer and snow surveys in winter

late. 89 mi. to Denver. "First 90° turn at 45 mi."—Carl. "Way car took it, should handle it at 60 mi."

→ Railway to Fairplay. Thru access in winter. Colorado & Southern train slowly backing over the crossing. Carl decided when 20 ft distant to give it the privilege of passing. "Better stay aware, young fellah, you'll get hurt, get killed," said the conductor thru the auto window after the train had passed. The scene had been persistently in our eyes.

Kenosha Pass - 10,000 ft.

Railway also there, and forests.

a Canyon Valley, but Ranger Station with bottom lands for snow surveys.

60 mi. to Denver.

" Baily, Colorado

Sez 'Come Again'."

Leaving Pike National Forest.

→ From top of grade good sites for dam surveys.

Mountain valleys with wooded sides seemingly all the way to Denver.

15 mi. from Denver we enter broad farmlands.

Denver. a Day of Conferences.

U. S. Geological Survey.

Robert Follansbee away. Might return that afternoon.

→ Gave us Stream Utilization Papers for both the Colorado and Green Rivers.

→ They had received our reprints for the past year, perhaps all. Continue to send them.

Gave following address for U.S.G.S. Topographic Maps of Colorado. 75¢ (unbacked and unbacked).

W. H. Kistler Stationery Co.

1636 Champa Street

→ This map was purchased.

→ Up to 1931, water data in Colorado were compiled by Colorado State Engineer (Mr. Ninterleider, present engineer). Cooperation began in 1933(?).

U. S. Forest Service

Colonel Peck absent. Was referred to Mr Cochran and Mr Robb

H. D. Cochran

W. L. Robb

Div. Timber Mgt.

Rocky Mt. Region

U. S. Forest Service

Denver Colo.

→ Gave them Geog. Rev. but promised to send other reprints.

who drew up earlier agreement with Mr Marr and Professor Clyde.

They felt under obligation to continue the cooperative agreement to conduct snow scale (stake) measurements for the U. S. Weather Bureau until released, and thus far had no positive opinion regarding the relative merits of the two methods. They had also kept at Mr Sherrick

informed regarding negotiations.

However, they generously accepted my suggestion that they carry on both methods during a transitional period of 2 years, if necessary, to determine the relative merits of the two systems or permit Mr Sherrier to link them together in continuity. That this would be only fair to Mr Sherrier, who had developed the snow-scale system to its highest efficiency and naturally disliked to abandon it.

It was understood, however, that the total snow courses during the period of transition should not exceed approx. 75 and that a portion even of these would probably be measured by local residents outside the Service. Furthermore, that equipment and expenses outside of salaries would be furnished from outside the Service. These expenses would be largely for travel by train and auto required under the new plan of reducing the length of ski and snowshoe trips.

Wait

U. S. Weather Bureau.

Mr Sherrier was on vacation but the Assistant in Charge gladly gave us full information regarding developments.

Mr Sherrier's devotion, to snow scales, noticed in our trip to the forests was

Mr. Cochran asked about my official work at Nevada and told with delight how Mr Hayes had tried to find me at the Engineering Building but had been directed by a student to the "Department of Modern Languages". I told him not but was in "Classics". He is an admiring comrade of Frank Drake (an roly-poly boy) and knew Charlie Bull.

affirmed. (No snow scale had been abandoned or relocated because of distance or tendency to be affected by wind or shelter because of desire to maintain the continuity of the records.)

The suggestion of a transitional or testing period seemed fair.

Recent correspondence seemed to indicate a lack of detailed agreement or even of definite opinion regarding snow courses or the desirability of using the appropriation of $100,000 recommended by the Water Planning Committee.

Report was immediately made to the Forest Service suggesting that the plan of a transitional period be held up pending further discussion between the Weather Bureau and Bureau of Agricultural Engineering at Washington.

A copy of Geog. Rev. was left for the office. Send also time on Snow Fall Bulletin 1935.

Debler states that no surveys are made by Weather Bureau at Elephant Butte Dam.

U.S. Bureau of Reclamation.

Mr Cochran had generously called up Mr Debler and arranged a conference with Mr Walter, Chief Engineer and Mr Debler, Hydraulic Engineer. The noon was the end of the week, both generously granted time and Mr Debler and we

continued our conferences ~~until~~ throughout the week-end.

Owing to the diversity of water users at ~~the~~ some of the dams, the policy had gradually become established of maintaining ownership and management of ~~the~~ such dams tho not of the distribution systems of canals below. Such had been the case at American Falls, where forecasts of the levels of Jackson Lake had been made since 1919 and further developments of irrigation projects on the Snake might lead to further extension of snow survey interest there.

They were now planning to install an experimental precipitation-snow survey system on the upper Colorado to determine ~~the relative value of~~ possible improvements in forecasting streamflow at Boulder Dam, and had designed some essential improvements in snow sampler apparatus.

The plan had the advantage of the plan of state financial cooperation in that the costs were charged against the water user with other charges for water at the dam.

It was also agreed that ~~the~~ all

Cooperation with U.S.G.S. sometimes difficult for in a large state like Colorado the Engineer Plan insufficient funds to cope adequately. Colorado has invested to date in expansion of

snow courses would be supplemental to each other in the two systems to avoid undue burden upon the Forest Rangers and that full exchange of data would be made.

Mr Dibler's complete report was loaned to me with promise of a report for the Station. Professor Clyde had previously received a report. Send complete reports.
E. B. Dibler, Hydraulic Engineer, U.S.R.S., Hdq Custom House, Denver

The use of precipitation gages in greatly will be of great value in determining precipitation during runoff in this land of spotted rains.

Close cooperation was urged and at least informally accepted. At least, the long period of forecasting on the Snake and present plans for Boulder Dam make the Reclamation Service the leading regional cooperators in the Columbia and Colorado Basins. Ultimately, if a more general and acceptable system of forecasting is developed, the Reclamation Service will relinquish its service. However, it could not continue to collect charges for such service at the dam.

→ Get Western Construction News (ask Tom King regarding exact issue) for Reclamation Projects.

also write W. H. Tuller, Manager
Boise Project of Water Control
Boise, Idaho

→ Not too late to begin summarizing the forecasts, the Boulder Dam mileage rapidly.

→ Late Chinook Winds Tie-up Meyer conference

for further developments on the Snake.

→ also Robert J. Newell, Construction Engineer
U.S. Reclamation Service
Ontario, Oregon.

R. J. Tipton (Ralph C. Dellen calls him "Tip".)

Two conferences on Saturday and Sunday.

Gave me a confidential report of the Advisory Board to read. It was a perfect presentation and had a background of water problems. I congratulated him strongly, tho he insisted that his experience was entirely second hand. He has a large and intimate background of water problems.

Evidently the Committee was endeavoring to divide "Basic data" from "Forecasting" and had assigned the former to the Weather Bureau and the latter to the Bureau of Agricultural Engineering. Commented Mr Tipton: "~~They~~ "The bureaus are far apart. I'm glad you are in the picture."

He also said that the formal Snow Survey Reports are disregarded.

The Advisory Committee Report recommended the adoption of the "snow course method" and the Mount Rose Snow Sampler or a lighter modification of it. also the Mt Rose Spring Balance. ~~and~~

The man Blodgett of NPA whom I have met a few times in connection with the National Resources Board and the Water Resources Committee. Knows quantity of water problems.

Practically all of the research problems suggested were recommended, including evaporation in large lakes, effect of clearing, etc. But to avoid scrambling or protest, no problem was mentioned by agency or locality.

→ He promised to send me copies of his consultative project reports and will return Committee data loaned by us to him.

→ They had succeeded in getting the Monograph from Senator McCarran and had returned it to him. So thus far it is safe.

His last comment was "I'm glad you're in the picture". I am, in return, glad if I can aid in the establishment of the national plan.

→ He was interested in the plan of a snow survey for Colorado Springs. For their reservoir on Crystal Creek they have only late rights, ~~but~~ So the snow survey will aid larger interests than themselves.

→ Write Mr. Tipton for addresses of interests.

R. J. Tipton, Consulting Engineer
First National Bank Building
Denver.

Evening

Went to hear Grace Moore sing, for my nerves were frazzled.

August 11 -

Further conferences with Debler and Tipton — most intimate and delightful. Of the deeper and larger problems connected with our common interests. It was comradeship and not formality.

Tipton greatly appreciated my approval of the Committee report and discussed specific problems in Colorado. He much prefers large field experimentation based upon field conditions to restricted laboratory investigations.

He took us Down Canon hotel again and would have invited us to his home if he had not been leaving for the country. Grateful for our assistance". He is the ideal chairman of the Western Subcommittee.

Copying Notes -

A persistent and heavy duty but essential. I have never lost my sense of direction and time and would have details also unless a daily record were made.

al Carveny and Martha and little Carl.

A memorable evening with an old Nevada student and intimate pal of Willis and Ames. So helpful Dr was both. Grateful to Willis.

Visited the park and across its lake saw the outline of the Rockies in dull golden blues.

→ Tipton feels that expansion of irrigation should be slow and effort must be made to avoid "mistakes" in the past. Says Pathfinder Dam on Nebraska is "white elephant" in its distribution system. Is in Wyoming. Also Shoshone in Wyoming.

August 12 - To Fort Collins.

Broad rolling acres. Snow fence. Grains, hay, vegetables. Does the belt reach to Nebraska? [Later: No, only a mountain-edge belt except along the trunk streams.]

"Longmont, the Friendly City".
The Chamber of Commerce bids you
"Come again" ".

A nose-diving plane and "Sieberling Tires". Too much nose dive. Should build around Sieberling Tires.

An right side of road appeared:
"Walk on Left Side". Wise.

Carl raised question of credit for apparatus and name. Once it might have been argued. But no more. The cause of snow surveying is as far above apparatus as the spine is above the cornerstone.

Fort Collins -

Worthy Campus, worthy homes, quiet town.

Letters.

The wars broadens. ~~Dr~~ Mr. Gregg has accepted the McRae Snow Sampler as the official apparatus ~~of the Weather Bureau~~ for national snow surveys. Mr McLaughlin can now present the method

of snow courses for consideration.

Charlie gone. A yearslong invalid but perished in an auto accident. To be buried today. Thus the difficulty in reaching us. Childhood and family memories crowd round.

Director Sandsten and President Lary.

