

Cotter Corporation
General Office

PDR

WM-22

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February 23, 1981

Mr. Albert J. Hazle, Director
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

Dear Mr. Hazle:

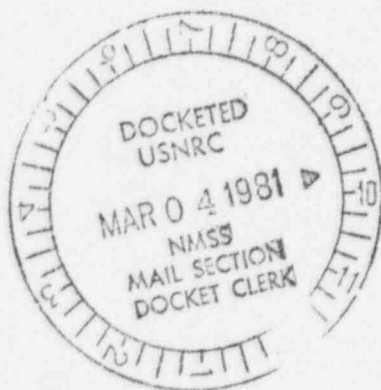
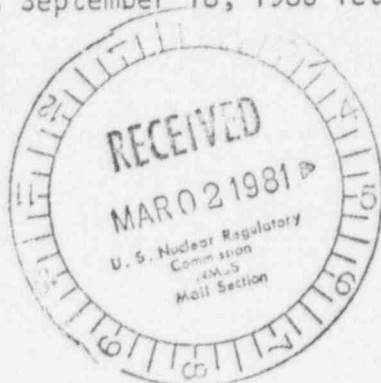
In accordance with the task completion schedule discussed in Cotter's December 19, 1980 and January 5, 1981 letter to the Department, Cotter encloses herewith ten copies of the Analytical Chemistry Report.

This report is responsive to the Department's concern expressed in Item 3 of its September 18, 1980 letter to Cotter.

Sincerely,

J.P. McCluskey
J.P. McCluskey
Executive Vice President

TS/na



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CONTENTS

- 4.1 INTRODUCTION
- 4.2 LIMITATIONS OF ANALYSIS
- 4.3 REVISED MONITORING PROGRAM
- 4.4 GROUNDWATER DISPERSION ANALYSIS
- 4.5 SURFACE WATER QUALITY

APPENDICES

Appendix

- A DERIVATION OF THE CONVECTIVE DISPERSION EQUATION
- B
 - 1. DEVELOPMENT OF A SECTION FROM WELL NUMBER 1 AT THE MILL TO WELL NUMBER 19.
 - 2. TIME SEQUENCE OF CONCENTRATIONS FOR SELECTED ELEMENTS AND WELLS IN THE CROSS-SECTION.
- C TABULATIONS OF GROUNDWATER QUALITY DATA THROUGH SEPTEMBER, 1980
- D TABULATION OF SURFACE WATER QUALITY DATA THROUGH SEPTEMBER, 1980

TABLES

Table No.

- | | |
|-----|--|
| 4-1 | Revised List of Surface and Groundwater Monitoring Stations. |
| 4-2 | Recommended List of Groundwater Chemical Parameters. |
| 4-3 | Summary of the Analytical Procedure for Obtaining v-D ₂ families of Solutions. |
| 4-4 | Surface Water Sampling Stations for Cotter Project
(by Logan, 1980) |
| B-1 | Summary of Open Intervals for Wells Along a Section From Cotter Well Number 1 to Well Number 19 in Lincoln Park. |
| B-2 | Concentrations of Selected Elements for the Section From Well Number 1 to Well Number 19. |
| B-3 | Se Concentrations at Selected Wells, 8-Jan-80 to 19-Aug-80 (ug/l) |
| B-4 | Mo Concentrations at Selected Wells, 8-Jan-80 to 19-Aug-80 (mg/l) |
| B-5 | U Concentrations at Selected Wells, 8-Jan-80 to 19-Aug-80 (mg/l) |

FIGURES

Figure No.

- 4-1 Orientation of Section Used for Dispersion Analysis, and a Schematic of Possible Groundwater Flow Directions
- 4-2 The Components of Dispersion. Fluid Particles: \circ at time t ; \bullet at time $t + \Delta t$. (after Fried, 1975)
- 4-3 Se Content as a Function of Distance From Station 1, Northeasterly Direction
- 4-4 Mo Content as a function of distance from Station 1, Northeasterly Direction
- 4-5 U Content as a Function of Distance From Station 1, Northeasterly Direction
- 4-6 Se Content as a Function of Time for 4 Wells, (ug/l)
- 4-7 Mo Content as a Function of Time for 4 Wells, (mg/l)
- 4-8 U-NAT'L Content as a Function of Time for 4 Wells (mg/l)
- 4-9 Occurrence of the First Trace of a Breakthrough Curve for Zero and Finite Dispersion
- 4-10 Field and Analytical Concentration Profiles for Se content as a Function of Distance From Station 1, Northeasterly Direction

Figure No.

- 4-11 Field and Analytical Concentration Profiles for Mo Content as
 a Function of Distance From Station 1, Northeasterly
 Direction
- 4-12 Field and Analytical Concentrations Profiles for U Content as
 a Function of Distance From Station 1, Northeasterly
 Direction
- B-1 Monitor Stations and Their Relative Distances From Cotter Well
 Number 1

4.1 INTRODUCTION

The purpose of this section of the report is to present a preliminary interpretation of the surface and groundwater chemical data amassed on and near the mill site. At this time, Wahler Associates has recommended to the Cotter Corporation a program of action that is more comprehensive than past investigations. Previous work has concentrated on analysis of the symptoms, not causes of any potential problems. That is, interpretation in previous reports has not considered the entire data base or, in fact, the relationship of the mill site and Lincoln Park to the regional setting. A sound data base including chemical data and data describing the physical characteristics of the surface and groundwater environment is required for proper analysis of the hydrologic regime.

This section of the report discusses the limitations of interpreting the present water quality data base and Wahler's recommended program for improving upon the existing (1980) data collection program. This section also assesses the status of the surface water analysis and presents one approach to analyzing the ground water quality data.

4.2 LIMITATIONS OF ANALYSIS

The existing (1980) data base is contained in Appendix C, and in Logan (1980). The majority of the chemical data has and is presently being collected at the mill site and in various locations in Lincoln Park. It appears that until recently all the emphasis for chemical analysis has been placed upon the symptom (Lincoln Park water quality) and the supposed source (Cotter Mill). Since 1977, Wahler (Logan) and more recently Wahler's Rocky Mountain Regional office has concentrated on analyzing cause and effect relationships. The prime requisite for a cause and effect relationship as stated above is a sound data base.

The existing (1980) data base has the following limitations: 1) a limited number of chemical parameters, 2) sampling locations, 3) frequency of analysis, and 4) quality assurance. An adequate baseline of data is

necessary for at least one year which encompasses major cations and anions in addition to the other parameters now being measured. Secondly, sampling locations have not been adequately spaced to allow a direct connection between supposed source (mill site) and Lincoln Park, especially in light of the complexity of geologic material comprising the media for fluid movement. Thirdly, the frequency of analysis (monthly) is adequate for temporal changes, but some locations should be sampled less frequently to accomodate more locations and thus optimize sampling and analysis efforts. Fourthly, quality assurance with regard to sample collection, preservation, storage and analysis is a concern and causes difficulties in interpreting the existing data base.

Most investigations involving possible ground-water contamination usually emphasize the symptoms. However, to adequately analyze chemical parameters, an understanding of the hydrodynamics is first necessary for without an accurate accounting of groundwater flow, water quality analyses are of little value. Wahler Associates has recommended a program to address both hydrodynamics and chemical interactions. (See Item 3/9-18-80 in Cotter's December 19, 1980 letter to the Department)

4.3 REVISED MONITORING PROGRAM

Due to the limitations of the previously implemented water sampling programs, as described above, and apparant inconsistencies in the existing data base, a complete re-evaluation of water sampling, preservation, storage and analytical procedures was conducted.

Wahler Associates has, in cooperation with Cotter Corporation, devised an expanded and comprehensive surface and groundwater sampling and testing program which is presently being implemented at the mill site and Lincoln Park areas.

The surface water monitoring program is described in detail in Section 2 of this Hydrology Report submitted to the Department on January 26, 1981.

This revised groundwater monitoring program includes all the previously monitored wells in addition to the recently completed Wolf Park Mine well and observation wells. Table 4-1 contains a list of all the surface and groundwater monitoring locations presently being sampled. Wahler is presently re-evaluating the number of sample locations and will eventually reduce this number and concentrate on those locations which will provide a more complete and reliable data base.

Each water sample is being tested for an expanded list of chemical parameters. A list of those parameters is contained in Table 4-2. It is anticipated that the number of parameters will decrease as the monitoring program progresses and trends have been established.

Appropriate water sampling equipment is being fabricated, (winch, boom, pumps and bailers) at the mill site to expedite the sampling program. Field testing equipment, i.e., PH meter, specific conductance and temperature

meters have been obtained and are being routinely used during the sampling program.

Water sample preservation, holding time (storage) and analyses have been specified by Wahler and Cotter and conform to U. S. Environmental Protection Agency, Methods For Chemical Analysis of Water and Waste, and Standard Methods, 13th Edition.

4.4 GROUNDWATER DISPERSION ANALYSIS

This section of the report summarizes steps which were taken to deduce a direction and mean velocity of shallow groundwater flow in the vicinity between the Cotter tailings ponds and the southwest corner of Lincoln Park. The solution process is based upon a knowledge of the concentration of chemical constituents in the groundwater as a function of distance in the assumed northeasterly groundwater flow direction from Cotter Pond No. 1, and the fact that the starting date for milling operations is known. Figure 4-1 shows the assumed groundwater flow direction for purposes of analysis. It was conveniently chosen so that maximum use of field data could be achieved. Note that the section passes through five monitor wells, of which four were determined to be useful for the analysis. Whether flow occurs entirely in the direction indicated on Figure 4-1 is subject to question, for the mean velocity in the northeast direction may very well be a component of another arbitrary mean velocity vector.

"Spatial variability in groundwater quality" can only be caused by a process called hydrodynamic dispersion. Hydrodynamic dispersion (or simply dispersion) is at best a very complicated process. In the following section, a brief synopsis of dispersion theory is given along with a discussion on its limitations. Qualitative discussion of the Cotter field data is also provided, followed by a verbal and mathematical statement of the problem at hand. A family of possible flow parameter combinations are finally presented which indicate what may be happening in the field.

This section is not intended to be a text on dispersion theory. However, the reader should appreciate the mechanics of dispersion and the difficulties encountered in modelling the phenomenon mathematically.

Background on the Dispersion Process

Let a fluid in a saturated porous medium contain a certain mass of dissolved species. This solute will be called a tracer, and could be identified by color, density, electrical conductivity, etc. Experience shows that as flow takes place, the tracer occupies an ever-increasing portion of the flow domain, beyond the region it is expected to occupy according to the average flow alone. This spreading phenomenon is called dispersion. It may be defined formally as follows (Fried, 1975):

Dispersion in fluid flow in porous media is the occurrence and evolution of a transition zone between two domains of the fluid phase with different compositions.

The mechanisms of dispersion are twofold. The first is physiochemical action, which acts through molecular diffusion resulting from chemical concentration gradients. Molecular diffusion takes place even in a fluid at rest. The second mechanism of dispersion is mechanical action, which causes the velocity distribution in and between the pores of a medium to be nonuniform. This is due to three boundary effects of the solid matrix, which are illustrated in Figure 4-2. Part (a) shows that the fact that fluids are viscous usually implies a zero velocity on the solid surface, thereby creating a velocity gradient in the fluid phase. Part (b) shows that variations in the pore dimensions create different maximum velocities along the pore axes. Finally, in part (c), fluid pathlines are shown to fluctuate with respect to the direction of mean flow.

Obviously, it would be impossible to account for all of the random motion of every fluid particle in a dispersive medium. Such a microscopic approach would require at first a detailed geometric description of every pore, which is itself impossible. Hence, the technique of spatial averaging is employed. The goal is to obtain a partial differential equation governing the dispersion process and to determine the nature of the

coefficients which appear in the equation. One technique of spatial averaging is to replace the medium by a greatly simplified model (an interconnected bundle of capillary tubes, for example) and to determine the spreading of a solute by analytical means. Another is to construct a statistical model of the microscopic motion of solute particles and to average these motions in order to obtain a macroscopic description of them. Bear (1972) gives a detailed summary on spatial and statistical averaging.

Fortunately, the form of the governing equation has been generally agreed upon. The accepted convective dispersion equation is derived in Appendix A. In it appears the coefficient of longitudinal dispersion, D_L , which is divided into coefficients representing the sum of two effects. Hence,

$$D_L = D^* + D_m ,$$

where:

D^* = coefficient of molecular diffusion.

D_m = coefficient of mechanical dispersion.

It is known that D_L is proportional to flow velocity, which motivates writing

$$D_m = \alpha_L v ,$$

where:

α_L = medium dispersivity.

v = fluid pore velocity.

Some Difficulties and Limitations of Dispersion Analysis.

From above, we see that the dispersion coefficient is velocity-dependent. This makes mathematical solutions difficult to obtain when the pore velocity cannot be treated as a constant.

A second problem with dispersion analysis is that the process itself is anisotropic. Mechanical dispersion is stronger in the direction of flow than in the transverse direction. The process of molecular diffusion is isotropic and time dependent, so that as flow becomes slow, overall dispersion cannot be viewed as being one-dimensional without significant error. Finally, this anisotropic process occurs in a completely isotropic medium. Little is known about dispersion in anisotropic media.

The third problem with modelling dispersion is that we find dispersivity in the field to be scale-dependent, even though theory shows that α_L should be a fixed medium property. Typically, α_L appears large at small scales and small at large scales. Care must be taken to understand the scale of a problem after a value for α_L is obtained.

Chemistry of Shallow Groundwater at the Cotter Site: 1.
Fixed-time Concentration Profiles along a section from the mill site to Lincoln Park.

In order to determine possible migration trends of shallow groundwater, chemical analyses of wells along a section from Pond No. 1 to the Lincoln Park area were arrayed. The concentration profiles in Figures 4-3 through 4-5 were based on water quality samples for wells with open intervals as closely matched as possible and taken at similar times. Part 1 of Appendix B describes the procedure by which the section was developed and gives a table of data upon which Figures 4-3 through 4-5 are based.

The elements considered to be representative (Selenium, Molybdenum, and Uranium) all undergo a decrease in concentration as a function of distance away from observation well #1. This, in short, is what motivates a dispersion analysis.

Note that all of the profiles are constructed by a straight-line fit between known points of chemical concentrations. The slopes of the curves

may therefore represent fictitiously high or low medium dispersivities, depending upon field chemical concentrations (unknown in the absence of monitor wells) between the stations which currently provide the data points. Thus, due to the limited amount of data, a family of solutions of combinations of flow velocity and medium dispersivity is justified for purposes of a thorough review of possible flow situations.

Chemistry of Shallow Groundwater at the Cotter Site: 2.
Concentration-Time Data For Selected Wells and Elements Along
A Section From The Mill Site To Lincoln Park.

Figures 4-6 through 4-8 show concentrations of elements as a function of time in each well along the section previously discussed. In obtaining data for this analysis, similar open intervals, although quite desirable, are not absolutely necessary. The data plotted in Figures 4-6 through 4-8 is given in tabular form in Part 2 of Appendix B.

By plotting element concentration as a function of time for each well on the same graph paper, one may be able to detect the following:

- a) A response time for reduced or increased concentrations at well 1 to have an effect on the concentrations in wells successively further down the section. That is to say that if the concentration-times graph for each well along the section could be shifted along the horizontal until all peaks and troughs matched on verticals, then the response time for concentration changes in conjunction with well separation distances could give a reasonable estimate of flow velocity along the section.
- b) A relative dampening of magnitude of concentration changes in wells successively farther down the profile from well 1. This could indicate possible chemical interaction between the groundwater and the soil matrix not taken into account by dispersion analysis.

Figures 4-6 through 4-8 show that the time span modelled is insufficient in duration for trends to be recognized. Data compiled by Logan (1980) indicates that past records are also insufficient in duration for purposes of trend determination. Wells which were monitored consistently over the years do not geographically form lines oriented in the direction of interest. It will, therefore, be useful to continue to monitor the wells in the section regularly.

Specific Assumptions Regarding Groundwater Flow At The Cotter Site.

Determination of mean flow velocity in the northeasterly direction from Cotter Pond No. 1 from existing chemical concentration profiles is generally regarded as an inverse problem. Normally, groundwater chemistry response to a man-made impulse is the desired result.

The fact that flow velocity, v , and medium dispersivity, α_L , are unknown requires that the solution process proceed by assuming a range of mean flow velocities. Then using a simplified relationship between V and α_L , a corresponding range of values for α_L can be determined, which may be checked for reasonableness. Hence, the results of this analysis are presented in terms of a family of possible flow situations.

The model assumes zero background concentrations of any elements in the groundwater prior to waste disposal, and a constant concentration of all elements at the origin of the section (well number 1) after disposal. Both of these assumptions reflect the extreme case for predicting Cotter's contribution (if any) to chemical concentrations in the groundwater. This is particularly important for the second assumption (constant concentration at the source). That is because current chemical concentrations of elements at well #1 were certainly not achieved instantaneously 20 years ago.

The model assumes no decay in chemical concentration due to interaction with the soil matrix. In addition, the pore velocity, v , is assumed

uniform along the section. Flow is regarded as being one-dimensional. Assumptions of lesser consequence are that the fluid density is constant and that the medium through which flow takes place is incompressible.

Analysis of Field Data: The Mathematical Model, Initial Conditions, Boundary Conditions, and Solution.

Equation A-5 is the governing equation for this analysis. Initial and boundary conditions are:

$$\begin{aligned} C(l,0) &= 0 & l > 0 \\ C(0,t) &= C_0 & t > 0 \\ C(\infty,t) &= 0 & t > 0, \end{aligned}$$

where: C = chemical concentration
 l = distance from the origin.

Ogata and Banks (1961) provide the following solution for this equation and initial and boundary conditions:

$$\frac{C}{C_0} = \frac{1}{2} \left[\operatorname{erfc} \left(\frac{l - vt}{2(D_l t)^{1/2}} \right) + \exp \left(\frac{vt}{D_l} \right) \operatorname{erfc} \left(\frac{l + vt}{2(D_l t)^{1/2}} \right) \right] \quad [4-1],$$

where erfc is the complimentary error function.

The second bracketed term in equation 4-1 can usually be neglected, so that:

$$\frac{C}{C_0} = \frac{1}{2} \operatorname{erfc} \left(\frac{l - vt}{2(D_l t)^{1/2}} \right) \quad [4-2]$$

This is the classical equation of a concentration front whose 50% relative concentration point moves with the mean flow; that is to say that the point $l = vt$ has $C/C_0 = 0.5$ at all times. A concentration - distance curve can be made based upon equation 4-2 as long as D_l and v are known.

