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Contamination Report No. 6

A Reconnaissance of Alleged Salt-Contamination of Soils near Stamford, Jones County, Texas

By

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Introduction

During the period October 7-9 the writer made a reconnaissance investigation of alleged salt-water contamination of cultivated land approximately four miles southeast of Stamford in Jones County. The study was made at the request of Mr. A. C. Humphreys, a former mayor and civic leader of Stamford, who has an interest in some of the land affected by the seepage. Mr. Humphreys stated that spots were appearing in fields of the area which appear to have a "greasy" brownish look similar to the color of soils exposed to oil field brines. He also reported that in the past two years some storm cellars dug to a depth of 6 to 8 feet below the ground have been flooded to a depth of 2 to 4 feet in places and that water in cisterns 15 to 20 feet deep has been contaminated by ground water and can no longer be used for drinking. The general presumption by those in the affected area is that the water has been elevated abnormally due to high-pressure leakage of salt water from oil wells.

General Geology and Occurrence of Ground Water

The area concerned in this investigation is underlain at the surface by Quaternary alluvium of the Seymour formation, which is of shallow but undetermined thickness in the area, probably in the order of 20 to 40 feet. The Seymour consists of fine to coarse grained sand, gravel, and clay beds, covered by a fertile sandy-loam soil. The underlying Permian rocks are members of the Clear Fork group which consist principally of red shales interspersed with thin to moderately thick beds of limestone, fine grained sandstones, dolomite, and gypsum.

Little data is available on the occurrence and quality of ground water in Permian rocks, but previous reports on Jones County state that in most places they produce limited amounts of highly mineralized water, which is generally unsuitable for domestic use. Ground water in the alluvium occurs in meager to moderate quantity depending upon the thickness of the permeable materials encountered in a well; however, well yields are generally low because of the lack of uniformity of grain size of the sediments. Shallow stock wells in the report area produce from the alluvium, but the water is generally unacceptable for drinking or general household use. Cisterns are used or water is hauled from Stamford for these purposes.

Water Levels in Wells

At the time of this investigation, heavy rains (5-6 inches) had fallen on the watershed and water still stood in the fields in many

places. However, evidence of excessive minerals in the soil was seen at several points, enough to document the existence of a soil problem, and it was readily apparent from water levels in nearby wells that it was due to a high water table which intersects the land surface, or nearly so, in places where soil damage was reported. Water levels measured in all available wells, flooded cisterns, and storm cellars ranged from about three to seven feet below ground level in the area most affected by soil damage. Comparison of water levels in selected wells for 1944 and 1959 indicates the water table has risen beneath the area an average of about 13 to 15 feet since 1944. The area in which the rise has occurred is too large to support the contention that subsurface leakage from oil wells is responsible. It is possible that some leakage could be occurring which would account for the indicated elevation of chloride levels in the area, but this is not considered likely as the high-chloride areas would almost certainly be more localized under this presumption. It is more probable that the rising water table has dissolved minerals from the previously unsaturated zone of aeration and from subsoil hardpan deposits near the surface.

Quality of Ground Water

Water samples were taken from wells, cisterns, etc., in the area to determine whether unusually high chloride concentrations existed in the water which should be associated with subsurface leakage of brine from oil operations (see Table 1). The chloride analyses of well waters varied between 61 and 1,130 ppm with the lowest chloride concentration nearest the principal seepage area, (Sample #1). Based on a few 1944 chemical analyses of water in this general area, there appears to have been some increase in chloride concentrations of water in the Seymour formation, though the evidence is not conclusive.

Nitrate in waters sampled ranged between concentrations of 3 and 1820 ppm, the latter being encountered in water from an invaded storm cellar (Sample #6). Water from wells averaged about 300 ppm in nitrate, an extremely high concentration for ground water. In attempting to account for this phenomenon, the United States Geological Survey reports that much nitrate has been found in the shallow subsurface of certain areas of the United States which were originally covered by mesquite, as this area undoubtedly was. The rising water table has apparently dissolved much of this residual nitrate resulting in a general elevation of nitrate concentration in ground water. The effect, if any, of such high nitrate concentrations on plant growth or soil character was not studied in this investigation.

Brine Production and Disposal

No producing oil wells are near the field-seepage areas, and no brine disposal pits are within one mile of the areas. However, many

abandoned oil or gas test wells are present in the general area of the seepage.

Conclusions

Soil damage in the area is apparently due to two effects, water-logging and "salting-out" of the soil due to concentration of minerals by evaporation of water from a high water table. In such a situation water reasonably low in mineral content can eventually cause soils to become infertile. Lowering of the water table in this area by pumping or ditching would probably alleviate the problem. In places, the water appears to be of a quality suitable for irrigation. It is doubtful, however, if the aquifer would sustain a significant amount of pumpage in this area.

