WASHINGTON STATE UNIVERSITY
TREE FRUIT RESEARCH CENTER
WENATCHEE, WASHINGTON

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FINAL
SITE INSPECTION REPORT

Prepared For

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Waste Programs Enforcement
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This report presents the results of a site inspection (SI) performed at two potential hazardous waste units at the Washington State University Tree Fruit Research Center (WSU TFRC) in Wenatchee, Washington. The SI is part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site assessment process. A preliminary assessment (PA) of the site recommended soil sampling to investigate suspected releases of pesticides and other hazardous substances to the environment. Soil samples were collected at the two suspected waste units on April 24 and 25, 1991. The PA also identified a storage shed that contains chemical products used by U.S. Environmental Protection Agency (EPA) in agricultural research. No additional investigation of the storage shed was performed for the SI, although recommendations for its disposition are included.

This report presents a summary of the objectives, activities, and results of the SI. Included are descriptions of site background conditions, the purpose and objectives of the SI, sampling methods, and analytical results, as well as summary and conclusions. Additional information can be found in the PA report (PRC, 1990) and the SI Quality Assurance Project Plan (QAPP) (PRC, 1991).

2.0 BACKGROUND

This section describes the site, including its operational practices, and discusses potential contaminant pathways that formed the basis for the sampling plan.

2.1 SITE DESCRIPTION

WSU TFRC is a 55-acre agricultural research facility located 1/2 mile west of the Wenatchee, Washington, city limit (Figure 1). Since 1937, many state and federal agencies have performed various types of agricultural research at the facility. Research on pesticide degradation in soils was conducted at the first potential waste unit, the 2,100 square-foot fenced Test Plot Area, by the U.S. Public Health Service (USPHS), which leased the land from WSU beginning in 1966. The EPA Health Effects Research Laboratory based in Research Triangle Park, North Carolina, continued the research at the Test Plot Area from the early 1970s to the early 1980s. Pesticides used in the research included herbicides, insecticides, and acaricides (which kill ticks and mites). A list of pesticides of concern used in research at the Test Plot Area is presented in Table 1. In 1985, WSU expressed concern that EPA had apparently abandoned the Test Plot Area without properly disposing of pesticide-contaminated soils.

The Test Plot Area is currently covered with vegetation and surrounded by a locked, 7-foot high chain-linked fence with a 2-foot barbed wire extension. Warning signs are posted on the fence indicating the unit contains pesticides. The Test Plot area slopes west to east at a grade of approximately 10 to 15 percent. A small drainage ditch runs along the west and north sides of the fence line. The soils in the Test Plot Area are about 8 percent clay, 27 percent silt, 64 percent sand, and 1 percent organic matter (Staiff and others, 1975).

During the PA (PRC, 1990), a second potential waste unit, the Laboratory Drain Field, was discovered. Figure 2 shows the locations of the Test Plot Area, the chemical storage shed used by EPA researchers, and the Laboratory Drain Field at the TFRC. The laboratory was used to support research at the Test Plot Area and other studies conducted by USPHS, the U.S. Department of Agriculture (USDA), and EPA from 1952 to 1985. Currently the laboratory is used by WSU graduate students.

Sink and floor drains from the laboratory flowed directly into the sanitary sewage drain field until 1977, when a separate drain field was constructed for the sink and floor drain line. In 1979, this second drain field failed to provide adequate infiltration; water backed up into sinks and floor drains, causing the laboratory to cease operation. At that time, a new 1,000-gallon septic tank was installed to provide pre-treatment settling of waste from the sink and floor

