97-e05

DEPARTMENT OF ECOLOGY

July 8, 1997

TO: Max Linden and Bob Barwin
Central Regional Office

FROM: Art Johnson
Environmental Investigations and Laboratory Services

SUBJECT: WAPATO LAKE - PESTICIDES LEVELS, SEDIMENT BIOASSAYS, AND ABUNDANCE OF BENTHIC INVERTEBRATES
(Waterbody Number WA-47-9040)

Summary

Pesticides, lead, and arsenic were analyzed in composite samples of whole rainbow trout, rainbow trout fillets, and bottom sediments collected August-September 1996 from Wapato Lake, located in the fruit orchards above Lake Chelan. Lead arsenate was used historically to control codling moths in apple trees.

DDT, its metabolites DDD and DDE, dieldrin, hexachlorobenzene, dacthal and chlorpyrifos were detected in the fish tissue samples. All concentrations were low, generally less than 10 ug/Kg (parts per billion), and do not represent a hazard to human health or wildlife.

However, high concentrations of DDD (to 650 ug/Kg) and DDE (to 470 ug/Kg) were found in the lake sediments. The sediments were toxic in Microtox® bioassays and benthic macroinvertebrates were virtually absent. These findings are consistent with the presence of a toxin. Although pesticides may not be involved, the DDD concentrations are high enough to have a severe adverse effect on benthic invertebrate communities. Comparable or higher concentrations of DDD and DDE have been reported in the sediments of Roses Lake further downstream in the drainage.

Lead and arsenic were not detectable in Wapato Lake rainbow trout. The concentrations found in the sediments, approximately 20 mg/Kg and 3 mg/Kg, respectively, are at natural background levels.

Recommendation

- Assess the health of the benthic invertebrate community in shallow nearshore areas of Wapato Lake. These areas would be expected to be more productive than the deepwater zone (54 - 58 feet) sampled in the present survey. Consider expanding the assessment to include the other lakes in the drainage - - Roses, Dry, and Antilon.

Background

In response to a request from the Central Regional Office, a survey was conducted last summer to determine if there were significant pesticide residues in the fish and sediments of Wapato Lake, located in the fruit orchards above Manson on Lake Chelan (Figure 1). Previous Ecology surveys had detected elevated levels of pesticides downstream of Wapato Lake. Sediment samples collected from Roses Lake in 1992 had high concentrations of the DDT metabolites DDD and DDE (Serdar et al., 1994). DDT and the organophosphorus insecticides azinphos-methyl, chlorpyrifos, and diazinon exceeded water quality criteria in 1994 samples from Stink Creek at the downstream end of the Wapato Lake drainage (Davis, 1996). Fish kills have occurred in Wapato Lake, although the cause is unknown and may not involve pesticides (Ken Williams, personal communication).

Sampling and Analysis

Rainbow trout and bottom sediment samples were obtained on September 12 and August 27, respectively. Sampling locations are shown in Figure 2. Rainbow trout were caught with gill nets set in the upper half of the lake. Three groups of eight fish each were selected to be analyzed as one whole fish composite and two composites of skin-on fillets. Sufficient numbers of other species could not be obtained for analysis, including through use of an electroshocker.

The fish used for fillet samples were separated by size. One composite consisted of fish with a median total length of 226 mm, the other 317 mm. The smaller fish would have been planted as fingerlings in May 1996, while the large ones would have been released as fingerlings in May 1995 (Ken Williams, personal communication).

A stainless steel, 0.05m^2 Ponar grab was used to collect sediment samples at one site each in the upper and lower lake. Sediment samples consisted of composites of the top 2-cm surface layer from five separate grabs. Water depths were 54 - 58 feet.

Fish samples were analyzed for 43 pesticides or breakdown products known to have significant bioaccumulation potential. The majority of these chemicals are no longer used in the U.S. The sediments were analyzed for 162 pesticide compounds that include most of the active ingredients in formulations currently in use. The fish and sediment analysis included PCBs, but these were not detected.

The samples were also analyzed for lead and arsenic. Large amounts of lead arsenate were used to control codling moths in Washington apple trees prior to the introduction of DDT in 1948. As a result, high levels of lead and arsenic are found in the soil of many older orchards (Benson, 1968; Kittle, 1994; Peryea, personal communication).

Sediment toxicity was evaluated through laboratory bioassays and an analysis of the benthic invertebrate community. Aliquots from sediment samples were tested against the amphipod *Hyalella azteca* and the bioluminescent bacteria, *Vibrio fischeri* (Microtox ®). The *Hyallela* assay is a ten-day test of survival. The Microtox system measures reduction in light output on contact with the sample.

Benthic invertebrate samples consisted of three separate grabs at each of the two sediment sampling sites shown in Figure 2. The entire grab's contents was sieved through a 0.5 mm screen and the retained organisms preserved in ethyl alcohol.

Detailed information on sampling methods and preparation of tissue and sediment samples can be found in Davis and Serdar (1996). The chemical analyses were done at the Ecology Manchester Environmental Laboratory, except sediment grain size which was analyzed by Soil Technology, Inc., Seattle. The sediment bioassays were conducted by CH2M Hill, Seattle. Appendix A contains descriptions of methods, supporting quality assurance information, and the complete chemical data showing all chemicals analyzed and associated detection limits. Identification and enumeration of benthic invertebrates was done by Aquatic Biology Associates, Corvallis, following the protocols in Plotnikoff and White (1996).

Results

Table 1 summarizes the results from chemical analysis of the fish tissue and sediment samples. Relatively few pesticides were detected. Fish samples contained trace amounts (generally less than 10 ug/Kg) of DDT compounds, dieldrin, hexachlorobenzene, dacthal, and chlorpyrifos. Of these, only dacthal (DCPA, a herbicide) and chlorpyrifos (Lorsban, an insecticide) are currently used. The highest concentrations and largest number of compounds were detected in the whole fish sample, followed by the fillet sample from the larger of the two groups of trout. Lead and arsenic were not detected in the fish samples. None of the pesticide concentrations detected exceed EPA (1993) screening values for 10^{-6} health risks, FDA action levels,

or other fish consumption guidelines. These levels would not be considered a concern for wildlife (Newell et al., 1987).

The sediments contained elevated concentrations of the DDT metabolites DDD (230 - 650 ug/Kg) and DDE (160 - 470 ug/Kg). (DDD also had some historical use as an insecticide, TDE/Rothane.) The highest concentrations occurred in the lower lake sample. Low concentrations of undegraded DDT and chlordane were also detected in the lower lake. Lead and arsenic concentrations measured in the sediments, approximately 20 and 3 mg/Kg, respectively, are not elevated above natural background (San Juan, 1994; PTI 1989).

Levels of DDT compounds in Wapato Lake are about half those found downstream in Roses Lake. As in Wapato, high concentrations in Roses Lake sediments (1,488 - 1,667 ug/Kg total DDT) are not reflected in the lake's fish; 103 ug/Kg total DDT was detected in rainbow trout fillets (Serdar et al., 1994). It appears that these compounds are effectively sequestered in the sediments. Recent Ecology data show a state median of 60 ug/Kg total DDT in fish fillets (Davis, 1996).

Findings from the sediment bioassays are summarized in Table 2. The survival rate of *Hyallela* amphipods exposed to Wapato Lake sediments was 83 - 88%, not significantly different from amphipods in laboratory control sediments (washed silica sand). The Microtox test, however, showed there was substantial toxicity in both sediment samples. A sediment concentration of approximately 4% (4.5% upper lake, 3.2 % lower lake) caused a 50% reduction in light output when compared to a control sediment. Microtox has been shown to be the more sensitive of these two bioassays in tests on Washington State freshwater sediments (Cubbage, personal communication).

Analysis of the invertebrate samples showed the only benthic organisms present were Porifera colonies (small sponges of 0.5-2 mm diameter). *Chaoborus* larvae (phantom midges) and *Daphnia* (water fleas) were also present in some samples but these are water column species that rest on the bottom during the day to avoid predation. Appendix B contains the sample data.

In the opinion of Dr. Robert Wisseman (1997), director of the laboratory doing the taxonomy:

"The virtual absence of benthic fauna is abnormal, and suggests the influence of toxins. Benthic fauna that would be normally found throughout temperate North America on soft lake bottoms of similar depth, would be:

Eutrophic lakes/ponds with near anaerobic bottom sediments. The minimum fauna expected would be Oligochaeta (worms) and Chironomidae (midges).

Mesotrophic and oligotrophic lakes/ponds with more aerobic bottom sediments. Common and widespread taxa include Oligochaeta, Chironomidae, Nematoda (roundworms), Sphaeriidae (fingernail clams), Ceratopogonidae (no-see-um midges), Hirudinea (leaches), Amphipoda (scuds), Isopoda, Gastropoda (snails), Sialis (alderflies), Callibaetis (mayflies), and several caddisfly genera. Other taxa can be expected depending on the proximity of other types of substrate."

Although constituents other than pesticides may be responsible for the absence of benthic invertebrates or the toxic effect seen in the Microtox test, sediment chemistry data point to DDD levels as one potential factor. Concentrations of 6 ug/Kg 4,4'-DDD (normalized to total organic carbon content) have been shown to result in severe adverse effects on sediment-dwelling organisms (Persaud et al., 1993). 4,4'-DDD concentrations in Lake Wapato sediments were 3.1 mg/Kg TOC in the upper lake and 8.9 mg/Kg TOC in the lower lake. Persaud et al. calculated a lowest effect level for 4,4'-DDD of 8 ug/Kg dry weight compared to 230 - 650 ug/Kg dry in Wapato Lake. Although DDE concentrations approach those of DDD, DDE has a low toxicity to invertebrates and no insectidal properties (McEwen and Stephen, 1979).

