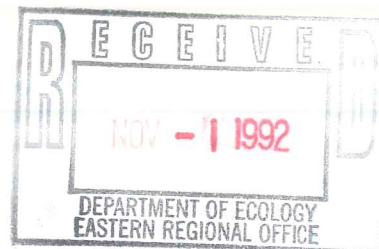


SEACOR



**REVISED FINAL DRAFT
REMEDIAL INVESTIGATION REPORT
WHITTEN OIL, INC.
WHITTY'S MINIMART
485 SOUTH MAIN STREET
COLVILLE, WASHINGTON**

SEACOR Job No. 00004-008-01

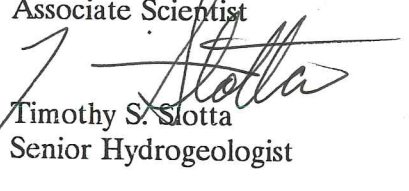
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October 30, 1992

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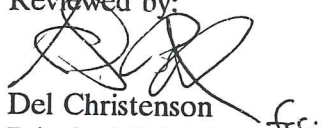

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1.0 INTRODUCTION

This Remedial Investigation (RI) Report was prepared for the Whitten Oil, Inc. facility (Whitty's Minimart) located at 485 South Main Street in Colville, Washington. This RI Report has been prepared in accordance with Section IV.1.a of Enforcement Order No. DE 91TC-E702 issued by the Washington Department of Ecology (Ecology) on October 23, 1991. Activities of the RI were performed in accordance with the April 24, 1992 Remedial Investigation Work Plan (Work Plan) prepared by SEACOR and were consistent with requirements of the Washington State Model Toxics Control Act (MTCA).

As stated in the Work Plan, the objectives of the site RI are:

- To assess the nature and extent of potential release(s) of petroleum hydrocarbons from the UST systems at Whitty's Minimart;
- To assess the possibility that other potential sources of hydrocarbons in the area surrounding Whitty's Minimart are contributing to the observed petroleum hydrocarbons in the groundwater and nearby drainage system; and
- Assess whether there is a relationship between the identified source(s) of hydrocarbons and the discharges of hydrocarbons which have been detected intermittently in a nearby drainage system.

A final draft of the RI Work Plan was completed by SEACOR and was conditionally approved by Ecology on April 3, 1992. The scope of the RI Work Plan included a Sampling and Analysis Plan, a Quality Assurance/Quality Control Plan, a Safety and Health Plan, a Public Participation Plan, a Site Waste Management Plan (SWMP) and a Project Management Plan. Any activities or procedures that varied from those procedures outlined in the RI Work Plan were discussed in advance with Ecology and are discussed in this RI report.

The RI was divided into 11 discrete tasks. A record search (Task 1) was completed to develop site background information and is discussed in Section 2.0 of this document. Tasks 2 through 8 were completed as part of the field data collection effort. Tasks 9, 10 and 11 were completed to prepare this report, develop a sampling and analysis plan (SAP) for continued monitoring of the site and to incorporate client and agency review/revisions and public comment. The objective, scope and method for each task completed as part of the field sampling program are discussed in Section 3.0 of this report. The analytical results and a discussion of applicable regulatory guidelines are included in section 4.0. Report findings are included in Section 5.0. References are provided in Section 6.0.

Appendices to the report include:

- Appendix A - Soil Vapor Survey Report
- Appendix B - Field Methods and Procedures
- Appendix C - Quarterly Sampling and Analysis Plan
- Appendix D - Borings Logs
- Appendix E - Analytical Data
- Appendix F - Data Validation Report
- Appendix G - Aquifer Test Analysis

2.0 SITE BACKGROUND AND FEATURES

2.1 SITE LOCATION AND BACKGROUND

The following sections provide a regional and local site description and discuss the results of previous studies conducted at, or associated with, the Minimart site.

2.1.1 Regional Description

The City of Colville is located in Stevens County, Washington approximately 40 miles south of the U.S./Canadian border. Colville is located at the junction of U.S. Route 395 and State Route 20, approximately 65 miles north of Spokane and 352 miles east of Seattle and lies at an approximate elevation of 1,600 feet above mean sea level (MSL). The terrain in the area consists of a valley surrounded by mountains, and forested by a variety of trees. The Colville River is located approximately one mile west of Colville and flows to the northwest to its confluence with the Columbia River. The 1990 census of Colville indicated the population was 4,360. The primary employers in Colville are related to the timber and lumber industries, and there is also a producer of magnesium alloys.

2.1.2 Site Description

Whitty's Minimart is a retail gasoline station located on an approximate 0.75 acre parcel in a residential and commercial neighborhood in Colville, Washington. The Whitty's Minimart property is located at 485 South Main Street in southwest Colville (Figure 1). A site plan showing site conditions prior to the RI is shown on Figure 2. The legal description for the property is:

The South 111 feet of the Southwest 1/4 of Block 25, COLVILLE, in the City of Colville, according to plat recorded in Volume A of Plats, page 1, in Stevens County, Washington.

SUBJECT TO easements, restrictions and reservations of record.

The site is presently owned and operated by Whitten Oil. The property has been owned and operated by Whitten Oil since March 1977. Records indicate that the site was previously operated as Larry's Exxon.

Land in the area around the site is zoned as a General Commercial District Zone C-3. The designation of the area as Zone C-3 was established by City of Colville Municipal Code. The purpose of the General Commercial District is to serve those commercial and business uses which, because of large space requirements, truck traffic generated, or similar characteristics, should not be located in the central business district of the City. In addition, the purpose of this district is to establish and preserve commercial areas having a variety of uses which are accessible primarily by automobile (Ord. 893 NS [part], 1983).

The Minimart property is bordered to the north by residential housing. An alley borders the east side of the site. Bowe's Office Equipment and vacant portions of residential lots bound the east side of the alley. Dominion Avenue borders the south side of the site. Colville Auto Repair is located on the south side of Dominion Avenue opposite the Minimart. U.S. Route 395 (Main Street)

borders the west side of the site. A parking lot and restaurant are located west of Main Street opposite the minimart. The site layout and nearby properties are shown on Figure 2.

Two storm drains are located adjacent to the Minimart site. One is located under the east side of Main Street and drains to the south. The other storm drain is occupied by a small unnamed creek that has been diverted below grade to run generally east to west under Dominion Avenue. The two storm drains are believed to converge at the west side of Main Street and then flow to an outfall southwest of the Minimart. The locations of the storm drains are shown on Figure 2. The small receiving creek flows to the west and southwest where it discharges into the Colville River in the vicinity of Colville's sewage disposal ponds (Figure 1).

Whitty's Minimart uses four underground storage tanks (USTs) for the storage of gasoline and diesel fuel products. The USTs include:

- A 10,000-gallon regular unleaded gasoline (unleaded) UST;
- A 6,000-gallon super unleaded gasoline (super) UST;
- A 6,000-gallon leaded gasoline (regular) UST; and
- A 2,000-gallon diesel fuel UST.

