



SALT LAKE COUNTY PUBLIC WORKS DEPARTMENT

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Salt Lake City, Utah 84190-4000
Telephone 468-3701

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WATER RIGHTS
SALT LAKE

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November 2, 1988

The Honorable John Hiskey
Salt Lake County Commissioner
2001 S State St #N2100
Salt Lake City, UT 84190-1000

Dear John:

SUBJECT: Boyer Company Well - Emigration Oaks Subdivision - TH #40
(Not for Commission Agenda)

I have reviewed the circumstances concerning the well described in Marlene Lehtinen's letter of October 11, 1988, with the State Engineer's Office, the City/County Board of Health, the developer, and an engineer who resides in Emigration Canyon and serves on the Emigration Community Council. There are differences of opinion regarding the relationship between the production from Boyer well and those in Freeze Creek and in shallower wells in the vicinity.

A significant portion of the reduction in the flows may be attributable to the drought conditions we are currently experiencing. Data which has been generated by the engineer resident indicates that there is also a strong relationship between the production from the Boyer well and flows and the water levels in area.

This is an issue which must ultimately be resolved by the State Engineer within the water rights administration framework. Interference among wells and priority of rights to produce water are issues which only he has the authority to resolve.


The County's interest is to assure that there will be sufficient water to support the remaining homes to be built in the Emigration Oaks subdivision without adversely impacting water supplies for other residents in the canyon. It is therefore appropriate that we participate with the residents, the developer, and the State Engineer in their evaluation of the water supply situation.

I have offered to participate with all of the affected parties in the review of these concerns within the framework of the State Engineer's

The Honorable John Hiskey
Boyer Well
November 2, 1988
Page 2

jurisdiction. Upon completion of this review, I will submit recommendations to you for any action which might be indicated the County should take.

Sincerely yours,



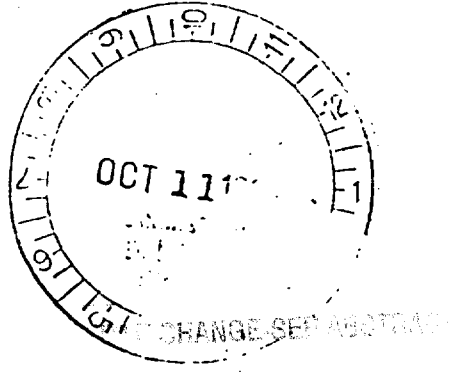
R.T. Holzworth, P.E., Associate Director
Salt Lake County Public Works Department

cc: Commissioner Barker
Commissioner Stewart
Romney Stewart
Marlene Lehtinen
Hank BrestVanKempen
Dick Moffat
Kent Miner
Utah State Engineer - Ed Feldt ✓

159

4911 Emigration Canyon
Salt Lake City, Utah 84108
October 11, 1988

Mr. D. Michael Stewart
Salt Lake County Commissioner
2001 South State Street
#N2100
Salt Lake City, Utah 84190-1000



Dear Mr. Stewart:

After last week's Emigration Canyon Community Council meeting regarding response to the canyon fire, I spoke with you about the negative impacts of the well drilled by the Boyer Company at the head of Freeze Creek on residents living in the Freeze Creek drainage. Since I am a member of the Emigration Canyon Community Council as well as a resident of the Freeze Creek drainage, you asked me to provide you with a letter describing the situation.

There are five homes situated directly at the bottom of the drainage. We are all very concerned about the negative impacts we have recently experienced since the Boyer Company began, during the last year or two, to regularly pump the well they drilled at the head of our drainage. We are especially alarmed since these significant, measurable, negative impacts have been experienced with only about one percent of the number of planned homes in the Emigration Oaks subdivision completed. Additional development of Boyer Company's Emigration Oaks property in the future will undoubtedly exacerbate these problems.

In 1984 the Boyer Company drilled a well approximately one mile north of Emigration Canyon Road. The well and the 300,000 gallon storage tank to which it is connected are sized for a projected 291 homes in the Emigration Oaks subdivision. This subdivision is approximately one and one half miles down canyon (west) from the Freeze Creek drainage. In essence, the Boyer Company intends to provide water to nearly 300 homes that is withdrawn from one point in the Canyon one and one half miles up canyon. This point is at the head of the Freeze Creek drainage which supplies current residents with water. It is important to note that 291 new homes effectively doubles the number of homes in the Canyon. It should also be pointed out that a number of years ago, a report produced by the State Water Engineer's Office stated that any sizeable removal of water from larger than single-family sized wells could produce problems.

