Notes on the Geology and Ground-Water conditions in the vicinity of Lime Springs, Howard County, Iowa

Lime Springs is located on the gently rolling upland of the Iowan drift area. The highest land in the town is in the southwest part at an elevation of about 1275 feet above sea level. From here the land surface slopes in a general north-eastward direction. The lower part of the town is at an elevation of about 1215 feet. The Upper Iowa River, flowing in a general eastward direction ½ to a mile north of Lime Springs, has cut out a shallow gorge which at places is 30 to 40 feet deep.

The drift cover is relatively thin in the locality of Lime Springs. In the higher part of town it probably reaches a thickness of 60 feet. In the business section there isfour to five feet of drift and bedrock is at the surface in the north east part of town.

The bedrock is composed of dolomite limestone in which have developed many sink holes and small caverns. In the process of excavating the basements of buildings and ditches for the sewer the slabs of dolomite limestone were observed to dip in every direction. Many channels were also observed in the outcrop of the limestone along the wall of the valley of the Upper Iowa just to the north of town.

Many small springs were observed along the south bank of the Upper Iowa river which were issuing from the limestone. It is from the these springs that the town gets its name. There are many springs reported to be coming up in the river bottom all along this stretch of the river.

Beside the city well there is awell owned and in use by the Lime Springs Creamery, an abandoned well owned by the railroad and several private wells. In the lowerm part of town the wells are about 50 feet deep and almost intirely in the limestone. In the higherpart of town the wells are about 100 feet deep, penetrating about 50 to60 feet of drift before entering the limestone. Alarge amount of water is abtained from the cavernous limestone.

The old city well is located in the basement of the city hall. The basemant floor is about 11 feet below the land surface and is partiallyexcavated in the limestone. The well is reported to be 140 feet deep and to be cased to adepth of between 10 and 12 feet with 10 inch casing. The depth to water could not be measured but was reported to be 30 feet below the pump base. It is probably about 6.0 below the pump base and when pumped at the reported rate of 250 gallons a minute the pumping level is probably about 30 feet below the pump base.

The new city well is located on the higher land in the southwest part of town. The elevation of the drilling platform is about 1268 feet. Drilling had progressed to a depth of 200 feet. A brief log follows

Pleistocene	drift	0-50 feet
	dol.	50- 100 feet
Devonian	yellow gray	
C.U.?	porous	
Wapsi?	dol ,gray	100-125 feet
	more dense	
	dol. greyish	125-180 feet
	dol. gray	180-197
	sandy,arg.	
Maquoketa	shale ,gray	197-200 feet

Water level in Creamery well about 1226.5
" " " New City well " 1227.5
" " " below dam in Upper Iowa River about 1165

Pollution probably comes from drainage well in downtown area.

The Kansan drift sheet, the oldest to be found at Lime Springs, is typically a pebbly and bouldery blue clay, with the upper zone weathered and oxidized to a yellow or brown color. In places, however, this oxidation of the upper portion of the Kansan drift has been retarded or eliminated entirely due to the protective coating of peaty interglacial soil or other similar deposits so that the fresh, unweathered blue clays of the Kansan lie immediately beneath the Buchanan gravel or other post-Kansan deposit.

Bedrock at Lime Springs is the Cedar Valley formation of Devonian age. This formation is dominantly limestone, occasionally dolomitic, with dolomite near the base. A thin sandy zone or thin sandstone may mark the base of the Cedar Valley formation. This formation should be about 110 feet thick.

The Maquoketa formation, of Ordovician age, lies unconformably beneath the Cedar Valley. The Maquoketa consists almost entirely of dolomite and dolomitic limestone, cherty in places, with none of the shale present at Lime Springs which is found in the formation in other parts of northeastern Iowa. The Maquoketa formation should total about 110 feet in thickness.

The Galena formation underlies the Maquoketa formation and should have a thickness of about 220 feet at Lime Springs. The Galena is composed of limestone, dolomitic limestone, and dolomite with abundant dolomite rhombs in places. About 80 feet below the top of the formation are some cherty horizons which mark the top of the Prosser member. Some additional chert is usually found near the bottom of the formation.