Mr Parshall of Ventura Flume fame, had arranged calls upon Director Sandsten and President Lary. The result was a triumphal march for snow surveying.

Director Sandsten recognized it as more valuable than some other things being done and supplementary to the Fort Collins water studies. He was very willing to have the Station undertake the direction of the Colorado Cooperative Snow Surveys and desired to give Mr Parshall a full time assistant to carry on the work. He emphasized the value of water to the state.

President Lary was fully as enthusiastic and had discussed the project with Director Sandsten. He emphasized the public welfare. I told him of the Walden River experience of granting water on the basis of the snowfields and saving crops. Regarding snow survey methods, I told him that the snow just talked. He called that genius. I always felt that the snow had ability.

Roosevelt National Forest.

Mr Krentzler, Supervisor, one of

the very few who remained untransferred.

→ Send him reprints.

This forest embraces the Pandre River which waters the Fort Collins district.

He was the original snow-scale designer in the Grand Mesa in 1903 when a young man. He now likens the new method of snow surveying to the forest-section surveying as compared with hit and miss control. He called it "timber-sectioning".

He heartily agrees to a transitional period for the snow survey and snow-scale methods.

Furthermore, he needs the information for both forestry and irrigation.

→ This spring waterusers in Nebraska refused to plant until they had definite information regarding the probable flow of the Platte. the Laramie River and the South Platte. by the following Monday morning. The Supervisor obtained sufficient eye observations to venture a safe forecast and saved the situation.

He feels that snow scales are too remote and heartily approves of the

→ more accessible snow courses. Romance can not give way to routine.

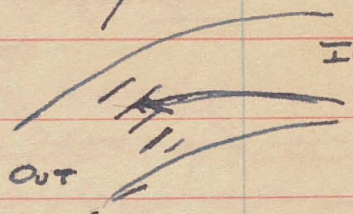
~~Storm~~

Water Laboratory

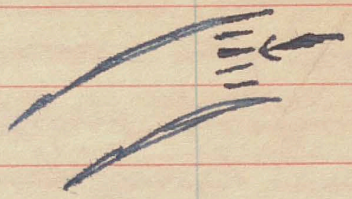
Fort Collins is fortunate in being the center for much testing of structures by the U.S. Reclamation Bureau.

→ The Roosevelt Dam was undergoing

test of its spillways which failed to carry the volume designed. The cause was evidently the position of the flash-board gates which stood diagonally to the running current. For example,



The gates should have been placed nearer the entrance - Thus,



→ Plainly the Roosevelt Reservoir does not carry all of the water produced on its watershed.

We can hardly expect this of the Coolidge Reservoir. It seems fair to expect it to exceed its watershed.

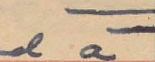
The Grand Coulee Dam was also under test to determine erosion in the stream immediately below the dam. The sandbars formed was impressive.

The gathering power of wellcasings of various diameters was under test and analysis.

Outside was the great evaporation basins where Rohwer had gathered much of his data on evaporation.

This basin was now serving as

a reservoir for the water used in the testing laboratory. By the aid of a powerful pump the spent water was returned to the reservoir for reuse.

At 7 p.m. Mr Parshall took us to his Ballona Laboratory in the stream bed of Pandre River. Here he had an immense Venturi flume of concrete, also a tiny 3 in. flume of tin. He also had a  in the bed of a flume which would catch gravel and stones and carry them edgewise then an orifice in the side of the flume. We rode home thru the badges in the darkness by the spot where the trappers had made their powder cache and thus given the name Cache la Pandre to the stream.

He introduces me as father of mean surveying. I refer to him in reply as brother or at least cousin.

August 13.

Carl went with Professor Clyde to lay out snow courses in the Medicine Bow National Forest. I remained in Mr Parshalls

office to write up notes, and complete the offical correspondence.

Professor Clyde had copied the material on snow survey sites from our forest maps and desired a copy also of our notes. This was accomplished by the aid of Laura, office typist.

Policies

It has been agreed in informal discussion (1) that close cooperation will be maintained with the Bureau of Reclamation, (2) that snow courses will be laid out quite apart from snow scales, (3) that a transitional year will be recommended, (4) that a bonus system be recommended to make it possible for Forest Rangers to employ substitutes, when desirable, in their stead. This would parallel the recommendation of the Advisory Board on hydraulic matters that Cooperative Weather Observers be paid in the future.

Needful articles

Engineering News - Record

June 28. "Forecasting Floods" by myself.

Aug 4 Grand Coulee Dam.
a great flood in Newyork
Melting snow and floods
Criticism of my articles.

(5) Write memo for complete compilation of snow courses. Part 2 to Two cuttings can be put in by explanation for diagrams to the above.
* Mean averaged by reading depth. Simplification needed.
* Write Regional Office and complete to explain.

Telegrams from Lamb.

The following telegrams were received and sent regarding the trip to the upper Missouri.

August 14.

Correspondence.

All correspondence - to Chief McLaughlin, Mr. Dobler, and Mr. Mann was read by Professor Clyde and approved after suggested changes had been made. Mr Marshall felt that this was quite sufficient for him.

→ # Because of their details, he urged that all letters written in longhand be borrowed and copied for record. The letters will become memoranda and guides in carrying out our agreements.

Projects at Fort Collins

It Mr Marshall feels that even the winter storms in Colorado are spotted and consequently snow measurements must be made at closer intervals than in the Sierra Nevada.

He therefore plans to move the Poudre Basin a snow experiment station as in the Logan in Utah and then Tahoe in Nevada-California. With the water laboratory already installed

"Storm wind here comes from the east, but sometimes rain."

the Poudre Basin will be ideal.

2. He also stated that Chinooks sometimes occurred at Fort Collins but with mild instead of strong winds. Since lack of wind should accelerated melting instead of evaporation, it was recommended that he establish a Chinook project here to accompany one under stronger wind conditions in Montana.

→ why the plant wasting of the natural compound spending season. #

Parting.

We parted at 10, the others setting forth to lay out snow courses, Carl and I to visit Rocky Mountain National Park before turning north.

We should prefenably have a final conference of all parties before the snow survey plan is finally put into action at any rate we shall meet at the Snow Conference in the winter.

Rocky Mountain National Park -

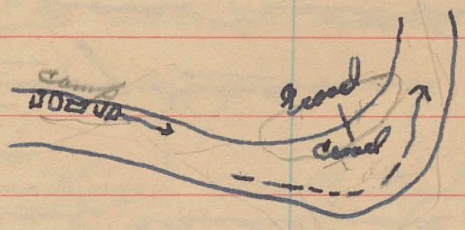
Rocky Mountain National Park consists of a scenic drive along the Continental Divide. Estes Park and Grand Lake are mild terminals. Longs Peak is the center piece.

Road from Loveland was once good.

Now it is warm and dusty.

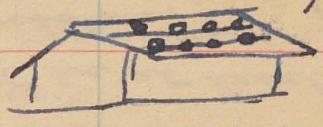
At Estes Park, water gage and recorder. Snow fence. Sites also for snow courses. "10560. 2 miles above sealevel", but still below timberline, Some glades.

Surfacing the road and oiling it at timberline. Construction camp one auto loop along the road



Timber is down again. No avalanche. Yes, fire. The trees are blackened and some still stand.

Three Swiss chalets at timber line 11,000ft, approx. Roofs held down by rocks



Grass lands above. Grassland landscape, but thin and hard.

Men shoveling at normal speed.

Summit 12110ft. - a long mesa. Breathing labored. Iceberg Lake has snow banks above and is never entirely clear of ice because sheltered from the sun.

Highest elevation of road along the mesa 12,183ft.

Snowbanks under the rim

Here also stone shelter cabins with roof held down by rocks. Swiss Chalet style.

On way down west side of Continental Divide → forests are all fir but shift to aspens at about 8,000 ft., then to lodgepole pine.

Grand Lake (about 8,000 ft) resembles Independence Lake but is only 1 mi x 1½ mi. It is 275 ft. deep. It is like Tahoe in being a center for sports only far more so, there is too much town. It is called Colorado's largest lake. It is at least a lake of bluffs and forests.

Frost here last night.

We rested in the grass on the bank of the lake before returning. I was brain-weary and Carl was ill. A sailboat was lazily riding the water while a passenger boat nearly blended with the forest across the lake.

Returning Home.

Snow course site → 1 mi. from Grand Lake a meadow for a snow course, near Park Checking Station.

1 mi. farther a large meadow.

½ mi. farther a sagebrush flat.

Sites all the way up toward head of river.

Erosion

On the curves heavy erosion in new excavation. May require facing.

Aug. 17: Didn't realize Grand Lake, 8,000 ft. land, is source of Grand River. Knew Mt. Rainier and Middle Park extends from Grand Lake to Kremmling. So we were there without realizing it.

→ Snow Survey Site

near western altitude mark "2 miles above the sea". 500 ft. below timberline. Forest still heavy. Glades also for protection.

Art Engineering.

Road getting the parapets and finish of roads even in Europe. They are covering the parapets with paper to prevent oil stain when surfacing the road.

Above Timberline

Alpine willow ankle deep as in Greenland, but it finally gives way to thin grass.

Short breathing! Really tight belt and waist, lungs can't expand - thought my health was failing. Unbuttoned my waist and regained my health.

Radiator boils. But 4000 ft. climb at top speed all the way up and even at 12,000 ft. yet Cad kicks. What does he want for $1000?

"Nevada". call the workmen at us. A Nevada plate is rare. We have seen but one during our entire trip.

A long-time view of Longs Peak in storm streamers (14,255 ft). Scenic apex of our drive. A long level road from which to view Longs Peak across the chasm.

What breathing below the belt. Delicious breathing now when the breath is deep.

South from Outlook Point.

Estes Park and hotel far below us.

green slopes

High forested bench above them. Then ^
gradually rising to base of aguan peak.

Enos Mills' country.

Snow surveys anywhere here.

Our view north takes us over Fall River with the Rim Trail Road curving like a the Tamalpais Railway. Beyond lie the sources of the Poudre in the Continental Divide.

Thus our mountain climbing has been by distant panorama or by auto. None by foot.

Long's Peak is now in a veil of thin storm clouds

From Estes Park.

Making the south circuit to Long's Peak Hotel.

Vapor rolling over ridge. The storm cloud reaches even into the valley.

The American flag is frequent. "Yes, they are getting almost as patriotic as the Japs.