D. Michael Stewart
October 11, 1988
Page Two

Already the Boyer Company has County approval to build 40 homes in the Emigration Oaks subdivision. It also has tentative approval to build an additional 65 homes, or a total of 105. Plans have been submitted to build the total 291 homes. Although only 3 homes have been built to date, the impacts on Freeze Creek itself and on the wells of those of us in the Freeze Creek drainage have already been significant. Current evidence indicates that there is insufficient water available to supply even the first phase of 40 homes in the Emigration Oaks subdivision let alone 291.

Freeze Creek which feeds into Emigration Creek has gone dry only once in the last thirty years. That one exception was in 1961, a very dry year. It is important to note, however, that the creek did not dry up in 1961 until September. This year, Freeze Creek was dry from the end of May, a time which in all previous years produced extremely heavy flow. There has been no flow whatsoever at any time since then.

My husband and I have a monitoring device that indicates the level of water in our well. Unlike previous years, this year our water level has declined significantly. During this summer, the distance from the top of the well to the water level has fallen by more than 45 feet. This significant drop in the water table level has never occurred in the past. Furthermore, ours is not the only well so affected. Neighbors south of us on the drainage have a similar monitoring system on their well. Their monitoring device has been in place longer than ours, providing data on the water table during previous dry years. With the pumping of the Boyer well this year, they have experienced the same precipitous drop in the water level as we have. Furthermore, this drop in their water table is unprecedented in records dating back approximately 30 years.

We are understandably concerned that with any appreciable increase in pumping by the Boyer Company to accommodate additional development in the Emigration Oaks subdivision, we will be without water in our wells. We already have been negatively impacted by the fact that the stream which used to flow through our front yard is now a dry ditch. It does not seem reasonable that a developer should be able to remove water for such a large number of homes from one point source in the Canyon that is located significantly higher than the homes served and, as a result, cause such negative impacts on families that have been residing in the canyon for up to twenty-five and thirty years.

I would sincerely appreciate your assistance in investigating this matter. It truly seems that an injustice is being done to long-term residents of Emigration Canyon.

Sincerely,

Marlene Lehtinen

Marlene Lehtinen

NO CHANGE-SEE ABSTRACT

M E M O R A N D U M

DATE: November 16, 1988
TO: Bob Morgan
FROM: Boyd Clayton and John Solum
SUBJECT: Freeze Creek and Boyer Well Investigation

We have been studying the Freeze Creek residents - Boyer Company well interference concerns as requested. It must be understood that our conclusions are tentative. There has been some investigative work performed in the canyon by Mr. Barnett in the mid 1960's, Mr. Brest van Kempen through the last several years, and ourselves in the last few weeks. The geology of the canyon is quite complex making aquifer response difficult to predict without additional aquifer related data.

I. Emigration Canyon as a Whole

The major geologic feature affecting Emigration Canyon area groundwater movement is a syncline, the axis of which parallels Emigration Creek. The syncline plunges to the northeast making it possible for groundwater to pond in confined aquifers toward the upstream end of the canyon and for water from aquifers to overflow into the stream at the lower portions of the canyon as the aquifer is cut by the stream. Although the existence of the structure is well known, local details are obscured due to the thick alluvial cover over almost all of the drainage.

The primary groundwater aquifer in the area appears to be the Twin Creeks Limestone. It underlies almost the entire basin and outcrops in higher elevations. This formation produces water for Tunnel and Wagner Springs near the base of the canyon (the prominent springs in the canyon).

II. Freeze Creek Drainage

Field observations in the Freeze Creek Canyon conducted in early November 1988, showed water was flowing to the stream high up the canyons from the Nugget Sandstone. The stream lost its flow as it crossed the Twin Creeks Formation. The stream received flow again after leaving the Twin Creeks Limestone.

A flow of about 2-3 GPM re-entered the stream at a point on the creek about 600 feet downstream and at an elevation approximately 40 feet below the Boyer wellhead. This point is probably in the Parleys Member of the Kelvin Formation. The flow remained in the stream until the stream crosses a natural gas pipeline just upstream from the Freeze Creek residences.

The Boyer well is located just off the main Boyer road and about 75 feet East of the creek. It was not in operation; nor did the flush tubes show evidence of recent discharge to the creek. Adjacent to the well, in the creek bed, is a small Parshall flume. Much of the area from this point to the north and to the east have been burned off by a fire in September, 1988.

III. Brigham Creek Drainage

Brigham Creek (the next drainage to the east) was next explored and it was found to exhibit about the same behavior as Freeze Creek. Flowing water was found at a point about where the Forest Boundary starts. The flora indicate the water has been present year-round. The water then disappeared and resurfaced at a point near the junction of the creek and the telephone line. From here for about 2500 feet downstream, a small flow of less than five gpm is extant. Near where the water ended, physical evidence of a fault was found, however, it was not possible to observe a plane.

