CLEANUP ACTION PLAN

Manhole 34 Facility
Sunnyside, Washington

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1.0 INTRODUCTION

1.1 PURPOSE

This document provides a Draft Cleanup Action Plan (CAP) for the remediation of total petroleum hydrocarbons (TPH) in soil and in the dissolved phase in groundwater and as light nonaqueous phase liquid (LNAPL) overlying groundwater at the Manhole 34 Facility (Facility), located in Sunnyside, Washington (Figure 1). The Facility is defined as the area located within and around the intersection of North Sixth Street and Yakima Valley Highway where concentrations of TPH in soil and groundwater have been observed (Figure 2). The cleanup activities described in this document include: source removal by recovery of LNAPL overlying groundwater; institutional controls to protect utility, maintenance, and construction workers from exposure to soils impacted with hydrocarbon constituents; monitored natural attenuation for remediation of soil and groundwater with concentrations of TPH; and monitoring and removal of LNAPL on surface water within the existing storm sewer system.

This CAP has been developed in accordance with the Washington State Department of Ecology (Ecology) *Model Toxics Control Act Cleanup Regulation* (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC). In accordance with WAC 173-340-360(2), the selected cleanup action, removal of LNAPL overlying groundwater at the Facility, and natural attenuation of TPH in the dissolved phase in groundwater and within the soil will meet the threshold requirements at the defined points of compliance; protect human health and the environment; comply with remedial action levels; comply with applicable state and federal laws; provide for compliance monitoring; and provide a permanent solution to the maximum extent practicable.

1.2 CLEANUP ACTION PARTICIPATION

Ecology expects that the Manhole 34 Coordinating Group will be responsible for maintenance of the cleanup action. The members of the Manhole 34 Coordinating Group are Texaco Refining and Marketing, Inc., Time Oil Co., and ARCO Products Company, a division of Atlantic Richfield Company.

1.3 CLEANUP ACTION PLAN ORGANIZATION

Combined within this CAP, either directly or by reference, are the following four documents which have been developed for proceeding with LNAPL recovery at the Facility: (1) Engineering Design Report (WAC 173-340-400[4][a]); (2) Sampling and Analysis and Compliance Monitoring Plans (combined) (WAC 173-340-410); (3) Operation and Maintenance Plan; and (4) Safety and Health Plan (WAC 173-340-810). These documents have been combined into one comprehensive CAP to minimize duplication of effort, and to expedite the cleanup action.

The CAP has been organized into the following sections:

- **Section 2.0 - Background:** Section 2.0 provides background Facility information including the Facility location and description, geologic and hydrogeologic setting, a summary of previous subsurface assessment investigation, and RI/FS activities.

- **Section 3.0 - Exposure Assessment:** Section 3.0 provides a summary of the exposure assessment conducted during the RI/FS including a discussion of the constituents and media of potential concern, potential routes of migration, and sensitive receptors.

- **Section 4.0 - Cleanup Standards:** Cleanup levels and points of compliance are discussed in Section 4.0.

- **Section 5.0 - Cleanup Action:** Section 5.0 presents a discussion of cleanup alternatives for groundwater, surface water and soil; presents the selected cleanup alternative; and presents cleanup action levels.

- **Section 6.0 - Design and Installation:** Section 6.0 describes the components and installation of the remedial design (Engineering Design Report).

- **Section 7.0 - Operation and Maintenance:** Section 7.0 specifies operation and maintenance considerations.

- **Section 8.0 - Sampling and Analysis, and Compliance Monitoring Plans:** Section 8.0 presents the Sampling and Analysis, and Compliance Monitoring Plans.

- **Section 9.0 - Health and Safety:** A site Health and Safety Plan (HASP), which includes safety monitoring components, was submitted to Ecology with the RI/FS Work Plan for the Facility (SEACOR 1993c). The HASP is incorporated in this CAP by reference in Section 10.0.

- **Section 10.0 - Background References:** Section 11.0 lists the references cited in the CAP.

2.0 BACKGROUND

2.1 PHYSIOGRAPHIC SETTING

2.1.1 Facility Location and Description

The Facility is located in the Yakima River Basin, city of Sunnyside, Washington, near the intersection of Sixth Street and Yakima Valley Highway (Figure 2). The limits of the Facility were defined in the RI/FS and include individual properties occupied by Jackpot Food Mart, Sunnyside Tire Center, Maries County Kitchen, Sav-on-Food, Holberg Auto and RV Sales, and J&J Auto Repair (Figure 2).

The Facility ground surface is covered with impermeable surfaces such as buildings, asphalt, or concrete; with the exception of exposed soil at the northern half of the Sunnyside Tire Center property. The ground surface elevation is approximately 745 feet above sea level, approximately 100 feet higher than the Yakima River (USGS 1965), which is located approximately 5 miles to the south. Surface water within the Facility is directed to the storm sewer system maintained by the city of Sunnyside. Water that enters this system is directed to an open ditch, located in the southern portion of Sunnyside (Figure 1), and is eventually channeled to the Yakima River.

The Facility land use is primarily light-commercial; however, there are several isolated areas of residential property within the vicinity of the Facility (Figure 3). The residential areas are located north to northwest of the Facility along Sixth Street and North Avenue, and south to southwest of the Facility along Seventh Street and Blaine Avenue. Included within the area north of the Facility are two schools: Sunnyside Headstart Preschool located at the intersection of Sixth Street and North Avenue and Sunnyside Christian School located at the intersection of Ninth Street and North Avenue.

2.1.2 Geology

The Facility is located in an area underlain by basaltic rocks of the Columbia River Group of middle Miocene through early Pliocene age (La Sala, Doty, Pearson 1973). Only the upper part of the Columbia River Group, the Yakima Basalt, is commonly exposed in the Yakima River Basin. The Yakima Basalt has been warped and folded to form the principle topographic features of the region. Lacustrine and fluvial sediments of Pliocene age partly fill the structural basins formed through folding of the basalt sequence. These sediments consist of laminated silt, fine sand, clay, and crossbedded sand and gravel. Recent stream sediments fill the stream valleys of the Yakima River Basin. These deposits are composed of unconsolidated silt, sand, and gravel which may exceed 500 feet in thickness (Kinnison and Sceva 1963).

The geology beneath the Facility was assessed by reviewing data from 68 borings drilled by others prior to the RI/FS and an additional 24 borings drilled for the RI/FS to a maximum depth of approximately 50 feet below ground surface (bgs). The subsurface soil conditions underlying the Facility consist of highly stratified layers of non-indurated sandy silts and silty fine sand. The silt and sandy silt occur near the surface with silty sand and fine sand occurring at depths greater than 10 to 15 feet bgs. Gravels were encountered at depths greater than 40 feet bgs. This is consistent with recent alluvial sediments of the Yakima River Basin.

2.1.3 Hydrogeology

Groundwater occurs regionally in permeable zones and fractures in the basaltic rocks mainly under artesian conditions and in unconsolidated alluvial deposits under both water-table and artesian conditions. The coarser grained members of recent stream alluvium have relatively high permeabilities and serve as important aquifers in the area (Kinnison and Sceva 1963). Groundwater recharge occurs primarily by infiltration of surface runoff and by loss of water from the Yakima River. During the late spring and summer months, irrigation contributes to groundwater recharge. Groundwater movement within the vicinity of the Facility is to the south.

Shallow groundwater conditions occur at the Facility at depths of approximately 6 to 9 feet bgs. The water table at the Facility appears to fluctuate seasonally by less than 1 foot. Contours of the water levels described in the RI/FS indicate that the shallow groundwater in the vicinity of Jackpot Food Mart and R&R Tire (Figure 4) flows towards the south to southwest at an approximate gradient ranging from 0.007 feet per foot (ft/ft) to 0.02 ft/ft. West of Sixth Street, the groundwater flows towards the southeast at a gradient of 0.01 ft/ft. The groundwater appears to converge along Sixth Street, indicating leakage of groundwater into the storm sewer system. Based on historic water level data for Well DMW-4 provided in the RI/FS and the depth to the storm sewer pipe in the vicinity of manhole 34 (MH-34), the groundwater table has never dropped to a depth equivalent to or below the storm sewer pipe.