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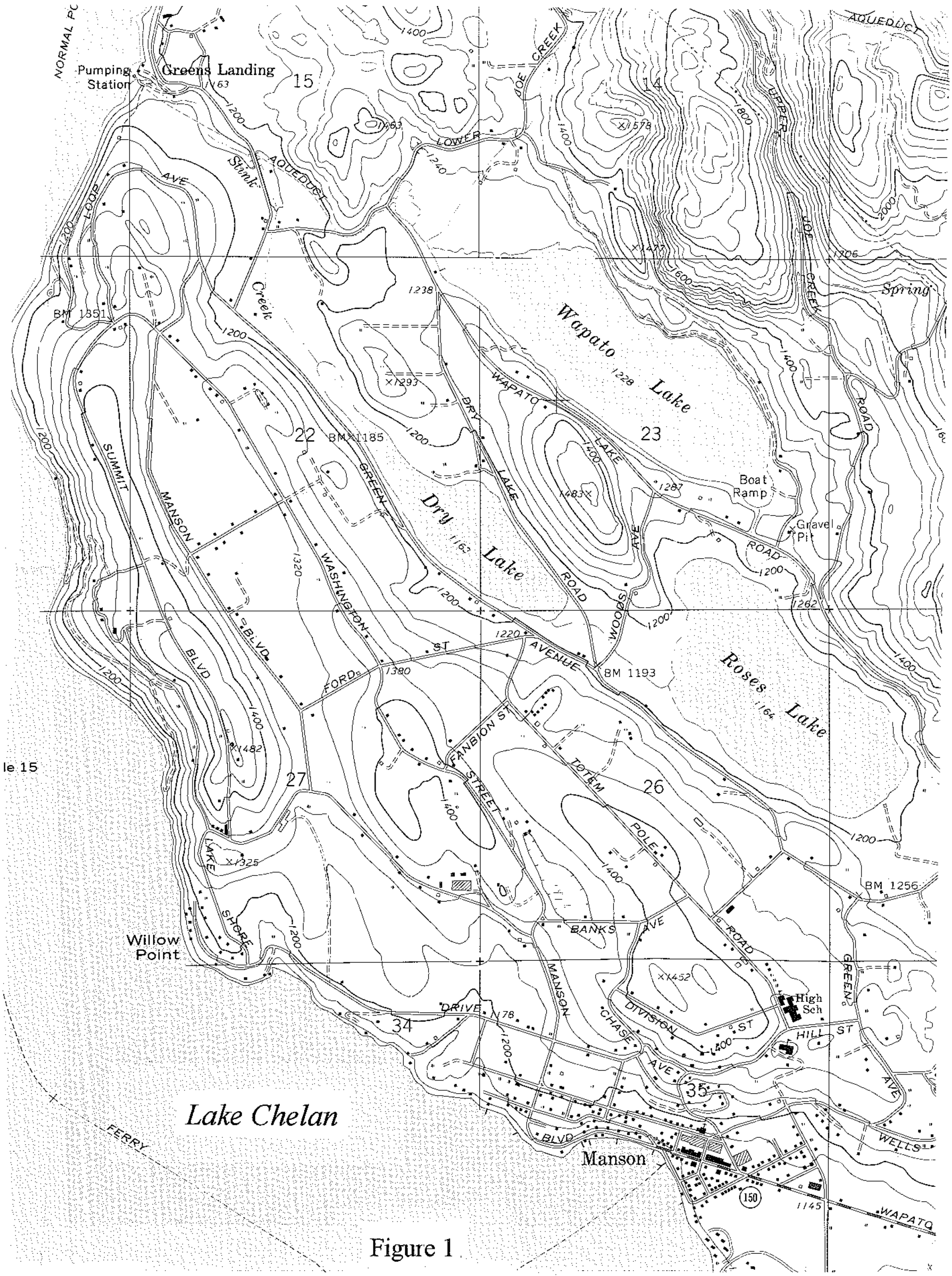
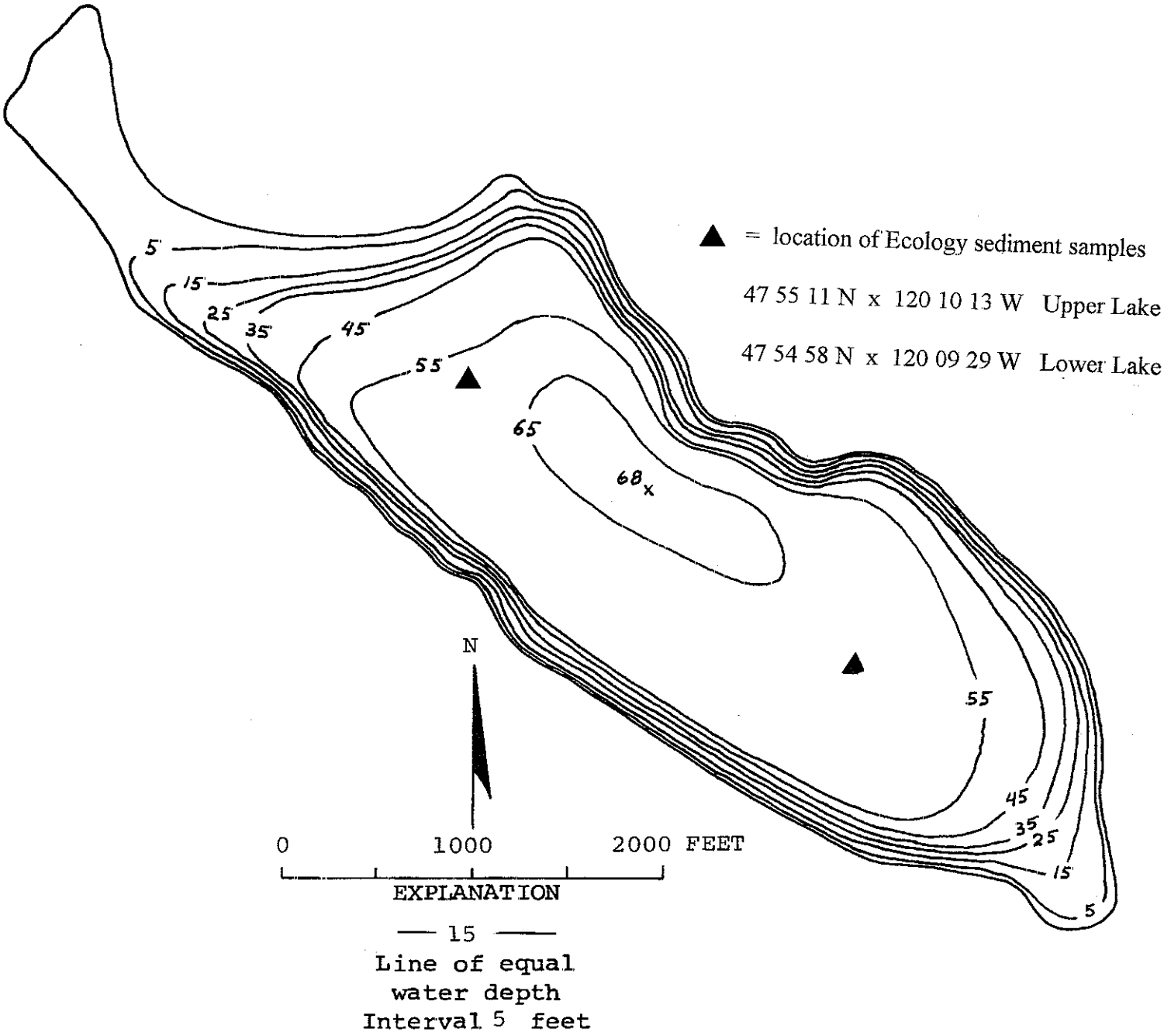

Pumping Station
Greens Landing
15
14
Stink Creek
AQUEDUCT
LOWER
JOE CREEK
UPPER
AQUEDUCT
LOOP AVE
BM 1351
Wapato Lake
23
22
BM 1185
Boat Ramp
Gravel Pit
WAPATO LAKE ROAD
DRY LAKE
Dry Lake
SUMMIT BLVD
MANSON BLVD
GREEN WASHINGTON AVENUE
WOODS AVE
BM 1193
Roses Lake
FORD ST
FANBION ST
STREET
TOTEM POLE ROAD
26
27
BM 1256
LAKE SHORE DRIVE
Willow Point
BANKS AVE
MANSON
CHASE AVE
DIVISION ST
HILL ST
High Sch
GREEN AVE
34
35
WELLS
BLVD
Manson
150
WAPATO
FERRY
Lake Chelan
le 15

Figure 1



Wapato Lake, Chelan County. From Washington Department of Game, February 15, 1950.

Figure 2

Table 1. Pesticides, Lead, and Arsenic Concentrations Detected in Wapato Lake Samples
[pesticides in ug/Kg (ppb); metals in mg/Kg (ppm); tissue on wet weight basis; sediment as dry weight]

Sample Type	Rainbow Trout			Sediment	
Tissue	Whole	Fillet	Fillet	--	--
Mean Length	204	226	317	--	--
Mean Weight	132	126	326	--	--
No Individuals	8	8	8		
Location	--	--	--	Upper Lake	Lower Lake
Date	12 Sept 96	12 Sept 96	12 Sept 96	27 Aug 96	27 Aug 96
Sample No.	37-8330	37-8331	37-8332	35-8082	35-8089
4,4'-DDE	**50**	**15**	**28**	**160**	**470**
2,4'-DDE	4.0 U	3.7 U	4.0 U	13 U	**15**
4,4'-DDT	**11**	**4.0**	**3.9**	13 U	**27**
4,4'-DDD	**6.1**	**1.8 J**	**3.3 J**	**230**	**650**
2,4'-DDD	**0.6 NJ**	3.7 U	4.0 U	**33**	**90**
DDMU	**3.3 J**	**1.1 J**	**2.2 J**	**30**	**90**
total DDT*	**68**	**21**	**35**	**423**	**1,222**
dieldrin	**1.4 J**	3.7 U	**0.9 J**	38 U	44 U
cis-chlordane	4.0 U	3.7 U	4.0 U	13 U	**6.1 J**
hexachlorobenzene	**0.5 NJ**	1.9 U	2.0 U	6.4 U	7.3 U
dacthal	**1.4 J**	3.7 U	**0.6 J**	170 U	180 U
chlorpyrifos	**0.9 J**	7.4 U	**1.5 J**	51 U	58 U
lead	0.2 U	0.2 U	0.2 U	**19.8**	**20.9**
arsenic	0.3 UJ	0.3 UJ	0.3 UJ	**2.9**	**3.0**
lipid	4.0%	2.6%	3.0%	--	--
total organic carbon	--	--	--	7.4%	7.3%
fines (silt+clay)	--	--	--	94%	98%

Note: detections shown in **bold**
U = not detected at or above reported value
J/NJ = estimated concentration
*excluding the metabolite DDMU

Table 2. Results of Bioassays on Lake Wapato Sediments

Location	Upper Lake	Lower Lake
Date	27 Aug. 96	27 Aug. 96
Sample No.	35-8082	35-8089
Hyallela		
Percent Survival (control = 88.3%)	83.3%	88.3%
Microtox		
EC50*	4.5%	3.2%

*EC50 = effective concentration reducing light output by 50%

APPENDIX A

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E , Port Orchard Washington 98366

CASE NARRATIVE

December 16, 1996

Subject: Grayland Cranberry Pesticides , Garrison Creek and Wapato Lake Fish Tissues

Samples: 96-358165 to -358171
96-388311
96-378330 to -378332

Case No. 1634-96
1608-96
1564-96

Officer: Dale Davis
Ed Rashin
Art Johnson

By: Dickey D. Huntamer
Norman Olson
Organics Analysis Unit

TISSUE
PESTICIDES/POLYCHLORINATED BIPHENYLS

ANALYTICAL METHODS:

The tissue samples from the three projects listed above were extracted and analyzed together as a batch using the Manchester Environmental Laboratory fish tissue procedure. The tissue was extracted with acetone by grinding with a Polytron tissue grinder, solvent exchanged to hexane, cleaned up using Florisil. The 50% Florisil fraction was partitioned with acetonitrile and further cleaned up with Forisil. Analysis was done following SW-846-8080 by dual column capillary gas chromatography with electron capture detectors.

HOLDING TIMES:

The samples were stored frozen until extraction. All extraction holding times were within the recommended limits.

BLANKS:

No target analytes were detected in the laboratory blanks.

SURROGATES:

Two of the surrogates, dibutylchlorendate (DBC) and decachlorobiphenyl (DCB) had acceptable recoveries. The surrogate, 4,4' dibromoctafluorobiphenyl (DBOB) was not used in the analysis. Tetrachloro-meta-xylene (TMX) was also added as a surrogate. Recoveries for TMX ranged from 38% to 82% except for sample, -388311 Garrison Creek, where only 5% was recovered. Recoveries for DBC and DCB in sample -388311 were acceptable so no qualifiers were added to the data.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

Matrix spike recoveries were acceptable for most of the compounds. The following four compounds had slight problems with matrix spike recoveries. No qualifiers were added to the data based on the matrix spike recoveries. The compounds were:

Spiked Sample	-378330		-378267	
Heptachlor	low(4%)	-LDP1	49%	--LDP1
	73%	-LDP2	16%	--LDP2
Methyl Parathion	108%	-LDP1	61%	- LDP1
	79%	-LDP2	33%	- LDP2
2,4-DDT	85%	-LDP1	79%	- LDP1
	36%	-LDP2	75%	- LDP2
Chlorpyrifos	191%	-LDP1	124%	-LDP1
	71%	-LDP2	147%	-LDP2

ANALYTICAL COMMENTS:

Endrin aldehyde was not included as a target due to the lack of recovery after the Florisil cleanup.