IV. Boyer Well Change Application Number a12710

The well resides as described above. From the well the water is pumped to a storage tank located to the east and about 300 feet higher in elevation. The operating sequence calls for the pump to turn on and flush for 3-5 minutes before pumping to the tank. The flushed water is discharged directly to Freeze Creek. The pump is operated until the tank is filled with the overflow being discharged into the Brigham Creek drainage.

The Boyer well drill log indicates the well was started in the Preuss Sandstone and intercepted the Twin Creeks Formation 120 feet below grade. Water was only encountered in the Twin Creeks Formation. The static level in the well was recorded as 5 feet below ground when the well was completed due to artesian pressures in the Twin Creeks. It has been reported the well sometimes overflows in the spring. Iron stains on the pump house floor observed during a tour of the well installation November 8, 1988 support the overflow report. An attempt was made to measure the water level in the Boyer well on November 8th, but the attempt failed. Either a special measuring device must be fabricated or the well seal must be altered to allow insertion of a well probe before levels can be taken. Assuming the seep in Freeze Creek downstream from the well originated in bedrock, the current water level could be no more than 40 feet below ground at the Boyer well.

V. Freeze Creek Wells Water Right Numbers 57-3329, 57-3275, 57-3030, 57-2943, and 57-1961

Well tops were located by level line. This information was then plotted against a cross section of Freeze Creek Canyon and data from the well logs. It reveals that the three upper most wells (Van Kempen, Smith, and Tease) are probably connected hydraulically and are drilled into the Kelvin Formation. The lower two wells (Smay and Jenkins) do not appear to share this direct connection with the upper three wells and are probably in the valley fill material which seems to consist of rubblized Kelvin Formation and may be controlled by water levels in Emigration Creek. The elevation of Emigration Creek at it's confluence with Freeze Creek is 22 feet below ground surface at the Smay well and 19 feet below ground at the Jenkins well. The historic data from the Smay well indicates it's level in 1966 was about 24 feet below ground surface.

The lowest level reported for the well in August of 1988 is about 30 feet below ground surface. This change in water level is not considered significant considering the dry year and fluctuating levels experienced throughout the drainage. A shallow well located across Emigration Creek from Freeze Creek went dry this summer and was replaced. The well log has not yet been received by the Division of Water Rights.

The remaining wells on Freeze Creek (Brest van Kempen, Smith and Tease) have historic static levels 40 feet above the Smay and Jenkins wells. The historic static level for the Brest van Kempen and Smith well are within 4 feet of each other. The dramatic decline experienced this summer (11 feet) was identical in both wells.

VI. Other Considerations

- A. Several wells in Section 32 (just downstream of the confluence of Emigration and Freeze Creek) are reported to be completed in the Twin Creeks Limestone near where it begins to outcrop in the stream as a result of the synclinal plunge. The wells are reported as adequate for domestic use with water levels near ground surface. Based on this data, it appears there is a significant gradient toward the stream and the canyon mouth. Unfortunately no water level observations in the Twin Creeks Limestone upstream of Section 32, but near Emigration Creek are available. Seepage runs made in 1966 reported significant gains in Emigration Creek, presumably from Twin Creeks inflow in the lower reaches of the stream.
- B. Based upon the drill log from the Boyer well, it is presumed the Twin Creeks Aquifer is confined in Section 33 with the head in the aquifer above stream level. This condition would cause an upward gradient and artesian pressures in overlying beds. This is only conjecture, however, since no wells have been completed to the Twin Creeks near Emigration Creek.
- C. The aquifer supplying the Upper Freeze residents is not well understood at present. Three theories for it's recharge are currently being considered. They are:
 1. The aquifer extends up the Emigration Creek drainage and is recharged in Section 27 where losses to the stream have been observed.
 2. The aquifer could be local and recharged directly from flows of Freeze Creek and precipitation infiltration not far upstream from the wells. If this is the case, the Boyer well would influence water levels primarily by reducing the flow to Freeze Creek. Because of the Boyer well's location near the creek and the probability the creek in the lower reach is fed by leakage from the Twin Creeks Formation this type of interference is possible, if the well is pumped on a continuous basis so a local cone of depression is formed. However, the current pumping level is insufficient to cause this problem (as evidenced by the observed flow of the stream).
 3. The aquifer could be recharged by the upward gradient of water moving from the Twin Creeks Formation toward Emigration Creek.