East of Estes Park snow fences.

To Loveland.

32 mi. to Loveland. This approach to the Park is too rough and dusty.

Pines plains like Roaring Fork.

"Miramonte" "Kum-an-up" "Tuck a Way Cabins", "Seven Pines" voiced the spirit of romance and comradeship.

a beautiful canyon, except for the road, leading out into the red open hills. Rose clouds behind us.

Irrigated lands. Among them eroded hills — windows, gateways, parapets — against the sky. I thought it clumps of trees. Merely rim rock fantasies.

Loveland Lake or Reservoir ? It matters not. It is equally pleasing. If ever there were lakes in this region, they have been expanded into reservoirs.

This is the proud land of cherries. We could purchase either cherry pie or cherry cider. We tried the latter.

To Fort Collins.

The round red full moon over rolling fields and lakes. To the west the mountains ~~were~~ outline in fading colors. It suggested "Peace and Plenty" at eventide.

August 15. Fort Collins - Cheyenne - Casper.

The rising mesa - 5,100 - 6,082 - 5,123 ft.

Now weigh 156½ lbs "Honest Weight". Herein lies my tight waist and hard breathing?

The corn is tasseling out. The grain is only new in the shock. In Utah a month ago. Is the season later here?

→ # Utah farmers live in town, says Clyde. Originally they were given a farm and

a block in town to be divided finally among the children. The purpose was to guard against Indians. Now it is a social ideal. Clyde, himself, lived in Springville, just north of Spanish Fork. Foreigners have crept into mining but not into agriculture, so Mormon pattern remains.

Leaving Colorado.

Riding the rolling Prairie. Why so many section-corner turns?

Rear dumped down on our seat by the rough road just before we reached the paved road at the Wyoming state line. Now as quiet as a Pullman.

Carl calls the Colorado roads the worst in the country.

Wyoming seems to be the Great Plains interspersed with ranges. Snow fences numerous - some being groves of trees. The prairie should grow abundant cattle. Snow fence in outskirts of ~~Hy~~ Cheyenne. They seem to be putting in tree-screens instead of snow fences.

Cheyenne 6,082 ft.

"Cheyenne
Home of Frontier Days".

Car Repaired

The front wheels have been shimmying above 40 miles of speed.

The allignment was true, but the tires did not balance like a match. So it was necessary to add weight as is done to a race horse to keep it from thowing its feet too high. 1 oz. error in the symmetry of a tire creates a pull of 12 lbs at 60 mi. But our tie-rod also was found bent and loose. We must take no chances with the car. Only the driver may be "loose".

Mr. Disterdick, U.S. Weather Bureau,

We called on the Wyoming office in admiration and found an eager colleague. Age does not control exploration.

Wyoming too needed snow surveys or at least forecasts. Distant calls had come for the Laramie (?) and Mr. Disterdick had gone into the field to obtain data. Snow scales had been largely or abandoned by the Regional Forester because other tasks took the Rangers' time. He is open minded and wants any method that will serve the public.

He had no information except that in a circular from the Chief of the Weather Bureau which gave only the

correspondence and formal agreements
→ passing between the Secretary of Agriculture,
and representatives of the Weather Bureau
and Bureau of Agricultural Engineering.
This pledged the Weather Bureau to
seek and adopt the best possible
methods of snow surveying. Copies
of this should be sent to all cooperators,
for it will allay uncertainty regarding
motives.

He is now taking a weather station
to the Teton National Park because
extremely low temperatures occur there.
The Park also requested a snow scale.
However since that request we had
called and interested them in snow
surveying.

→ Dept. Wm. Geog. Rev., Report of amer. Geophys-
ical Union 1933-34 and Conference with Mr. Hayes.
He has some there for reprints.

→ # He requests particularly that we all
have a conference before the new plan
actually starts so as to cooperate
most efficiently and stresses the need
of promptness in forecasts. Salt Lake
City would be a satisfactory conference
center for him.

We talked of Mrs. Lathrop at Yellowstone. Ill health and concentration at a one-man station were breaking him. He might ~~now~~ obtain a transfer.

"Wyoming was the source of large rivers but used them little. However, it was now making claims to the Snake & a few irrigation districts.

Maud Johnston

Foster mother of war-laddies. So we called for Willie and Anne's sake and our old friendship. "Has my boy grown up?" "He always declared that his middle name was "Speed". You must be much alike".

Wyoming now a strong rival of Nevada. Went to airport to get Barbara Hutton to stop. They have a 90-day law; gay and gambling to entertain stopovers. NO night limit.

Wyoming Plains.

At 2:30 pm. on our way toward Bozeman 670 mi. ahead and only 1½ days in which to make it.

The great flat plains. Rich deep grass. No drought here. How a cowboy could ride and ride and ride.

→ Snow fences but trees were now being grown . . . . . to take their place.

The hills soon become rolling. Roads a delight. Wyoming is proud of its roads.

Rain clouds. We seem to bring them.

They plan to have to have an expensive day with set up "Buffalo Bill".

To Cheeseman. "a mile a minute."

Near erosion. Low limerock.

No more trees with snow fences. Is it an experiment?

Irrigation - Wheatland.

Flash streams. Dry in late summer.

"18 mi. Wheatland." But an irrigation ditch. Then farming land like Fort Collins. Cottonwoods but no fruit trees.

Has rained here. Fields fragrant. Mountain ranges to the west.

At Wheatland a railway. Now raining.

The North Platte.

The North Platte is very small. Two branches, two bridges.

Range again, but cutting wild hay. up into the forest fringes along bluffs or low ridges. Dry farming?

Glendo: "Drive slow and save a life".

Platte near Alum as large as the Green.

"127 mi. in 2 hrs 20 mins. 140 mins. = 127 mi. including stops. 65 mi. to Casper.

Heavy rain. Dry farming?F Some farms abandoned. Rain, vapor over distant hills. Evening. Wet. Greens and golds in the ranges.

Elevation almost uniform: Cheyenne 6062 ft. to Douglas 4815 ft. Douglas largest town from Cheyenne.

"First rain in 6 months. Hope it lasts 24 hours". "Yes, dry farming but irrigation most of town". "Winter range. Now dry but rain will stiffen it up. Stock now in mountains and north. Snow here in winter but one side of the hill is always blown bare. Stock badly depleted and must be built up."

Now 8400 mi. from Rand.

Cheyenne forecast had been: "Local showers and cooler", but the storm seems widespread.

The North Platte again. Seems even larger. "Exactly 1 mile above sea level".

→ Medicine Bow National Forest.

Clyde and Carl had been at Medicine Bow to lay out courses for the North Platte and the Laramie. The plan clears up. Well worth while. The views will please Dieterdicks.

Sorry that I could not see Pathfinder Dam. Get pictures; also map of the Medicine Bow National Forest.

Oil! Oil tanks in rolling landscape. Chicago & Northwestern Ry. Snow fences. Brown ranges.

At Glenrock large oil refineries by Conoco.

The Platte is now marked by a broad belt of trees.

Oil derricks! "The Ohio Oil Co", "Conoco", 70 derricks in sight and a landscape of derricks continues to unfold. This is the "Big Muddy Oil District". "Texaco". More refineries. Is Casper an oil town?

Casper.

"The Hub of Wyoming"; Heart of the West". Oil everywhere. Town 18,000 not yet filled out.

Raincoats. "Beginning ninth week since rain has fallen". Longed for.

Aug. 16 -

Carl is better this morning. The viola in the band with Clyde had jarred a headache into worse and given him a very stiff neck. Linen and cold were warning him for bed but he still insisted on the road and our schedule.

The rain is ceasing. Cloud dawn at base of Casper Range. Overcast, damp, cool.

Oil refineries everywhere. An unfashioned town. Industry here but not comfort.

→ Irrigation Projects and Storage on Platte.

The North Platte has a 6 span bridge. and 3 dams are made or planned at its source. The Pathfinder which

controls the present water is to be supplemented by the Seminoe Dam above it and the Alcova Dam below, thus providing a trinity of dams to conserve the water for 66,000 more acres of cultivated lands. Clyde's canyon in the Medicine Bow National Forest will become increasingly valuable.

Wyoming's Centers of Irrigation Interest.

Wyoming has more possible centers of irrigation interest than at first appears.

1. Medicine Bow Wks and North Platte.
   3 reservairs.
2. Laramie River.
3. Wind River – Big Horn.
4. Shoshone Reservoir
   But reserva large.
5. Green.

Present Complexity in Forecasting

Four bureaus or organizations now forecasting: Weather Bureau, Agricultural Engineering, Reclamation Service, Geological Survey.

The Columbia also is not a unit in interest. Weather Bureau in general forecast. Reclamation Service and Geological Sveny on upper Snake. Army on lower Columbia. Agricultural Engineering

to irrigation alone. Columbia has more water than can be used. So interest in snow surveying slight - except on upper Snake.

Who will issue the broadcasts? Hill, Crandall, Darlington, Mann, Army, Hayes? Each his own client and judge.

From the Platte to the Shoshone. (5123 - 5018 ft.)

or Casper to Cody.

Two railroads here: C B & Q and C & NW Rys.

Rolling hills and low ridges, mtns. seared in the distance. Cloud scuds close overhead. Cumulo-stratus and the blue sky beyond.

Hall's Half Acre.

Beyond Powder River is a miniature Bryce Canyon with subdued colors. They sometimes call it the Devil's Kitchen. But why hellish?

The whole map of Wyoming is filled with battles, deaths, and graves as historical monuments. Was it then so wild?

"Coal, Outlaws"

Max. for season 90°F. Coats on today, and windows nearly closed.

Hiland - 5998 ft.

Our divide into the Big Horn and

yellowstone.

Snow fences in long lane on either side of ~~highway~~ railway.

→ No runoff from present rain on the range.

Sloping Wyoming.

Now down from Hiland 5998 ft. to Thermopolis 4326 ft. with the Wind River and its successor the Big Horn. and thence to Greybull 3788 ft.

Scenic Wind River Canyon.

Rim rock. Some color. River gray and thick from recent rain.

Tunnels for both railway and auto road, the latter with views out into the gorge. However, only a very mild Glenwood Springs canyon. The lower end terminates in red and Wind River merges into Big Horn.

Thermopolis - 4326 ft.