Kelthane breaks down to 4,4' dichlorobenzophenone. Both compounds were monitored for but no spike recoveries calculated. Data flagged as estimated quantitation limits, "UJ".

Trifluralin was not spiked but was monitored for and it is also flagged "UJ".

No other analytical problems were encountered in the analysis. The data is acceptable for use as qualified.

DATA QUALIFIER CODES:

U	-	The analyte was not detected at or above the reported value.
J	-	The analyte was positively identified. The associated numerical value is an estimate.
UJ	-	The analyte was not detected at or above the reported estimated result.
REJ	-	The data are unusable for all purposes.
EXP	-	The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6.
NAF	-	Not analyzed for.
N	-	For organic analytes there is evidence the analyte is present in this sample.
NJ	-	There is evidence that the analyte is present. The associated numerical result is an estimate.
E	-	This qualifier is used when the concentration of the associated value exceeds the known calibration range.
bold	-	The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Lead

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Project Officer: Art Johnson
Date Reported: 22-NOV-96

Method: EPA239.2
Matrix: Tissue
Analyte: Lead

Sample	QC	Field ID	Result	Qualifier	Units	Received	Analyzed
96378330		SM RBT WH	0.2	U	mg/Kg	09/16/96	11/15/96
96378331		SM RBT FL	0.2	U	mg/Kg	09/16/96	11/15/96
96378332		LG RBT FL	0.2	U	mg/Kg	09/16/96	11/15/96
96378332	Matrix Spike		100 %			09/16/96	11/15/96
96378332	Matrix Spike		100 %			09/16/96	11/15/96
BLN63895		SPB4497	0.2	U	mg/Kg		
LCS64016		SLC4498	86 %				11/15/96

Authorized By: Randy L Knox Release Date: 11/25/96

PROCEDURAL BLANKS

The procedural blanks associated with these samples show no analytically significant levels of analyte

SPIKED SAMPLES ANALYSIS

Spiked and duplicate spiked sample analysis were performed on this data set. All spike recoveries are within the CLP acceptance limits of +/- 25%.

PRECISION DATA

The results of the spiked and duplicate spiked samples are used to evaluate precision on this sample set. The relative percent difference (RPD) for all analytes is within the 20% CLP acceptance window for duplicate analysis.

LABORATORY CONTROL SAMPLE (LCS) ANALYSIS

LCS analyses, except those for arsenic, are within the windows established for each parameter. Arsenic data is qualified UJ, as undetected at estimated detection level due to low recovery of arsenic from the DORM-1 and DORM-2 LCS samples

Please call Randy Knox at SCAN 360-871-8811 or Jim Ross at SCAN 360-871-8808 to further discuss this project

RLK:rlk

November 25, 1996

To: Art Johnson

From: Randy Knox, Metals Chemist RBK

Subject: Wapato Lake Project Tissue

QUALITY ASSURANCE SUMMARY

Data quality for this project is generally good with the exception that recovery of arsenic from the LCS samples is low No other significant quality assurance issues are noted with the data

SAMPLE INFORMATION

The samples from the Wapato Lake Project were received by the Manchester Laboratory on 9/16/96 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals)

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits AA calibration gave a correlation coefficient (r) of 0 995 or greater, also meeting CLP calibration requirements.

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN64094 **Method:** SW8080
Blank ID: OBT6276A2 **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** ug/Kg

Analyte	Result	Qualifier	Analyte	Result	Qualifier
Alpha-BHC	3.6	U	PCB - 1254	36	U
Beta-BHC	3.6	U	PCB - 1260	36	U
Gamma-BHC (Lindane)	3.6	U	Dacthal (DCPA)	3.6	U
Delta-BHC	3.6	U	PCB - 1232	36	U
Heptachlor	3.6	U	Diazinon	36	U
Aldrin	3.6	U	Ethion	14	U
Heptachlor Epoxide	3.6	U	Parathion	7.1	U
Trans-Chlordane (Gamma)	3.6	U	Methyl Parathion	7.1	U
Endosulfan I	3.6	U	Treflan (Trifluralin)	3.6	UJ
Dieldrin	3.6	U	Chlorpyriphos	7.1	U
4,4'-DDE	3.6	U			
Endrin	3.6	U	**Surrogate Recoveries**		
Endosulfan II	3.6	U			
4,4'-DDD	3.6	U	**Dibutylchlorendate**	**69**	%
Endrin Aldehyde	3.6	U	**Tetrachloro-m-xylene**	**51**	%
Endosulfan Sulfate	3.6	U	**Decachlorobiphenyl**	**78**	%
4,4'-DDT	3.6	U			
Endrin Ketone	3.6	U			
Methoxychlor	3.6	U			
Alpha-Chlordene	3.6	U			
Gamma-Chlordene	3.6	U			
Oxychlordane	3.6	U			
DDMU	3.6	U			
Cis-Chlordane (Alpha-Chlordane	3.6	U			
Cis-Nonachlor	3.6	U			
Kelthane	14	UJ			
2,4'-DDE	3.6	U			
Trans-Nonachlor	3.6	U			
2,4'-DDD	3.6	U			
2,4'-DDT	3.6	U			
Mirex	3.6	U			
Toxaphene	110	U			
4,4'-Dichlorobenzophenone	14	UJ			
Hexachlorobenzene	1.8	U			
Pentachloroanisole	1.8	U			
Tetradifon (Tedion)	14	U			
PCB - 1242	36	U			
PCB - 1248	36	U			

Authorized By: _____ Release Date: 12/13/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN64093 **Method:** SW8080
Blank ID: OBT6276A1 **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** ug/Kg

Analyte	Result	Qualifier	Analyte	Result	Qualifier
Alpha-BHC	3.6	U	PCB - 1254	36	U
Beta-BHC	3.6	U	PCB - 1260	36	U
Gamma-BHC (Lindane)	3.6	U	Dacthal (DCPA)	3.6	U
Delta-BHC	3.6	U	PCB - 1232	36	U
Heptachlor	3.6	U	Diazinon	36	U
Aldrin	3.6	U	Ethion	14	U
Heptachlor Epoxide	3.6	U	Parathion	7.1	U
Trans-Chlordane (Gamma)	3.6	U	Methyl Parathion	7.1	U
Endosulfan I	3.6	U	Treflan (Trifluralin)	3.6	UJ
Dieldrin	3.6	U	Chlorpyriphos	7.1	U
4,4'-DDE	3.6	U			
Endrin	3.6	U	**Surrogate Recoveries**		
Endosulfan II	3.6	U			
4,4'-DDD	3.6	U	**Dibutylchlorendate**	**68**	**%**
Endrin Aldehyde	3.6	U	**Tetrachloro-m-xylene**	**48**	**%**
Endosulfan Sulfate	3.6	U	**Decachlorobiphenyl**	**82**	**%**
4,4'-DDT	3.6	U			
Endrin Ketone	3.6	U			
Methoxychlor	3.6	U			
Alpha-Chlordene	3.6	U			
Gamma-Chlordene	3.6	U			
Oxychlordane	3.6	U			
DDMU	3.6	U			
Cis-Chlordane (Alpha-Chlordane	3.6	U			
Cis-Nonachlor	3.6	U			
Kelthane	14	UJ			
2,4'-DDE	3.6	U			
Trans-Nonachlor	3.6	U			
2,4'-DDD	3.6	U			
2,4'-DDT	3.6	U			
Mirex	3.6	U			
Toxaphene	110	U			
4,4'-Dichlorobenzophenone	14	UJ			
Hexachlorobenzene	1.8	U			
Pentachloroanisole	1.8	U			
Tetradifon (Tedion)	14	U			
PCB - 1242	36	U			
PCB - 1248	36	U			

Authorized By: _____ Release Date: 12/13/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96378332 **Date Received:** 09/16/96 **Method:** SW8080
Field ID: LG RBT FL **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** ug/Kg

Analyte	Result	Qualifier	Analyte	Result	Qualifier
Alpha-BHC	4.0	U	PCB - 1254	40	U
Beta-BHC	4.0	U	PCB - 1260	40	U
Gamma-BHC (Lindane)	4.0	U	**Dacthal (DCPA)**	**0.6**	**J**
Delta-BHC	4.0	U	PCB - 1232	40	U
Heptachlor	4.0	U	Diazinon	40	U
Aldrin	4.0	U	Ethion	16	U
Heptachlor Epoxide	4.0	U	Parathion	7.9	U
Trans-Chlordane (Gamma)	4.0	U	Methyl Parathion	7.9	U
Endosulfan I	4.0	U	Treflan (Trifluralin)	4.0	UJ
Dieldrin	**0.9**	**J**	**Chlorpyriphos**	**1.5**	**J**
4,4'-DDE	**28**				
Endrin	4.0	U	**Surrogate Recoveries**		
Endosulfan II	4.0	U			
4,4'-DDD	**3.3**	**J**	**Dibutylchlorendate**	**67**	**%**
Endrin Aldehyde	4.0	U	**Tetrachloro-m-xylene**	**53**	**%**
Endosulfan Sulfate	4.0	U	**Decachlorobiphenyl**	**81**	**%**
4,4'-DDT	**3.9**				
Endrin Ketone	4.0	U			
Methoxychlor	4.0	U			
Alpha-Chlordene	4.0	U			
Gamma-Chlordene	4.0	U			
Oxychlordane	4.0	U			
DDMU	**2.2**	**J**			
Cis-Chlordane (Alpha-Chlordane	4.0	U			
Cis-Nonachlor	4.0	U			
Kelthane	16	UJ			
2,4'-DDE	4.0	U			
Trans-Nonachlor	4.0	U			
2,4'-DDD	4.0	U			
2,4'-DDT	4.0	U			
Mirex	4.0	U			
Toxaphene	120	U			
4,4'-Dichlorobenzophenone	16	UJ			
Hexachlorobenzene	2.0	U			
Pentachloroanisole	2.0	U			
Tetradifon (Tedion)	16	U			
PCB - 1242	40	U			
PCB - 1248	40	U			

Authorized By: D. Norton Release Date: 12/13/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96378331 **Date Received:** 09/16/96 **Method:** SW8080
Field ID: SM RBT FL **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** ug/Kg

Analyte	Result	Qualifier	Analyte	Result	Qualifier
Alpha-BHC	3.7	U	PCB - 1254	37	U
Beta-BHC	3.7	U	PCB - 1260	37	U
Gamma-BHC (Lindane)	3.7	U	Dacthal (DCPA)	3.7	U
Delta-BHC	3.7	U	PCB - 1232	37	U
Heptachlor	3.7	U	Diazinon	37	U
Aldrin	3.7	U	Ethion	15	U
Heptachlor Epoxide	3.7	U	Parathion	7.4	U
Trans-Chlordane (Gamma)	3.7	U	Methyl Parathion	7.4	U
Endosulfan I	3.7	U	Treflan (Trifluralin)	3.7	UJ
Dieldrin	3.7	U	Chlorpyriphos	7.4	U
4,4'-DDE	**15**				
Endrin	3.7	U	**Surrogate Recoveries**		
Endosulfan II	3.7	U			
4,4'-DDD	**1.8**	**J**	**Dibutylchlorendate**	**63**	**%**
Endrin Aldehyde	3.7	U	**Tetrachloro-m-xylene**	**38**	**%**
Endosulfan Sulfate	3.7	U	**Decachlorobiphenyl**	**80**	**%**
4,4'-DDT	**4.0**				
Endrin Ketone	3.7	U			
Methoxychlor	3.7	U			
Alpha-Chlordene	3.7	U			
Gamma-Chlordene	3.7	U			
Oxychlordane	3.7	U			
DDMU	**1.1**	**J**			
Cis-Chlordane (Alpha-Chlordane	3.7	U			
Cis-Nonachlor	3.7	U			
Kelthane	15	UJ			
2,4'-DDE	3.7	U			
Trans-Nonachlor	3.7	U			
2,4'-DDD	3.7	U			
2,4'-DDT	3.7	U			
Mirex	3.7	U			
Toxaphene	110	U			
4,4'-Dichlorobenzophenone	15	UJ			
Hexachlorobenzene	1.9	U			
Pentachloroanisole	1.9	U			
Tetradifon (Tedion)	15	U			
PCB - 1242	37	U			
PCB - 1248	37	U			