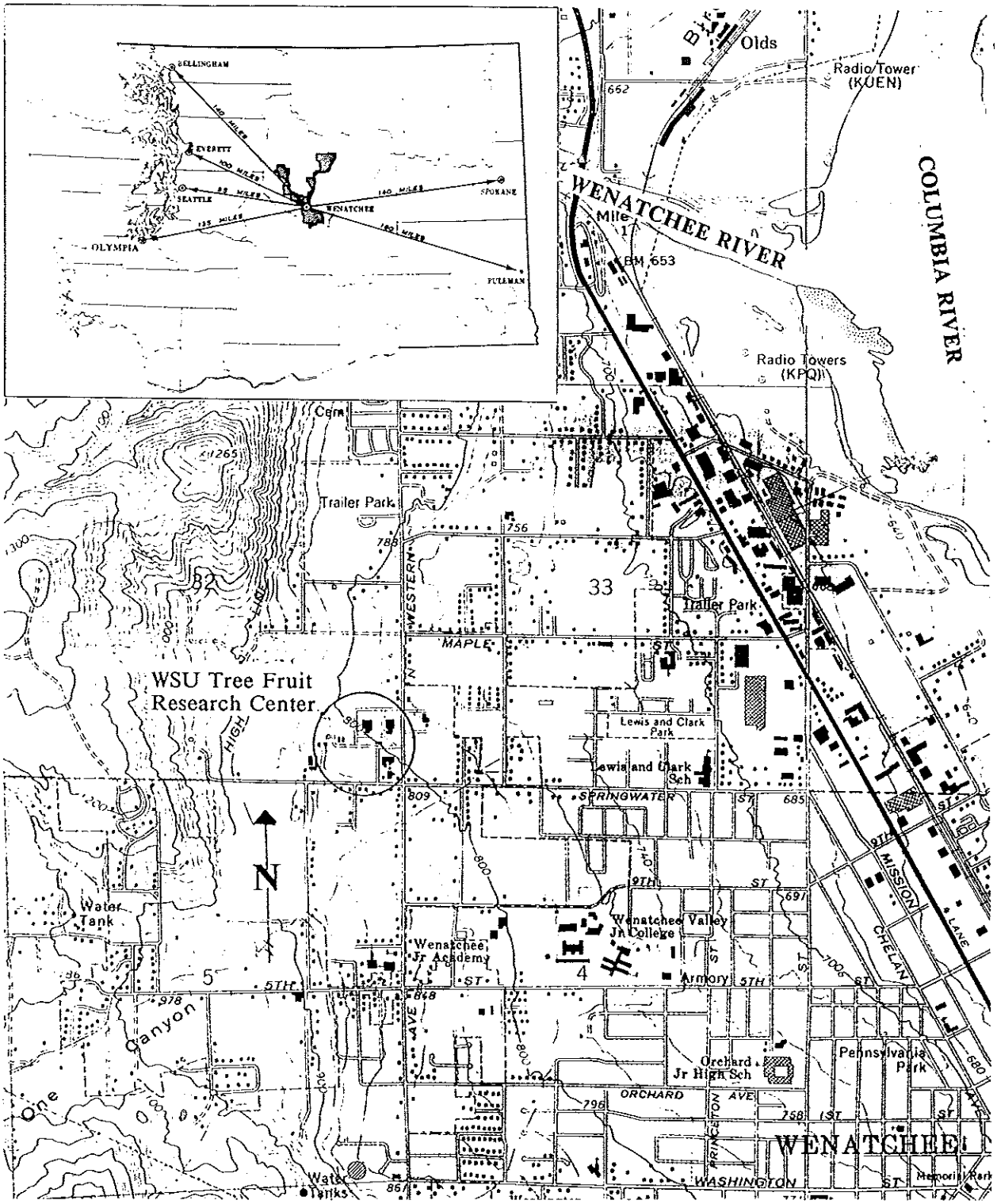


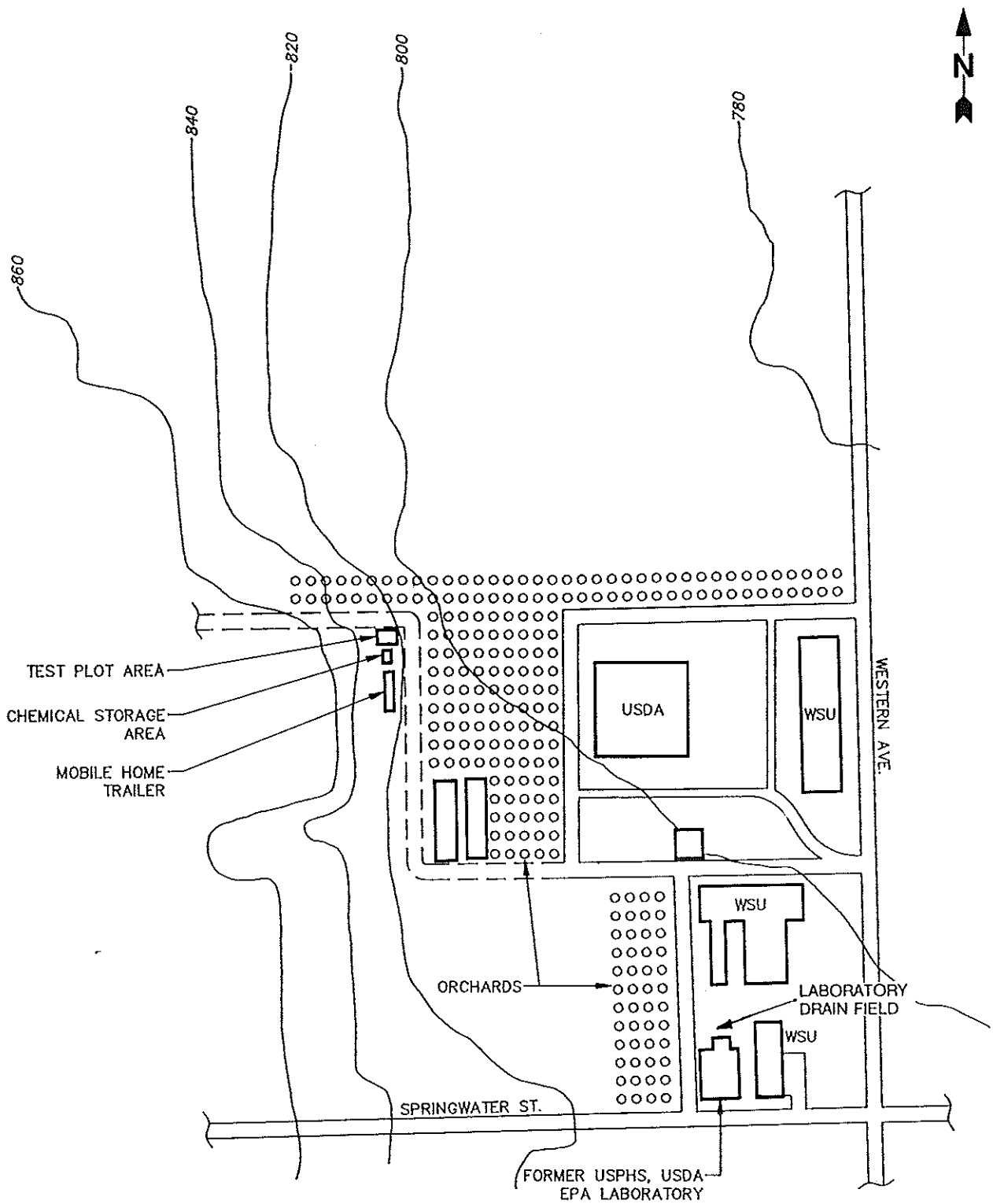
Figure 1. Location Map for the WSU Tree Fruit Research Center, Wenatchee, Washington (elevations in feet)

0 ——— 2000ft

Source: USGS, 1987; SCS/USDA, undated

TABLE 1
PESTICIDES OF CONCERN USED IN RESEARCH AT THE TEST PLOT AREA
(Hagihara, 1987, 1990; Loiselle, 1990)

Pesticide Type and Chemical Name	Chemical Abstract Service (CAS) Number
Organochloride Pesticides	
Dichlorodiphenyltrichloroethane (4-4'-DDT) and its breakdown products:	50-29-3
Dichlorodiphenyldichloroethylene (4,4'-DDE)	72-55-9
Dichlorodiphenyldichloroethane (4,4'-DDD)	72-54-8
Dieldrin	60-57-1
Endrin	72-20-8
Organophosphorus Pesticides	
Azinphos methyl (guthion)	86-50-0
Disulfoton (disyston)	298-04-4
Parathion ethyl	56-38-2
Parathion methyl	298-00-0
Carbamate Pesticides	
Carbaryl	63-25-2
Carbofuran (furadan)	1563-66-2



ELEVATIONS IN FEET

0 150' 300' 450' 600'

SCALE 1" = 300'

SOURCE: USGS, 1987

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WSU TREE FRUIT RESEARCH CENTER
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FIGURE 2

WSU TREE FRUIT RESEARCH CENTER

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drains. The outlet from this new tank was connected to the existing sanitary sewage drain field (EPA, unpublished). It is not known exactly what contaminants entered the laboratory sink and floor drains, but according to former employees, "just about everything" used in the laboratory was discarded in the sinks (PRC, 1990). While EPA acknowledges its responsibility for the Test Plot Area, the multiple tenants of the laboratory indicate that there may be some shared responsibility for the septic and drain field system. Figure 3 shows the most likely current configuration of the drain field area.