A petroleum hydrocarbon-like sheen and odors have been observed periodically in an outfall of an unnamed creek formerly located downstream of the site (Figure 2). Recently, the creek culvert has been altered by construction activity and the former discharge location has been paved over. Petroleum hydrocarbons have been identified in soil and groundwater beneath the Whitty's Minimart station, as well as at Colville Auto Repair located across Dominion Street south of the site. Fill ports for at least one UST are also located on the lot occupied by the Colville Chamber of Commerce building, north and upgradient of the storm drain that is located on the east side of Main Street and which discharges to the creek culvert.

2.2 PREVIOUS SITE STUDIES

The following section provides an historical description of the investigative activities previously performed at the site. The locations of samples collected as part of previous investigations are shown in Figure 3.

In July, 1984, Petroleum Equipment Maintenance Co. of Spokane, Washington conducted tightness tests of the four UST systems at the Minimart. According to the tests, the regular gasoline dispensing line and the diesel fuel UST failed. A portion of the regular gasoline dispensing line was replaced as was the diesel fuel tank and distribution line.

The Whitty's Minimart site was studied again in 1984 by Soil Exploration Company of St. Paul, Minnesota. This 1984 study investigated potential sources of gasoline identified entering the storm sewer and the small unnamed creek near the Minimart site. During the 1984 investigation, evidence of gasoline was noted in four of seven borings completed on or adjacent to the Minimart site. Gasoline odors were generally noted in the soil between 4 to 6 feet below the surface. Measurable

free product was noted in two of the borings adjacent to the west side of the Minimart site. No soil or groundwater samples were collected for chemical analysis nor was field instrumentation, such as a PID, used to assess potential gasoline concentrations. Also during the 1984 investigation, a cut-off trench equipped with a sump was installed along a portion of the west side of the property to intercept and prevent gasoline in the subsurface from entering the storm sewer and the creek. The trench reportedly intercepted the majority of free product observed along the storm sewer line running along Main Street. A "Gasoline Spill Investigation and Remedial Measures Implementation" report (Soil Exploration Company, August 16, 1984) was issued documenting this work. Subsequent to the 1984 investigation, free product was reportedly periodically pumped from the sump.

During July of 1990, gasoline was again reported to be present in the creek, and Ecology initiated an "emergency response" to mitigate the presence of the fuel. Emergency response activities included pumping the sump at the site's cut-off trench. During a second emergency response in fall of 1990 two additional trenches were constructed by Olympus Environmental, Inc. (Olympus) along the southern and western boundaries of the site. The scope of work of the Olympus response was to excavate two trenches, one along Dominion and one along Main Street, and to install a vapor extraction system (VES) in the trenches. (Olympus Environmental, Inc., 1990. Results of Remedial Action and Whitten Oil in Colville, Washington).

A Site Hazard Assessment (SHA) was performed at the site by an Ecology contractor in 1991. According to the stated objectives in the Science Applications International Corporation (SAIC), June 28, 1991 Report, "Whitten Exxon Oil, Remedial Investigation, Colville, WA" (SAIC, June 28, 1991) the SAIC investigation was conducted to "identify the source of the petroleum and to delineate the nature and extent of contamination in the immediate area of Whitten Exxon." As part of the SAIC investigation, several borings and monitoring wells were completed on the Minimart site and Colville Auto Repair facility. Petroleum hydrocarbons were detected in groundwater and soil at the Minimart and at Colville Auto Repair. The investigation recommended additional work to further define the source(s) of petroleum hydrocarbons being released to the storm sewer system

On July 15, 1991, Ecology issued Enforcement Order No. DE 91-E701 mandating Whitten Oil to conduct UST system tightness tests and subsequent excavation to expose product distribution lines and the tops of the tanks at the Minimart. Pursuant to the Order, Whitten Oil completed the following UST system tests and initial responses:

UST SYSTEM TIGHTNESS TEST		
Date	System Test	Result
August 10 and 11, 1991	Regular UST	Tight
	Regular Dispensing Line	Suspect
	Unleaded UST	Suspect
	Unleaded Dispensing Line	Suspect
	Super UST	Suspect
	Super Dispensing Line	Tight
	Diesel UST	Tight
August 13, 1991	Diesel Dispensing Line	Tight
	Regular Dispensing Line	Tight
August 13, 1991	Unleaded Dispensing Line	Failed
	Unleaded UST	Tight
August 29, 1991	Super UST	Tight
		Tight

Based upon the results of the UST and associated system tests, the tops of the USTs and dispensing pipelines were excavated and exposed on August 20 and 21, 1991. Pin-hole leaks were observed in the unleaded dispensing line near the east pump island. Bob Comfort, of Petroleum Equipment, Inc., of Spokane, conducted the line tightness test which identified the leaks in the pipe. After excavating around the leaking portion of the pipe, Mr. Comfort stated that it looked to him as though the pipe was damaged during installation. In an invoice sent to SEACOR, Mr. Comfort stated there were indentations on the pipe and it appeared the pipe was damaged at the time of initial installation. He also noted the presence of a red sealing compound under the pipe at the location of the leak. Additional pressure testing and excavation of the unleaded line revealed leaks at the pin-holes.

In order to comply with the requirements of regulations specified in Washington Administrative Code (WAC) 173-340-450(3) of the Model Toxics Control Act (MTCA), which specifies steps to be completed in response to a confirmed petroleum release, Whitten Oil subsequently completed a series of interim response actions. These response actions included removal and replacement of product dispensing lines between August 27 and 30, 1991, and collection of soil samples from along the product dispensing lines and from near the regular and super UST fill ports on August 20 and 21, 1991. This included excavation and collection of soil samples from beneath the location of the dispensing line pin-holes. On August 30, 1991, soil samples were collected from these same areas after replacing the product dispensing lines.

A supplemental site characterization study (SEACOR, November 26, 1991. 90-Day Site Characterization Report for Whitten Oil, Inc., Whitty's Minimart) was performed to comply with WAC 173-340-450(4)(b) which requires preparation of a site characterization report. On October 3 and 4, 1991, a field study was completed consisting of the following elements:

- Drilling and sampling six shallow soil borings around the location of the dispensing line pin-holes.
- Drilling and sampling a groundwater monitoring well near the northwest corner of the Minimart station site.

One soil sample was collected from each of the six borings completed in the vicinity of the pin-hole leaks at the Minimart. The sample that was collected above the groundwater level with the highest photoionization detector (PID) reading from each boring was selected for analysis of gasoline and diesel petroleum hydrocarbons. The results of the analyses were compared to the Method A soil cleanup level specified by the MTCA.

The results of the laboratory analyses indicated that soil samples from three of the six borings collected at a depth just above the water table exceeded the MTCA Method A cleanup level for Total Petroleum Hydrocarbons (TPH) as diesel, and that three of the soil samples also met or exceeded MTCA Method A cleanup levels for one or more gasoline constituents.