To incorporate values of D_2 and v which make maximum use of current knowledge of the flow situation, another version of the solution given by equation 4-1 is written:

$$t = t_{1/2} - \Delta t/2 \quad [4-3],$$

where:

$$\Delta t = \left(\frac{4\pi D_2 t_{1/2}}{v} \right)^{1/2} \quad [4-4]$$

The key to these equations is that time, rather than distance, is the independent variable. Figure 4-9 shows the relationship between $t_{1/2}$, t , and Δt for an observer at a fixed distance, x , from an assumed chemical source. The variable $t_{1/2}$ represents the time it would take for the 50% relative concentration point of a profile to pass the observer at a given mean flow velocity, A . Without dispersion, $t_{1/2}$ would be the same as x/A . This is shown by the broken line in Figure 4-9, which represents "plug" or "piston" flow. Now consider dispersion, and let t be the time it takes for the observer at distance x to notice the first trace of the dispersed chemical front to appear at his location. The dispersed chemical front, shown by the continuous line of Figure 4-9, would only require its 50% relative concentration point to move at a mean velocity B , where B is less than A . Then by defining Δt as the "length" of the dispersed zone, measured as the time it takes for the chemical front to pass a fixed point at relative concentrations just greater than zero through 100%, equation 4-3 is explained with the visual aid of Figure 4-9.

For the problem at hand, x is the distance from well number 1 to well number 19, or 7125 feet. The value of t is 20 years, assuming the first trace of the chemical front passed well number 19 in 1978.

A family of solutions is then obtained as follows:

- 1) a value for $t_{1/2}$ is chosen.
- 2) v is calculated as $x/t_{1/2}$.

- 3) Δt is calculated by equation 4-3.
- 4) α_l is calculated by equation 4-4.
- 5) assuming mechanical dispersion dominant over molecular diffusion, D_l is expressed as $\alpha_l v$.
- 6) C/C_0 profiles are plotted as a function of l by equation 4-2.
- 7) steps 1-6 are repeated until the reasonable range for α_l is surpassed on both the low and high side.

Results and Discussion

Results of the calculations required to obtain analytical concentration curves for the elements Selenium, Molybdenum, and Uranium are summarized in Table 4-3. Theoretical profiles are superimposed on field profiles for each element in Figures 4-10 through 4-12. Because the family of flow parameters are the same for each element and the analytical solution (equation 4-2) is presented in terms of the concentration of a chemical constituent relative to the concentration at the source, these three curves differ only by the amplitude, C_0 , of chemical concentration at the origin ($l=0$). The magnitudes of concentrations at the origin were conveniently chosen as 32 milligrams per liter for Molybdenum, 10 milligrams per liter for Uranium, and 75 micrograms per liter for Selenium. The high concentrations observed for all elements at station number 1 in August of 1979 are not considered valid normalizing values for two reasons. The first is that later-time data shows the phenomenon to have been temporary. The second reason is that even if the phenomenon was not short-lived, it would take more than a matter of months before for it to affect concentrations further down the profile. In this sense, the technique of matching the analytical solution to observed concentrations at the far end of the section is overall an attractive one, because fluctuations of C_0 at the origin are subdued with time and distance travelled.

Comparison of the analytical solution with field data reveals a consistent overestimation of concentrations at the northeast end of the

section by analytical means. Although this may be caused by chemical interaction of the element with the soil matrix, a more logical explanation centers around the boundary conditions assumed for the mathematical model. It is likely that C_0 in the field increased in proportion to the years of operation of the Cotter mill. If this was the case, then the mathematical model could reasonably be scaled to some fraction of C_0 currently observed at well #1, rather than the full value. Inspection of Figures 4-10 through 4-12 shows that the field data could be fit more accurately by this procedure. In any case, it is certain that there is a component of groundwater flow along the section of interest. As an order of magnitude approximation, a pore velocity of 1 ft/day in this direction is reasonable.

Independent contaminant sources having other origins cannot be ruled out as the cause of chemical concentrations in certain wells in Lincoln Park to be higher than those observed in well #19. Finally, the mean flow direction and magnitude in the Lincoln Park area might not be along the given section (see Figure 4-1), whereupon the concentrations in well #19 being less than those in other wells in Lincoln Park could be explained by transverse dispersion.

4.5 SURFACE WATER QUALITY

The Cotter mill site is located south of the Arkansas River (Figure 1 in the Wahler January, 1981 report) and is the largest flowing watercourse in the proximity of the mill site. Several other smaller streams are tributary to the Arkansas River. A principal tributary to the river is Sand Creek, which drains through the Cotter property (Figure 4-1). The flows in the lower reaches of Sand Creek are affected by the U. S. Soil Conservation Service (SCS) detention dam, located on Sand Creek north of the Cotter property as shown on Figure 4-1.

The Arkansas River near Canon City is perennial. Because the tributary streams are dry much of the year, most of the downcutting and terracing is developed in the valley by the Arkansas River. Locally, the river loses its carrying capacity and begins to aggrade due to gradient reduction and the loss of water to irrigation ditches and wells.

Surface runoff in the vicinity of the Cotter mill site is directly related to precipitation, ground water levels, and evapotranspiration and indirectly related to consumption of water for irrigation, domestic stock, and water supply. The greatest depletion of surface runoff along the Arkansas River due to irrigation, recharge to ground water and evapotranspiration generally occurs during the month of June. Since the major streams are hydraulically connected with the shallow aquifer system, surface water and ground water constitute a common supply.

The chemical water quality of the Upper Arkansas River and its tributaries above Canon City is generally considered to be excellent except for iron and manganese concentrations, which are greater than the maximum allowable limits as set by the Colorado Department of Health. Abandoned mining operations in the vicinity of Leadville, Colorado are noted to account for these high concentrations. The total hardness of the

Arkansas River water above Canon City commonly ranges from 40 to 275 mg/l and the dissolved solids concentrations range from 60 to 350 mg/l. The total hardness and dissolved solids concentrations increase to more than 200 mg/l and from 500 to 600 mg/l, respectively, near Pueblo, Colorado (U. S. Department of the Interior, Bureau of Reclamation, 1972).

Information relevant to surface water quality in the Canon City area is available from selected locations along the Arkansas River and its tributaries. Principal agencies in the collection of water quality data on the Arkansas River and streams in the area are Cotter, the Colorado Department of Health, and the U. S. Geological Survey.

Cotter maintains two water quality sampling sites on the Arkansas River near Canon City at stations located near Grape Creek and Fourmile Road. Water quality data for these sampling sites have been reported by both Logan (1980) and Cotter (1980) and are included in Appendices C and D. These data suggest that the river near Canon City is moderately hard and alkaline.

Results of additional surface water quality samples collected from miscellaneous sites within and near the Cotter mill site have also been reported by Logan (1980) and Cotter (1980). The sampling sites are noted in Table 4-4 and the related quality data are included in Appendix D. The quality data for the SCS reservoir on Sand Creek indicate excessive concentrations of sulfates and total dissolved solids (TDS). Quality data for the SCS spring also indicate excessive sulfate and TDS concentrations, and those for Wilkerson Spring indicate moderately high TDS concentrations.

Historically, the Colorado Department of Health performed a water quality survey of the Arkansas River from November, 1971 through June, 1972.

The purposes of this survey were (Misbach, C.T., 1973):

1. To determine the existing water quality.
2. To determine if the Arkansas River and tributaries were meeting the Water Quality Standards of the State of Colorado.
3. To determine effluent data on point and nonpoint sources of pollution and the effect of these sources on the quality of the streams.
4. To determine if wastewater treatment plants discharging to the Arkansas River and its tributaries were in compliance with State Water Quality Standards.
5. The collection and tabulation of water quality data was to be used in preparation of the Water Quality Management Plan for the Arkansas River Basin.

Both chemical and bacteriological analyses were made of collected water samples. Samples were collected from the Arkansas River and from major tributaries at their confluences with the Arkansas River. Also, wastewater treatment plants which discharged to the Arkansas River and its tributaries were composite sampled.

Results of the historic water quality survey indicated that the Arkansas River was in compliance with the Water Quality Standards for Colorado existing at that time, except for point source discharges in violation of the Basic Standards, Paragraph A, which states that all wastes capable of treatment prior to discharge must receive secondary treatment with a minimum of 80 percent BOD removal. The municipal wastewater treatment facility at Canon City reportedly removed less than 80 percent BOD when its discharge was sampled. Two other point discharges which reportedly served to degrade the quality of the Arkansas River were Canyon Concrete Company in Canon City and a dairy with washwater and confinement area discharges to Plum Creek, a tributary to the Arkansas River near Florence, Colorado, located east of the Cotter mill site.

These latter point discharges, however, were reported not to degrade the quality of the Arkansas River below existing State Water Quality Standards (Misbach, G. T., 1973).

COTTER CORPORATION
REVISED STATION LIST
Effective December 1, 1980

<u>Old No.</u>	<u>New No.</u>	<u>Location</u>
6	106	Portec
11	111	Salardino
14	114	DiOrto
17	117	Hahn
18	118	A. M. Greer (Creek)
19	119	Seeley
20	120	Calhoun
21	121	Cooper
22	122	Martin
23	123	Blossom
24	124	Merlino
29	129	Caldwell
35	135	Golf Course
36	136	McMillan No. 2
37	137	McKellar
38	138	Bosco Field
39	139	Bosco House
40	140	Ransom House
41	141	Ransom Field
42	142	Peterson
44	144	Boughton
	303	OW-1A
	313	OW-5B
	314	OW-5A
	315	OW-14C
	316	OW-14B
	317	OW-14A
	324	OW-11
	325	OW-12
	326	OW-13C
	327	OW-13B
	328	OW-13A
	329	OW-15
	330	OW-16
	331	OW-17
	332	Wolf Park Mine
	333	Cotter #1
	334	Cotter #2
	335	Cotter #3
	336	Cotter #4
	337	Cotter #5
	338	Cotter #6
	502	Arkansas River at Grape Creek
	504	Arkansas River at Four Mile
	505	SCS Reservoir
	515	Sand Creek NW of Mill
	518	Main Impoundment
	519	Plum Creek

TABLE 4-1. Revised List of Surface and Groundwater Monitoring Stations.

COTIER REVISION
REVISED STATION LIST
Effective December 1, 1980
Page 2

<u>Old</u> <u>No.</u>	<u>New</u> <u>No.</u>	<u>Location</u>
	520	DeWeese Dye Ditch, upstream of confluence with Forked Gulch
	521	Forked Gulch as it crosses under Western Forge Road
	522	Unnamed channel as it crosses under Western Forge Road
	523	Sand Creek at toe of SCS Dam
	524	Pool behind SCS Dam on Sand Creek
	525	Unnamed small impoundment
	526	DeWeese Dye Ditch, upstream of confluence with unnamed channel
	527	Unnamed channel upstream of DeWeese Dye Ditch
	528	Unnamed tributary to Sand Creek as it crosses under mill entrance road
	529	Pool behind Diversion Catch Dam
	530	Unnamed tributary to Sand Creek upstream of Oak Creek Grade Road and southeast of gap in ridge
	531	Unnamed tributary to Sand Creek upstream of Oak Creek Grade Road and southwest of gap in ridge
	701	Pond 1 Trench
	702	Pond 2 Trench
	703	Pond 3 Trench
	704	Main underdrain, composite
	705	Main underdrain, northwest
	706	Main underdrain, toe
	707	Main underdrain, south
	708	Trench south of SCS reservoir
	710	Toedrain
	711	Subdrain North
	712	Subdrain Middle
	714	S-5 Trench East
	715	S-5 Trench Middle
	716	S-5 Trench West

TABLE 4-2

EXPANDED LIST OF SURFACE AND GROUNDWATER QUALITY PARAMETERS FOR ANALYSES

Aluminum	Molybdenum
	Nickel
Arsenic	
	pH*
Bicarbonate	
	Polonium-210
Cadmium	Potassium
Calcium	Radium-226
Carbonate	Selenium
Chemical Oxygen Demand	
Chloride	
	Sodium
Copper	Specific Conductance*
Dissolved Oxygen*	Sulfate
Dissolved Solids, Total	Suspended Solids, Total
	Temperature*
Hardness	Thorium-230
Iron, Soluble	Uranium
Lead	Vanadium
Lead-210	Zinc
Magnesium	
Manganese	

* Field determinations.

TABLE 4-3

SUMMARY OF THE ANALYTICAL PROCEDURE FOR OBTAINING v - D_L FAMILIES OF SOLUTIONS

x flow distance (ft)	$t_{1/2}$ time for 50% concentration to appear (years)	v average flow velocity (ft/yr)	Δt span, in units of time, of dispersed zone (years)	α_L medium dispersivity, equation 4-4 (ft)	D_L coefficient of longitudinal dispersion (ft ² /yr)
7125	21	339.3	2	5.1	1744.5
7125	21.5	331.4	3	11.0	3657.4
7125	22	323.9	4	18.7	6069.9
7125	23	309.8	6	38.6	11950.9
7125	24	296.9	8	63.0	18700.5

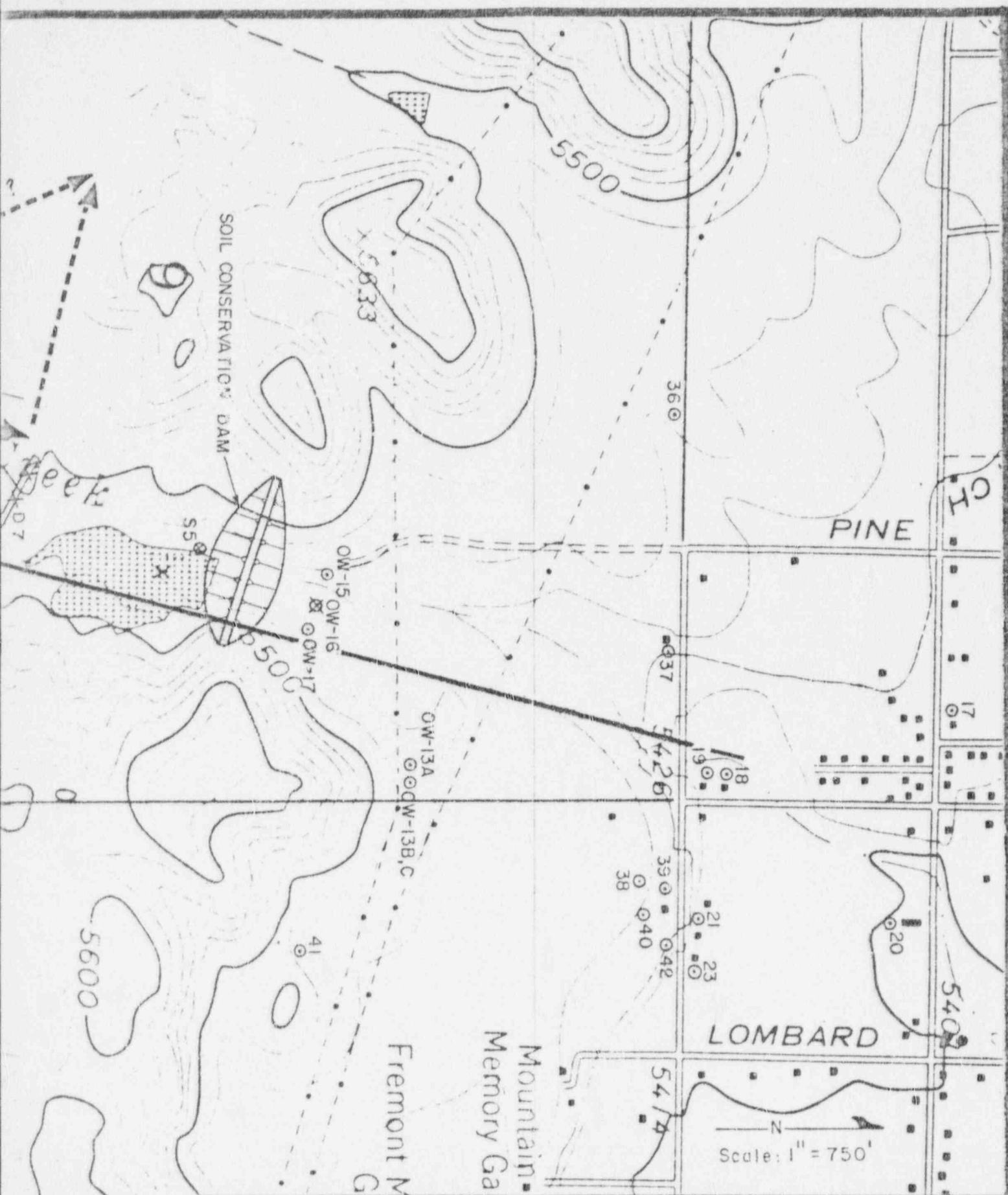
TABLE 4-4

SURFACE WATER SAMPLING STATIONS FOR COTTER PROJECT (BY LOGAN, 1980)

<u>Station Number</u>	<u>1/</u>	<u>Station</u>	<u>2/</u>
501	x	DeWeese-Dye ditch at Cooper's	S1
502	M	Arkansas R., Grape Crk.	
503	x	Arkansas R, 9th Ave.	
504	M	Arkansas R., 4 Mile	S4
505	M	SCS Reservoir	S5
506		Smaller spring	S6
507		Canon City seepage	S7
508		Retzer spring	S8
509		County ROW spring	S9
510		McHale spring	S10
511		Mullins spring	S11
512		Oloman spring	S12
513	x	SCS spring, S.end reservoir	S13
514	x	Wilkerson spring	S14
515	M	Sand Crk. NW of mill	
516		Sand Crk. in Lincoln Park	S2
517		Brookside Drain	S3

1/ x = The chemical record has been assembled.
M = A monitoring station.

2/ = Former station number.