Laboratory hydraulic permeability tests conducted for the RI/FS indicate that the permeabilities range from 5.5×10^{-6} feet per minute (ft/min) to 1.9×10^{-5} ft/min. Field aquifer tests conducted for the RI/FS indicated hydraulic conductivities ranging from 1.9×10^{-2} ft/min to 1.4×10^{-1} ft/min. The results of the field test are indicative of sandy soils found at depth and not representative of the hydrocarbon-impacted silty soils found at a more shallow depth.

2.2 PREVIOUS ENVIRONMENTAL STUDIES AND CURRENT STATUS

LNAPL was first discovered at the Facility in February 1989 by the city of Sunnyside and Ecology officials after initial reports of gasoline odors were received from the Town House Motel, located approximately 240 feet west of MH-34 (Figure 2). The discovery of LNAPL at MH-34 prompted investigations of potential source areas located near the intersection of Sixth Street and Yakima Valley Highway. Results from these investigations indicated the presence of a layer of LNAPL overlying shallow groundwater in the area.

Three properties were identified by Ecology as potential source areas within the Facility. These properties include:

1) The property located on the northeast corner of Sixth Street and Yakima Valley Highway, presently operated as a Jackpot Food Mart. The property is currently owned by Time Oil Company.

2) The property located immediately east of Jackpot Food Mart, along the north side of Yakima Valley Highway, presently operated as the Sunnyside Tire Center. The property is currently owned by LaVon Philipp.

3) The property located on the southeast corner of Sixth Street and Yakima Valley Highway, presently operated as the Helberg Auto and RV Sales. The property is currently owned by Robert C. Mathias.

These potential source areas are referred to for the remainder of this CAP by the present businesses operating at the property (e.g., Jackpot Food Mart) and constitute the properties within the Facility.

2.2.1 Pre-RI/FS Site Investigations

A total of 68 soil borings were drilled during investigations conducted prior to the RI/FS, 26 of which were converted into groundwater monitoring wells. Laboratory analyses indicated that the chemicals of concern were primarily TPH in the gasoline, diesel, and oil ranges.

The results of the previous investigations found LNAPL overlying the shallow groundwater. The extent of the LNAPL was fairly well delineated to the west, north, and east by the previous investigations; however, to the south and hydraulically downgradient of the Facility, the extent of LNAPL was not characterized by the previous investigations.

2.2.2 Remedial Investigation/Feasibility Study

Based on the results of the previous investigations, Ecology notified eight previous and current owners/operators located within the vicinity of MH-34 of their status as potential liable parties (PLPs). Five of the PLPs notified by Ecology subsequently organized into the Manhole 34 Coordinating Group (Coordinating Group) and entered into an Agreed Order (NO. DE 93 TC-C465) with Ecology. The Agreed Order called for the implementation of an RI/FS as set forth and described in the Facility Scoping Document (SEACOR 1993a).

The purpose of the RI/FS was to collect, develop, and assess information regarding impacts at the Facility to enable the selection of an appropriate cleanup action or actions. RI/FS field activities included the installation of shallow soil borings and groundwater monitoring wells, collection and laboratory analysis of soil and groundwater samples, aquifer tests, and hand bailing LNAPL from MH-34 and MH-35. The RI/FS scope of work is outlined in greater detail in the RI/FS report and further detailed in the Facility Scoping Document (SEACOR 1993a).

The RI/FS report dated November 9, 1994 was submitted to Ecology for review. The RI/FS was approved by Ecology in November 1994. Key observations and results of the RI/FS include the following:

- The Facility is in the area of a busy intersection, with numerous commercial business activities and significant vehicular traffic. Numerous subsurface utilities are routed beneath the Facility.

- Field observations, physical testing and pilot studies indicate that subsurface soils consist of low permeability stratified sandy silt underlain by relatively permeable silty fine sands.

- Concentrations of TPH detected in the subsurface soil at the Facility appear to reside within the low permeability silts within the vadose zone.

- Two separate LNAPL plumes were identified at the Facility: a larger plume, based on lateral extent and thickness, located generally under Yakima Valley Highway; and a smaller plume located primarily under the southern portion of R&R Tires and Sixth Street.

- The extent of LNAPL appears to be relatively unchanged since monitoring began in 1989. This observation may indicate the migration of LNAPL may be very limited in the future.

- Past performance of the LNAPL recovery system at RW-1 has been poor, presumably because of low yielding soils (silt) within the LNAPL horizon.

- The storm sewer system appears to be dewatering and capturing shallow groundwater in the area, discharging potentially contaminated groundwater with concentrations of dissolved hydrocarbons and LNAPL to the drain system.

- LNAPL observed in MH-34 during the RI/FS appears to consist primarily of diesel or fuel oil, with possibly trace amounts of highly volatilized gasoline amounting to no more than a few percent of the total LNAPL. This observation conflicts with pre-RI/FS LNAPL sample results that indicated gasoline as the primary petroleum hydrocarbon in MH-34. Based, in part, on these conflicting observations, it appears that separate sources may be contributing LNAPL into MH-34.

- During initial RI/FS activities approximately 5 gallons of LNAPL was removed from MH-34 and MH-35. Over the course of the RI/FS LNAPL recovery was monitored. LNAPL did not reenter the manholes during the course of the RI/FS.

- Based on the shallow depth to groundwater (5 to 8 feet below surface grade) and the absence of clay layers at the Facility that would impede vertical migration and promote lateral spreading of petroleum hydrocarbons in the subsurface, the extent of unsaturated zone impacts are likely limited to the potential source areas where releases may have occurred.

- Dissolved TPH in groundwater appears to occur only in close proximity to the observed presence of LNAPL. This may be due, in part, to the effect of the storm sewer system, which has historically been dewatering (capturing) shallow groundwater in the area. Alternatively, partitioning (dissolving) of petroleum constituents into groundwater may have been greatly reduced because of limited surface water infiltration through the LNAPL layer, due to the surface coverage of asphalt, concrete, and buildings.

- Heavier TPH was not detected during the RI/FS and is not included as a constituent of concern.

- Analysis of metals indicate that groundwater contains naturally occurring background concentrations of iron, manganese, and total dissolved solids in excess of their respective maximum contaminant levels (WAC 173-340-720[1][a][ii][B]).

- Dissolved lead does not appear to be a chemical of concern at the Facility.

- Aquifer testing indicates that the silt in which LNAPL occurs has a very low permeability and will likely not produce recoverable groundwater at a rate greater than 0.5 gallons per minute (gpm) (WAC 173-340-720[1][a][ii][A]).

- Aquifer testing indicates that implementation of remedial actions incorporating groundwater extraction would be limited in effectiveness, due to the low permeabilities in soil where LNAPL occurs, and higher permeabilities in underlying water-bearing sands.

- Pilot studies indicate that implementation of air injection and vapor extraction techniques would be limited in effectiveness, due to the stratified and fine grained nature of the soil, and low permeabilities in the thin unsaturated zone.

- Due to the stratification of subsurface soils, low air and water permeabilities, and the nature of the contaminants and where they occur (i.e., constituents which are less dense than water occurring in low permeability silts), traditional remedial alternatives, such as groundwater pumping and treatment, air sparging, and vapor extraction would have limited application and success.

2.2.3 Groundwater Monitoring

Groundwater monitoring was conducted by SECOR on March 16-17, 1999 and by Farallon Consulting, L.L.C. (Farallon) on June 7, 2001. Groundwater monitoring included:

- Measurement of depth to water and LNAPL thickness in MW-1 through MW-5, MW-7, MW-10 , MW-11, MW-13, MW-14, DMW-4 and DMW-5.
- Measurement of depth to water in MW-8, MW-9, MW-12, MW-15, MW-17, MW-19, MW-20, MW-21, MW-26 through MW-29, DMW-1, DMW-2, DMW-3, and DMW-6;
- Measurement of LNAPL thickness on surface water in MH-31 through MW-35, MW-37 and MH-38, and;
- Collection of groundwater samples from MW-8, MW-12, MW-20, MW-25, and MW-27; and,
- Monitoring of vapors with a photoionization detector and explosivity meter and measurement of LNAPL thickness on surface water in MH-31 through MW-35, MW-37 and MH-38.