A groundwater monitoring well (MW-1) was installed in the City easement near the northwest corner of the site to help assess groundwater flow direction and the presence of potential upgradient hydrocarbon sources. Groundwater was not encountered during well completion. Results of the PID organic vapor readings of the soil from the monitoring well showed no positive readings. A soil sample collected from the MW-1 boring was tested and revealed no detectable levels of petroleum hydrocarbon analytes.

A shallow hand auger boring was completed adjacent to the 6,000-gallon leaded gasoline (regular) UST at the Minimart to assess the apparent vertical extent of petroleum hydrocarbons in the soil at this location. The results of the PID organic vapor screening of the hand auger boring near the regular UST indicated detectable levels of organic vapors to an approximate depth of 4 feet. A soil sample collected from 4 feet and submitted to a laboratory contained no analytes exceeding MTCA Method A cleanup levels. Based on field observations of the affected soil locations of the tank and fillports, the petroleum hydrocarbons detected with the PID at this location are believed to be from minor UST overfills at the site (SEACOR, November 26, 1991).

2.2.1 Soil Sampling Results

Soil samples collected from borings completed during previous investigations at the site and south of the site contained detectable concentrations of: purgeable hydrocarbons (total petroleum hydrocarbons as diesel [TPH-D]); extractable hydrocarbons (total petroleum hydrocarbons as gasoline [TPH-G]); and benzene, toluene, ethyl benzene and xylenes (BTEX). Concentrations exceeding MTCA Method A levels were detected in soil samples collected from just above the groundwater level beneath the fuel distribution lines at the site.

The highest concentrations of petroleum hydrocarbons detected in each boring were immediately above the groundwater level (i.e., at a depth of 5 to 6 feet below-grade). None of the excavations or borings (including the excavation immediately below the pin-hole leaks) indicated a vertical plume of hydrocarbons from the surface (or near-surface) to the groundwater level.

2.2.2 Groundwater Sampling Results

Groundwater samples collected by Ecology's contractor from monitoring wells MW-3, MW-7 and MW-8 during previous investigations at the site contained TPH-G and BTEX. Concentrations exceeding MTCA levels were detected in groundwater collected near the west and southwestern portions of the property.

2.2.3 Surface Water and Storm Drain Sampling Results

A surface water sample previously collected from a manhole southwest of the site contained TPH-G and BTEX. The exact source(s) of these compounds in the storm drain was not determined. Several facilities on the eastern side of Main Street were considered potential contributors of petroleum hydrocarbons in the creek. Also, the data provided by the previous studies did not clearly define the source(s) of the petroleum hydrocarbons observed in the small creek southwest of the Minimart.

3.0 PROJECT DESCRIPTION

This section describes the tasks performed during the RI at the Whitty's Minimart site. The following is a brief description of Tasks 1 through 9 conducted as a part of the RI data collection effort at Whitty's Minimart. Results of the activities completed pursuant to these tasks are discussed in Section 4.0 of this document.

3.1 TASK 1 - RECORD SEARCH

A record search was completed for the site and surrounding properties to assess past and present uses of various facilities in the area. These data were used to identify other potential sources which may have impacted the site and surrounding areas. This task included performing a review of historical aerial photographs, land use maps, and agency files and conducting interviews. Records of monitoring and water supply wells in the vicinity of the Minimart were also reviewed.

3.2 TASK 2 - SOIL VAPOR SURVEY

SEACOR retained the services of Tracer Research Corporation of Tucson, Arizona to conduct a soil vapor survey. The survey was completed at the site and surrounding areas to assess the lateral extent of hydrocarbons in the subsurface and to identify potential hydrocarbons sources in the study area and to finalize proposed drilling locations. The soil vapor survey was completed along the storm drains in Main Street and Dominion Avenue and around the station at the Minimart site as shown in Figure 3.

A total of 31 soil vapor samples were collected and analyzed for total volatile hydrocarbons and BTEX constituents in the field by Tracer Research using a portable gas chromatograph. Results were used to identify the proposed soil boring locations for subsequent phases of the study. A complete copy of the soil vapor survey report is presented in Appendix A of this report.

3.3 TASK 3 - BACKHOE TRENCH

A backhoe trench was excavated to locate and assess the nature of the potential subsurface structure that was encountered north of the building on the Minimart site during the Ecology investigation. As shown on Figure 4, a backhoe trench was excavated on the northern portion of the property.

The excavation was monitored for potentially elevated concentrations of volatile organic compounds (VOCs) using a PID. Geology in the excavation was logged and photo-documented. The methods used to complete the backhoe trench excavation are presented in Appendix B to this report.

3.4 TASK 4 - SOIL BORINGS

Shallow soil borings were completed to assess the lateral extent of petroleum hydrocarbons in soil beneath the Minimart site and nearby properties. A total of six soil borings were drilled on-site and eight borings were drilled off-site at locations shown in Figures 4 and 5. The purpose of the soil borings was to collect soil samples for laboratory analysis, to assess vertical and lateral extent of petroleum hydrocarbons in the soil, and to facilitate the construction of groundwater monitoring wells in the first encountered saturated zone in selected borings. Soil boring locations were identified based on the results of previous investigations and the soil vapor survey.

Soil borings were drilled with a hollow stem auger and samples were collected with a split-spoon sampler. The sampler was driven 18 inches at 2.5 foot intervals to the total depth of the borehole. Depth of observed changes in lithology and depth to the first encountered saturated zone were noted. Each boring was advanced a minimum of 5 feet into the first encountered saturated zone. Borings B-8 and B-9 were advanced to 25 and 23.5 feet deep, respectively. Up to two soil samples from each boring were analyzed for TPH-G and/or TPH-D and BTEX constituents. The methods used to complete the soil borings are presented in Appendix B of this report.

3.5 TASK 5 - MONITORING WELLS

Groundwater monitoring wells were constructed to collect groundwater samples and evaluate hydrogeologic conditions in the first encountered saturated zone. Four-inch diameter wells were constructed in nine of the soil borings: three on-site and six off-site. The locations of the monitoring wells, shown on Figure 4, were selected to help assess the apparent extent of petroleum hydrocarbons as well as to evaluate the potential interrelationship between surface and storm drain water and groundwater quality. Hydrogeologic data were collected to assess characteristics of the saturated zone in the event that groundwater remediation is implemented in the future. Hydrogeologic data were collected by measuring water levels to assess groundwater gradient and direction and by recording water level recovery during rising head well recovery tests in three of the wells.

Each of the wells were developed, sampled, surveyed, and sounded according to the methods and procedures described in Appendix B to this report. The wells were completed in accordance with the rules and regulations outlined in Chapter 173-340 WAC: Minimum Standards for Construction and Maintenance of Wells.

