FOLSOM BASIN DISPOSAL SITE, KLAMATH COUNTY, OREGON

By V. C. Newton, Jr.*

Purpose of Investigation

The present study was initiated in February 1970 by the Department of Geology and Mineral Industries for the purpose of evaluating geologic conditions of the Klamath Hills with respect to establishment of an experimental barrel washing facility. The geologic data will assist with plans for the disposal operation. Siting and design of the facility is a cooperative effort among scientists from Oregon State University, Waste Management Group; the Klamath County Extension Service; and the State Department of Agriculture. Experiments at the site will include tests for solar evaporation and bacterial degradation of herbicide and pesticide wastes. This project is the first of its kind in the State to locate regional collection stations for washing used herbicide and pesticide containers. Administration of newly enacted pollution regulations requires the orderly disposal of toxic wastes so this project serves a very important need in society. The findings in this research will relate to other areas where use is made of agricultural chemicals.

The objectives of the study by the Department are to define the following characteristics of the disposal site: (1) relationships to the regional geology, (2) foundation material, and (3) containment and isolation properties. These

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* Geologist - Petroleum Engineer, State of Oregon Department of Geology and Mineral Industries.

findings will supplement data on the chemical and biologic processes involved in waste disposal. Requirements for testing and monitoring to protect groundwater supplies are the responsibility of the State Engineer.

Geography

The proposed waste disposal facility is situated in a small closed basin within the Klamath Hills, 8 miles south of the city of Klamath Falls. Because this small valley lies at the base of Folsom Peak it is here referred to as Folsom Basin. This property and several thousand acres surrounding it are owned by the O'Connor Livestock Company.

Folsom Basin is enclosed by lava-capped hills on the west, north, and east, and a low pass approximately 40 feet higher than the valley floor forms the southern border. Folsom Ridge, bordering the east side of the valley, rises 400 feet above the valley floor. Relief of the ridge to the west is only 100 feet.

Annual precipitation in the Klamath Hills averages 14 inches with a considerable amount as snow. Climate of the region is arid with a mean temperature of 50 F. Land use in the hills is principally for grazing sheep, but some grain is grown on the slopes. Erosion of the land surface is taking place very slowly under present climatic conditions and because of the resistant capping lavas and ash beds.

Geology

The Klamath Hills are a result of block faulting which uplifted that area while the larger surrounding region sank. Forces at the crust of the

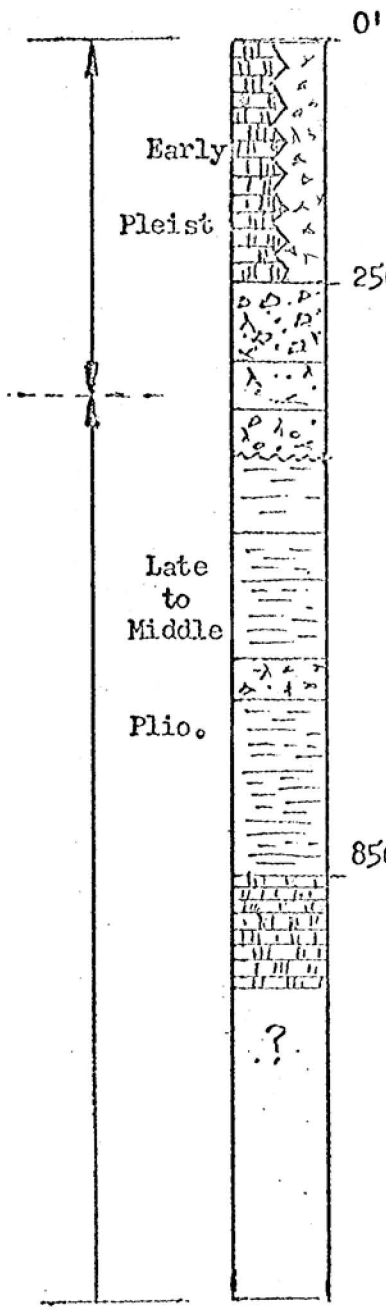
earth have caused large masses of rock to break apart, some being down-dropped and others pushed upward in a pattern referred to as "Basin and Range Structure." This fracture pattern, which is aligned in a general north-south direction extends from southernmost Nevada into southeastern Oregon. The rocks involved in block faulting in eastern Oregon are largely of volcanic and lacustrine origin. Thousands of feet of volcanic rocks were deposited, and in basin areas, lake sediments were interbedded with the volcanics as intermountain lakes formed from time to time. Thick lacustrine beds of considerable areal extent indicate that many of the lakes were quite large.

The Klamath Hills are bounded by large faults and also dissected by smaller faults, all generally aligned in a NW-SE direction (see geologic map). Folsom Basin was formed by relatively minor fault displacement (250'-350') which to some extent was a hinge-type or tilted movement. The Klamath Hills were uplifted as a unit by normal type faulting. Folsom Ridge has an apparent northeasterly dip where as the opposite ridge and Folsom Basin have a southeasterly dip. The fault planes appear to be nearly vertical.