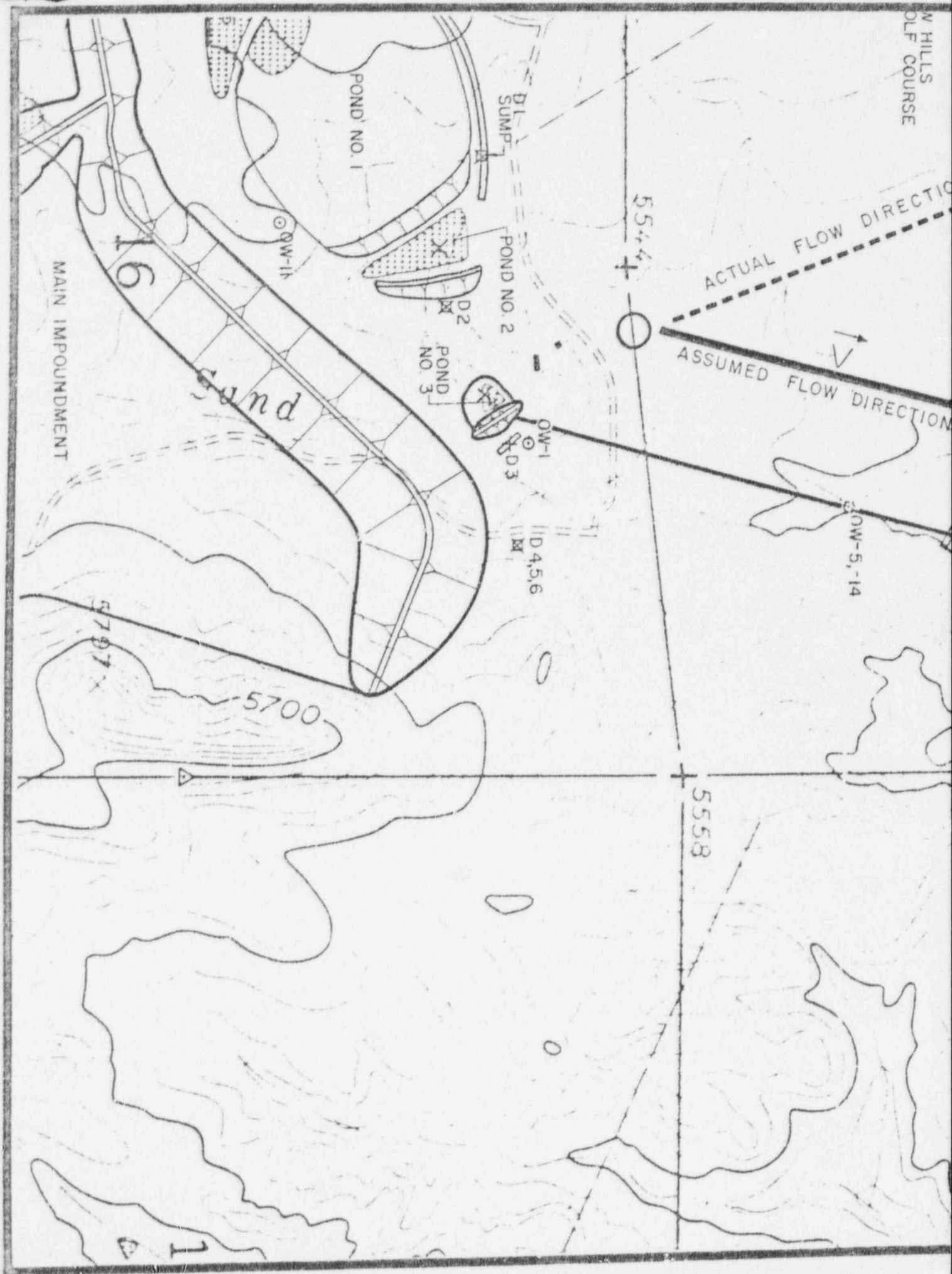


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ORIENTATION OF SECTION USED FOR DISPERSION ANALYSIS, AND A
SCHEMATIC OF POSSIBLE GROUNDWATER FLOW DIRECTIONS

PROJECT #102 B 100

FIGURE: 4-1



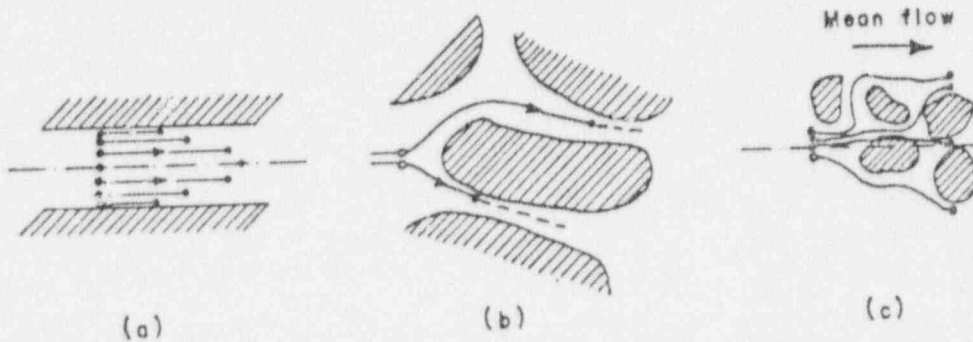
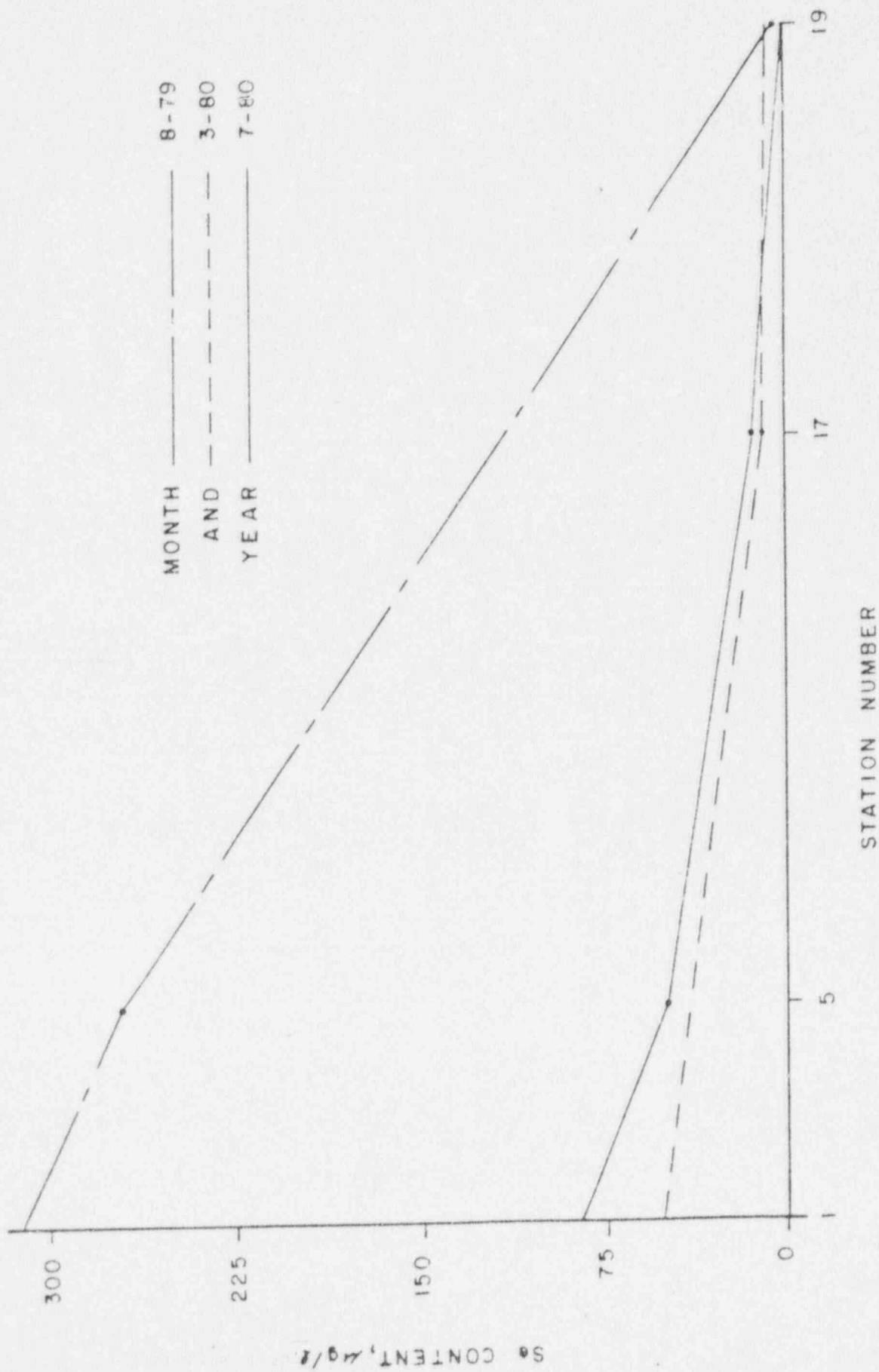

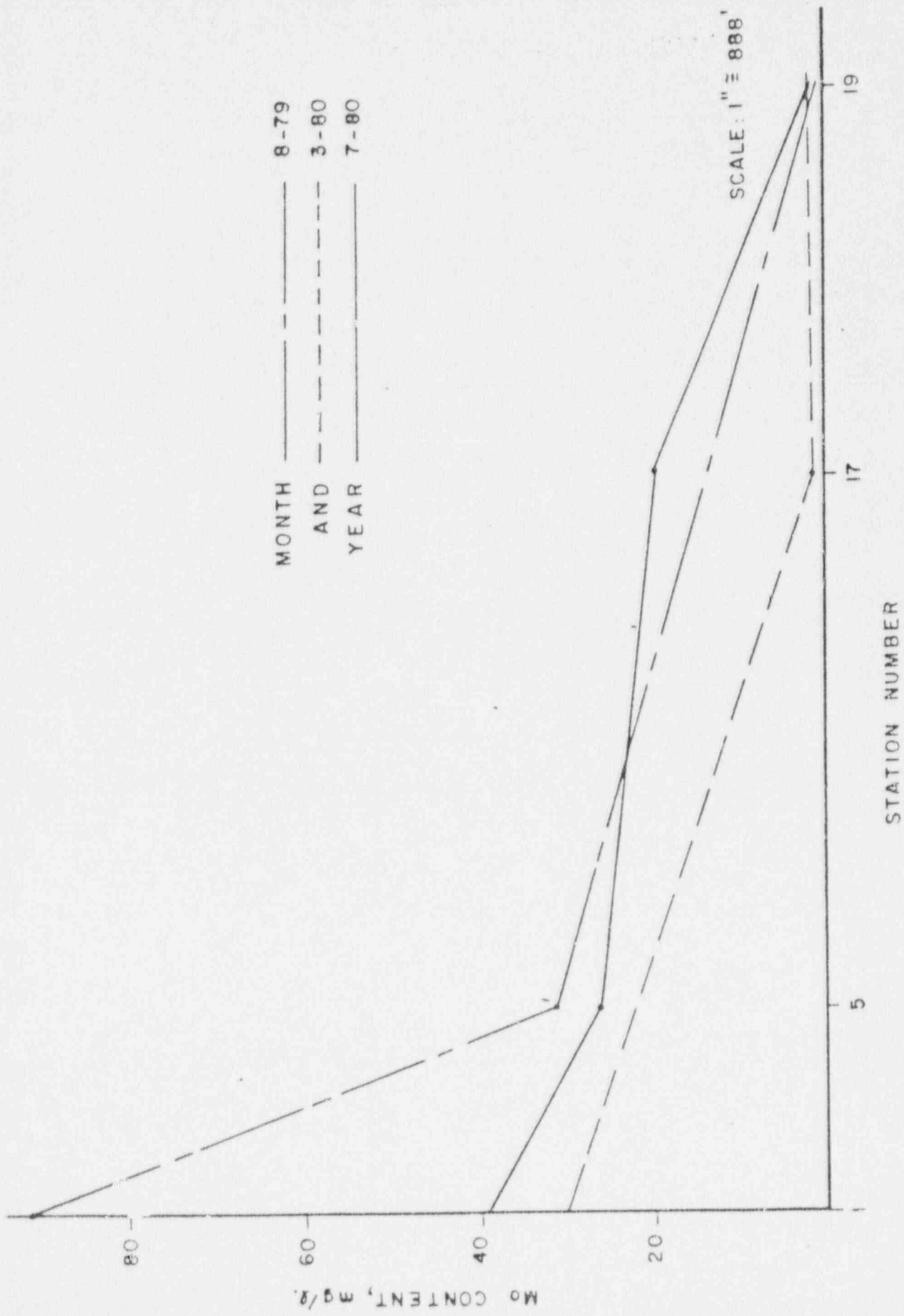


Figure 4-2. The Components of Dispersion. Fluid Particles: \circ at time t ; \bullet at time $t + \Delta t$. (after Fried, 1975)



	Se content AS A FUNCTION OF DISTANCE FROM STATION 1, NORTHEASTERLY DIRECTION	FIGURE: 4-3 PROJECT #CCT.102B100
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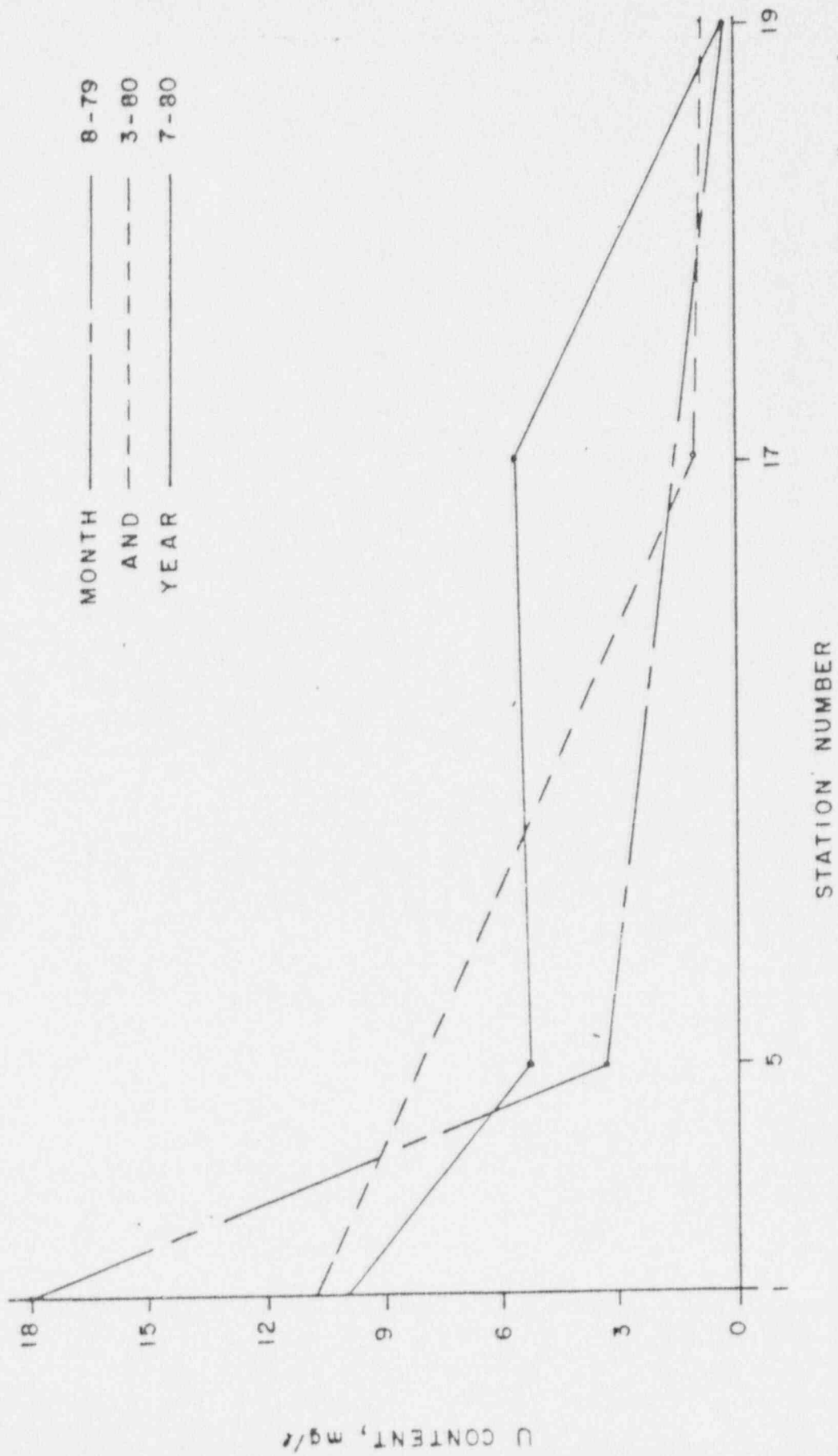
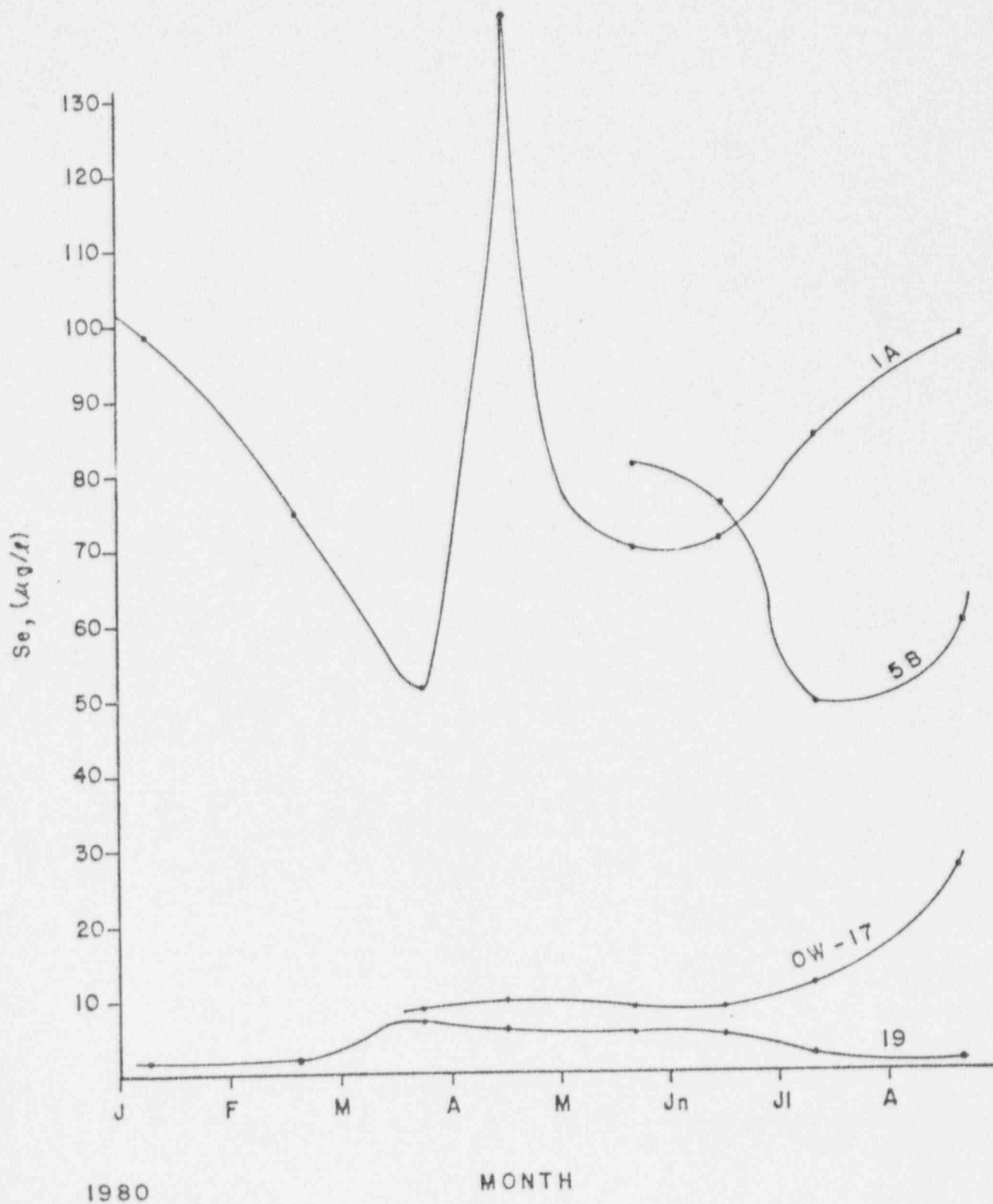