3.6 TASK 6 - GROUNDWATER SAMPLING

One groundwater sample was collected from each well and submitted to North Creek Analytical of Bothell, Washington for analysis of selected petroleum hydrocarbon constituents. Groundwater samples were collected from existing and newly installed monitoring wells to assess the extent of affected groundwater beneath the facility, to assess other potential sources of hydrocarbons, and to monitor for the presence of free phase hydrocarbons.

3.7 TASK 7 - SURFACE WATER AND STORM DRAIN WATER SAMPLING

Samples of water from nearby surface water at the creek outfall and storm drains were collected and analyzed to assess the presence of petroleum hydrocarbons as well as to aid in the identification of potential source(s) of the hydrocarbons. Surface water and storm drain water were sampled from the six locations shown in Figure 6.

3.8 TASK 8 - AQUIFER TESTING

Aquifer tests were performed to evaluate groundwater system characteristics in the vicinity of the site. Although, the RI Work Plan called for conducting a 24-hour pump test on monitoring well MW-10, the well did not yield sufficient water to warrant conducting a pump test. As an alternative and in accordance with Ecology approval, a rising head recovery test was conducted on three wells (MW-7, MW-10 and MW-11). Each well was quickly evacuated with a bailer and groundwater recovery over time was recorded with a pressure transducer and automated data logger. Test procedures are presented in Appendix G to this report.

3.9 TASK 9 - SURFACE WATER AND GROUNDWATER MONITORING PROGRAM

A draft surface water and groundwater monitoring program has been developed to assess groundwater and surface water conditions on a regularly scheduled basis. The draft groundwater monitoring and analysis plan is included in Appendix C to this document and describes the location and frequency of groundwater and surface water monitoring activities to be completed as part of the remediation effort at the site.

4.0 INVESTIGATION RESULTS

4.1 SUBSURFACE GEOLOGY

The Whitty's Minimart site is located on the east side of the Colville River Valley, which was created by glaciation during the late Wisconsin age approximately 10,000 years ago. Sediments in the valley are characteristic of till, outwash and glaciolacustrine deposits which have been eroded and subsequently filled by alluvium from the Colville River. The alluvial materials are typically silts, sands, and gravel.

Soils encountered during drilling consisted of interbeds of a brown gravelly sand or silt to a maximum depth of 13 feet in MW-1. The shallow interbedded zone was underlain by a brown-olive silty clay. All except two borings were terminated at 15 feet depth or shallower. The total thickness of the clay unit was penetrated at a depth of 20 to 22 feet two borings: B-8, located across Main Street directly west of the site, and at B-9 located west of the Chamber of Commerce building. In B-8 and B-9 the clay was underlain at 20 to 22 feet BGS by a grey clayey sandy silt to silty sand. The depth of the investigation was limited to a maximum depth of 25 feet which was obtained in boring B-8 and the extent of the underlying silt layer is unknown. The locations of two geologic cross sections are shown on Figure 7. The corresponding cross sections are shown on Figures 8 and 9. Boring logs and well construction details are presented in Appendix D.

4.2 LOCAL HYDROGEOLOGY

During the RI, a total of nine monitoring wells were installed at the site and surrounding areas (Figure 5) to assess the extent of the petroleum hydrocarbons in shallow groundwater and to assess potential sources of petroleum hydrocarbons. Three wells (MW-9, MW-10 and MW-11) were completed on the Minimart site. The remaining six wells (MW-12 through MW-17) were completed in the vicinity of the site along Main Street.

Groundwater was generally first encountered during drilling at approximately 5.5 to 6 feet BGS in the upper sandy silts and sands which overlie the clay layer which was encountered at approximately 6 to 13 feet BGS. The upper sandy silts and sands appear to produce only a limited quantity of water, due to a typically limited saturated thickness of 1 to 2 feet. Based on the two deeper soil borings B-8 and B-9, the clay layer which underlies the upper silts and sands appears to act as an aquitard and to confine the deeper water-bearing layers. During drilling of B-8 and B-9, water levels representing the potentiometric head in the deeper silts and sands (20 to 22 feet BGS) were allowed to stabilize within the hollow portion of the auger flights. After approximately 12 hours, the water level in both borings stabilized at approximately the same elevation as the shallower water bearing layer. Based on the observed absence of significant head differentials, detectable petroleum hydrocarbon odors, indications of discoloration, or elevated PID readings in soil immediately above the deeper water-bearing zone, this zone is not believed to have been affected by petroleum hydrocarbons and was not investigated further as agreed to by Ecology.

The elevation of the monitoring well casings were measured relative to a bench mark at the Stevens County courthouse by a Washington-licensed land surveyor. Water levels were measured with an electronic water level meter. Table 1 presents the survey results and the water level readings. Stabilized groundwater elevations measured on June 16, 1992 and interpreted groundwater elevation contours are shown on Figure 10. The contour pattern indicates that first encountered groundwater appears to generally flow towards the south to southwest at a gradient of approximately 0.02 feet per foot (ft/ft). The storm sewers southwest of the Minimart intersect the table and the groundwater appears to generally flow to the southwest along the storm sewers.

Efforts to develop and purge the recently installed monitoring wells indicated that the recharge rates in the upper groundwater zone was slow. Each of the monitoring wells installed during this RI were capable of being bailed dry during development.

4.3 RECORD SEARCH

A records search was completed to assess current and former land uses on and near the site. SEACOR reviewed aerial photographs, from a private citizen from Colville, USGS Orthophoto map and City of Colville Public Works Department. Land use maps and agency files were also reviewed. Select individuals from the area were interviewed. The results of this process are presented below.

4.3.1 Aerial Photographs

As part of the record search, aerial photographs from 1976, 1979, 1980 were reviewed to assess nearby properties and potential off-site sources of petroleum hydrocarbons. No potential sources were identified. However, a ground level reconnaissance of the area during the RI revealed that there were gasoline pumps at Colville Auto Repair, and several potential UST fill ports as well as a potential former pump island base at the Chamber of Commerce facility.

4.3.2 Land Use Maps

Land use maps from the County Assessors office at the Colville County Court House, the Washington Department of Natural Resources, and the U.S. Agricultural Stabilization and Conservation Service were reviewed. Review of the land use maps did not identify additional potential sources of petroleum hydrocarbons in the vicinity of the site.

4.3.3 Agency File Review

Ecology files were reviewed to assess the number and location of domestic wells in the site area. Review of Ecology files indicated that there are domestic wells and municipal wells within one mile of the site. The closest domestic well is 1,500 feet south of the site. The depth of the well is 42 feet.

Files with the County Health District also were reviewed to assess if there was any information regarding the Whitten Oil property and the creek southwest of the site. Available files were reviewed for the period between 1977 and 1990. The only information regarding the site was a record of communication between Ecology and the County Health District.