Relationships of rock units were investigated on the slope of Folsom Peak. The descriptions of these units along with information from test drilling and water wells have been combined to make a generalized rock column for the Klamath Hills (see p. 4). Discussions with Eugene Ciancanelli, geologist with Geothermal Resources, Inc. who has recently made detailed studies of the Klamath Hills, indicate that stratigraphic relationships are complicated by facies changes, especially between the north and south ends of the Klamath Hills.

KLAMATH HILLS

GENERALIZED GEOLOGIC COLUMN



Basalt, cinders, palagonite tuff breccia, etc, thickness between 100 and 400 feet.

Pyroclastic Tuff - large fragments of tuff and basalt, siliceous.

Lithic Tuff - fine grained, uncemented.

Lithic Tuff - coarse, siliceous.

Diatomite - Fairly pure, up to 80' thick.

Tuffaceous Lake Sediments - silts and silty sand.

Tuff and Breccia

Tuffaceous Lake Sediments - as above described.

Basalt - top portion weathered, fresh samples similar to the younger basalt.

A synthesis of geologic history from the study of this area agrees very well with that described for the region by Peterson and McIntyre (1970). The oldest rocks exposed in the Klamath Hills are typified by lake sediments of middle to late Pliocene age. These sediments include beds of volcanic ash and tuff as well as diatomite. The lake beds and interbeds of tuff were gently compressed into broad NW to NE trending folds before younger volcanic rocks were deposited (Peterson and McIntyre, 1970). Tuff, breccias and some lava flows of early pleistocene age appear to have been deposited upon an eroded surface of lake beds to a thickness of 150 feet to 200 feet. Extrusion of basalt with some explosive eruptions of cinders and other pyroclastic rocks followed.

The upper basalt unit and associated eruptive rocks now occur as isolated ridge cappings at several locations in the area, indicating considerable erosion since they were extruded. Sizeable talus deposits from these rocks developed below Folsom Peak and the other peaks in the north portion of the hills. Movement on the fault bordering the east side of Folsom Basin has displaced the basalt talus so that it now is opposite diatomite. This relationship can be seen at the gravel pit on the south end of Folsom Peak.

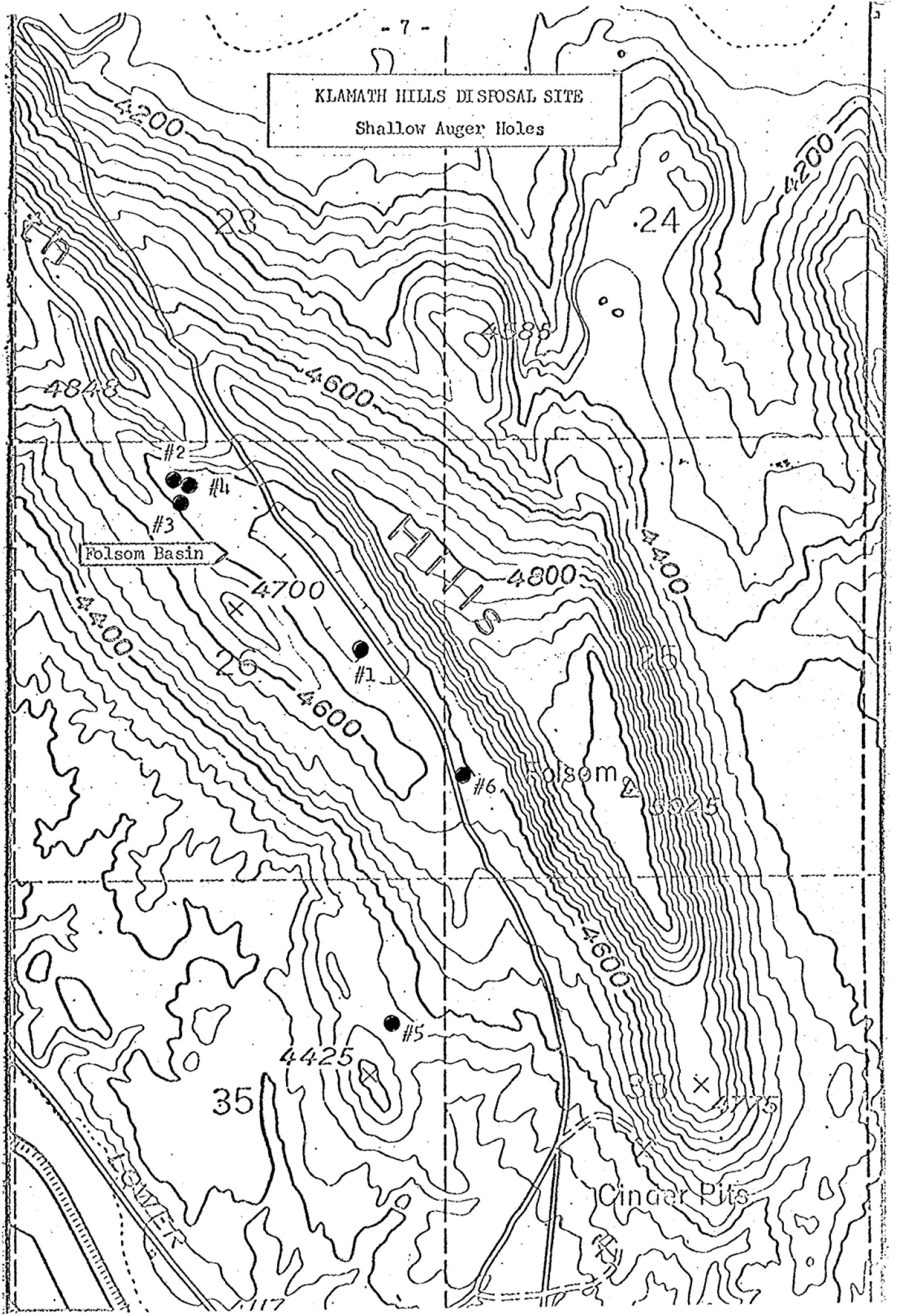
A high heat flow in Klamath Hills may indicate volcanic activity within Holocene time or at least be evidence of near-surface magma bodies. Most water wells in the area encounter hot water. A well on the Liskey Ranch in sec. 34, T. 40 S., R. 9 E., yields 200 F brackish water. The prospect for development of geothermal resources or the existence at depth of a magmatic heat source in the vicinity of the Klamath Hills should not interfere with the proposed waste facility.