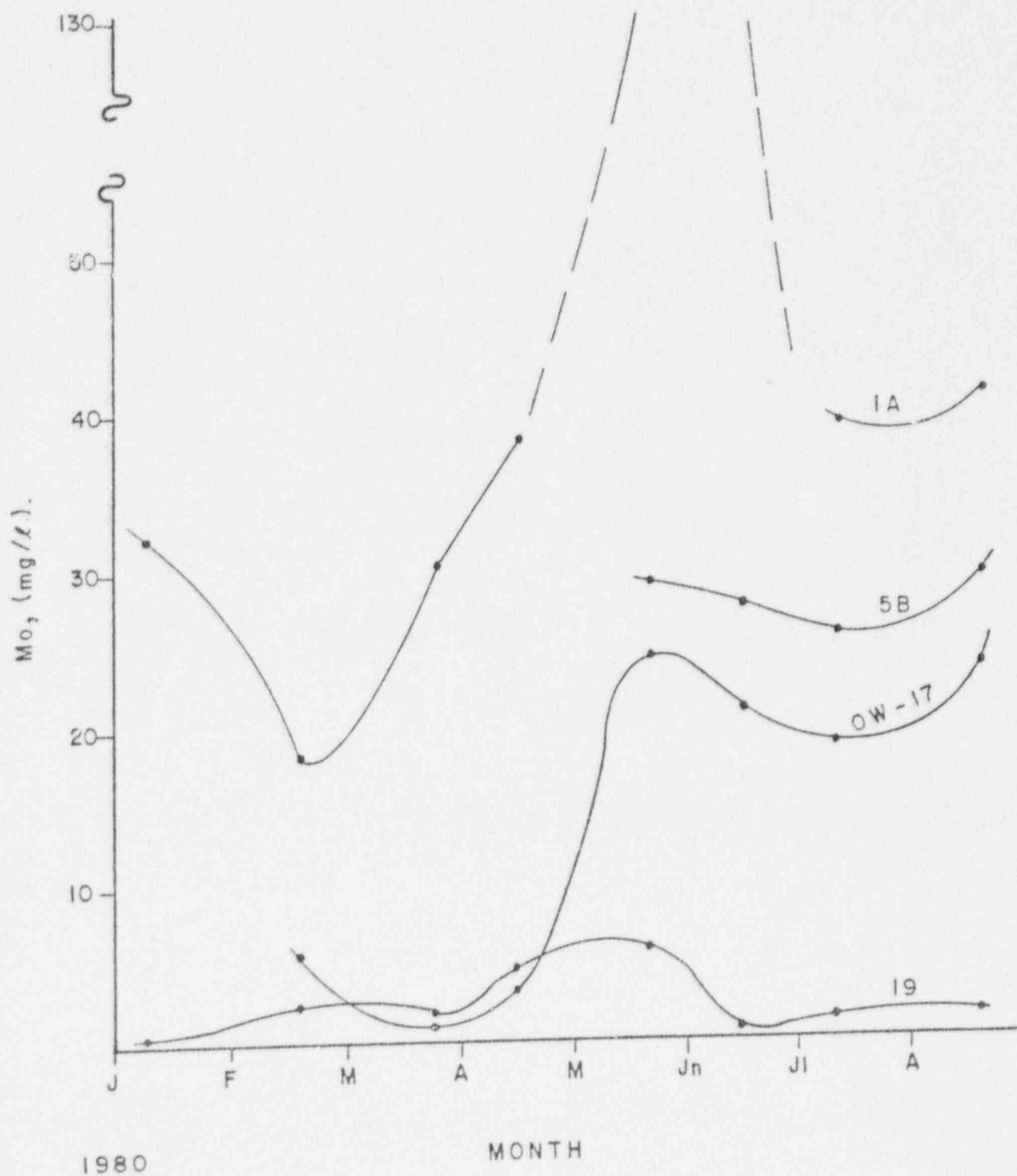
FIGURE: 4-5

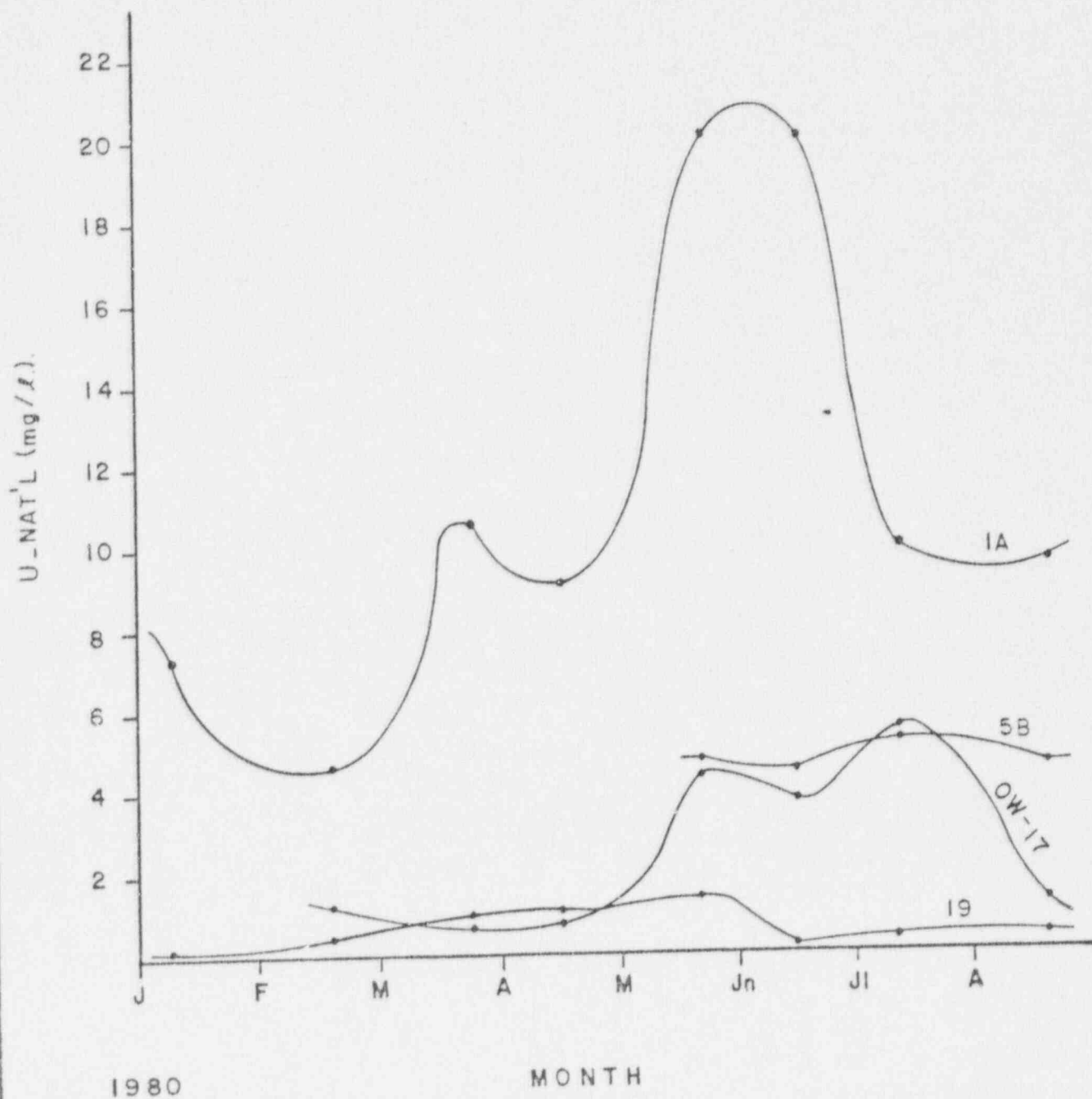
U CONTENT AS A FUNCTION OF DISTANCE FROM
STATION 1, NORTHEASTERLY DIRECTION

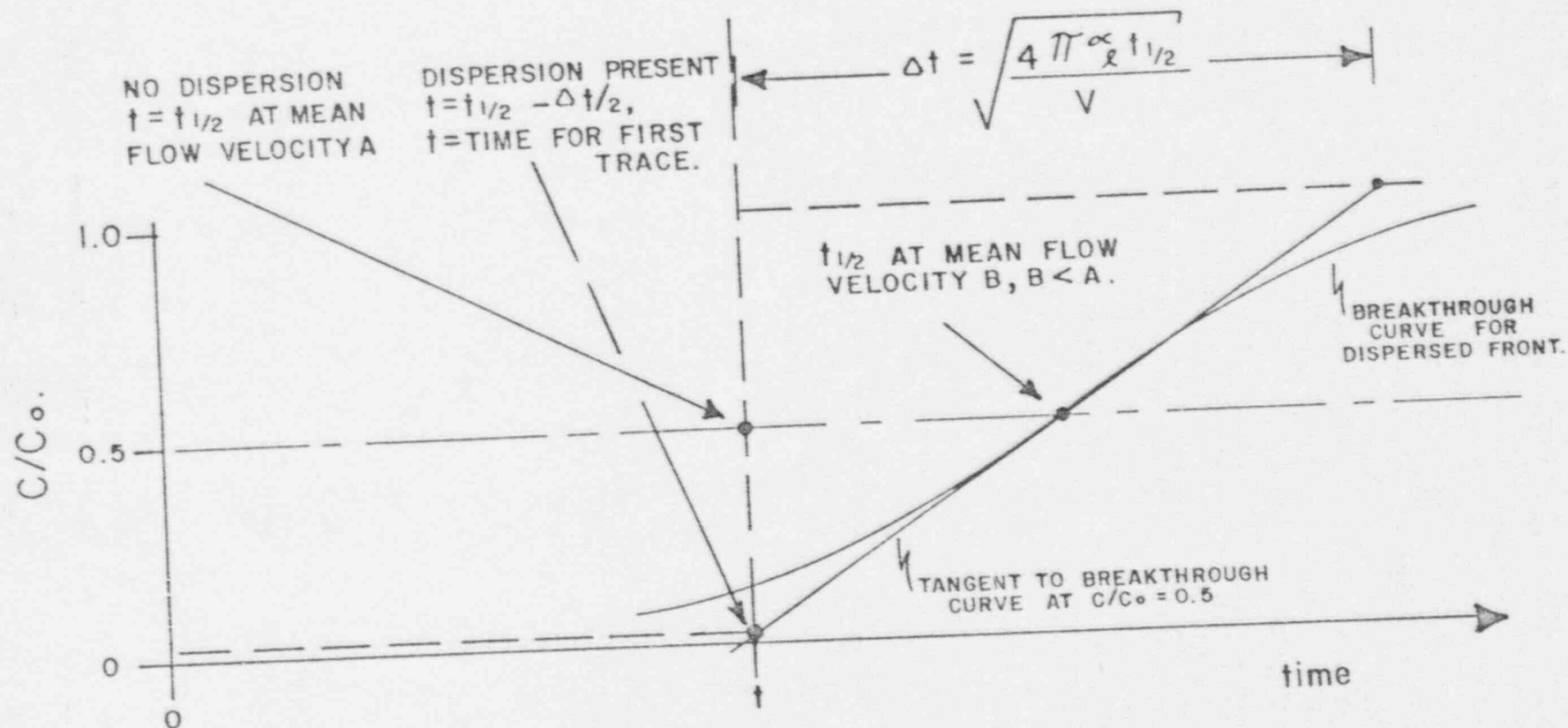
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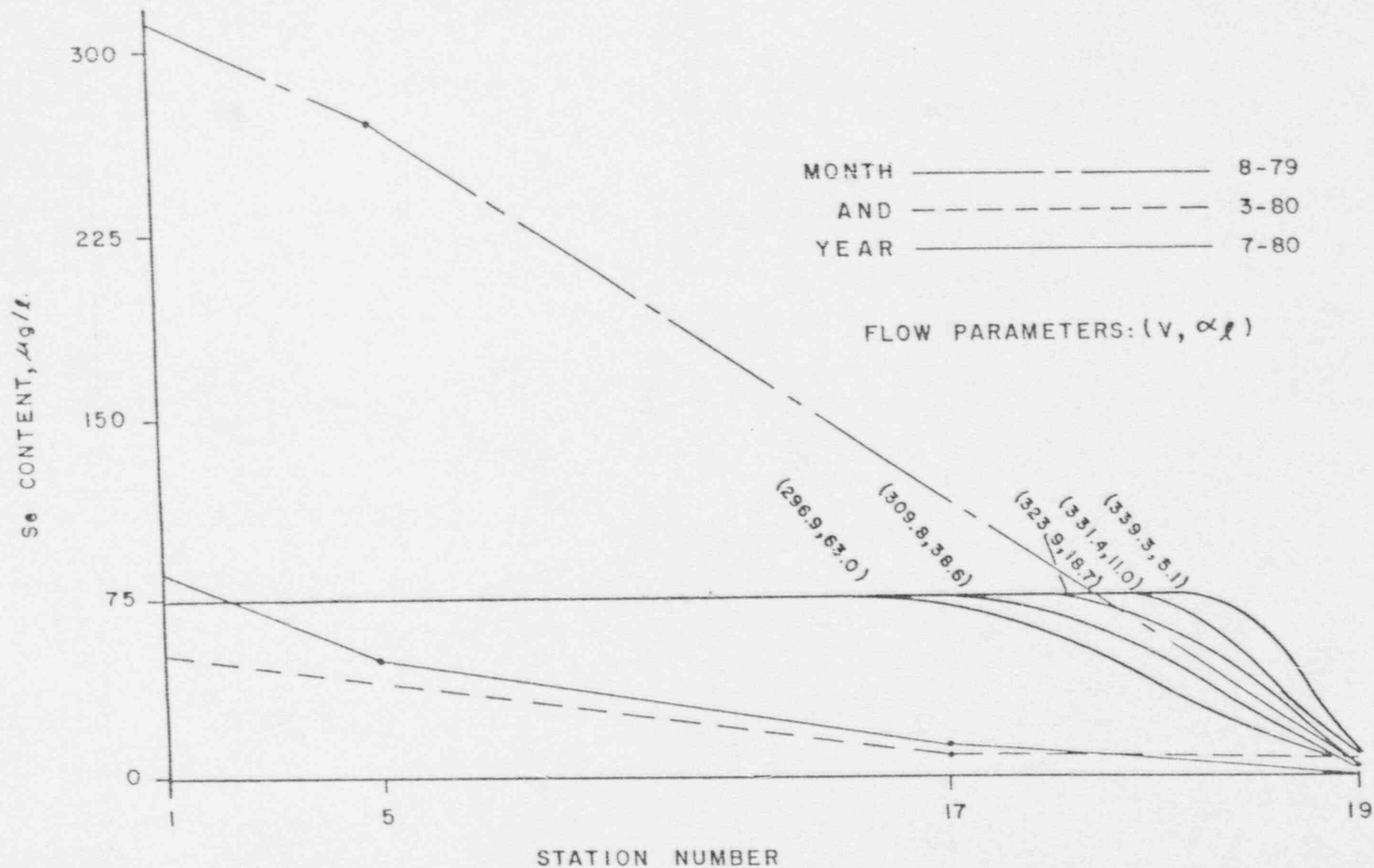
PROJECT # COT.102B100