Authorized By: D. Hallock Release Date: 12/13/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96378330 (Matrix Spike - LMX2) **Date Received:** 09/16/96 **Method:** SW8080
Field ID: SM RBT WH **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** % Recovery

Analyte	Result	Qualifier
Alpha-BHC	89	
Beta-BHC	94	
Gamma-BHC (Lindane)	95	
Delta-BHC	102	
Heptachlor	73	
Aldrin	86	
Heptachlor Epoxide	83	
Trans-Chlordane (Gamma)	86	
Endosulfan I	80	
Dieldrin	76	
4,4'-DDE	121	
Endrin	77	
Endosulfan II	97	
4,4'-DDD	102	
Endosulfan Sulfate	104	
4,4'-DDT	82	
Endrin Ketone	107	
Methoxychlor	104	
Alpha-Chlordene	79	
Gamma-Chlordene	96	
Oxychlordane	94	
DDMU	103	
Cis-Chlordane (Alpha-Chlordane	97	
Cis-Nonachlor	91	
2,4'-DDE	88	
Trans-Nonachlor	92	
2,4'-DDD	100	
2,4'-DDT	36	
Mirex	96	
Hexachlorobenzene	49	
Pentachloroanisole	53	
Tetradifon (Tedion)	87	
Dacthal (DCPA)	103	
Diazinon	122	
Ethion	84	
Parathion	101	
Methyl Parathion	79	
Chlorpyriphos	71	

Surrogate Recoveries

Dibutylchlorendate	74	%
Tetrachloro-m-xylene	77	%
Decachlorobiphenyl	82	%

Authorized By: D. Norton Release Date: 12/23/96

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96378330 (Matrix Spike - LMX1) **Date Received:** 09/16/96 **Method:** SW8080
Field ID: SM RBT WH **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** % Recovery

Analyte	Result	Qualifier
Alpha-BHC	97	
Beta-BHC	104	
Gamma-BHC (Lindane)	103	
Delta-BHC	114	
Heptachlor	4	
Aldrin	74	
Heptachlor Epoxide	93	
Trans-Chlordane (Gamma)	95	
Endosulfan I	92	
Dieldrin	89	
4,4'-DDE	89	
Endrin	89	
Endosulfan II	108	
4,4'-DDD	112	
Endosulfan Sulfate	116	
4,4'-DDT	89	
Endrin Ketone	116	
Methoxychlor	114	
Alpha-Chlordene	63	
Gamma-Chlordene	100	
Oxychlordane	98	
DDMU	93	
Cis-Chlordane (Alpha-Chlordane	91	
Cis-Nonachlor	97	
2,4'-DDE	87	
Trans-Nonachlor	85	
2,4'-DDD	106	
2,4'-DDT	85	
Mirex	97	
Hexachlorobenzene	34	
Pentachloroanisole	57	
Tetradifon (Tedion)	101	
Dacthal (DCPA)	121	
Diazinon	92	
Ethion	88	
Parathion	103	
Methyl Parathion	108	
Chlorpyriphos	191	

Surrogate Recoveries

Dibutylchlorendate	78	%
Tetrachloro-m-xylene	52	%
Decachlorobiphenyl	82	%

Authorized By: _____ Release Date: 12/13/96

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pesticides in Tissue; WSPMP list

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96378330 **Date Received:** 09/16/96 **Method:** SW8080
Field ID: SM RBT WH **Date Prepared:** 10/02/96 **Matrix:** Tissue
Project Officer: Art Johnson **Date Analyzed:** 11/01/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Alpha-BHC	4.0	U
Beta-BHC	4.0	U
Gamma-BHC (Lindane)	4.0	U
Delta-BHC	4.0	U
Heptachlor	4.0	U
Aldrin	4.0	U
Heptachlor Epoxide	4.0	U
Trans-Chlordane (Gamma)	4.0	U
Endosulfan I	4.0	U
Dieldrin	**1.4**	**J**
4,4'-DDE	**50**	
Endrin	4.0	U
Endosulfan II	4.0	U
4,4'-DDD	**6.1**	
Endrin Aldehyde	4.0	U
Endosulfan Sulfate	4.0	U
4,4'-DDT	**11**	
Endrin Ketone	4.0	U
Methoxychlor	4.0	U
Alpha-Chlordene	4.0	U
Gamma-Chlordene	4.0	U
Oxychlordane	4.0	U
DDMU	**3.3**	**J**
Cis-Chlordane (Alpha-Chlordane	4.0	U
Cis-Nonachlor	4.0	U
Kelthane	16	UJ
2,4'-DDE	4.0	U
Trans-Nonachlor	4.0	U
2,4'-DDD	**0.6**	**NJ**
2,4'-DDT	4.0	U
Mirex	4.0	U
Toxaphene	120	U
4,4'-Dichlorobenzophenone	16	UJ
Hexachlorobenzene	**0.5**	**NJ**
Pentachloroanisole	2.0	U
Tetradifon (Tedion)	16	U
PCB - 1242	40	U
PCB - 1248	40	U
PCB - 1254	40	U
PCB - 1260	40	U
Dacthal (DCPA)	**1.4**	**J**
PCB - 1232	40	U
Diazinon	40	U
Ethion	16	U
Parathion	8.0	U
Methyl Parathion	8.0	U
Treflan (Trifluralin)	4.0	UJ
Chlorpyriphos	**0.9**	**J**

Surrogate Recoveries

Dibutylchlorendate	**71**	**%**
Tetrachloro-m-xylene	**74**	**%**
Decachlorobiphenyl	**88**	**%**

Authorized By: D. Hunter Release Date: 12/13/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Arsenic

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Project Officer: Art Johnson
Date Reported: 22-NOV-96

Method: EPA206.2
Matrix: Tissue
Analyte: Arsenic

Sample	QC	Field ID	Result	Qualifier	Units	Received	Analyzed
96378330		SM RBT WH	0.3	UJ	mg/Kg	09/16/96	11/21/96
96378331		SM RBT FL	0.3	UJ	mg/Kg	09/16/96	11/21/96
96378332		LG RBT FL	0.3	UJ	mg/Kg	09/16/96	11/21/96
96378332	Matrix Spike		80 %			09/16/96	11/21/96
96378332	Matrix Spike		78 %			09/16/96	11/21/96
BLN63895		SPB4497	0.3	U	mg/Kg		
LCS63896		SLC4497	62 %				
LCS64016		SLC4498	64 %				

Authorized By: Sally Lull Release Date: 11/22/96

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Percent Lipids

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Project Officer: Art Johnson
Date Reported: 19-DEC-96

Method: EPA608.5
Matrix: Tissue
Analyte: Lipids

Sample	QC	Field ID	Result	Qualifier	Units	Received	Analyzed
96378330		SM RBT WH	4.04		%	09/16/96	10/11/96
96378331		SM RBT FL	2.60		%	09/16/96	10/11/96
96378332		LG RBT FL	2.97		%	09/16/96	10/11/96
BLN64243		OBT6276B1	0.00	U	%		
BLN64244		OBT6276B2	0.00	U	%		

Authorized By: _____ Release Date: 12/19/96

Manchester Environmental Laboratory

7411 Beach Dr E, Port Orchard Washington 98366

CASE NARRATIVE

November 25, 1996

Subject: Grayland and Wapato Lake sediments, week 35

Samples: Grayland - 96358155 - 62
Wapato - 96358032 & 39

Officer(s): Dale Davis (Grayland)
Art Johnson (Wapato)

By: Norman Olson
Bob Carrell
Organics Analysis Unit

PESTICIDE & HERBICIDE ANALYSIS

ANALYTICAL METHODS: (SW846-8081 & Draft EPA Method 8085; formerly modified 1618 & 1658) Separate samples for the neutrals and Acids were extracted following Manchester Laboratory's standard operating procedure for the extraction of pesticides and herbicides. The neutral target compounds were extracted by soxhlet extraction with acetone as the extraction solvent followed by solvent exchange to hexane. The acid target compounds were hydrolyzed with base and extracted with diethyl ether in separatory funnels. The extracts were analyzed by capillary Gas Chromatography with Electron Capture Detection (GC/ECD) and Gas Chromatography with Atomic Emission Detection (GC/AED). Confirmations of detected pesticides and herbicides were performed either via Dual Dissimilar Column retention time comparison and/or Gas Chromatography and Ion-Trap mass spectrometry (GC/ITD).

All analytes have a respective practical quantitation limit (PQL) that is higher than the corresponding method detection level (MDL). If a target analyte is detected and confirmed at a concentration below its PQL, the reported concentration is qualified as an estimate, ' J' qualifier. This procedure also applies to the method blanks.

This method has been utilized for determination of pesticides and herbicides in soil samples on numerous occasions. However, the use of the method on sediment samples with large proportions being water (70 to 90% water), we have less experience. Although the matrices from the two projects differ, the high percentage water common to both is probably the most significant factor influencing method applicability towards each target compound. Therefore, most of the target compounds were spiked, in duplicate, into both a Grayland sample and a Wapato sample. The data from the four spiked samples should be enough to make a decision on the applicability of the method for each target compound.

Analytes showing no applicable toward the method, via zero matrix spike recoveries, were deleted from the target compound list reports. Decisions were made on the need to qualify some targets due to their respective recovery performance. The deletion and the qualification of the targets is discussed in each of the individual parameter sections below.

Both projects, Grayland and Wapato Lake, were extracted and analyzed in the same batch, Therefore the information that follows is a compilation of the data.

NITROGEN-CONTAINING PESTICIDE ANALYSIS

BLANKS: No nitrogen-containing target compounds were detected in the laboratory blanks. Hence, the blanks demonstrate the system was free from this type of contamination.

HOLDING TIMES: All samples were extracted within 14 days of sampling.

SURROGATES: 1,3-Dimethyl-2-nitrobenzene recoveries ranged from 28% to 70% No established acceptance limits have been placed on the recoveries of this surrogate for this matrix. Due to the nature of the sample matrices, very large percentage water, these recoveries were not unexpected No qualifiers were attached to the nitrogen-containing pesticides on the basis of surrogate recoveries.

MATRIX SPIKING: All nitrogen-containing target pesticides were spiked except Triallate and appropriate levels of Hexazinone. Therefore, the quantitation limits for these two analytes were 'J' qualified throughout

Ten of nitrogen-containing targets were not recovered from the matrix spiked samples and were deleted from the target list, they are the following:

Chlorthalonil	Fluridone	Diuron	Pendimethalin
Tebuthiuron	Atraton	Metalaxyl	
Norflurazon	MGK 264	Prometon	

Six of the targets showed low recoveries from at least one of the spiked sample duplicates For example, the fluorinated amines showed good recoveries from the Wapato spike but very low recoveries from the Grayland sample The following are the targets that were 'J' qualified due to low recoveries:

Ethalfluralin	Benfluralin	Carboxin
Trifluralin	Oxyfluorfen	Profluralin

COMMENTS: Data is useable as qualified.

ORGANOPHOSPHOROUS PESTICIDE ANALYSIS

BLANKS: No organophosphorous target compounds were detected in the laboratory blanks.

HOLDING TIMES: All samples were extracted within 14 days of sampling.

