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The term irrigation water quality is frequently used but very seldom is it adequately defined. The term is sometimes used to mean only the total dissolved solids, TDS, expressed in milligrams per liter (mg/l) or the equivalent, parts per million (ppm) as determined by evaporating a given volume of water and weighting the residue. Often the salinity is determined only by measuring the electrical conductivity, EC, (or specific conductance as it sometimes is called) and reporting it in millimhos per centimeter at 25°C (mmhos/cm), or in micromhos per centimeter (μmhos/cm). Such determinations of irrigation water quality are useful but are too limited in scope to be completely satisfactory.

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IRRIGATION WATER QUALITY EVALUATION

by

J. E. Christiansen, E. C. Olsen, and Lyman S. Willardson

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IRRIGATION WATER QUALITY EVALUATION[a/]

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INTRODUCTION

The term irrigation water quality is frequently used but very seldom is it adequately defined. The term is sometimes used to mean only the total dissolved solids, TDS, expressed in milligrams per liter (mg/l) or the equivalent, parts per million (ppm) as determined by evaporating a given volume of water and weighing the residue. Often the salinity is determined only by measuring the electrical conductivity, EC, (or specific conductance as it sometimes is called) and reporting it in millimhos per centimeter at 25° C (mmhos/cm), or in micromhos per centimeter (μmhos/cm). Such determinations of irrigation water quality are useful but are too limited in scope to be completely satisfactory.

Complete Chemical Analysis

There are many other factors besides TDS or EC that should be considered when evaluating the quality of an irrigation water. To properly evaluate the quality of a water, a complete chemical analysis is required. Such an analysis should include the determination of the

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following cations: Calcium, Ca^{++}, magnesium, Mg^{++}; sodium, Na^{+}; and potassium, K^{+}; and the following anions: bicarbonate, HCO_3^{-}; carbonate (if present), CO_3^{--}; sulfate, SO_4^{--}; chloride, Cl^{-}; nitrate, NO_3^{-}, or nitrate nitrogen, $NO_3^{-}N$. Preferably these ions should be reported in milliequivalents per liter (me/l), but they are sometimes reported in milligrams per liter (mg/l) or parts per million (ppm). Generally potassium, K^{+}, and nitrate, NO_3^{-} or NO_3-N, which are essential plant nutrients, are found in relatively small amounts in comparison with the other ions, and are sometimes omitted in the analyses. When all ions are reported in me/l, the sum of the cations should equal, approximately, the sum of the anions. When chemical analyses are carefully made and expressed in me/l, the difference in cations and anions should not exceed about 5 percent. A larger difference may indicate an error in the analysis or reporting. Usually the omission of K^{+} and/or NO_3^{-} has only a small effect on the balance of cations and anions.

Factors That Degrade the Water Quality

The principal factors that degrade a water with respect to its use for irrigation are:

1. The salinity which can be expressed by one or more of the following means:

   a. Total dissolved solids, TDS, which may be expressed as mg/l, ppm, or tons per acre foot (t/af).

   b. The total salinity expressed in me/l.

   c. The effective salinity, ES, expressed in me/l.

   d. The electrical conductivity, EC, expressed in mmhos/cm or μmhos/cm at 25° C.

2. Relative amount of Na^+ present which can be expressed as a percentage of the cations, Na%, or as the sodium adsorption ratio, SAR, or the adjusted SAR.

3. The presence and amount of residual sodium carbonate, Na_2CO_3.

4. Amount of boron, B, expressed in mg/l or the equivalent, ppm.

Conditions that Affect the Suitability of Water for Irrigation

The conditions under which an irrigation water is used may be just as important as the quality of the water per se. Conditions that must be taken into consideration are:

1. The adequacy of the drainage
2. The suitability of the method of irrigation
3. The physical properties of the soils to be irrigated
4. The salt tolerance of the crops to be irrigated
5. The overall management of the irrigation and drainage

Almost every writer on the subject of water quality has emphasized most of these conditions. Some have placed major emphasis on salt tolerance of crops, others on soil conditions. Only a few have emphasized drainage conditions which the writers believe to be of paramount importance. Many instances can be cited where waters of high salinity have been used successfully where drainage conditions were not a limiting factor; that is where the water table was maintained at a depth of several meters below the surface, either by natural drainage or where the water supply was from ground water wells.

The irrigation method is also important. Flooding methods are generally most successful for highly saline waters. With furrows, high

concentrations of salts build up in the beds between furrows. With sprinklers, precipitation of salts on the foliage may be very detrimental. The more recently developed drip irrigation method is promising, especially where the seasonal rainfall is sufficient to leach the salts, which are deposited during the irrigation season below the root zone. Most sub-irrigation methods are not suitable for even mildly saline waters except in areas of high seasonal rainfall and satisfactory drainage.

The physical properties of the soil are also important, but they must be considered in connection with the drainage and irrigation method. On fine textured soils with low infiltration rates, adequate penetration of water and leaching may be difficult to obtain. Under such conditions salts concentrate in the soil. Flooding in basins can assure adequate application of water where the crops grown can withstand flooding for the time required to infiltrate the water.

Crops vary in their tolerance to salts, and some crops can withstand much higher salinity than others without suffering excessive yield reductions. Many authors, including Bernstein (1963, 1964, 1974), have rated crops with respect to their salt tolerance.

The management of the water including the drainage is very important. With adequate drainage and ample applications of water at fairly frequent intervals it is possible to use fairly saline waters without accumulating high concentrations of salts in the soil profile. Soils with dense, or low permeability, strata within the rooting depth may be difficult to manage with saline waters.

The current emphasis on management of irrigation water to reduce salt loads in downstream waters, as advocated by Van Schilfgaard, et al

(1974) could result in excessive build-up of salts in irrigated soils. A permanent irrigated agriculture requires a salt balance of the highly soluble sodium salts within the root zone. Any water management practice that does not maintain this balance will reduce the productivity of the soil. This objective can best be met by efforts to maximize the uniformity of water applications and irrigation efficiency and to apply adequate but not excessive applications of water, taking into consideration the leaching accomplished by seasonal rainfall.

Brief Review of Irrigation Water Classification Schemes

The above mentioned water quality factors have been discussed and used by many soil scientists. Some have proposed classification schemes based on two or more of the factors, usually total salinity and the relative amount of sodium. In some instances boron and residual sodium carbonate have been included.

Scofield (1933) and Eaton (1942) indicated that waters with a sodium percentage of 70 or more were generally unsuitable for irrigation. Scofield (1935) published a table of permissible limits for irrigation waters which included consideration of chlorides and sulfates in addition to total salinity and sodium percentage, Table 1.

Wilcox and Magistad (1943) adopted a more simplified classification as given in Table 2. This same classification was used by Magistad and Christiansen (1944).

Table 1. Permissible limits for classes of irrigation water.

Scofield. (1935)

Classes of water	Concentration, total dissolved solids			Concentration	
	Electrical Conductivity	Gravimetric	Sodium	Chlorides (Cl)	Sulfates (SO_4)
	µmhos*	ppm	%	me/l	me/l
Class 1, Excellent	250	175	20	4	4
Class 2, Good	250- 750	175- 525	20-40	4-7	4-7
Class 3, Permissible	750-2000	525-1400	40-60	7-12	7-12
Class 4, Doubtful	2000-3000	1400-2100	60-80	12-20	12-20
Class 5, Unsuitable	3000	2100	80	20	20

*Micromhos/cm at 25°C.

Table 2. Standards for irrigation waters. Wilcox and Magistad (1943)

Water class	Electrical conductivity	Salt Content		Sodium	Boron
	μmhos	ppm	taf	percent	ppm
Class 1	1000	700	1	60	0.5
Class 2	1000-3000	700-2000	1-3	60-75	.5-2.0
Class 3	3000	2000	3	75	2.0

Explanation:

Class 1. Excellent to good, suitable for most plants under most conditions

Class 2. Good to injuri , probably harmful to more sensitive crops.

Class 3. Injurious to unsatisfactory, probably harmful to most crops and unsatisfactory for all but the most tolerant. If a water falls in Class 3 on any basis, i.e., electrical conductivity, salt content, percentage of sodium, or boron content, it should be classed as unsuitable under most conditions. Where the salts present are largely sulfates, the values for salt content in each class can be raised 50 percent.

Wilcox (1948) suggested a different classification in the form of the diagram shown in Figure 1. The main difference in this scheme and previous classifications is that waters having a low salt concentration in conjunction with a high sodium percentage (60 to 90) could be rated as excellent. Wilcox also presented a table of permissible limits similar to that given by Scofield (1933) except that it did not contain limits for Cl and SO_4.

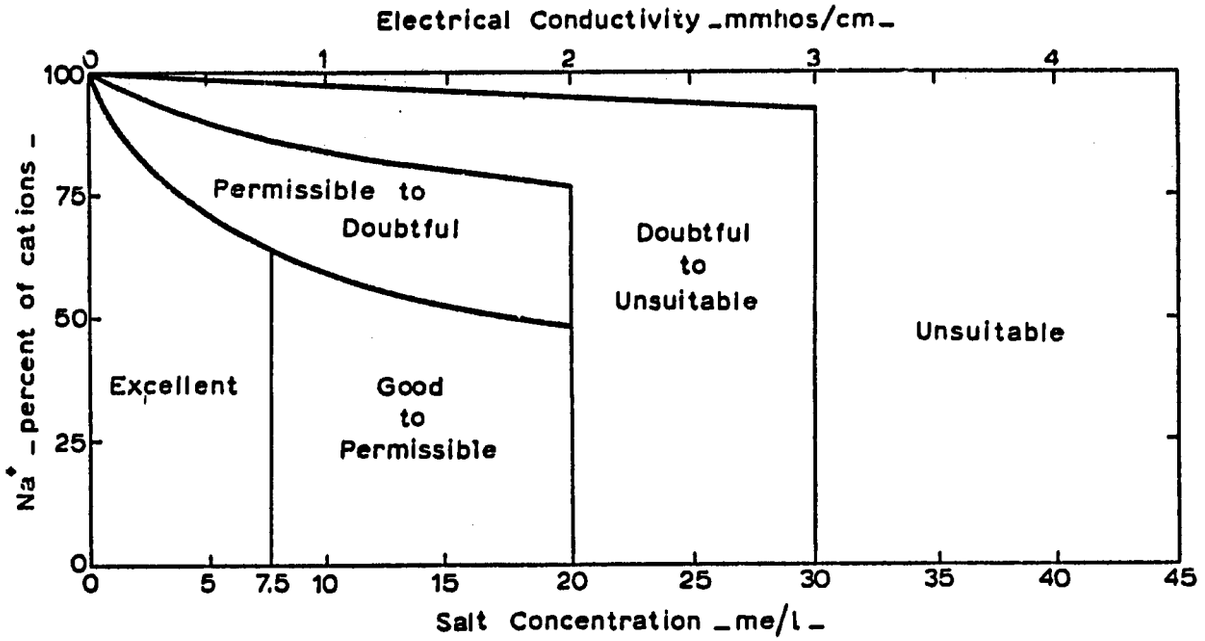

Figure 1. Water Classification According to Wilcox (1948). [Redrawn]

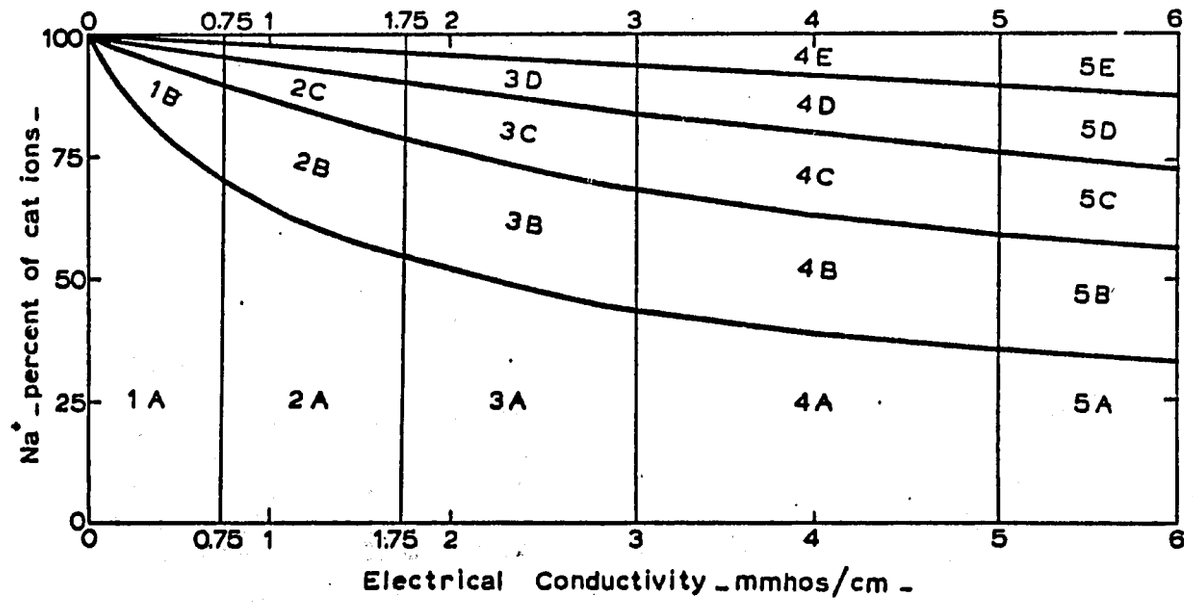

Figure 2. Irrigation Water Classes According to Thorne and Thorne (1951). [Redrawn]

In a study of Utah waters Thorne and Thorne (1951) presented a diagram similar to Wilcox's as given in Figure 2. The diagram recognized two main criteria: electrical conductivity with a rating number, 1 to 5, and the sodium effect with a letter, A to E. This diagram gives a 1A rating to a water having a low electrical conductivity (below 750 μmhos) and a high Na% (above 60).