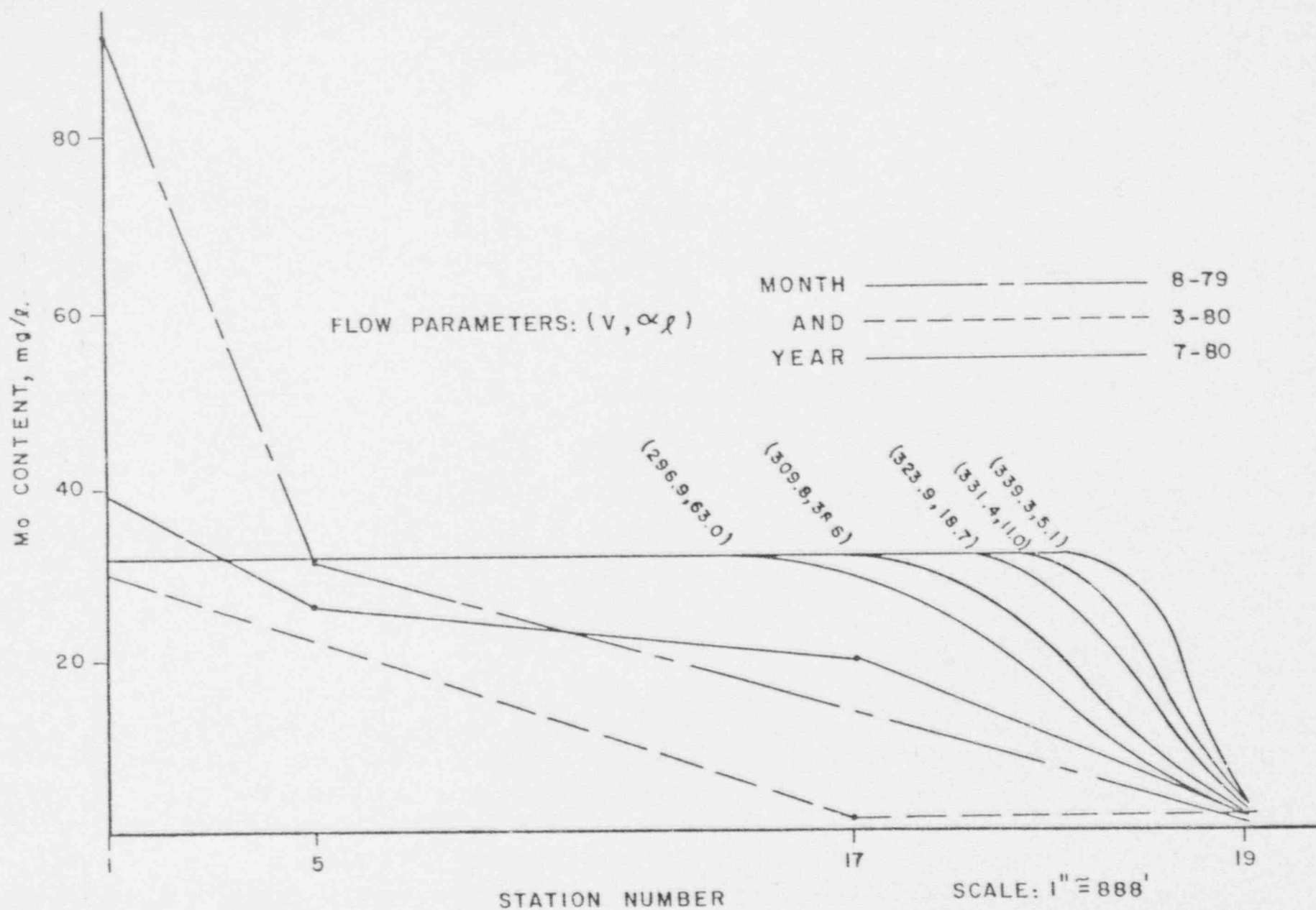


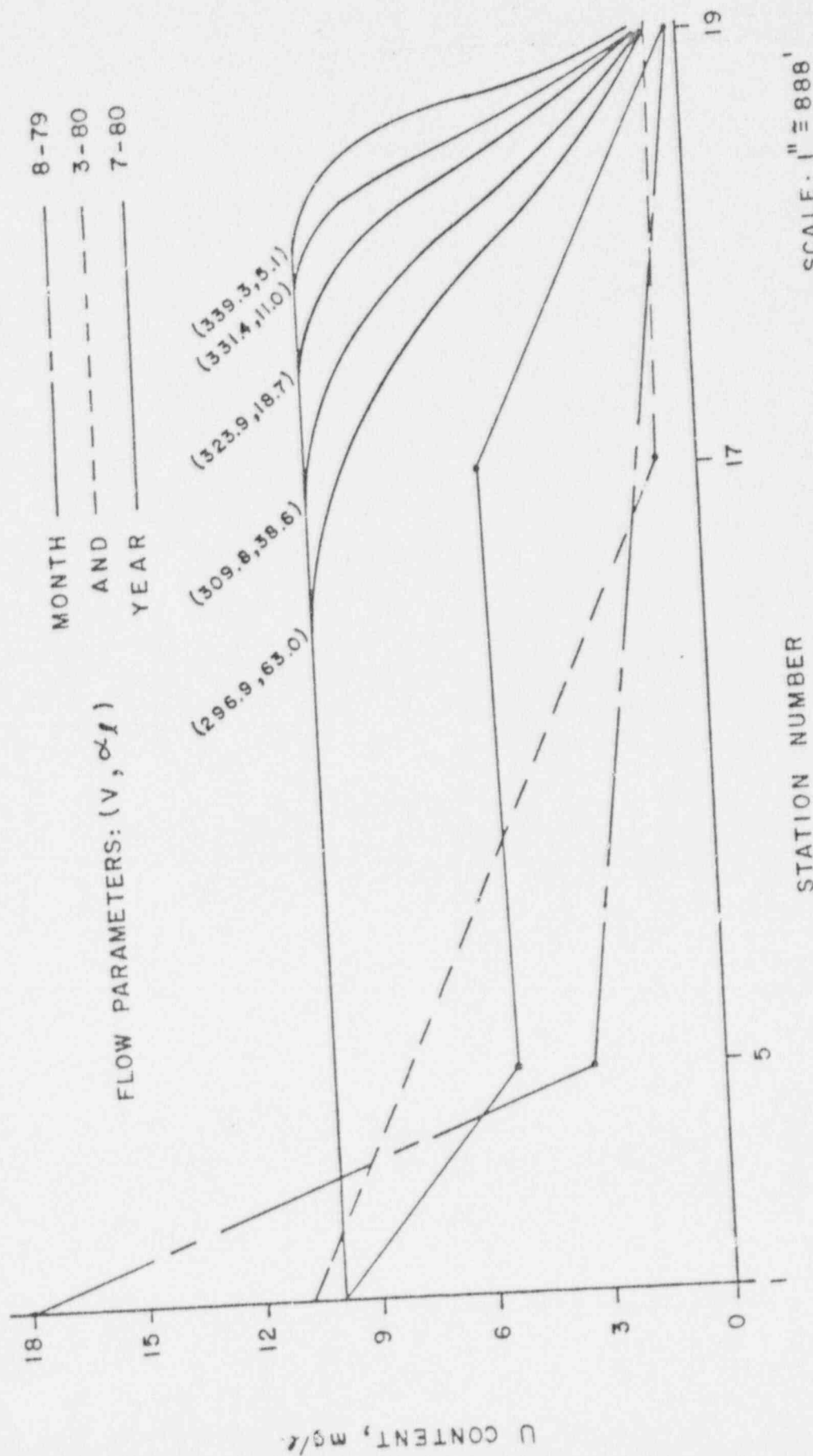












FIELD AND ANALYTICAL CONCENTRATION PROFILES FOR
U CONTENT AS A FUNCTION OF DISTANCE FROM
STATION 1, NORTHEASTERLY DIRECTION

FIGURE: 4-12

PROJECT # COT.102B100

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APPENDIX A

DERIVATION OF THE CONVECTIVE DISPERSION EQUATION

APPENDIX A. DERIVATION OF THE CONVECTIVE DISPERSION EQUATION

Let a control volume in a saturated porous medium contain a fluid of overall density ρ and concentration C of dissolved species ζ . The medium has porosity n . The control volume has volume V and surface area A .

Expressing C as $\frac{\text{mass of species } \zeta}{\text{mass of fluid in control volume } V}$

then $\rho C = \frac{\text{mass of species } \zeta}{\text{volume of fluid in control volume } V}$

where $\rho = \frac{\text{mass of fluid in control volume } V}{\text{volume of fluid in control volume } V}$

Expressing that the time rate of change of mass of species ζ in V is equal to the net flux of species ζ through the control surface A in the absence of sources or sinks, then:

$$\frac{\partial}{\partial t} \int_V \rho n C \, dV + \int_A \vec{J} \cdot d\vec{A} = 0 \quad [A-1],$$

where \vec{J} is the convective and dispersive flux of ζ across dA , usually written as:

$$\vec{J} = \underbrace{\rho C \vec{q}}_{\substack{\text{transport} \\ \text{by} \\ \text{convection}}} - \underbrace{\rho n \underline{D} \nabla C}_{\substack{\text{transport} \\ \text{by} \\ \text{dispersion}}} \quad [A-2],$$

where \underline{D} is the dispersion tensor, and ∇ is the del operator. Substituting [A-2] into [A-1] and transforming the surface integral by the divergence theorem,

$$\frac{\partial}{\partial t} (\rho n C) + \nabla \cdot (\rho C \vec{q}) - \nabla \cdot (\rho n \underline{D} \nabla C) = 0$$

Expanding and collecting like terms,

$$\begin{aligned} C \left(\frac{\partial}{\partial t}(\rho n) + \nabla \cdot \rho \vec{q} \right) + \rho n \frac{\partial C}{\partial t} + \rho \vec{q} \cdot \nabla C \\ = \nabla \cdot (\rho n \underline{D} \nabla C) \end{aligned} \quad [A-3]$$

We note that the bracketed term in equation A-3 is identically zero, for it represents the conservation of mass for the entire fluid. Finally, dividing by ρn ,

$$\frac{\partial C}{\partial t} + \vec{v} \cdot \nabla C = \frac{1}{\rho n} \nabla \cdot (\rho n \underline{D} \nabla C) \quad [A-4],$$

where \vec{v} is the average pore velocity of the whole fluid.

One usually assumes the medium to be incompressible and approximates the fluid density as a constant. Then for one-dimensional flow in the "x" direction and constant longitudinal dispersion,

$$\frac{\partial C}{\partial t} = D_L \frac{\partial^2 C}{\partial x^2} - v_L \frac{\partial C}{\partial x} \quad [A-5]$$

is the governing dispersion equation.

Note that this equation is nothing more than a statement of conservation of mass. It poses no restrictions on the potential field which causes flow.

APPENDIX B 1

DEVELOPMENT OF A SECTION FROM WELL NUMBER 1 AT THE MILL TO WELL NUMBER 19

APPENDIX B

1. Development of a Section from Well #1 at the Mill to Well #19:

Wells along this section include 1,5,14,17,13,19. Table B-1 summarizes their open intervals.

Table B-1. Summary of open intervals for well along a section from Cotter well #1 to well #19 in Lincoln Park.

		WELL					
		1.	5.	14.	17.	13.	19.
OPEN	C	9-20	20-35	215-350	0-46	5-47	0-28
INTERVAL	B	22-42	35-49	370-650		74-210	
IN							
FEET	A	58-99	55-97	675-751		244-277	

In order to obtain useful concentration profiles through these wells, proper combinations of open intervals are required. The combinations are shown by numbered arrows. Combination 2 was chosen for data reduction, since it has the most common open intervals.

The profile then consists of wells 1B, 5B, 17, 13C, and 19. Well 13C is eliminated because no data has been recorded for it. Wells 13B, 13A and 14 have open intervals far too different than the rest of the profile and are not adequate sources of data.

Well 1C, data would substitute for well 1B data, but well 1C appears not to have been monitored. Therefore, 1A replaces 1B.

Well 5C replaces well 5B if, for the latter, data is unavailable. If 5C also has no data, 5A is not used as a substitute; it would make the overall profile less valid.

The profile has monitor points and distances from station 1 as indicated in Figure B-1. Table B-2 consists of the data used to construct the profiles found in Figures 4-3 through 4-5.

TABLE B-2. Concentrations of selected elements for the Section from Well #1B to Well #19.

Date	Element	WELL			
		1B	5B	OW-17	19
28, Aug. 79	Se $\mu\text{g}/\text{l.}$	310	*280		† 5
	Mo $\text{mg}/\text{l.}$	92	* 31		† 2
	U-NATL $\text{mg}/\text{l.}$	18	*3.2		† .06
22, Mar. 80	Se $\mu\text{g}/\text{l.}$	** 52		8.	7.
	Mo $\text{mg}/\text{l.}$	**30.4		1.1	2.0
	U-NATL $\text{mg}/\text{l.}$	**10.7		.96	.8
11, Jul. 80	Se $\mu\text{g}/\text{l.}$	**85.	48.	12.	1
	Mo $\text{mg}/\text{l.}$	**39.	25.6	19.1	1.1
	U-NATL $\text{mg}/\text{l.}$	**10.	5.3	5.4	.3

Source: Logan, 1980

** USING WELL 1A DATA.

* USING WELL 5C DATA.

† DATA FROM 3-SEP-79.

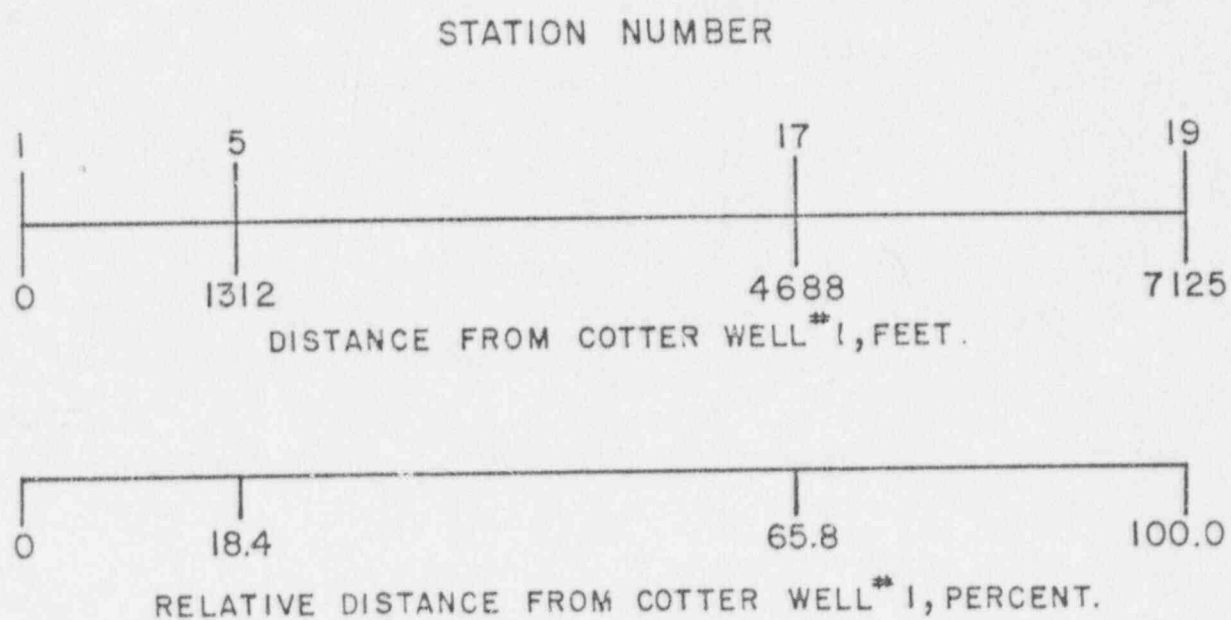


Figure B-1. Monitor Stations and Their Relative Distances From Cotter Well Number 1

APPENDIX B 2

TIME SEQUENCE OF CONCENTRATIONS FOR SELECTED ELEMENTS
AND WELLS IN THE CROSS-SECTION

2. Time sequence of concentrations for selected elements and wells in the cross-section:

Tables B-3 through B-5 were constructed from the data compiled in Appendix C, and represent the most recently compiled chemical trends. A dash in the table represents no data available for a particular well at a particular time. These tables are the basis for Figures 4-5 through 4-7.

TABLE B-3. Se concentration at selected wells, 8-Jan.-80 to
19-Aug.-80.

($\mu\text{g/l}$)

DATE	WELL			
	1A	5B	OW-17	19
8 JAN.	98	-	-	1
18 FEB.	75	-	-	1
22 MAR.	52	-	8	7
16 APR.	166	-	9	5
20 MAY	69	82	8	5
JUN.	72	77	7	5
10 JUL.	85	48	12	1
19 AUG.	98	60	26	1

TABLE B-4. Mo concentrations at selected wells, 8-Jan.-80 to 19-Aug.-80.

($\mu\text{g}/\text{L}$)

DATE	WELL			
	1A	5B	OW-17	19
8 JAN.	32.1	-	-	.57
18 FEB.	18.6	-	5.7	2.3
22 MAR.	30.4	-	1.1	2.0
16 APR.	37.9	-	3.3	4.3
20 MAY	146.8	29.7	24.0	6.0
JUN.	129.0	28.3	21.3	.5
10 JUL.	39.1	25.6	19.1	1.3
19 AUG.	41.7	29.5	23.8	1.5

TABLE B-5. U-NAT'L Concentrations at Selected Wells, 8-Jan.-80 to 19-Aug.-80.

(mg/l)

DATE	WELL			
	1A	5B	OW-17	19
8 JAN.	7.19	-	-	.164
18 FEB.	4.63	-	1.36	.489
22 MAR.	10.7	-	.96	.834
16 APR.	9.14	-	.69	1.04
20 MAY	20.26	4.92	4.6	1.33
JUN	20.11	4.57	3.87	.14
10 JUL.	10.0	5.25	5.41	.3
19 AUG.	9.69	4.66	1.35	.38

APPENDIX C
TABULATION OF GROUNDWATER QUALITY
DATA THROUGH SEPTEMBER, 1980

Portac H6

	V	P	EC	HCO ₃	SO ₄	Cl (mg/l)	U	Mo	Se	Ra	Th (Pb)	Pb	Po	Water Depth
Sept 1979		9.0	1440	76	556	92	0.03	<0.1	<0.05	0.3	0.6	1.30	0.7	746
Oct 1979		9.0	1260	90	571	98	<0.03	0.2	<0.01	0.0	0.0	0.0	0.2	753
Nov 1979		9.0	1610	103	574	99	0.03	<0.1	<0.01	0.2	0.0	7.9	2.0	740
Dec 1979		9.4	1600	79	566	70.5	0.03	<0.1	<0.01	0.4	0.6	13.0	0.0	700
7 Jan 1980		9.0	1440	118	575	116.6	0.001	0.08	0.001	0.0	1.3	0.3	0.0	793
12 Feb 1980		9.2	1610	75.6	545	76.4	0.007	0.2	<0.01	0.6	1.6	0.0	0.0	790
25 Mar 1980		9.4	1700	82.5	590	93.9	0.029	0.17	0.008	5.1	0.0	9.0	0.0	821
15 Apr 1980		9.8	1450	77	549	93.5	<0.03	0.2	<0.05	0.0	0.0	0.0	0.0	810
20 May 1980		9.5	1540	114.7	531.2	85.0	<0.01	<0.1	<0.05	0.5	0.0	2.4	0.0	780
5 Jun 1980		7.5	1480	87	553	77.0	0.02	<0.1	<0.01	0.0	0.0	0.0	0.0	725
23 Jul 1980		8.24	1570	92	535	89.0	0.01	<0.02	0.001	0.1	2.3	0.0	0.0	733
19 Aug 1980	<0.02	8.05	650	180	640	61.0	0.03	0.7	<0.001	0.0	0.0	0.1	0.0	726
4 Sep 1980	0.05	8.51	1550	114	637	91.0	0.012	0.2	<0.001	0.1	0.0	0.0	0.0	643

