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M E M O R A N D U M
May 30, 1984

To: Bob Goodman

From: Bill Yake BY

Subject: Western Processing: Characterization of "Lake Nieuwenhuis" Water Quality and Quantity

INTRODUCTION

Winter rainfall has ponded in the central portion of the Western Processing site. This pond is now commonly referred to as "Lake Nieuwenhuis." On March 6, 1984, we proposed a project which would characterize the quality and quantity of water in this pond (proposed Scope of Work, Project #3).

The purpose for this study is to provide basic data to be used as decisions are made regarding the disposition of this water. Pending decisions include whether or not the water requires treatment; degree of treatment required; where it will be discharged; and the rate at which it should be discharged. We understand that active consideration is being given to routing the water to pretreatment facilities at Crosby-Overton. Subsequently, this water would then be routed to a secondary wastewater treatment plant at Renton, with final discharge to the Green/Duwamish River.

The first survey was conducted on April 11, 1984. During this survey, measurements were made to determine pond volume. Samples were obtained for laboratory analysis for conventional pollutants and trace metals. A second survey was conducted on April 18, 1984. On this date, a single set of water samples was obtained for organic priority pollutant analysis (volatile organics, base/neutrals, acid extractables, pesticides, and PCBs).

Subsequent to these field surveys, contact with EPA Region X revealed that the pond had been sampled previously on November 30, 1983. This sampling was done at Jim Willman's request and was conducted by Jerry Portele (Roy Weston Inc., Seattle) and John Sainsbury (EPA). Analytical results from these samples are also included here.

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Another sample was collected on January 19, 1984 by Jim Oberlander and Greg Gregory (WDOE). This sample was analyzed for pH, conductivity, and selected total metals. Results from this sample are also included here.

Table 1 summarizes information on the various water quality samples obtained from "Lake Nieuwenhuis."

Estimation of Pond Volume

Figure 1 shows "Lake Nieuwenhuis." The figure was obtained from tracing an aerial photo (AMD 84010, Frame No. 10) obtained during an overflight on December 11, 1983. The approximate scale on the photo and figure is 1 inch = 60 feet.

On April 11, 1984, four transects of the lake were made. These are denoted in Figure 1 as A, B, C, and D.

Depth was measured at 20- to 25-foot intervals along each transect using a top-setting rod. Measured depths (in feet) are noted on Figure 1. Half-foot depth contours were drawn into the map. Pond area and areas of each of the contours were determined using a planimeter.

The volume of the pond was then calculated using Equation 1 to determine the volumes between each set of contours:

Equation 1: $(d/3)\cdot(a_1 + a_2 + \sqrt{a_1 a_2})$

where: d = the interval between contours (in this case 0.5 foot)
a_1 = the area (ft^2) of a contour
a_2 = the area (ft^2) of the adjacent contour

Based on these measurements, the area of the pond is approximately 1.8 acres, and the volume is about 79,000 cubic feet (1.8 acre-feet or 590,000 gallons).

Water Quality

Figure 2 shows the locations at which samples were obtained by both EPA and WDOE.

Table 1 reports the results of water quality analyses. Table 1a contains results for conventional analyses; Table 1b reports metals results, and Table 1c summarizes organic priority pollutant results. It should be noted that Table 1c reports only those priority pollutants which were detected in one or more samples. The analyses of EPA samples included full base/neutral and acid extractable scans, while the analysis for volatile organics included all halogenated volatiles (Hall detector). Analyses of WDOE samples included full

Table 1. Identification of samples and analyses conducted on "Lake Niewenhaus".

Date of Sampling	Responsible for Sampling	Number of Samples	Analyses						Laboratory	EPA log Number	WDOE Log Number
			Conventionals	Metals	VOA	Base/ Neutrals	Acid Extractables	Pesticides			
11/30/83	EPA	3		X	X[1]	X	X		EPA-Manchester	48030	
				X	X[1]	X	X			48031	
				X	X[1]	X	X			48032	
01/19/84	WDOE	1	X[2]						WDOE-Tumwater		121249
				X[3]					WDOE-Redmond		121249
4/11/84	WDOE	1	X						WDOE-Tumwater		141538
				X[4]					EPA-Manchester	15594	141538
4/18/84	WDOE	1			X	X	X	X	EPA-Manchester	16509	141692

[1]Chlorinated VOAs only (Hall detector).