The U.S. Salinity Laboratory (1954) published a semi logarithmic diagram in Handbook 60, Figure 3, which rates waters with respect to total salinity (electrical conductivity) and sodium hazard, the sodium adsorption ratio (SAR). This classification scheme has been extensively used since its publication. Although not included in this classification diagram, Handbook 60 contains a discussion of the effects of boron and residual sodium carbonate in irrigation water. The permissible limits for boron are as stated in Table 3 (Scofield, 1936).

Table 3. Permissible limits of boron for several classes of irrigation waters (Scofield, 1936)

Boron class	Sensitive crops	Semitolerant crops	Tolerant crops
	ppm	ppm	ppm
1	0.33	0.67	1.00
2	0.33 - 0.67	0.67 - 1.33	1.00 - 2.00
3	0.67 - 1.00	1.33 - 2.00	2.00 - 3.00
4	1.00 - 1.25	2.00 - 2.50	3.00 - 3.75
5	1.25	2.50	3.75

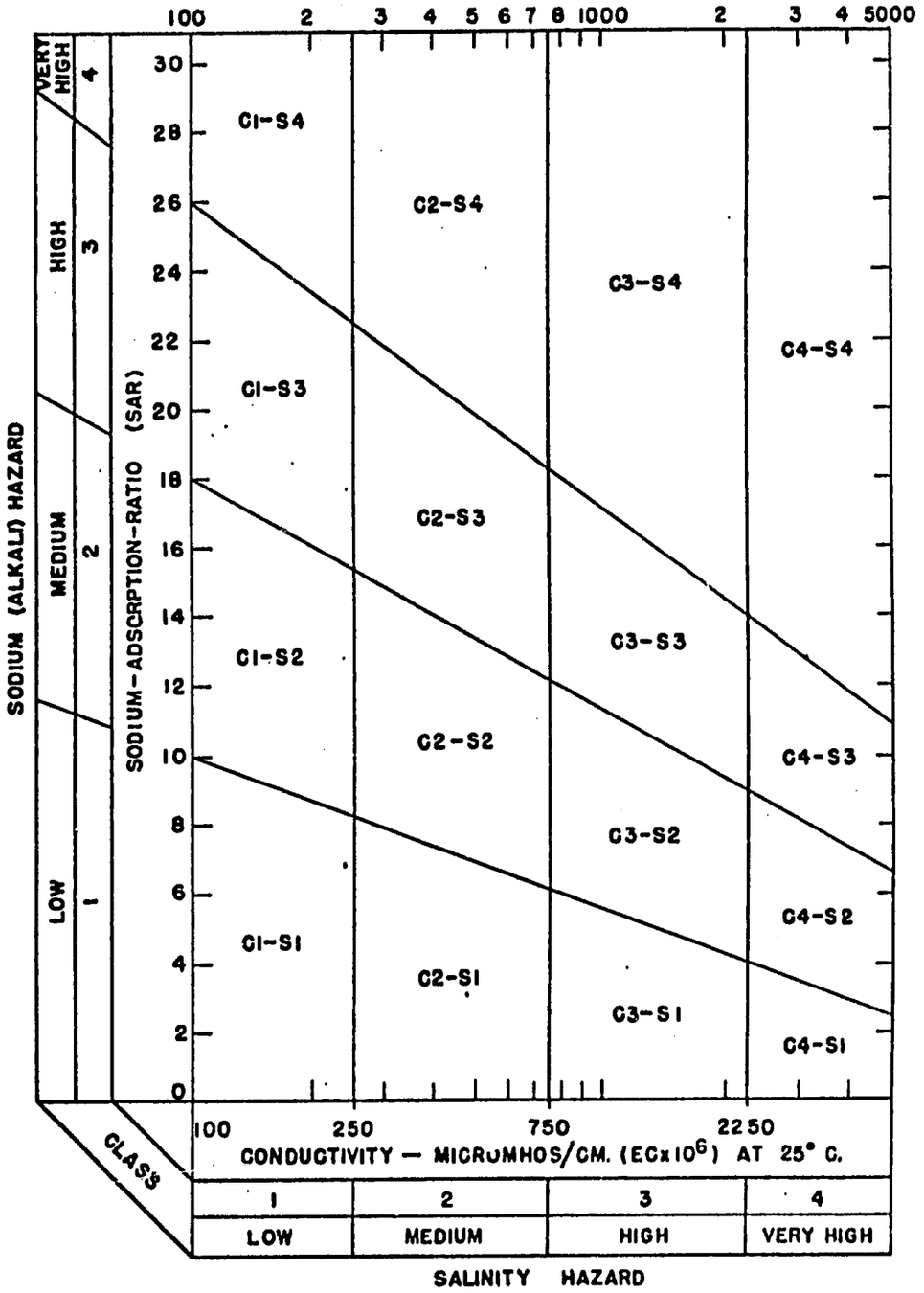

Figure 3. Diagram for the Classification of Irrigation Waters According to the U.S. Salinity Laboratory, Handbook 60 (1954).

With respect to residual sodium carbonate, Eaton (1950) is quoted in Handbook 60 as saying that, "Waters with more than 2.5 me/l of residual sodium carbonate are not suitable for irrigation purposes. Waters containing 1.25 to 2.5 me/l are marginal, and those containing less than 1.25 me/l are probably safe."

Wilcox (1958) discussed four factors affecting water quality: salinity, sodium, boron, and sodium carbonate. His limits for electrical conductivity are the same as for the Salinity Laboratory classification, but he presented another sodium diagram, Figure 4, for classifying water with respect to the sodium hazard, S1 to S4.

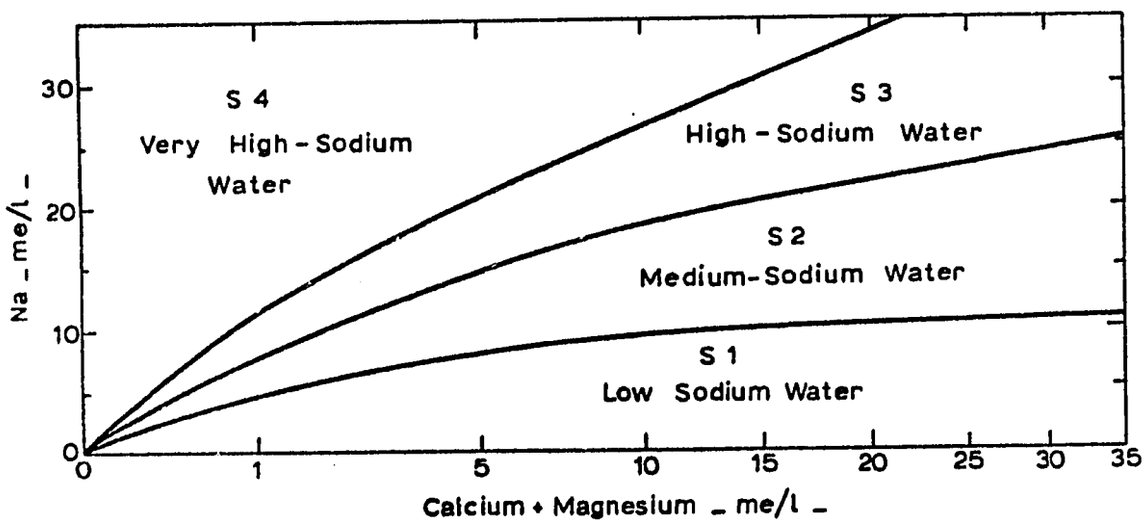

Figure 4. Sodium Diagram According to Wilcox (1958). [redrawn]

Doneen (1954) presented a classification scheme based on the effective salinity expressed in me/l. He defined effective salinity as the total salinity less that of the $CaCO_3$, $Ca(HCO_3)_2$, $MgCO_3$, $Mg(HCO_3)_2$ and $CaSO_4$ subtracted in that order. These salts have relatively low solubilities and will precipitate in the soil when their concentrations reach the solubility limits which vary somewhat with the salt concentration and pH. They are not effective in greatly increasing the salinity of the soil solution by concentration due to evapotranspiration. This precipitation of Ca and Mg carbonates, and $CaSO_4$ in the soil increases the sodium percentage in the soil solution but decreases the total concentration of soluble salts. Doneen's tentative classification of irrigation waters based on effective salinity and soil conditions is given in Table 4.

Table 4. Tentative classification for effective salinity of irrigation waters. Doneen (1954).

Soil conditions	Terms used	Class 1	Class 2	Class 3
Little or no leaching of the soil can be expected	me/l	3	3- 5	5
	ppm	165	165- 275	275
	lb/ac ft	450	450- 750	750
Some leaching but restricted; deep percolation or drainage slow	me/l	5	5- 10	10
	ppm	275	275- 550	550
	lb/ac ft	750	750-1500	1500
Open soils; deep percolation of water easily accomplished	me/l	7	7- 15	15
	ppm	385	385- 825	825
	lb/ac ft	1050	1050-2250	2250

Proposed Evaluation of Irrigation Waters

As a result of their experience in Guatemala, Christiansen and Olsen (1972), and Christiansen (1973), proposed a procedure for evaluating the quality of water for irrigation that recognized seven factors that should be considered: EC, Na%, SAR, Na_2CO_3, Cl^-, effective salinity, (ES), and boron. This evaluation for irrigation water, with some modification of the limiting values, is given in Table 5.

Table 5. Evaluation of Irrigation Water Quality, Maximum Values

Evaluation Rating	EC mmhos	Na^+ %	SAR	Na_2CO_3 meq/1	Cl^- meq/1	ES meq/1	Boron ppm
1	0.5	40	3	0.5	3	4	0.5
2	1.0	60	6	1.0	6	8	1.0
3	2.0	70	9	2.0	10	16	2.0
4	3.0	80	12	3.0	15	24	3.0
5	4.0	90	15	4.0	20	32	4.0
6	Higher than limits for 5						

In this evaluation a water rated number 1 in all categories would be considered excellent for agricultural use, and a water that exceeded the limits for class 5 (which would be rated 6) would generally not be usable for irrigation. Intermediate values are relative to these extremes. Waters are evaluated with respect to each factor, and no

attempt should be made to combine the ratings into a single index. A water might be rated 1 for all factors except boron which might be 5. This one degrading factor would limit the use of this water on many crops.

Whether or not a water of any classification could be used successfully would depend on the drainage conditions and the tolerance of the crop to salinity, high sodium and boron. The effectiveness of the drainage would determine whether the salts present, including the boron, might accumulate and concentrate in the soil under normal irrigation practice.

Effect of Degrading Factors on Plants and Soils

All of the above mentioned water quality factors have been used and discussed by various soil scientists. Most of the proposed classification schemes are based on two or more of the factors, usually total salinity, the relative amount of sodium, and boron. When salts are concentrated in the soil solution, each of the degrading factors has a detrimental effect on plant growth or yield, or on the physical and/or chemical properties of the soil. Therefore, consideration should be given to all of them.

Total Salinity. The total salinity, as most often expressed by electrical conductivity, EC, has a primary effect of reducing plant growth and yields. Sometimes this effect is not apparent from visible symptoms and therefore is not noticeable except in isolated spots where salinity levels are extreme. Research has shown that the reduction in growth and/or yield is approximately proportional to the concentration

of salts in the soil solution in the root zone. This has been determined and demonstrated by growing plants in sand cultures where the concentration of salts can be kept constant by continuous circulation of the soil solution through the sand by adding water to the solution as it is removed by evapotranspiration.

Under field conditions, however, the root system of the crop grown is not subjected to a uniform concentration of salts throughout the root zone. In general, where an adequate amount of water is applied, the concentration of salts in the soil solution will increase with depth, and the crop will extract most of its water supply from the upper layers where soil where the salt concentration is lowest. Thus the effect of salt concentration on growth and yield may be less than would be expected from research on sand cultures.

Recent research on crops grown in lysimeters indicates that fairly high salt concentrations at the bottom of the lysimeters, with much lower concentrations in the upper half of the soil profile, do not greatly reduce yields (Bernstein and Francois, 1973).