Seeding #111

Date	PM	EC	WCS	SI	CI	(mg/l)	M _o	Se	step	TL (pCi/l)	TL (pCi/l)	TL (pCi/l)
7 Jan 1980	6.3	1290	534	302	25	0.13	40.1	4005	1.2	0.0	11.0	0.9
13 Feb 1980	6.8	1350	564	314	24.5	0.03	40.1	4001	2.7	0.0		0.2
25 Mar 1980	4.8	1350	576	275	23.5	0.00	40.1	4001	1.3	0.0		0.0
15 Apr 1980	No sample		5514	120	32.8	0.008	0.05	4001	1.3	0.0	0.6	0.3
15 Apr 1980	7.0	1400	4734	115	29.6	0.006	0.11	4007	1.3	0.8	0.0	0.0
15 Apr 1980	7.0	1100	577	303	26.5	0.003	40.1	4001	0.8	0.0	0.7	0.0
15 Apr 1980	7.0	1240	4456	300.4	27.5	0.001	40.1	4005	2.8	1.1	0.0	0.0
6 Jul 1980	7.0	125	414	316	27.5	0.07	40.1	4001	2.0	0.0	2.5	0.0
6 Jul 1980	6.0	1310	446	330	28.5	0.01	40.1	4001	0.1	0.0	0.1	0.0
19 Aug 1980	7.92	1470	462	182	12.5	0.02	0.3	4007	0.0	0.0	0.1	0.0
11 Sep 1980	8.18	1300	663	325	24.5	0.018	40.2	4000	1.4	0.0	0.0	0.3

Di Orio #14

		pH	urine EC	HCO ₃	SO ₄	Cl	(mg/L)	Mo	Se	216 Pa	230 Th	210 Pb	210 Po
Sep	1979	6.6	529	3710	41	715	0.03	0.1	< 0.005	0.0	2.6	4.5	0.0
Oct	1979	6.4	530	390	42	65	0.06	0.1	< 0.001	0.5	0.0	1.0	0.2
Nov	1979	7.8	530	377	40	60	0.09	0.1	< 0.001	0.4	0.7	15.0	0.0
Dec	1979	6.4	545	375	43	65	0.07	< 0.1	< 0.001	0.1	0.0	10.0	0.0
7 Jan	1980	6.5	470	318	31	110.3	0.018	< 0.05	0.06	0.0	0.7	3.0	0.2
12 Feb	1980	7.0	420	343.8	10	126	0.018	0.6	< 0.001	0.0	1.0	1.5	0.0
18 Mar	1980	7.6	620	375.8	10	56	0.005	< 0.01	0.06	0.9	0.0	0.9	0.0
15 Apr	1980	7.4	395	375	38	7.0	0.03	0.2	0.15	0.2	7.0	4.2	0.3
19 May	1980	7.3	450	297	33.3	71.0	0.01	< 0.1	< 0.005	0.1	1.6	1.4	0.0
4 Jun	1980	7.0	450	205	37	105	0.02	< 0.1	0.003	0.8	0.0	3.0	0.2
9 Jul	1980	7.7	128	34	26	65	< 0.01	< 0.02	0.002	0.0	0.0	0.0	0.0
18 Aug	1980	8.0	1580	360	434	280	0.05	0.2	< 0.001	0.3	0.0	0.8	0.0
11 Sep	1980	8.5	500	423	49	190	0.05	< 0.2	8.005	0.1	0.0	12	0.0

Creek #118
(G. 200)

V	PH	EC	HCO ₃	SO ₄	Cl	Mn	Fe	Si	Ca	Mg	Na	Al	SiO ₂	SiO ₂ /Al ₂ O ₃	SiO ₂ /MgO	SiO ₂ /FeO	SiO ₂ /Na ₂ O	SiO ₂ /K ₂ O	SiO ₂ /Total
8 Jan 1950	7.2	590	251	140	51.7	0.13	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
13 Feb 1950	7.3	710	312.3	15	5.0	0.108	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
20 Mar 1950	7.5	790	324.1	10	12.9	0.19	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
15 Apr 1950	—	N ₂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19 May 1950	7.7	730	251	190	140	0.23	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
2 Jun 1950	8.2	4070	229	54	10	0.7	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
18 Aug 1950	8.13	460	259	165	6.5	0.02	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
1 Sep 1950	8.73	430	297	41	10.0	0.043	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
26 Sep 1950	8.69	520	331	83	6.5	0.141	0.05	0.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3

Sealey #19

6

	PH	EC	HCO ₃	SO ₄	Cl	NO ₃	Se	70% Ca	70% Ca (pH 11)	70% Ca	70% Ca	Water
5-1980	6.9	43.9	1251	27	515	0.06	0.05	0.0	0.0	0.4	0.2	10.8
13-1980	7.5	44.0	1245	45	50	0.08	0.05	0.0	0.0	0.0	0.2	11.1
14-1980	7.6	35.1	790	58	75	0.05	0.05	0.0	0.0	0.0	0.7	11.0
15-1980	7.7	6.10	363	15	38.4	0.164	0.05	0.0	0.0	0.0	0.0	16.5
16-1980	7.4	1750	3045	515	35.3	0.087	0.05	0.0	0.0	0.0	0.1	19.0
17-1980	7.5	2000	351.4	770.0	33.4	0.834	0.007	0.0	0.0	0.0	0.2	21.3
18-1980	7.5	1750	213	773	44	1.03	0.005	0.0	0.0	0.0	0.0	24.0
19-1980	7.6	3000	3640	1242	645	1.33	0.004	0.0	0.0	0.0	0.2	25.0
20-1980	7.0	225	77	33	85	0.014	0.005	0.0	0.0	0.0	0.3	23.7
21-1980	7.1	180	68	32.1	8.0	0.04	0.004	0.0	0.0	0.0	0.0	21.0
22-1980	8.35	760	307	144.4	125	0.24	0.004	0.0	0.0	0.0	0.2	22.0
23-1980	8.64	680	306	125	105	0.30	0.001	0.0	0.0	0.0	0.2	14.3
24-1980	8.3	800	307	142.2	145	0.36	0.001	0.0	0.0	0.0	0.1	14.5
25-1980	8.16	830	326	298	105	0.41	0.001	0.0	0.0	0.0	0.9	17.35
26-1980	8.14	710	338	285	140	0.34	0.001	0.0	0.0	0.0	0.3	12.5
27-1980	7.73	630	320	109	10.0	0.298	0.000	0.0	0.0	0.0	0.6	17.3

Calhoun #20

Date	pH	EC	HCO ₃	SO ₄	Cl (mg/l)	U	Mo	Se	SRP	22.7L (pCi/l)	210Pb	213Po	Water Depth
1-17	6.9	710	310	79	57	.110	.01	< .005	.01	.10	11.0	.90	9.2
Oct 17	7.0	650	403	41	11	.06	.04	< .001	.02	.00	.00	.15	9.7
Nov 17	7.8	520	343	21	50	.03	.02	< .001	.04	.00	.00	.10	11.2
Dec 17	6.9	470	341	36	30	.03	.02	< .001	.00	.00	.00	.00	15.8
Jan 1980	7.0	460	353	483.9	28.4	.050	.03	< .002	.03	.07	.00	.01	18.2
Feb 1980	7.1	460	309.9	10	30	.006	.02	< .001	.05	.05	.00	.00	21.9
Mar 1980	7.3	540	331.8	10	61.1	.051	.077	< .008	.41	.23	.00	.00	24.1
Apr 1980			No water										
May 1980			No water										
Jun 1980			No water										
Jul 1980			No water										
Aug 1980			No water										
Sep 1980			No water										

9

#73

Sam

	pH	u _{EC}	HCO ₃	SO ₄	Cl (mg/l)	U	Mo	Se	225 P.	230 TH (P.C.I.I.)	210 P ₁₆	210 P ₀	Water Depth
Sep 1979	6.7	405	381	54	1210	0.10	0.3	< 100.5	0.3	4.7	8.1	1.0	17.9
Oct 1979	7.4	590	415	47	140	0.15	1.0	< 100.1	0.2	1.1	6.7	0.5	18.5
Nov 1979	7.5	470	343	48	55	0.16	0.6	< 100.1	0.4	0.0	0.0	0.0	21.0
Dec 1979	6.6	500	318	46	55	0.03	0.2	< 100.1	0.2	0.6	0.0	0.0	22.5
Jan 1980	7.1	520	265	10	22.7	0.052	0.18	< 100.1	0.0	0.0	0.0	0.5	27.45
Feb 1980	7.0	580	273	10	38.4	0.072	0.4	< 100.1	0.2	0.5	0.0	0.1	90.8
Mar 1980	7.8	670	320.1	10	24.5	0.28	0.65	0.13	0.0	0.0	22.8	0.2	36.4
Apr 1980	7.8	930	269	310	37.0	0.23	0.9	< 100.1	1.5	0.0	1.9	0.0	74.1
May 1980	7.3	1500	307.6	567.9	55.0	0.44	2.2	0.05	0.2	1.6	1.9	0.7	36.5
June 1980	7.1	1000	283	312	31.5	0.41	1.4	0.04	0.6	0.0	0.8	0.3	31.5
July 1980	8.09	570	332	71	12.5	0.13	0.4	< 100.1	0.2	1.5	0.0	0.2	16.5
Aug 1980	6.18	500	315	219	10.5	0.06	0.6	< 100.1	0.2	0.0	1.8	0.0	20.0
Sep 1980	7.05	420	332	51	12.0	0.061	< 0.2	< 100.1	0.4	0.0	0.0	0.0	

10

Station A24

Date	pH	Temp	HCO ₃	SO ₄	Cl ⁻ (mg/l)	U	Mn	Se	37C P _a	235 Th (pCi/l)	210 Pb	210 Po
Sept 12	7.1	70.5	383	115	13.0	0.23	0.9	4.005	0.0	0.0	4.5	0.0
Sept 13	7.5	54.0	345	143	15.5	0.25	1.1	4.001	0.1	0.2	4.0	0.7
Sept 14	8.0	73.0	366	122	14.5	0.25	0.7	4.001	0.3	0.1	0.0	0.0
Sept 15	7.0	75.0	352	133	14.0	0.30	0.5	4.001	0.0	0.5	0.0	0.0
Sept 16	6.6	64.0	400	86	3.5	0.154	0.64	4.001	0.0	1.3	0.0	0.3
Sept 17	7.1	61.0	378.2	10	5.7	0.127	0.8	4.001	0.4	1.0	0.5	1.0
Sept 18	7.0	73.0	356.2	10	5.6	*	0.97	*	*	*	*	*
Sept 19	7.6	53.0	352	87	11.5	0.21	1.1	4.005	0.0	0.0	3.4	0.0
Sept 20	7.6	71.0	371.3	91.8	10.0	0.21	0.9	0.070	1.0	1.6	2.1	0.0
Sept 21	7.6	50.0	283	93	10.5	0.15	1.0	0.003	0.2	0.7	0.0	0.0
Sept 22	8.4	62.0	355	73	10.5	0.17	0.8	2.001	0.0	0.8	0.0	0.0
Sept 23	8.0	71.0	326	235	14.0	0.16	1.1	4.001	0.0	0.0	0.0	0.0
Sept 24	8.0	53.0	352	14	10.5	0.176	0.4	2.001	0.0	0.0	1.3	0.0

aldwell 7/29

13

[illegible]

14

osco House #39

Year	Month	U	pH	EC	HCO ₃	SO ₄	Cl	U	Mo	Se	526 Pa	520 Th	FSY	510 Po	510 Po	Water Depth
1976	Oct	10.16	7.6	580	314	91	710	10.20	1.2	4.005	0.3	0.9	0.9	0.5	0.0	22.2
1976	Nov	10.16	7.6	530	295	71	710	10.18	0.8	4.001	0.1	1.7	0.5	0.5	0.5	24.5
1976	Dec	10.16	7.6	600	297	124	9.5	0.31	0.7	4.001	0.2	1.6	5.2	0.6	0.6	29.3
1977	Jan	10.16	7.0	1080	363	298	22.0	0.40	2.5	4.001	1.6	3.1	6.5	2.5	2.5	32.5
1977	Feb	10.16	7.0	1660	341	455	47.2	1.58	4.35	0.01	0.3	0.0	0.0	0.9	0.9	37.9
1978	Mar	10.16	7.3	3000	231.8	1230	66.8	1.16	7.6	4.001	0.5	1.6	3.4	2.1	2.1	41.5
1978	Apr	10.16	7.9	3000	366.0	1280	92	1.25	4.0	4.001	0.7	1.3	3.1	0.5	0.5	44.5
1978	May	10.16	7.4	2500	271	1179	75	1.16	4.5	4.005	0.6	0.0	0.0	0.2	0.2	43.1
1978	Jun	10.16	7.4	2100	197	858	57.5	0.87	5.5	4.005	0.5	0.0	0.6	0.0	0.0	39.3
1978	Jul	10.16	7.6	1610	271	1068	72.5	1.16	3.4	4.001	0.6	2.5	0.0	0.3	0.3	40.0
1978	Aug	10.16	8.26	870	325	5627	36.5	0.92	1.9	4.001	0.0	0.0	0.0	0.5	0.5	52.1
1978	Sep	10.16	8.26	670	210.3	210.3	160	0.28	1.1	4.001	0.1	0.0	0.0	0.1	0.1	71.1
1978	Oct	10.16	8.26	840	126	126	120	0.23	1.4	4.001	0.0	0.8	0.0	0.7	0.7	31.3
1978	Nov	10.16	8.26	840	152.1	152.1	135	0.32	1.3	4.001	0.0	0.8	0.0	0.6	0.6	31.3
1978	Dec	10.16	8.30	630	133	133	10.5	0.17	1.1	4.001	0.6	1.0	0.0	0.0	0.0	28.3
1979	Jan	10.16	6.27	600	102	102	11.5	0.10	0.4	4.001	0.1	0.0	0.0	0.0	0.0	28.3
1979	Feb	10.16	8.5	450	58	58	8.0	0.015	0.1	4.001	0.0	0.0	0.0	0.0	0.0	28.6
1979	Mar	10.16	8.27	820	83	83	7.5	0.167	0.8	4.001	0.0	0.0	0.0	0.0	0.0	28.6

Core #40

15

House #40	V	pH	unholcm EC	HCO ₃	SO ₄	Cl	mg/l	U	Mo	Se	250 R	250 Th	6510 Rb	510 Pb	Water Depth
1975	7.0	316	1600	316	80	8.0	0.13	4.1	0.005	0.7	1.2	0.8	0.6	0.2	29.6
1976	6.9	334	1400	324	129	11.0	0.28	1.0	0.001	0.2	3.9	0.0	0.4	0.0	30.6
1977	7.1	309	1720	309	75	14.0	0.25	0.9	0.002	0.0	3.5	0.1	0.4	0.0	31.6
1978	7.1	363	1500	363	230	15.0	0.33	2.3	0.001	0.0	0.0	0.0	1.3	0.0	32.6
1979	7.1	341	1500	341	292	13.2	0.398	2.71	0.002	0.0	0.0	0.0	0.0	0.0	33.6
1980	7.0	364	1090	364	579	11.9	0.543	5.2	0.015	0.0	0.0	0.0	0.0	0.0	34.6
1981	7.4	2049	1700	2049	1175	62.6	0.997	7.6	0.005	0.0	0.0	0.0	0.0	0.0	35.6
1982	8.1	2700	2700	202	1304	76.5	1.1	9.2	0.005	0.0	0.0	0.0	0.0	0.0	36.6
1983	7.8	409	2700	409	1898	115	1.2	5.9	0.005	0.0	0.0	0.0	0.0	0.0	37.6
1984	7.4	238	4000	238	1247	98.5	1.16	4.7	0.003	0.0	0.0	0.0	0.0	0.0	38.6
1985	7.2	329	4500	329	10958	82	0.84	2.3	0.002	0.0	0.0	0.0	0.0	0.0	39.6
1986	7.5	284	2800	284	3288	31.0	0.37	1.3	0.003	0.0	0.8	0.0	0.0	0.0	40.6
1987	8.17	252	1150	252	1601	17.5	0.24	0.8	0.001	0.0	0.0	0.0	0.0	0.0	41.6
1988	7.78	297	820	297	1058	12.0	0.16	1.6	0.001	0.0	0.0	0.0	0.0	0.0	42.6
1989	8.31	259	680	259	155	12.5	0.12	1.5	0.001	0.0	0.6	0.0	0.0	0.0	43.6
1990	8.36	259	700	259	123	13.0	0.14	0.6	0.001	0.0	0.0	0.0	0.0	0.0	44.6
1991	8.38	284	650	284	85	11.0	0.37	0.6	0.001	0.0	0.0	0.0	0.0	0.0	45.6
1992	8.77	274	560	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	46.6
1993	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	47.6
1994	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	48.6
1995	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	49.6
1996	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	50.6
1997	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	51.6
1998	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	52.6
1999	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	53.6
2000	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	54.6
2001	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	55.6
2002	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	56.6
2003	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	57.6
2004	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	58.6
2005	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	59.6
2006	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	60.6
2007	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	61.6
2008	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	62.6
2009	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	63.6
2010	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	64.6
2011	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	65.6
2012	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	66.6
2013	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	67.6
2014	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	68.6
2015	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	69.6
2016	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	70.6
2017	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	71.6
2018	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	72.6
2019	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	73.6
2020	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	74.6
2021	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	75.6
2022	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	76.6
2023	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	77.6
2024	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	78.6
2025	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	79.6
2026	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	80.6
2027	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	81.6
2028	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	82.6
2029	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	83.6
2030	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	84.6
2031	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	85.6
2032	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	86.6
2033	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	87.6
2034	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	88.6
2035	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	89.6
2036	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	90.6
2037	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	91.6
2038	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	92.6
2039	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	93.6
2040	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	94.6
2041	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	95.6
2042	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	96.6
2043	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	97.6
2044	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	98.6
2045	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	99.6
2046	2.02	274	2.02	274	89	10.5	0.10	0.6	0.004	0.0	0.0	0.0	0.0	0.0	100.6