Groundwater samples were analyzed for TPH-G, TPH-D, TPH-O, and BTEX. Also included with the laboratory analysis were groundwater parameters including pH, specific conductivity, turbidity, dissolved oxygen, redox, temperature, alkalinity, nitrates, sulfates, dissolved manganese, dissolved iron, and visible sheen.

The results of the groundwater monitoring conducted subsequent to the RI/FS indicate that the concentrations of dissolved phase TPH-G, TPH-D, TPH-O and BTEX in groundwater has decreased. The monitoring results indicate that off-site migration of the dissolved phase petroleum hydrocarbons is not occurring. The extent and thickness of LNAPL on groundwater appears to have decreased based on the most recent monitoring results.

3.0 EXPOSURE ASSESSMENT

An exposure assessment was performed as a part of the RI/FS to identify chemicals of concern, media of concern, and assess potential routes of migration and sensitive receptors at the Facility. The results of previous investigations at the Facility and the RI/FS were used in the assessment. The results of the exposure assessment were included in the RI/FS submitted to Ecology. A summary of the exposure assessment is presented in the following sections.

3.1 CHEMICALS OF CONCERN

Data obtained during previous investigations and RI/FS activities has demonstrated the presence of various petroleum hydrocarbon constituents at the Facility. The following were retained in the RI/FS as chemicals of concern at the Facility:

- TPH in the gasoline range.
- TPH in the diesel range.
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX).
- LNAPL.

3.2 MEDIA OF CONCERN

The chemicals of concern were identified in the following media at the Facility:

- **Soil** - Chemicals of concern are present in soil contiguous with the LNAPL plumes overlying groundwater.
- **Groundwater** - Chemicals of concern are present in groundwater. LNAPL is present overlying groundwater in two discrete, well-defined plumes.
- **Surface Water** - Surface water is a medium of concern based on the past presence of LNAPL within the storm sewer system.

3.3 ROUTES OF MIGRATION AND SENSITIVE RECEPTORS

The RI/FS assessed the potential threat to human health and the environment. The only complete exposure pathways identified include:

- Subsurface migration of LNAPL into the storm drain system.
- Direct contact with surface water (including floating LNAPL) in the facility storm drain system.

- Off-site transport of surface water (including floating LNAPL) into the adjacent storm drain system and ultimately to the Yakima River.

- Atmospheric transport of volatile constituents of concern in the storm drain system.

Soil and groundwater may present future potential exposure pathways to human and environmental receptors during construction and utility maintenance activities at the Facility. Due to the existing impermeable surfaces, impermeable soils, and use of piped water for the residences and schools in the vicinity, there are no exposure pathways which would allow human contact with the existing or residual contamination which may be present after initiation of the remediation.

4.0 CLEANUP STANDARDS

Cleanup standards, as defined in WAC 173-340-700, for the Facility include establishing cleanup levels and points of compliance at which the cleanup levels will be attained for the Facility. The cleanup standards have been established for the Facility in accordance with MTCA (WAC 173-340-700 through WAC 173-340-760).

4.1 CLEANUP LEVELS

Cleanup levels are the concentrations of the identified constituents of concern that will be met at the points of compliance defined for the Facility. Cleanup levels have been established for dissolved TPH and BTEX in groundwater, LNAPL in groundwater and surface water, and TPH in soil. The cleanup levels are presented by media of concern in the following sections.

4.1.1 Groundwater

The cleanup levels for TPH and BTEX for groundwater throughout the Facility are the MTCA Method A Cleanup Standards (WAC 173-340-720, Table 1, MTCA Method A Cleanup Levels). The cleanup level for LNAPL is a technology based cleanup level based on the physical ability of the LNAPL recovery system. The cleanup levels are:

- 1,000 micrograms per liter (µg/l) for TPH
- 5 µg/l for benzene, 40 µg/l for toluene, 30 µg/l for ethylbenzene, and 20 µg/l for total xylenes
- LNAPL - Less than 0.01 feet

4.1.2 Surface Water

The state of Washington has not established numeric freshwater chronic water quality standards for TPH or BTEX constituents in Chapter 173-201(A); however WAC-201A 040 (5) states that the EPA Water Quality Criteria for Water, 1986 may be used to set a cleanup level for toxic contaminants not listed. The EPA Water Quality Criteria for Water has the following levels for some of the listed chemicals of concern:

5300 µg/l for benzene, 17,500 µg/l for toluene, 32,000 µg/l for ethylbenzene

For all other contaminants not listed above, a narrative cleanup standard of "no statistically significant impacts to surface water" is proposed as the cleanup level for dissolved constituents of concern in, and LNAPL on, surface water at the Facility.

4.1.3 Soil

The cleanup levels for soil throughout the Facility are the MTCA Method A Cleanup Standards (WAC 173-340-740, Table 2, MTCA Method A Cleanup Levels). The cleanup levels are:

- 100 milligrams per kilogram (mg/kg) for TPH in the gasoline range
- 200 mg/kg for TPH in the diesel range
- 0.5 mg/kg for benzene, 40 mg/kg for toluene, 20 mg/kg ethylbenzene, and 20 mg/kg for total xylenes

4.2 POINTS OF COMPLIANCE

This CAP has established points of compliance for groundwater [WAC 173-340-720(6)], surface water [WAC 173-340-730(6)], and soil [WAC 173-340-740(6)] at the Facility. The points of compliance, have been established pursuant to WAC 173-340-410(1)(b) to confirm that the cleanup action has obtained the cleanup standards defined for the Facility and meets the performance standards set for the operation of the cleanup action.

4.2.1 Groundwater

Points of compliance for groundwater have been defined to confirm that the cleanup and performance standards for the cleanup action have been met at the Facility. The following wells have been defined as the points of compliance: MW-8, MW-12, MW-20, MW-25, and MW-27 (for well location refer to Figure 5). Groundwater sampling and analysis conducted during the RI/FS indicates the groundwater at these points meets the MTCA Method A cleanup levels for TPH and BTEX. If at any time analysis of groundwater in these wells shows that concentrations of TPH or BTEX exceed the MTCA Method A cleanup levels, additional groundwater sampling will be conducted and a plan, subject to Ecology's review and approval, to augment or increase remediation efforts will be developed and implemented.

The points of compliance for the groundwater are located as close as possible to the source of contamination and do not exceed the property boundaries of the Facility. The points of compliance include the LNAPL recovery wells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-10, MW-11, MW-13, MW-14, DMW-4, DMW-5, and A1/VE Figure 6). The technology based LNAPL cleanup level of 0.01 feet and MTCA Method A cleanup levels for groundwater for TPH and BTEX as defined in Section 4.1 of this CAP will be met at the points of compliance to the outer boundary of the defined LNAPL plume.

4.2.2 Surface Water

The points of compliance for surface water are manholes 31, 32, 33, and 34 (for manhole locations, refer to Figure 5). In order to establish that no significant impacts to surface water occur across the Facility, manhole 29 and 38, the nearest upgradient manholes, will be used to establish the Facility's baseline water quality conditions. The data from the upgradient manholes and the points of compliance (MH-31 through MH-34) will be statistically analyzed in accordance with Guidance on Sampling on Data Analysis Methods, Washington State Department of Ecology, Toxics Cleanup Program, Publication No. 94-49, to evaluate if impacted groundwater and/or LNAPL is entering the storm sewer upstream of the Facility. It should be noted that significant variations in surface water quality analytical results typically occur in urban watersheds as a result of seasonal changes, weather patterns, precipitation rates, and human activities. During cleanup, data obtained in upflow and Facility manholes will be accumulated and assessed using the necessary statistical analysis to make meaningful comparisons between upflow and Facility surface water quality.