- D. Gradients (although somewhat difficult to identify due to lack of data) suggest flow in the Twin Creeks Limestone is toward the southwest. Similar gradients are probably evident in all water bearing formations of the area due to the orientation of the syncline. Seepage runs conducted in 1966 on Emigration Creek showed loss of about 0.5 cfs in Section 27 and gains of the same amount in Section 33. Whether this phenomenon is occurring in consolidated or unconsolidated materials is not known at the present time.
- E. There is significant cover of unconsolidated materials over the bedrock in the entire drainage. The cover is quite heterogeneous in that it contains boulders as well as fine grained materials and may cause difficulty in identifying formations with certainty, mask bedrock interfaces and allows formation of unconsolidated fill aquifers which are difficult to distinguish from consolidated rock aquifers.
- F. The general trend throughout the region is for artesian pressures particularly near the Freeze Creek confluence with Emigration Creek. The condition is expressed not by a tendency for water to flow to the surface, but for water in wells to rise above elevations of overlying aquitards when drilling through water bearing strata.
- G. The Boyer well has been pumped enough to fill their 300,000 gallon tank about 7 times or about 2 million gallons. This figure was arrived at by reviewing the operating history of the project with Dick Moffat of Boyer, reading the totalizing meter on the well and reviewing the power consumption records. Mr. Moffat's recollection was the tank was filled at least twice during testing in 1986. It was drained in the winter since the system wasn't being used and refilled again in 1987. In 1988 the tank was drained once due to a vandalism problem, and once by a line break caused by a maintenance vehicle hitting a fire hydrant. Just short of 2 tanks full (530,000 gallons) were metered to the three residences in the Boyer development during the latter part of 1987 and 1988. Part of this metered amount was used to water down roofs of the houses during a forest fire in the area in September 1988.

Boyer has a totalizing meter on their pump which indicates 1.7 million gallons have been pumped to date. This number could be correct, but appears to be about one tank filling low based upon the other information collected. The meter does not register flush water which is pumped to Freeze Creek when the pump is first started, but estimates are this quantity is probably less than 10,000 gallons.

Mr. Moffat indicated the meter was installed with the pump and has measured all withdrawals, but it seems plausible the first test filling was not measured.

The total power usage reported for the well as reported by Mr. Moffat and the Freeze Creek residents is almost identical leaving the total as of November 8, 1988 at 9000 KWH. Of this amount, about 5300 KWH has been used this year, 1000 KWH in 1987, and 2700 KWH in 1986 suggesting a tank recharge requires about 1300 KWH. There is an electric heater in the pump house which could have operated in the winter of 1987 (we neglected discussing this with Mr. Moffat). It's operation would create some problems in estimating pumping based upon power consumption. However, the numbers at present seem consistent with the 2 million gallon estimate.

Mr. Moffat said the well is equipped with a 40 HP pump which considering the 38 KW demand shown on the meter numerous times suggests line and motor losses are about 22% rather than 12% suggested by the Freeze Creek residents. The pump lift based on a topographic map provided by Boyer and the well log is at least 600 feet not 250 as suggested by the Freeze Creek group. Using 2 million gallons as the pumpage and 9000 KWH as power consumption the resulting pump efficiency is 53% and overall efficiency is 42%.

It is important to note using the demand and KWH reading from the electric meter, the pump has run no more than 240 hours in 3 years. This translates to 10 days of total operation at least 4 of which occurred prior to 1988.

- H. It also appears from the log of the Brest van Kempen well that it may have been improperly constructed. The well is 72 feet deep with water encountered from 45 to 60 feet. The well was cased, however, for its entire length with only the lower 20 feet perforated. This means the well is producing from an altitude of 52 feet and not 45 feet or a loss of 7 feet of producing horizon. If this is true, it may help to explain slow recovery times and possibly even affect the static level.
- I. The Smay well log also reveals an unusual construction. Water was encountered from 50-76 feet, yet the well was perforated from 61 to 76 feet. The loss of eleven feet of producing horizon may also be influencing this well.