[2]pH and conductivity only.

[3]Selected total metals only.

[4]Selected metals only, total and dissolved.

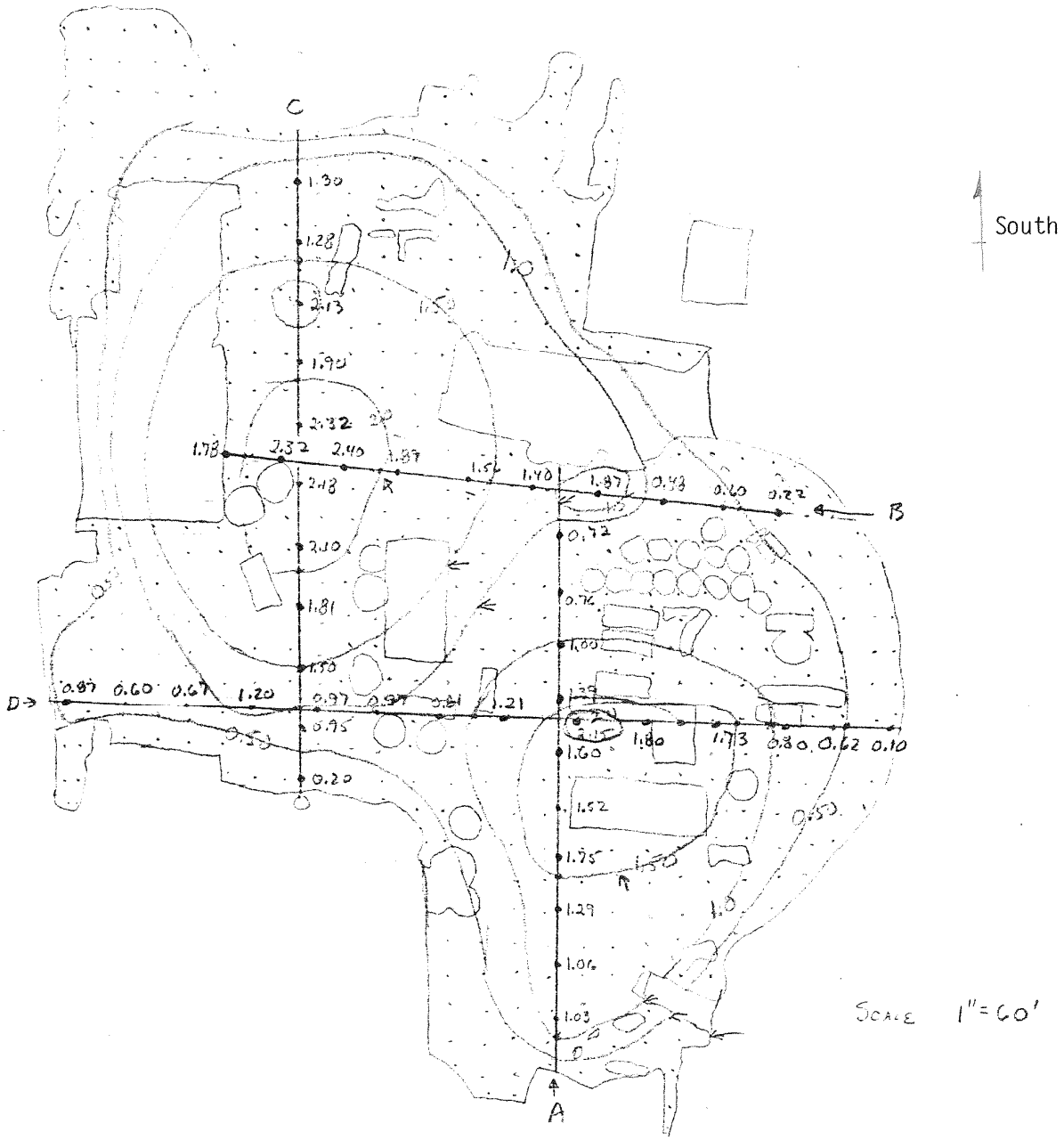

Figure 1. "Lake Nieuwenhuis": pond depth contours (depths measured in feet).