The cleanup levels for surface water defined in Section 4.1 of this CAP will be met at the defined points of compliance.

4.2.3 Soil

Previous facility studies and the RI/FS indicate that the extent of concentrations of TPH and/or BTEX above the MTCA Method A cleanup levels in the unsaturated zone soil are limited to the capillary fringe zone and does not extend beyond the limits of the LNAPL plume. Sampling and analysis has shown that concentrations of TPH and BTEX in soil located beyond the LNAPL plume are below the MTCA Method A cleanup levels for soil. In addition, since virtually all of the Facility is paved, a complete pathway for exposure of soil to human and environmental receptors is not present.

The points of compliance defined for soil is the soil horizon directly overlying the LNAPL plume throughout the Facility. The soil horizon within the LNAPL layer will be considered clean if the cleanup levels are met in the overlying soil (points of compliance) in accordance with the criteria set forth in WAC 173-340-740(6)(d). The cleanup levels for soil defined in Section 4.1 of this CAP will be met at the points of compliance.

5.0 CLEANUP ACTION

The RI/FS included a detailed analysis of alternative cleanup actions for the Facility. The objective of the cleanup action at the Manhole 34 Facility is to mitigate the potential risks and exposure pathways. The alternative identified in the RI/FS as the most technically feasible option includes removal of LNAPL overlying groundwater, thereby eliminating the continued source of hydrocarbon constituents to the storm sewer system and groundwater, coupled with monitored natural attenuation. In this draft Cleanup Action Plan, Ecology is proposing to select this alternative as the cleanup action for the site. In this section of the draft Cleanup Action Plan, Ecology identifies in more detail the components of the cleanup action and explains why this action is being selected. Cleanup levels for surface water and groundwater will be met at the defined points of compliance by source removal and monitored natural attenuation. Institutional controls will be implemented to protect utility, maintenance, and construction workers from contact with hydrocarbon-impacted soil.

5.1 CLEANUP ACTION EVALUATION

Regulatory requirements (WAC 173-340-360) for selection of cleanup actions at contaminated sites require the following: the protection of public health and the environment through compliance with cleanup standards established in WAC 173-340-700 through WAC 173-340-760; compliance with applicable state and federal laws; and the implementation of compliance monitoring. Also, the remediation method must provide for a reasonable restoration time frame and must take into consideration any concerns raised during public comment on the draft CAP. Finally, the law requires that permanent remediation solutions be considered and implemented to the maximum extent practicable.

5.1.1 Groundwater

Groundwater cleanup alternatives evaluated included:

- LNAPL removal,
- Monitored natural attenuation,
- Groundwater extraction and treatment, and
- Other *in situ* methods such as air injection and vapor extraction.

Based on field observations, physical testing, and pilot testing conducted during the RI/FS, groundwater extraction and other *in situ* alternatives were not deemed effective or practical. Field observations and physical testing indicate that subsurface soil consists of low permeability stratified sandy silt underlain by relatively permeable silty fine sands. Aquifer testing indicates that the silt in which dissolved TPH and LNAPL occur has a very low permeability and will likely not produce recoverable groundwater at a rate greater than 0.5 gpm (WAC 173-340-720[1][a][ii][A]). Pilot studies further indicate that air injection and vapor extraction techniques would have limited effectiveness due to the stratified and fine-grained nature of the soil.

Based on the impracticability of implementing groundwater extraction and/or other *in situ* remediation alternatives, the selected cleanup alternative for groundwater includes the removal of LNAPL overlying groundwater, source removal, and monitored natural attenuation of dissolved hydrocarbons by passive bioremediation. LNAPL removal will reduce and eventually eliminate the source of dissolved hydrocarbons to groundwater. The selection of this cleanup action for the Facility was based on the specific subsurface soil and groundwater conditions which indicate that this remedy is permanent to the maximum extent practicable.

In addition to the Facility conditions stated above, the selection of LNAPL removal and natural attenuation as the cleanup alternative for groundwater is supported by the following findings:

- There is not presently a complete pathway for exposure of dissolved hydrocarbons in groundwater to human and environmental receptors except through the storm drain system.

- Chemical analysis indicates that dissolved petroleum hydrocarbons in groundwater do not extend laterally significantly beyond the LNAPL plume. Additionally, the extent and configuration of the LNAPL plume has not changed significantly with time. This observation may indicate that natural attenuation has been acting to minimize and/or mitigate migration of hydrocarbons in groundwater at the Facility.

5.1.2 Surface Water

During RI/FS activities approximately 1 to 2 inches LNAPL was observed in and manually bailed from MH-34 and MH-35. The configuration of MH-34 is such that it acts as a large sump accumulating LNAPL until the level of water rises in the manhole and discharges to the flowing storm water system; hence LNAPL entering the storm sewer system sometimes accumulates in MH-34 and MH-35. During the course of the RI/FS, LNAPL did not reenter the manholes.

Analysis indicated that the LNAPL consisted primarily of diesel or fuel oil, with trace amounts of highly volatilized gasoline amounting to no more than a few percent of the total LNAPL. This result conflicts with a pre-RI/FS LNAPL sample which found gasoline as the primary petroleum hydrocarbon present. The limited data suggests that urban runoff, unidentified sources, and migration of LNAPL and/or groundwater containing dissolved hydrocarbons into the storm sewer system may impact surface water. Analysis of water samples obtained from the manholes during the RI/FS did not indicate a contribution of dissolved hydrocarbons from the Facility.

Based on these findings, an actively engineered cleanup alternative for surface water is not necessary. The selected cleanup action for surface water includes monitoring LNAPL thickness and, if necessary, manual removal of accumulated LNAPL.

5.1.3 Soil

Soil cleanup alternatives evaluated included source removal, soil excavation and treatment/disposal, natural attenuation, institutional controls, and other *in situ* methods such as vapor extraction. Based on field observations, physical testing, chemical analysis, and pilot testing conducted during previous studies and the RI/FS, soil excavation and other *in situ* alternatives were not deemed effective or practical. Data gathered indicate that hydrocarbons in the unsaturated zone are primarily limited to the capillary fringe zone of the LNAPL plumes. *In situ* measures for soil where hydrocarbon constituents exist is not practical due to the low air permeability calculated from pilot testing. Widespread soil excavation is not practical due to the presence of several subsurface utilities, the location of potentially impacted soil beneath the intersection of Yakima Valley Highway and North Sixth Street, the disruption to local businesses and traffic required for excavation, and the possibility that soil which is placed as backfill in the excavation following remediation may become re-contaminated with hydrocarbons from migration through the backfill material of LNAPL overlying groundwater.

Based on the impracticability of implementing soil excavation and the ineffectiveness of *in situ* remediation alternatives, the selected cleanup alternative for soil is LNAPL removal from the groundwater surface and implementation of institutional controls to protect utility, maintenance, and construction workers from contact with hydrocarbon-impacted soil. LNAPL removal to reduce the source of hydrocarbons to soil coupled with institutional controls shall provide a permanent solution to the maximum extent practicable. The institutional controls shall be adequate to provide reasonable assurances that utility, maintenance, and construction workers are notified of the hazard and can take the proper precautions for adequately protecting themselves when working at the Facility.

5.2 SELECTED CLEANUP ACTION

The proposed cleanup action, includes:

- Removal of LNAPL overlying groundwater from the recovery trenches and selected recovery wells (Figure 6).
- Monitored natural attenuation of residual hydrocarbon constituents in groundwater.
- Monitoring and removal of LNAPL from surface water in manhole sumps.
- Implementation of institutional controls for excavation within the Facility LNAPL plumes to protect utility, maintenance, and construction workers from contact with hydrocarbons and requirements to maintain paved, impermeable surfaces.