The largest medicinal hot springs in the world. But the "terraces" are Mammoth Hot Springs in the making - reds, browns, greens, yellows, mineral and algae. A cone also  with water from the top.

Big Horn and Gray Bull Rivers.

→ Irrigated lands down the Big Horn

Grain in shocked or threshed Oil.

Mesa here as bare as Little Colorado.

→ Of consequence, for the Gray Bull comes from the Teton and Wyoming Forest and the Wind river comes from the latter. Both forests are snow gatherers.

Above Worland a large substation (?) of the Mountain States Power Co.

[Mr. Lamb suggests that its source of power may be the Shoshone or also the Wind River.]

→ Are the Big Horn and Gray Bull used up for irrigation locally? or do they add to the flow of the Yellowstone in Montana?

~~The town of Greybull~~

Diagonally thru Wyoming

We are climbing out of Big Horn Basin at Greybull 3788 ft. and ascending toward the northwest corner of Wyoming to Cody 5018 ft.

Rain brewing again.

Sand and grass. Wind erosion as in the Little Colorado.

Desert upland. Tall ranges coming into view to the west. Probably no rain here yesterday.

Our only gravel. 36 mi. But 60 mi. more to go.

What's in a Name?

"The Green Lantern"

"The yellow Slipper"

The red Beacon.

Cody. 5018 ft.

Founded by Buffalo Bill. Owned the leading hotel the Irma. His childhood home brought fame from Iowa. But he is buried near Denver.

However, Gertrude Vanderbilt Whitney's statue of Buffalo Bill is erected on a mound in town. One could wish that the mound were a bluff, for he seems to be looking far down.

Up to Shoshone Dam.

a polished, waterworn rock canyon a parapet road under overhanging rocks and then tunnels.

a concrete crescent dam

Height 328 ft.

Length of crest 200 ft.

Capacity 456 000 acre ft.

Area of water surface 10 sq. mi.

Length of reservoir 10 mi.

Maximum width 4 mi.

Maximum depth 233 ft.

Level 5356 ft. above sea.

1905 – 1910

Cost $1, 354, 000.

Cheap storage.

Last year drawn down 23 ft for drought.
Sufficient in the reservoir to last 3 drought years.
→ Hole blown in spillway 20 ft. square to
expedite runoff without reservoir rising
so high. A semi-guide said it was to
save wear on the valves. Ask problem.
The use for power is relatively small.
→ More land available but not taken up (?).

A mild canyon. The thin wavy
strata fascinating. The water milk
gray but not thick.
Sign "No parking on grade" changed
to "No spanking on grade." Romance is
powerful here.
The blare of our horn was deafening
as we sped thru the tunnels and
warned coming approaching cars of our
progress.
On a sign
"Dont Miss Casper
262 miles."
No, we didnt and never shall.

Cody to Livingston to Bozeman.

North of Cody the Shoshone bridge has
2 spans.

Economy: a stream, a railroad trestle,
an highway bridge at an angle beneath.

"You are entering Montana".

On the stem of an oil-tank truck:

"Sound your horn.
The road is yours."

9,000 mi. from Rand.

No rain except few drops.

Clark Fork - Wide irrigated bottom lands. Rim rock on west side of valley.

Smelled a train, overtook it. a freight.

The Yellowstone.

at Laurel entering the valley of the Yellowstone, 10 mi. wide but narrowing. Steep mountain walls on either side. Agricultural

→ How much has river grown in volume since leaving Park?

Now all cars have Montana plates. Strange. and the insulators on the powerlines suggest pendent sugar-pine cones.

Forests on the slopes. Trees along the river. Spacious tranquil landscape thru wooded gap.

Snow fences on hill slopes.

3-span bridge over the Yellowstone. Northern Pacific parallels our road.

1. 50 mi. to Livingston. Geese and sheep grazing.

snowfences long. a band of drifting snow, 2 ducks wheeling close overhead.

Livingston. Older than when I saw it in the 90's. Southward the V-shaped canyon portal to the Park whence issues the Yellowstone.

The old home of my pioneer uncle. But the name Church has vanished from the phone book, and only one Winslow remains. Somehow reminds of family ties that are mostly curios?

To Bozeman. We leave the Yellowstone, up and over. The train tunnels under ~~down under~~. Russet and greens and gold on the hillside. Forests thick. Plenty snow banks. In the next valley Bozeman. 7:25 p.m. 523 mi. and on time.

Aug. 17-

Surprises. Birches and poplars. and mixed luck.

Mr Hanson is gone. Yesterday he tried to wire the trains thinking I was coming that route. I was at the hotel

thinking only of writing my notes before making delaying contacts. Mr Lamb was at the other hotel phoning to Manson. Manson told him that I was to meet him (Lamb) at the hotel despite my definite instructions.

So birches and poplars were the only welcome I received. Manson had to depart early for a reunion at Logan, Utah and Lamb did not arrive at the Station. I thought that he was driving in from Helena. But a foolish idea to phone the hotels brought him at top speed.

Meantime I had overlooked making a courtesy call on Director Linfield but was learning much from Mr Manson's assistants. Thus the old luck swung back to normal.

Murdock, however, was in California visiting his children. Odd how family matters Chinooks. Creep in.

Chinooks are rare at Bozeman but frequent at Havre and Great Falls to the east. There are also expensive

stations in central and eastern Montana. The Chinooks are usually strong winds. The conditions supplement those at Fort Collins. Why not a double experiment.

Testing Snow Survey Accuracy

We Monson tried the Gallatin(?). But set Oct-~~Feb~~ Mch. precipitation over against Apr – Sept. runoff. Closest agreement was 50 percent.

I suggested Dec-Mch over against Apr-July or at this elevation and latitude Dec-Apr. over against May-Aug. But modified by the departure in precipitation during runoff. Unfortunately snow surveying means only "snow = runoff"

Needs

The Montana runoff does not parallel Montana growing season. The peak of runoff is in June. The water is wanted in a bunch in July. Hence storage is necessary.

The Missouri too deep in its bed and the soil there too poor. But the tributary streams valuable and storage projects are under way.

Some local snow surveys are being planned by the college.

~~From~~

Monsoon Himself.

Under the glass top of Hannah's desk I noted various clippings and inevitably himself

Mark Twain said that when he was a boy of fourteen his father was so ignorant that he could hardly stand it to have the Old Man around, but when he got to be twenty-one it simply astonished him how much the Old Man had learned in seven years.

"Some people grow under responsibility — others merely swell."

"Every failure teaches a man something if he will learn."

Our Program.

We are luckier than even our ignorance permits. We have been wanting to visit the headwaters of the Columbia but expected to find them in British Columbia.

They are here in a little ganglion in a bend in the Continental Divide

where the storm track passes. Here cluster the upper Columbia, Clarks Fork and the Snake which promptly part by devious paths to unite again in the lower Columbia. A modest mountain state could readily be formed to contain them all. Call it Columbia.

And the Missouri takes its back or eastern side.

Our trip into Canada will now be largely to study the headwaters of the Bow. The trip thus Banff to Trail will be largely a western movement to reach the Lower Columbia.

~~Mr Lamb and his circuit~~

Mr Lamb and His Circuit.

The U.S.G.S. seems to produce rugged men, field men who understand watersheds and their products.

Mr Lamb has had 31 years of service. He longs for more and has the physique to bear it. His hair is slightly gray, his speed is alert and his blue eyes see you off.

He has grown into his snow avocation. To divide the St. Marys, an international stream, he went into snow surveying in 1923(?) with Canada. He aided the Army Engineers with stream measurements.

away was established in Parks, the Reclamation Service and the late Geo. Marx regards and pleasant Canadian.

When the snow sampling in Glacier National Park began in the year 1[illegible]

He was asked in February to make a snow survey for the Missouri. It was made on schedule in April at the lower and more accessible elevations and snow course locations have been steadily moved up. The courses are such as I would have chosen myself.

The work is not formally cooperative between the U.S.F.S. and the Army Engineers. The U.S.F.S. made no objection. So Mr Lamb carries on, eager to expand the work into a state snow survey and to include essential research work with it.

Mr Henson is supplementing the surveys and the Experiment Station may well someday assume the state work. However, the surveys now essential to forecasting the Missouri represent those mainly essential for Montana. This is particularly true if the Yellowstone is included.

The Forest Service has not yet been called into cooperation.

The Seven Streams.

The fan of streams supplying the Fort Peck Reservoir are in the western end of the state: The Gallatin, Madison, Beaver Head, Deep Hole, [Rimini-Stemple], Sun, Marias, Swift Current.

Others ?

Mr Lamb offers to take us to all these, then thru Glacier National Park

and to the Bow River Project at Calgary. Since there will be time he will include also the headwaters of Clarks Fork and upper Columbia. The Army Engineers will pay his expenses for the entire trip. I ride in his car, Carl follows in his, for we shall part from Mr. Lamb in Canada.

The Gallatin Basin.

→ Obtained a base map from the Gallatin National Forest at Bozeman. Send reprints in return.

The Gallatin Gateway is the most fitting and harmonious entrance to Yellowstone Park excepting possibly the highway from Billings via Red Lodge to Tower Falls at the northeast corner of the Park.

The Gallatin Gateway is used by the Chicago, Milwaukee & St Paul, the Livingstone by the Northern Pacific, and the West Yellowstone by the Oregon Short Line. The Burlington and Northwestern approach as near as Casper in route to the

South Entrance at Jackson Lake.

The Gallatin approach to the Park is thru grainfields and golden ranges and forested slopes and "is as fine as any drive in the Park."

Gallatin River is a beautiful stream at the gate of the Forest. There is a stream gaging station, and a reservoir site just above it.

The gateway to Gallatin National Forest is fit to be the gateway of the Park itself. Its heavy logs remind one of a fort.

In Montana all gaging is cooperative and in charge of Mr Lamb.

Mr Lamb was born in Colorado and educated at Fort Collins. So has all the natives understanding and interest.

Low-level courses selected first, as near gaging station. Now at 7,500, the highest land available along the road in timber where shelter from wind is complete. Here aspens also where available, but avoids large pines and windswept open places.

An ideal course selected at West Yellowstone where people are resident

→ Mr Lamb has charge of cooperative Federal-State projects. Report here was dreamed Transport of the Colorado scenic by Tunnel to the Great Basin. Trip Zion, very practicable except as to Zion Tunnel.

throout the winter.