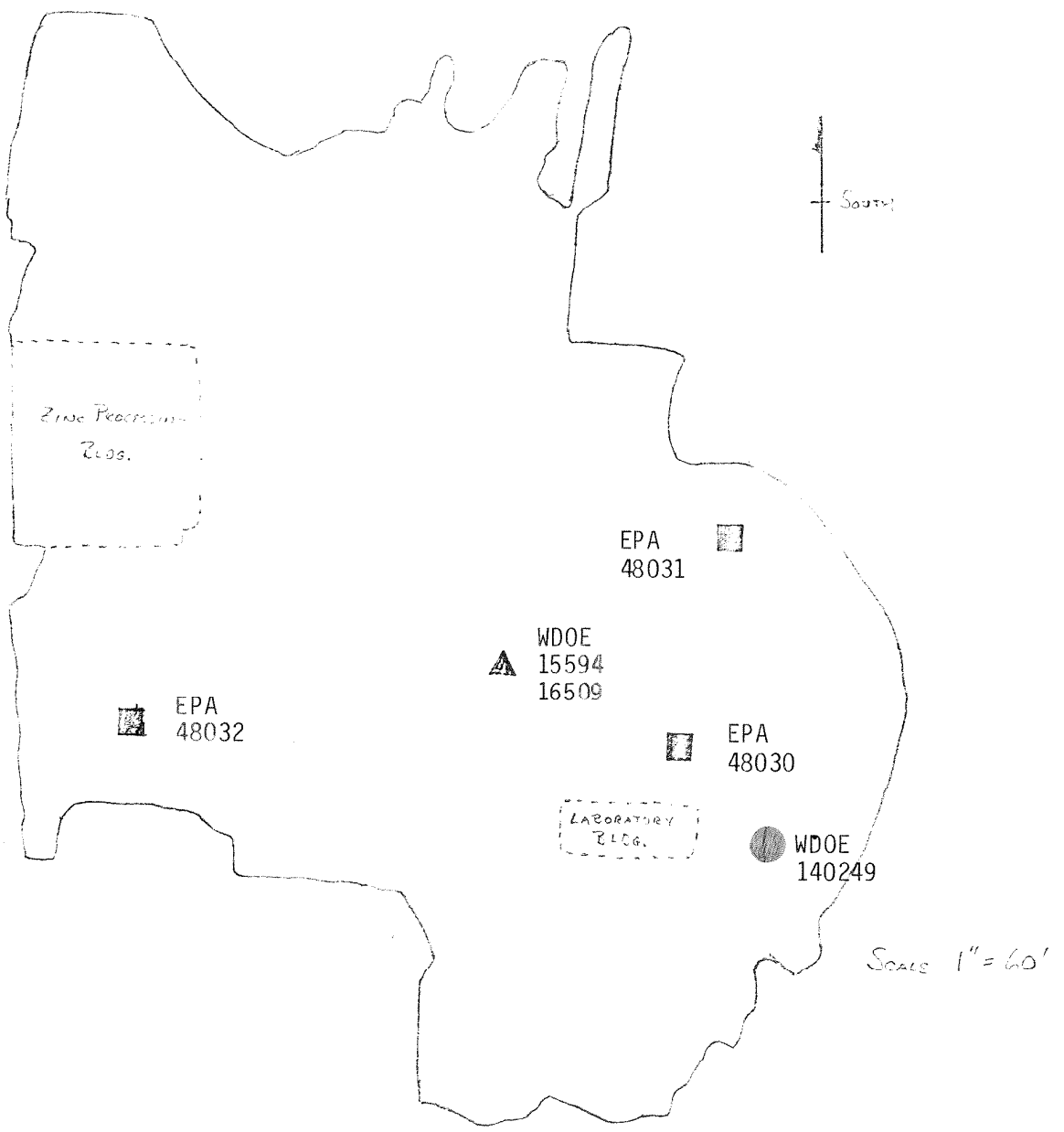

Figure 2. Water quality sampling locations, "Lake Nieuwenhuis."