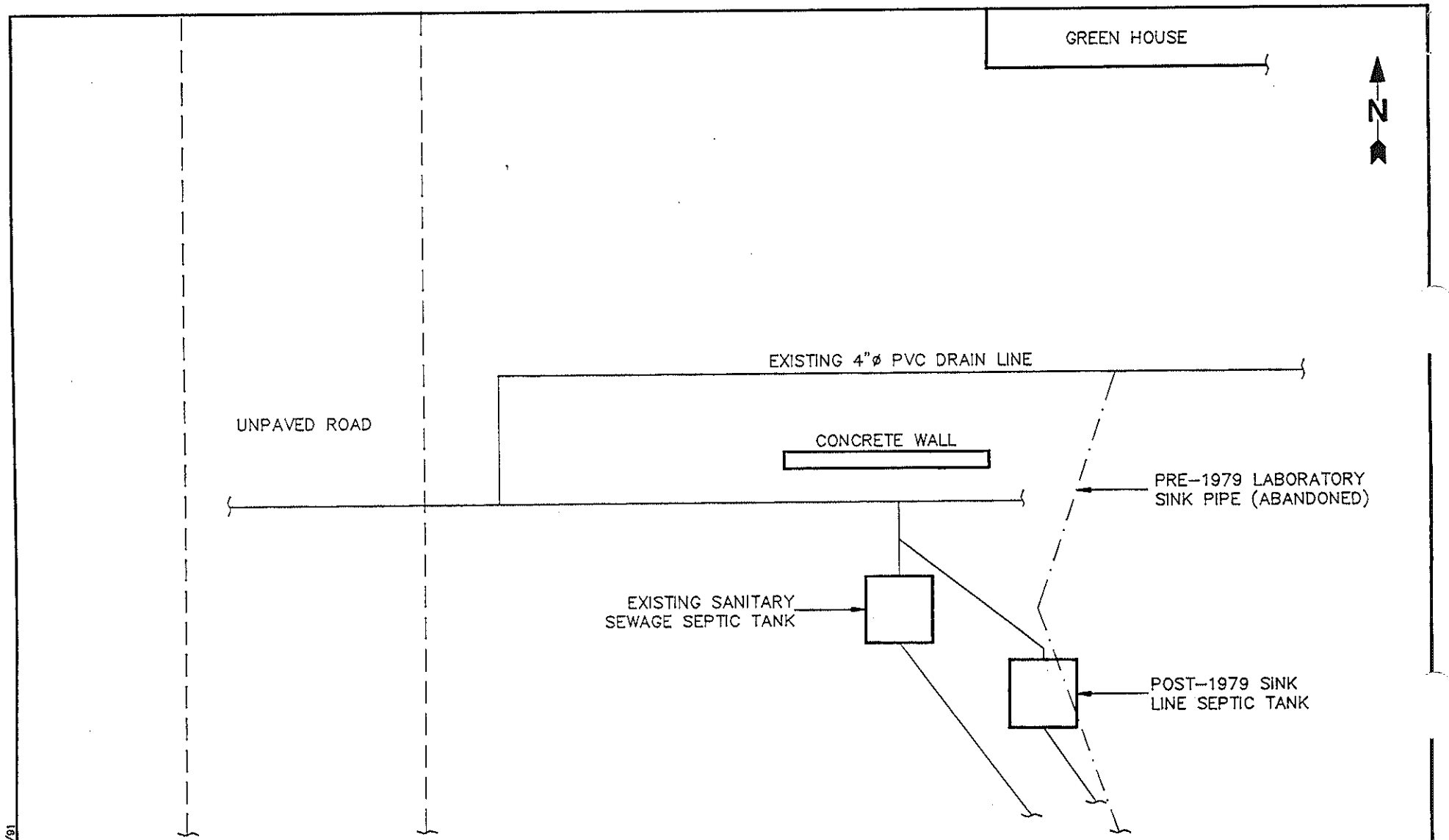
2.2 POTENTIAL RECEPTORS

This section discusses potential receptors at the two suspected hazardous waste units.

2.2.1 Test Plot Area

As identified in the PA, the potential receptors closest to the Test Plot Area are the residents of a trailer home located about 45 feet south of the fenced boundary (Figure 2 and Photo 1, Appendix A). The occupants of this trailer home as well as the residents of Wenatchee obtain their drinking water from a well field 12 miles upgradient of the site. Therefore, the only exposure routes of concern for these residents and other nearby populations are ingestion and inhalation of and dermal contact with soil from the Test Plot Area. Also, information collected during the PA indicates that the amount of pesticide leaching from the soil of the Test Plot Area is likely to be negligible. A study performed at the Test Plot Area (Staiff and others, 1975) sampled the soil down to 30 centimeters (11.8 inches) 8 years after concentrated azinphos methyl (guthion) was applied. The authors concluded, "Even though the exact rate of penetration is unknown, it is important to note the lack of leaching in this soil type beyond 30 cm (11.8 inches) even though the plot was subjected to 8 years of normal weathering which included abundant snowfall and approximately 25 cm (9.8 inches) of rainfall per year." Similar results were shown for parathion, another organophosphate (OP) pesticide (Wolf and others, 1973). Although no leaching studies were carried out with the organochloride (OC) pesticides (endrin, dieldrin, DDT), one would expect less leaching compared to the OP compounds. The lower leaching potential is due to the lower water solubility of the OC pesticides (Sax and Lewis, 1987).

Sampling efforts outside the Test Plot Area therefore focused on the top 6 inches of soil. Available information points to wind movement of pesticide-contaminated soil as the primary mechanism for release of contaminants from the Test Plot Area to nearby receptors.



NOT TO SCALE

LEGEND

——— EXISTING DRAIN LINE

— · — FORMER SINK DRAIN LINE

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FIGURE 3

LABORATORY SEPTIC TANK AND DRAIN FIELD

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2.2.2 Laboratory Drain Field

Contaminants that may have been released from the Laboratory Drain Field would not be found in surface soils. According to as-built drawings, the drain pipe trench appears to be 7 feet deep and is backfilled with 5.5 feet of 3-inch drain rock. A 4-inch-diameter, perforated pipe rests on the drain rock, which is covered by 1 foot of soil (EPA, unpublished). Therefore, any contamination that may have been released from the drain field would be found in subsurface soils at the bottom of the trench. Localized perched groundwater, the existence of which is inferred from regional geologic information collected during the PA, may act as a secondary source of contamination if this water has been impacted by contaminants released from the drain field. Use of this water, which was not documented during the PA, would be the most likely pathway for exposure to these contaminants.

The drinking water supply for the city of Wenatchee is drawn from the Columbia River. The intake is located near the Rocky Reach dam, upstream of the city and the WSU TFRC (Jones, 1992). The nearest well is located 1.3 miles from the site. Surface water runoff from the site drains northeast into the city storm sewer system.

Sampling efforts for the Laboratory Drain Field concentrated on determining whether subsurface soils adjacent to the drain pipe trench contain hazardous substances.

3.0 PURPOSE AND OBJECTIVES

The purpose and objectives of the SI are presented below. Also, data types, uses, and analytical requirements are discussed.

3.1 PURPOSE

The purpose of the SI was to collect data to determine what hazardous substances are present at the site and whether they are being released to the environment. The data are used to:

- Determine the potential need for a removal action
- Support the data needs of the Hazard Ranking System (HRS) model
- Determine the threat or potential threat to public health and the environment that may be posed by the site

3.2 OBJECTIVES

Soil samples were collected outside the Test Plot Area from surrounding orchard and non-orchard areas, and from the Laboratory Drain Field. The objectives for soil sampling of the three areas were:

- Near the Test Plot Area to determine whether a release of pesticides to the surface soil occurred outside the Test Plot Area
- In orchard and non-orchard areas to determine a range of site and area background levels for pesticides suspected of being released from the Test Plot Area
- In the Laboratory Drain Field to determine whether a release of hazardous substances from the drain field to adjacent subsurface soils occurred

Data generated from this investigation were originally intended to meet the requirements of EPA's site assessment process. It is anticipated that these data will also be used to satisfy the site assessment requirements of the Washington State Department of Ecology's Model Toxics Control Act.

3.3 DATA TYPES, USES, AND ANALYTICAL REQUIREMENTS

Data types, uses, and analytical requirements necessary to satisfy the objectives stated in Section 3.2 are summarized in Table 2. Specific sampling and analytical methods used are described in Sections 4.1 and 4.2.