Ecology files for the site and surrounding sites identified as containing leaking USTs were also reviewed. Review of Ecology files indicated there were four facilities within one mile of the site that

had documented past releases from UST systems. The sites include the Colville Auto Repair site located at 505 S. Main; The Pacific Northwest Bell Telephone Company, U.S. West Communications Colville central office site located at 269 Oak Street; the Stevens County Sheriff Ambulance Shack located at 252 E Birch; and Ron's Stop N Shop located at 284 N Main. Refer to Figure 1 for the location of these sites. Review of the agency files for facilities with leaking USTs within one mile of the site indicated that no samples have been collected to assess the potential impact of the facilities on the small creek southwest of the site. The following descriptions provide a summary of the status of each of the four facilities in the vicinity of the Minimart reported to have leaking USTs.

Colville Auto Repair

Review of records for the Colville Auto Repair site indicated that the site owners have been named potentially liable parties because there may have been a release of a "hazardous substance" at the facility.

The Ecology files contained a brief report prepared by an Ecology staff member on August 6, 1990. This report describes some of the activities and site characteristics during closure of three gasoline USTs observed by Ecology personnel. Contaminated groundwater and soil were noted in the UST excavation. The report further states that "there had been obvious spill and overfill in the past," and that there was some water in two of the USTs.

An additional letter written by one of the Colville Auto Repair operators, Jay E. Coogan, states that retail fuel sales ended on June 4, 1990 and that the station had sold regular, supreme and unleaded gasolines prior to that time.

U.S. West Communications Colville Central Office

A site status letter (October 9, 1990) submitted to Ecology and prepared by Century West Engineering was reviewed. The letter indicated that during closure and site assessment activities for a 400-gallon heating oil UST and 300-gallon diesel UST, that TPH and xylene concentrations detected in soil exceeded MTCA Method A cleanup levels. Based on these preliminary findings, an independent Remedial Investigation/Feasibility Study (RI/FS) was scheduled to begin in October 1990. Following completion of the RI/FS, a Cleanup Action Plan (CAP) was to be prepared and presented to Ecology during February 1991. No tank closure reports were available at the time of the file review.

Stevens County Sheriff Ambulance Shack

The following information was obtained from a review of a "site check and evaluation letter" dated December 20, 1991 and site status correspondence dated December 4, 1991.

During the removal of two 1,000-gallon unleaded fuel USTs, portions of the tank backfill surrounding each tank was observed to be impacted by petroleum hydrocarbons releases. Over-excavation was performed until obviously affected soil had been removed. An Ecology representative was notified and a site inspection was performed. During over-excavation, groundwater was observed within the tank cavities. Subsequent to excavating, confirmation soil and groundwater samples were collected and submitted for chemical analyses. Based upon review of analytical results, Ecology "advised the county that based on the information they provided, additional work was not required."

Ron's Stop N Shop

There was no available information in the Eastern Regional Office Ecology files about the remedial activities completed at Ron's Stop N Shop. Based upon interviews with Ecology personnel, removal of tanks at the site was overseen by Ecology. A small volume of petroleum affected soil identified at the site was reportedly related to past surface spillage and the problem "was not substantial" (Phil Leinart, Department of Ecology, personal communication). The affected soil was reportedly excavated. The final disposition of the excavated soil was not available. Analytical results of tank closure soil samples were not available for review in order to confirm reported observations at the site.

4.3.4 Interviews

Owners or representatives of the owners of selected property in the vicinity of the site were interviewed to assess the presence or absence of suspected USTs. According to the real estate agent for the Merchants Mercantile store located north of the site (refer to Figure 2) at 435 S. Main the store was heated by natural gas and never owned a heating oil tank. According to the property owner of the Les Schwab Company located at 434 S. Main, northwest of the site, no USTs were present at that facility. Carrol Whitten, the former owner of the Minimart, recalls that some USTs were removed from the Les Schwab facility at some time in the past.

4.4 SOIL VAPOR SURVEY RESULTS

A total of 31 sampling locations were completed during a soil vapor survey of the site and vicinity. Refer to Figure 3 for the locations of the sampling sites. There are no cleanup levels established under the Model Toxics Control Act for soil vapor concentrations of petroleum hydrocarbons. For illustrative purposes, soil vapor concentrations of 100 $\mu\text{g/L}$ (or approximately 34 ppm) are shown on Figure 2 of Appendix A. Samples exceeding 100 $\mu\text{g/L}$ were noted at sample locations SG-4, SG-7, and SG-21 located on Dominion Avenue southwest of the site, and at SG-23 located near the southeastern portion of the site. Based in part on the results of the soil vapor survey, the proposed monitoring well location directly across Main Street from the Minimart was not completed, as approved by Ecology. A complete copy of the soil vapor survey report is presented in Appendix A of this report.

4.5 BACKHOE TRENCH

The backhoe trench investigation consisted of excavating a trench to approximately 5 feet BGS in the northcentral portion of the site. Soil encountered during the excavation consisted of a brown fine to medium sandy silt. At approximately 5 feet BGS, an extremely hard grey gravelly silt layer was encountered. Attempts to excavate through the consolidated silt layer with the backhoe were unsuccessful. The source of this layer is unknown, but it is assumed to be naturally occurring material. A jackhammer was used to penetrate the dense consolidated material and a marker was placed in the hole in the excavation so that a boring for monitoring well MW-15 could subsequently be advanced through the consolidated material. During excavation, soil samples were collected and evaluated in the field for organic vapors using a PID. Evaluation of the soil samples did not detect the presence of any organic vapors, and no samples were collected for laboratory analysis.

4.6 SOIL SAMPLE RESULTS

Soil samples were collected and analyzed from the 13 borings completed during the RI. Soil samples were collected for analyses at two depths in each boring: a shallow depth (3.5 to 4 feet) and a depth near the groundwater surface (5.5 to 8.5 feet). Two borings, B-8 and B-9, did not encounter shallow groundwater. Samples were also collected and analyzed from a greater depth in borings MW-16, B-9, B-10, and B-11 (11 to 13.5 feet). These deeper soil samples were collected and analyzed to assess if petroleum hydrocarbons were present at depth in those areas based on petroleum hydrocarbon concentrations. Each of the soil samples was analyzed for TPH-G and BTEX using EPA Methods 8015 and 8020, respectively. Because diesel fuel is sold at the Minimart and past analyses have detected it, selected soil samples were also analyzed for TPH-D by EPA Method 8015. Results of the laboratory analyses are contained in Appendix E. A summary of the analytical results are presented in Table 2. Boring locations and corresponding concentration isocontours of TPH-G are shown in Figure 11.