The Decorah and Platteville formations lie below the Galena. These two formations consist almost entirely of limestone and green shale. They have an aggregate thickness of about 75 feet with the green shale in the upper 50 feet and the Glenwood shale member in the lower 7 to 10 feet.

The St. Peter formation underlies the Platteville formation and has a total thickness of about 75 to 80 feet at this locality. The formation consists of clean, white sandstone.

The St. Peter sandstone is underlain by the Prairie du Chien formation, totaling about 300 feet in thickness, which is made up of three members. The upper member, the Willow River, is a sandy dolomite, cherty in part; the second member, the Root Valley (New Richmond) is a sandstone, somewhat dolomitic; and the lower member, the Oneota, is a cherty dolomite which may be somewhat sandy.

The Jordan formation, of Cambrian age, underlies the Prairie du Chien formation. The Jordan is a sandstone, resembling the St. Peter in character, and should be at least 75 feet thick at Lime Springs.

Present water supply

According to information in the files of the Iowa Geological Survey, the town of Lime Springs derives their present water supply from one drilled well about 160 feet deep. The curb elevation of the well is given as 1244 feet and the static level of water in the well as 25 feet below curb.

From the depth and elevation, it would appear that the well was finished in the limestones and dolomites of the Maquoketa formation.

According to information obtained from the State Department of Health, the present supply is chlorinated before distribution to the consumers.

Future development of water supply

Possible sources of ground water for a municipal supply at Lime Springs are limited to the bedrock formations since the glacial drift is probably too thin and lacking in satisfactory sand or gravel horizons to furnish adequate quantity for the town.

The rocks of the Cedar Valley, Maquoketa, and Galena formations are all essentially either limestone or dolomite and are possibly water-bearing. Water occurs in these types of rocks, however, in cracks and crevices and in porous zones and it is not possible to predict in advance where such zones might be encountered during the drilling of a well.

Water encountered in these three formations mentioned above should have a static level of from 25 to 50 feet below ground surface and a temperature of from 50 to 52 degrees Fahrenheit. The water should be of good quality, moderately hard, but satisfactory for domestic purposes.

The St. Peter sandstone is a good aquifer in this region, supplying water for the city well at Cresco, and should furnish ample quantity for a municipal well at Lime Springs. The static level of water in a well penetrating the St. Peter sandstone should be about 90 to 100 feet below ground level. The temperature of the water should be from 52 to 54 degrees Fahrenheit and the water should be of satisfactory quality.

The next deeper source of water is the Jordan sandstone, although the rocks of the Prairie du Chien formation are often water bearing in places. The static water level in a well to the Jordan sandstone would probably be about 150 feet below ground surface. The water should be of good quality, have a temperature of about 56 degrees Fahrenheit, and be available in abundant quantities.

A well drilled at Lime Springs would require casing through the thin surficial mantle of glacial drift, and in a deep well probably a liner or casing through the shales of the Decorah and Platteville formations. No other casing should be necessary. The first casing, however, should not be placed until a sufficient thickness of the upper bedrock had been penetrated

so that an effective seal can be obtained to prevent bacteriological contamination from surface waters.

A summary of the geologic formations, with their character, thickness and depth, is shown on a following page. All depths are based on a starting elevation of 1245 feet and would necessarily have to be revised for a different elevation.

If a well is drilled at Lime Springs, it is requested that a complete set of samples be saved for the Iowa Geological Survey. These samples should be collected for each five-foot interval of drilling, or for each formation if less than five feet thick. Sample containers will be furnished by the Survey upon request.

Summary of Geologic Section

at

Lime Springs, Iowa

(All depths based on a starting elevation of 1245 feet)

Formation	Thickness in feet	Depth in feet From	Depth in feet To
Pleistocene system			
Glacial drift (clay, sand and gravel)	25±	0	25±
Devonian system			
Cedar Valley formation (limestone and dolomite, sandy at base)	110±	25±	135
Ordovician system			
Maquoketa formation (dolomite and limestone, cherty in part)	110	135	245
Galena formation (limestone and dolomite, cherty near middle and base)	225	245	470
Decorah-Platteville formations (limestone and green shale)	75	470	545
St. Peter formation (sandstone)	75	545	620
Prairie du Chien formation (sandy dolomite, cherty in part, with sandstone near the middle)	300	620	920
Cambrian system			
Jordan formation (sandstone)	75+	920	995+