SURROGATES: Triphenylphosphate recoveries from the sediment samples and blanks ranged from 41% to 101%. No recovery acceptance limits have been established for this surrogate in this matrix No qualifiers were attached on the basis of Triphenylphosphate surrogate recoveries

MATRIX SPIKING: All organophosphorous pesticide (OPPest) target compounds were spiked.

Eight of OPPest targets were not recovered from the matrix spiked samples and were deleted from the target list, they are the following:

Imidan	Mevinphos
Fensulfothion	Methyl Parathion
Fenamiphos	Methyl Paraoxon
Phosphamidan	Dimethoate

Three of the OPPest targets showed low recoveries from at least one of the spiked sample duplicates. The following are the targets that were 'J' qualified due to low recoveries:

Fenitrothion
EPN
Parathion

COMMENTS: The data is useable as qualified

ORGANOCHLORINE PESTICIDE ANALYSIS

BLANKS: No organochlorine target compounds were detected in the laboratory blanks.

HOLDING TIMES: All samples were extracted within 14 days of sampling

SURROGATES: Surrogate recoveries from the sediment samples and blanks ranged from 25% to 84%, 17% to 88% and 17% to 94% for Dibromooctafluorobiphenyl, Tetrachloro-meta-xylene and Decachlorobiphenyl respectively. Only two of the samples had Decachlorobiphenyl recoveries of less than 40%. No recovery acceptance limits have been established for these surrogates in this matrix No qualifiers were attached on the basis of surrogate recoveries

MATRIX SPIKING: All of the organochlorine targets (CL-Pest/PCB) were spiked except for Toxaphene, Tetradifon, HCB, PCP-methyl and the PCBs.

Three analytes, Methoxychlor, Captan and Captafol, were not recovered from the spiked matrices and, therefore, were not included in the target list reports. Kelthane was recovered as its breakdown product, 4,4'-dichlorobenzophenone, but the recovery was not quantitated. Kelthane was qualified 'J' throughout on this basis

COMMENTS: The data is useable as qualified.

SULFUR-CONTAINING AND PYRETHROID PESTICIDE ANALYSIS

BLANKS: None of these types of target analytes were detected in the laboratory blanks.

HOLDING TIMES: All samples were extracted within 14 days of sampling.

SURROGATES: There no designated surrogate compounds for these groups of targets Recovery efficiencies of surrogates from other neutral pesticide groups should also apply to this group.

MATRIX SPIKING: Recoveries for the Sulfur-containing pesticide, Propargite, ranged from 42% to 82%.

None of the pyrethroid pesticides were spiked Therefore, the quantitation limits for all of these analytes were 'J' qualified throughout In addition, interferences in the samples caused the practical quantitation limits for these analytes to be raised

COMMENTS: The data is useable as qualified.

ACID HERBICIDE ANALYSIS

BLANKS: No acid herbicide target compounds were detected in the laboratory blanks

HOLDING TIMES: All samples were extracted within 14 days of sampling.

SURROGATES: 2,4,6-Tribromophenol recoveries from sediment samples and blanks ranged from 35% to 95%, except for the recovery from one of the matrix spiked samples from Grayland which was 309%. This high recovery is not a problem because it occurred in a matrix spike sample and the target analyte recoveries associated with the spiked were in order No recovery acceptance limits have been established for this surrogate in this matrix No qualifiers were attached on the basis of Tribromophenol surrogate recoveries

MATRIX SPIKING: All acid herbicide targets were spiked Two analytes, Acifluorfen and Dinoseb, were not recovered from either the Grayland sample nor the Wapato sample, therefore neither were included in the target list reports One other analyte, 4-nitrophenol, was not recovered from the Wapato sample, and it also was not included in the Wapato target list report and was 'J' qualified for the Grayland reports.

COMMENTS: Only samples 96358158 & 62 for Grayland and samples 96358082 & 89 for Wapato were analyzed for acid herbicides

The data is useable as qualified

DATA QUALIFIER CODES:

U	-	The analyte was not detected at or above the reported value.
J	-	The analyte was positively identified. The associated numerical value is an estimate.
UJ	-	The analyte was not detected at or above the reported estimated result.
REJ	-	The data are unusable for all purposes
NAF	-	Not analyzed for.
N	-	For organic analytes there is evidence the analyte is present in this sample
NJ	-	There is evidence that the analyte is present. The associated numerical result is an estimate.
E	-	This qualifier is used when the concentration of the associated value exceeds the known calibration range

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorophenoxy Herbicides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63681 **Method:** SW8150
Blank ID: OBS6254A1H **Date Prepared:** 09/10/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/04/96 **Units:** ug/Kg

Analyte	Result	Qualifier
2,4,6-Trichlorophenol	65	U
3,5-Dichlorobenzoic Acid	110	U
2,4,5-Trichlorophenol	65	U
Dicamba I	110	U
2,3,4,6-Tetrachlorophenol	60	U
MCPP (Mecoprop)	220	U
MCPA	220	U
Dichlorprop	120	U
Bromoxynil	110	U
2,4-D	110	U
2,3,4,5-Tetrachlorophenol	60	U
Trichlopyr	92	U
Pentachlorophenol	54	U
2,4,5-TP (Silvex)	87	U
2,4,5-T	87	U
2,4-DB	130	U
Bentazon	160	U
Ioxynil	110	U
Picloram	110	UJ
Dacthal (DCPA)	87	U
2,4,5-TB	98	U
Diclofop-Methyl	160	U
4-Nitrophenol	190	UJ

Surrogate Recoveries

2,4,6-Tribromophenol	**59**	**%**

Authorized By: K Carey Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorophenoxy Herbicides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63682 **Method:** SW8150
Blank ID: OBS6254A2H **Date Prepared:** 09/10/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/04/96 **Units:** ug/Kg

Analyte	Result	Qualifier
2,4,6-Trichlorophenol	65	U
3,5-Dichlorobenzoic Acid	110	U
2,4,5-Trichlorophenol	65	U
Dicamba I	110	U
2,3,4,6-Tetrachlorophenol	60	U
MCPP (Mecoprop)	220	U
MCPA	220	U
Dichlorprop	120	U
Bromoxynil	110	U
2,4-D	110	U
2,3,4,5-Tetrachlorophenol	60	U
Trichlopyr	92	U
Pentachlorophenol	54	U
2,4,5-TP (Silvex)	87	U
2,4,5-T	87	U
2,4-DB	130	U
Bentazon	160	U
Ioxynil	110	U
Picloram	110	UJ
Dacthal (DCPA)	87	U
2,4,5-TB	98	U
Diclofop-Methyl	160	U
4-Nitrophenol	190	UJ

Surrogate Recoveries

2,4,6-Tribromophenol	**53**	**%**

Authorized By: P Cline Release Date: 11/21/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorophenoxy Herbicides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 **Date Received:** 08/28/96 **Method:** SW8150
Field ID: UPPER **Date Prepared:** 09/10/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/04/96 **Units:** ug/Kg

Analyte	Result	Qualifier
2,4,6-Trichlorophenol	130	U
3,5-Dichlorobenzoic Acid	210	U
2,4,5-Trichlorophenol	130	U
Dicamba I	210	U
2,3,4,6-Tetrachlorophenol	120	U
MCPP (Mecoprop)	420	U
MCPA	420	U
Dichlorprop	230	U
Bromoxynil	210	U
2,4-D	210	U
2,3,4,5-Tetrachlorophenol	120	U
Trichlopyr	180	U
Pentachlorophenol	110	U
2,4,5-TP (Silvex)	170	U
2,4,5-T	170	U
2,4-DB	250	U
Bentazon	320	U
Ioxynil	210	U
Picloram	210	UJ
Dacthal (DCPA)	170	U
2,4,5-TB	190	U
Diclofop-Methyl	320	U

Surrogate Recoveries

2,4,6-Tribromophenol	**71**	**%**

Authorized By: R Carey Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorophenoxy Herbicides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 **Date Received:** 08/28/96 **Method:** SW8150
Field ID: LOWER **Date Prepared:** 09/10/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/04/96 **Units:** ug/Kg

Analyte	Result	Qualifier
2,4,6-Trichlorophenol	140	U
3,5-Dichlorobenzoic Acid	230	U
2,4,5-Trichlorophenol	140	U
Dicamba I	230	U
2,3,4,6-Tetrachlorophenol	130	U
MCPP (Mecoprop)	460	U
MCPA	460	U
Dichlorprop	250	U
Bromoxynil	230	U
2,4-D	230	U
2,3,4,5-Tetrachlorophenol	130	U
Trichlopyr	190	U
Pentachlorophenol	120	U
2,4,5-TP (Silvex)	180	U
2,4,5-T	180	U
2,4-DB	280	U
Bentazon	340	U
Ioxynil	230	U
Picloram	230	UJ
Dacthal (DCPA)	180	U
2,4,5-TB	210	U
Diclofop-Methyl	340	U

Surrogate Recoveries

2,4,6-Tribromophenol	**72**	**%**

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorophenoxy Herbicides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 (Matrix Spike - LMX1) **Date Received:** 08/28/96 **Method:** SW8150
Field ID: LOWER **Date Prepared:** 09/10/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/04/96 **Units:** % Recovery

Analyte	Result	Qualifier
2,4,6-Trichlorophenol	82	
3,5-Dichlorobenzoic Acid	109	
2,4,5-Trichlorophenol	98	
Dicamba I	162	
2,3,4,6-Tetrachlorophenol	92	
MCPP (Mecoprop)	127	
MCPA	124	
Dichlorprop	111	
Bromoxynil	51	
2,4-D	109	
2,3,4,5-Tetrachlorophenol	108	
Trichlopyr	106	
Pentachlorophenol	98	
2,4,5-TP (Silvex)	106	
2,4,5-T	58	
2,4-DB	114	
Bentazon	107	
Ioxynil	120	
Picloram	63	
Dacthal (DCPA)	173	
2,4,5-TB	108	
Diclofop-Methyl	77	

Surrogate Recoveries

2,4,6-Tribromophenol	64	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorophenoxy Herbicides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 (Matrix Spike - LMX2) **Date Received:** 08/28/96 **Method:** SW8150
Field ID: LOWER **Date Prepared:** 09/10/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/04/96 **Units:** % Recovery

Analyte	Result	Qualifier
2,4,6-Trichlorophenol	70	
3,5-Dichlorobenzoic Acid	79	
2,4,5-Trichlorophenol	86	
Dicamba I	120	
2,3,4,6-Tetrachlorophenol	80	
MCPP (Mecoprop)	94	
MCPA	87	
Dichlorprop	85	
Bromoxynil	54	
2,4-D	80	
2,3,4,5-Tetrachlorophenol	93	
Trichlopyr	83	
Pentachlorophenol	85	
2,4,5-TP (Silvex)	76	
2,4,5-T	83	
2,4-DB	82	
Bentazon	79	
Ioxynil	120	
Picloram	48	
Dacthal (DCPA)	134	
2,4,5-TB	80	
Diclofop-Methyl	51	

Surrogate Recoveries

2,4,6-Tribromophenol	66	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Sulfur Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Project Officer: Art Johnson
Date Reported: 26-NOV-96

Method: EPA1618
Matrix: Sediment/Soil
Analyte: Propargite

Sample	QC	Field ID	Result	Qualifier	Units	Received	Analyzed
96358082		UPPER	130	U	ug/Kg	08/28/96	10/13/96
96358089		LOWER	150	U	ug/Kg	08/28/96	10/13/96
BLN63759		OBS6249A1	31	U	ug/Kg		10/13/96
BLN63760		OBS6249A2	31	U	ug/Kg		10/13/96