TABLE 2
DATA TYPES, USES, AND ANALYTICAL REQUIREMENTS

Activity	Data Type	Data Use	Contaminants of Concern[a]	Levels of Concern[b]	Analytical Methods
Sampling near Test Plot Area	Surface soil samples	• HRS scoring • Release determination • Removal action evaluation	Organochloride, organophosphate, and carbamate pesticides	0.1 - 100 µg/kg	CLP SAS[c] CLP RAS[d]
Sampling in non-orchard areas	Surface soil samples	• Area background information	Organochloride, organophosphate, and carbamate pesticides	0.1 - 100 µg/kg	CLP SAS[c] CLP RAS[d]
Sampling in orchard areas	Surface soil samples	• Site background information	Organochloride, organophosphate, and carbamate pesticides	0.1 - 100 µg/kg	CLP SAS[c] CLP RAS[d]
Sampling in the Laboratory Drain Field	Subsurface soil samples	• HRS scoring • Release determination • Removal action evaluation	CLP RAS volatiles, semivolatiles, pesticides, polychlorinated biphenyls (PCB), metals and cyanide	10 - 1,700 µg/kg organics and 0.04 - 1,000 mg/kg inorganics	CLP RAS[d]

Notes:

a See Table 1 for specific pesticides of concern.

b Based on contract-required quantitation or detection limits (see Section 4.2).

c Contract Laboratory Program (CLP), Special Analytical Services (SAS), see Section 4.0.

d Contract Laboratory Program, Routine Analytical Services (RAS), see Section 4.0.

4.0 SAMPLING AND ANALYSIS METHODS

This section describes methods used to collect soil samples from the Test Plot Area, orchard and non-orchard areas (surface background), and the Laboratory Drain Field. Analysis methods for contaminants of concern are also described.

4.1 SAMPLING METHODS

This section addresses surface soil sampling at the Test Plot Area and background areas and subsurface soil sampling in the Laboratory Drain Field. A summary of sampling activities is presented in Table 3. All sample collection, equipment decontamination, sample handling, and shipping were performed in accordance with the QAPP (PRC, 1991) except as noted. Exact sampling locations are described in Appendix B.

4.1.1 Test Plot Area and Surface Background Areas

Twelve samples, including quality assurance/quality control (QA/QC) samples, were collected at the Test Plot Area. Sampling locations are shown in Figure 4. All samples except TP-3 were composites of the top 6 inches of soil located beneath the root zone (Photo 2, Appendix A). Total depth for all samples was 7 to 8 inches below ground surface. Sample TP-3 was collected from the same location as sample TP-2 but consisted of a composite of soil from 6 to 12 inches below the root zone. Sample TP-3 was collected in such a way as to be directly comparable with a sample collected by Hagihara (1987) at this depth. Other sample locations were chosen to include an upwind station (TP-7), one in the drainage ditch (TP-1), stations at the fence line (TP-2 through TP-6), and stations downwind close to the potential receptors (TP-8 through TP-11).

Surface soil samples were collected using a 3-inch-wide stainless steel scoop. One scoop was dedicated to each sampling station at the Test Plot Area, eliminating the need for decontamination between stations and reducing the chance for cross-contamination. Following use at the Test Plot Area, the scoops were decontaminated and used the following day at the background locations. A rinsate blank was collected from one of the scoops following decontamination at the Test Plot Area. Other QA/QC samples included one duplicate (TP-10 and TP-11) and one sample used for matrix spike/matrix spike duplicate analysis (TP-6).

At the request of WSU personnel, one soil boring was advanced 7 feet east of the eastern line fence surrounding the Test Plot Area. The purpose of this boring was to look for a layer with low permeability. Such a layer could direct any water that infiltrated into the Test Plot

TABLE 3
SUMMARY OF SOIL SAMPLE ANALYSES, QA/QC SAMPLES,
PRESERVATION, AND HOLDING TIMES

Location	Type	Parameters[a]	Environmental Samples[b]	QA/QC Samples[c]			Preservation Techniques	Maximum Holding Time
				TB	RB[d]	Duplicate		
Test Plot Area	Surface Soil	Organochloride Organophosphorus Carbamate pesticides	10	0	1	1	Ice to 4°C	7 days
Surface Background								
Non-Orchard Area (Area background)	Surface Soil	Organochloride Organophosphorus Carbamate pesticides	3	0	0	1	Ice to 4°C	7 days
Orchard Area (Site background)	Surface Soil	Organochloride Organophosphorus Carbamate pesticides	3	0	0	1	Ice to 4°C	7 days
Laboratory Drain Field	Subsurface Soil	Volatile organics Semivolatile organics[e] Pesticide/PCBs Total Metals Cyanide	3	1	1	0	Total metals HNO_3 to < pH 2 Others ice to 4°C	Total metals- 6 months Others-7 days
		TOTALS	19	1	2	3		

Notes:

a See Table 1 for specific pesticides of concern.

b Includes one sample in twenty used for matrix spike/matrix spike duplicate analysis.

c TB = Trip Blank.
RB = Rinsate Blank.

d One rinsate sample was collected for each type of sampling equipment (stainless steel scoop and hand auger).

e Analyses only performed on two samples (see Section 4.1.2).