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STATE OF IOWA
IOWA GEOLOGICAL SURVEY
GEOLOGY ANNEX
IOWA CITY

REPORT ON THE GEOLOGY AND GROUND WATER POSSIBILITIES

at

Lime Springs, Howard County

Introduction

Lime Springs is located in the north-central part of Howard County, about three miles south of the Minnesota boundary. The town occupies part of sections 28 and 29 of Forest City township. Population of Lime Springs, according to the 1940 census, is 567. The town is served by the Chicago, Milwaukee, St. Paul and Pacific Railroad, State Highway 156, and County road "F". The general surface elevation in town is about 1245 feet above sea level.

The areal drainage is controlled by the Upper Iowa River which flows eastward to the Mississippi River. The channel of the river lies about one-half mile north of the limits of Lime Springs.

The surrounding territory is dominantly agricultural and there are no known industries which would be large consumers of water.

Geology

Bedrock in the vicinity of Lime Springs is covered with a mantle of glacial drift of Pleistocene age. The total thickness of this drift is not exactly known but is probably less than 50 feet in most places. The drift at the surface belongs to the Iowan substage and is composed almost entirely of yellow clay which is often pebbly. The Iowan drift is very thin, however, and in a few places absent entirely.

Separating the Iowan drift from the underlying Kansan drift is the Buchanan gravel of Loveland age composed of fairly coarse, imperfectly sorted, weather stained gravel.

cc to R. B. McAllister, State Dept. of Health, Decorah, Iowa, November 23, 1943

June 10, 1944

Mayor A. J. Cray
Lime Springs, Iowa

Dear Sir:

I am very glad to have your letter of June 1 concerning developments in regard to the new Lime Springs water well. Like you I am sorry that it has been necessary to go so deep for a satisfactory well.

At a depth of 358 feet you are probably in the upper portion of the Galena dolomite. The few other wells in the vicinity of Lime Springs on which we have information indicate that water should occur in the Prosser member of the Galena formation. We expect the top of the Prosser at approximately 400 feet in depth.

It is possible that a bailer test will indicate that you already have a sufficient quantity of water to make a satisfactory town well. You may wish to discuss this possibility with your drilling contractor.

I suggest that any samples that are available at the well be sent to us so that we may examine them and come to a better conclusion on where to expect the top of the Prosser. If I can be of further service I trust that you will not hesitate to let me hear from you.

Very truly yours,

H. G. Hershey

HGH:N

72-978

Exchange State Bank

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Lime Springs, Iowa June 1st 1944.

Mr. H. G. Hershey,

Geology Annex,

Iowa City Iowa.

Dear Sir:-I have your letter of the 29th and note that Mr. Allen's letter was returned to you.

This must have been an error of the P. O. department ad Mr. Allen was here until last Friday when he returned home to report to the draft board, and has not returned. I would be pleased to have a copy of your letter as we were expecting a letter from you after your recent visit.

We are disappointer in having to go so deep for a satisfactory well and a part of our worry is on account of financing.

We are now down 358 feet and about fifty feet of this in the solid rock after going through 160 feet of shale. The water stands at about 40 feet from the top which means that we have 218 feet of water. We would like some expert advice about testing the well and do not want to test twice on account of the expense.

The driller having gone to the army we have no idea when the work will be continued.

Yours very truly,

A.J.Cray. Mayor. AJCray

ARTHUR C. TROWBRIDGE
DIRECTOR AND STATE GEOLOGIST
H. GARLAND HERSHEY
ASSOCIATE STATE GEOLOGIST
KATHRYN T. NEUZIL
SECRETARY

STATE OF IOWA
IOWA GEOLOGICAL SURVEY
GEOLOGY ANNEX
IOWA CITY

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May 26, 1944

Mr. Cecil Allen
Lime Springs, Iowa

Dear Mr. Allen:

We have studied the samples from the Lime Springs well to a depth of 270 feet. Above 265 feet the material is undoubtedly Maquoketa. The sample between 265 and 270 indicates that the top of the Galena occurs at 270 feet or should occur almost immediately below that depth.