Ransom Field #41

16

	V	pH	EC	HCO ₃	SO ₄	Cl	U	Mo	Se	pic Ra	Th	Ci	pic Pb	pic Po	Water	Depth
Sep 1975	7.2	1910	537	564	4545	0.99	0.2	4005	0.2	0.2	1.7	0.0	0.0	0.0	70.2	1
Oct 1975	7.3	2110	714	529	4545	0.15	0.2	4005	0.2	0.4	3.0	0.0	0.0	0.2	71.0	2
Nov 1975	7.3	1970	698	512	4545	0.09	0.2	4005	0.2	0.8	3.2	0.0	0.0	0.0	71.2	3
Dec 1975	7.3	1940	715	495	4545	0.09	0.1	4005	0.2	0.1	0.0	0.0	5.9	0.0	71.5	4
Jan 1980	7.1	2000	671	355	4545	0.05	0.1	4005	0.2	0.1	0.0	0.0	0.0	0.0	71.7	5
Feb 1980	7.5	1860	7125	485	4545	0.05	0.2	4005	0.2	0.1	0.0	0.0	2.4	0.2	71.8	6
Mar 1980	7.0	2000	695.4	365	4545	0.12	0.1	4005	0.2	0.1	0.0	0.0	1.7	0.2	71.85	7
Apr 1980	7.8	1950	655	471	4545	0.04	0.1	4005	0.2	0.1	0.0	0.0	2.4	0.0	71.85	8
May 1980	7.6	1980	7012	455	4545	0.05	0.2	4005	0.2	0.1	0.0	0.0	0.0	0.0	71.85	9
Jun 1980	7.7	1950	643	437	4545	0.09	0.1	4005	0.2	0.1	0.0	0.0	0.0	0.0	71.85	10
Jul 1980	8.02	2000	707	437	4545	0.37	0.6	4005	0.2	0.0	0.0	0.0	0.0	0.0	71.85	11
Aug 1980	8.42	2000	698	423	4545	0.062	0.2	4005	0.2	0.0	0.0	0.0	0.0	0.0	71.85	12
Sep 1980	8.88	1800	823	440	4545	0.062	0.2	4005	0.2	0.0	0.0	0.0	0.0	0.0	71.85	13

Boughton #144

18

V	PH	EC	NO ₃	SO ₄	Cl	(mg/l)	u	Mn	Se	200 P ₂	370 P ₂	(P ₂ 11)	200 P ₂	370 P ₂	Depth of water
Sept 1979	6.6	590	374	60	7.5	106	0.5	0.005	0.0	0.0	0.3	0.0	0.0	0.0	7.24
Oct 1979	7.5	460	299	37	5.5	0.3	0.4	0.001	0.0	0.0	0.0	0.0	0.0	0.0	1.14
Nov 1979	8.4	475	277	47	7.5	0.5	0.4	0.001	0.0	0.0	0.0	0.0	0.0	0.0	1.38
Dec 1979	6.5	740	376	109	12.0	0.6	0.2	0.001	0.0	0.0	0.0	0.0	0.0	0.0	1.16
Jan 1980	7.1	840	447	142	5.88	0.57	0.32	0.006	0.0	0.0	0.0	0.0	0.0	0.0	2.31
Feb 1980	7.0	730	390.4	30	2.90	0.076	0.4	0.001	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Mar 1980	7.3	820	405.0	35	5.5	0.061	0.47	0.011	0.0	0.0	0.0	0.0	0.0	0.0	3.42
Apr 1980	7.5	530	281	116	11.0	0.06	0.1	0.012	0.0	0.0	0.0	0.0	0.0	0.0	3.20
May 1980	7.2	750	320	135	17.5	0.12	0.4	0.005	0.0	0.0	0.0	0.0	0.0	0.0	3.45
Jun 1980	7.1	600	327	92	12.0	0.05	0.3	0.001	0.0	0.0	0.0	0.0	0.0	0.0	2.94
Jul 1980	7.9	750	320	99	22.5	0.06	0.4	0.001	0.0	0.0	0.0	0.0	0.0	0.0	2.00
Aug 1980	8.18	860	374	1250	19.5	0.06	0.9	0.001	0.0	0.0	0.0	0.0	0.0	0.0	1.84
Sept 1980	8.49	850	381	124	16.5	0.106	0.11	0.001	0.0	0.0	0.0	0.0	0.0	0.0	1.67

OW-1K

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OW-11

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	V	pH	EC	HCO ₃	SO ₄	Cl	U	Mo	Se	270 Pa	270 Th	270 Pb	270 P _o	Water Data
Sep 1979		6.8	810	337	206	95	0.03	<0.1	0.007	3.0	0.6	12.0	0.5	113.1
Oct 1979		7.2	840	369	186	100	0.06	<0.1	<0.001	1.1	0	0.0	0.5	111.2
Nov 1979		6.8	810	366	218	10.0	0.09	0.1	<0.001	1.4	0.0	0.4	0.0	111.7
Dec 1979		7.2	850	386	198	10.0	0.07	<0.1	<0.001	1.2	0.0	0.4	0.0	111.5
Jan 1980		7.9	810	353	160	27.1	0.006	<0.05	0.002	1.2	0.7	8.3	0.0	102.1
Feb 1980		7.6	770	312.3	15	27.1	0.023	<0.05	<0.001	4.4	0.0	0.0	0.1	102.0
Mar 1980		7.6	920	336.2	50	28.4	0.069	0.07	<0.005	10.0	0.0	7	1.2	105.5
Apr 1980		6.4	800	341	216	11.5	0.67	0.2	<0.005	7.6	0.0	1.5	0.3	109.3
May 1980		7.3	900	328.7	186.7	12.0	<0.01	<0.1	0.007	1.9	0.0	1.0	0.3	116.0
Jun 1980		7.6	870	341	188	12	<0.01	<0.1	0.004	0.8	0.5	1.5	0.0	115.5
Jul 1980		8.23	940	343	189	13	0.01	<0.02	<0.001	3.2	0.0	0.0	0.0	116.5
Aug 1980		8.23	1150	275	118	12.5	0.06	1.1	<0.001	1.9	0.6	2.1	0.1	116.0
Sep 1980		8.18	880	345	196	12.0	<0.01	<0.2	0.001	0.6	0.6	0.7	0.2	115.0

	EC	HCO ₃	SO ₄	Cl	U	P ₁₀	Se	210Rn	210Pb	210Po	Water Depth Below
1979	3250	187	1578	48	0.06	0.1	<0.005	0.8	0.0	0.6	51.3
1979	3305	253	1586	50.0	<0.03	0.1	<0.001	1.0	0.0	0.3	52.5
1979	3400	274	1651	47.0	<0.03	0.1	<0.001	0.6	0.0	0.0	53.3
1979	3400	307	1611.7	48.5	0.06	<0.1	<0.001	1.0	0.0	0.0	54.1
1980	3400	235	57	61.7	0.04	<0.005	0.002	0.7	0.0	0.0	55.0
1980	3400	275.2	1720	89.5	0.009	<0.005	<0.001	1.4	0.0	1.0	56.0
1980	3400	317.2	1540	43.5	0.04	0.04	<0.005	1.7	0.0	0.5	57.0
1980	3450	284	1446	54	0.18	<0.18	0.006	1.7	0.1	0.0	58.9
1980	3500	328.9	1413.1	50.5	0.02	<0.1	0.011	0.4	0.5	0.0	59.4
1980	3500	261	1373	54.5	0.04	0.1	<0.001	0.3	0.0	0.1	60.5
1980	3500	263	1570	58.5	0.04	<0.02	<0.001	0.4	0.0	0.1	61.5
1980	3400	143	2890	37.5	0.08	1.0	0.003	0.9	0.1	0.0	62.5
1980	3500	278	1273	67.0	<0.01	70.2	0.010	0.1	3.8	0.0	63.5

OW-13 B

	V	pH	EC	HCO ₃	SO ₄	Cl	U	Mn	Se	235Ra	230Th	210Pb	210Po	Water Depth
26 Mar 1980		10.7	840	2049	102	29.0	0.002	0.11	4.005	1.6	0.0	4	3.1	
18 Apr 1980		12.0	1408	414	126	11.5	4.01	0.3	4.005	9.0	0.0	1.9	0.0	
21 May 1980		10.4	1150	552	77	23.5	0.04	0.1	4.005	0.0	3.6	5.8	0.0	
10 Jun 1980		10.0	1200	577	36.1	26.0	4.01	0.1	0.002	0.0	0.0	4.2	0.0	
30 Jul 1980		9.67	1180	618	9	32	0.36	4.002	4.0001	0.8	0.0	0.0	0.4	
20 Aug 1980	<0.02	9.42	1150	559	159	32.5	0.05	1.1	0.001	0.0	5.2	2.6	2.5	
23 Sep 1980	0.5	9.78	1030	534	15	36.0	4.0.01	4.0.2	0.001	0.0	0.0	1.6	8.5	

OW-13B

	V	pH	Alkalinity EC	HCO ₃	SO ₄	Cl	mg/l U	Mo	Se	mg/L	300 Th	PCl/1	210 Pb	210 Po	Water Depth
May 1980		9.5	1400	190	532	37	0.114	0.6	0.007	0.0	0.0	0.0	1.7	1.9	
Apr 1980		10.0	1350	179	479	40.5	0.06	0.8	0.012	0.0	0.0	0.0	1.3	0.6	
May 1980		9.8	1400	2833	441.5	38.5	0.09	0.6	0.005	0.3	0.0	0.0	0.0	0.7	
Jun 1980		9.7	1550	229	464	47	0.05	1.3	0.001	0.0	0.0	0.1	0.0	0.2	
Jul 1980	0.02	7.65	1600	297	347	41	0.06	2.0	0.001	0.2	0.0	0.8	0.1	0.1	
Aug 1980	0.02	8.98	1580	289	520	42.0	0.05	0.9	0.003	0.3	0.0	0.8	0.1	0.7	
Sept. 1980	0.03	8.86					<0.01			2.3			0.1	1.0	

OW-13C

Date _____

PH

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 HCO_3^-

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210 Pa

Water
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OW-14A

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	V	PH	EC	PCO ₂	CO ₂	U	M ₀	Se	mg/L	370 Th	200 Ph	100 P ₀	Water Depth
Sep 1977			4400	344	38	0.03	0.02	0.004	0.7	0.0	0.9	0.1	
Oct 1977	US												
Nov 1977	NS												
Dec 1977													
Jan 1978		10.0	590	35	100	0.001	0.005	0.012	0.1	0.0	2.6	0.0	
Feb 1978		10.6	600	51.2	15	0.002	0.005	0.001	0.0	0.0	0.1	0.0	
Mar 1978	NS												
Apr 1978	NS												
May 1978	NS												
Jun 1978	NS												
30 Jul 1978		9.58	3300	103	1349	0.03	0.2	0.001	0.0	0.0	1.7	0.0	
20 Aug 1978		9.07	3500	77	1417	0.04	1.5	0.001	0.5	1.2	0.0	0.0	
29 Sep 1978		8.69	3700	116	1634	0.01	0.4	0.001	0.8	0.0	5.1	0.4	

	V	pH	EC	HCO ₃	SO ₄	Cl	U	M ₀	Se	116 R ₀₁	210 Th	210 R ₀	210 R ₀	Water Depth
Sep 1976			3800	287	1480	28	0.00	8.5	0.043	0.5	3.7	3.4	0.0	
Oct 1979			NS											
Nov 1979			1790	126	647	36.5	<0.03	1.4	0.003	0.0	1.7	5.3	0.0	
Dec 1979		11.3	1850	159	639	30.5	0.03	0.5	0.001	0.0	0.0	5.9	0.2	
Jan 1980		10.8	1240	165	560	55.4	0.006	0.5	0.002	0.0	0.0	0.0	0.5	
Feb 1980		10.6	940	97.6	160	0.6	0.000	<0.05	<0.001	0.3	0.0	0.0	0.2	
Mar 1980		10.9	1300	224.5	120	1.9	0.003	0.2	0.012	0.0	0.0	1.8	0.0	
Apr 1980		11.4	1000	179	277	16.5	0.001	0.2	<0.005	0.0	0.0	0.2	0.1	
May 1980		10.8	1750	144	724	82.5	1.26	1.6	<0.005	0.0	0.0	2.4	0.2	
Jun 1980		10.1	1100	170	210.4	1.5	0.001	0.2	<0.001	0.2	0.5	0.0	0.0	
Jul 1980		10.4	1200	183	271	19	<0.01	0.2	<0.001	0.0	0.0	0.0	0.0	
Aug 1980		10.45	1400	176	437	23	0.001	1.5	<0.001	0.3	0.0	0.1	0.2	
Sep 1980		10.32	1200	267	265	30.5	<0.01	0.3	<0.001	0.6	0.0	1.9	0.0	

	V	pH	µmole/lm EC	NaCO ₃	SO ₄	Cl	mg/l U	M.	Se	²³⁸ Pa	²³² Th	²¹⁰ Pb	²¹⁰ Po
1			3250	275	1200	64	1.07	6.7	0.50	0.7	0.0	9.1	0.0
2	1979			N S									
3	Oct		1260	352	274	100	0.03	1.2	0.008	0.7	0.8	0.0	0.7
4	Nov	11.6	1140	264	285	190	0.10	0.5	<0.001	0.8	0.0	4.8	1.3
5	Dec		1020	353	110	312	0.055	0.05	0.006	0.0	3.3	4.9	1.4
6	Jan	10.6	1000	283	45	237	0.055	0.44	0.035	0.2	1.0	0.5	0.1
7	Feb	10.2	1200	294.5	55	312	0.016	0.05	0.05	0.0	0.0	0.0	1.0
8	Mar	9.6	980	281	284	215	0.02	<0.1	<0.005	0.3	0.0	0.5	0.4
9	Apr	9.7	1000	353	216	200	0.02	<0.1	<0.005	0.0	0.5	0.2	0.0
10	May	9.3	1100	359	240	215	0.01	0.2	0.002	0.0	0.0	0.0	0.2
11	Jun	9.4	1270	297	282	33	<0.01	0.4	<0.001	0.0	0.0	0.0	0.3
12	Jul	9.0	1190	341	325	235	1.15	1.6	<0.001	0.3	0.0	2.3	0.0
13	Aug	10.2	1330	178	117	230	<0.01	0.3	<0.001	0.0	0.0	2.5	0.0
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OW-15

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V	pH	EC	HCO ₃	SO ₄	Cl	U	Mo	Se	220 Pa	230 Th	210 Pb	210 Po	Water Depth
14 Feb 1980	7.1	3200	2048	870	83.7	0.41	0.1	0.008	1.4	0.0	6.2	0.0	26.5
22 Mar 1980	7.3	2300	125	936	84.5	0.122	0.07	0.019	1.6	0.0	1.8	0.2	24.5
14 Apr 1980	7.4	1800	188	1111	119	<0.03	0.1	<0.005	2.1	0.5	1.5	0.6	24.5
20 May 1980	7.1	2700	25.7	1676	135	0.21	0.1	0.003	0.5	0.0	0.0	0.0	16.4
9 Jun 1980	7.5	3600	0.17	1576	170	0.39	0.1	0.004	0.6	0.0	0.0	0.4	16.9
11 Jul 1980	7.92	3700	371	2108	155	0.38	0.02	0.005	0.3	3.1	0.0	1.5	18.5
19 Aug 1980	7.93	3400	273	1556	150.0	0.29	0.02	0.014	1.3	1.9	2.1	0.1	18.6
11 Sept 1980	8.17	3000											

OW-16.

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	V	pH	EC	11CO ₃	SO ₄	Cl	U	Mo	Se	276Ra	230Th	214Pb	210Po	Water	Depth
Feb 1980		7.2	1700	1141.9	3600	323.4	5.41	24.3	0.015	0.7	37	26	0.9	29.8	1
Mar 1980		7.3	9200	545	5445	205	7.36	8.0	0.020	1.1	55	35	1.2	20.0	2
Apr 1980		7.3	7800	475	4641	245	5.37	24.4	0.010	0.0	15	27	1.4	20.5	3
May 1980		7.5	8700	375	3716	180	3.63	24.5	0.010	0.4	21	4.5	1.3	17.25	4
Jun 1980		7.7	6500	325	3754	205	3.43	19.4	0.010	0.1	23	0.0	0.5	18.05	5
Jul 1980		8.11	7700	374	456.7	260	3.41	24.7	0.031	0.0	0.0	0.0	0.7	18.9	6
19 Aug 1980	20.00	8.01	8500	426	4771	260	4.57	21.6	0.019	0.0	5.8	1.0	0.0	18.8	7
11 Sept 1980	20.5	8.43	8500				4.09								8

MADE IN U.S.A.