The rising water table, culminating in surface seepage in certain areas, appears surprising in view of the seven-year drought ended in 1957; however, data on other areas blanketed by Seymour alluvium in Knox and Haskell Counties indicate that similar water-table rises have occurred in those areas beginning when the land was first cleared and tilled and continuing until springs developed in lowlands and water-table wells began to flow in the early thirties. A documentary account of this phenomenon is attached hereto relating instances in which water levels were reported to have risen as much as 40-60 feet since the turn of the century. Perhaps irrigation has solved the problem of soil damage in these areas as water levels are now considerably below ground level in the irrigated areas except at the outer margins of the alluvium.

A possibility exists that the seepage areas are largely coincident with the feather-edge of the alluvial deposit but, if so seepage would have probably been noticed long ago, unless the rising water table has but recently reached the level at which water would discharge naturally in these places. No soil damage in this area was reported prior to flood year 1957, and residents commonly dug shallow storm cellars in the affected area prior to that time.

Ground Water in Northwest Haskell County

The problem of the control of ground water in Haskell and Knox Counties promises to develop into a major scientific and engineering project. The following data has been collected by two days study of the situation and is enough to disclose that a scientific study should begin at once and continue until some feasible and practical solution is found for the control of encroaching ground water in this area, otherwise all the sand area in the northwest part of Haskell County and that part of Knox County south of the Brazos River is probably doomed to become waste salt marsh land within a few years. This same land is now producing upwards to a bale of cotton to the acre, some of it producing as much as two bales to the acre. The area most accutely threatened produced two bales per acre in 1932, and one and one-half bales per acre in 1933. The land now waste land produced upward to a bale to the acre each year from 1915 until 1929 when the marsh began to appear in large spots, with the exception of the drouth years of 1917 and 1918. The possibility of a loss of some 500 square miles of the very best land in Texas should stimulate thought and action.

Besides making a personal investigation of the affected areas, the writer interviewed reputable persons who have been residents of this area for many years and took down their statements as given, a few of these statements are given below:

Mr. Hudspeth, manager of the City Water Works of Rochester connected with the Water plant for seven years stated that the water level 1926 in the city well (sheet water in fine gravel) stood at 45 feet below the ground level. At this date it stands at 35 feet, 4 feet of this rise having occurred during the last two years. Pumps and motors had to be moved on this account. Mr. Hudspeth was raised 5 miles west of Rochester. Twenty five years ago the water on his home place was 70 to 75 feet below the surface, the water was hard and gip so much that water was hauled for domestic uses. Now this same well has water standing 45 feet below the ground level and the water is soft and fresh. Laundry work is done without breaking the water. This is a rise of 20 to 25 feet in twenty five years.

A. M. Allen, a resident of the vicinity for 33 years and a well digger in his youth states that he dug a well on his father's place in 1906. The well was located in a canyon near the Brazos River and a well was made at 16 feet. The water level gradually rose until 1918 when it began to run over the top of the well which it still does. Please note that 1917 and 1918 were the driest years of all history of the county and this drouth affected all west Texas. A well on the B. E. Carr place 8 miles west of Rochester was dug to a depth of 78 feet where water was found that rose to a depth of 4 feet. The water was very hard. Now the water stands 13 feet from the top and is soft and fresh. He dug a well in a canyon to a depth of 44 feet near Judd and obtained water to a depth of less than 10 feet in the well. Water is now running over the top of the well.

J. H. Wolf, a resident since 1906 stated that one well on his place west of Rochester one mile stood 75 feet below the top and the water was gip. Now the same well is soft water standing at 47 feet from the top. Another well was dug 108 feet finding gip water, this well now has an abundance of soft water at 45 feet.

Numerous others were interviewed and their statements all tended to show the same thing: that the rise of ground water in this area is no myth, but a fact, that the rise has been about a foot per year with some little acceleration during the last few years, and the water has changed from hard, gip and salt water to soft fresh water.

This was all very beneficial to this county until recent years; for fresh water had been very hard to obtain, but in 1928 numerous small spots of water logged land began to appear here and there, the following year changing to a salt marsh which was wholly non-productive, these spots have increased in size year by year until at this date there are some of from five to one hundred twenty acres, they would aggregate probably 200 acres at the present time.