- Implementation of a compliance monitoring program to confirm that LNAPL and dissolved hydrocarbons are not entering the storm sewer system (drains) or migrating downgradient with groundwater

The proposed cleanup action meets MTCA requirements by providing a remediation technology which is permanent to the maximum extent practicable. Specifically, the proposed cleanup action includes the following components, which together meet the MTCA standard: (1) removal of the source (LNAPL) resulting in the natural attenuation of TPH in soil and groundwater to below cleanup levels (WAC 173-340-360[9][b]); (2) implementation of institutional controls restricting groundwater use and underground excavation work in the area (WAC 173-340-360[9][e]); (3) prevention of surface water contact with contaminated soils by maintaining paved, impermeable surfaces (WAC 173-340-360[9][f]); (4) minimization of the potential for direct contact by institutional controls and LNAPL removal (WAC 173-340-360[9][g]); and (5) elimination of greater overall threat to human health and the environment by direct removal of LNAPL (WAC 173-340-360[9][i]).

The proposed cleanup action also meets the regulatory requirements for a "permanent solution to the maximum extent practicable" (WAC 173-340-360[5]): (1) it protects human health and the environment; (2) it provides for long-term and short-term remediation effectiveness; (3) it permanently reduces the mobility and volume of hazardous substances; (4) can be implemented with consideration given to the restrictions imposed by existing structures and subsurface conditions; and (5) is practicable.. The selected alternative has incorporated prevention or minimization of present or future releases by removing the LNAPL, removing certain underground storage tanks, and monitoring the natural attenuation of the residual dissolved phase TPH in groundwater.

5.3 RESTORATION TIME FRAME

As required by WAC 173-340-360(6), a cleanup shall provide for a reasonable restoration time frame by considering the following factors:

(i) Potential risks posed by the site
(ii) Practicability of achieving shorter restorations time frame;
(iii) Current uses of the site;
(iv) Potential future uses of the site;
(v) Availability of alternative water supplies;
(vi) Effectiveness and reliability of institutional controls;
(vii) Ability to control and monitor migration of contamination;
(viii) Toxicity of the hazardous substances; and
(ix) Natural processes which reduce concentrations of the hazardous substances.

The proposed cleanup takes into consideration all of the factors listed above. Any potential risk has been addressed and minimized by elimination of the defined exposure pathways as a direct result of LNAPL removal. There is no practical remediation option which would result in a shorter timeframe. The current and future use of the site will remain as commercial, which was incorporated into the evaluation. The effectiveness of the institutional controls in the CAP will be evaluated annually. A long-term monitoring plan has been developed to monitor the migration of contamination and demonstrate the effectiveness of natural attenuation. The toxicity of TPH contamination is well understood and natural processes will be effective in reducing concentrations of TPH in groundwater to meet the cleanup levels.

Based on evaluation of these factors, and the specific subsurface soil and groundwater conditions existing at the site, monitored natural attenuation is the remediation alternative which is the most permanent to the maximum extent practicable.

5.4 COMPLETION OF CLEANUP

This cleanup will be deemed complete when all components of the remedy, including institutional controls, are implemented and compliance with the cleanup levels at the designated points of compliance have been achieved. Following completion of the cleanup, Ecology shall provide public notice and an opportunity for public comment prior to removing the site from the Hazardous Sites List in accordance with WAC 173-340-330 (4), unless Ecology becomes aware of circumstances at the Facility that present a previously unknown threat to human health and the environment.

6.0 DESIGN AND INSTALLATION

The draft cleanup alternative presented herein includes recovery of LNAPL from Facility monitoring wells and two recovery trenches and monitored natural attenuation of dissolved TPH in groundwater and soil. Additional details regarding the design and installation of the draft cleanup alternative are presented in the following sections.

6.1 REMEDIATION ALTERNATIVE DESCRIPTION

Product recovery canisters will be installed in Facility wells that contain measurable LNAPL and two LNAPL recovery trenches will be constructed at the Facility. Facility wells in which recovery canisters are to be installed are illustrated on Figure 5. The approximate location of the recovery trenches is illustrated on Figure 6. A conceptual cross-section of the trench design is illustrated on Figure 7. Each trench will be constructed with recovery points spaced at regular intervals. A product recovery canister will be installed in each recovery point. Design details for the trenches and recovery points will be provided in a design package to be completed by the selected remediation contractor. LNAPL that enters into each canister reservoir will be manually emptied and placed in a temporary storage compound located at the Facility. To comply with Washington State Dangerous Waste Storage Requirements, recovered LNAPL stored in the compound will be removed from the Facility for disposal prior to the end of a 90-day period that begins at the date of generation.

Removal of LNAPL overlying groundwater using product recovery canisters will be implemented for a period of one year. During that time, Facility-specific data including LNAPL yield (collectively and well/trench recovery point-specific), well/trench recovery point-specific LNAPL thickness and recovery data, and storm water and groundwater sampling data will be obtained and reviewed to assess remediation progress.

Institutional controls will also be established to protect utility, maintenance, and construction workers. Deed restrictions will be filed and notice provided annually to the city public works, building, and inspection departments and all area utilities, that informs anyone who does excavating in the area or performs maintenance on the storm sewer and other subsurface utilities that they should adhere to a health and safety plan prepared in compliance with 29 CFR 1910.120 and any applicable state Labor & Industries requirements for working in potentially impacted media.

After removal of the source (LNAPL), natural attenuation processes will be sufficiently effective to achieve the cleanup objectives at the Facility. Extensive monitoring, as discussed in Section 8.0, will be conducted to measure the progress of natural attenuation and plume migration, if any.

6.2 LNAPL RECOVERY SYSTEM

LNAPL recovery will be conducted by suspending a recovery canister from the top of the well/recovery point casing down to the LNAPL and water interface. The canister will be partially submerged, with a debris screen and a hydrophobic filter that prevents debris and water from entering, but allows LNAPL to enter into the canister's reservoir. The canister will be manually removed from each well/recovery point on a regular, scheduled basis and the reservoir drained through a drain port located at the base of the canister. The emptied canister will then be replaced in the well/recovery point.

The screen and filter on the recovery canister is buoyant and fluctuates vertically to compensate for ambient water level fluctuations. The typical filter vertical fluctuation range is approximately 14 inches. The RI noted that water levels fluctuate less than one foot per year. The canister's hanging-depth should not require frequent adjustments.

The recovered LNAPL will be placed in a Department of Transportation (DOT) approved 55-gallon drum equipped with an anti-static wire, spill control funnel, and fill fitting with flame arrester. This drum will be contained and secured within a secondary containment storage system. This secondary containment storage system shall be a weather-proof, lockable, polyethylene container with gull-wing covers (or equivalent). The secondary containment shall be secured within a storage compound, consisting of a concrete pad or other impermeable surface and surrounded by a chain-link fence with a lockable gate.

The maximum quantity of LNAPL to be collected during each site visit has been estimated at 2.5 gallons, based on reservoir volume of 0.5 liters (0.13 gallons) and 20 of the recovery canisters. Based on weekly recovery at startup, an estimated 10 gallons of LNAPL will be recovered in the first month. The site visit frequency may be reduced to bi-weekly (every two weeks) depending on the recovery rate during the first month.

The recovered LNAPL will be transported to a licensed Transporter, Storage, and Disposal (TSD) facility for disposal or recycling within 90 days of initial recovery. Transportation and handling of the LNAPL will be conducted in accordance with the Washington State Dangerous Waste Regulations (Chapter 173-303 WAC).

6.3 LNAPL RECOVERY SYSTEM INSTALLATION

The remediation components include the following:

- Mobilization and installation of site control
- Installation of additional groundwater monitoring wells
- Installation of recovery trenches
- Installation of the LNAPL recovery canisters in existing wells containing LNAPL at the Facility and trench recovery points
- Construction of a secure storage area with secondary containment
- Decontamination and demobilization

The following sections describe these components in more detail.

6.3.1 Mobilization and Site Controls

Equipment and materials will be obtained by the selected remediation contractor prior to arriving at the Facility. Any equipment and/or materials available in proximity of the Facility will be purchased by the contractor if they are of sufficient quality and reasonable costs.