VII. CONCLUSIONS

- A. Freeze Creek and Brigham Creek are normally perennial streams with the main source being the Nugget Sandstone. Surface expression along the entire reach will occur in years where the runoff is sufficient to saturate the Twin Creek Limestone which seems to act both as a reservoir and as a conduit to conduct water to Emigration Creek. In dry years, water is virtually totally absorbed by the limestone with a corresponding decline in surface expression. Brigham Creek exhibited a similar habit with the water issuing from the Nugget Sandstone, crossing the Twin Creek Limestone and soon disappearing, later reappearing, and finally disappearing in it's downstream movement. This fact lends credence that what is happening is due to a dry cycle and not the pumping of the Boyer well.
- B. The surface expression of water in the lower reaches of Freeze Creek end at the pipeline. It is possible that the backfill of the pipeline is interfering with the flow of the creek especially when flows are minimal.
- C. Possible previously unknown faulting may be influencing the water migration of Freeze Creek.
- D. The well logs seem to indicate the upper three wells are more closely related hydrologically than the lower two wells. If this is true, it is unlikely the Smay or Jenkins wells would suffer the same changes that would affect the upper three wells.
- E. The Boyer well producing horizon resides in the Twin Creek Limestone. The Freeze Creek wells reside in the Kelvin Formation and/or

valley fill. The Kelvin Formation is resistant and serves as an aquitard and an aquiclude and is separated from the Twin Creek Limestone by the Pruess Sandstone. Direct communication between the Boyer well and the Freeze Creeks wells would require an extensive network of fractures over 4000 feet in length.