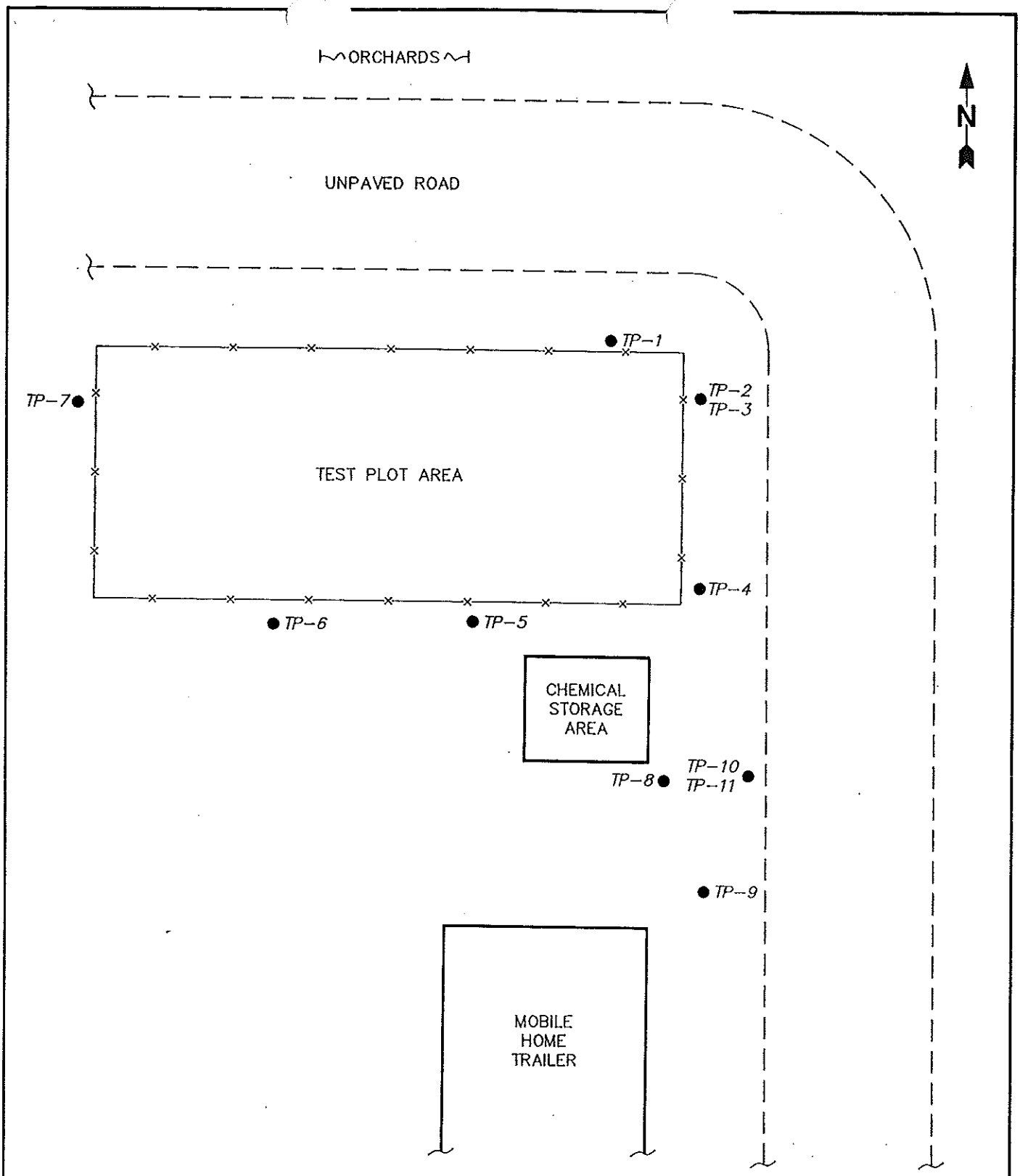

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FIGURE 4

SAMPLE LOCATIONS FOR THE TEST PLOT AREA

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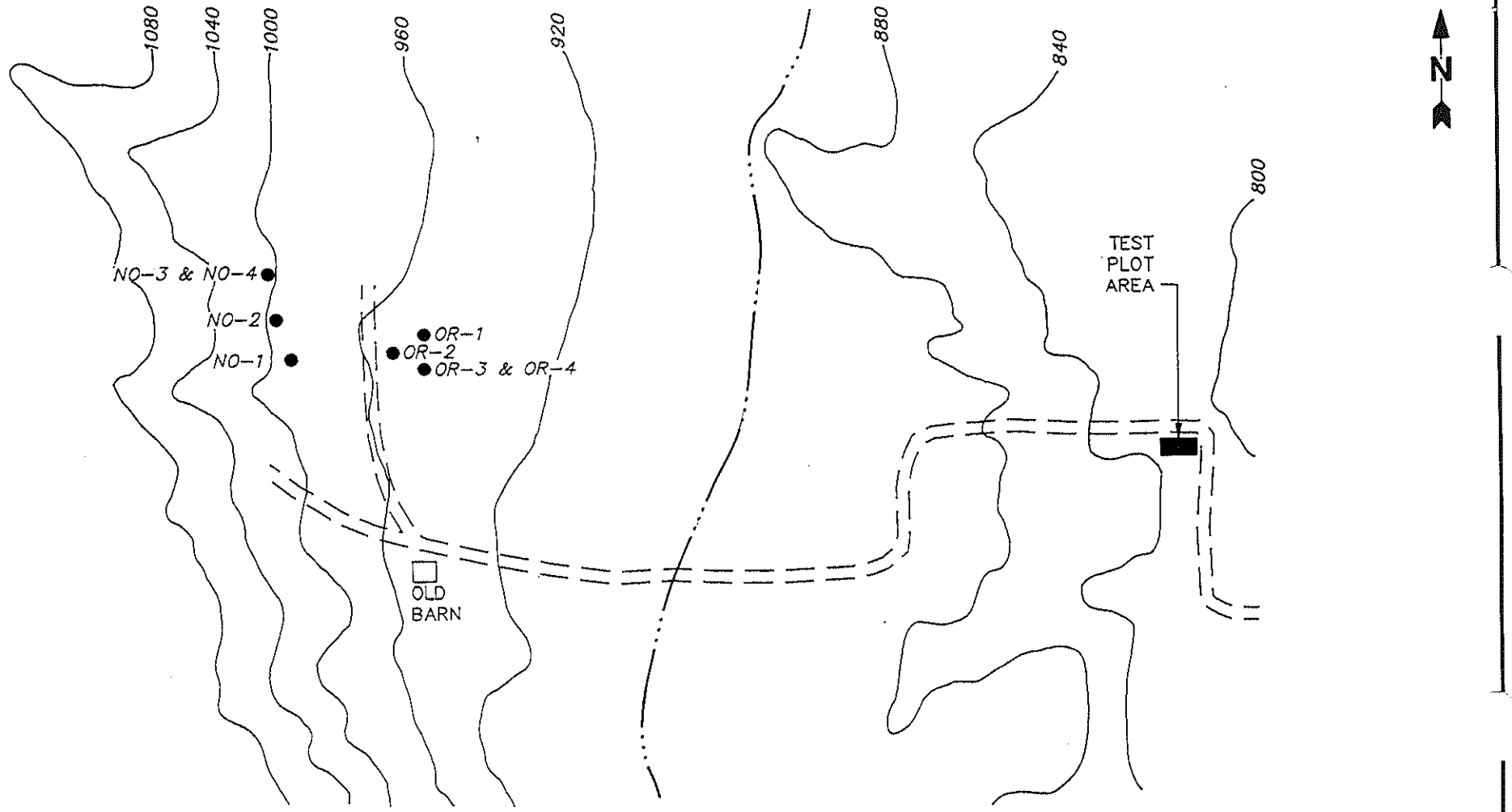
Area (and may become contaminated) to potentially transport pesticides laterally. If this was the case, the surface soil samples collected as part of the SI would not detect this release pathway. The boring was advanced using a 3-inch-diameter hand auger. Stratigraphy was noted to a depth of 6 feet below ground surface.

Eight surface background samples (including QA/QC) were collected using the same methods used for most of those collected from the Test Plot Samples Area. Background locations are shown in Figure 5. Orchard samples were chosen to be representative of site background conditions (Photo 3, Appendix A), and non-orchard samples were chosen to represent area background (Photo 4, Appendix A). Site background samples were intended to detect concentrations of the contaminants of concern that are the result of human activities unrelated to the Test Plot Area. Area background samples were intended to detect the contaminants of concern present in the environment unrelated to activities at the WSU TFRC. One duplicate sample was submitted to the laboratory for QA/QC purposes from each background area (OR-3, OR-4, NO-3 and, NO-4).

4.1.2 Laboratory Drain Field

Subsurface soil samples from near the Laboratory Drain Field were collected using a 3-inch-diameter bucket auger. Because of problems encountered, only two of the five samples planned for the drain field area were obtained (Figure 6). The bucket auger could not penetrate to the desired depth because of rocks encountered at three locations. According to EPA as-built sketches obtained from WSU, the perforated pipe used in the drain field for the sink drains was located in a trench 7 feet north of an existing concrete wall (Photo 5, Appendix A). One foot of drain rock appeared to be located on either side of the pipe. The sampling plan proposed to collect three samples adjacent to the trench where the old sink and floor drain line terminated, two samples near the current outlet from the old septic tank, and two subsurface background samples away from the drain field all at a depth of 7 feet below ground surface (Figure 6).