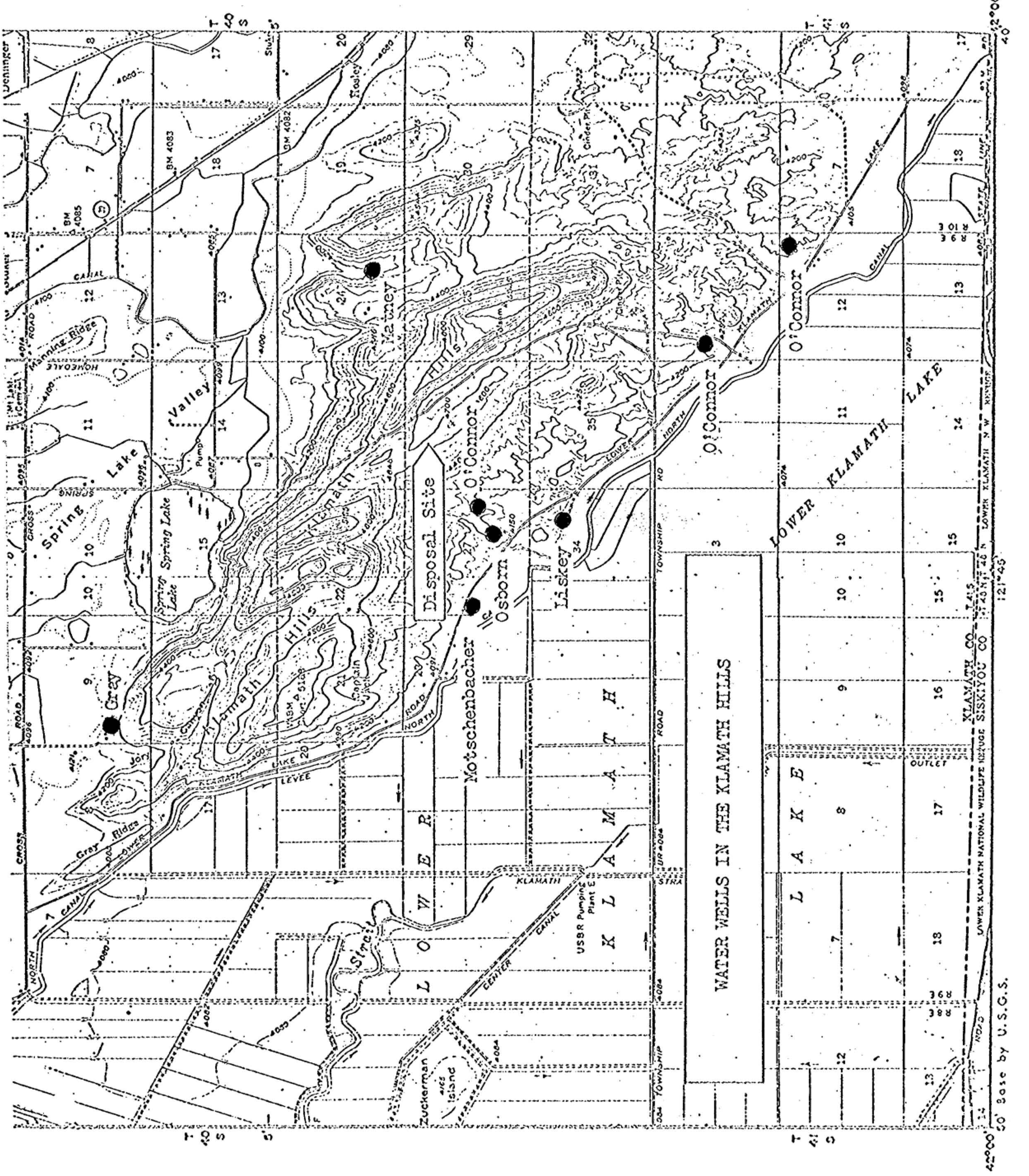
Shallow Drilling

Six shallow auger and diamond core holes were drilled in Folsom Basin to investigate the nature of the rocks beneath the ground surface (see p. 7). Foundation material in the vicinity of theproposed disposal site was explored to a depth of approximately 60 feet. Hole #2 was abandoned at a depth of 26 feet because of caving, so Hole #4 was drilled as a twin and caving overcome by running 15 feet of 2-inch casing. Loss circulation at 57 feet in Hole #4 prevented further penetration of the rock.