- F. It cannot be stated with a high degree of confidence if it is possible for interference to occur, let alone, if it is occurring. However, at this point in time, our opinion is that the probable cause of the falling water levels is climatically controlled.
- G. The reduction of capacity experienced in the Smith well which necessitated lowering the pump, could be partly attributed to the gradual filling of the lower 25 feet of the well with some material of unknown origin and composition. We were told the pump could not be lowered below 80 feet because it hit this material.
- H. The Boyer Well could cause interference only if the well's drawdown influence cone extends over 4000 feet in radius. The Twin Creeks formation is not extremely permeable (about 200 ft/year) in the vicinity of the Boyer well and so if relatively homogeneous the drawdown cone could be extensive as continual pumping ensues. However, a drawdown cone would take some time to develop since partial dewatering of the aquifer and release of water from pore storage is required.

VII. RECOMMENDATIONS

- A. A pump test may be of value. However, such a test would have to be carefully conceived. For example, if the pump returns are discharged to Freeze Creek, static levels downstream may be improperly influenced.
- B. It may be of value to meter the 5 residential wells.
- C. Questions regarding interference could be resolved to a great extent by modifying the Boyer well to allow measurement of water levels. The well must cause significant sustained drawdown to be a threat to the Freeze Creek system.
- D. A long term study, perhaps cooperative in nature, to determine water level contours and gradients would be the best solution.

FREEZE CREEK
FLOWS HERE
~2 GPM 11/88

FREEZE CREEK
WENT DRY HERE
11/88

BOYER
WELL
LOCATION

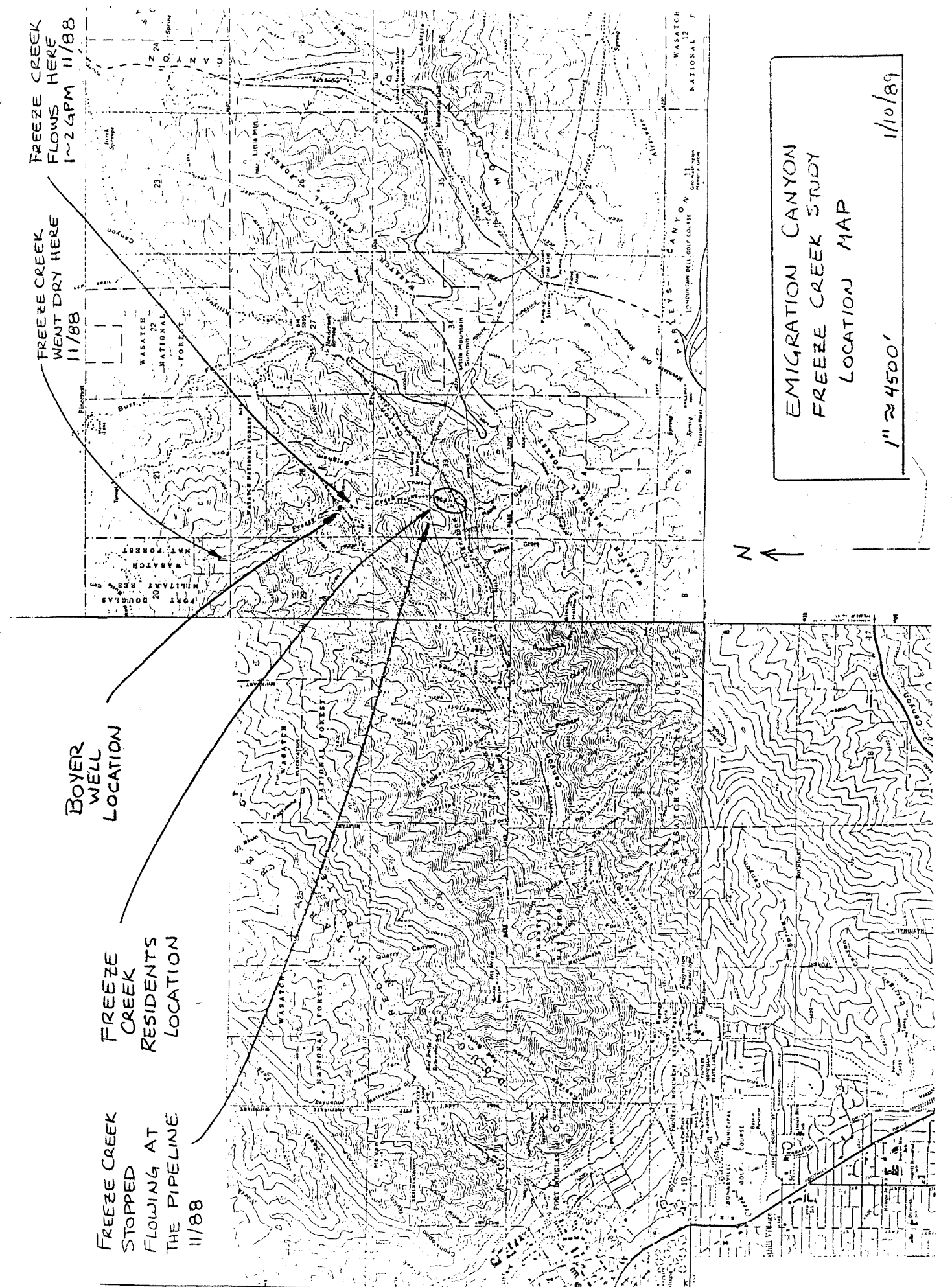
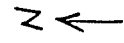
FREEZE
CREEK
RESIDENTS
LOCATION