A long road if snow is deep but has drives in bare winters & the West Entrance.

→ Plans with Professor Hansen to lay out
higher courses in the Park itself.
Park is divided naturally into south, northwest, northeast between the Snake, Gallatin and yellowstone. Why not plan the three snow survey districts with the Park officials? A resident of the West Entrance can survey there, and low-level courses can be reached up the Gallatin from Bozeman. Write Wammack
→ # regarding Mr Lynch and Professor Hansen.

Mr Lamb prefers to select snow courses in winter to escape erosion by wind,
→ and then to clear them summers. Plans to mark them also. Send him a model of California's marker.

Used any type of sampler he could get at first in emergency. Orders are filled very slowly. Recommended the Mt Rose type to Tipton. Has some of
→ the Utah type. Finds this sampler light, simple and easy to carry.

The army is appropriating $1500 a year for the work.

Times of Survey.

Snow never melts April 1 and the snow melts during April no water is lost from the snow before May 1.

In Glacier National Park the lakes are still frozen even in May or later and snow survey forecast is not wanted until May 1. The snow survey forecast would also be more exact May 1 because more of the season's precipitation would be included. However, the April 1 data is also necessary because of runoff at low levels.

Monthly snow surveys are also made in the winter.

The Chinook Project.

Mr Lamb suggests that the U.S. Weather Bureau at Helena (Mr Vaughn) be asked to cooperate with instruments. Agreed. Thermometers, thermograph, anemometer, precipitation gages. Shall write Mr Hayes and Mr Gregg.

Mr Lamb should be the leader of the project and Nevada be advisor. Thus Lamb, Mansur, Vaughn, Elges.

The Madison Basin.

The Madison adjoins the Gallatin on the west and is directly approached from above by way of West Entrance.

Not as large as Gallatin but has very large storage. Reservoir of the Montana Power Company, which

serves all Montana, as Washington Water Power Co. does eastern Washington.

This reservoir is for storage only. One power plant down stream on the Madison. The remainder are on the Missouri itself.

→ at Great Falls? Power lines now extended to Fort Peck Reservoir at 250 mi. distance. 50,000 ~~kilowatts~~ horsepower used.

Storage on Madison sufficient now, for power demand has fallen off. 350 000 acre ft approx. Dam 90 ft.

→ Weather station at dam. Power Company has promised cooperation in service when snow survey plan is fully carried out. Snow courses in timber on west side of reservoir. More will be laid out higher in same region. Resident observer may make snow surveying easy here.

The work in Montana will become easy. "Everybody for it and nobody against it.

Water distribution

The State Engineer develops projects, but does not adjudicate or distribute water. This is the function of the district courts who appoint water commissioners subject to them. Since more than one county constitutes a judicial district, an entire stream may come under the jurisdiction of a single

* 1/3 kilowatt = 1 1/3 horsepower

court. But more frequently the stream may be sectioned between courts as in Oregon. The result is not happy.

On the Madison the farmers are better off than before, for they no get late water. They may even get more than decreed at least, if the 2000 secft of stored water released, not more than 700 secft get to the power plant.

Fort Peck Permanent.

Minimum elevation of conveer already set. Snow at lower levels not stable. They are now seeking to go higher.

Little irrigation and no power will be developed at Fort Peck. The soil is not fertile. The Montana Power Co. has already extended its lines to Fort Peck and a power company in Dakota is producing more cheaper power from lignite and encroaching on Montana's hydroelectric field.

Improvement of navigation will be the chief function of the dam. and navigation is beset by truck-traffic, and railroads seeking trade. Hanover,

Runoff of the Missouri: Then
1a. 2,650,000 cfs to 15,000,000 cfs.

the Dam must always be regulated and this will require snow surveying.

Yellowstone Lake.

The Yellowstone has no present storage. Idaho frightened the Park Service by proposing to tunnel the lake into Idaho for power. That would have killed Yellowstone Falls.

Yet a dam at "Fishermans Bridge would be inoffensive and keep Yellowstone Lake more stable than now and the Falls larger late in the season. the smaller earlier. This might aid the water-users in low seasons. Study this problem. Or would the annual peak of the Yellowstone occur in July when water is most needed? Would a dam really mean a greater fluctuation if the waterusers is to be benefitted?

However, as in the case of Grand Lake the Park Service prefers to have nature primitive.

Testing the Missouri Snow Survey Courses.

Even with 2 years record it is possible to determine the minimum number of snow survey courses essential in each basin by comparing the seasonal percentages of the individual courses with each other. To determine

* Would not the water-users need a warning and protection system? Would not the army also desire one as supplement to Ft. Peck?

* Would not the water-users need a warning and protection system? Would not the army also desire one as supplement to Ft. Peck? and Nothing

the seasonal percentages let the first seasons measurement be regarded as the base or 100 percent.

The courses are now relatively few and may need increasing.

The Ruby Basin

No snow courses in the Ruby Basin nor storage. However, irrigation projects are being planned there and Professor Hanson and Professor Murdock are considering snow surveys there.

To reach the Beaverhead, the third stream in the series, the Ruby Basin had to be crossed and Montana's Virginia City visited

The summit between the Madison and the Ruby was 7200 ft. and represented a bare divide.

Virginia City.

In the foothills leading down to the Ruby appeared a V on the apex of a hill. Then a town

"Virginia City
Cradle of Montana's History"

Then over the door of a crumbled building "Hanged here

_____

_____"

a veritable roll of "honor" for the Vigilantes.

A museum is here and an antique court house with lawns perfectly kept. The much of the town is falling apart. Still the county seat and the meeting place of the Territorial Legislature.

On the road map is an adjoining town of "Nevada".

But the evidence of the town's origin is a lode of rocks in mounds reaching 7 miles down the narrow valley until it abruptly stops at a field of alfalfa. Had the mines played out or did the farmers think their crops looked prettier? Millions have been taken out in placer mining and dredges are now at work going deeper.

Beaverhead Basin and Dillon.

First irrigated valley in Montana. Due probably to mining excitement in the neighboring basin or at least in southwest Montana. A railroad up the Ruby to Alder near Virginia City indicates the line mining.

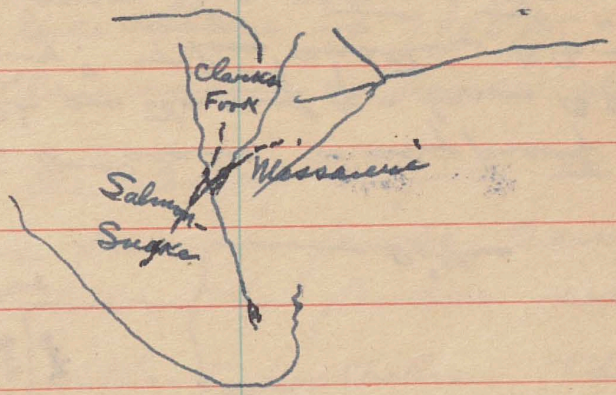
A long run far up Beaverhead Valley brought us for the night to Dillon. Here the Oregon Short Line from Salt Lake City to Butte. Here also "County Farm". We call it "County Hospital".

Tough. But we must stay up till 11:30 p.m. and up again at 5 a.m. to keep our notes within sight of our progress. Carl has sent our schedule

of postoffices to Emily. We are going persistently now without time out for resting.

August 18. Dillon – Salmon – Hamilton.

Over the Continental Divide into Idaho and the Salmon and again over the Continental Divide into the Bitter Root. Thus we passed over the forked Continental Divide from the Missouri to the Snakes and back into the Clark's Fork.



The Beaverhead.

The Beaverhead is not a good water source as shown by sagebrush and barrenness. Gaging station only at Dillon. Some forest cover on the higher mountains at its head.

A snow bank or two.

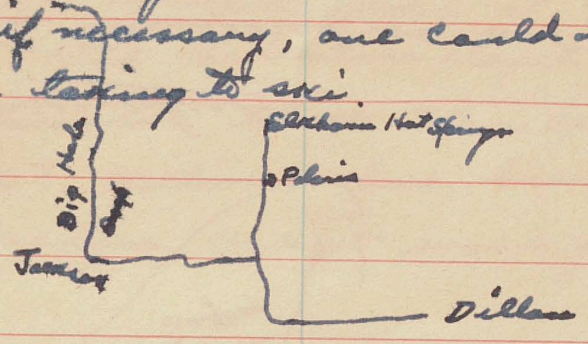
Study quantitative runoff up and down the stream.

The Oregon Short Line crosses the Divide near Monida, but the pass is low

and unforested. However, it might be the point of departure to more distant snow courses.

Coats and vests today.

The ~~two~~ representative courses for the basin have been selected on the west rim northwest of Dillon and near Polaris – a lone house to which the mail stage goes. Name for a ghost town in the hills nearby. So if necessary, one could ride this far before taking to skis.



Enroute to Polaris, a very pretty mountain valley. DL on the roof of a barn. A collegian gone farming? Then another KE in the grillwork over his gate. Then "Polaris", a log house and hay ranch, head of auto navigation in part two winters.

Beaverhead National Forest.

1/8 of the trees brown and dead from an insect pest. (so should be called "The brown death".)

→ Elkhorn Hotsprings here, a resort with Caretaker undoubtedly. Nearby one snow course and at the top of the hill another – both in the timber.

Upper course at 8,000 ft. Snow over 18 in. deep in 1935.

The miracle of "white spots" or islands of snow. Except for them the valleys would be perpetual deserts.

Why?

Hayes failed to come to Helena as scheduled. He would not see Clyde, He did not write me. He did not call Carl.

~~Big~~ Hole Basin.

Elevation of summit from Beaverhead into Big Hole Basin is 7100 ft.

4 golden eagles or hawks along the way.

Verily the lodgepole pine is the settlemans friend - fences, corrals, barns, roofs, crates. The fences set up on the ground in a ^ without postholes. The Indian used only the slenderest for his tepees.

Big Hole is a great hay country. Wild hay but irrigated. Jackson is a tiny old town. The Continental Divide high and wooded rises to the west. Here is the snow-sweep course for this basin.

The valley is probably 20 mi. across.

→ Check the percentages of the courses at Edachoma Hot Springs and on the Continental Divide. Do they harmonize? The distance between them is not normally too great

Wisdom.

How come? A Mormon settlement.?
Mr Lamb says No.

Have a map of the Beaverhead National Forest with winter Ranger Stations marked.
→ Get "Directory" and send reprints to the Montana Forests.