The higher the salt concentration of the irrigation water, the higher will be the salt concentration in the soil solution in the upper part of the root zone, and the more rapid will be the increase in salt concentration in all parts of the soil profile unless adequate leaching

occurs. Yield reduction is closely correlated with the total salinity of the irrigation water.*

Chloride Concentration, Cl^-. The principal reason for including Cl^- in the proposed evaluation is because Cl^- is sometimes determined when complete analyses are not made.

Chloride ions, Cl^-, represent a hazard because they are absorbed by plant tissues and accumulate in the leaves resulting in leaf burns when present in excessive amounts. This has sometimes been referred to as chloride toxicity. For high chloride waters the rating for Cl^- may be higher than for EC and/or ES and for low Cl^- waters the reverse may be true. Some scientists have considered the chloride ion Cl^- twice as toxic as the sulfate ions SO_4^{--}. Doneen (1963) introduced the term "potential salinity" which he defined as the sum of the Cl^- and half of the SO_4^{--}.

Residual Sodium Carbonate, Na_2CO_3. Residual sodium carbonate is very deleterious to the physical properties of soils. It creates what is known as a "black alkali" because Na_2CO_3 dissolves organic matter in the soil, which leaves a black stain on the soil surface when the soil

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*The following are approximate relations between the salinity expressed in parts per million (ppm), milliequivalents per liter (me/l), and as osmotic pressure in atmospheres, OP, to the conductivity, EC, in mmhos/cm.

Ppm = 650 x EC
Me/l = 10 x EC
OP = 0.36 x EC

These relationships are reasonably accurate for waters of average composition for the range of EC values found in irrigation waters. They do not hold well for EC values in excess of 5 mmhos/cm.

dries. Soils with sodium carbonate or sodium bicarbonate have a high pH, usually in the range of 8.5 to 10.0. Such soils are referred to as "sodic" and have poor "tilth," being very hard with large cracks when dry and very sticky when wet. As mentioned in Handbook 60, 2.5 me/l of residual sodium carbonate is generally considered an upper limit for acceptable irrigation waters.

The presence of residual sodium carbonate is not indicated by Na% or SAR values, but must be determined from complete analyses by subtracting the sum of the Ca^{++} and Mg^{++} from the $HCO_3^- + CO_3^{--}$. If the result is positive, i.e., the sum of the HCO_3 and CO_3 exceeds the $Ca^{++} + Mg^{++}$, residual Na_2CO_3 is present in the amount indicated by the difference. If $Ca^{++} + Mg^{++}$ exceeds the $HCO_3 + CO_3$, no residual sodium carbonate is present. Fortunately the latter condition is true for most waters used for irrigation.

Relative Amount of Sodium. The sodium percentage is a useful index of water quality as it shows at a glance the relative amount of sodium present. The primary effect of Na is on the physical properties of the soil: the permeability, infiltration rate, and tilth. Soils subjected to a salt solution with a high Na% remain aggregated and permeable as long as the total concentration of the solution remains constant, but when a solution of low concentration is applied to the soil, the aggregates disperse and the permeability decreases. This is why some soils when irrigated with a low salt water that has a high Na% have very low infiltration rates. This is especially noticeable when a soil previously irrigated with a fairly saline water is later irrigated with a water of

low electrical conductivity. The infiltration rate is then greatly reduced.*

The sodium adsorption ratio, SAR, which is computed from the equation

$$SAR = Na^{+} / \sqrt{(Ca^{++} + Mg^{++})/2}$$

where the constituents are expressed in me/l, does not always indicate a high Na%, and thus does not indicate the effect of high sodium, low salt waters on permeability and infiltration.

SAR values do not indicate whether or not residual sodium carbonate is present, although they are presumed to indicate the sodium hazard. They are included in the proposed classification scheme because they are routinely computed and reported when complete analysis are made. The limiting values for the different classes were adjusted so that for most waters the rating based on the SAR would be the same as the rating for the Na%.

Recently a term called the adjusted SAR has come into use. This term, adj. SAR, is expressed by the equation

$$\text{Adj. SAR} = SAR\ [1 + (8.4 - pHc)]$$

in which pHc is a function of the Ca + Mg + Na, Ca + Mg and $CO_3 + HCO_3$. The adj. SAR values that have been computed have ranged from about 1.5 to 4.0 times the SAR values.

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*This phenomenon was experienced in the western San Joaquin Valley, California, where fairly saline well waters, some of which also had a high Na%, were replaced with a low salt water from the California Aqueduct.

Boron, B. Boron is an essential element for plant growth, but it is very toxic when present in only a few parts per million. Boron is present in some irrigation waters in amounts that are objectionable, but not usually in amounts that are toxic. Where soils contain objectionable amounts of boron, but when the irrigation waters are low in boron, it can be leached from the soil if the drainage conditions permit leaching.

Concentration of Salts in Soils

When water is consumed by the crop most of the dissolved constituents remain in the soil. Some of the ions are absorbed by the plant roots and move into the plant tissues, but the amounts taken up by the crops and removed from the soil in this manner are usually very small percentages of the amounts that are added in the irrigation water. It is the resulting salinity of the soil solution within the root zone that is most important. Thus, as the water is transpired into the atmosphere, the salts remaining in the soil solution become more concentrated. Since the natural salts present in soils and irrigation waters have different solubilities, some of them ($CaCO_3$, $MgCO_3$ and $CaSO_4$) may precipitate in the soil as the concentration increases. Once precipitated, these salts are generally not harmful to the soil-plant environment. The more soluble salts will remain in solution and increase in concentration to very high hazardous values unless removed by deep percolation below the root zone and disposed of by natural or man made drainage. Where drainage is inadequate, that is where the water table is within one meter of the ground surface after an irrigation, the salts added with the water are not effectively removed and saline and/or sodic soils develop.

Cation Exchange

The process of concentration of salts in the root zone through the evapotranspiration process is somewhat complicated by a phenomenon known as cation exchange. All soils have a capacity to adsorb cations on the fine clay and colloidal particles. The amount of cations that a soil can adsorb and hold is called the exchangeable cation capacity of the soil. The adsorbed sodium ions, expressed as a percentage of the cation exchange capacity is called the exchangeable sodium percentage, ESP. When the ESP exceeds about 15%, the soil is considered sodic. Under a given irrigation management practice, the ESP of the soil is related to the salinity of the water and especially the SAR or the adjusted SAR values.

Evaluation of Irrigation Waters

To evaluate a water for irrigation use according to the proposed evaluation scheme, a computer program was prepared to accomplish the following objectives[a/]

1. Convert all ions to me/l if reported in mg/l or ppm
2. Compare the sum of the cations and anions by computing the ratio cations/anions (CA/AN)
3. Compute the sodium percentage (NA-PCT)
4. Compute the SAR (SAR) and the adjusted SAR (ASAR) values
5. Compute the effective salinity (ES)
6. Compute the residual sodium carbonate (RNACO) if present

[a/] Table headings are given in parentheses.

7. When appropriate, as for monthly analyses of surface waters, compute the mean values weighted according to the stream flow (Q-CFS)
8. Evaluate the water according to each of the factors listed in Table 4
9. Compute the value of a missing ion in the analyses when necessary from the difference in the sums of the cations and anions given, in which case CA/AN = 1.000
10. Compute a hierarchical synthesis of the salts present in each analysis, and when CA/AN $\neq$ 1.0 computes the residual ions

Computer Printout Tables

A selection from a number of water analyses that have been evaluated with the computer program is included in the Appendix. These tables are intended to illustrate a number of different kinds of waters, some of which are of excellent quality, while others are of questionable value for irrigation. Some of the data were taken from the USGS Water Quality reports for Colorado and Utah. Other data were from miscellaneous sources.

ACKNOWLEDGMENTS

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APPENDIX TABLES

COMPUTER PRINTOUTS

TABLE 6. EVALUATION OF WATER QUALITY DATA FOR ARKANSAS RIVER NEAR COOLIDGE, KANSAS, 1972-73.

DATE	FLOW CFS	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
		MILLIEQUIVALENTS PER LITER																	
1011	44.	18.96	14.81	21.75	.28	55.80	4.61	47.89	2.26	.05	54.79	38.98	5.29	4.39	36.84	.00	.00	14.81	1.018
CLASS									1			1	2	6	6	1	0		
1102	42.	18.96	13.98	24.80	.28	58.02	5.15	47.89	4.51	.04	57.59	42.73	6.11	4.50	39.06	.00	.00	17.29	1.008
CLASS									2			2	3	6	6	1	0		
1206	23.	21.96	13.98	26.54	.14	62.61	4.87	52.05	4.23	.04	61.19	42.38	6.26	5.43	40.65	.00	.00	17.73	1.023
CLASS									2			2	3	6	6	1	0		
0104	87.	21.46	16.45	26.54	.25	64.69	5.39	54.13	5.08	.05	64.65	41.02	6.09	4.61	43.24	.00	.00	17.65	1.001
CLASS									2			2	3	6	6	1	0		
0201	130.	17.46	13.98	24.80	.23	56.48	5.03	45.80	4.23	.05	55.11	43.90	6.25	4.22	39.01	.00	.00	17.53	1.025
CLASS									2			2	3	6	6	1	0		
0307	95.	18.46	14.81	25.66	.31	59.24	4.97	49.97	4.51	.04	59.49	43.32	6.29	4.37	40.78	.00	.00	17.72	.996
CLASS									2			2	3	6	6	1	0		
0410	200.	17.46	13.98	20.88	.21	52.54	4.82	45.80	3.95	.04	54.61	39.74	5.27	3.79	35.07	.00	.00	14.72	.962
CLASS									2			1	2	5	6	1	0		
0510	180.	19.46	14.81	24.36	.28	58.91	5.10	49.97	4.51	.03	59.61	41.35	5.89	4.26	39.45	.00	.00	16.72	.988
CLASS									2			2	2	6	6	1	0		
0613	390.	12.47	9.05	12.62	.21	34.35	4.03	29.15	2.31	.02	35.51	36.72	3.85	2.75	21.88	.00	.00	10.06	.967
CLASS									1			1	2	4	4	1	0		
0711	101.	16.47	12.34	20.44	.25	49.50	4.64	41.64	3.67	.05	49.99	41.30	5.39	3.69	33.03	.00	.00	14.82	.990
CLASS									2			2	2	5	6	1	0		
0808	160.	15.47	10.69	18.70	.21	45.07	4.29	39.56	3.10	.04	47.00	41.50	5.17	3.29	29.61	.00	.00	13.91	.959
CLASS									2			2	2	5	5	1	0		
0919	19.	19.96	14.81	25.66	.33	60.76	4.90	47.89	4.80	.04	57.62	42.24	6.16	4.44	40.80	.00	.00	17.39	1.055
CLASS									2			2	3	6	6	1	0		
AVG.	123.	16.59	12.54	20.13	.24	49.49	4.64	41.94	3.58	.03	50.20	40.66	5.27	3.71	32.90	.00	.00	14.53	.986
CLASS									2			2	2	5	6	1	0		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 6A. NATURAL SALTS IN ARKANSAS RIVER NEAR COOLIDGE, KANSAS, 1972-73.

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
1C_1	44. 3747.	4.61	.00	14.36	.28	21.75	.00	2.26	.00	.00	11.50	.05	.00	.00	.00	55.80	54.79	54.79
RESIDUAL IONS,	CA=	.00	MG=	1.01	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
1102	42. 3920.	5.15	.00	13.82	.28	24.80	.00	4.51	.00	.00	8.99	.04	.00	.00	.00	58.02	57.59	57.59
RESIDUAL IONS,	CA=	.00	MG=	.43	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
1206	23. 4187.	4.87	.00	17.09	.14	26.54	.00	4.23	.00	.00	8.29	.04	.00	.00	.00	62.61	61.19	61.19
RESIDUAL IONS,	CA=	.00	MG=	1.42	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0104	87. 4374.	5.39	.00	16.06	.25	26.54	.00	5.08	.00	.00	11.28	.05	.00	.00	.00	64.69	64.65	64.65
RESIDUAL IONS,	CA=	.00	MG=	.04	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0201	130. 3771.	5.03	.00	12.43	.23	24.80	.00	4.23	.00	.00	8.34	.05	.00	.00	.00	56.48	55.11	55.11
RESIDUAL IONS,	CA=	.00	MG=	1.36	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0307	95. 4030.	4.97	.00	13.50	.31	25.66	.00	4.51	.00	.00	10.29	.00	.00	.00	.00	59.24	59.49	59.24
RESIDUAL IONS,	CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.21	CL=	.00	NO3=	.04		
0410	200. 3657.	4.82	.00	12.65	.21	20.88	.00	3.95	.00	.00	10.03	.00	.00	.00	.00	52.54	54.61	52.54
RESIDUAL IONS,	CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	2.03	CL=	.00	NO3=	.04		
0510	180. 4026.	5.10	.00	14.36	.28	24.36	.00	4.51	.00	.00	10.29	.00	.00	.00	.00	58.91	59.61	58.91
RESIDUAL IONS,	CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.67	CL=	.00	NO3=	.03		
0613	390. 2399.	4.03	.00	8.44	.21	12.62	.00	2.31	.00	.00	6.74	.00	.00	.00	.00	34.35	35.51	34.35
RESIDUAL IONS,	CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	1.14	CL=	.00	NO3=	.02		
0711	101. 3387.	4.64	.00	11.83	.25	20.44	.00	3.67	.00	.00	8.67	.00	.00	.00	.00	49.50	49.99	49.50
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.45	CL=	.00	NO3=	.05		
0808	160. 3165.	4.29	.00	11.17	.21	18.70	.00	3.10	.00	.00	7.59	.00	.00	.00	.00	45.07	47.00	45.07
RESIDUAL IONS,	CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	1.88	CL=	.00	NO3=	.04		
0919	19. 3966.	4.90	.00	15.06	.33	25.66	.00	4.80	.00	.00	6.83	.04	.00	.00	.00	60.76	57.62	57.62
RESIDUAL IONS,	CA=	.00	MG=	3.14	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 7. EVALUATION OF WATER QUALITY DATA FOR GREEN RIVER AT GREEN RIVER, UTAH, 1972-73. (COLORADO RIVER)