Table 1a. Water quality analyses: conventional parameters.

Parameter	Value	
Date	1/19/84	4/11/84
Temperature (°C)		9.6
Dissolved Oxygen (mg/L)		8.8
pH (S.U.)	/.4	/.4
Specific Conductivity (umhos/cm)	1540	1020
Turbidity (NTU)		22
Chemical Oxygen Demand (mg/L)		1060
Total Hardness (mg/L as $CaCO_3$)		260
NH_3-N (mg/L)		18.7
NO_2-N (mg/L)		<0.01
NO_3-N (mg/L)		0.1
O-PO_4-P (mg/L)		<0.1
T-PO_4-P (mg/L)		0.1
Total Solids (mg/L)		720
Total Non-Volatile Solids (mg/L)		570
Total Suspended Solids (mg/L)		10
Total Non-Volatile Suspended Solids (mg/L)		3

Table 1b. Water quality analyses: metals.

Sampling Agency	USEPA/Weston				WDOE	WDOE	
Date Sample Collected	11/30/83				1/19/84	4/11/84	
EPA Laboratory Number	48030	48031	48032	Average	121249	15594	
	Total	Total	Total	Total	Total	Dissolved	Total
Metal							
Ag (ug/L)	2.9	1.9	2.1	2.3			
As (ug/L)	12	9	8	10			
Be (ug/L)	<0.2	<0.2	<0.2	<0.2			
Cd (ug/L)	420	450	440	430	200	45.7	46.8
Cr (ug/L)	290	170	210	220	<20	<1	42
Cu (ug/L)	1400	1400	1400	1400	650	17	171
Hg (ug/L)	0.2	0.15	0.15	0.17			0.057
Ni (ug/L)	199	192	197	196	150	85	130
Pb (ug/L)	2210	1650	1980	1950	280	24	477
Sb (ug/L)	15	17	20	17			
Se (ug/L)	11	1	1	2			
Tl (ug/L)	2	1	2	2			
Zn (ug/L)	36,300	33,900	35,400	35,200	14,000	12,620	12,520

Table 1c. Water quality analyses: organic priority pollutants.

Sampling Agency	USEPA/Weston				WDOE
Date Sample Collected	11/30/83				4/18/84
EPA Laboratory Number	48030	48031	48032	Average	16509
Volatile Organics					
chloroform (ug/L)	6.1	7.0	10u	(6)	2.1
carbon tetrachloride (ug/L)	5u	10u	10u	10u	5.3
1,1,1-trichloroethane (ug/L)	55	29	17	34	33
trichloroethylene (ug/L)	153	86	30	90	96
tetrachloroethylene (ug/L)	25	22	19	22	5.9
ethylbenzene					2m
toluene					2.3
Base/Neutrals					
1,2,4-trichlorobenzene (ug/L)	20m	20u	20u	<20	0.2u
isophorone (ug/L)	8m	8u	8u	<8	0.2u
phenanthrene (ug/L)	8u	8u	8m	<8	0.2u
fluorene (ug/L)	8u	8m	8u	<8	0.2u
pyrene (ug/L)	8u	8u	8u	<8	5.0
di-n-octyl phthalate (ug/L)	12u	12u	12u	<12	0.60
Pesticides/PCBs					
PCB-1254 (ug/L)					0.08
PCB-1260 (ug/L)					0.05

m = Compound detected; concentration less than limit of quantification.
u = Compound not detected at stated detection level.
< = "Less than."
( ) = Estimated average.

base/neutral, acid extractable, pesticide (and PCBs), and volatile organics (gas chromatograph) scans. Laboratory data sheets including a full listing of priority pollutants and detection limits are avalable on request.