The upper 50 feet of rock underlying Folsom Basin consists of tuff and tuffaceous silt which apparently have low permeabilities. Drilling fluid returns in Hole #4 light colored suggesting that diatomite had been reached at 53 feet but no core was recovered. Circulation was lost while coring at 55 feet in Hole #4 and the hole took water at a rate of 5 gpm rate. Deeper drilling is needed to determine the extent of the permeable zones beneath the test site.

Logs of water wells drilled in the area show the stratigraphic sequence to a depth of 400 feet (see water well map p. 8). The O'Connor water well in sec. 27, T. 40 S., R. 9 E., is closest to the proposed disposal site. The log from this well shows more than 100 feet of fine clayey sediments were penetrated before reaching the water table (see water well logs in Appendix). The log of the O'Connor well shows 30 feet of diatomite at the top of the hole and no other beds of this material below this depth. The exposure of diatomite at the gravel pit below Folsom Peak show it to be as much as 80 feet thick at that location.


KLAMATH HILLS DISPOSAL SITE
Shallow Auger Holes
4200
23
24
4200
4585
4600
4848
#2
#4
#3
Folsom Basin
4700
4400
4800
4400
HILLS
26
#1
4600
25
#6
Folsom
4600
35
#5
4425
36
4775
Cinder Pits
LOWER


WATER WELLS IN THE KLAMATH HILLS
Disposal Site
Grey
Mauney
O'Connor
O'Connor
O'Connor
Osborn
Liskey
Motschenbacher
Klamath Hills
Spring Lake
Spring Lake Valley
Manning Ridge
Gray Ridge
Lower Klamath Lake
USBR Pumping Plant E
Zuckerman Island
Klamath Co
Siskiyou Co
Base by U.S.G.S.

Summary

There are both favorable and unfavorable attributes of the Folsom Basin disposal site. The favorable characteristics are:

(1) Relatively impermeable sedimentary rocks and volcanics which underlie the valley.

(2) The site is an estimated 150 feet above the water table.

(3) The climate is arid, with minimized erosion and runoff.

(4) The land is limited to grazing.

On the negative side of the ledger:

(1) To some extent the basin is a groundwater recharge area.

(2) The valley is bordered by a large fault which may channel seepage into domestic wells.

The fault, at valley level, cuts rock that probably was not competent enough to fracture during movement so it is likely that there are no fissures to act as channels for seepage. Cementation along the fault resulting from ascending mineralized water could assist in sealing off the fault zone; however, not much cementation was noted along the fault at the south end of Folsom Peak.

(3) Thermal waters occur along the west side of the Klamath Hills but no springs were seen around the hills which could transport chemicals to lower lying lands.

Recommendations

The main danger at Folsom Basin site is the possibility of vertical seepage to the water table. An exploratory hole should be drilled and

cored to the top of the groundwater surface near the proposed disposal facility in order to determine the porosity and permeability of rocks underlying the valley. The hole could later be used to monitor any seepage that may occur from the surface spreading of chemicals. Travel time of seepage through the foundation rocks could be estimated from the core data and these values correlated with degradation rates of the waste chemicals.

Location of the disposal facility should be as far west as possible of the fault that parallels the base of the ridge east of the valley and at a location in the basin which is judged to be the greatest distance from usable water. The advice of the State Engineer should be sought in this matter. An understanding of rock characteristics and hydrologic conditions at Folsom Basin will allow the disposal system to be designed for a desired safety factor. The considerations for investigation of this site should also include tests of foundation materials for ion exchange and sorption properties.

References

Peterson, N.V., and McIntyre, J.R., 1970, Geology and Mineral resources of eastern Klamath County and western Lake County: Oregon Dept. of Geology and Mineral Industries Bull. 66.

Peterson, N.V., and Groh, E.A., 1967, Geothermal potential of the Klamath Falls area: Oregon Dept. of Geology and Mineral Industries, the ORE BIN, Nov. 1967.

Oregon Department of Geology
& Mineral Industries
Revised October 23, 1970

O'CONNER RANCH

DESCRIPTIONS OF AUGER SAMPLES
(Power Auger)

HOLE NO. 1 DATE February 7, 1970

LOCATION SW1/4 NE1/4 Sec 26, T 40S, R 9E Klamath County

ELEVATION 4560' Topo WATER LEVEL Water Table Not Encountered

DRILLER Ron Jackson DESCRIPTIONS BY V.C. Newton

Sample Depth	Description of Material
0 - 5'	Silty Loam; dark gray with a few small irregular pieces of volcanic ash. No moisture.
5 - 9'	Fine Sandy, Clayey Tuffaceous Silt; dark brownish gray with small grains of weathered feldspar, some quartz, subrounded pieces of basalt and other volcanic debris. Occasional small pieces of white ash. Some thin layers of hardpan in this formation. No moisture.
9 - 11'	Tuffaceous Clayey Silt; medium brown, fine size pieces of feldspar and volcanic material as before, some fragments of pyroxene crystals and light colored ash. No moisture.
11 - 12'	Silty Clay; medium brown, fairly soft and contains moisture.
12 - 17'	Clayey Tuffaceous Siltstone; medium brown, firm with feldspar and volcanic debris as before. No moisture.
17 - 21'	Clayey Tuffaceous Siltstone; dark greenish gray, very firm, composed as above, some fragments of white weathered ash. No moisture.