Results of the soil samples have been compared to MTCA Method A cleanup levels in soil for BTEX and TPH as gasoline and diesel. The soil samples exceeded the MTCA Method A cleanup level for TPH-G in MW-11 at 6 feet, MW-16 at 6 feet, B-10 at 8.5 feet, B-11 at 6 feet. The soil samples from MW-11 at 6 feet, MW-16 at 6 feet, and B-10 at 8.5 feet exceeded the MTCA Method A cleanup level for TPH-D. The MTCA Method A cleanup level for benzene was exceeded in MW-10 at 8 feet. The MTCA Method A cleanup level for ethyl benzene was exceeded in MW-11 at 6 feet and B-10 at 8.5 feet. The cleanup level for xylene was exceeded at MW-11 at 6 feet, B-10 at 8.5 feet and B-11 at 6 feet. No other samples contained analytes exceeding MTCA Method A cleanup levels.

Soil samples from MW-16 and from B-10 were also analyzed for use as fuel fingerprints to assist in distinguishing between species of petroleum hydrocarbons which may be preset at the Minimart and the nearby Colville Auto Repair facility. Results of the fuel fingerprint analysis indicated that the gas chromatograms of the two samples are similar and contained a complex mixture of both gasoline and diesel range hydrocarbons. Ecology suggested the soil sample from MW-16 be analyzed for total lead content to possibly differentiate between contaminants at the two sites. The results of the total lead analysis are similar in concentration to samples collected during previous investigations at the Whitten Oil site.

Detectable concentrations of petroleum hydrocarbons, although not in excess of MTCA Method A cleanup criteria, were observed in the samples from boring B-9 near the Chamber of Commerce site.

4.7 GROUNDWATER SAMPLE RESULTS

Groundwater samples were collected from the monitoring wells that were installed as part of the RI and from the wells installed during previous studies of the site. Groundwater samples were analyzed for TPH-G, TPH-D and BTEX using EPA Methods 8015 and 8020. The results of the laboratory analysis are contained in Appendix E. A summary of the analytical results is presented in Table 3. Monitoring well locations and corresponding concentration isocontours of TPH-G are shown in Figure 12.

The concentration of the analytes detected in the groundwater have been compared to the MTCA Method A cleanup levels for groundwater which are as stringent, or more stringent, than Federal

levels and have therefore been used as a basis for comparison with the reported groundwater concentrations of petroleum hydrocarbons.

Groundwater samples that exceeded MTCA Method A cleanup levels are tabulated below:

Sample Number	Exceeded Criteria					
	TPH-D	TPH-G	Benzene	Toluene	Ethyl Benzene	Xylene
MW-3	X	X	X		X	X
MW-7	X	X	X	X	X	X
MW-8	X	X	X	X	X	X
MW-8 Duplicate	X	X	X			
MW-10	X	X	X	X	X	X
MW-11		X	X	X	X	X
MW-12			X		X	X
MW-16	X	X	X	X	X	X

No other sample analytes exceeded MTCA Method A cleanup levels for groundwater.

The elevation of the storm sewer in the vicinity of MW-13 downgradient of the Minimart was below the elevation of the water table on June 15, 1992. As shown by the groundwater elevation contours shown on Figure 10, groundwater appears to flow to the southwest and tends to follow the storm sewer southwest of the Minimart.

4.8 SURFACE AND STORM DRAIN WATER SAMPLE RESULTS

Surface, storm drain, and storm drain collection sump water samples were collected and analyzed from six different locations during the RI. Refer to Figure 6 for surface and storm drain water sample locations. The occurrence of noticeable petroleum odor and sheen on the creek has been sporadic; therefore, five of the locations were sampled twice to assess temporal effects on petroleum hydrocarbon concentrations. The creek outfall located along the alley west of Main Street was altered by construction activity and was inaccessible during the second round of sampling. Surface, storm drain, and storm drain collection sump water samples were collected on April 29, 1992 and June 15, 1992. According to the Washington Department of Natural Resources and Wenatchee Weather Station, .03 inches of precipitation accumulated in the Colville area on April 29, 1992 and .02 inches of precipitation accumulated on June 15, 1992. Each of the surface water samples were analyzed for TPH-G and BTEX using EPA Methods 8015 and 8020 respectively, and TPH-D using EPA Method 8015. Results of the laboratory analyses are contained in Appendix E. A summary of the analytical results is presented in Table 4.

Sample SD-2 was collected from a storm drain collection sump located adjacent to the Colville Auto Repair facility. This sump is connected to the storm drain by an overflow pipe. During each of the

sampling events the water level in the sump was below the overflow pipe. The analytes detected in the sample would likely discharge to the creek whenever the sump overflows to the storm drain.

MTCA Method A surface water cleanup levels may be calculated using water quality criteria published in the water quality standards for surface waters of the State of Washington (WAC 173-201). However, no numeric criteria are listed in the WAC for TPH-D, TPH-G and BTEX components. Therefore, to evaluate concentrations of petroleum hydrocarbons in surface water and storm drain water, upstream concentrations (SD-4 and SD-5) were compared to downstream concentrations. Water Quality Criteria from the US E.P.A. were also used to assess potential effects of petroleum hydrocarbon concentrations on fresh water aquatic species.

Surface and storm drain water samples that exceeded upstream concentrations of TPH-G (nondetected) included SD-1 on April 29, 1992 and SD-3 (and the duplicate sample for SD-3 [SD-3 Dup]) on April 29, 1992 and June 15, 1992. Upstream concentrations of TPH-D (nondetected except for 2,100 ppm at SD-5 on April 29, 1992) were exceeded in the sample from SD-2 on April 29, 1992 and June 15, 1992, and in the sample from SD-3 and (SD-3 Dup) on April 29, 1992. TPH-D and TPH-G constituents were not detected at the creek outfall when it was sampled on April 29, 1992. As stated before, this sample point was inaccessible during the June sampling event.

Upstream concentrations of one or more BTEX constituents were exceeded in samples from the creek outfall on April 29, 1992, SD-1 on April 29, 1992 and June 13, 1992, SD-3 (and SD-3 Dup) on April 29, 1992 and June 15, 1992. However, none of the detected BTEX concentrations exceeded the U.S. EPA Water Quality Criteria Acute Toxicity Concentrations for freshwater aquatic species as shown on Table 4.

4.9 AQUIFER TEST RESULTS

Aquifer testing was performed at Wells MW-7, MW-10, and MW-11 on June 16, 1992. The data collected from these tests were used to estimate in-situ horizontal hydraulic conductivities. These estimated values are representative of the materials immediately surrounding the screened interval of the wells.

For each aquifer test, the water level was rapidly lowered by bailing groundwater from the well using a PVC bailer. Water level recovery was then monitored every ten seconds using a pressure transducer, capable of detecting water level changes of less than 0.01 feet. The monitored data were recorded on a data logger. A more detailed discussion of the aquifer testing procedures is presented in Appendix F.

Hydraulic conductivities were estimated for each test by applying the Bouwer and Rice (1976) method to the recorded water level recovery data. The Bouwer and Rice method is applicable to both fully or partially penetrating wells in unconfined aquifers.