DATE	FLOW CFS	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
		MILLIEQUIVALENTS PER LITER																	
1011	3600.	4.24	2.55	3.74	.09	10.62	3.29	6.66	.82	.01	10.78	35.22	2.03	.96	6.38	.00	.23	4.40	.985
CLASS									1			1	1	2	2	1	1		
1108	5850.	3.74	2.55	3.04	.10	9.43	3.51	5.20	.68	.01	9.40	32.27	1.72	.87	5.69	.00	.16	3.73	1.004
CLASS									1			1	1	2	2	1	1		
1213	3460.	3.79	2.55	3.31	.07	9.72	3.57	5.41	.65	.01	9.64	34.01	1.86	.91	5.93	.00	.17	4.05	1.008
CLASS									1			1	1	2	2	1	1		
0110	3730.	3.74	2.47	3.00	.07	9.28	3.52	4.89	.65	.01	9.07	32.33	1.70	.86	5.54	.00	.18	3.70	1.023
CLASS									1			1	1	2	2	1	1		
0208	4000.	3.74	2.30	2.65	.07	8.77	3.47	4.37	.65	.01	8.50	30.25	1.53	.80	5.03	.00	.14	3.30	1.031
CLASS									1			1	1	2	2	1	1		
0313	4950.	3.74	2.55	3.83	.08	10.20	3.61	6.04	.76	.01	10.41	37.53	2.16	.93	6.46	.00	.16	4.70	.979
CLASS									1			1	1	2	2	1	1		
0410	3900.	3.89	3.13	4.35	.10	11.47	3.82	6.45	1.07	.01	11.35	37.94	2.32	1.08	7.57	.00	.23	5.20	1.010
CLASS									1			1	1	3	2	1	1		
0509	11660.	2.84	2.06	2.43	.06	7.44	3.15	3.75	.51	.01	7.41	33.31	1.58	.72	4.30	.00	.15	3.23	1.004
CLASS									1			1	1	2	2	1	1		
0612	20850.	1.85	1.15	1.22	.04	4.25	2.08	1.79	.28	.00	4.16	28.65	.99	.44	2.17	.00	.14	1.68	1.023
CLASS									1			1	1	1	1	1	1		
0710	8490.	2.30	1.56	1.91	.05	5.82	2.46	3.12	.45	.00	6.04	32.88	1.38	.57	3.36	.00	.13	2.55	.964
CLASS									1			1	1	2	1	1	1		
0809	5050.	3.64	2.47	3.18	.08	9.36	3.25	5.20	.79	.01	9.25	33.92	1.82	.84	5.72	.00	.17	3.87	1.012
CLASS									1			1	1	2	2	1	1		
0911	4720.	3.89	2.71	3.31	.08	10.00	3.05	6.04	.85	.01	9.94	33.07	1.82	.90	6.10	.00	.18	3.87	1.005
CLASS									1			1	1	2	2	1	1		
AVG.	6688.	3.00	2.03	2.52	.06	7.62	2.94	4.07	.57	.01	7.59	33.15	1.59	.72	4.62	.00	.16	3.22	1.004
CLASS									1			1	1	2	2	1	1		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.
ZERO VALUES FOR BORON CLASS INDICATES DATA NOT AVAILABLE

TABLE 7a NATURAL SALTS IN GREEN RIVER AT GREEN RIVER, UTAH, 1972-73. (COLORADO RIVER)

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		---MILLIEQUIVALENTS PER LITER---																
1011	3600.	768.	3.29	.00	.95	.03	3.74	.00	.92	.00	.00	1.73	.00	.00	.00	.00	10.62	10.78	10.62
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.15	CL=	.00	NO3=	.01		
1103	5850.	680.	3.51	.00	.24	.10	3.04	.00	.68	.00	.00	1.83	.01	.00	.00	.00	9.43	9.40	9.40
RESIDUAL IONS,		CA=	.00	MG=	.04	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
1213	3460.	609.	3.57	.00	.22	.07	3.31	.00	.65	.00	.00	1.82	.01	.00	.00	.00	9.72	9.64	9.64
RESIDUAL IONS,		CA=	.00	MG=	.09	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0110	3730.	662.	3.52	.00	.22	.07	3.00	.00	.65	.00	.00	1.60	.01	.00	.00	.00	9.28	9.07	9.07
RESIDUAL IONS,		CA=	.00	MG=	.21	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0208	4000.	624.	3.47	.00	.27	.07	2.65	.00	.65	.00	.00	1.38	.01	.00	.00	.00	8.77	8.50	8.50
RESIDUAL IONS,		CA=	.00	MG=	.27	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0313	4950.	747.	3.61	.00	.14	.08	3.63	.00	.76	.00	.00	1.79	.00	.00	.00	.00	10.20	10.41	10.20
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.21	CL=	.00	NO3=	.01		
0410	3900.	813.	3.82	.00	.07	.10	4.35	.00	1.07	.00	.00	1.93	.01	.00	.00	.00	11.47	11.35	11.35
RESIDUAL IONS,		CA=	.00	MG=	.11	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0503	11660.	544.	2.34	.30	.00	.06	2.48	.00	.51	.00	.00	1.20	.01	.00	.00	.00	7.44	7.41	7.41
RESIDUAL IONS,		CA=	.00	MG=	.03	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0512	20850.	316.	1.85	.24	.00	.04	1.22	.00	.28	.00	.00	.54	.00	.00	.00	.00	4.25	4.16	4.16
RESIDUAL IONS,		CA=	.00	MG=	.09	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0710	8490.	439.	2.30	.16	.00	.05	1.91	.00	.45	.00	.00	.95	.00	.00	.00	.00	5.82	6.04	5.82
RESIDUAL IONS,		CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.21	CL=	.00	NO3=	.00		
0803	5050.	567.	3.25	.00	.40	.08	3.18	.00	.79	.00	.00	1.56	.01	.00	.00	.00	9.36	9.25	9.25
RESIDUAL IONS,		CA=	.00	MG=	.11	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0911	4720.	709.	3.05	.00	.84	.08	3.31	.00	.85	.00	.00	1.80	.01	.00	.00	.00	10.00	9.94	9.94
RESIDUAL IONS,		CA=	.00	MG=	.05	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 8. EVALUATION OF WATER QUALITY DATA FOR SEVIER RIVER NEAR LYNNDYL, UTAH, 1972-73. (SEVIER LAKE)

DATE	FLOW CFS	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
		MILLIEQUIVALENTS PER LITER																	
1017	49.	3.54	6.75	9.57	.15	20.01	5.02	6.04	9.31	.00	20.36	47.83	4.22	2.36	14.99	.00	.28	10.39	.982
CLASS									3			2	2	4	3	1	1		
1111	48.	4.14	6.75	10.00	.14	21.03	5.02	6.45	9.31	.01	20.79	47.57	4.29	1.99	16.01	.00	.25	10.63	1.011
CLASS									3			2	2	3	4	1	1		
1213	28.	5.79	10.36	21.32	.19	37.65	6.46	12.28	18.20	.01	36.95	56.61	7.50	3.46	31.20	.00	.60	20.12	1.019
CLASS									5			2	3	5	5	1	2		
0116	7.	7.48	13.98	32.62	.23	54.33	7.88	18.11	27.08	.01	53.09	60.05	9.96	4.93	46.44	.00	.90	28.27	1.023
CLASS									6			3	4	6	6	1	2		
0216	33.	4.94	9.05	19.58	.18	33.75	6.11	11.24	16.09	.01	33.44	58.00	7.40	3.13	27.63	.00	.47	19.34	1.009
CLASS									5			2	3	5	5	1	1		
0314	69.	4.44	7.07	10.00	.14	21.66	5.03	6.45	9.59	.01	21.08	46.18	4.17	2.10	16.63	.00	.23	10.43	1.028
CLASS									3			2	2	4	4	1	1		
0417	50.	4.39	7.65	11.31	.16	23.51	5.02	7.91	11.23	.00	24.22	48.11	4.61	2.21	18.49	.00	.33	11.57	.971
CLASS									4			2	2	4	4	1	1		
0516	726.	3.94	6.83	13.05	.19	24.01	5.28	8.54	11.00	.01	24.83	54.36	5.62	2.30	18.73	.00	.43	13.95	.967
CLASS									4			2	2	4	4	1	1		
0614	314.	3.59	6.42	11.75	.17	21.92	5.16	7.08	10.44	.01	22.69	53.58	5.25	2.24	16.76	.00	.33	12.87	.966
CLASS									4			2	2	4	4	1	1		
0712	808.	3.44	5.02	9.57	.15	18.18	5.11	5.41	7.62	.01	18.15	52.63	4.65	1.75	13.07	.00	.31	11.15	1.002
CLASS									3			2	2	3	3	1	1		
0814	544.	3.14	4.52	7.83	.16	15.66	5.02	4.79	6.21	.00	16.01	50.01	4.00	1.54	10.64	.00	.26	9.45	.978
CLASS									3			2	2	3	3	1	1		
0917	66.	3.94	6.75	13.05	.20	23.94	5.38	7.08	10.16	.00	22.61	54.51	5.65	2.20	18.57	.00	.38	14.03	1.059
CLASS									4			2	2	4	4	1	1		
AVG.	228.	3.65	5.89	10.83	.17	20.54	5.18	6.62	9.05	.01	20.86	52.73	4.96	2.00	15.36	.00	.34	12.09	.985
CLASS									3			2	2	3	3	1	1		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.
ZERO VALUES FOR BORON CLASS INDICATES DATA NOT AVAILABLE

TABLE 8A. NATURAL SALTS IN SEVIER RIVER NEAR LYNNDYL, UTAH, 1972-73. (SEVIER LAKE)

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
1017	49. 1317.	3.54	1.47	.00	.15	5.89	.00	5.27	3.68	.00	.00	.00	.00	.00	.00	20.01	20.36	20.01
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.36	NO3=	.00		
1111	48. 1359.	4.14	.87	.00	.14	6.32	.00	5.87	3.44	.00	.00	.00	.00	.00	.01	21.03	20.79	20.79
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.24	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
1213	28. 2381.	5.79	.67	.00	.19	12.10	.00	9.70	8.50	.00	.00	.00	.00	.00	.01	37.65	36.95	36.95
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.70	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0116	7. 3403.	7.48	.40	.00	.23	17.88	.00	13.50	13.50	.00	.00	.00	.00	.00	.01	54.33	53.09	53.09
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	1.23	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0216	33. 2162.	4.94	1.17	.00	.13	11.06	.00	7.88	8.20	.00	.00	.00	.00	.00	.01	33.75	33.44	33.44
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.30	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0314	69. 1380.	4.44	.59	.00	.14	6.31	.00	6.48	3.11	.00	.00	.00	.00	.00	.01	21.66	21.08	21.08
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.58	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0417	50. 1545.	4.39	.62	.00	.16	7.76	.00	7.03	3.55	.00	.00	.00	.00	.00	.00	23.51	24.22	23.51
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.70	NO3=	.00		
0516	726. 1604.	3.94	1.34	.00	.19	8.35	.00	5.49	4.70	.00	.00	.00	.00	.00	.00	24.01	24.83	24.01
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.81	NO3=	.01		
0614	314. 1464.	3.59	1.57	.00	.17	6.91	.00	4.85	4.83	.00	.00	.00	.00	.00	.00	21.92	22.69	21.92
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.76	NO3=	.01		
0712	808. 1210.	3.44	1.67	.00	.15	5.26	.00	3.35	4.27	.00	.00	.00	.00	.00	.01	18.18	18.15	18.15
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.03	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0814	544. 1072.	3.14	1.87	.00	.16	4.53	.00	2.65	3.20	.00	.00	.00	.00	.00	.00	15.66	16.01	15.66
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.35	NO3=	.00		
0917	66. 1509.	3.94	1.43	.00	.20	6.87	.00	5.31	4.84	.00	.00	.00	.00	.00	.00	23.94	22.61	22.61
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	1.33	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 9. EVALUATION OF WATER QUALITY DATA FOR WEBER RIVER AT GATEWAY, UTAH, 1972-73. (SALT LAKE)