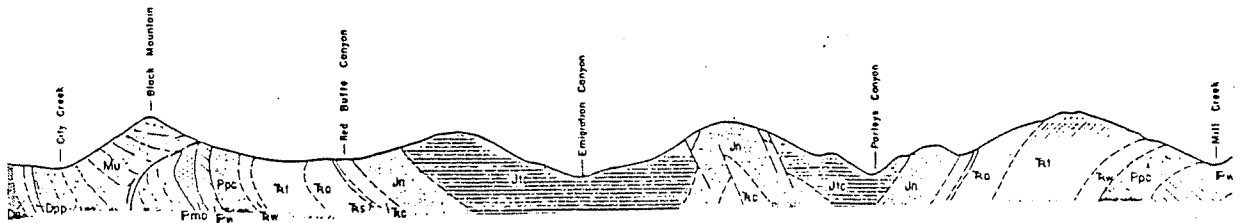
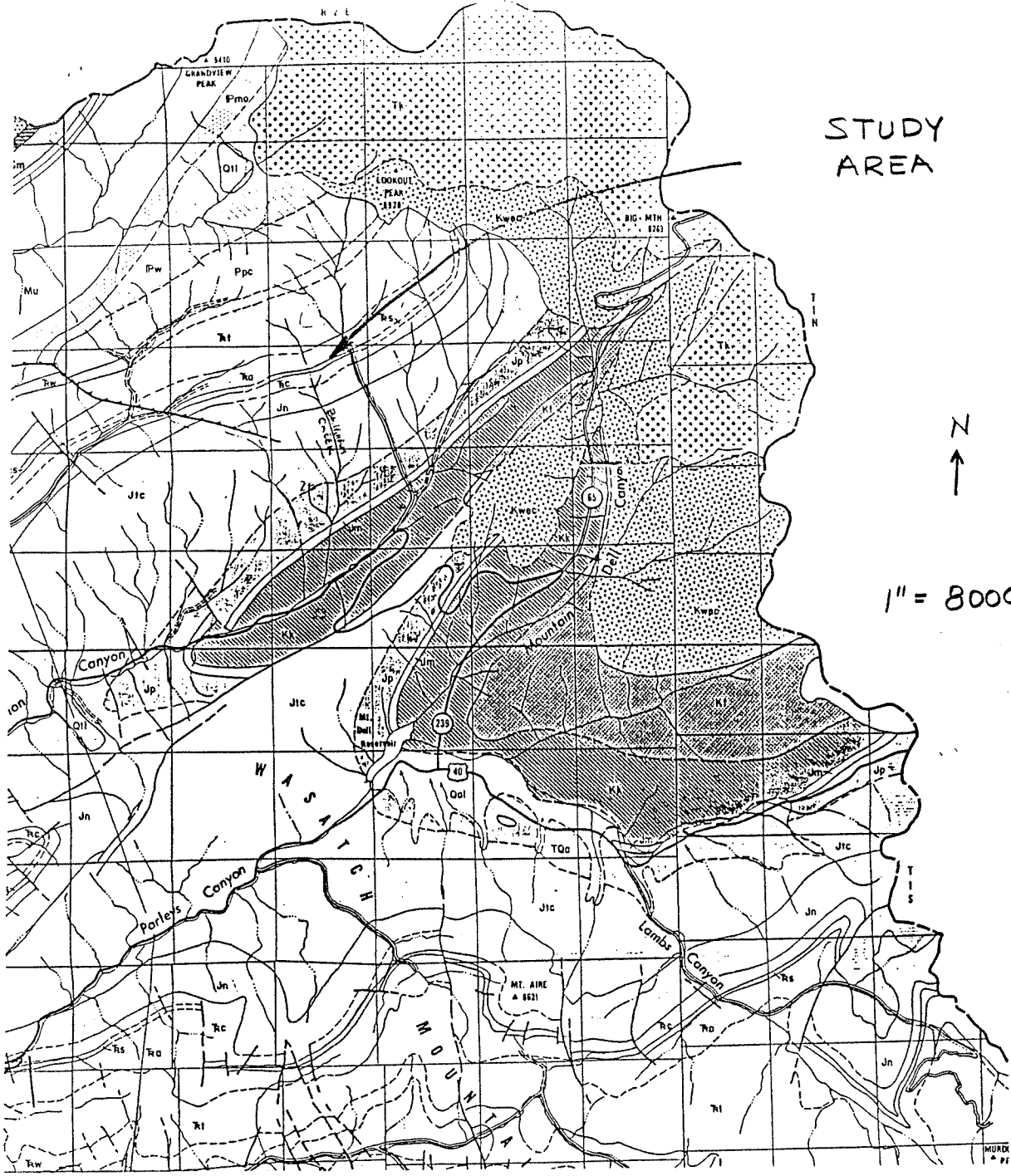
FREEZE CREEK
STOPPED
FLOWING AT
THE PIPELINE
11/88