Authorized By: _____ Release Date: 11/26/96

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Nitrogen Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Dichlobenil	130	U
Propachlor (Ramrod)	150	U
Ethalfluralin (Sonalan)	97	UJ
Treflan (Trifluralin)	96	UJ
Simazine	64	U
Atrazine	64	U
Pronamide (Kerb)	260	U
Terbacil	190	U
Metribuzin	64	U
Alachlor	230	U
Prometryn	64	U
Bromacil	260	U
Metolachlor	260	U
Diphenamid	190	U
Napropamide	190	U
Oxyfluorfen	260	UJ
Eptam	130	U
Butylate	130	U
Vernolate	130	U
Cycloate	130	U
Benefin	97	UJ
Propazine	64	U
Triallate	170	UJ
Ametryn	64	U
Terbutryn (Igran)	64	U
Hexazinone	96	UJ
Pebulate	130	U
Molinate	130	U
Chlorpropham	260	U
Triadimefon	170	U
Butachlor	220	U
Carboxin	710	UJ
Fenarimol	190	U
Di-allate (Avadex)	240	U
Profluralin	150	UJ
Cyanazine	97	U

Surrogate Recoveries

1,3-Dimethyl-2-nitrobenzene	40	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Nitrogen Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 (Matrix Spike - LMX1) **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** % Recovery

Analyte	Result	Qualifier
Dichlobenil	77	
Propachlor (Ramrod)	12	
Ethalfluralin (Sonalan)	37	
Treflan (Trifluralin)	33	
Simazine	30	
Atrazine	35	
Pronamide (Kerb)	54	
Terbacil	51	
Metribuzin	35	
Alachlor	51	
Prometryn	36	
Bromacil	40	
Metolachlor	58	
Diphenamid	31	
Pendimethalin	42	
Napropamide	65	
Oxyfluorfen	42	
Eptam	55	
Butylate	65	
Vernolate	61	
Cycloate	55	
Benefin	48	
Prometon (Pramitol 5p)	31	
Propazine	33	
Triallate		NAF
Ametryn	24	
Terbutryn (Igran)	38	
Hexazinone		NAF
Pebulate	71	
Molinate	50	
Chlorpropham	66	
Triadimefon	59	
Butachlor	21	
Carboxin	27	
Fenarimol	79	
Di-allate (Avadex)	73	
Profluralin	54	
Cyanazine	30	

Surrogate Recoveries

1,3-Dimethyl-2-nitrobenzene	52	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Nitrogen Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 (Matrix Spike - LMX2) **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** % Recovery

Analyte	Result	Qualifier
Dichlobenil	69	
Propachlor (Ramrod)	9	
Ethalfluralin (Sonalan)	46	
Treflan (Trifluralin)	46	
Simazine	30	
Atrazine	36	
Pronamide (Kerb)	51	
Terbacil	47	
Metribuzin	32	
Alachlor	42	
Prometryn	31	
Bromacil	31	
Metolachlor	55	
Diphenamid	21	
Pendimethalin	49	
Napropamide	48	
Oxyfluorfen	59	
Eptam	77	
Butylate	107	
Vernolate	76	
Cycloate	78	
Benefin	82	
Prometon (Pramitol 5p)	0	
Propazine	46	
Triallate		NAF
Ametryn	50	
Terbutryn (Igran)	59	
Hexazinone		NAF
Pebulate	88	
Molinate	78	
Chlorpropham	93	
Triadimefon	28	
Butachlor	27	
Carboxin	6	
Fenarimol	49	
Di-allate (Avadex)	46	
Profluralin	81	
Cyanazine	54	

Surrogate Recoveries

1,3-Dimethyl-2-nitrobenzene	61	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Nitrogen Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: LOWER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Dichlobenil	150	U
Propachlor (Ramrod)	170	U
Ethalfluralin (Sonalan)	110	UJ
Treflan (Trifluralin)	110	UJ
Simazine	73	U
Atrazine	73	U
Pronamide (Kerb)	290	U
Terbacil	220	U
Metribuzin	73	U
Alachlor	260	U
Prometryn	73	U
Bromacil	290	U
Metolachlor	290	U
Diphenamid	220	U
Napropamide	220	U
Oxyfluorfen	290	UJ
Eptam	150	U
Butylate	150	U
Vernolate	150	U
Cycloate	150	U
Benefin	110	UJ
Propazine	73	U
Triallate	190	UJ
Ametryn	73	U
Terbutryn (Igran)	73	U
Hexazinone	110	UJ
Pebulate	150	U
Molinate	150	U
Chlorpropham	290	U
Butachlor	250	U
Carboxin	800	UJ
Fenarimol	220	U
Di-allate (Avadex)	280	U
Profluralin	170	UJ
Cyanazine	110	U
Triadimefon	190	U

Surrogate Recoveries

1,3-Dimethyl-2-nitrobenzene	47	%

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Manchester Environmental Laboratory

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Analysis Report for

Nitrogen Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63759 **Method:** EPA1618
Blank ID: OBS6249A1 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Dichlobenil	31	U
Propachlor (Ramrod)	38	U
Ethalfluralin (Sonalan)	24	UJ
Treflan (Trifluralin)	24	UJ
Simazine	16	U
Atrazine	16	U
Pronamide (Kerb)	63	U
Terbacil	47	U
Metribuzin	16	U
Alachlor	56	U
Prometryn	16	U
Bromacil	63	U
Metolachlor	63	U
Diphenamid	47	U
Napropamide	47	U
Oxyfluorfen	63	UJ
Eptam	31	U
Butylate	31	U
Vernolate	31	U
Cycloate	31	U
Benefin	24	UJ
Propazine	16	U
Triallate	41	UJ
Ametryn	16	U
Terbutryn (Igran)	16	U
Hexazinone	23	UJ
Pebulate	31	U
Molinate	31	U
Chlorpropham	63	U
Triadimefon	41	U
Butachlor	55	U
Carboxin	170	UJ
Fenarimol	47	U
Di-allate (Avadex)	59	U
Profluralin	38	UJ
Cyanazine	24	U

Surrogate Recoveries

1,3-Dimethyl-2-nitrobenzene	70	%

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Analysis Report for

Nitrogen Containing Pesticides

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63760
Blank ID: OBS6249A2 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg **Method:** EPA1618

Analyte	Result	Qualifier
Dichlobenil	31	U
Propachlor (Ramrod)	38	U
Ethalfluralin (Sonalan)	24	UJ
Treflan (Trifluralin)	24	UJ
Simazine	16	U
Atrazine	16	U
Pronamide (Kerb)	63	U
Terbacil	47	U
Metribuzin	16	U
Alachlor	56	U
Prometryn	16	U
Bromacil	63	U
Metolachlor	63	U
Diphenamid	47	U
Napropamide	47	U
Oxyfluorfen	63	UJ
Eptam	31	U
Butylate	31	U
Vernolate	31	U
Cycloate	31	U
Benefin	24	UJ
Propazine	16	U
Triallate	41	UJ
Ametryn	16	U
Terbutryn (Igran)	16	U
Hexazinone	23	UJ
Pebulate	31	U
Molinate	31	U
Chlorpropham	63	U
Triadimefon	41	U
Butachlor	55	U
Carboxin	170	UJ
Fenarimol	47	U
Di-allate (Avadex)	59	U
Profluralin	38	UJ
Cyanazine	24	U

Surrogate Recoveries

1,3-Dimethyl-2-nitrobenzene	44	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Organophosphorous Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Demeton-O	45	U
Sulfotepp	38	U
Demeton-S	45	U
Fonofos	38	U
Disulfoton (Di-Syston)	38	U
Methyl Chlorpyrifos	51	U
Fenitrothion	45	UJ
Malathion	51	U
Chlorpyriphos	51	U
Merphos (1 & 2)	77	U
Ethion	45	U
Carbophenothion	64	U
EPN	64	UJ
Azinphos Ethyl	100	U
Ethoprop	51	U
Phorate	45	U
Diazinon	51	U
Ronnel	45	U
Fenthion	45	U
Parathion	51	UJ
Bolstar (Sulprofos)	45	U
Azinphos (Guthion)	120	U
Coumaphos	77	U
Dichlorvos (DDVP)	51	U
Dioxathion	110	U
Propetamphos	130	U
Tetrachlorvinphos (Gardona)	130	U
Butifos (DEF)	90	U
Abate (Temephos)	580	U

Surrogate Recoveries

Triphenyl Phosphate	**66**	**%**

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Organophosphorous Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 (Matrix Spike - LMX1) **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** % Recovery

Analyte	Result	Qualifier
Demeton-O	14	
Sulfotepp	56	
Demeton-S	18	
Fonofos	56	
Disulfoton (Di-Syston)	50	
Methyl Chlorpyrifos	57	
Fenitrothion	54	
Malathion	51	
Chlorpyriphos	54	
Merphos (1 & 2)	27	
Ethion	51	
Carbophenothion	54	
EPN	56	
Azinphos Ethyl	44	
Ethoprop	57	
Phorate	49	
Diazinon	56	
Methyl Parathion	57	
Ronnel	41	
Fenthion	42	
Parathion	52	
Bolstar (Sulprofos)	40	
Imidan	41	
Azinphos (Guthion)	40	
Coumaphos	37	
Dichlorvos (DDVP)	32	
Dioxathion	33	
Propetamphos	88	
Tetrachlorvinphos (Gardona)	55	
Butifos (DEF)	77	
Abate (Temephos)	13	

Surrogate Recoveries

Triphenyl Phosphate	41	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Organophosphorous Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 (Matrix Spike - LMX2) **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** % Recovery

Analyte	Result	Qualifier
Demeton-O	13	
Sulfotepp	78	
Demeton-S	37	
Fonofos	76	
Disulfoton (Di-Syston)	71	
Methyl Chlorpyrifos	82	
Fenitrothion	75	
Malathion	69	
Chlorpyriphos	83	
Merphos (1 & 2)	40	
Ethion	72	
Carbophenothion	76	
EPN	81	
Azinphos Ethyl	63	
Ethoprop	53	
Phorate	51	
Diazinon	55	
Methyl Parathion	53	
Ronnel	53	
Fenthion	48	
Parathion	60	
Bolstar (Sulprofos)	55	
Azinphos (Guthion)	34	
Coumaphos	35	
Dichlorvos (DDVP)	20	
Dioxathion	25	
Propetamphos	69	
Butifos (DEF)	35	
Abate (Temephos)	9	
Imidan	38	
Tetrachlorvinphos (Gardona)	41	

Surrogate Recoveries

Triphenyl Phosphate	46	%

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Organophosphorous Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: LOWER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Demeton-O	51	U
Sulfotepp	44	U
Demeton-S	51	U
Fonofos	44	U
Disulfoton (Di-Syston)	44	U
Methyl Chlorpyrifos	58	U
Fenitrothion	51	UJ
Malathion	58	U
Chlorpyriphos	58	U
Merphos (1 & 2)	87	U
Ethion	51	U
Carbophenothion	73	U
EPN	73	UJ
Azinphos Ethyl	120	U
Ethoprop	58	U
Phorate	51	U
Diazinon	58	U
Ronnel	51	U
Fenthion	51	U
Parathion	58	UJ
Bolstar (Sulprofos)	51	U
Azinphos (Guthion)	130	U
Coumaphos	87	U
Dichlorvos (DDVP)	58	U
Dioxathion	120	U
Propetamphos	150	U
Tetrachlorvinphos (Gardona)	150	U
Butifos (DEF)	100	U
Abate (Temephos)	650	U

Surrogate Recoveries

Triphenyl Phosphate	**79**	**%**

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Analysis Report for

Organophosphorous Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63759 **Method:** EPA1618
Blank ID: OBS6249A1 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Demeton-O	11	U
Sulfotepp	9.4	U
Demeton-S	11	U
Fonofos	9.4	U
Disulfoton (Di-Syston)	9.4	U
Methyl Chlorpyrifos	13	U
Fenitrothion	11	UJ
Malathion	13	U
Chlorpyriphos	13	U
Merphos (1 & 2)	19	U
Ethion	11	U
Carbophenothion	16	U
EPN	16	UJ
Azinphos Ethyl	25	U
Ethoprop	13	U
Phorate	11	U
Diazinon	13	U
Ronnel	11	U
Fenthion	11	U
Parathion	13	UJ
Bolstar (Sulprofos)	11	U
Azinphos (Guthion)	28	U
Coumaphos	19	U
Dichlorvos (DDVP)	13	U
Dioxathion	27	U
Propetamphos	31	U
Tetrachlorvinphos (Gardona)	31	U
Butifos (DEF)	22	U
Abate (Temephos)	140	U