O'CONNER RANCH

DESCRIPTIONS OF AUGER SAMPLES
(Diamond Core)

HOLE NO. 2 DATE February 8, 1970

LOCATION NW1/4 NE1/4 Sec 26, T 40S, R 9E Klamath County

ELEVATION 4560' Topo WATER LEVEL No Water Encountered

DRILLER Ron Jackson DESCRIPTIONS BY V.C. Newton and Don Baggs

Sample Depth	Description of Material
0 - 3'	Clayey Tuffaceous Silt; medium brownish gray, with fine fragments of feldspar, quartz and volcanic debris. Occasional fragments of pyroxene crystals and pumice. No moisture.
3 - 5'	Fine Sandy Tuffaceous Silt; medium brown, contains fragments as above, very fine, slightly moist, firm.
5 - 9'	Tuffaceous Clayey Siltstone; medium brown, very firm, fragments as above but with scattered pieces of pumice. No moisture.
9 - 18'	Lithic Tuff; medium brown, contains medium size pieces of pumice and basalt.
18 - 21'	Tuffaceous Sandstone; grayish brown, medium grain, composed of feldspar, quartz and small pieces of basalt.
21 - 24'	Lithic Tuff; medium brown, consists of medium size fragments of basalt and pumice. Appears to have fair porosity.
24 - 26'	Lithic Tuff; as above but finer material and porosity is less.

Oregon Department of Geology
& Mineral Industries
Revised October 23, 1970

O'CONNER RANCH

DESCRIPTIONS OF AUGER SAMPLES
(Diamond Core)

HOLE NO. 3 DATE August 2, 1970

LOCATION NE1/4 NW1/4 Sec 26, T 40S, R 9E Klamath County

ELEVATION 4570' Topo WATER LEVEL No Water Encountered

DRILLER Bob Doler DESCRIPTIONS BY V.C. Newton

Sample Depth	Description of Material
0 - 6'	Lithic Tuff; grayish brown, firm, consists of feldspar, quartz, fine fragments of basalt and pieces of mafic mineral. No moisture.
6 - 12'	Lithic Tuff; tan color, very firm, consists of fine to medium size particles of eruptive debris; feldspar, quartz and fragments of pyroxene crystals. No moisture.
12 - 13'	Core - Crystal Ash; medium gray, microcrystalline, hard. Consists of crystal fragments of feldspar, some pyroxene and probably some quartz although the core appeared to be mostly feldspar fragments cemented together.

O'CONNER RANCH

DESCRIPTIONS OF AUGER SAMPLES
(Diamond Core)

HOLE NO. 4 DATE August 3, 1970

LOCATION NE1/4 NW1/4 Sec 26, T 40S, R 9E Klamath County

ELEVATION 4560' Topo WATER LEVEL No Water Encountered

DRILLER Bob Doler DESCRIPTIONS BY V.C. Newton

Sample Depth	Description of Material
0 - 9'	Tuffaceous Silt; medium grayish brown, loose, friable, consists of eruptive debris; feldspar, quartz and fragments of pyroxene crystals.
9 - 53'	Tuffaceous Siltstone and Lithic Tuff; medium brown, firm to very firm, consists of eruptive debris; feldspar, quartz, mafic mineral fragments. Portions are partially silicified (of the Tuff).
53 - 57'	Diatomaceous Sediments (?); Light colored sediment could be seen in the circulating water while drilling this interval. The hole took water at a rate of 5 gallons per minute in this interval. None of the material was recovered in the core barrel. Drilling was halted at this depth as the pipe kept sticking.

O'CONNER RANCH

DESCRIPTIONS OF AUGER SAMPLES
(Hand Auger)

HOLE NO. 5 DATE October 8, 1970

LOCATION SW1/4 NE1/4 Sec 35, T 40S, R 9E Klamath County

ELEVATION 4380' Topo WATER LEVEL None Encountered

DRILLER Newton DESCRIPTIONS BY V.C. Newton

Sample Depth	Description of Material
0 - 6'	Diatomaceous Silt and Diatomite; drilled in saddle between basalt outcrops.

O'CONNER RANCH

DESCRIPTIONS OF AUGER SAMPLES
(Hand Auger)

HOLE NO. 6 DATE October 8, 1970

LOCATION SW1/4 SW1/4 Sec 25, T 40S, R 9E Klamath County

ELEVATION 4590' Topo WATER LEVEL None Enccountered

DRILLER Newton DESCRIPTIONS BY V.C. Newton

Sample Depth	Description of Material
0 - 4'	Tuffaceous Sand; brown, fine grained, friable.
4 - 12'	Diatomaceous Sand; tan, very silty, may also be bentonitic.
12 -	Hit hard cobble or silicified tuff?