Raking and baling hay with the same machine! Perfect bales too.

Nevada! The forested mountains and sagebrush uplands. Hay lands far up the benches.

Over Gibbons Pass to the Salmon

So near and alluring. I had crossed the Salmon near its mouth. I must see it at its source.

At the base of the Bitterroots the General Gibbons Battle Field with the Nez Perce Indians under Chief Joseph. A near tragedy of the Little Big Horn type. 1/3 killed or wounded. The inscriptions read like a prizefight, "shot above the eye", "wounded in the fleshy part of his eye", "had his leg broken by a bullet", "this tree received four bullets". But by the side of a large monument in a cage of iron bars is a slender pillar bearing the portrait head of Chief Joseph with words of praise from friends and followers. This has also been made a "Campground".

→ "Killed one", "killed this", "Exploit 36 years".

Why not Gettysburg?

"The Brown Death"

As we ascend to Gibbons Pass, 1/2 of the trees are dead. "Large areas similar in Montana". "The plague started in Glacier National Park 20 years ago. Aspens and young trees seem unharmed, living the fire. A ghost forest. I feel depressed.

→ Will the new growth ultimately replace the dead?

The endless forest. Lodgepole pine.

Summit of Pass 7,500 ft.

→ Here a snow course, a triple index for Big Hole, Salmon, and Bitterroot Basins. The course can be approached from Missoula on the trunk auto road from Montana into Idaho. The road probably will be kept open.
Here is the Montana-Idaho state line.

Down to Salmon.

More water on the west side.
In the Salmon National Forest Douglas and ponderosa trees. The brown death seems less prevalent.

→ Hay ranch. Telephone. Good site for snow survey. Near Twin Creek Camp.

Lewis and Clark Monuments.

They came across Beaverhead and Big Hole over Gibbons Pass to Salmon and Snake on their way down the Columbia.

They did not consider it a world feat. In his Diary, Clark wrote on his birthday that now he would try to do something for his country. "He didnt realize that he was performing one of the greatest feats in American history". - Lamb.

Gibbonville approx. 5000 ft.

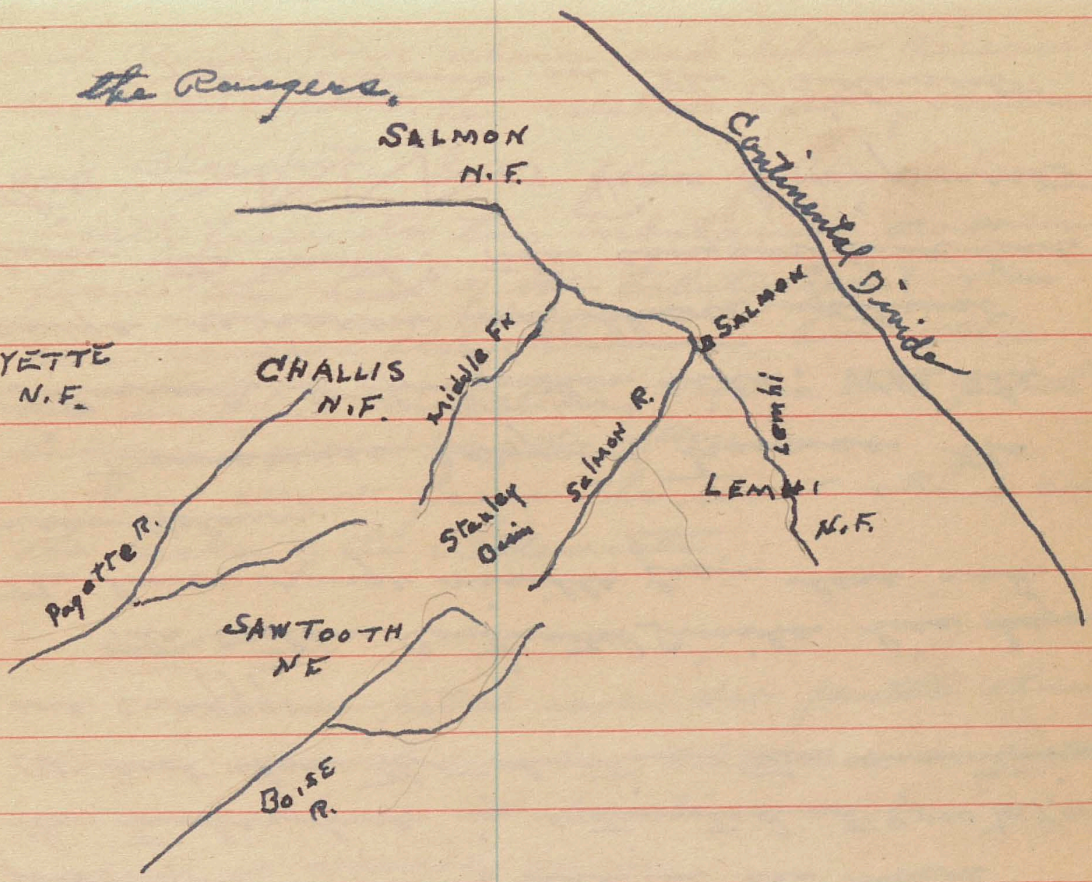
a good snowcourse site here. The brown death now mostly gone. Out of timber into grass. Hills bare as in Beaverhead Basin.

The Salmon River

→ The Salmon River quite a stream. But at Salmon we learn that this is only a portion and that the real source of the stream is 150 mi. south in the Challis National Forest in Stanley Basin, thus sharing the watersheds of the Payette and Boise Rivers. Hanenah, its east fork, the Lemhi is fed from the Continental Divide, opposite Dillon.

Thus the forecast of the Salmon can depend largely upon those for the Payette and Boise modified by the snowcovers at Gibbons Pass.

We were generously given maps of the Salmon and Challis Forests with details written in by the Salmon Forest "office force busily at work on Sunday. We examined also their Personnel list and promised to send reprints, one copy for the office, the other for circulation among



Down into the Bitterroot to Clark's Fork.

Back and up to the "Triple Indian Corner" at the summit and down by the trail line into the Bitterroot Basin where the Bitterroot and Blackfoot unite at Missoula to form Clark's Fork.

Not so happy, for Carl is trailing in the dust alone.

A snow course at the head of the Bitterroot and one at the head of the Blackfoot. Possibly too few.

Down the East Fork of the Bitterroot.

→ Bridge to the West Fork. Good sites.

Rain south this morning. Evidence

here and now rain itself. But rain spotted. It is now on the peaks to the west.

On the main Bitterroot are fields. The sunset colors are in the east and the hills are reddish brown with the alpenglow of sunset. The river has a 2-span bridge but is almost dry.

Stop at Hamilton after nearly 300 mi. rough travel. Fire in the hotel stove.

Aug. 19. Hamilton (3571 ft.) to Missoula (3208 ft.)
~~(3571 ft.)~~

The western or main Continental Divide known as the Bitterroot here is sharp and craggy but the eastern ~~Divide~~ side of it is forested and at 8,000 ft makes good snow courses. Here in the north the timberline is estimated at 8,000 to 9,000 ft. at least above that elevation the mountains are craggy.

The eastern Continental Divide lies beyond the lower range visible from here and near Helena.

Transverse canyons traverse the Bitterroots to the farther side. Was the range rebroken into blocks upthrust from the south? The canyons look like this: ⩘⩘⩘. View looking west.

Gaging stations on the Bitterroot

and Clark's Fork above and below Missoula.
→ See Water Papers for relative flow of Bitterroot and Blackfoot. Do the flow of Clark's Fork mostly from its two tributaries or even from the head of the tributaries? The side canyons flow streams but these are used largely in irrigation. This is true of both divides, i.e. of both sides of the valley.

→ The flow of the Bitterroot is in May or June.

Now about from the recent storm on the peaks of the Bitterroots.

Speed limit

The newspaper says: Not faster than 40 mi. around curves. Otherwise as fast as you please. Mr Lamb's maximum speed is usually 40 mi.

Bird.

Mare birch. "a net ground tree". Does well here.

Florence.

Here mean Florence is the famous woolliest focal point in the Bitterroots on the west side of the valley. Why? at Hamilton the Government has a laboratory for the study of serums.

→ Here more snow course sites.

"Model T"

How long will Ford Model T survive? As long as there are parts? Montgomery Ward will have them.

Up Lolo Pass into Idaho.

Lolo. Bitterroot Valley once noted for Mc Intosh apples. Shipped loads out. Not as popular now.

On rough roads again. Up and thru the Bitterroot Range into Clearwater National Forest.

The canyon is dry but the road is narrow. "This road is getting no better fast" - Lamb. He resembles the Statue of Nathan Hale by ———.

→ It is Tahae and Blackwood Canyon again. Courses way on north face of canyon just within the throat where 2 ranches are. Lolo Hot Springs 12 mi. farther.

A Ranger Station 8 mi. from Hot Springs. Pools in road. Rain here recently. Steep hillside. Trees and a carpet of low shrubs and grass - as smooth as cloth. No trace of erosion.

→ Lolo Hot Springs and Postoffice. Quite a settlement. Here shelter the year round.

Lolo Pass - Idaho-Montana State line.
Map. 5187 ft. Aneroid 5100 ft.

Old fire in St Joe National Forest

in 1910(?) burned itself out at this point. The whole country was devastated and the trees stark and gray when we laid out the Spokane snow system. Now young growth is well started.

→ Good sites for snow courses just to the east.

High mountains ahead. A lodge 11 mi. below. Forest also is heavy below summit. "Oregon mast timber" here.

The Clear Water Forest.

And Lochsa River is clear. There is a Lolo Divide Road leading 125 mi. into this country but we forgot to fill our tanks. Besides we did not know where it led.

CCC Camp in midst of mountain road and trail building.

Down into ferns and cedars. Large cedars 18 in. to 2 ft. thick.

A long meadow. Gas low.

→ Powell Camp and Ranger Station. All winter? In depths of forest and mountains.

→ Get Lolo and Clear Water Forest maps.

A novel cabin at Erickson's Lodge. Has log walls and a canvas roof. Easily dismantled for winter.

* → Basis for Selecting Snow Courses.

Since the elevations in the northern Rockies are low, the selection will depend upon snow depth and persistence rather than upon altitude. Therefore, sites must be selected where the snow does not runoff from December to April 1.