Calculations to estimate hydraulic conductivities are also presented in Appendix F. The hydraulic conductivities ranged from 2×10^{-6} feet per minute (approximately 0.02 gallons per day per square foot) at well MW-11, and 5×10^{-6} feet per minute (approximately 0.05 gallons per day per square foot) at well MW-10, to 2×10^{-4} feet per minute (approximately 2 gallons per day per square foot) at well MW-7. The apparent groundwater flow velocity (based on hydraulic conductivity,

groundwater gradient and an assumed porosity of 40 percent) is on the order of 0.07 to 7 feet per year. The storage coefficient for the water table aquifer can not be calculated with a high degree of confidence using slug or bail test methods. This is due to phenomena such as well-bore storage and well inefficiencies, which can significantly effect the calculated results for the storage coefficient.

The calculated hydraulic conductivities above are "typical" values for silty sand to sandy silt deposits (Freeze and Cherry, 1979). Review of the boring logs for these wells indicate that the upper portion of the screen intervals for these wells consist of silts and sands and that the lower portion is predominately clay. Since the entire length of the screen interval was used to calculate the hydraulic conductivity for each well, the calculated values likely represent an "average" hydraulic conductivity for the screened portion of the aquifer. Greater conductivity values likely exist for the upper (silts and sands) screened portions. Conversely, lower conductivity values likely exist for the lower (clay) screened portions. Based on experience at similar sites, clays of the type encountered during drilling at the site typically have hydraulic conductivities on the order of 1×10^{-6} feet per minute.

5.0 SUMMARY OF FINDINGS

The following sections provides a summary of findings resulting from the activities conducting during this RI.

5.1 SOIL INVESTIGATION

A total of 13 soil borings were completed in the vicinity of the site as part of the RI. Fifteen soil borings had also been completed at the site during previous investigations. Soil encountered in the borings consisted of a mixed zone of silts, sands and gravels to a depth of 7 to 8 feet BGS, underlain by a clay layer. The two deeper soil borings indicate that the clay layer appears to be underlain by silts and sands at a depth of approximately 20 to 22 feet BGS.

Based on the results of the soil samples collected as part of the RI, there are three areas that exhibit concentrations of petroleum hydrocarbons in excess of MTCA Method A soil cleanup levels. These areas include soil sampled from the boring for MW-16 located west of the Colville Auto Repair facility, at MW-11 located in Dominion Avenue south of the Whitten Oil facility, and the Minimart site as evidenced in samples from Well MW-10 southwest of the pump islands and by borings B-10 and B-11 located immediately north of the pump islands. The Minimart appears to be the source(s) for the petroleum hydrocarbons detected in soil at the Minimart and under Dominion Avenue. Colville Auto Repair appears to be the source for the petroleum hydrocarbon detected in the soil at boring MW-16. The highest concentrations of petroleum hydrocarbons in the soil were detected during the interim response actions at, or very near the groundwater table below the pin-hole leaks at the Minimart site. As stated before, these high concentrations were not observed to extend vertically through the soil from the leak to just above the groundwater level.

The soil samples from boring B-9 near the Chamber of Commerce site also contained detectable concentrations of petroleum hydrocarbons which included gasoline and diesel fuel range organics and xylenes. While the reported concentrations do not exceed MTCA Method A soil cleanup criteria, they do suggest that the Chamber of Commerce site may be a separate source of petroleum hydrocarbons in the storm drain and creek southwest of the site.

A "fuel fingerprint" analysis was completed on the samples from MW-16 and B-10 to assist in distinguishing between the types of petroleum hydrocarbons contained in each of the samples. Because the recent product line leaks at the minimart were associated with unleaded fuel, the soil sample from MW-16 was also analyzed for total lead to further assist in distinguishing between the two sample areas. Analysis of the two gas chromatograms for soil samples from boring MW-16 and B-10 indicated that the identified petroleum hydrocarbon constituents in the soil most closely resembled refined diesel fuels similar to oil typically used during winter months to prevent freezing and consists of a mixture of gasoline and diesel range hydrocarbons. Although the gas chromatographs of the fuel fingerprints for the soil samples in B-10 and MW-16 were similar, the areas do not appear to be related, because MW-5, MW-6 and MW-12 contain low or non-detected concentrations of petroleum hydrocarbons and are located between Colville Auto Repair (the location of MW-10) and the Whitten Oil Property (the location of B-10). The full history of fuel storage at the Colville Auto Repair facility is uncertain, but it is known that it dispensed regular, super and unleaded gasolines.

The highest concentration of petroleum hydrocarbons encountered in soil during the investigation was in MW-11 located in Dominion Avenue downgradient of the diesel UST and dispensing pump at the Minimart. The petroleum hydrocarbons contained in the MW-11 soil sample were a complex mixture of diesel and gasoline range fuel products.

The next highest concentrations in soil were observed in the samples from borings B-10 and B-11, located immediately north of the east and west Minimart pump islands, respectively, and between 30 to 40 feet from the identified pin-hole leaks. These borings are located in an upgradient groundwater flow direction from the UST system at the site. The transport pathway for petroleum hydrocarbons detected in these borings was not determined during the RI.

5.2 GROUNDWATER INVESTIGATION

Groundwater is first encountered at a depth of approximately 6 feet BGS within shallow silt and sand deposits. These deposits overlie an apparently laterally continuous clay layer which appears to act as an aquitard and confines deeper water bearing layers. The depth at which the clay layer was first encountered was generally 7 to 8 feet BGS. Therefore, the saturated thickness of the first water bearing layer was generally limited to approximately 1 to 2 feet. Based on two deeper borings drilled during the RI, the clay aquitard has an apparent thickness of 9 to 16 feet.

Groundwater elevation contours for stabilized water elevations which were measured on June 15, 1992 indicate that first encountered groundwater appears to generally flow towards the south to southwest. Estimated hydraulic conductivity at the site is on the order of 2×10^{-6} to 2×10^{-4} feet per minute. A hydraulic gradient of 0.02 foot/foot and an estimated aquifer porosity of 40 percent (from Freeze and Cherry, 1979) allow a calculated apparent groundwater flow velocity of approximately 0.07 to 7 feet/year.

Analytical results of the groundwater samples collected from the monitoring wells indicated that there are two areas containing petroleum-hydrocarbons in excess of MTCA Method A cleanup levels. The two areas include the western portion of Colville Auto Repair (MW-16 and MW-12), and the southwestern portion of the Minimart site. The reported diesel concentration in groundwater generally consisted of a mix of gasoline and diesel range products or were partly attributable to heavier oil range products.

The highest petroleum hydrocarbon concentrations in groundwater were observed in the sample from the monitoring wells on the Minimart site. Groundwater samples from wells upgradient of the site and pump islands did not exhibit detectable petroleum hydrocarbon concentrations. The concentration of petroleum hydrocarbons in groundwater at the Minimart site are highest in the area downgradient of the gasoline pump islands. Petroleum hydrocarbon concentrations in groundwater in excess of MTCA Method A cleanup levels do not appear to extend to the west side of Main Street.