There is a possibility that this material is slide debris as the hole is a short distance from the Folsom fault scarp.

Original and Duplicate with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT

STATE OF OREGON

State Well No. G--041 49/9-24k1

State Permit No. G-- 557

(1) OWNER:

Name Leo Matney

Address Route 1, Box 626, Klamath Falls, Oregon.

(2) LOCATION OF WELL:

County Klamath Owner's number, if any-- 1 in NW¼ ¼ SE¼ ¼ Section 24 T. 40 S. R. 9 E W.M.

Bearing and distance from section or subdivision corner South 21 degrees, 17' west, 4,230 feet from the NE corner of Sec. 24, in T. 40 S, Range 9, E.W.M. in Klamath County, Oregon.

TYPE OF WORK (check):

New Well ☐ Deepening ☐ Reconditioning ☒ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☒ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☒ Driven ☐

Cable ☒ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐

12" Diam. from Top ft. to 148 ft. Gage

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☒ No

Type of perforator used

SIZE of perforations in. by in.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

SCREENS: Well screen installed ☐ Yes ☒ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.

Diam. Slot size Set from ft. to ft.

CONSTRUCTION:

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Was a surface seal provided? ☐ Yes ☐ No To what depth? ft.

Material used in seal—

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS: to 9/1/57

Static level 120 ft. below land surface Date 9/ /49

Artesian pressure lbs. per square inch Date

Accepted by:

[Signed] Leo Matney (Owner) Date Nov. 30th, 19 57.

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Interstate E

Yield: 450 gal./min. with 2 ft. drawdown after 2 hrs.

" 600 " 2½ " 4 "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water 65 Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well 12" inches.

Depth drilled 148½ ft. Depth of completed well 148½ ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil	0	3
Chalk	3	30
Rock	30	33
Chalk	33	36
Rock	36	40
Gravely Chalk	40	57
Rock	57	61
Cemented Gravel	61	78
Rock	78	82
Cemented Gravel	82	84
Rock	84	93
Cemented Gravel	93	121
Rock	121	148½

(Note) This well was Drilled in Sept 1949 as an 8" Well. It Was reamed out to a 12" Well in summer of 1957.

Work started May 19 57 Completed May 19 57

(13) PUMP:

Manufacturer's Name Fairbanks, Morse & Co

Type: Vertical Turbine H.P. 15

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME OREN L. STOREY WELLDRILLING (Person, firm, or corporation) (Type or print)

Address 2615 Wiard St. K. Falls, Oregon

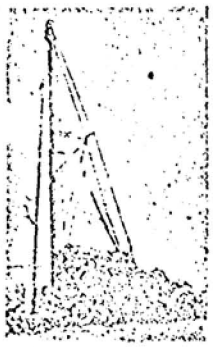
Driller's well number

[Signed] Oren L. Storey (Well Driller)

License No. 191 Date Nov. 24, 19 57

(USE ADDITIONAL SHEETS IF NECESSARY)

47-12A
Klamath



E. E. STOREY

Well Drilling

TUxedo 4-3990
3831 Hope Street
KLAMATH FALLS, OREGON

O'CONNOR LIVESTOCK CO.
ROUTE 1, BOX 868
KLAMATH FALLS, OREGON
NE¼NE¼S12T41SR9E

Started 12/13/65 Finished 3/8/66

LOG

0	to	46	chalk rock
46	"	81	brown lava rock
81	"	123	brown shale
123	"	131	brown lava rock
131	"	169	green shale with layers of brown lava
169	"	173	green shale
173	"	200	gray shale with layers of brown lava
200	"	207	gray shale
207	"	214	brown lava
214	"	221	gray shale
221	"	238	gray shale with coarse sand
238	"	261	gray shale
261	"	263	gray basalt
263	"	344	green shale with small streaks of lava
344	"	396	gray shale
396	"	493	brown shale
493	"	500	yellow shale
500	"	633	brown and yellow shale
633	"	651	sticky green shale
651	"	718	brown lava
718	"	740	blue basalt
740	"	742	black basalt
742	"	761	blue basalt
761	"	775	black wormy lava
775	"	779	black cinder, hard
779	"	784	decomposed black lava
784	"	818	brown lava
818	"	827	black lava broken
827	"	839	brown lava, broken
839	"	841	black lava, broken
841	"	846	brown lava, broken
846	"	888	black lava, broken

Hole cut in size FROM 16" TO 12" @ 795'

STATIC WATER LEVEL 139' 6" on 3-9-66

continued ....

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM 10, OREGON within 30 days from the date of well completion.

WATER WELL REPORT

STATE OF OREGON
(Please type or print)

State Well No. 40/9-27J

State Permit No.

(1) OWNER:

Name O'Connor Ranch

Address RT 1, Box 868

KLAMATH FALLS, ORE.