DATE	FLOW CFS	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
		MILLIEQUIVALENTS PER LITER																	
1005	324.	2.99	1.32	.65	.06	5.02	4.06	.56	.59	.00	5.22	12.99	.44	.50	.96	.00	.04	.95	.962
CLASS									1			1	1	1	1	1	1		
1031	169.	3.64	1.65	1.09	.07	6.44	4.59	.81	.96	.01	6.37	16.88	.67	.51	1.86	.00	.05	1.50	1.012
CLASS									1			1	1	2	1	1	1		
1123	440.	3.34	1.40	.70	.06	5.50	4.31	.62	.59	.05	5.58	12.65	.45	.48	1.19	.00	.16	.99	.986
CLASS									1			1	1	1	1	1	1		
0104	122.	2.59	1.56	1.00	.07	5.23	3.20	.81	.96	.01	4.97	19.12	.69	.46	2.04	.00	.06	1.39	1.052
CLASS									1			1	1	1	1	1	1		
0131	300.	3.59	1.40	.74	.06	5.79	4.41	.77	.68	.01	5.86	12.77	.47	.52	1.38	.00	.06	1.04	.988
CLASS									1			1	1	2	1	1	1		
0227	510.	3.39	1.48	.78	.06	5.72	4.31	.67	.71	.00	5.69	13.69	.50	.52	1.41	.00	.04	1.10	1.006
CLASS									1			1	1	2	1	1	1		
0402	600.	3.59	1.48	.87	.07	6.02	4.33	.69	.79	.00	5.81	14.46	.55	.54	1.69	.00	.02	1.21	1.036
CLASS									1			1	1	2	1	1	1		
0423	845.	2.69	1.15	.65	.05	4.55	3.21	.77	.56	.01	4.55	14.33	.47	.42	1.34	.00	.07	.93	1.000
CLASS									1			1	1	1	1	1	1		
0509	1460.	2.89	1.15	.57	.05	4.66	3.57	.50	.45	.00	4.53	12.14	.40	.42	1.09	.00	.05	.81	1.030
CLASS									1			1	1	1	1	1	1		
0628	480.	3.14	1.23	.57	.10	5.05	3.88	.54	.54	.00	4.96	11.21	.38	.46	1.16	.00	.03	.81	1.017
CLASS									1			1	1	1	1	1	1		
0726	355.	3.29	1.32	.74	.06	5.41	4.13	.67	.68	.00	5.48	13.66	.49	.51	1.28	.00	.06	1.05	.988
CLASS									1			1	1	2	1	1	1		
0827	403.	3.29	1.07	.65	.06	5.08	3.54	.60	.54	.00	4.69	12.85	.44	.50	1.54	.00	.05	.91	1.084
CLASS									1			1	1	1	1	1	1		
AVG.	501.	3.14	1.28	.69	.06	5.17	3.86	.63	.60	.01	5.10	13.32	.46	.47	1.31	.00	.06	.98	1.014
CLASS									1			1	1	1	1	1	1		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.
ZERO VALUES FOR BORON CLASS INDICATES DATA NOT AVAILABLE

TABLE 9A. NATURAL SALTS IN WEBER RIVER AT GATEWAY, UTAH, 1972-73. (SALT LAKE)

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		-MILLIEQUIVALENTS PER LITER-																
1005	324.	401.	2.99	1.07	.00	.06	.50	.00	.25	.15	.00	.00	.00	.00	.00	.00	5.02	5.22	5.02
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.20	NO3=	.00		
1031	169.	486.	3.64	.95	.00	.07	.74	.00	.70	.26	.00	.00	.00	.00	.00	.01	6.44	6.37	6.37
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.08	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
1129	440.	432.	3.34	.97	.00	.06	.56	.00	.43	.14	.00	.00	.00	.00	.00	.00	5.50	5.58	5.50
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.03	NO3=	.05		
0104	122.	377.	2.59	.60	.00	.07	.74	.00	.96	.00	.00	.00	.00	.00	.00	.00	5.23	4.97	4.97
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.26	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0131	300.	451.	3.59	.82	.00	.06	.71	.00	.58	.03	.00	.00	.00	.00	.00	.00	5.79	5.86	5.79
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.07	NO3=	.01		
0227	510.	439.	3.33	.92	.00	.06	.60	.00	.56	.14	.00	.00	.00	.00	.00	.00	5.72	5.69	5.69
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.03	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0402	600.	450.	3.59	.73	.00	.07	.62	.00	.75	.04	.00	.00	.00	.00	.00	.00	6.02	5.81	5.81
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.21	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0423	845.	350.	2.69	.52	.00	.05	.65	.00	.56	.00	.00	.06	.01	.00	.00	.00	4.55	4.55	4.55
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0503	1460.	357.	2.89	.68	.00	.05	.45	.00	.45	.00	.00	.00	.00	.00	.00	.00	4.66	4.53	4.53
RESIDUAL IONS,		CA=	.00	MG=	.02	NA=	.11	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0628	480.	389.	3.14	.74	.00	.10	.44	.00	.49	.04	.00	.00	.00	.00	.00	.00	5.05	4.96	4.96
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.08	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
0726	355.	422.	3.29	.84	.00	.06	.60	.00	.48	.14	.00	.00	.00	.00	.00	.00	5.41	5.48	5.41
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.06	NO3=	.00		
0827	403.	373.	3.29	.25	.00	.06	.54	.00	.54	.00	.00	.00	.00	.00	.00	.00	5.08	4.68	4.68
RESIDUAL IONS,		CA=	.00	MG=	.28	NA=	.11	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 10. EVALUATION OF WATER QUALITY DATA FOR CALIFORNIA AQUEDUCT NEAR KETTLEMAN CITY, 19 2.

IDENTIFICATION	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
	MILLIEQUIVALENTS PER LITER																	
JANUARY 26	1.30	.99	1.57	.00	3.85	.79	1.00	2.06	.00	3.85	40.67	1.47	.50	2.55	.00	.20	1.696	1.000
CLASS								1			2	1	1	1	1	1		
FEBRUARY 16	1.30	1.15	1.61	.00	4.06	.67	1.35	2.03	.00	4.06	39.66	1.45	.53	2.76	.00	.20	1.621	1.000
CLASS								1			1	1	2	1	1	1		
MARCH 15	1.40	1.07	1.65	.00	4.12	.74	1.35	2.03	.00	4.12	40.13	1.49	.50	2.72	.00	.20	1.718	1.000
CLASS								1			2	1	1	1	1	1		
APRIL 19	.85	.66	.74	.00	2.25	.75	.54	.96	.00	2.25	32.93	.85	.28	1.40	.00	.20	.837	1.000
CLASS								1			1	1	1	1	1	1		
MAY 17	.90	.74	.91	.00	2.55	.90	.52	1.13	.00	2.55	35.79	1.01	.30	1.65	.00	.20	1.105	1.000
CLASS								1			1	1	1	1	1	1		
JUNE 21	1.00	.90	1.30	.00	3.21	.86	.71	1.64	.00	3.21	40.68	1.34	.40	2.21	.00	.10	1.508	1.000
CLASS								1			2	1	1	1	1	1		
JULY 19	1.20	1.15	1.33	.00	3.74	1.10	.92	1.72	.00	3.74	37.21	1.28	.46	2.54	.00	.10	1.690	1.000
CLASS								1			1	1	1	1	1	1		
AUGUST 16	1.10	1.15	1.91	.00	4.16	.66	.79	2.71	.00	4.16	45.97	1.80	.54	3.07	.00	.20	1.930	1.000
CLASS								1			2	1	2	1	1	1		
SEPTEMBER 20	.70	.99	1.74	.00	3.43	.55	.56	2.31	.00	3.43	50.79	1.90	.43	2.73	.00	.20	1.658	1.000
CLASS								1			2	1	1	1	1	1		
OCTOBER 18	.45	1.15	1.04	.00	2.64	.70	.40	1.55	.00	2.64	39.47	1.17	.35	1.95	.00	.10	1.133	1.000
CLASS								1			1	1	1	1	1	1		
NOVEMBER 15	.85	.74	1.26	.00	2.85	.87	.54	1.44	.00	2.85	44.26	1.42	.36	1.98	.00	.10	1.499	1.000
CLASS								1			2	1	1	1	1	1		
DECEMBER 15	1.30	1.15	1.87	.00	4.32	.76	1.17	2.40	.00	4.32	43.30	1.69	.57	3.02	.00	.20	1.980	1.000
CLASS								1			2	1	2	1	1	1		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 10A. NATURAL SALTS IN CALIFORNIA AGUEDUCT NEAR KETTLEMAN CITY, 1972.

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
JANUARY 26	207.	.73	.00	.51	.00	.49	.00	.99	1.07	.00	.00	.00	.00	.00	.00	3.85	3.85	3.85
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
FEBRUARY 16	226.	.67	.00	.62	.00	.73	.00	1.15	.88	.00	.00	.00	.00	.00	.00	4.06	4.06	4.06
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
MARCH 15	228.	.74	.00	.66	.00	.69	.00	1.07	.96	.00	.00	.00	.00	.00	.00	4.12	4.12	4.12
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
APRIL 19	114.	.75	.00	.10	.00	.44	.00	.66	.30	.00	.00	.00	.00	.00	.00	2.25	2.25	2.25
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
MAY 17	125.	.90	.00	.00	.00	.52	.00	.74	.39	.00	.00	.00	.00	.00	.00	2.55	2.55	2.55
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
JUNE 21	165.	.86	.00	.13	.00	.57	.00	.90	.73	.00	.00	.00	.00	.00	.00	3.21	3.21	3.21
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
JULY 19	187.	1.10	.00	.09	.00	.82	.00	1.15	.57	.00	.00	.00	.00	.00	.00	3.74	3.74	3.74
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
AUGUST 16	226.	.66	.00	.43	.00	.36	.00	1.15	1.56	.00	.00	.00	.00	.00	.00	4.16	4.16	4.16
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
SEPTEMBER 20	187.	.55	.00	.15	.00	.41	.00	.99	1.33	.00	.00	.00	.00	.00	.00	3.43	3.43	3.43
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
OCTOBER 19	133.	.45	.25	.00	.00	.40	.00	.90	.65	.00	.00	.00	.00	.00	.00	2.64	2.64	2.64
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
NOVEMBER 15	144.	.85	.02	.00	.00	.54	.00	.72	.72	.00	.00	.00	.00	.00	.00	2.85	2.85	2.85
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
DECEMBER 15	236.	.76	.00	.54	.00	.62	.00	1.15	1.25	.00	.00	.00	.00	.00	.00	4.32	4.32	4.32
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 11. EVALUATION OF WATER QUALITY DATA FOR SALINE WELL WATERS FROM WESTERN SAN JOAQUIN VALLEY, 1968

IDENTIFICATION	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
	MILLIEQUIVALENTS PER LITER																	
16S/14E-03H01M	5.44	4.77	13.83	.00	24.04	4.13	12.91	6.49	.01	23.54	57.53	6.12	2.20	18.60	.00	1.80	14.388	1.021
CLASS								3			2	3	4	4	1	3		
15S/15E-08B01M	4.94	4.77	20.44	.00	30.16	3.41	22.90	4.80	.01	31.11	67.80	9.28	2.84	25.22	.00	2.30	20.551	.969
CLASS								2			3	4	4	5	1	4		
15S/15E-17A01M	13.07	14.15	12.03	.00	39.32	3.11	31.02	6.49	.02	40.64	30.76	3.28	3.23	26.24	.00	.81	8.477	.967
CLASS								3			1	2	5	5	1	2		
15S/15E-20N05M	6.69	7.07	7.57	.00	21.33	3.38	15.72	2.48	.10	21.68	35.49	2.89	1.89	14.64	.00	.84	6.946	.984
CLASS								1			1	1	3	3	1	2		
15S/15E-21B01M	11.53	13.82	14.09	.00	39.44	2.95	29.98	5.02	.03	37.98	35.73	3.96	3.14	27.91	.00	1.40	10.021	1.038
CLASS								2			1	2	5	5	1	3		
15S/15E-25N02M	12.72	13.74	17.84	.00	44.30	3.34	34.14	5.64	.02	43.15	40.26	4.90	3.50	31.57	.00	.94	12.686	1.027
CLASS								2			2	2	5	5	1	2		
15S/15E-22Q01M	11.43	14.23	11.75	.00	37.40	2.85	28.73	4.94	.02	36.54	31.40	3.28	2.98	25.98	.00	1.70	8.294	1.024
CLASS								2			1	2	4	5	1	3		
15S/15E-34P01M	5.99	8.80	5.31	.00	20.10	2.66	15.91	1.92	.06	20.54	26.41	1.95	1.74	14.11	.00	.81	4.570	.978
CLASS								1			1	1	3	3	1	2		
16S/14E-10Q01M	4.94	2.80	9.57	.00	17.31	1.80	14.39	1.18	.00	17.37	55.30	4.87	1.63	12.37	.00	2.30	9.293	.996
CLASS								1			2	2	3	3	1	4		
16S/14E-15Q01M	6.39	2.55	9.57	.00	18.51	2.16	15.09	.90	.00	18.16	51.71	4.53	1.67	12.12	.00	1.60	9.253	1.019
CLASS								1			2	2	3	3	1	3		
16S/14E-22K01M	5.39	2.71	10.35	.00	18.46	2.39	14.57	2.03	.01	19.01	56.09	5.14	1.76	13.07	.00	1.40	10.520	.971
CLASS								1			2	2	3	3	1	3		
16S/15E-02N02M	12.43	19.91	5.48	.00	37.81	2.49	29.98	4.18	.16	36.80	14.50	1.36	2.88	25.39	.00	1.40	3.503	1.027
CLASS								2			1	1	4	5	1	3		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 11A. NATURAL SALTS IN SALINE WELL WATERS FROM WESTERN SAN JOAQUIN VALLEY, 1968