All work areas will be barricaded off to prevent unauthorized entry by the public. Signs will be posted indicating that construction activities are in progress, smoking is prohibited, and no unauthorized entry permitted.

6.3.2 Additional Well Installation

Five additional monitoring wells will be installed at the approximate locations shown on Figure 6. The purpose of these wells is to provide additional information on LNAPL conditions in the southeast portion of the inferred LNAPL plume. However, some or all of these wells may be used as recovery wells depending on the results of groundwater monitoring. These wells will be used to determine the overall length of the product recovery trench along Yakima Valley Highway and will also serve as groundwater monitoring points, depending on the presence or absence of LNAPL.

Well installation activities will be performed in accordance with the Facility RI/FS Sampling and Analysis Plan (SEACOR 1993b). Well construction will be completed in accordance with regulations outlined in WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells*. The groundwater wells will be constructed with 2- or 4-inch diameter, threaded, flush-jointed, PVC casing, and 0.010-inch slotted well screen. The well screen will be set approximately 5 feet above and 10 feet below the water table. The wells will be land-surveyed and developed, as specified in the Facility RI/FS Sampling and Analysis Plan. Health and safety procedures will be conducted, as specified in the Facility Health and Safety Plan (SEACOR 1993c).

6.3.3 Product Recovery Trenches

Two recovery trenches will be constructed to enhance removal of LNAPL overlying groundwater at the Facility. The proposed approximate location of each trench is illustrated on Figure 6. One of the trenches will be installed on the property line between the Jackpot Food Mart and Sunnyside Tire Center. The trench will extend to the north for approximately 35 feet from the southern property line of the Jackpot and Sunnyside Tire sites. The anticipated length of the trench is approximately equal to the distance between wells MW-7 and AI/VE-1.

The second trench will be located on the south side of Yakima Valley Highway. The trench will trend east-west paralleling the highway. The western extent of the trench will be terminated approximately at the property line between R&R Tires and DB Restaurant. The precise length of the trench will be determined upon assessing the data obtained from the newly installed wells (refer to Section 6.2.2).

Each recovery trench will be approximately 18 to 24 inches wide and have a total depth of approximately 15 feet. At regular intervals (approximately 10 to 20 foot intervals) along the length of each trench vertical recovery points will be installed. Recovery points will be constructed using 4-inch diameter, Schedule 40 blank and slotted PVC. Each trench will be backfilled using suitable free draining rock. The drain rock will be self-compacting and provide permeable backfill that allows movement of LNAPL into the recovery points. Each trench will be completed to match the existing surface material. Each recovery point will be secured in a lockable, water-tight, traffic-rated meter box.

A conceptual cross-section of the trench design is provided on Figure 7. The precise trench and recovery point specifications will be provided in a detailed design package to be completed by the selected remediation contractor. As well as providing detailed design drawings and specifications, the design package will identify all applicable permits and health and safety precautions associated with trench construction.

6.3.4 LNAPL Recovery Canisters

The LNAPL recovery canisters will:

- Recover LNAPL with a specific gravity of less than one (1).
- Fit inside a 2-inch and/or 4-inch diameter well/recovery point.
- Recover LNAPL down to a thickness of 0.01 foot.

The recovery canisters will include a floating intake head, guide rod, flexible tube, a well centering disk, and a storage canister. The floating intake head will consist of an outer debris screen, a flotation collar, and an inner, semi-permeable, oleophyllic, hydrophobic screen (or equivalent). This dual screen shall prevent particulate material from impinging on the hydrophobic screen, which could potentially reduce its effectiveness to repel water.

6.3.5 Well/Recovery Point Head Monuments

A securable, water-tight, traffic-rated monument will be installed (or has been installed) at each well/recovery point. A minimum of 6 inches of clearance is typically required between the top of the well/recovery point cap and the monument bolt-down cover. This spacing is usually required to allow room for the extra support cable above the well/recovery point cap.

The length of each cable will be adjusted periodically to ensure that the filter of the recovery canister is situated at the LNAPL and water interface. Any extra support cable will be rolled and neatly tied with tie wraps and stored within the well monument.

6.3.6 LNAPL Storage Compound

The LNAPL storage compound shall consist of an 8-foot by 8-foot, 6-inch thick, wire mesh reinforced, concrete pad (or equivalent), surrounded by a medium gauge, 8-foot high chain-link fence. Access to the compound will be via a minimum 4-foot wide, lockable gate, with sloped concrete sidewalk to facilitate the use of a drum dolly, if necessary. The LNAPL storage drum(s) and secondary containment system shall be placed within this storage compound for security and to prevent vandalism.

The secondary containment system will be located in an area to facilitate drum removal and to maximize the available space. The secondary containment will be secured so that the accumulation of foreign fluids (such as rainwater) will be eliminated. At least two empty 55-gallon drums should be placed in the secondary containment area. Two anti-static wires will be connected from each drum to a ground rod. A third anti-static wire will be connected to the drum in-use with a free-end equipped with a clip. This clip will be connected to the storage container used to transfer LNAPL collected from the canisters to the drum to prevent the discharge of static electricity generated by flowing liquids. A spill-control funnel with fill fitting and flame arrester will be installed on top of the primary 55-gallon drum. The fill fitting will also be an automatic pressure and vacuum relief valve. A polyethylene funnel cover will be installed to prevent rainwater from infiltrating the drum. Where applicable all containers will be properly labeled.

6.3.7 Cleanup and Demobilization

Upon completion of the construction activities and recovery canister installation, the contractor will provide to-scale as-built drawings of the installed wells, recovery trenches and storage compound; remove all construction debris; and return the site to its original condition. All construction related garbage will be placed in garbage bags and removed for proper disposal.

6.4 INSTITUTIONAL CONTROLS

Infrequent exposure to utility, maintenance, and construction workers during subsurface excavation and utility work maintenance will be managed or prevented with institutional controls established in accordance with WAC 173-340-440. These controls will include filing restrictive covenants to notify future property owners of the presence of subsurface contamination and providing annual notice to City public works, health department, building and inspection departments, and all area utilities, that informs anyone who does excavating in the area or performs maintenance on the storm sewer and other subsurface utilities that they should adhere to a health and safety plan prepared in compliance with 29 CFR 1910.120 and any applicable state Labor & Industries requirements for working in potentially impacted media. The annual notice will provide information on the contamination present onsite, instruction information of who to contact prior to excavation, and how to properly dispose of any contaminated soil.

Institutional controls will include:

- Deed restrictions filed on parcels to provide notice to future property purchasers;
- Annual notice to City departments and area utilities
- Groundwater use restrictions within the area of contamination; and
- Restrictions on excavation and storm drain work.

6.5 MONITORED NATURAL ATTENUATION

Natural attenuation processes will be used to remediate the TPH by biological degradation. A sampling program will be conducted to evaluate the performance of the natural attenuation processes using the following criteria:

- Demonstrate that natural attenuation is occurring as expected;
- Identify potential degradation products resulting from biodegradation;
- Document changes in plume geometry;
- Monitor groundwater;
- Monitor for new releases which could effect the natural attenuation processes;
- Demonstrate the efficiency of institutional controls in protecting potential receptors;
- Detect changes in environmental conditions which may adversely effect the efficacy of the natural attenuation process;
- Estimate the total mass of hydrocarbons present in each phase (LNAPL, soil, and groundwater);
- Calculate first-order decay rates for each contaminant of concern; and
- Verify that cleanup levels have been met.

Section 8.0 provides specific monitoring protocols for collecting the necessary data.