Surrogate Recoveries

Triphenyl Phosphate	**101**	**%**

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Department of Ecology

Analysis Report for

Organophosphorous Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63760 **Method:** EPA1618
Blank ID: OBS6249A2 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Demeton-O	11	U
Sulfotepp	9.4	U
Demeton-S	11	U
Fonofos	9.4	U
Disulfoton (Di-Syston)	9.4	U
Methyl Chlorpyrifos	13	U
Fenitrothion	11	UJ
Malathion	13	U
Chlorpyriphos	13	U
Merphos (1 & 2)	19	U
Ethion	11	U
Carbophenothion	16	U
EPN	16	UJ
Azinphos Ethyl	25	U
Ethoprop	13	U
Phorate	11	U
Diazinon	13	U
Ronnel	11	U
Fenthion	11	U
Parathion	13	UJ
Bolstar (Sulprofos)	11	U
Azinphos (Guthion)	28	U
Coumaphos	19	U
Dichlorvos (DDVP)	13	U
Dioxathion	27	U
Propetamphos	31	U
Tetrachlorvinphos (Gardona)	31	U
Butifos (DEF)	22	U
Abate (Temephos)	140	U

Surrogate Recoveries

Triphenyl Phosphate	**61**	**%**

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Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorinated Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Alpha-BHC	13	U
Beta-BHC	13	U
Gamma-BHC (Lindane)	13	U
Delta-BHC	13	U
Heptachlor	13	U
Aldrin	13	U
Heptachlor Epoxide	13	U
Trans-Chlordane (Gamma)	13	U
Endosulfan I	38	U
Dieldrin	38	U
4,4'-DDE	**160**	
Endrin	38	U
Endosulfan II	38	U
4,4'-DDD	**230**	
Endrin Aldehyde	38	U
Endosulfan Sulfate	38	U
4,4'-DDT	13	U
Endrin Ketone	38	UJ
Alpha-Chlordene	13	U
Gamma-Chlordene	13	U
Oxychlordane	38	U
DDMU	**30**	
Cis-Chlordane (Alpha-Chlordane	13	U
Cis-Nonachlor	13	U
Kelthane	150	UJ
2,4'-DDE	13	U
Trans-Nonachlor	13	U
2,4'-DDD	**33**	
2,4'-DDT	13	U
Mirex	38	U
Toxaphene	380	U
Hexachlorobenzene	6.4	U
Pentachloroanisole	6.4	U
Tetradifon (Tedion)	51	U
PCB - 1242	130	U
PCB - 1248	130	U
PCB - 1254	130	U
PCB - 1260	130	U
PCB - 1232	260	U
PCB - 1221	130	U

Surrogate Recoveries

4,4-Dibromooctafluorobiphenyl	**36**	**%**
Tetrachloro-m-xylene	**20**	**%**
Decachlorobiphenyl	**28**	**%**

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorinated Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 (Matrix Spike - LMX1) **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** % Recovery

Analyte	Result	Qualifier
Alpha-BHC	54	
Beta-BHC	45	
Gamma-BHC (Lindane)	42	
Delta-BHC	41	
Heptachlor	6.1	
Aldrin	34	
Heptachlor Epoxide	8.7	
Trans-Chlordane (Gamma)	40	
Endosulfan I	45	
Dieldrin	45	
4,4'-DDE	51	
Endrin	37	
Endosulfan II	40	
4,4'-DDD	41	
Endrin Aldehyde	34	
Endosulfan Sulfate	58	
4,4'-DDT	43	
Endrin Ketone	12	
Alpha-Chlordene	33	
Gamma-Chlordene	42	
Oxychlordane	41	
DDMU	55	
Cis-Chlordane (Alpha-Chlordane	39	
Cis-Nonachlor	42	
Kelthane		NAF
2,4'-DDE	101	
Trans-Nonachlor	89	
2,4'-DDD	126	
2,4'-DDT	105	
Mirex	87	

Surrogate Recoveries

4,4-Dibromooctafluorobiphenyl	47	%
Tetrachloro-m-xylene	48	%
Decachlorobiphenyl	47	%

Authorized By: SM Release Date: 11/24/96 Page: 2

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorinated Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 (Matrix Spike - LMX2) **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** % Recovery

Analyte	Result	Qualifier
Alpha-BHC	66	
Beta-BHC	71	
Gamma-BHC (Lindane)	67	
Delta-BHC	52	
Heptachlor	21	
Aldrin	52	
Heptachlor Epoxide	24	
Trans-Chlordane (Gamma)	62	
Endosulfan I	54	
Dieldrin	55	
4,4'-DDE	127	
Endrin	44	
Endosulfan II	48	
4,4'-DDD	116	
Endrin Aldehyde	40	
Endosulfan Sulfate	59	
4,4'-DDT	66	
Endrin Ketone	17	
Alpha-Chlordene	75	
Gamma-Chlordene	93	
Oxychlordane	92	
DDMU	140	
Cis-Chlordane (Alpha-Chlordane	95	
Cis-Nonachlor	96	
Kelthane		NAF
2,4'-DDE	42	
Trans-Nonachlor	39	
2,4'-DDD	61	
2,4'-DDT	48	
Mirex	40	

Surrogate Recoveries

4,4-Dibromooctafluorobiphenyl	58	%
Tetrachloro-m-xylene	64	%
Decachlorobiphenyl	58	%

Authorized By: _____ Release Date: 11/22/96 Page: 3

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorinated Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: LOWER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Alpha-BHC	15	U
Beta-BHC	15	U
Gamma-BHC (Lindane)	15	U
Delta-BHC	15	U
Heptachlor	15	U
Aldrin	15	U
Heptachlor Epoxide	15	U
Trans-Chlordane (Gamma)	15	U
Endosulfan I	44	U
Dieldrin	44	U
4,4'-DDE	**470**	
Endrin	44	U
Endosulfan II	44	U
4,4'-DDD	**650**	
Endrin Aldehyde	44	U
Endosulfan Sulfate	44	U
4,4'-DDT	**27**	
Endrin Ketone	44	UJ
Alpha-Chlordene	15	U
Gamma-Chlordene	15	U
Oxychlordane	15	U
DDMU	**90**	
Cis-Chlordane (Alpha-Chlordane	**6.1**	**J**
Cis-Nonachlor	15	U
Kelthane	170	UJ
2,4'-DDE	**15**	
Trans-Nonachlor	15	U
2,4'-DDD	**90**	
2,4'-DDT	15	U
Mirex	44	U
Toxaphene	440	U
Hexachlorobenzene	7.3	U
Pentachloroanisole	7.3	U
Tetradifon (Tedion)	58	U
PCB - 1242	150	U
PCB - 1248	150	U
PCB - 1254	150	U
PCB - 1260	150	U
PCB - 1232	290	U
PCB - 1221	150	U

Surrogate Recoveries

4,4-Dibromooctafluorobiphenyl	**53**	**%**
Tetrachloro-m-xylene	**45**	**%**
Decachlorobiphenyl	**51**	**%**

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorinated Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63759 **Method:** EPA1618
Blank ID: OBS6249A1 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Alpha-BHC	3.1	U
Beta-BHC	3.1	U
Gamma-BHC (Lindane)	3.1	U
Delta-BHC	3.1	U
Heptachlor	3.1	U
Aldrin	3.1	U
Heptachlor Epoxide	3.1	U
Trans-Chlordane (Gamma)	3.1	U
Endosulfan I	9.4	U
Dieldrin	9.4	U
4,4'-DDE	3.1	U
Endrin	9.4	U
Endosulfan II	9.4	U
4,4'-DDD	3.1	U
Endrin Aldehyde	9.4	U
Endosulfan Sulfate	9.4	U
4,4'-DDT	3.1	U
Endrin Ketone	9.4	UJ
Alpha-Chlordene	3.1	U
Gamma-Chlordene	3.1	U
Oxychlordane	3.1	U
DDMU	3.1	U
Cis-Chlordane (Alpha-Chlordane	3.1	U
Cis-Nonachlor	3.1	U
Kelthane	38	UJ
2,4'-DDE	3.1	U
Trans-Nonachlor	3.1	U
2,4'-DDD	3.1	U
2,4'-DDT	3.1	U
Mirex	9.4	U
Toxaphene	94	U
Hexachlorobenzene	1.6	U
Pentachloroanisole	1.6	U
Tetradifon (Tedion)	13	U
PCB - 1242	31	U
PCB - 1248	31	U
PCB - 1254	31	U
PCB - 1260	31	U
PCB - 1232	63	U
PCB - 1221	31	U

Surrogate Recoveries

4,4-Dibromooctafluorobiphenyl	**79**	%
Tetrachloro-m-xylene	**88**	%
Decachlorobiphenyl	**94**	%

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Chlorinated Pesticides (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63760 **Method:** EPA1618
Blank ID: OBS6249A2 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Alpha-BHC	3.1	U
Beta-BHC	3.1	U
Gamma-BHC (Lindane)	3.1	U
Delta-BHC	3.1	U
Heptachlor	3.1	U
Aldrin	3.1	U
Heptachlor Epoxide	3.1	U
Trans-Chlordane (Gamma)	3.1	U
Endosulfan I	9.4	U
Dieldrin	9.4	U
4,4'-DDE	3.1	U
Endrin	9.4	U
Endosulfan II	9.4	U
4,4'-DDD	3.1	U
Endrin Aldehyde	9.4	U
Endosulfan Sulfate	9.4	U
4,4'-DDT	3.1	U
Endrin Ketone	9.4	UJ
Alpha-Chlordene	3.1	U
Gamma-Chlordene	3.1	U
Oxychlordane	3.1	U
DDMU	3.1	U
Cis-Chlordane (Alpha-Chlordane	3.1	U
Cis-Nonachlor	3.1	U
Kelthane	38	UJ
2,4'-DDE	3.1	U
Trans-Nonachlor	3.1	U
2,4'-DDD	3.1	U
2,4'-DDT	3.1	U
Mirex	9.4	U
Toxaphene	94	U
Hexachlorobenzene	1.6	U
Pentachloroanisole	1.6	U
Tetradifon (Tedion)	13	U
PCB - 1242	31	U
PCB - 1248	31	U
PCB - 1254	31	U
PCB - 1260	31	U
PCB - 1232	63	U
PCB - 1221	31	U

Surrogate Recoveries

4,4-Dibromooctafluorobiphenyl	**54**	**%**
Tetrachloro-m-xylene	**58**	**%**
Decachlorobiphenyl	**65**	**%**

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pyrethrins (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358082 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: UPPER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Resmethrin	1300	UJ
Phenothrin	1300	UJ
cis-Permethrin	1300	UJ
Fenvalerate (2 isomers)	260	UJ

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pyrethrins (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: 96358089 **Date Received:** 08/28/96 **Method:** EPA1618
Field ID: LOWER **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Resmethrin	1500	UJ
Phenothrin	1500	UJ
cis-Permethrin	1500	UJ
Fenvalerate (2 isomers)	290	UJ

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pyrethrins (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63759 **Method:** EPA1618
Blank ID: OBS6249A1 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Resmethrin	310	UJ
Phenothrin	310	UJ
cis-Permethrin	310	UJ
Fenvalerate (2 isomers)	63	UJ

Authorized By: _____ Release Date: 11/26/96 Page: 1

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Pyrethrins (GC/AED)

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Sample: BLN63760 **Method:** EPA1618
Blank ID: OBS6249A2 **Date Prepared:** 09/05/96 **Matrix:** Sediment/Soil
Project Officer: Art Johnson **Date Analyzed:** 10/13/96 **Units:** ug/Kg

Analyte	Result	Qualifier
Resmethrin	310	UJ
Phenothrin	310	UJ
cis-Permethrin	310	UJ
Fenvalerate (2 isomers)	63	UJ

Authorized By: _____ Release Date: 11/26/96 Page: 1

September 12, 1996

To: Art Johnson

From: Randy Knox, Metals Chemist RSK

Subject: Wapato Lake Project Sediment

QUALITY ASSURANCE SUMMARY

Data quality for this project is excellent. No significant quality assurance issues are noted with the data

SAMPLE INFORMATION

The samples from the Wapato Lake Project were received by the Manchester Laboratory on 8/28/96 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals)

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples show no analytically significant levels of analytes except lead. The reported lead detection level is raised to 0.4 mg/Kg. At this detection level there is no observed lead contamination.