The samples suggest that the shaly material encountered above a depth of 265 feet will not cause serious trouble if left uncased. However, final decision on this point will not be possible until after a pumping test is run. We expect the top of the Prosser formation at approximately 400 feet and it is usually within the Prosser that water has been found in the wells in the general area around Lime Springs with which we are familiar.

I will appreciate it greatly if you will let me know when you plan to have a pumping test. If I can be of service before that time do not hesitate to write.

Very truly yours,

H. G. Hershey

H. G. Hershey

HGH:N

Returned unclaimed.

Memorandum
To: H. G. H
From: S E Trdgs.
Concerning: Lime Spring well samples from 205 to 270 ft.
date May 24, 1944

The rock from 205 to 270 feet at Lime Springs is entirely Maquoketa except possibly the limestone from 265 to 270 feet which may be Galena since doughnut crinoids are present. Though I sieved the samples from 255 to 270 feet I could find no flattened oolites. No cinnamon specks were observed either.

The detail of the Cresco well log by Carmody is really not sufficient for close correlation and the Floyd Co. Home well 30 miles away appears to be of more value. The latter well indicates something of a transitional zone from Maquoketa to Galena in which brown shale is associated with the limestone carrying doughnut crinoids above the cinnamon specked limestone. This would indicate that a similar zone is now being penetrated at Lime Springs.

The Maquoketa lithology at Lime Springs is similar to that at Floyd Co Home. It is brown dolomite, highly argillaceous and silty apparently interbedded with some brown shale which does not show very well in the samples. My guess is that within 10 feet more of drilling there should be no more trouble from shale - at least above the Decorah.

(to come after next paragraph) Floyd Co. Home stopped 33 feet into the Prosser but just how much water was obtained I do not know. We should

1268
360
908

soon have a report on the pumping test.

If these several hypotheses can be assumed correct the 'Prosser' should be reached at about 360 feet.

Lime Springs
Howard Co.

May 5, 1944
D.A.B. & W.E.H.

Not drilling. Bailer lost in hole. Drillers not around and could find no samples.

Mayor reports
Shale 197 - 210 feet
Rock. 210 - 220 feet drilling depth

Will set 12" casing and cement. Mc. Allister will be on the job when this is done.

Depth to water 35.4 feet below drilling platform

Lime Springs

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April 14, 1944

Mr. R. B. McAllister
Public Health Engineer
District Health Service No. 5
Decorah, Iowa

Dear Mr. McAllister:

The detailed study of the samples from Lime Springs has been completed to a depth of 200 feet. The results substantiate the conclusions which we reached at Lime Springs April 7.

The dolomite and limestone of Devonian age is mostly porous and no horizon appears dense enough to assure a shut-off. The gray silty dolomite from 95 to 125 feet is the only horizon which might be reasonably successful, but there are several reasons for setting casing into the Maquoketa shale. In the first place, the old contaminated town well goes below the dolomite horizon and hence the lower Devonian water may not be good. Secondly, the dolomite from 125 to 180 feet is very porous and apparently much creviced and jointed; this suggests that the gray silty dolomite beds have also been jointed. In any case there can be no assurance that the gray dolomite is a good seal. On the other hand the Maquoketa shale is impervious and there is little doubt about getting a good shut off if casing is carried all the way through the Devonian formation and into the Maquoketa.

It is thus my opinion that the Devonian water should be entirely shut out and casing set firmly in the Maquoketa shale as you suggested in the field on April 7. The shale is not expected to be more than 10 feet thick. The Maquoketa itself (below the shale) and also the underlying Galena will be mostly limestone with some dolomite. It seems very likely that sufficient water can be obtained for the town from these formations.

Let us know how things go and whenever we can help out we shall be glad to do so.

Very truly yours,

S. E. Harris, Jr.

SEH:N

November 22, 1943

Mr. R. B. McAllister
Public Health Engineer
District Health Service No. 5
Decorah, Iowa

Dear Mr. McAllister:

In response to a request which you made some time ago I take pleasure in submitting the inclosed report on the geology and ground water possibilities at Lime Springs in Howard County, Iowa.