7.0 OPERATION AND MAINTENANCE

7.1 OPERATIONAL PROCEDURES

7.1.1 Decanting Recovered LNAPL

To minimize the potential for spillage from aboveground decanting of recovered LNAPL from the canisters a portable work station will be available where canisters can be placed while the well/recovery point is monitored for LNAPL thickness. The portable work station will also hold a 5-gallon tank (or equivalent) used to contain recovered LNAPL from the canisters, and other ancillary tools and equipment and be designated as hazardous materials only. The following procedures will be performed during canister emptying:

- Set up traffic control and place the portable work station immediately adjacent to the well/recovery point ready for monitoring.
- Open the well/recovery point head, measure fluid levels in the well (if accessible), retrieve the canister from the well, and directly place the canister over the portable work station.
- Open the drain valve on the bottom of the canister and empty the contents of the reservoir into a clear plastic, graduated container.
- Close the drain valve and place the canister in the bed of the portable work station.
- Note the amount of LNAPL in the graduated container and pour the contents into the 5-gallon container.
- Gauge the depth to groundwater and thickness of the LNAPL in the well/recovery point.
- Compare the length of the cable used to hang the canister with the measured depth to water.
- Adjust the cable length, as necessary, so that the canister filter is at the water/LNAPL interface.
- Lower the canister back into the well/recovery point and secure the well/recovery point head.
- Document measurements and observations.

7.1.2 Manhole Monitoring

Storm sewer manholes will be monitored for LNAPL using the following procedures:

- Set up traffic control and place the portable work station immediately adjacent to the manhole ready for monitoring.
- Monitor the percent of the Lower Explosive Limit within the manhole through the holes on the manhole cover.
- Remove the manhole cover entirely from the manhole.
- Visually inspect for the presence of LNAPL.
- If LNAPL is present, measure the depth and thickness.
- Remove any accumulated LNAPL.
- If LNAPL is not present, measure the depth to water.
- Place the manhole cover back to its original position. Document measurements and observations.

7.1.3 Traffic Control

Traffic controls will be necessary to protect workers during all field operations. A traffic control plan will be provided by the selected remediation contractor and included with their health and safety plan. The contractors traffic control plan and health and safety plan will meet all requirements of the city of Sunnyside, OSHA, and the Washington Industrial Safety and Health Act (WISHA). The plans will be submitted for review before beginning any field work.

7.1.4 Waste Disposal

Wastes generated during the remediation action will be disposed of in accordance with federal, state, and local requirements. Documentation will be maintained for disposal of all wastes generated as part of the cleanup action.

Solid wastes generated from the work, such as disposable clothing, rags, and construction debris, will be disposed of at an acceptable landfill if the material is not designated dangerous waste by the state of Washington. Suitable containers for solid wastes will be provided by the remediation contractor on site for the duration of the remediation. Solid waste which is designated as dangerous waste under the state of Washington regulations will be disposed of at a licensed TSD facility approved to accept dangerous wastes.

Liquid wastes will be contained on site pending proper disposal. Liquid wastes may include decontamination water generated from equipment decontamination and recovered LNAPL. The decontamination water and recovered LNAPL will not be mixed on site and will be considered separate waste streams.

The decontamination water will be analyzed prior to disposal. The disposal option will depend on the analytical results and may include: disposal to the city of Sunnyside sewer system; off-site disposal at a licensed TSD; or disposal as a dangerous waste. The selected remediation contractor will be responsible for confirming the disposal facility.

Recovered LNAPL will be disposed of at a licensed TSD facility for destruction or recycling. The transportation, handling, and disposal will be arranged and confirmed by the selected remediation contractor.

Proper documentation including shipping manifests, chain-of-custody forms, and disposal confirmation shall be provided by the selected remediation contractor.

7.2 MAINTENANCE

7.2.1 Canisters

When canisters are removed for emptying, the following will be inspected:

- The outer, larger-screened particulate filter will be inspected and cleaned of debris and other material (i.e., bio-matter) that may otherwise clog the intake.
- The filter will be checked for ease of glide along the canister's shaft. This area will be cleaned if there are signs of mineral build-up or bio-fouling.
- The tube leading from the filter to the canister reservoir will be inspected for mineral build-up or bio-fouling. This part will be cleaned or replaced if it becomes clogged.

7.2.2 Waste Storage Area

The waste storage area will remain locked and secured at all times when field personnel are not present. The storage area will be kept free of garbage or debris by placing such matter in plastic garbage bags and removing from the Facility after each site visit.

7.3 SCHEDULE

An operation and maintenance schedule will be prepared by the selected remediation contractor. Weekly visits are envisioned for the first month of operation. The requirements for operation frequency will depend on the observed LNAPL recovery rate. When more specific operational data has been obtained, a long-term schedule can be established.

7.4 LNAPL RECOVERY SYSTEM EVALUATION

LNAPL overlying groundwater in the points of compliance will initially be recovered by placing product recovery canisters in Facility wells and trench recovery points. During the first year of product recovery, Facility-specific data including LNAPL yield (collectively and well/recovery point-specific), well/recovery point-specific LNAPL thickness and recovery data, and storm water and groundwater sampling data will be obtained and reviewed to assess remediation progress. Based on this analysis, modifications to the remedial system will be assessed for technical and economic feasibility and, if warranted, implemented changes or modifications to the collection system or monitoring schedule will only be made after approval by Ecology. Potential system modifications may include, but are not limited to, the installation of additional recovery wells and/or recovery trenches, and the use of vacuum enhanced pumping to enhance the rate of LNAPL recovery.

8.0 SAMPLING AND ANALYSIS, AND COMPLIANCE MONITORING PLANS

The Sampling and Analysis, and Compliance Monitoring Plans have been combined and prepared in accordance with WAC 173-340-410 and WAC 173-340-820. The Sampling and Analysis Plan specifies the procedures for collecting monitoring data during remediation. The Compliance Monitoring Plan provides methods for assessing progress and effectiveness of the cleanup action.

8.1 PURPOSE

The purpose of Compliance Monitoring Requirements (WAC 173-340-410) and Sampling and Analysis Plans (WAC 173-340-820) is to provide specific methods and procedures for the following monitoring requirements:

- Baseline Data Collection - Assess site conditions prior to start-up of active remediation.
- Performance Monitoring - Initial operation and monitoring to demonstrate that the system is performing as intended and to optimize system performance.
- Confirmational Monitoring - Monitor to confirm that cleanup performance standards are being met. This includes periodic monitoring to assess progress toward meeting cleanup objectives as well as confirm that long-term cleanup objectives are met.

8.1.1 Baseline Data Collection

Prior to starting up LNAPL recovery, a round of monitoring and sampling data will be obtained from wells and manholes within the Facility to establish the baseline conditions. Monitoring will consist of gauging the depth to water and presence and thickness (if applicable) of LNAPL. Samples from select wells and manholes will be collected and analyzed for hydrocarbons and other parameters necessary to evaluate the effectiveness of natural attenuation (Section 8.3.7). This information will be used with, and compared against, data collected during the remediation phase of the project. Comparison of on-going operating data with baseline data will help assess progress toward meeting final cleanup objectives.

8.1.2 Performance Monitoring

Performance monitoring will consist of measuring LNAPL thickness, water levels, and collecting groundwater samples for chemical analysis of hydrocarbons from the points of compliance. The monitoring data will be compared with the baseline data to evaluate the effectiveness of the LNAPL removal system and the natural attenuation processes and to ensure compliance with established cleanup levels.

8.1.3 Compliance Monitoring

When the results of ongoing performance monitoring show that a sustainable thickness of LNAPL of 0.01 feet is maintained for one quarter without active LNAPL recovery, the recovery canisters will be removed. Compliance monitoring, consisting of well/recovery point and manhole gauging and sampling will continue at the Facility for at least five years to evaluate the effectiveness of the natural attenuation. Compliance monitoring will be conducted monthly for three months and quarterly thereafter for three quarters. After the first year, the frequency of compliance monitoring may be adjusted. If, at any time during compliance monitoring, LNAPL reappears (i.e., a sustained thickness of greater than 0.01 foot), the remedial action will be reactivated. Monitoring will continue until the concentration of TPH in groundwater meets the cleanup levels established for the Facility or until Ecology determines that natural attenuation processes can be expected to fully remediate areas of residual contamination at concentrations which exceed the cleanup levels.