SPIKED SAMPLES ANALYSIS

Spiked and duplicate spiked sample analysis were performed on this data set. All spike recoveries are within the CLP acceptance limits of +/- 25%.

PRECISION DATA

The results of the spiked and duplicate spiked samples are used to evaluate precision on this sample set. The relative percent difference (RPD) for all analytes is within the 20% CLP acceptance window for duplicate analysis.

LABORATORY CONTROL SAMPLE (LCS) ANALYSIS

LCS analyses are within the windows established for each parameter.

Please call Bill Kammin at SCAN 360-871-8801 to further discuss this project.

RLK:rlk

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Arsenic

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Project Officer: Art Johnson
Date Reported: 10-SEP-96

Method: EPA206.2
Matrix: Sediment/Soil
Analyte: Arsenic

Sample	QC	Field ID	Result	Qualifier	Units	Received	Analyzed
96358082		UPPER	2.9		mg/Kg Dry Wt.	08/28/96	09/06/96
96358089		LOWER	3.0		mg/Kg Dry Wt.	08/28/96	09/06/96
96358089	Matrix Spike		82 %			08/28/96	09/06/96
96358089	Matrix Spike		77 %			08/28/96	09/06/96
BLN63172		SPB3589	0.3	U	mg/Kg Dry Wt.		09/06/96
ERA63173		SLC3589	96 %				09/06/96

Authorized By: Lolly Cull Release Date: 9/12/96

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Lead

Project Name: Wapato Lake **LIMS Project ID:** 1564-96

Project Officer: Art Johnson
Date Reported: 10-SEP-96

Method: EPA239.2
Matrix: Sediment/Soil
Analyte: Lead

Sample	QC	Field ID	Result	Qualifier	Units		Received	Analyzed
96358082		UPPER	**19.8**		mg/Kg	Dry Wt.	08/28/96	09/09/96
96358089		LOWER	**20.9**		mg/Kg	Dry Wt.	08/28/96	09/09/96
96358089	Matrix Spike		**118 %**				08/28/96	09/09/96
96358089	Matrix Spike		**116 %**				08/28/96	09/09/96
BLN63172		SPB3589	**0.4**	**U**	mg/Kg	Dry Wt.		
ERA63173		SLC3589	**113 %**					

Authorized By: Kelly Cull Release Date: 9/12/96 Page: 1

WA DOE: Wapato Lake
Grain Size Distribution[1]

Table 1

Sample Number	Gravel % > US #4 sieve	Sand % US #4 - #200 sieve	Silt % 0.075 - 0.002 mm	Clay % < 0.002 mm
35-8082	2	4	47	47
35-8089 Dup 1	0	1	59	40
35-8089 Dup 2	1	1	61	37

[1] Samples submitted were analyzed for grain size following ASTM D-422 methodology

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA 98366

September 24, 1996

Project: Wapato Lake

Samples: 35-8082, 8089

Laboratory: Sound Analytical

By: Pam Covey

Case Summary

These samples were received at the Manchester Environmental Laboratory (MEL) on August 28, 1996 and sent to Sound Analytical on September 6, 1996 for TOC analysis using PSEP method

The samples were analyzed within acceptable holding limits, and the method blank associated with these samples has shown the process is free from contamination.

One sample was analyzed in triplicate and was within acceptable limits for the Relative Percent Difference (RPD)

For consistency with MEL reporting protocol, all non-detect values have been qualified with a "U" (the analyte was not detected at or above the reported result).

The results are acceptable for use as amended.

SOUND ANALYTICAL SERVICES, INC.

ANALYTICAL & ENVIRONMENTAL CHEMISTS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: WA Department of Ecology Date: September 17, 1996

Report On: Analysis of Solid Report No.: 59255

IDENTIFICATION:
Samples received on 09-06-96
Project: Wapato Lake

ANALYSIS:

Lab Sample No. 59255-1 Client ID: 35-8082

General Chemistry
Units: mg/kg

Parameter	Method	Result	PQL
Total Organic Carbon	PSEP	74,000	100

Lab Sample No. 59255-2 Client ID: 35-8089

General Chemistry
Units: mg/kg

Parameter	Method	Result	PQL
Total Organic Carbon	PSEP	73,000	100

ND - Not Detected
PQL - Practical Quantitation Limit

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4813 PACIFIC HIGHWAY EAST, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

QUALITY CONTROL REPORT

General Chemistry

Client: WA Department of Ecology
Lab No: 59255q
Units: mg/kg

QC Batch No. 296
Date Analyzed: 9-11-96

METHOD BLANK

Parameter	Result	PQL
Total Organic Carbon	100 ND	100

ND = Not Detected
PQL = Practical Quantitation Limit

TRIPLICATE

Parameter	Lab Sample No.	Sample Result	Duplicate Result	Triplicate Result	%RSD
Total Organic Carbon	59255-i	74,100	76,900	75,600	1.9

%RSD = Percent Relative Standard Deviation

BIOASSAY REPORT

ACUTE BIOASSAYS

Conducted August 30 through
September 9, 1996

Prepared for

WASHINGTON STATE DEPT. OF ECOLOGY
PORT ORCHARD, WASHINGTON

Prepared by

CH2M HILL
2300 NW Walnut Boulevard
Corvallis, Oregon 97330

September 26, 1996
Lab I.D. No. C01708

INTRODUCTION

CH2M HILL conducted acute bioassays from August 30 through September 9, 1996, on samples provided by Washington State Department of Ecology, Port Orchard, Washington. The organisms tested were the amphipod (*Hyalella azteca*) and the bioluminescent bacteria (*Vibrio fischeri*).

METHODS AND MATERIALS

TEST METHODS

The amphipod tests were performed according to: *Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates*, ASTM: E1383-90.

The Microtox tests were performed according to: *Microtox M500 Manual, Solid Phase Test Protocol*, Microbics Corporation Version 3.

TEST ORGANISMS

The amphipods were obtained from Chesapeake Cultures, Nayes, Virginia. The amphipods used were juveniles and were 2 to 3 millimeters in length. The organisms used for the Microtox testing were obtained from Microbics Corporation. All test organisms appeared vigorous and in good condition prior to testing.

DILUTION WATER

The water used for acclimation and dilution water during the static testing for the amphipods was reconstituted moderately hard water with a total hardness of 86 mg/l as $CaCO_3$, alkalinity of 64 mg/l as $CaCO_3$, and pH of 7.6. The dilution water used for the Microtox testing was a 2 percent sodium chloride solution provided by Microbics corporation.

SAMPLE PREPARATION

For the *Hyallela azteca* bioassays, 50ml of sample was placed in a test chamber, 200 ml of dilution water was then added and allowed to stand overnight. The test solutions were aerated slowly for 30 minutes prior to addition of test organisms.

For the Microtox testing, the sample was placed in dilution water and the organisms were allowed direct contact with the sample.

TEST CONCENTRATIONS

The *Hyalella azteca* bioassay concentration tested was 100 percent sample sediment with reference sediment for the control. The laboratory control was 16 grade washed silica sand. The photoperiod during the test was 16 hours light, 8 hours dark, and the temperature remained at 20±1°C throughout the test.

The dilutions for the Microtox testing were 0.01, 0.02, 0.04, 0.08, 0.15, 0.31, 0.62, 1.23, 2.47, 4.93, 9.87, and 19.7 percent sample sediment with dilution water as control. A control sediment was obtained from Northwestern Aquatic Sciences and was used as a reference control to compensate for color and turbidity interferences in the test. A control sediment from the Wapato Lake sampling area was not available.

SAMPLE COLLECTION AND DESCRIPTION

The samples were collected August 27, 1996 and shipped to CH2M HILL's Corvallis laboratory. The samples were stored at 4°C in the dark until test initiation. Chain of custody for sample collection is provided in Appendix C.

MONITORING OF BIOASSAYS

The amphipod tests were monitored at initiation and every 48 hours thereafter for dissolved oxygen and pH. Conductivity was monitored at test initiation and termination. Mortality was determined at test termination. Light intensity output of the bacteria was monitored at test initiation and termination in the Microtox test. Temperature was monitored continuously throughout the testing period.

RESULTS AND DISCUSSION

STATIC BIOASSAYS

The raw data sheets are presented in Appendix A and the results are summarized in the Tables below. Table 1 summarizes the survival data from the *Hyalella azteca* tests:

Table 1
Summary of Results
Hyalella azteca

Sample ID	# alive / # tested (% survival)
Test date 5/3/94	
Lab Control	53 / 60 (88.3%)
100% Upper	50 / 60 (83.3%)
100% Lower	53 / 60 (88.3%)

The *Hyalella azteca* showed no statistically significant reduction in survival when compared to the lab control. The no observed effect concentration (NOEC) and the lowest observed effect concentration (LOEC) were 100 and greater than 100 percent, respectively for both samples. Sediment control survival was 88.3 percent.

The LC_{50} value (the concentration of sample causing a 50 percent reduction in biological measurement, e.g. survival) was calculated on survival. The LC_{50} value for survival was greater than 100 percent for both samples.

Table 2 summarizes the results of the Microtox testing performed.

Table 2
Summary of Results
Microtox Testing

Sample ID	EC50 value without reference sediment adjustment	EC50 value with reference sediment adjustment
Upper Lake	1.29 %	4.47 %
Lower Lake	1.17 %	3.20 %

The Microtox testing showed a reduction in bacteria luminescence when compared to the control values and when compared to the reference sediment.

REFERENCE TOXICANT TEST

The 48-hour LC_{50} value and 95-percent control chart limits for the reference toxicant test (cadmium for the amphipods and phenol for the bacteria) conducted in August are listed below. The results indicate that the organisms was within their expected sensitivity range.

Table 3
Reference Toxicant Tests

Species	LC_{50}	95% C.I.
Microtox	17.6 mg/l	14.0 to 21.7 mg/l
Hyalella azteca	8.3 µg/l	4.9 to 13.3 µg/l

APPENDIX B

Benthic Invertebrate Biomonitoring-September 27, 1996 Sampling Wapato Lake, near Lake Chelan, Washington

For Washington Department of Ecology, Olympia, WA.
Sample analysis by Aquatic Biology Associates, Corvallis, OR.
Ponar dredge samples; 0.05m2, 500 micron; 54-58 feet depths; substrates of dark, organic ooze

Lake Location	Lower	Lower	Lower	Upper	Upper	Upper
Sample Identification	358090	358091	358093	358083	358084	358085
BENTHIC INVERTEBRATES						
Porifera colonies	10	35	103	15	27	61
NON-BENTHIC INVERTEBRATES						
Daphnia	16	0	1	7	2	0
Chaoborus	8	10	4	16	10	5

Abundances are per 0.05 square meter.