A backhoe and operator provided by WSU removed the first 2 feet of gravel and compacted soil. Two borings about 8.8 and 9 feet north of the concrete wall were advanced using the hand auger to a depth of about 3.5 feet. At that point, rocks were encountered that the auger could not penetrate. These rocks appeared to be drain field rocks. The sampling locations were then moved further from the concrete wall. Holes were augered at distances of 13, 14.5, and 15.5 feet north of the wall. In each hole, rocks that the hand auger could not penetrate were encountered 3 to 3.5 feet below ground surface. However, one subsurface background boring located 36 feet east and 24 feet south of the east edge of the concrete wall (Figure 5) was advanced 7 feet below ground surface and a sample was collected. The subsurface soils consisted



SOURCE: USGS, 1987

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FIGURE 5

LOCATIONS OF SURFACE BACKGROUND SAMPLING STATIONS

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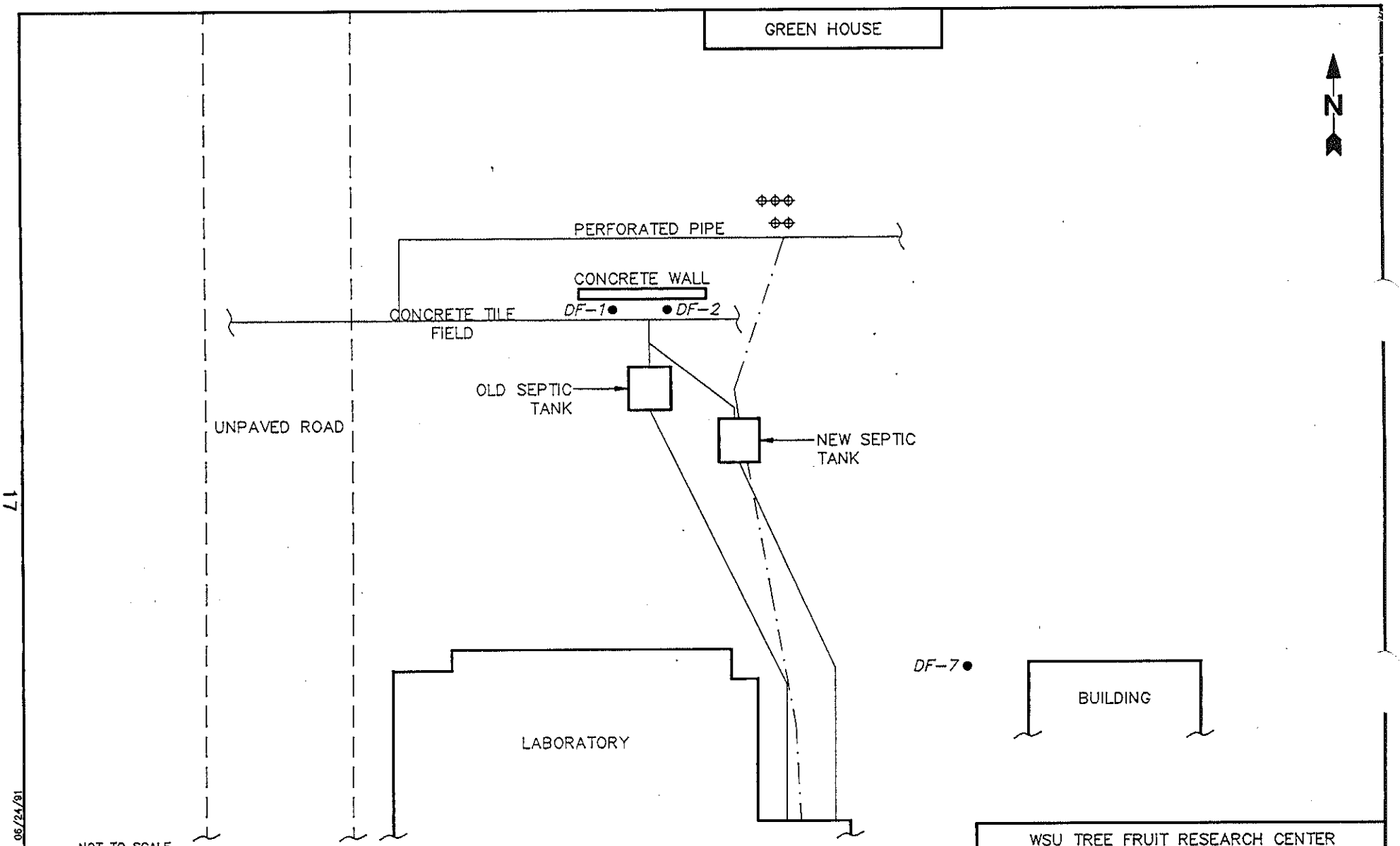

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FIGURE 6

LABORATORY DRAIN FIELD
SAMPLE LOCATIONS

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of silty clayey sands, and no large rocks were encountered. The second subsurface background sample was not collected.

Samples DF-1 and DF-2 were collected near the outlet of the old septic tank at a depth of about 4 feet below ground surface. Rocks, that the hand auger could not penetrate, were encountered at this depth. At station DF-2, only a small volume of soil was recovered from the hole because of rocks. Therefore, not enough sample material could be obtained for all the intended analyses. Samples from this station were analyzed only for volatile organic, pesticide and PCB, metals, and cyanide.

4.2 ANALYSIS METHODS

Table 4 lists the analysis methods used on all samples collected. CLP RAS contract-required quantitation limits (CRQL) for organics and contract required detection limits (CRDL) for inorganics are listed in Appendix C. CLP SAS CRQLs are presented in Appendix D in the SAS request forms.

TABLE 4
ANALYTICAL METHODS

Parameter[a]	Methods
Organochloride pesticides	CLP RAS[b] (Included under pesticides and PCBs)
Organophosphorus pesticides	CLP SAS[c] Extraction - Method 3550[d] Analysis - Method 3600[d] Cleanup - Method 8140[d]
Carbamate pesticides	CLP SAS[b] Extraction - Method 3550[d] Analysis - Method 531.1[e]
Volatile organics	CLP RAS[b]
Semivolatile organics	CLP RAS[b]
Pesticides/PCBs	CLP RAS[b]
Total metals	CLP RAS[f]
Cyanide	CLP RAS[f]

Notes:

a See Table 1 for specific analytes.

b EPA Contract Laboratory Program, Routine Analytical Services - Organics (EPA, 1988a).

c EPA Contract Laboratory Program, Special Analytical Services.

d EPA (1986).

e EPA (1988b).

f EPA Contract Laboratory Program, Routine Analytical Services - Inorganics (EPA, 1988c)

5.0 SAMPLE RESULTS AND DISCUSSION

This section presents analytical results for soil samples collected at the Test Plot Area, background areas, and the Laboratory Drain Field. Discussion of whether the data quality objectives proposed in the QAPP (PRC, 1991) were met is followed by discussion of results in the context of the objectives of the SI. For HRS scoring purposes the criteria for an observed release is met when a "significant" concentration of a chemical of concern is observed in an environmental sample. The Region 10 definition of significant concentration is presented in Table 5. Concentrations with the "J" qualifier are estimated, but were still used in the evaluation process for defining positive detections and elevated levels within the two conditions stated in Table 5.

5.1 TEST PLOT AREA AND BACKGROUND AREAS

Data quality objectives, analytical results, and a discussion of the results for samples collected from the Test Plot Area and background areas are presented below.

5.1.1 Subsurface Stratigraphy and Analytical Results

Field observation of the one boring done outside the Test Plot Area did not indicate the presence of a confining layer. From the surface to about 18 inches below ground surface, the soil was gravelly, silty sand, tan in color, and low in organic matter. From about 18 to 72 inches below ground surface, the soil was similar except that it consisted of less gravel and more fine-grained sands.

Most of the objectives for data quality specified in the QA objectives (PRC, 1991) were met for the samples collected from around the Test Plot Area and background areas. Data points that did not meet the objectives were appropriately qualified. Full results and the data validation report are presented in Appendix E.