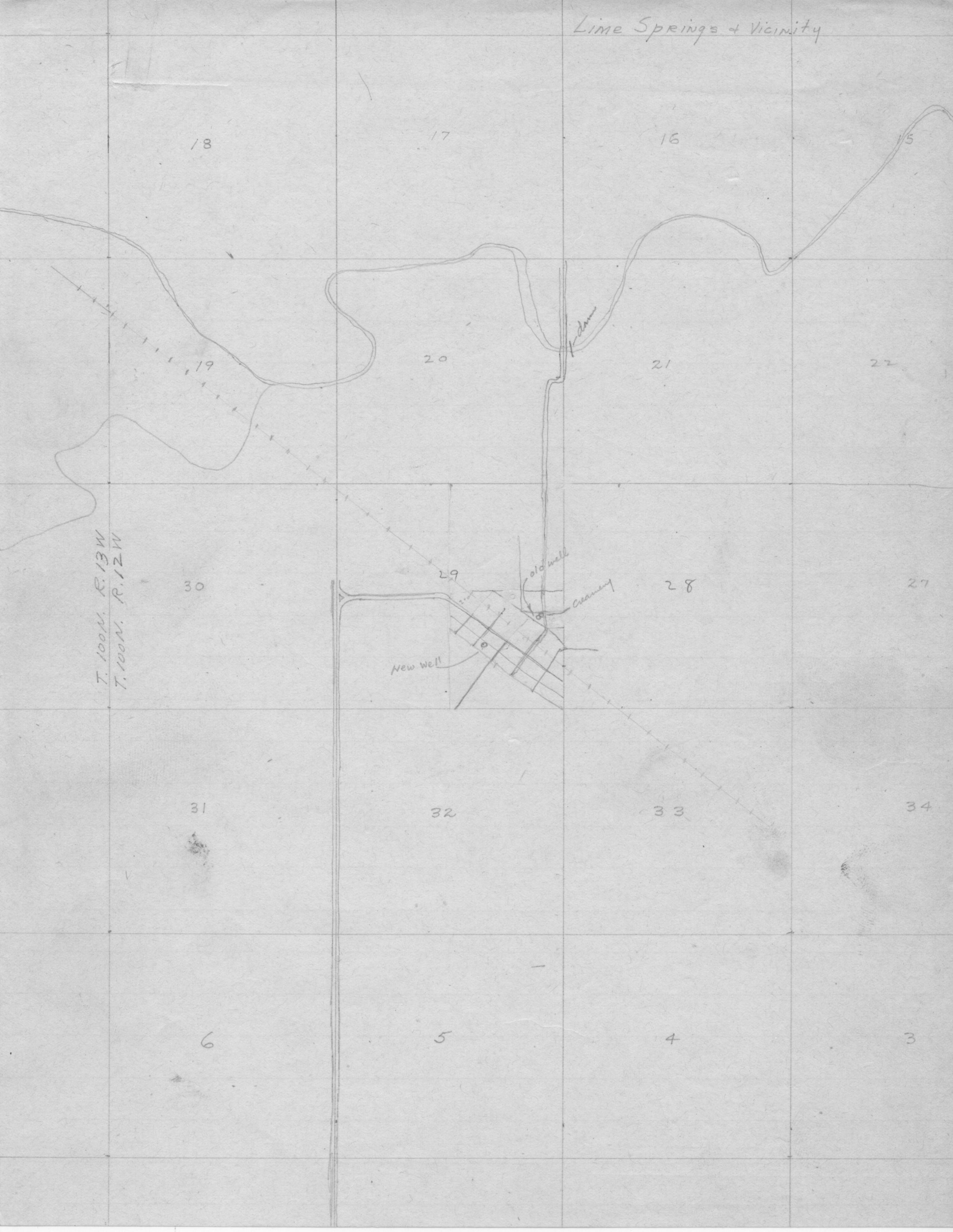
The data on which this report is based came entirely from our files and we have not made a field investigation. It may be desirable to do some field work if the town plans definitely on drilling a well and I will appreciate it if you will keep me informed of developments there.

Very truly yours,

H. G. Hershey

HGH:N

Inc.


Lime Springs & Vicinity
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