The largest of these is in the extreme northwest corner of Haskell County and is designated "A" on the accompanying map. This marsh area now containing approximately 120 acres. This lies in two areas, the larger affecting the property of Jewel Day, Mrs. E. Castleman, Mrs. Lucy Day, a Mrs. Lewis and Mrs. Tib Burnett whose property lies in Knox County. The small area is of small extent and is on Mrs. Lucy Day's property. V. E. Davis property is also affected and lies in this larger area.

Jewel Day has lived on this place since boyhood. His house formerly stood in what is now the marsh. He had a good well of water which did not fail in 1917-1918. In 1928 a small spot appeared near his house and at the same time small spots appeared on his neighbors' lands. The land became boggy, water rose to the top of his well and he was afraid to use it. This condition gradually increased until he found it necessary to move his house and dig another well on higher ground. Land that produced 2 bales per acre in 1932 became non productive in 1933. The spread was very rapid in 1933 and now the spots that appeared on his neighbors' land and on his are now one big salt marsh, producing nothing, and the condition is becoming the same on other adjacent ground. His experience is typical of that of all his neighbors. It is my opinion that fully 3000 acres will be reduced to this condition within five years unless drastic steps are taken to control this water.

Day set his house when it was moved on a little rise 15 feet above the marsh which appeared first at the foot of this rise. The water in the well stands two feet above the ground level of the marsh and it is soft water and not salty to taste. Another house stands nearby on the Castleman place. The well is likewise on the rise and stands about 75 feet from the rim of the marsh, but the water level is one foot above the level of the marsh. This water is not salty to taste.

The soil of the affected area is very light sandy loam, or rather a loamy sand, very likely at one time the bed of the Brazos or formed by it in flood time. There is a gradual slope toward the Brazos about 2 miles away of about 10 feet per mile and the movement of the marsh is mostly in that direction. At some places small quantities of water are standing on the surface, although it has not rained here for several weeks. Holes dug from a few inches to a foot produced water. Farther out from the affected area water was found at two feet, three feet, etc., according to the distance from the marsh, although it was on ground lower than the marsh. Where the water was as much as two feet from the top, the soil produced abundantly but where it was a foot or less it is barren. The top of the soil is covered with a white substance salty to taste, probably a mixture of salt and gip. This occurs to a slight degree where the land is still productive, but as the accumulation increases, the soil loses its productiveness.

It is my opinion that the ground water is fresh and free from minerals in a large degress, and that this deposit of mineral found is from the lower depths of the soil brought by the water as it rises and deposited as it evaporates.

It is possible to cut a drainage canal from this area to the River and to lay drain tile from the affected areas to the canal. This would probably not only protect the areas now threatened but would probably eventually reclaim the land become salty by the prevention of the evaporation of mineral bearing water and the gradual flushing of the soil by rain water. If the water level could be maintained at a depth sufficient to prevent any considerable evaporation yet shallow enough to allow plant life to draw from it, this land would be a farmer's paradise, yielding good crops regardless of rainfall.

Southeast of Rochester, and about 12 miles southeast of this area described, we find small areas forming, which are spreading but probably not so rapidly as this one. No information is at hand at the present of any such water logged areas in Knox County with the exception of its extreme southwest corner, but it is well known that the ground water is rising in that county as it is in Haskell County, therefore it is a reasonable certainty that such conditions will at an early date be encountered in that county as well.

It seems to me that no time should be lost to begin investigations such as may lead to some satisfactory way coping with this menace to the State by loss of some 300,000 acres of its best farming land.

(signed) W. A. Bandy,
Employee of Board

Haskell, Texas
February 3, 1934

Table 1 - Chemical Analyses and Water Levels of Ground Water in the Seymour Alluvium southeast of Stamford, Jones County, Texas

Map No.	Sampling point	Depth (ft.)	Water level (ft. below ground)	Date	Chemical Constituents (ppm)							
					Ca	Mg	Ca + Mg (epm) /1	Na + K	HCO_3	SO_4	Cl	NO_3
1	Dug well	16	3.5	10/8	9	5	-	120	160	82	61	2.5
2	Dug well	17	7.0	10/9	85	162	-	635	364	408	930	280
3	Cistern /1	-	-	10/8			4.6		264		87	47
4	Dug well	18	10.6	10/8			6.5		660		280	100
5	Invaded Cistern	24	6.3	10/8			10.6		148		120	270
6	Invaded Storm Cellar	6	3.2	10/8	450	289		403	310	256	850	1,820
7	Dug well	20	3.8	10/9	53	61		223	328	58	360	36
8	Dug well	23	4.4	10/9	170	132		437	360	312	570	610
9	Dug well	14	4.1	10/8	100	217		325	454	416	462	485
10	Dug well	26	5.7	10/8	95	263		786	600	742	1,130	212
11	Dug well	20	9.6	10/8			18.0		556		520	370
12	Drilled well	45	10.9	10/9	53	36		76	314	28	40	130
13	Drilled well	56	17.9	10/9	288	156		687	342	612	1,180	338
14	Invaded Storm Cellar	6-7	3.6	10/8			25.2		460		940	152
15	Effluent from sub-soil drainage at airport	3-5 /2	-	10/8			12.8		412		390	215

/1 equivalents per million--from hardness determination.