Because concentrations of petroleum hydrocarbon as in wells MW-5, MW-6 and MW-12 at Colville Auto Repair are lower than in wells both upgradient and downgradient from them, the petroleum hydrocarbons detected in samples from well MW-16 of Colville Auto Repair are not likely to be related to potential sources on the Minimart site. The reported concentration of TPH-G in the sample from MW-16 was significantly higher than in the sample from MW-12 and suggests a separate source in the vicinity of MW-16 at Colville Auto Repair.

While no analytical data are available from the deeper water-bearing zone, the relatively impermeable overlying clay layer should act as a significant aquitard to minimize vertical migration of dissolved constituents into the deeper water-bearing zone. Based upon field observations there were minimal differences in piezometric head between the shallow and deeper groundwater zones and there is no significant hydraulic head to promote migration of petroleum hydrocarbons across the aquitard.

The storm drain at sample point SD-1 located near well MW-13 southwest of the Minimart was below the June 15, 1992 elevation of the groundwater in MW-13. These data and the groundwater elevation contours at and near the Minimart (refer to Figure 10) suggest that the storm drain(s) and/or backfill around them are diverting local groundwater flow toward the southwest along the course of the drain(s). The storm drain at sample point SD-4, which is located near the southeast corner of the Minimart, is approximately 1 foot above the June 15, 1992 water table elevation in nearby monitoring wells and this also indicates that the drains may further influence local groundwater flow direction on a seasonal basis during periods when the groundwater table is higher.

5.3 SURFACE WATER INVESTIGATION

Analytical results of surface water samples indicate that the concentration of petroleum hydrocarbons in the storm sewer located upstream of the site (SD-5) contained diesel fuel constituents during the first sampling episode. This was not verified during subsequent sampling. The storm drain collection sump water at Colville Auto Repair site (SD-2) contained diesel constituents and low levels of toluene. This sump does not appear to be downgradient of the SD-3 or SD-4 locations on the Minimart and may be a separate contributing source for hydrocarbons observed in the storm sewer. During each of the sampling events southwest of the site at SD-3, the surface water contained a mixture of diesel and gasoline constituents. In the creek upstream of the site at SD-4, no petroleum hydrocarbon constituents were detected. Downstream in the creek (SD-1 and the creek outfall), the surface water samples contained low levels of BTEX gasoline constituents during each sampling event. TPH-G was detected in SD-1 only during the first event.

Based upon the sample results, the diesel constituents detected in the upstream sample were not detected downstream. TPH-G and TPH-D constituents were not detected in the creek outfall nor did observed concentrations of BTEX constituents at the outfall exceed the acute freshwater toxicity levels published in the U.S. EPA Water Quality Criteria for 1986. The reported BTEX concentrations are also less than the U.S. EPA Water Quality Criteria one in 1,000,000 cancer risk concentrations associated with consuming fish from affected waters. These data indicate that releases of petroleum hydrocarbons to the storm drain are not causing significant adverse effects in the creek.

6.0 CONCLUSIONS

Petroleum hydrocarbons have been identified in the soil, groundwater and storm drains in the vicinity of the Minimart. Based on the data and findings of this RI, the following conclusions regarding the nature and extent of the petroleum hydrocarbons have been developed:

- Gasoline and diesel range petroleum hydrocarbons have impacted the soil and groundwater beneath the Minimart site. Pin-hole leaks were identified near the east pump island at the Minimart site. It was not determined how much of the identified petroleum hydrocarbons beneath the site are a result of the identified leaks.
- Gasoline and diesel range petroleum hydrocarbons have impacted the soil and groundwater beneath the Colville Auto Repair site. The Colville Auto Repair site is an additional potential source of petroleum hydrocarbons to the storm drain system and the creek.
- The majority of petroleum hydrocarbons that have impacted the soil are found in the relatively thin zone of seasonal groundwater fluctuation and the capillary fringe above the groundwater level.
- The direction of groundwater flow is to the southwest and appears to be influenced by submerged storm drains. The degree and/or area of influence may vary with seasonal fluctuations of the local groundwater table.
- The area of impacted groundwater does not extend to the west side of Main Street.
- The Colville Chamber of Commerce site and normal street runoff are also potential sources of petroleum hydrocarbons to storm drain systems and the creek.
- The exact source(s) of the petroleum hydrocarbons in the unnamed creek southwest of the site has not been identified.

7.0 REFERENCES

Agricultural Stabilization and Conservation Service, 1980. Aerial Photograph of Colville, Washington.

Big Sky Industrial, June 14, 1991. TV 24" Storm Drain Pulling S-N on Main Street Between Columbia and Dominion Street.

Bouwer, H. and R.C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfirmed Aquifers With Completely or Partially Penetrating Wells. Water Resources Research. V.12 pp 423-428.

CBC Enviro Engineering, September 5, 1991. UST Test Results (Precision Tank Testing) Whitten Oil, Inc., 485 South Main Street, Colville, Washington.

City of Colville, Department of Public Works. 1979 aerial photograph of Colville.

City of Colville Municipal Code, Ordinance 893 NS[PART], 1983.

Colville Chamber of Commerce, Undated Pamphlet.

Garringer, Murel, April 28, 1992. Personal Communication.

Les Schwab Company, Manager Colville Store. April 28, 1992. Personal Communication.

Luce and Associates, July 1, 1992. Report Data Validation for Whitten Oil, Client Project Number 00004-008-01, Luce and Associates Project Number 062692-01.

Olympus Environmental Inc., 1990. Results of Remedial Action at Whitten Oil in Colville, Washington.

Science Application International Corporation (SAIC), June 28, 1991. Whitten Exxon Oil, Remedial Investigation, Colville, Washington.

SEACOR, November 26, 1991. 90-Day Site Characterization Report for Whitten Oil, Inc., Whitty's Minimart.

Soil Exploration Company, August 16, 1984. Gasoline Spill Investigation and Remedial Measures Implementation.

Stevens County Auditor, April 1, 1977. Sale Agreement and Statutory Warranty Deed for Larry's Exxon.

Tracer Research Corporation, May 22, 1992. Shallow Soil Gas Investigation, Whitty's Minimart, Colville, Washington, May 6 and 7, 1992.

United States Environmental Protection Agency, May 1, 1986. Quality Criteria for Water 1986.

Washington State Administrative Code (WAC), June 15, 1991. Draft WAC 173-201 Water Quality Standards for Surface Waters of the State of Washington.

Washington State Department of Ecology, July 15, 1991. Enforcement Order No. DE-91-E701.

Washington State Department of Ecology, Eastern Regional Office, April, 1992 Personal Interview With Phil Leinart, P.G.

Washington State Department of Ecology, Various Dates. Eastern Regional Office Files for Various Facilities in Colville, Washington.

Washington State Department of Natural Resources, 1989. Orthophoto Map, T.25N.R39E., Stevens County.