(2) LOCATION OF WELL:

County KLAMATH Driller's well number 4

NE ¼ SE ¼ Section 27 T. 40S R. 9E W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]

If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):

Domestic [ ] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [X]

(5) TYPE OF WELL:

Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(6) CASING INSTALLED:

Threaded [ ] Welded [X]

" Diam. from ft. to ft. Gage

8 5/8 " Diam. from +8" ft. to 20 ft. Gage 250

" Diam. from ft. to ft. Gage

(7) PERFORATIONS:

Perforated? [ ] Yes [X] No

Type of perforator used

Size of perforations in. by in.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

(8) SCREENS:

Well screen installed? [ ] Yes [X] No

Manufacturer's Name

Model No.

Diam. Slot size Set from ft. to ft.

Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Well seal—Material used in seal CONCRETE

Depth of seal 20 ft. Was a packer used? NO

Diameter of well bore to bottom of seal 12 in.

Were any loose strata cemented off? [ ] Yes [X] No Depth

Was a drive shoe used? [X] Yes [ ] No

Was well gravel packed? [ ] Yes [X] No Size of gravel:

Gravel placed from ft. to ft.

Did any strata contain unusable water? [ ] Yes [X] No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level 10 ft. below land surface Date 3/18/64

Artesian pressure lbs. per square inch Date

(11) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? [ ] Yes [X] No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.

" " " "

" " " "

Bailer test 15 gal./min. with 16 ft. drawdown after 1 hrs.

Artesian flow g.p.m. Date

Temperature of water 10° Was a chemical analysis made? [ ] Yes [X] No

(12) WELL LOG:

Diameter of well below casing 8

Depth drilled 200 ft. Depth of completed well 200 ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil	0	4
GRAY CLAY	4	25
YELLOW CLAY	25	95
BLUE CLAY	95	125
GRAY SHALE	125	174
BLUE LAVA BROKEN	174	196
GREEN SHALE	196	200

Work started 3/16 19 64 Completed 3/18 19 64

Date well drilling machine moved off of well 3/18/64 19

(13) PUMP:

Manufacturer's Name

Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME E E STOREY
(Person, firm or corporation) (Type or print)

Address 3831 Hope KLAMATH FALLS

Drilling Machine Operator's License No. 115

[Signed] E E Storey
(Water Well Contractor)

Contractor's License No. 77 Date 3/25/64 19

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

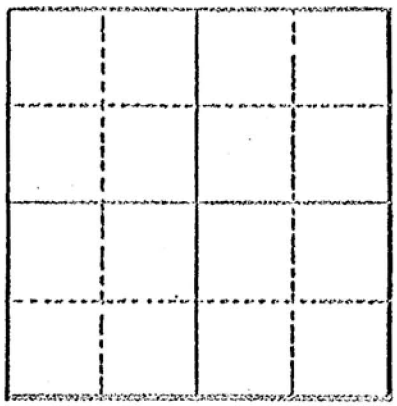
Well Record

STATE WELL NO. 40/9-1E1
COUNTY Klamath
APPLICATION NO. .....

OWNER: O'Connor
MAILING ADDRESS: .....
CITY AND STATE: .....

LOCATION OF WELL: Owner's No. .....

Sel ¼ NW ¼ Sec. ..... T. ..... N. S., R. ..... E. W., W.M.



Bearing and distance from section or subdivision corner .....

Section .....

Altitude at well 4,180

TYPE OF WELL: Drilled. Date Constructed .....

Depth drilled 400 Depth cased .....

CASING RECORD:

6 inch

FINISH:

AQUIFERS:

WATER LEVEL:
100 feet below land surface, 1954

PUMPING EQUIPMENT: Type Jet H.P. .....
Capacity 5 G.P.M.

WELL TESTS:
Drawdown ..... ft. after ..... hours ..... G.P.M.
Drawdown ..... ft. after ..... hours ..... G.P.M.

USE OF WATER Domestic, stock Temp. ..... °F. ....., 19.....
SOURCE OF INFORMATION USGS
DRILLER or DIGGER .....
ADDITIONAL DATA:
Log ..... Water Level Measurements ..... Chemical Analysis ..... Aquifer Test .....

REMARKS:

NE1/4 SW1/4 Sec 27

STATE ENGINEER
Salem, Oregon

State Well No. 40/9-27L1
County Klamath
Application No. .....

Well Log

Owner: L. Motschenbacher Owner's No. .....

Driller: E. E. Storey Date Drilled 1953

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Alluvium (some fault-disturbed materials):			
Soil, boulders and clay	0	63	63
Yonna formation:			
Boulders and sand (agglomerate?):	63	105	42
Sandstone	105	132	27
Rock, gray (tuff or agglomerate?)	132	148	16
Rock, water-bearing (tuff or agglomerate?)	148	150	2
Sandstone, blue	150	155	5
STATIC WATER LEVEL 55' on August 1953			

RECEIVED
NOV 10 1965
STATE ENGINEER
SALEM, OREGON

OBSERVATION WELL
WATER WELL REPORT
STATE OF OREGON

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

State Well No. 40/9-27P

State Permit No. .....

OWNER: Ottis Osborn

Name

Address Midland, Oregon

(2) LOCATION OF WELL:

County Klamath Owner's number, if any—

SE ¼ SW ¼ Section 27 T. 40S R. 9E W.M.