/2 estimated depth of pipes in system, which was designed to augment drainage of the airport runway area.

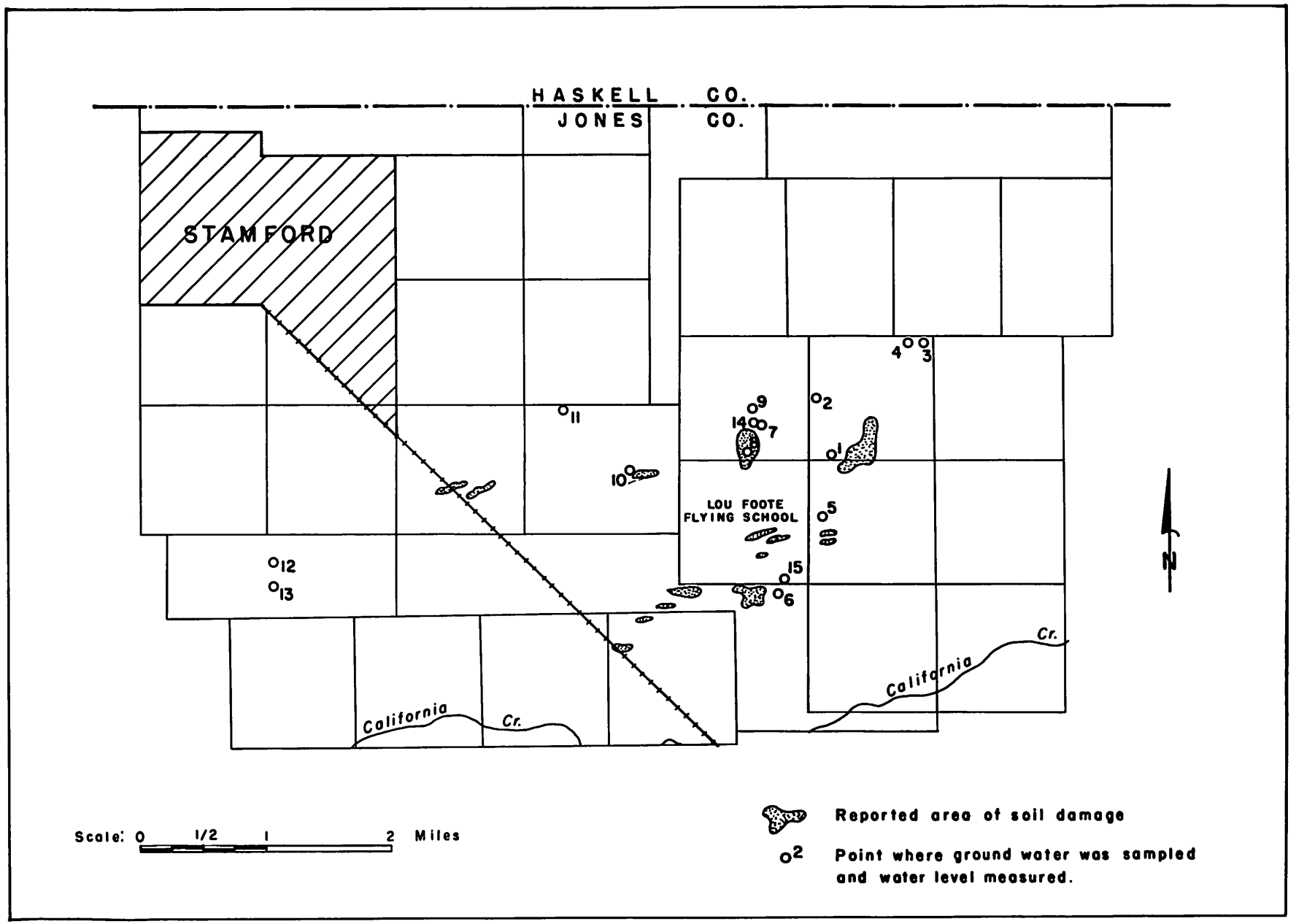

FIGURE 1 - MAP SHOWING LOCATIONS OF WELLS SAMPLED, AND AREAS OF REPORTED SOIL DAMAGE NEAR STAMFORD, TEXAS