This can be determined by the Rangers by noting whether the soil beneath is wet or merely moist. The lowest level of persistence must be determined in the regions where snow surveys are desirable.

Only a Dog.

But he has the makings of a boy and even a man. Bouncing on a truck platform with all legs spread and innards shaking. This first we met him.

On our return we passed him on the cab roof above the driver with all nails scratching and lunging to bark at us as his car lurched by.

Saved. No gas at the lodge. The CCC's could not sell any. We made the summit and coasted to Hot Springs for gas. We got dinner instead. The blue-green

gas didn't work. So we coasted again, Carl's empties car in the lead, and how empty he was, at Lolo he took 15 gals and we took 13. No wonder for with the trip into Missoula the day's run was 290 miles.

The Beaver Death.

This disease seems mostly on the east side of the range. The trees are luxuriant on the west side.

Wooden Bridges

Wooden bridges naturally in the forest. But they are even on the railways and highways in the valley. All but persisting. Steel and concrete coming in slowly.

Fort Missoula.

Still active. A water tank painted checkerboard style in black and yellow. As beacon(?) or to keep airplanes from crashing it.

Montana's Leading Cities

Butte 30,000. Mining

Great Falls Power. { Rocky land. Falls have changed little since measured by Lewis and Clark.

Billings Agriculture

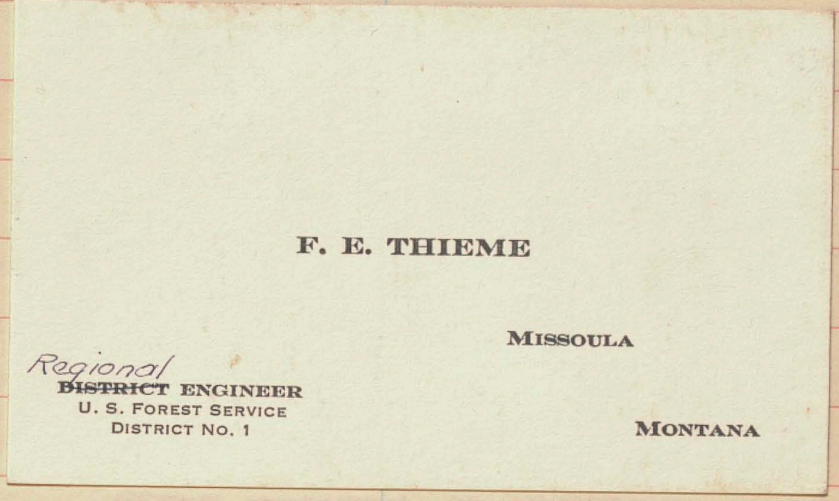
Missoula Agriculture

Helena 13000(?) { Old placer mining town. Capital.

I shall remember Missoula for its bells — strange the harmonious after the silences,

Missoula - Regional Office No. 1 - U.S. Forest Service

Fortunate again - Mr Lamb had a friend in the Forest Service at Missoula. He was Mr Thieme Regional Engineer of District No. 1 embracing all the National Forests in Montana and Idaho.



I have promised to send reprints to him and he is sending Directory and Maps of forests in Montana - Idaho to me at Helena.

He is ready and even eager to begin snow surveying.

1. Snow scales have been abandoned as unsatisfactory. They have found no correlation in them. No relation to forest fire immunity.

2. A civilian has charted the years of peak flow (i.e. high runoff) against years of bad fire hazard (or occurrence) and finds only one year in doubt. Mr Lamb and I suggested that heavy run off meant damp forests. Consequently

higher relative humidity and less inclination to combustion. The Forest Service has long associated low humidity with fire tendency.

Research entire Forestry → We must ask for the data and work on the problem. It is of first importance as a research problem.

Mr Thiene will be glad to try snowsurveying as a substitute.

3. The Service has its Rangers well distributed for winter observations. Is using them in protection of wild game. Is moving the older men in and is planning to use a motor-sled of two spiral-cylinders for longer trips.

4. Is willing to accept bonus if the Government permits.

→ 6. Spotted precipitation pertains to entire basins rather than parts of basins. Thus the Bitterroot and St. Joe, but there were 125 mi. apart. at distances of 20 mi. no difference.

But because of the cost better have the stations 60 mi. apart at first as Mr. Lamb does, then closer together as found necessary.

7. The 3-zone plan satisfactory.

8. Because of lack of funds, better to urge the appropriation of $100,000 for equipment and maintenance.

→ 9. As a preliminary, it was agreed that ~~was~~ the elevation of unmelting snow cover April 1 would be determined by the Rangers.

10. That no further steps would be taken until a plan was worked out and presented.

→ Take up the plan with Major Sweeny and Mr. McLaughlin and possibly with the Weather Bureau and Canada. Mr. Lamb should take charge of the work with Professor Mawson as assistant and understudy. A large opportunity to organize the Columbia.

The Dams -

The present idea of the dams is little different from the original one but points in its appeal.

1. The Water Resources Committee has recommended the Cooperative Observers be paid despite the additional ~~cost~~ expense involved.

2. The Forest Service cooperators are asked to perform an

unusual task under exacting and frequently unpleasant conditions the work calls for eagerness rather than obedience.

3. The task usually requires 2 men rather than one. Since only one Ranger is usually resident in a district, it is necessary to employ an assistant from the locality. for this wages must be paid.

4. Sometimes the Ranger is too old or because of prolonged sedetary occupation in the office during the winter is physically too soft to undertake the work. Yet he would feel humiliated if another Ranger were imported into his community to do what appears to be his work.

5. Yet, if he received a bonus for the work, he could use this bonus to hire a substitute in case he felt unable to perform the task. at the same time he would be responsible for the performance

of the work as before. Also in case of emergency it would be easy for the usual assistant to do the work and the house be used to employ a helper. Thus more observers would be familiar with the location of the courses and the nature of the work.

6. The custom is already established in the Aviation Branch of granting extra compensation when flying. There should be no Departmental rivalry for the rigor of the work is acknowledged.

A Presidential order or one by Congress or the Civil Service would probably be necessary but an statement of circumstances could probably be obtained.

It is interesting to note that because of the rigors of the work Mr Marshall has suggested the possibility of some automatic and remote control devices. If only a robot had brains but even his joints might rust.

August 20 - North into Flathead Basin.

The nights are too short for notes and rest. But nearly caught up. Instant relief.

We must visit the remainder of the Clark's Fork sources and so are going north into Flathead Basin. Quite new names there. The Kootenai can be visited in Canada, its real source. In Montana - Idaho it is merely a channel or conduit.

A Water Supply Picture of Clark's Fork.

The value of the Flathead Basin is apparent in the relative flow of the branches of the upper Clark's Fork. The figures are for May 1932:

Clark's Fork from Butte Blackfoot from Helena	453,000 acre ft.
Bitterroot from Hamilton	463,000 "
Flat Head from Glacier Natl Park	2,630,000 "
Total	3,546,000 "

Ratio is thus 1, 1, 6, or 3 times the flow in all of the southern branches combined for the Flathead branches combined.

Clark's Fork near mouth at Metaline Falls, Wash. 4,420,000 acre ft.

Ratio of upper feeders to mouth 1, 1, 3.

Thus the area of necessary snow-averaging would be confined to the

↑ Or it must only flow large over summer of natural storage in Flathead Lake in manner dependable.

Continental Divides, which in Montana form a V.

To Flathead Lake.

No. 10 oiled road east-west thru the state. No. 93 a trunk line under improvement from Idaho to Canada. We take the latter.

"War". I feel easier. Will even join the clans, "I even hope the Ethiopians will fill the wops so full of holes that they cant hold spaghetti". — Lamb. As I copied it down, I remarked: "I'm not sure that I can spell spaghetti, but I think people will understand."

Flathead Indian Reservation.

Cutoner, Summerer. Mission Range at head of valley. Its pyramid peaks white with new snow. Rain here recently on the road.

National Bison Range. Golden grass, rolling hills. Not as many buffalo as in Yellowstone Park.

Mission Range rises like Tetons and only less rugged. Not over 10,000 ft. or even less. So in Glacier Park.

St. Ignatius.

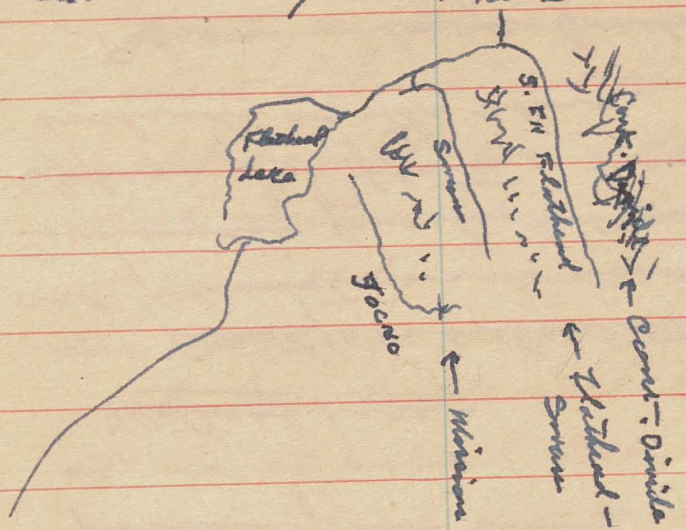
Old Catholic mission 1850. French-Canadian. Came from north, possibly

from Hudson Bay.

French at Fort Collins probably trappers from St. Louis.

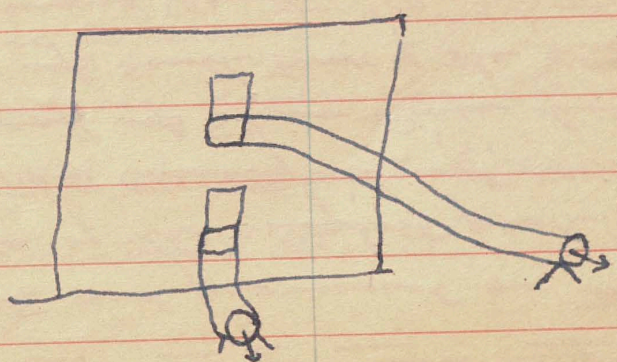
all this Reservation one big irrigation project from Jocko River at south end of Mission Range. Same land above ditch. Shallow reservoir.