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
15S/14E-03H01M	1600.	4.13	.00	1.31	.00	11.60	.00	4.77	1.72	.00	.00	.00	.00	.00	.01	24.04	23.54	23.54
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.50	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/15E-08B01M	2117.	3.41	.00	1.53	.00	20.44	.00	4.77	.00	.00	.00	.00	.00	.00	.00	30.16	31.11	30.16
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.93	CL=	.02	NO3=	.01	
15S/15E-17A01M	2635.	3.11	.00	9.95	.00	12.09	.00	6.43	.00	.00	7.66	.00	.00	.00	.00	39.32	40.64	39.32
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	1.31	CL=	.00	NO3=	.02	
15S/15E-20N05M	1461.	3.39	.00	3.31	.00	7.57	.00	2.48	.00	.00	4.59	.00	.00	.00	.00	21.33	21.58	21.33
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.25	CL=	.00	NO3=	.10	
15S/15E-21B01M	2535.	2.95	.00	8.58	.00	14.09	.00	5.02	.00	.00	7.31	.03	.00	.00	.00	39.44	37.98	37.98
RESIDUAL IONS,		CA=	.00	MG=	1.46	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/15E-25N02M	2889.	3.34	.00	9.38	.00	17.84	.00	5.64	.00	.00	6.93	.02	.00	.00	.00	44.30	43.15	43.15
RESIDUAL IONS,		CA=	.00	MG=	1.15	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/15E-22Q01M	2414.	2.85	.00	8.59	.00	11.75	.00	4.94	.00	.00	8.41	.02	.00	.00	.00	37.40	36.54	36.54
RESIDUAL IONS,		CA=	.00	MG=	.87	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/15E-34P01M	1359.	2.66	.00	3.33	.00	5.31	.00	1.92	.00	.00	6.88	.00	.00	.00	.00	20.10	20.54	20.10
RESIDUAL IONS,		CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.38	CL=	.00	NO3=	.06	
16S/14E-10Q01M	1208.	1.80	.00	3.14	.00	9.57	.00	1.18	.00	.00	1.61	.00	.00	.00	.00	17.31	17.37	17.31
RESIDUAL IONS,		CA=	.00	MG=	-.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.07	CL=	.00	NO3=	.00	
16S/14E-15Q01M	1280.	2.16	.00	4.22	.00	9.57	.00	.90	.00	.00	1.30	.00	.00	.00	.00	18.51	18.16	18.16
RESIDUAL IONS,		CA=	.00	MG=	.34	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
16S/14E-22K01M	1310.	2.39	.00	3.00	.00	10.35	.00	2.03	.00	.00	.68	.00	.00	.00	.00	18.46	19.01	18.46
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.54	CL=	.00	NO3=	.01	
16S/15E-02N02M	2379.	2.49	.00	9.93	.00	5.48	.00	4.18	.00	.00	14.57	.16	.00	.00	.00	37.81	36.80	36.80
RESIDUAL IONS,		CA=	.00	MG=	1.01	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 12. EVALUATION OF WATER QUALITY DATA FOR HIGH SODIUM WELL WATERS FROM WEST SAN JOAQUIN VALLEY, 1968

IDENTIFICATION	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
	MILLIEQUIVALENTS PER LITER																	
15S/15E-12G01M CLASS	1.00	.25	14.92	.00	16.17	3.80	6.08	6.77 3	.01	16.66	92.30 6	18.91 6	1.68 3	14.92 3	2.56 4	1.40 3	27.393	.970
15S/16E-01M01M CLASS	.75	.16	10.87	.00	11.79	3.61	.06	8.46 3	.02	12.15	92.25 6	16.10 6	1.28 3	10.87 3	2.69 4	1.50 3	21.324	.970
15S/16E-05E03M CLASS	.80	.82	13.14	.03	14.79	5.90	4.68	4.63 2	.01	15.22	88.83 5	14.59 5	1.47 3	13.17 3	4.28 6	.67 2	25.742	.971
15S/16E-05L01M CLASS	.55	.08	14.70	.00	15.33	4.98	.35	10.30 4	.02	15.65	95.88 6	26.17 6	1.63 3	14.70 3	4.35 6	1.80 3	33.417	.980
15S/16E-07C01M CLASS	.70	.00	15.23	.04	15.96	2.88	4.89	7.90 3	.03	15.71	95.38 6	25.76 6	1.66 3	15.26 3	2.19 4	1.40 3	27.803	1.016
15S/16E-07Q02M CLASS	.50	.00	11.83	.00	12.33	2.39	6.29	3.81 2	.00	12.49	95.95 6	23.69 6	1.32 3	11.83 3	1.89 3	1.40 3	20.839	.987
15S/16E-11F01M CLASS	.60	.16	8.74	.07	9.58	3.93	.60	5.19 2	.04	9.77	91.26 6	14.15 5	1.01 3	8.82 3	3.17 5	1.30 3	18.483	.981
15S/16E-13Q02M CLASS	1.50	.49	6.09	.00	8.08	3.93	1.23	2.68 1	.02	7.87	75.37 4	6.10 3	.79 2	6.09 2	1.94 3	.51 2	10.604	1.027
15S/16E-23J01M CLASS	.50	.08	4.78	.00	5.37	3.05	1.06	1.07 1	.01	5.19	89.17 5	8.88 3	.53 2	4.79 2	2.47 4	.51 2	9.988	1.034
15S/16E-19L01M CLASS	1.20	.16	6.44	.00	7.80	3.72	.69	3.05 2	.00	7.45	82.54 5	7.80 3	.78 2	6.44 2	2.36 4	.44 1	12.102	1.046
15S/16E-30B03M CLASS	.25	.00	3.31	.00	4.16	2.23	.37	1.30 1	.00	3.90	94.01 6	11.08 4	.43 1	3.91 1	1.98 3	.44 1	7.095	1.067
16S/14E-03H01M CLASS	.60	.16	15.44	.00	16.21	3.28	10.41	2.82 1	.02	16.53	95.29 6	25.00 6	1.66 3	15.44 3	2.51 4	1.40 3	29.277	.981

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 12A. NATURAL SALTS IN HIGH SODIUM WELL WATERS FROM WEST SAN JOAQUIN VALLEY, 1968

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
15S/15E-12G01M	1143.	1.00	.25	.00	.00	6.09	2.56	.00	6.28	.00	.00	.00	.00	.00	.00	16.17	16.66	16.17
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.43	NO3=	.01	
15S/16E-01M01M	803.	.75	.16	.00	.00	.06	2.69	.00	8.12	.00	.00	.00	.00	.00	.00	11.79	12.15	11.79
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.34	NO3=	.02	
15S/16E-05E03M	1091.	.80	.82	.00	.03	4.65	4.28	.00	4.20	.00	.00	.00	.00	.00	.00	14.79	15.22	14.79
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.42	NO3=	.01	
15S/16E-05L01M	1049.	.55	.08	.00	.00	.35	4.35	.00	10.00	.00	.00	.00	.00	.00	.00	15.33	15.65	15.33
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.30	NO3=	.02	
15S/16E-07C01M	1070.	.70	.00	.00	.04	4.85	2.19	.00	7.90	.00	.00	.00	.00	.00	.03	15.96	15.71	15.71
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.26	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/16E-07J02M	877.	.50	.00	.00	.00	6.29	1.89	.00	3.65	.00	.00	.00	.00	.00	.00	12.33	12.49	12.33
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.16	NO3=	.00	
15S/16E-11F01M	685.	.60	.16	.00	.07	.53	3.17	.00	5.04	.00	.00	.00	.00	.00	.00	9.58	9.77	9.58
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.15	NO3=	.04	
15S/16E-13Q02M	583.	1.50	.49	.00	.00	1.23	1.94	.00	2.68	.00	.00	.00	.00	.00	.02	8.08	7.87	7.87
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.21	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/16E-23J01M	409.	.50	.08	.00	.00	1.06	2.47	.00	1.07	.00	.00	.00	.00	.00	.01	5.37	5.19	5.19
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.17	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/16E-19L01M	554.	1.20	.16	.00	.00	.69	2.36	.00	3.05	.00	.00	.00	.00	.00	.00	7.80	7.45	7.45
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.35	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/16E-30B03M	307.	.25	.00	.00	.00	.37	1.98	.00	1.30	.00	.00	.00	.00	.00	.00	4.16	3.90	3.90
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.26	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
15S/14E-03H01M	1182.	.60	.16	.00	.00	10.41	2.51	.00	2.52	.00	.00	.00	.00	.00	.00	16.21	16.53	16.21
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.30	NO3=	.02	

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 13. EVALUATION OF WATER QUALITY DATA FOR IRRIGATION WATERS IN SELECTED AREAS OF CALIFORNIA. DONEEN, 1958.

IDENTIFICATION		CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
		MILLIEQUIVALENTS PER LITER																	
KERN CO	NO 01	.31	.09	4.19	.00	4.59	1.83	.13	2.74	.00	4.70	91.29	9.37	.48	4.19	1.43	.00	7.052	.977
CLASS									1			6	4	1	2	3	0		
KERN CO	NO 03	.21	.05	2.42	.00	2.68	1.20	.67	.68	.00	2.55	90.30	6.71	.27	2.42	.94	.00	2.793	1.051
CLASS									1			6	3	1	1	2	0		
VENTURA	NO 04	3.50	1.40	6.40	.00	11.30	4.20	5.50	1.80	.00	11.50	56.64	4.09	1.04	7.10	.00	.00	8.689	.983
CLASS									1			2	2	3	2	1	0		
VENTURA	NO 06	11.80	8.60	9.90	.00	30.30	6.10	27.30	3.10	.00	36.50	32.67	3.10	2.88	18.50	.00	.00	8.646	.830
CLASS									2			1	2	4	4	1	0		
LAKE CO	07	.60	5.40	.30	.00	6.30	5.90	.10	.40	.00	6.40	4.76	.17	.50	.40	.00	.00	.418	.984
CLASS									1			1	1	1	1	1	0		
LAKE CO	09	2.30	15.80	2.10	.00	20.20	18.30	.10	.80	.00	19.20	10.40	.70	1.50	2.10	.20	.00	2.281	1.052
CLASS									1			1	1	3	1	1	0		
YOLO CO	10	1.20	3.70	.70	.00	5.60	4.70	.40	.60	.00	5.70	12.50	.45	.54	.90	.00	.00	1.000	.982
CLASS									1			1	1	2	1	1	0		
YOLO CO	12	.60	1.10	3.60	.00	5.30	4.20	.70	.70	.00	5.60	67.92	3.90	.52	3.60	2.50	.00	6.761	.946
CLASS									1			3	2	2	1	4	0		
S BARBARA	13	11.10	7.00	5.30	.00	23.40	2.70	19.90	.50	.00	23.10	22.65	1.76	1.87	12.30	.00	.00	4.259	1.013
CLASS									1			1	1	3	3	1	0		
S BARBARA	15	8.90	6.30	4.00	.00	19.20	8.50	7.50	3.20	.00	19.20	20.83	1.45	1.61	10.30	.00	.00	4.156	1.000
CLASS									2			1	1	3	3	1	0		
W FRESNO	16	2.80	2.20	4.60	.00	9.60	1.90	7.00	.80	.00	9.70	47.92	2.91	1.10	6.80	.00	.00	5.252	.990
CLASS									1			2	1	3	2	1	0		
W FRESNO	18	2.30	.80	27.40	.00	30.50	2.70	10.30	17.60	.00	30.60	89.84	22.01	3.30	27.80	.00	.00	35.570	.997
CLASS									5			5	6	5	5	1	0		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 13A. . NATURAL SALTS IN IRRICATION WATERS IN SELECTED AREAS OF CALIFORNIA. DONEEN, 1958.