Bearing and distance from section or subdivision corner LOT 3

(3) TYPE OF WORK (check):

New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic [ ] Industrial [ ] Municipal [ ]

Irrigation [X] Test Well [ ] Other [ ] Stock water

(5) TYPE OF WELL:

Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(6) CASING INSTALLED: Threaded [ ] Welded [X]

10 3/4 O.D. Diam. from 0 ft. to 179 ft. Gage .250

..... Diam. from ..... ft. to ..... ft. Gage .....

..... Diam. from ..... ft. to ..... ft. Gage .....

(7) PERFORATIONS: Perforated? [ ] Yes [X] No

Type of perforator used

SIZE of perforations in. by in.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

(8) SCREENS: Well screen installed [ ] Yes [X] No

Manufacturer's Name .....

Type ..... Model No. .....

..... Slot size ..... Set from ..... ft. to ..... ft.

..... Slot size ..... Set from ..... ft. to ..... ft.

(9) CONSTRUCTION:

Was well gravel packed? [ ] Yes [X] No Size of gravel: .....

Gravel placed from ..... ft. to ..... ft.

Was a surface seal provided? [X] Yes [ ] No To what depth? 179 ft.

Material used in seal— Concrete

Did any strata contain unusable water? [ ] Yes [X] No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level 32 ft. below land surface Date 11-4-65

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] ..... Date ....., 19.....
(Owner)

(11) WELL TESTS: Drawdown is amount water level is lowered below static level Ken Hartley

Was a pump test made? [X] Yes [ ] No If yes, by whom?

Yield: 450 gal./min. with 2 ft. drawdown after 4 hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water 186 Was a chemical analysis made? [ ] Yes [X] No

(12) WELL LOG: Diameter of well 10" I.D. inches.

Depth drilled 418 ft. Depth of completed well 418 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL Page 1 of 2 Pages	FROM	TO
Sandy loam	0	4
Yellow shale	4	19
Sand, gravel & boulders	19	21
Yellow shale	21	38
blue shale	38	50
lava boulders & shale	50	53
blue shale	53	126
fine gravel	126	127
gray shale, caving	127	152
gray-blue shale	152	168
sandy blue shale	168	173
blue shale with hard streaks	173	189
lava boulders embedded in blue shale	189	200
lava rock cemented	200	240
brilliant blue shale	240	261
lava rock and blue shale	261	272
gravel	272	273
gray sicky shale	273	285
soft brown sandy clay	285	306
grey blue shale	306	347
hard basalt boulders	347	353
boulders & black sticky clay	353	366
blue basalt rock	366	374
sticky clay	374	375

Work started Sept. 16 19 65 Completed Nov. 8 19 65

(13) PUMP:

Manufacturer's Name .....

Type: ..... H.P. .....

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ken Hartley Well Drilling
(Person, firm, or corporation) (Type or print)

Address Box 542, Klamath Falls, Oregon

Driller's well number .....

[Signed] Ken Hartley
(Well Driller)

License No. 161 Date Nov. 8, 19 65

(USE ADDITIONAL SHEETS IF NECESSARY)

ft. drawdown after hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

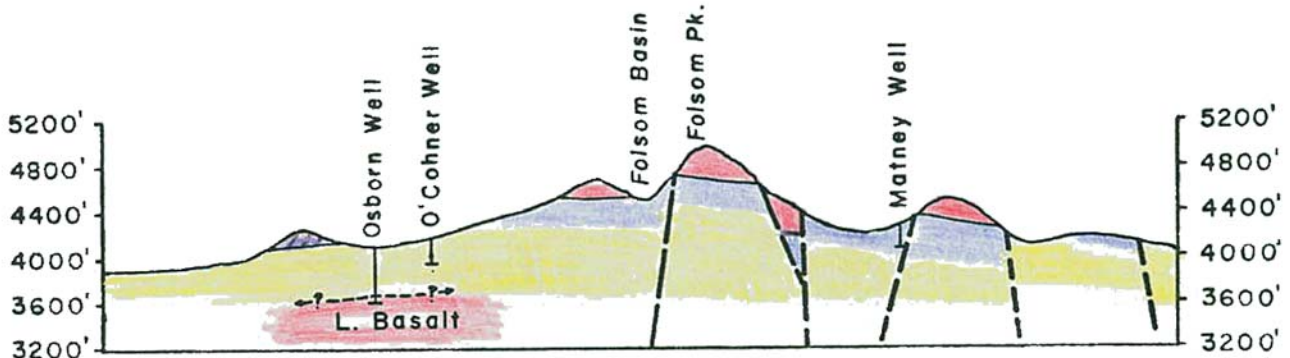
(12) WELL LOG:

Diameter of well ..... inches.

Depth drilled ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Page 2 of 2 pages		
boulders and clay	375	380
pink volcanic ash, sticky	380	383
loose lava rock in clay	383	395
broken blue basalt	395	405
red lava	405	417
dense hard basalt	417	418



CROSS SECTION A – A'
KLAMATH HILLS

PLEISTOCENE

Qb

Upper Basalt

QTv1

Late eruptive rocks
cinder cones, tuffs

QTv2

Basalt flows, pyroclastic breccia, tuff and some interbedded tuffaceous sandstone

Tst

PLIOCENE

lacustrine - fluviatile tuffaceous siltsone and diatomite.

KLAMATH HILLS MAP