Two ranges from here to Continental Divide: Mission Range and Flathead-Swan Range. Thus



Ronan

School has two metal tubes to the ground to slide down in case of fire. How the children would like fire drill.



Looks like turning out graduates.

Back view of Mission Range. a glacier white and prominent on the north side of the highest peak.

The country is not easily accessible. a road up Swan River but only half way up South Fork of the Flathead. "A rugged country. One of the largest undeveloped regions in the northwest. Hope they leave it that way" – Lamb. We shall approach it from Glacier Park. Today we shall see only the lower portion of the basin.

a way good source of information. a paying station there. study the water power.

Flathead Lake –

Beautiful in the distance as Tahoe and Yellowstone. A wooded island. Surrounding forests but not as heavy. Slopes also flatter. Farming land and orchards on the shore. 30 mi. by 6 mi.

Polson a large lumber town. Passenger traffic once on lake but abandoned when auto roads were built. The sternwheeler "Klondyke" warped and weathered is still moored to the shore.

Lake levels –

Fluctuation on ordinary year 10 ft. a very complete lake-level recording gage with high tower.

Lake is now within 2 ft of minimum level.

→ Storage of little value for irrigation. Yet there is some irrigation at head of lake.

Montana Power Co. Project

Yet Flathead Lake is capable of generating 350,000 horsepower. and maximum outflow has been 76,000 sec ft.

a canyon throat and rapids a short distance downstream affords an opportunity for a dam 180 ft. high which will confine the lake and yet permit by means of flash boards the discharge of excessive floodwater.

The lake level will be maintained at the stipulated level of 2893.0 ft. above sealevel. or — ft. below normal maximum.

$1,000,000 to $1,500,000 already spent, but work has been stopped during depression because of decrease in demand for power. The Indians are to receive a royalty on power and are eager for the work to proceed.

The Government license will probably be renewed tho the work has been abandoned.

The canyon, which will become a long inlet, is now beautiful. The water is green, the rapids are turbulent. Some of the wall, which will project above the new waterlevel, resembles Bryce Canyon in form altho its color is gray.

Around the Lake.

The ride around the lake affords a forest view much like Tahoe. Many lakes or bays. The cutting of timber is controlled by the Indians or Forest Service. Shore in private ownership.

Trees on edge of lake. Sailing and boating most attractive - so many bays.

West Side. A snow fence. Several large islands. Mountains to the southwest 5000 ft. elevation. The lake is 3000 ft. But no snow there April 1. This is the rain side of the lake. The snow side is the east.

Somers.

More lumbering. The Great Northern comes here.

Another lake-level station. Plan 3 ft. above max. known level.

1894 - . . 29.02 ft.

1932 - . . 28.96

The intake is far out and 3 ft. below min. level to keep below freezing, for the

lake ices over.

Research in evap.

Here is an opportunity to study the acceleration of evaporation by whitecaps.

The lake inflow can be exactly gaged except for seepage which should be small in the autumn.

The gages at each end of the lake will show the fluctuation due to piling up of the water by the winds. The average of the two should give the loss.

Recording anemometers should be installed.

The tiny "seiches" or tides now recorded can probably be eliminated by having the intake pipe placed below the level of short-wave surface disturbances.

Water-table Measurements

East of Somers on north shore of lake are 3,000 - 4,000 acres that may be affected by the rise in the level of the lake due to storage.

So 3 series of soil-water wells (max. depth to present watertable 12 ft.) have been driven by long-auger (i.e. wood) to study the rise in underground water with rise in the level of the lake. The owners are eager to sell. The damage will be the basis of settlement. The lands can be re-leased for planting at periods when the

level is low.

East Side. A ferry is operated by the county across the inlet of the lake. There is a bridge higher up. A tugboat of slender lines has been beached to graveold in the river. Other tugboats are in service at the mills.

On ferry 3 popcorn carloads for 25 ¢. A munching auto crew.

Swan River. a powerplant near the ferry with only a forebay. But the stream is controlled by Swan Lake and consequently holds up strong all winter.

Some seepage here into lake.

A cutover country but being settled and landscaped toward the south. Orchards are planted in clearings of ~~pine~~ pine and fir, Cherries the leading fruit.

View from the east side particularly attractive for the opposite shore has many wooded tongues of land like the Nevada side of Lake Tahoe. But the beaches are gravel, not sand. The east side also has heavier forest, underbrush and ferns.

Swan Canyon.

The problem of selecting power canyons is simple when the streamflow is analyzed. The three forks of the Flathead in and along the west side

of Glacier National Park furnish 90 percent of the runoff below Flathead Lake. Thus only surveys at the Continental Divide need be considered. The Swan is relatively small but lies almost entirely on the South Fork. Here are the figures for May 1932:

Middle Fork Belton	633,000
South Fork near Columbia Falls	892,000
Flathead = N. Fork near Columbia Falls but above Mid. Fk.	738,000
	2,263,000
Main River at Columbia Falls	2,610,000
Swan River (Big Fork)	213,000
Mission River at Poulson	2,630,000

Mileage.

Our trip to Flathead registered 240 mi. Since Carl's car remained in the garage, this should be added to our total.

(3208ft)

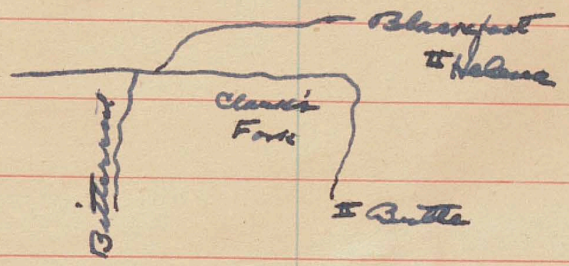
Missoula to Helena (4009ft).

The State University is undergoing a change from old style buildings to those more like those at U.C.L.A, except that they lack in strength.

Two pictures in N.Z. Album. I marked plainly on one: "The last Rocky and it Hills and Canyons" → "My one mile and one."

Up Hell Gate Canyon on Clark's Fork to ~~the Blackfoot and Helena and Butte and the Little Belt mts on the~~ Clark's Fork. To the south is the Bitterroot.

We are lucky again, for the road to Helena takes us far up Clark's Fork until it turns toward Butte.



The canyon is called Hell Gate. Did Clark name it.

The Milwaukee Electric beat us. Steep turns slowed us up.

Snow-caps everywhere. The question is where, at 65 mi. from Helena a large area of low, grass hills but on the rim to southeast are moderate mountains covered on upper slopes with forests. Near here the Land has a most rawness.

Up the hill to Helena over a summit of about 6500ft. Snow fence. Far to the

south were pointed out the two snow courses at about 8000 ft. This is the Continental Divide. The Milwaukee had turned south to Butte now 71 mi. away. The Northern Pacific goes with us by tunnel to Helena.

East of the Divide the landscape is dry and gray.

Helena.

Built in a gulch. An old placer town. Buildings quaint but worthy of the 80's when built. But the Federal Building is Italian - It looks masterly. Asked why. The answer: Cass Gilberts.

Thats Why?

Mr Lamb lives at the Montana Club and took us to dinner. So he is unmarried. Is that why he looks young and cheerful?

Letters from Home.

The snow course method has been granted by the Weather Bureau.

We may remain until September 3.

The wisdom of our coming to Montana and going to Canada is questioned but we may decide.

~~When~~ It here. Montana needs water.

When the division crew made Carl's final check on the 4th. We had come 110 feet and would pay one dollar expense if necessary.

The Canadians raise water. We use it. It is proper to show them. Rather pay the cost than turn back.

Mr McLaughlin wants us to meet Mann in Oregon. We can reach him at Logan Aug. 23.

The Director of the Forest Experiment Station at Missoula asks for reprints. We planned to invite him to Helena but he is away.

August 21. Conferences

Word from Canada for early conference on reclamation matters at the northeastern part of the state forced speed in program to allow him time to accompany us to the Bow and get return in time for conference. He has played host unusually.

The best part is that when the Canadians abandoned snow surveying in 1923(?) after a brief trial he refused to stop and to their mutual satisfaction has unofficially continued snow surveying in the apportionment of the international St Mary's water for the Lethbridge Project.

He is now taking us up to Calgary to revisit the Bow and actually determine whether the Bow, watershed is so wild that snow courses can not be established there.

Maps and Reports.

An entire roll of forest maps

has arrived from Thiene.

→ On the bank's wall is a U.S.F.S. Map of Montana in 2 sections. Ordered it from Washington.

He has kindly marked all of his snow courses on the Forest Maps. The remainder unvisited are as follows:

Southwest of Helena - Missouri-Clarks Fork (Canyon).
Rimini (2 gages on stream below).

Northwest of Helena - Blackfoot - Missouri.
Stemple

Swan River -
Between Swan River
+ S. Fork of Flathead

Summit Great Northern
Middle Fork Flathead
+ Marias River

Swift Current
Middle Fork Flathead
and Swift Current *

* For division of
St Marys River
between U.S. + Canada

→ We are welcome to use all snow survey data and reports for analysis to determine the optimum number of courses.

Conference with Jr. S. James, State Engineer

In keeping with Mr. McLaughlin's desire we extended our greetings to Mr. James but were rewarded then Mr. Lamb with a conference and a visit at lunch.

→ Mr. James also returned to the Capitol to obtain a conservation map showing the water need and conservation plans for Montana.

He is chairman of the Conservation Board and ~~is~~ has a program of small reservoirs for obtaining supplemental water. The management of these will require forecasts. He will gladly cooperate and can probably use some conservation funds. He will also recommend an appropriation by the next legislature. Mr. Lamb will also endeavor to supplement them by small allotments from routine funds.

The Montana problem is forecasting for the small tributaries. The water is beyond their use when it reaches the deeper main streams such as Clark's Fork and Missouri.

It was suggested that the Army Engineers be requested to make surveys on the Yellowstone as a supplemental source of water for the improvement of navigation and the conservation of water above Fort Peck Dam.

Secret of Montana lands

The poorest land - that in southeast Montana -

was so poor that it was reclaimed for grazing. The better plains lands because of the copious precipitation from 1900 – 1916(?) were plowed for wheat instead of being kept for grazing. Consequently, the latter have dried up and eroded, while the ~~latter~~ former have preserved their land and their grass.

Long time records indicate that the past 25 years have been wetter on the average than the 25 years previous. So lands must be carefully classified and all water stored.