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		---MILLIEQUIVALENTS PER LITER---																
KERN CO NO 01	331.	.31	.09	.00	.00	.13	1.43	.00	2.63	.00	.00	.00	.00	.00	.00	4.59	4.70	4.59
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .11	NO3= .00									
KERN CO NO 03	202.	.21	.05	.00	.00	.67	.94	.00	.68	.00	.00	.00	.00	.00	.00	2.68	2.55	2.55
RESIDUAL IONS,		CA= .00	MG= .00	NA= .13	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
VENTURA NO 04	831.	3.50	.70	.00	.00	5.50	.00	.70	.90	.00	.00	.00	.00	.00	.00	11.30	11.50	11.30
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .20	NO3= .00									
VENTURA NO 06	2374.	6.10	.00	5.70	.00	9.90	.00	3.10	.00	.00	5.50	.00	.00	.00	.00	30.30	36.50	30.30
RESIDUAL IONS,		CA= .00	MG= -.00	NA= .00	K= .00	HCO3= .00	SO4= 6.20	CL= .00	NO3= .00									
LAKE CO 07	476.	.60	5.30	.00	.00	.10	.00	.10	.20	.00	.00	.00	.00	.00	.00	6.30	6.40	6.30
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .10	NO3= .00									
LAKE CO 09	1448.	2.30	15.80	.00	.00	.10	.20	.00	.80	.00	.00	.00	.00	.00	.00	20.20	19.20	19.20
RESIDUAL IONS,		CA= .00	MG= .00	NA= 1.00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
YOLO CO 10	424.	1.20	3.50	.00	.00	.40	.00	.20	.30	.00	.00	.00	.00	.00	.00	5.60	5.70	5.60
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .10	NO3= .00									
YOLO CO 12	435.	.60	1.10	.00	.00	.70	2.50	.00	.40	.00	.00	.00	.00	.00	.00	5.30	5.60	5.30
RESIDUAL IONS,		CA= .00	MG= .00	NA= -.00	K= .00	HCO3= .00	SO4= .00	CL= .30	NO3= .00									
S BARBARA 13	1580.	2.70	.00	8.40	.00	5.30	.00	.50	.00	.00	6.20	.00	.00	.00	.00	23.40	23.10	23.10
RESIDUAL IONS,		CA= .00	MG= .30	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
S BARBARA 15	1351.	8.50	.00	.40	.00	4.00	.00	3.20	.00	.00	3.10	.00	.00	.00	.00	19.20	19.20	19.20
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .00	NO3= .00									
W FRESNO 16	681.	1.90	.00	.90	.00	4.60	.00	.80	.00	.00	1.40	.00	.00	.00	.00	9.60	9.70	9.60
RESIDUAL IONS,		CA= .00	MG= -.00	NA= .00	K= .00	HCO3= .00	SO4= .10	CL= .00	NO3= .00									
W FRESNO 18	1981.	2.30	.40	.00	.00	10.30	.00	.40	17.10	.00	.00	.00	.00	.00	.00	30.50	30.60	30.50
RESIDUAL IONS,		CA= .00	MG= .00	NA= .00	K= .00	HCO3= .00	SO4= .00	CL= .10	NO3= .00									

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 14. EVALUATION OF WATER QUALITY DATA FOR DRAINAGE WATERS IN LOWER CHANCAY VALLEY, LAMBAYEQUE, PERU, 1966.

IDENTIFICATION		CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
		MILLIEQUIVALENTS PER LITER																	
GENERAL COL CLASS	2	4.32	1.04	13.50	.00	18.86	8.30	3.26	6.80	.00	18.86	71.58	8.25	1.23	13.50	3.44	.00	20.029	1.000
									3			4	3	3	3	5	0		
GENERAL COL CLASS	3	.84	3.56	16.50	.00	20.90	6.40	6.90	7.60	.00	20.90	78.95	11.12	1.38	16.50	2.00	.00	24.388	1.000
									3			4	4	3	4	3	0		
LAMBAYAQUE CLASS	5	4.56	1.96	10.50	.00	17.02	10.40	1.22	5.40	.00	17.02	61.69	5.82	1.02	10.50	3.88	.00	15.112	1.000
									2			3	2	3	3	5	0		
LAMBAYAQUE CLASS	6	5.76	.00	7.80	.00	13.56	9.20	.36	4.00	.00	13.56	57.52	4.60	.87	7.80	3.44	.00	11.568	1.000
									2			2	2	2	2	5	0		
CHICLAYO CLASS	8	5.00	3.72	35.50	.00	44.22	8.00	18.82	17.40	.00	44.22	80.28	17.00	2.75	36.22	.00	.00	42.237	1.000
									5			5	6	4	6	1	0		
CHICLAYO CLASS	9	3.20	3.20	23.50	.00	29.90	10.00	6.10	13.80	.00	29.90	78.60	13.14	1.92	23.50	3.60	.00	32.873	1.000
									4			4	5	3	4	5	0		
CHICLAYO CLASS	10	3.80	3.20	24.00	.00	31.00	7.60	7.60	15.80	.00	31.00	77.42	12.83	2.45	24.00	.60	.00	31.009	1.000
									5			4	5	4	5	2	0		
GALLINAZO CLASS	13	6.16	3.24	36.00	.00	45.40	6.80	13.60	25.00	.00	45.40	79.30	16.61	2.85	38.60	.00	.00	40.559	1.000
									6			4	6	4	6	1	0		
GALLINAZO CLASS	14	5.38	3.50	25.00	.00	33.88	7.20	-.92	27.60	.00	33.88	73.79	11.86	3.14	26.68	.00	.00	29.480	1.000
									6			4	4	5	5	1	0		
POMALEA-MON CLASS	15	9.80	20.24	21.50	.00	51.54	6.00	24.74	20.80	.00	51.54	41.72	5.55	9.85	41.74	.00	.00	15.943	1.000
									6			2	2	6	6	1	0		
POMALEA-MON CLASS	16	7.38	4.98	47.00	.00	59.36	6.80	32.36	20.20	.00	59.36	79.18	18.91	3.35	51.98	.00	.00	47.671	1.000
									6			4	6	5	6	1	0		
POMALEA-MON CLASS	18	1.76	12.28	22.50	.00	36.54	10.00	17.54	9.00	.00	36.54	61.58	8.49	1.61	26.54	.00	.00	23.911	1.000
									3			3	3	3	5	1	0		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.
SO4 NOT REPORTED. COMPUTED FROM DIFFERENCE IN CATIONS AND ANIONS REPORTED.

TABLE 14A. NATURAL SALTS IN DRAINAGE WATERS IN LOWER CHANCAY VALLEY, LAMBAYEQUE, PERU, 1966.

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
GENERAL COL 2	1200.	4.32	1.04	.00	.00	3.26	3.44	.00	6.80	.00	.00	.00	.00	.00	.00	18.86	18.86	18.86
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
GENERAL COL 3	1111.	.84	3.56	.00	.00	6.90	2.00	.00	7.60	.00	.00	.00	.00	.00	.00	20.90	20.90	20.90
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
LAMBAYAQUE 5	1195.	4.56	1.96	.00	.00	1.22	3.88	.00	5.40	.00	.00	.00	.00	.00	.00	17.02	17.02	17.02
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
LAMBAYAQUE 6	1010.	5.76	.00	.00	.00	.36	3.44	.00	4.00	.00	.00	.00	.00	.00	.00	13.56	13.56	13.56
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHICLAYO 8	2078.	5.00	3.00	.00	.00	18.92	.00	.72	16.68	.00	.00	.00	.00	.00	.00	44.22	44.22	44.22
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHICLAYO 9	1755.	3.20	3.20	.00	.00	6.10	3.60	.00	13.80	.00	.00	.00	.00	.00	.00	29.90	29.90	29.90
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHICLAYO 10	1703.	3.80	3.20	.00	.00	7.60	.60	.00	15.80	.00	.00	.00	.00	.00	.00	31.00	31.00	31.00
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CALLINAZO 13	2304.	6.16	.64	.00	.00	13.60	.00	2.60	22.40	.00	.00	.00	.00	.00	.00	45.40	45.40	45.40
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CALLINAZO 14	2155.	5.38	1.82	.00	.00	.00	.00	1.68	25.00	.00	.00	.00	.00	.00	.00	33.88	33.88	33.88
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.92	CL=	.92	NO3=	.00		
POMALEA-MON 15	2052.	6.00	.00	3.80	.00	20.94	.00	20.24	.56	.00	.00	.00	.00	.00	.00	51.54	51.54	51.54
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
POMALEA-MON 16	2432.	6.80	.00	.58	.00	31.78	.00	4.98	15.22	.00	.00	.00	.00	.00	.00	59.36	59.36	59.36
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
POMALEA-MON 18	1643.	1.76	8.24	.00	.00	17.54	.00	4.04	4.36	.00	.00	.00	.00	.00	.00	36.54	36.54	36.54
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 15. EVALUATION OF WATER QUALITY DATA FOR SURFACE WATERS IN PISCO VALLEY, PERU, 1969-70.

IDENTIFICATION	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
	MILLIEQUIVALENTS PER LITER																	
RIO PISCO P HM	1.50	.30	1.15	.05	3.00	1.60	.30	1.10	.00	3.00	38.33	1.21	.32	1.40	.00	.10	1.668	1.000
CLASS								1			1	1	1	1	1	1		
LAG AGNOCOCHA	1.04	.21	.36	.03	1.64	.30	1.10	.20	.00	1.60	21.95	.46	.16	.60	.00	.01	.237	1.025
CLASS								1			1	1	1	1	1	1		
LAG S FRANCISC	1.08	.27	.94	.10	2.39	1.20	.10	1.00	.00	2.30	39.33	1.14	.25	1.13	.00	.01	1.304	1.039
CLASS								1			1	1	1	1	1	1		
RIO SANTUARIO	1.08	.36	.88	.05	2.37	1.20	.30	.80	.00	2.30	37.13	1.04	.27	1.17	.00	.04	1.211	1.030
CLASS								1			1	1	1	1	1	1		
E H LETRAYOC	2.40	.80	2.10	.10	5.40	2.40	.60	2.40	.00	5.40	38.89	1.66	.63	2.80	.00	.00	2.927	1.000
CLASS								1			1	1	2	1	1	0		
TOMA BERNALES	2.65	.90	2.10	.10	5.75	2.80	.50	2.40	.00	5.70	36.52	1.58	.67	2.95	.00	.00	2.948	1.009
CLASS								1			1	1	2	1	1	0		
C TORO LAT 4	2.50	.90	2.15	.11	5.66	2.60	.60	2.40	.00	5.60	37.99	1.65	.69	3.06	.00	.00	3.002	1.011
CLASS								1			1	1	2	1	1	0		
C HUARANGAL	7.00	.12	24.80	.20	32.12	2.80	7.00	21.80	.50	32.10	77.21	13.14	3.77	25.12	.00	.00	26.115	1.001
CLASS								6			4	5	5	5	1	0		
TOMA CASALLA	11.00	3.00	26.50	.25	40.75	3.50	12.70	24.00	.50	40.70	65.03	10.02	4.04	29.75	.00	.00	23.475	1.001
CLASS								6			3	4	6	5	1	0		
TOMA FIGUEROA	18.00	4.50	36.50	.40	59.40	3.50	16.90	38.50	.50	59.40	61.45	10.88	5.83	41.40	.00	.00	27.141	1.000
CLASS								6			3	4	6	6	1	0		
TOMA CAUCATO	19.00	4.50	39.50	.55	63.55	3.50	19.00	40.50	.50	63.50	62.16	11.52	5.30	44.55	.00	.00	28.844	1.001
CLASS								6			3	4	6	6	1	0		
C CAUCATO (TM)	20.00	5.00	39.00	.40	64.40	4.00	17.90	42.00	.50	64.40	60.56	11.03	6.38	44.40	.00	.00	28.521	1.000
CLASS								6			3	4	6	6	1	0		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 15A. NATURAL SALTS IN SURFACE WATERS IN PISCO VALLEY, PERU, 1969-70.

IDENTIFICATION	TDS	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
	MG/L	MILLIEQUIVALENTS PER LITER																
RIO PISCO P HM	225.	1.50	.10	.00	.05	.25	.00	.20	.00	.00	.00	.00	.00	.00	.00	3.00	3.00	3.00
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
LAG AGNOCOCHA	123.	.30	.00	.74	.03	.33	.00	.20	.00	.00	.00	.00	.00	.00	.00	1.64	1.60	1.60
RESIDUAL IONS,		CA=	.00	MG=	.01	NA=	.03	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
LAG S FRANCISC	176.	1.03	.12	.00	.10	.00	.00	.15	.85	.00	.00	.00	.00	.00	.00	2.39	2.30	2.30
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.09	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
RIO SANTUARIO	176.	1.08	.12	.00	.05	.25	.00	.24	.56	.00	.00	.00	.00	.00	.00	2.37	2.30	2.30
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.07	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
E H LETRAYOC	382.	2.60	.00	.00	.10	.50	.00	.80	1.60	.00	.00	.00	.00	.00	.00	5.40	5.40	5.60
RESIDUAL IONS,		CA=	-.20	MG=	.00	NA=	.00	K=	.00	HCO3=	-.20	SO4=	.00	CL=	.00	NO3=	.00	
TOMA BERNALES	408.	2.65	.15	.00	.10	.40	.00	.75	1.65	.00	.00	.00	.00	.00	.00	5.75	5.70	5.70
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.05	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
C TORO LAT 4	399.	2.50	.10	.00	.11	.49	.00	.80	1.60	.00	.00	.00	.00	.00	.00	5.66	5.60	5.60
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.06	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
C HUARANCAL	2043.	2.90	.00	4.20	.20	2.60	.00	.12	21.00	.00	.00	.00	.00	.00	.50	32.12	32.10	32.10
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.02	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
TOMA CASALLA	2593.	3.50	.00	7.50	.25	4.95	.00	3.00	21.00	.00	.00	.00	.00	.00	.50	40.75	40.70	40.70
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.05	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
TOMA FIGUEROA	3703.	3.50	.00	14.50	.40	2.00	.00	4.50	34.00	.00	.00	.00	.00	.00	.50	59.40	59.40	59.40
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
TOMA CAUCATO	3970.	3.50	.00	15.50	.55	2.05	.00	4.50	36.00	.00	.00	.00	.00	.00	.50	63.55	63.50	63.50
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.05	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
C CAUCATO (TM)	4009.	4.00	.00	16.00	.40	1.50	.00	5.00	37.00	.00	.00	.00	.00	.00	.50	64.40	64.40	64.40
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 16. EVALUATION OF WATER QUALITY DATA FOR IRRIGATION WATERS AT SELECTED STATIONS IN TUNISIA, 1962-69.