Although the data are relatively self-explanatory, several issues bear mentioning.

Initially, there was some concern that the pond might be stratified or otherwise non-homogeneous. Field tests on April 11, 1984 for temperature and conductivity at various depths and locations indicated that the pond was homogeneous, as one would expect for a shallow body of water exposed to wind mixing. The metals results for EPA's three November 30, 1983 samples are very similar, also supporting the conclusion that water quality in the pond is generally homogeneous.

The conventional pollutant results are not especially remarkable except for somewhat elevated chemical oxygen demand (COD) (1060 mg/L), conductivity (1020 umhos/cm), and ammonia (18.7 mg NH_3-N/L). The elevated COD is somewhat unusual in light of the relatively high dissolved oxygen concentration (8.8 mg/L). There are two possible explanations; either the compounds responsible for the elevated COD are refractory (resistant to biochemical oxidation), or conditions in the pond water are not conducive to bacterial degradation of these compounds. Elevated metals concentrations might well inhibit any biological oxidation of these compounds.

Although conductivity and ammonia are somewhat elevated, they are both within the range of concentrations detected in municipal sewage.

Metals concentrations are generally elevated in the ponded water. Metals with highest concentrations in descending order are: zinc, lead, copper, cadmium, nickel, and chromium. Concentrations measured in April of 1984 are lower than those measured in November of 1983, with January concentrations being generally intermediate. April concentations for specific metals range from 10 percent to 65 percent of November values. One possible explanation for this could be the continued dilution of pond water by rainfall during the intervening time period.

It is also worth noting that the distribution between the dissolved and particulate form varies between specific metals. Dissolved metals are defined here as those metals passing through a 0.45 micron filter prior to acidification. Nearly all of the zinc and cadmium and most of the nickel were present in the dissolved form. Lead, copper, and especially chromium were primarily present in the particulate form.

Several base/neutral compounds were detected at very low concentrations. It is important to note that no base/neutral compound was detected in more than one of the total of four samples. The absence of four of these compounds in the April 1984 sample places some doubt on the earlier results. Detection limits on the April samples were much improved over those for the November samples.

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The detection of PCBs in water samples is unusual, but may, in part, reflect the excellent (low) detection limits achieved by the EPA-Manchester laboratory. The concentrations reported were 50 and 80 ng/L (parts per trillion).

As noted earlier, we understand that consideration is being given to routing the ponded water to Crosby-Overton for pretreatment with subsequent discharge to the Renton wastewater treatment plant (WTP). Table 2 summarizes METRO's waste discharge permit limits on both Western Processing and Crosby-Overton.

Based on these permits, the only measured constituents exceeding the current limits are zinc (12.5 mg/L versus 5 mg/L) and total halogenated hydrocarbons (about 150 ug/L versus 1 ug/L). It may well be impractical to expect that the concentrations for chlorinated volatiles can be decreased to 1 ug/L prior to discharge to the Renton WTP. The rationale for this condition in the permit was to prevent Western Processing from disposing of solvents to METRO facilities, and the 1 ug/L limit was based on background concentrations in METRO sewage. Discussion between METRO and ourselves might well lead to establishing a more moderate limit.

BY:cp

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Table 2. METRO's waste discharge permit limits for Western Processing and Crosby-Overton.

Parameter	Western Processing Concentration mg/L	Western Processing Load lbs/day	Crosby-Overton Concentration mg/L	Crosby-Overton Load lbs/day
Flow (MGD) 0.14				
Metals				
Ag	1	1.6		
As			1	
Cd	3	3.5	3	5.6
Cr	6	6.99	6	10
Cu	3	3	3	3
Hg			0.1	
Ni	6	6.99	6	10
Pb	3	3	3	3
Zn	5	5.82	5	9.4
Cyanide	2		2	
Total Halogenated Hydrocarbons	0.001			
Polynuclear Aromatics				
naphthalene	0.0005			
benzo(a)pyrene	0.00001			
fluoranthene	0.0005			