EMIGRATION CANYON
FREEZE CREEK STUDY
LOCATION MAP

1" ~ 4500'

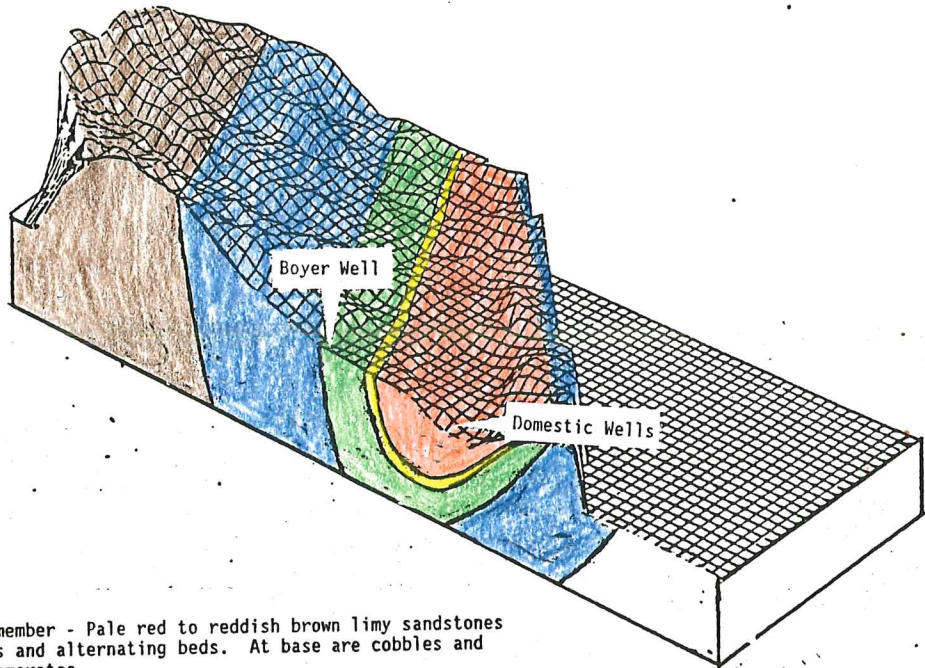
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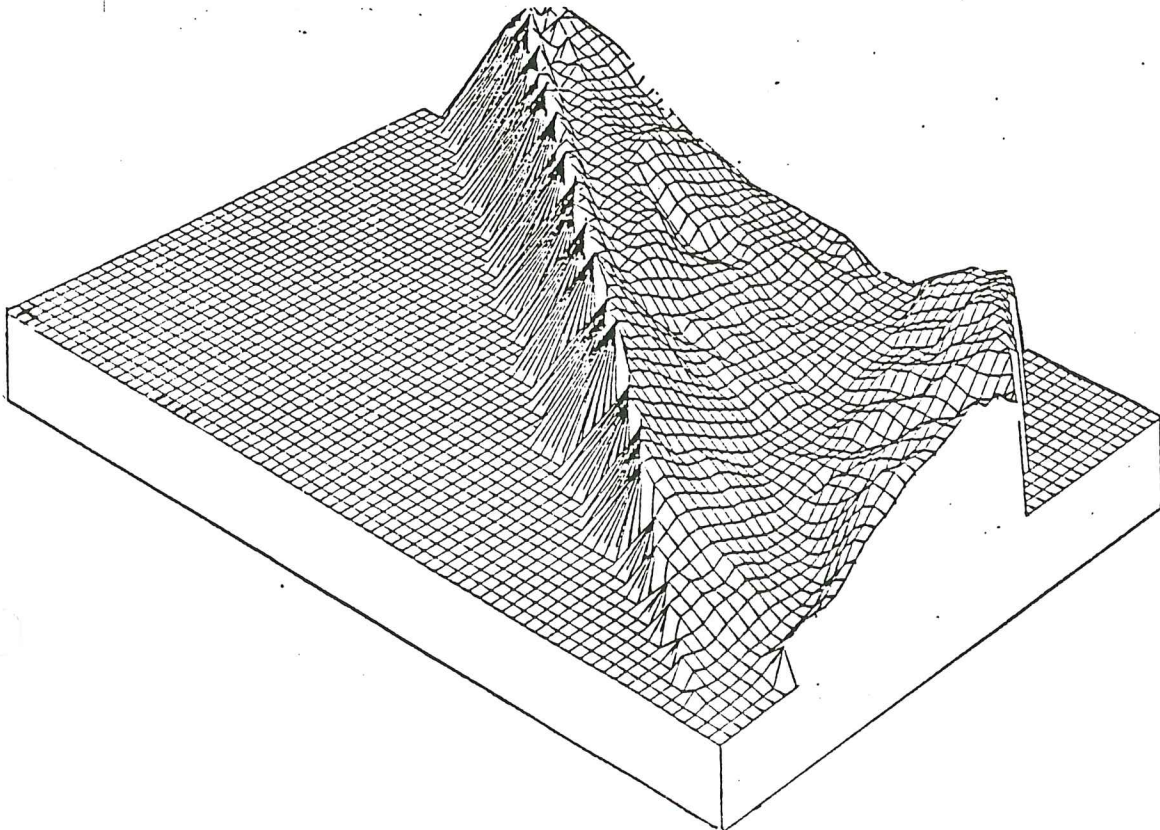


EMIGRATION CANYON
 FREEZE CREEK STUDY
 GEOLOGIC MAP

1/10/99



- Kku** Kelvin upper member - Pale red to reddish brown limy sandstones and siltstones and alternating beds. At base are cobbles and boulder conglomerates.
- Kkp** Kelvin lower member (Parley's Member) - Originally thought to be Morrison Formation. Now, lower member (100 feet) of Kelvin Formation also known as Parley's Member. White nodular limestone, lavender-gray siltstone and sandstone, and coarse conglomerate.
- Jp** Preuss Sandstone - Dark red sand and mud. Fine grained, fractures, joints and bedding planes.
- Jtc** Twin Creek Limestone - Pale gray with thin beds of red shale.
- Jn** Nugget (Navajo) Sandstone - Reddish-orange, massive, cross-bedded sandstone.



LITHOLOGIC REFERENCE
(From Well Drillers' Reports)

- 1 Topsoil
- 2 Silt
- 3 Gravel
- 4 Red Clay
- 5 Red Rock
- 6 Hardpan and Broken Red Rock
- 7 Boulders
- 8 Loose Gravel
- 9 Red Rock, Boulders
- 10 Conglomerate, Red Rock
- 11 Broken, Loose, Red Rock
- 12 Conglomerate
- 13 Red Sandstone
- 14 Clay
- 15 Clay and Gravel
- 16 Broken Limestone
- 17 Gravel and Conglomerate
- 18 Cobbles and Boulders
- 19 Clay and Cobbles
- 20 Pruess Sandstone
- 21 Limestone, hard, fractured
- 22 Limestone, very little water