IDENTIFICATION	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACC ME/L	BORON MG/L	ASAR	CA/AN
	MILLIEQUIVALENTS PER LITER																	
KSAR GHERISS W	18.00	15.50	29.00	.60	63.10	3.20	37.90	20.90	.00	62.00	45.96	7.03	4.90	45.10	.00	.00	18.560	1.018
CLASS								6			2	3	6	6	1	C		
TOZEUR WELL	9.00	6.70	17.60	.60	33.90	2.40	13.00	17.60	.00	33.00	51.92	6.28	3.10	24.90	.00	.00	14.181	1.027
CLASS								5			2	3	5	5	1	0		
MESSAOUDIA W	11.20	3.10	16.30	.50	31.10	3.80	14.40	12.40	.00	30.60	52.41	6.10	2.80	19.90	.00	.00	14.802	1.016
CLASS								4			2	3	4	4	1	0		
NAKTA WELL	13.50	7.50	37.80	.50	59.30	3.00	20.80	36.70	.00	60.50	63.74	11.67	5.50	45.80	.00	.00	27.970	.980
CLASS								6			3	4	6	6	1	0		
ZARZIS WELL	14.80	6.20	81.30	.80	103.10	2.10	32.60	70.20	.00	104.90	78.86	25.09	9.20	88.30	.00	.00	54.226	.963
CLASS								6			4	6	6	6	1	0		
CHERFECH W65-6	7.00	2.60	11.30	.10	21.00	3.00	5.90	11.50	.00	20.40	53.81	5.16	2.00	14.00	.00	.00	11.358	1.029
CLASS								4			2	2	3	3	1	0		
CHERFECH S66	9.70	5.20	20.30	.20	35.40	2.70	11.90	20.60	.00	35.20	57.34	7.44	3.30	25.70	.00	.00	16.943	1.006
CLASS								6			2	3	5	5	1	0		
CHERFECH S66-7	8.20	3.90	13.40	.10	25.60	2.70	8.50	14.00	.00	25.20	52.34	5.45	2.30	17.40	.00	.00	12.157	1.016
CLASS								4			2	2	4	4	1	0		
CHERFECH S67	11.90	4.80	22.90	.20	39.80	2.50	14.10	23.40	.00	40.00	57.54	7.92	3.80	27.90	.00	.00	18.048	.995
CLASS								6			2	3	5	5	1	0		
CHERFECH W67-8	9.60	3.70	19.10	.20	32.60	1.90	10.60	19.80	.00	32.30	58.59	7.41	3.10	23.00	.00	.00	15.463	1.009
CLASS								5			2	3	5	4	1	0		
CHERFECH S68	10.60	4.70	19.90	.20	35.40	2.10	12.90	20.50	.00	35.50	56.21	7.19	3.40	24.80	.00	.00	15.688	.997
CLASS								6			2	3	5	5	1	0		
CHERFECH W68-9	9.30	3.50	17.10	.20	30.10	2.70	9.70	17.50	.00	29.90	56.81	6.76	2.90	20.80	.00	.00	15.106	1.007
CLASS								5			2	3	4	4	1	0		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.

TABLE 16A. . NATURAL SALTS IN IRRIGATION WATERS AT SELECTED STATIONS IN TUNISIA, 1962-69.

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		-MILLIEQUIVALENTS PER LITER-																
KSAR GHERISS W 4008.		3.20	.00	14.30	.60	22.50	.00	15.50	5.40	.00	.00	.00	.00	.00	.00	63.10	62.00	62.00
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	1.10	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
TOZEUR WELL 2097.		2.40	.00	6.60	.60	5.30	.00	6.70	10.90	.00	.00	.00	.00	.00	.00	33.90	33.00	33.00
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.90	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
MESSAOUDIA W 2031.		3.80	.00	7.40	.50	6.50	.00	3.10	9.30	.00	.00	.00	.00	.00	.00	31.10	30.60	30.60
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.50	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
NAKTA WELL 3745.		3.00	.00	10.50	.50	9.80	.00	7.50	28.00	.00	.00	.00	.00	.00	.00	59.30	60.50	59.30
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	1.20	NO3=	.00		
ZARZIS WELL 6467.		2.10	.00	12.70	.80	19.10	.00	6.20	62.20	.00	.00	.00	.00	.00	.00	103.10	104.90	103.10
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	1.80	NO3=	.00		
CHERFECH W65-6 1322.		3.00	.00	4.00	.10	1.80	.00	2.60	8.90	.00	.00	.00	.00	.00	.00	21.00	20.40	20.40
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.60	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHERFECH S66 2211.		2.70	.00	7.00	.20	4.70	.00	5.20	15.40	.00	.00	.00	.00	.00	.00	35.40	35.20	35.20
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.20	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHERFECH S66-7 1605.		2.70	.00	5.50	.10	2.90	.00	3.90	10.10	.00	.00	.00	.00	.00	.00	25.60	25.20	25.20
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.40	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHERFECH S67 2502.		2.50	.00	9.40	.20	4.50	.00	4.80	18.40	.00	.00	.00	.00	.00	.00	39.80	40.00	39.80
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.20	NO3=	.00		
CHERFECH W67-8 2023.		1.90	.00	7.70	.20	2.70	.00	3.70	16.10	.00	.00	.00	.00	.00	.00	32.60	32.30	32.30
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.30	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		
CHERFECH S68 2221.		2.10	.00	8.50	.20	4.20	.00	4.70	15.70	.00	.00	.00	.00	.00	.00	35.40	35.50	35.40
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.10	NO3=	.00		
CHERFECH W68-9 1893.		2.70	.00	6.50	.20	2.20	.00	3.50	14.00	.00	.00	.00	.00	.00	.00	30.10	29.90	29.90
RESIDUAL IONS,	CA=	.00	MG=	.00	NA=	.20	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00		

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2

TABLE 17. EVALUATION OF WATER QUALITY DATA FOR MISSOURI RIVER AND GROUND WATERS, BOYD COUNTY, NEBRASKA

IDENTIFICATION	CA	MG	NA	K	CATIONS	HCO3	SO4	CL	NO3	ANIONS	NA PCT	SAR	EC MMHOS	ES ME/L	RNACO ME/L	BORON MG/L	ASAR	CA/AN
	MILLIEQUIVALENTS PER LITER																	
MO R 220774 1A	2.84	1.81	3.22	.00	7.87	3.43	4.16	.23	.06	7.87	40.89	2.11	.76	4.45	.00	.00	4.322	1.000
CLASS								1			2	1	2	2	1	0		
MO R 220774 1B	2.89	1.81	3.18	.00	7.88	3.45	4.16	.25	.02	7.88	40.30	2.07	.73	4.43	.00	.00	4.256	1.000
CLASS								1			2	1	2	2	1	0		
MO R 220774 4A	2.94	1.81	3.09	.00	7.84	3.21	4.37	.25	.01	7.84	39.38	2.00	.75	4.63	.00	.00	4.065	1.000
CLASS								1			1	1	2	2	1	0		
MO R 220774 4B	2.89	1.81	3.13	.00	7.84	2.99	4.58	.25	.01	7.84	39.97	2.04	.74	4.85	.00	.00	4.072	1.000
CLASS								1			1	1	2	2	1	0		
GR W 220774 1	2.79	.49	.70	.00	3.98	2.91	.94	.08	.05	3.98	17.47	.54	.39	1.07	.00	.00	1.020	1.000
CLASS								1			1	1	1	1	1	0		
GR W 220774 1	.80	.33	20.49	.00	21.62	9.37	.10	12.13	.02	21.62	94.78	27.29	2.14	20.49	8.24	.00	48.086	1.000
CLASS								4			6	6	4	4	6	0		
GR W 220774 4	.80	.49	19.97	.00	21.26	8.72	.10	12.41	.02	21.26	93.92	24.84	2.23	19.97	7.43	.00	44.530	1.000
CLASS								4			6	6	4	4	6	0		
GR W 220774 6	.70	.49	19.58	.00	20.77	8.25	.10	12.41	.01	20.77	94.26	25.35	2.23	19.58	7.05	.00	44.016	1.000
CLASS								4			6	6	4	4	6	0		
GR W 220774 8	.80	.49	20.27	.00	21.56	9.32	.10	12.13	.01	21.56	94.01	25.22	2.24	20.27	8.03	.00	45.894	1.000
CLASS								4			6	6	4	4	6	0		
GR W 220774 10	6.99	5.64	5.61	.00	18.44	14.86	1.87	1.69	.02	18.44	30.43	2.22	1.61	5.61	2.03	.00	6.732	1.000
CLASS								1			1	1	3	2	4	0		
GR W 220774 11	.65	.49	20.10	.00	21.24	9.00	.10	12.13	.01	21.24	94.62	26.59	2.24	20.10	7.86	.00	46.610	1.000
CLASS								4			6	6	4	4	6	0		

NOTE-ZERO VALUES FOR K AND/OR NO3 INDICATE THAT DATA ARE NOT AVAILABLE OR THAT THE VALUES ARE LESS THAN 0.005 ME/L.
HCO3 NOT REPORTED. COMPUTED FROM DIFFERENCE IN CATIONS AND ANIONS REPORTED.

TABLE 17A. NATURAL SALTS IN MISSOURI RIVER AND GROUND WATERS, BOYD COUNTY, NEBRASKA

IDENTIFICATION	TDS MG/L	CACO3	MGCO3	CASO4	K2SO4	NASO4	NACO3	MGCL2	NACL	KCL	MGSO4	MGNO3	KNO3	CACL2	NANO3	CATION	ANIONS	SALTS
		MILLIEQUIVALENTS PER LITER																
MO R 220774 1A	510.	2.84	.58	.00	.00	3.22	.00	.23	.00	.00	.94	.06	.00	.00	.00	7.87	7.87	7.87
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
MO R 220774 1B	526.	2.89	.55	.00	.00	3.18	.00	.25	.00	.00	.99	.02	.00	.00	.00	7.88	7.88	7.88
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
MO R 220774 4A	520.	2.94	.27	.00	.00	3.09	.00	.25	.00	.00	1.28	.01	.00	.00	.00	7.84	7.84	7.84
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
MO R 220774 4B	518.	2.89	.09	.00	.00	3.13	.00	.25	.00	.00	1.45	.01	.00	.00	.00	7.84	7.84	7.84
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 1	260.	2.79	.12	.00	.00	.70	.00	.08	.00	.00	.24	.05	.00	.00	.00	3.98	3.98	3.98
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 1	1180.	.80	.33	.00	.00	.10	8.24	.00	12.13	.00	.00	.00	.00	.00	.02	21.62	21.62	21.62
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 4	1220.	.80	.49	.00	.00	.10	7.43	.00	12.41	.00	.00	.00	.00	.00	.02	21.26	21.26	21.26
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 6	1220.	.70	.49	.00	.00	.10	7.05	.00	12.41	.00	.00	.00	.00	.00	.01	20.77	20.77	20.77
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 8	1210.	.80	.49	.00	.00	.10	8.03	.00	12.13	.00	.00	.00	.00	.00	.01	21.56	21.56	21.56
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 10	1220.	6.99	5.84	.00	.00	1.87	2.03	.00	1.69	.00	.00	.00	.00	.00	.02	18.44	18.44	18.44
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	
GR W 220774 11	1220.	.65	.49	.00	.00	.10	7.86	.00	12.13	.00	.00	.00	.00	.00	.01	21.24	21.24	21.24
RESIDUAL IONS,		CA=	.00	MG=	.00	NA=	.00	K=	.00	HCO3=	.00	SO4=	.00	CL=	.00	NO3=	.00	

NOTE-NAMES OF SOME SALTS ARE ABBREVIATED, NASO4 = NA2SO4, NACO3 = NA2CO3, MGNO3 = MG(NO3)2