A summary of analytical results for contaminants of concern for the Test Plot Area and background areas is presented in Table 6. One other contaminant, endrin ketone, was detected but only in background samples (OR-1, 32 µg/kg, and OR-2, 130 µg/kg). Both values were qualified with a "J.

TABLE 5
SIGNIFICANCE CRITERIA FOR HRS SCORING

- If the sample measurement is less than the sample quantitation limit[a], no observed release is established.
- If the sample measurement is greater than or equal to the sample quantitation limit[a], an observed release is established as follows:
  - If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the SQL[a]
  - If the background concentration equals or exceeds the detection limit, an observed release is established when a sample measurement is three times or more the background concentration

[a] If the SQL cannot be established, determine if there is an observed release as follows:

- If the sample analysis was performed under EPA CLP, use the CRQL in place of the SQL.
- If the sample analysis was not performed under EPA CLP, use the detection limit in place of the SQL

TABLE 6

SUMMARY OF ANALYTICAL RESULTS FOR PESTICIDES OF CONCERN
IN SURFACE SOILS AT THE TEST PLOT, NON-ORCHARD AND ORCHARD AREAS

Pesticide	TEST PLOT AREA			NON-ORCHARD AREA			ORCHARD AREA		
	Frequency of Detection[a]	Range of SQL[b] (µg/Kg)	Range of Concentrations(µg/Kg)	Frequency of Detection[a]	Range of SQL[b] (µg/Kg)	Range of Concentrations(µg/Kg)	Frequency of Detection[a]	Range of SQL[b] (µg/Kg)	Range of Concentrations(µg/Kg)
Organochloride									
4-4'-DDT	11/11	—	11,000 J - 11.0 J	2/4	17	31 J - 2,600 J	4/4	—	3,100 J - 28,000 DJ
4-4'-DDE	11/11	—	5,100 J - 11.0 J	3/4	17	1 J - 3,400 J	4/4	—	150 DJ - 1,200 DJ
4-4'-DDD	0/11	1,800 - 17	—	0/4	17 - 170	—	0/4	170 - 180	—
Dieldrin	1/11	1,800 - 1.2	1.2 J	0/4	17 - 170	—	0/4	—	—
Endrin	1/11	1,800 - 65	65 J	0/4	17 - 170	—	1/4	170 - 180	48J
Organophosphate									
Disulfoton	0/11	0.27 - 0.30	—	0/4	0.28 - 0.29	—	0/4	0.29 - 0.30	—
Parathion methyl	0/11	0.27 - 0.30	—	0/4	0.28 - 0.29	—	0/4	0.29 - 0.30	—
Parathion ethyl	0/11	0.27 - 0.30	—	0/4	0.28 - 0.29	—	0/4	0.29 - 0.30	—
Azinphos methyl	0/11	0.27 - 0.30	—	0/4	0.28 - 0.29	—	0/4	0.29 - 0.30	—
Carbamate									
Carbaryl	0/11	10	—	0/4	10	—	0/4	10	—
Carbofuran	0/11	10	—	0/4	10	—	0/4	10	—

a Includes one duplicate

b Sample quantitation limit, only for samples which did not exceed the SQL

D The compound was identified in an analysis at a secondary dilution level

J The associated numerical value is an estimated quantity

5.1.2 Discussion of Results

None of the contaminants of concern were found in significant concentrations for HRS scoring purposes. The organochloride pesticides 4-4'-DDT and 4-4'-DDE were found in all samples collected from near the Test Plot Area and at all but one sampling station in the background areas (4-4'-DDT for NO-3 and NO-4, duplicates). The highest overall concentration found was for 4-4'-DDT: 28,000 µg/kg ("J"-qualified) in an orchard area at station OR-1.

Samples TP-2 and TP-3 were collected from a location previously sampled by Hagihara (1987). A comparison of the results is provided in Table 7. Concentrations of 4-4'-DDT and 4-4'-DDE are higher in the samples collected during the SI than in the samples collected in 1987. However, the differences are small enough to indicate possible variation within or between analytical methods (Hagihara did not specify the analytical method). Nevertheless, the persistence of DDT and its metabolites is apparent in the comparison. The detection limit for ethyl parathion in the study was higher than the reported result from Hagihara; therefore, direct comparison is not possible.

The results for the Test Plot Area and background area samples may indicate the ubiquitous nature of DDT, its metabolites, and other organochloride pesticides (endrin ketone) in the normal background of the Wenatchee Area. Nevertheless, the concentrations of DDT and DDE outside the Test Plot Area may have their source within the Test Plot Area. The maximum concentration outside the Test Plot Area (11,000 µg/kg for 4-4'-DDT at TP-2) is greater than the maximum concentration for this contaminant from the non-orchard background area (2,600 µg/kg at NO-1). However, both values are qualified due to an undetermined bias. Therefore, all that can be said with certainty is that there are compounds in the Test Plot Area above detection limits. Further investigation (not within the scope of this study) would be required to draw the conclusion that these levels exceed normal background .

In contrast to the organochloride pesticides, organophosphate and carbamate pesticides are relatively nonpersistent (Doull, and others, 1980). However, studies done within the Test Plot Area have shown that concentrated applications can persist for many years (Wolf, and others, 1973; Staiff and others, 1975). Because no organophosphate or carbamate pesticides were found at levels above SQLs, there are three possible explanations. If these pesticides are being transported out of the Test Plot Area, then their concentrations are below the SQLs or they have

TABLE 7
COMPARISON OF SELECTED PESTICIDE CONCENTRATIONS FROM HAGIHARA (1987) TO THOSE FOUND DURING THE SI AT THE SAME LOCATION (mg/kg)

STUDY	DATE SAMPLED	COMPOSITED DEPTH	DDT[a]	DDE[b]	Ethyl Parathion
Hagihara (1987)	4/23/87	0 to 12 inches[c]	4.1	2.3	0.2
SI	4/25/91	0 to 6 inches[d]	11 J	4.7 J	0.29 UJ
		6 to 12 inches[e]	9.8 J	5.1 J	0.29 U

Note:

[a] Reported as PP_9-DDT and assumed to be para-, para- DDT (4-4'-DDE). The SI reports it as 4-4'-DDT.

[b] Reported as PP_9-DDE and assumed to be para-, para- DDE (4-4'-DDE). The SI reports it as 4-4'-DDE.

[c] Reported for sample O-3.

[d] Sample TP-2 (see Figure 4).

[e] Sample TP-3 (see Figure 4).

J = The associated numerical value is an estimated quantity.

U = Analyzed for but not detected. The associated numeral is the sample quantitation limit.

UJ = Analyzed for but not detected. The sample quantitation limit is an estimated quantity.

been released in the past and have degraded to levels below the SQLs. The third possibility isthat no transport is occurring. Nevertheless, no significant concentrations were found outside the Test Plot Area.

5.2 LABORATORY DRAIN FIELD

A discussion of the data quality objectives, analytical results, and samples collected from the Laboratory Drain Field are presented below.

5.2.1 Analytical Results

Most of the precision and accuracy criteria specified in the QA objectives (PRC, 1991) were met. Data points that did not meet the objectives were appropriately qualified. Appendix E presents the full results and the data validation report for the samples. As discussed in Section 4.1.2, only three of seven planned samples were collected from the Laboratory Drain Field. Therefore, the completeness criterion of 90 percent was not met for the unit. Of the three samples collected, one was a background sample (DF-7), and the other two were collected near the outlet of the old septic tank (DF-1 and DF-2). One of these samples did not contain sufficient volume to perform the analysis for semivolatile organic compounds.