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Ow-17

Pond Temperature

Date	PH	EC	W/L	5-4	115.7	255	0.011	113	3030	870	2170	25
Sept (1)	7.0	44000	2878	24077	1085	115.7	255	0.011	113	870	2170	25
Sept (2)	7.2	44000	2820	24470	1125	98.22	235	0.390	4.7	553	270	9.2
Sept (3)	7.2	44000	2949	24159	1035	94.15	232.5	0.210	1.2	70	37	11
Sept (4)	7.2	44000	2748	23641	1100	89.13	230.	0.300	2.3	290	240	11
Sept (5)	7.0	43800	2790	24437	1170	77.89	250	0.313	0.5	110	370	15
Oct (1)	7.0	44200	2709	24416	1160	103.02	246	0.160	2.0	70	250	17
Oct (2)	7.2	44000	2709	24344	1050	77.32	252	0.475	0.9	46	8.7	12
Oct (3)	7.2	44000	2709	24344	1050	72.15	250	0.172	1.3	22	13	12
Oct (4)	7.2	43200	2725	24356	1025	99.4	268	0.180	2.5	604	33	16
Oct (5)	7.2	43600	2401	27600	1546	103	254	0.113	1.3	770	170	17
Oct (6)	7.3	43600	2307	25400	945	104	247	0.151	1.6	145	17	8
Oct (7)	7.1	44500	31.52	25400	—	100.5	98.6	0.057	0.0	17	0	21
Oct (8)	7.3	4500	—	25400	—	106	—	0.039	1.2	50	59	5.1
Oct (9)	7.2	35000	2915.2	25260	13104	102	231.1	0.573	1.2	17	88	8.1
Oct (10)	7.0	46000	2380	24500	710	84.8	248	0.063	—	—	—	—
Oct (11)	6.9	44700	2594	23147	890	73.05	—	—	—	—	—	—
Oct (12)	7.0	47400	2187	24039	815	91.2	259	0.068	1.5	57	23	14.0
Oct (13)	7.1	46500	2208	24698	915	83.55	273	0.121	2.1	43	82	4.0
Oct (14)	8.1	42500	2386.1	24653	900	86.05	233	0.135	3.5	21	82	12
Oct (15)	8.03	44800	2161	24443	975	102.01	241.5	0.151	0.7	23	100	16
Oct (16)	8.04	46900	2404	24492	975	91.18	238.5	0.175	0.7	11	11	18
Oct (17)	7.97	50100	2343	24176	950	85.42	340	0.228	2.8	240	67	21
Oct (18)	7.86	47700	2475	25147	950	89.14	241.0	0.190	2.6	17	17	8.9
Oct (19)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (20)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (21)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (22)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (23)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (24)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (25)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (26)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (27)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (28)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (29)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (30)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (31)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (32)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (33)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (34)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (35)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (36)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (37)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (38)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (39)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (40)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (41)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (42)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (43)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (44)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (45)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (46)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (47)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (48)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (49)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (50)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (51)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (52)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (53)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (54)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (55)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (56)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (57)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (58)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (59)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (60)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (61)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (62)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (63)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (64)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (65)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (66)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (67)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (68)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (69)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (70)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (71)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (72)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (73)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (74)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (75)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (76)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (77)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (78)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (79)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (80)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (81)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (82)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (83)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (84)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (85)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (86)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (87)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (88)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (89)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (90)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (91)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (92)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (93)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (94)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (95)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (96)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (97)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83	120	11
Oct (98)	7.36	47700	2498	25377	950	80.45	257	0.135	2.9	83		

2 T. m. l.

	V	pH	Temp. °C	EC	Ca	Cl	U	Mg	Sc	27% Na	23% K	PCl/210 K	210 F
(1)	8.2	19200	1122	11115	550	5334	20	0.011	1.1	1140	500	110	
(2)	8.0	46000	2293	24200	940	5491	190	0.415	3.9	170	627	52	
(3)	7.9	17500	1002	9090	865	2151	64	0.073	3.7	61	16	37	
(4)	7.6	49000	2298	20553	85	6747	204	0.206	4.0	40	191	120	
(5)	7.7	13100	709	6148	820	1072	283	0.280	1.3	430	18	36	
(6)	8.0	52000	2474	28702	1260	1407	226	0.155	7.0	36	69.0	170	
(7)	7.8	13200	659	5821	915	1981	33.4	0.190	4.6	38	22	24	
(8)	7.8	49200	2476	26571	810	5978	206	0.170	15.0	65	16.0	64	
(9)	7.8	32000	1248	1660	1209.6	32.0	118	0.195	4.8	26	16.0	54	
(10)	7.6	11000	412	1400	1122.7	10.6	245	0.267	2.1	12	170	30	
(11)	8.0	51200	28548	3190	1258.5	75.1	227	0.570	4.1	44	11	6.1	
(12)	8.4	21000	1576.2	17000	757.3	26.7	55.6	0.102	2.3	32	49	3.8	
(13)	8.3	37000	1440	17000	510	41.7	53.5	0.041	1.1	13	13	6.3	
(14)	8.0	37000	1440	17000	510	21.3	1370	0.095	7.9	20	13	5.0	
(15)	7.9	28700	1660	12312	440	3.4	4.5	0.692	3.5	45	13	4.8	
(16)	8.2	51000	2551	21200	485	66.2	247	0.016	4.5	15	21	16	
(17)	8.2	51000	2332.5	28916	870	66.59	233	0.220	6.1	30	35	8.8	
(18)	8.2	10300	414.7	5147	415	9.10	32.1	0.017	2.6	11	51	0.4	
(19)	8.0	10400	355	5816.6	3652	824	33.5	0.072	2.5	22	22	2.3	
(20)	8.0	14900	606	1147.1	915.5	13.04	71.5	0.177	0.3	37	16	4.2	
(21)	8.0	14800	517	7317	760	12.38	43.3	0.305	9.7	9.7	0.7	3.8	
(22)	8.0	13600	454	6078	1015	6.81	15.1	0.232	0.5	13	14	2.2	
(23)	8.0	24100	14030	11541	915	25.80	83.6	0.232	0.8	2	89	11	
(24)	8.0	48900	24130	27458	930	6733	129	0.142	7.0	2	89	11	

Sept. 1980
Sept. 1980

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Ponds Trench

	V	pH	EC	NO ₃	SO ₄	Cl	U	Mo	Se	2200 Ra	2300 H	210 Pb	210 Po
Sept 79 (1)		7.3	6200	304	2640	285	5.15	21.6	0.22	0.2	24	26.0	0.0
Oct 79 (2)		7.8	10600	516	4350	790	6.59	21.3	0.325	0.8	23	26.0	0.5
Oct 79 (1)		7.7	11600	564	4913	850	7.98	23.4	0.060	0.9	21	19.0	0.0
Nov 79 (1)		7.4	4400	873	7310	735	12.25	84.0	0.224	0.7	40	9.2	3.7
Nov 79 (2)		7.5	10000	533	3517	870	5.04	15.6	0.248	0.1	24	4.0	1.2
Dec 79 (1)		7.7	11000	611	4483	880	7.94	22.7	0.12	0.1	14	5.7	1.4
Dec 79 (2)		7.7	10300	522	4127	225	6.49	24.9	0.140	0.0	28	9.0	2.0
8 Jan 80 (1)		7.8	16000	920	8055	865	15.29	43.3	0.205	0.9	0.6	5.7	2.8
8 Jan 80 (2)		7.9	14400	977	11460	932.4	26.6	81.0	0.175	0.1	3.3	12.0	3.5
21 Jan 80 (1)		7.5	17000	412	2700	551.6	19.9	58.1	0.102	0.3	21	17.0	6.2
21 Jan 80 (2)		8.0	8300	404.6	600	686.7	4.75	12.3	0.080	0.2	13	3.1	0.0
29 Jan 80 (1)		8.1	16000	306	3820	940	3.61	2.0	0.108	0.0	4.0	2.4	0.0
29 Jan 80 (2)		7.5	2000	90	716	116	19.2	21.0	0.140	0.7	34	3.2	0.0
19 Mar 80 (1)		8.1	20300	966	11100	700	0.16	3.5	0.036	0.2	0.6	0.0	3.6
31 Mar 80 (1)		8.4	26600	1278.7	13627	710	17.21	81.6	0.665	1.6	0	2.4	3.7
30 Jun 80 (1)		8.31	7100	4249	3465	415	24.94	117.0	0.246	0.5	24	1.6	2.1
30 Jun 80 (2)		8.02	7100	217	3312	275	5.76	2.66	0.065	1.9	8.6	9.0	1.0
11 Jul 80 (1)	0.03	7.57	16100	384	452	950	4.19	18.7	0.667	2.1	2.1	9.0	2.4
30 Jul 80 (2)	20.02	18.5	13200	385	4608	935	6.20	19.3	0.194	0.0	23	9.0	3.6
12 Aug 80	20.02	18.2	10400	314	3150	1035	4.33	26.6	0.171	0.0	39	0.0	2.0
29 Aug 80	20.02	18.2	10600	418	3880	1040	4.52	17.5	0.176	0.0	0.0	0.0	2.2
17 Sept 80	20.02	18.2	10600	414	3880	1040	5.22	18.5	0.357	0.3	0.0	15	0.8
24 Sept 80	20.02	18.2	10600	414	3880	1040	14.6	14.5	0.398	0.3	15	0.0	0.5

S-5 Trenches - Composite - F - Mid. L. - W

E 37
M 40
W 41

		PH	FC	HCU	So	Mo	So	...	257h	210p	210p		
Sept (1)		7.6	5250	362	2911	255	0.91	8.4	0.008	0.0	250	22	0.00
(2)		7.7	6300	378	2860	240	4.02	11.1	0.085	0.2	32.0	20	0.0
Oct (1)		7.6	6500	406	3130	215	4.93	12.5	0.10	0.1	21.0	25	0.0
(2)		7.6	6900	431	3283	255	5.03	13.5	0.081	0.2	46	0.0	2.8
Nov (1)		7.4	6100	366	2944	235	4.4	9.7	0.062	0.6	21.6	0.0	0.6
(2)		7.4	6500	480	3023	235	5.18	0.7	0.037	0.3	44	6.9	1.8
Dec (1)		7.7	6500	466	3329	245	5.27	15.4	0.040	0.0	18	11.0	1.8
(2)		7.6	7000	363	2066	200	3.54	6.9	0.024	0.3	0.0	7.3	1.6
Jan (1)		7.6	4700	363	2066	200	4.67	16.4	0.045	1.4	1.3	5.5	1.2
(2)		7.6	7070	282	900	2170.8	310	13.1	0.063	0.5	26	4.0	4.1
Feb (1)		7.8	7300	271	200	152.5	306	3.9	0.042	0.3	26	0.0	1.1
(2)		7.8	2400	259	300	156.2	2.67	1.2	0.028	0.7	1.0	4.1	3.2
Mar (1)		7.4	4000	224	100	221.3	19.10	24.9	0.060	0.2	2.1	4.4	4.9
(2)		7.4	9000	224.5	1000	219.2	8.04	3.7	0.037	0.1	1.6	0.8	0.8
Apr (1)		7.3	3800	311.5	1595	182.7	2.57	0.4	0.036	0.4	2.6	0.0	0.9
(2)		7.3	3300	351.4	1455	182.7	4.8	20.9	0.048	0.3	11.0	0.0	5.6
May (1)		8.0	—	—	—	—	4.07	5.03	0.018	0.5	12.0	5.8	2.9
(2)		1.8	—	—	—	—	2.27	1.87	0.012	0.2	2.6	4.6	1.8
Jun (1)		8.0	1500	11.2	2500	171.5	4.1	7.1	0.043	7.3	0	7	0.0
(2)		7.9	5000	382.8	200	223.0	11.81	1.5	0.027	4.7	0	0	0.2
Jul (1)		8.0	1500	366.6	1345	115.2	2.36	1.0	0.010	4.6	2.5	0	0.0
(2)		—	—	—	—	—	4.6	—	0.026	3.9	0.0	0	1.4
Aug (1)		7.6	8100	307	4304	205	1.8	17.6	0.135	0.1	0.5	4.1	0.0
(2)		7.5	4300	313	2218	200	2.07	7.4	0.035	0.0	4.7	4.2	0.0
Sep (1)		7.4	5200	210	1403	110	2.10	3.6	0.022	0.0	0.0	2.7	0.0
(2)		7.4	8000	220	3118	170	2.46	12.5	0.028	0.0	0.4	2.2	4.3
Oct (1)		7.1	5000	294	2122	200	5.37	6.5	0.007	0.0	2.7	0.0	0.9
(2)		7.1	3100	200	1350	165	1.27	2.2	0.021	0.0	5.4	0.0	2.1
Nov (1)		7.1	3100	200	1350	165	1.56	11.8	0.003	0.1	0.0	1.1	0.9
(2)		7.4	4000	200	1200	165	1.56	11.8	0.003	0.1	0.0	1.1	0.9
Dec (1)		7.4	4000	200	1200	165	1.56	11.8	0.003	0.1	0.0	1.1	0.9
(2)		7.4	4000	200	1200	165	1.56	11.8	0.003	0.1	0.0	1.1	0.9
Jan (1)		8.1	6130	215	2410.1	155	1.47	10.5	0.012	0.0	1.5	1.4	1.4
(2)		7.7	4200	215	1616	230	2.47	1.0	0.020	0.0	5.2	5.8	0.8
Feb (1)		7.7	1300	215	1265.1	135	1.17	1.7	0.005	0.0	0.0	0.4	2.4
(2)		7.7	1300	215	1265.1	135	1.53	11.6	0.011	0.5	2.5	0.0	1.0
Mar (1)		7.6	200	112	100	170	2.63	4.1	0.001	0.0	2.7	0.0	0.0
(2)		7.45	4000	112	100	170	2.63	4.1	0.001	0.0	1.0	0.6	1.2
Apr (1)		7.45	4000	112	100	170	2.63	4.1	0.001	0.0	1.0	0.6	1.2
(2)		7.45	4000	112	100	170	2.63	4.1	0.001	0.0	1.0	0.6	1.2

Underdrains - South - NW - Composite

Sept	PH	FC	HCO ₃	SO ₄	Cl	U	M ₀	Se	2007h	2007b	2007c
NW	7.0	3100	82	181	270	0.2	2.5	2.055	0.2	4.6	0.7
Sept	7.2	7900	332	1810	1075	0.71	2.01	2.05	0.5	2.0	0.0
S	7.5	10400	777	4350	510	2.17	2.25	2.0	2.0	2.0	0.0
NW	7.5	8200	380	1849	1140	1.0	3.2	2.05	0.0	0.0	0.0
S	7.5	10000	726	4057	40	8.36	20.3	2.044	0.0	11.0	17.0
Oct	7.3	7750	361	1816	1070	1.15	2.09	2.00	0.3	0.0	0.0
S	7.6	9900	664	4249	470	7.55	21.1	2.00	0.1	1.0	2.0
NW	6.9	7700	160	1810	1140	0.7	0.7	2.18	0.3	0.0	0.0
S	7.1	9400	618	3887	505	6.3	15.9	0.58	0.1	2.0	1.4
Nov	7.0	8050	360	1847	1175	0.53	11.3	1.07	0.0	1.3	0.0
S	7.2	9400	611	3987	505	6.78	17.5	1.00	0.0	13.0	4.1
Dec	6.8	8100	318	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
S	7.1	9200	571	1031	505	6.40	20.2	1.05	0.1	5.7	0.0
NW	6.5	8100	212	1827	1175	0.74	0.2	1.56	0.4	0.4	0.0
S	7.1	9400	665	3740	570	6.26	18.2	0.80	1.4	0.6	1.2
Jan	6.8	8100	312	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
S	7.2	9000	550	1031	505	6.46	16.1	1.17	0.8	1.3	1.7
Feb	6.8	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
S	7.0	8050	183	1031	505	5.06	17.0	2.23	0.3	3.7	0.4
Feb (1)	6.4	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
Feb (2)	6.4	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
Mar (1)	6.4	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
Mar (2)	6.4	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
Apr (1)	6.4	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0
Apr (2)	6.4	8100	311	1810	1175	0.57	0.1	1.50	0.0	0.0	0.0

S-5 Trenches F-1 M.J.H. - W-1 A

	PH	μmole/l	HCO ₃	CO ₃	Cl	U	M ₀	Se	200 R ₀	200 T ₀	PSI/10	200 P ₀	200 P ₀	200 P ₀
11 July	8.23	3400	297	1242	160	2.17	166	0.018	0.4	18	0.0	0.0	3.5	4.022.1
11 July	8.11	4100	275	1511	205	2.89	243	0.022	0.0	38	0.0	0.0	1.2	4.022.2
24 July	8.07	7400	290	3777	170	1.35	98	0.022	0.2	23	0.0	0.0	0.7	4.022.3
30 July	8.04	3400	372	1223	165	2.01	144	0.012	0.3	32	0.0	0.0	5.5	4.022.4
30 July	8.03	4000	707	1633	220	2.19	211	0.020	0.0	25	0.0	0.0	2.0	4.022.5
30 July	8.02	7300	243	3882	195	2.05	98.7	0.021	0.0	45	0.0	0.0	1.0	4.022.6
12 Aug	7.96	3400	308	1231	170	1.08	26	0.015	0.0	16	0.0	0.0	1.7	4.022.7
	8.05	4000	286	1988	210	2.52	43	0.021	0.0	32	0.0	0.0	0.6	4.022.8
	8.06	7600	320	3747	185	1.77	140	0.043	0.0	0.8	0.0	0.0	0.5	4.022.9
29 Aug	7.73	3400	407	1279	170	1.54	27	0.007	0.1	10	0.0	0.0	5.1	4.022.10
	7.78	4000	308	1490	210	2.44	42	0.021	0.0	0.6	0.0	0.0	2.0	4.022.11
	8.07	7600	264	3545	195	1.80	150	0.044	0.0	12	0.0	0.0	1.0	4.022.12
15 Sept.	8.05	3400	302	1273	175	1.59	16	0.047	0.5	0.0	0.0	0.0	2.6	4.022.13
	8.01	5100	372	1600	210	3.12	249	0.078	0.0	0.0	0.0	0.0	1.1	4.022.14
	8.24	7300	241	3532	194	2.03	121.4	0.021	0.0	0.0	0.0	0.0	4.7	4.022.15
	8.18	2900	270	1773	210	1.53	15	0.016	0.1	0.0	0.0	0.0	8.6	4.022.16
20 Sept.	8.18	2900	270	1773	210	2.17	20.7	0.068	0.0	1.0	0.0	0.0	1.5	4.022.17
	8.22	3400	302	1273	175	1.59	16	0.047	0.5	0.0	0.0	0.0	2.6	4.022.18

Golf Course

	P H	phosphorus EC	HCO ₃	SO ₄	Cl	U	Mo	Sc	230Ra	230Th	210Pb	210Po	210Bi
9 Jul	7.5	5400	434	2365.3	153.5	0.09	< 0.1	0.002	1.3	0.0	0.0	0.2	0.01
10 Jul	8.3	5100	400	2299	129	0.06	< 0.02	< 0.001	0.1	0.0	0.0	0.0	0.01
11 Jul	8.16	5200	473	2217	142	0.04	0.7	0.001	0.8	0.0	0.0	0.2	0.01
12 Jul	8.99	5100	426	2255	125	0.05	< 0.2	0.003	0.0	0.0	0.0	0.0	0.01

APPENDIX D
TABULATION OF SURFACE WATER QUALITY
DATA THROUGH SEPTEMBER, 1980

Date	pH	EC	THCO ₃	SO ₄	Cl	U	M ₀	S ₀	216 R _L	220 T _L	216 P _L	220 P _L
Sep 1979						<0.03	<0.1	<0.05	0.0	0.0	15.0	4.1
Oct 1979						<0.03	<0.1	0.004	0.0	0.3	0.0	0.0
Nov 1979						0.6	<0.1	<0.001	0.1	1.6	0.0	0.0
Dec 1979						<0.03	<0.1	0.002	0.0	6.9	3.4	0.0
Jan 1980	7.0			1	41	1.004	<0.05		0.0			
Feb 1980	7.6	240	117.6	10	25	0.005	<0.05		0.0			
Mar 1980	8.9	250	126.9	10	0.6	0.01	0.6		0.6			
Apr 1980	7.5					<0.01	<0.1	<0.005	0.1			
May 1980	8.2					<0.01	<0.1	<0.005	0.0	0.0	1.6	0.0
Jun 1980	8.6					20.01	<0.1		0.3			
Jul 1980	8.04	240	124	77	95	<0.01	<0.02	<0.001	0.0	0.0	0.6	0.1
Aug 1980						0.01	0.6	0.001	0.0			
Sept 1980						<0.106	<0.2	0.001	0.0			

Arkansas River 4 1/2"

Date		Temp	Wind	Clouds	Humidity	Barometer	Direction	Speed	Time	Notes
1977	Sept	7.0	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1977	Oct	7.8	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1977	Nov	8.9	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1977	Dec	7.6	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Jan	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Feb	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Mar	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Apr	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	May	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Jun	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Jul	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Aug	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7
1978	Sept	8.2	340	157.6	10	10.7	10.7	10.7	10.7	10.7

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