Results for organic compounds are presented in Table 8. Results in boldface type exceeded the detection limits. Inorganic results are presented in Table 9.

5.2.2 Discussion of Results

Significant quantities of acetone, total xylene, and lead were detected in sample DF-2 collected near the old septic tanks. Low quantities of organochloride pesticides (including DDT and DDE) were detected in samples (including background). Pentachlorophenol was detected in the one background sample.

Arsenic was detected in one sample at two-and-one-half times background. Lead arsenate is a pesticide that was used in agriculture for control of apple maggots before development of organic pesticides (McEwen and Stephenson, 1979). However, no conclusions can be drawn based on the limited number of samples collected.

TABLE 8
ORGANIC CHEMICALS DETECTED IN THE LABORATORY DRAIN FIELD
(μg/kg)

Compound	Sampling Station DF-1	DF-2	DF-7
Acetone	11 UJ	**130 J**	11 UJ
Xylene	6 UJ	**23 J**	5 UJ
Pentachlorophenol	3,700 UJ	NS	**81 J**
Gamma-BHC (lindane)	**4.1 J**	9.1 UJ	18.0 UJ
Dieldrin	**8.3 J**	18.0 UJ	36.0 UJ
Endrin	**8.4 J**	18.0 UJ	36.0 UJ
4-4'-DDT	**56.0 J**	**300.0 J**	**16.0 J**
4-4'-DDE	**67.0 J**	**530.0 J**	**17.0 J**

Values in bold face type indicate concentrations above the sample quantitation limit

Note:

NS = No sample collected.

U = The analyte was analyzed for and was not present above the associated value.

J = The associated numerical value is an estimated quantity.

UJ = The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

TABLE 9
RESULTS OF INORGANIC ANALYSES IN THE LABORATORY DRAIN FIELD

PRC Sample	DF-1		DF-2		DF-7		DF-9	
Matrix	Soil		Soil		Soil		Water	
Concentration	(mg/kg)		(mg/kg)		(mg/kg)		(µg/L)	
	Result	Q	Result	Q	Result	Q	Result	Q
Aluminum	15,200		16,400		15,300		81	U
Antimony		R		R		R	19	U
Arsenic	12.4	J	11.9	J	4.9	J	2	UJ
Barium	133		140		120		32	U
Beryllium	.88		.88		.75		1	U
Cadmium	.37		.37	U	.32	U	2	U
Calcium	5,920		5,790		6,130		332	
Chromium	15.3		16.9		15.5		2	U
Cobalt	8.7		8.9		8.0		2	U
Copper	11.0		10.7		9.8		7	U
Iron	25,200		27,300		26,300		60	U
Lead	18.9	J	32.4	J	8.8	J	2.6	J
Magnesium	5,840		5,490		5,900		120	U
Manganese	490		528		483		1	U
Mercury	.10	U	.11	U	.09	U	.2	U
Nickel	15.4		14.8		13.7		16	U
Potassium	2,340		2,410		1,950		682	U
Selenium	1.0	UJ	1.0	UJ	.81	UJ	1	U
Silver	.35	U	.37	U	.32	U	2	U
Sodium	252		227		266		628	U
Thallium	.55		.37		.31		1.3	
Vanadium	39.6		44.4		42.7		2	U
Zinc	61.4		66.0		62.6		13	U
Cyanide	.58	U	NA		.55	U	10	U

Q = Data qualifier.

R = Unusable, analyte may or may not be present.

J = Estimated quantity.

U = Analyzed for, but not detected above the given detection limit.

UJ = Analyzed for, but not detected. Associated value is an estimated detection limit.

NA = No analysis.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section describes conclusions and recommendations for further action.

6.1 TEST PLOT AREA AND CHEMICAL STORAGE SHED

Comparisons between samples collected outside the Test Plot Area to those of background did not indicate a measurable release of the contaminants of concern to surface soils. However, the data contain an unknown bias due to a laboratory precision problem. Therefore, all that can be said with certainty is that there are compounds in the Test Plot Area above detection limits. Additional sampling should be done within the Test Plot Area to determine whether the concentrations present are definitely above area background levels and to determine the depth of pesticides in the soil. The results would provide information on the volume of soil that requires remediation.

The storage shed near the Test Plot Area contains chemicals used in pesticide research. An inventory of the shed's contents is presented in Table 10. Removal and disposal of these chemicals is recommended. The shed contains more than 4 gallons of tetrahydrofuran (CAS no. 109-99-9). Upon exposure to air, tetrahydrofuran forms organic peroxides that can spontaneously explode (Genium, 1985).

Bids were solicited from three contractors for removal and disposal of the chemicals. Table 11 summarizes the three bids submitted. It should be noted that the bid from Olympus Environmental, Inc., does not include disposal costs. All prices are subject to change.

6.2 LABORATORY DRAIN FIELD

Measurable concentrations of acetone, total xylene, and lead were found in one sample (DF-2). However, it is not possible to assess whether the release was from the Laboratory Drain Field system based on the data collected. As-built drawings proved to be inaccurate for locating the drain pipes.

It is recommended that all portions of the existing and abandoned septic tank and drain field be removed. At that time, soil samples should be collected near the drain pipes to determine the presence of contaminants. Any contaminated soils should be remediated. Non-laboratory wastes (sanitary sewage) should be plumbed to the sewage treatment plant servicing Wenatchee or to a new septic tank and drain field system. Laboratory wastes should be managed to avoid future potential for release to the environment. A cost estimate for removal of the existing septic tank system is provided in Table 12.

TABLE 10
CHEMICAL STORAGE SHED INVENTORY
(Hagihara, 1990)

Chemical	Volume
2-Butanone	3 gallons
Carbon tetrachloride	7 pints
Benzene	13 gallons
Isopropylamine	2 pints
Iso-octane	11 pints
Methyl cyclohexane	1 liter
Pyridine	5 pints
Dioxane	6 pints
Tetrahydrofuran	4 gallons and 8 pints
Isoamyl alcohol	1 gallon and 1 pint
n,n-Dimethylformamide	11 pints
Acetic anhydride	5 pints
2-Chloro-2-methylpropane	1 liter
Monoethanolamine	1 gallon
n-Butanol	4 liters
1(2-Methoxypropoxy)2-propanol	5 kilograms
2-Methyl 2,4-pentanediol	3 gallons
Ethylene dichloride	23 pints
Amyl alcohol	4 pints
Amyl acetate	4 pints
Isoamyl acetate	2 pints
Hexane	33 gallons
Cyclohexane	1 pint

TABLE 11
BIDS RECEIVED FOR REMOVAL AND DISPOSAL OF CHEMICALS IN STORAGE SHED

Contractor	Description	Cost
Sol-Pro, Inc. Tacoma, Washington[a]	Packaging, transport, and disposal	$2,147
Riedel Environmental Services, Inc. Seattle, Washington, and Western Compliance Services, Inc. Sherwood, Oregon[b]	Profiling of fees, labor, equipment, transportation, and disposal	$3,530
Olympus Environmental, Inc. Kent, Washington[c]	Organization into disposal groups; Travel, packaging and labeling, preparation of disposal contract, transport to disposal facility, and billing of disposal fees (disposal fees not included)	$5,300- $9,500

Notes:

[a] Pase, 1991

[b] Annen, 1991

[c] Nock, 1991

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