8.2 MONITORING OBJECTIVES

Objectives have been established to determine when the Facility is considered clean. The following criteria were taken into account:

- The methods used to confirm the cleanup standards will be technically feasible and defensible to Ecology.
- The data used to establish the cleanup standards will be reproducible and of sufficient quality.
- The cleanup standard will be acceptable to Ecology.

The cleanup standards will ensure long-term protection of the groundwater, soil, and surface water.

8.3 MONITORING PROCEDURES

8.3.1 LNAPL Monitoring and Recovery Locations

The proposed LNAPL monitoring and recovery points include: MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-10, MW-11, MW-13, MW-14, DMW-4, and DMW-5 (Figure 5). Each of these wells is constructed of 2-inch diameter PVC.

Additional monitoring wells and recovery trench wells that will be installed at the Facility will be added as LNAPL monitoring and recovery points when LNAPL is encountered. Ecology will be notified of modifications to the proposed recovery system.

8.3.2 LNAPL Monitoring Procedures

LNAPL thickness monitoring will be performed at the well/recovery point locations using a battery-powered oil/water interface probe (MMC Oil-Water Interface Probe Model D-240 1-2UI or equivalent). The interface probe will be capable of measuring LNAPL down to a thickness of 0.01 inch. Measurements will be made relative to a surveyed elevation located and clearly marked at the top of each well casing and to top of each recovery point casing. The following procedures will be used:

- Record the well/recovery point number, date, time, and initials of field personnel taking measurements.
- Lower the oil/water interface probe slowly into the well/recovery point until the indicator is activated by contact with LNAPL or groundwater. The probe will be raised and lowered a minimum of three times to verify the fluid type (LNAPL or groundwater) and depth measurement. The depth measurement will be recorded on a *Monitoring Well Data Form.*

8.3.3 Groundwater Level Monitoring Locations

Water level measurements will be collected at the monitoring wells located within the Facility used for the LNAPL monitoring and recovery system (Section 6.1.1). Groundwater measurements will also be collected from Facility wells; MW-8, MW-9, MW-12, MW-15, MW-17, MW-20, MW-21, MW-26, MW-27, MW-28, MW-29, DMW-1, DMW-2, DMW-3, and DMW-6 (Figure 5).

8.3.4 Surface Water Level Monitoring Locations

The proposed surface water monitoring points are MH-29, MH-31, MH-32, MH-33, MH-34, MH-35, and MH-38 (Figure 5). These manholes are located upflow, midflow, and downflow relative to known areas of impact at the Facility.

8.3.5 Groundwater and Surface Water Level Monitoring Procedures

Water level monitoring will be performed using a battery-powered water level indicator (Solinst or equivalent). Measurements will be made relative to a surveyed elevation located and clearly marked at the top of each well casing or northern rim of the manholes. The following procedure will be used:

- Record the well or manhole number, date, time, and initials of field personnel taking measurements.
- Insert the water level indicator probe until a constant tone or a red light is activated. Measure the depth-to-water from the designated measuring point at the top of casing

record the value to the nearest 0.01 foot. Repeat the procedure three times to ensure accuracy. The depth measurement will be recorded on a *Monitoring Well Data Form*.

- Record well or manhole conditions (e.g., cracked casing, missing cap, subsidence features) and any other pertinent observations.

- Ensure that all markings clearly indicate the well or manhole location and number.

8.3.6 Groundwater Sample Locations and Procedures

Groundwater samples will be collected on a semi-annual basis (every 6 months) at monitoring wells MW-8, MW-12, MW-20, MW-25, and MW-27 (Figure 5). This sampling schedule may be modified based on presence or absence of LNAPL at the monitoring wells sampled. Ecology will approve all proposed changes to the sampling schedule. Sampling activities will be performed in accordance with procedures specified in the Facility RI/FS Sampling and Analysis Plan (SEACOR 1993b). Samples will be analyzed for diesel range TPH by Ecology method WTPH-D, gasoline range TPH by Ecology method WTPH-G, and BTEX by EPA method 8020.

8.3.7 Natural Attenuation Monitoring Procedures

Groundwater samples will be analyzed for parameters necessary to evaluate the effectiveness of natural attenuation processes. The groundwater parameters which will be analyzed are in accordance with EPA guidelines and will include: dissolved oxygen, dissolved manganese, nitrate, dissolved ferrous iron, sulfate, redox potential, alkalinity, pH, and temperature. This suite of analyses will be conducted at startup, as a baseline data, and quarterly for the first year, and semi-annually thereafter.

8.3.8 Monitoring Schedule

Performance Monitoring

Performance monitoring will be conducted during the active LNAPL recovery process. The recovery process will likely be more active during the initial stages of the process and will dictate the monitoring schedule. Monitoring of LNAPL will occur at least once a quarter during active remediation regardless of the active recovery schedule. Once a sustainable thickness of 0.01 foot or less of LNAPL is maintained in all of the recovery wells for at least one quarter without active LNAPL removal, active recovery will be discontinued. Performance monitoring for natural attenuation will continue until the cleanup levels are met.

Compliance Monitoring

Compliance monitoring will be modified upon discontinuation of active recovery and when performance monitoring shows that the concentrations of TPH are below the cleanup levels. Monitoring will be conducted monthly for three months, and quarterly thereafter for three quarters. After one year of analytical data which shows concentrations of TPH in groundwater below the cleanup levels, the Facility will be considered clean and no further action will be necessary.

8.3.9 Equipment Decontamination

All materials coming in contact with LNAPL and/or groundwater will be thoroughly cleaned and decontaminated between monitoring locations. All equipment will be cleaned in an aqueous solution of Liqui-Nox 7 cleanser (or equivalent), rinsed with tap water, and rinsed a second time with distilled water between well locations.

8.4 WASTE CHARACTERIZATION

8.4.1 Decontamination Water

Decontamination water generated from the active LNAPL recovery and groundwater monitoring will be sampled and analyzed prior to disposal. The decontamination water samples will be collected directly from the 55-gallon storage drums and placed directly into laboratory containers. The sample container will be clearly labeled, denoting the sample date, time, job identifier, and sampler's name. Tops will be screw-threaded, Teflon-lined, and taped in place.

Samples will be stored on-ice in coolers pending delivery to the laboratory for analysis. Chain-of-custody procedures will be followed. Chain-of-custody forms will be relinquished upon sample delivery to the laboratory.

At a minimum decontamination water will be analyzed for:

- Diesel range TPH by Ecology method WTPH-D
- Gasoline range TPH by Ecology method WTPH-G
- BTEX constituents by EPA method 8020

Additional analyses may be required by the selected disposal facility. Analytical results will be review by the selected remediation contractor prior to disposal.

8.4.2 Recovered LNAPL

Recovered LNAPL will be sampled and analyzed by the selected disposal facility prior to transportation and disposal. The LNAPL samples will be collected from the 55-gallon storage drums and placed directly into sterilized containers supplied by the disposal facility or their designated laboratory.

The sample container will be clearly labeled denoting the sample date, time, job identifier, and sampler's name. Tops will be screw-threaded, Teflon-lined, and taped in-place.

Samples will be stored on ice in coolers pending delivery to the laboratory for analysis. Chain-of-custody procedures will be followed. Chain-of-Custody forms will be relinquished upon sample delivery to the laboratory.

Samples will be analyzed in accordance with the parameters defined by the selected disposal facility.

8.5 DOCUMENTATION

Field report and monitoring well data forms will be used to document each monitoring event. Entries will include:

- Name of field personnel
- Date and time of monitoring
- Station number
- Observed readings
- Abbreviated field procedures
- General observations

9.0 HEALTH AND SAFETY

A health and safety plan was prepared for remedial investigation activities (SEACOR 1993c). This plan has been reviewed by Ecology and is incorporated by reference in this Work Plan.

The selected remediation contractor will be responsible to prepare their own health and safety plan. The health and safety plan will be prepared in accordance with Washington State (Chapter 49.18 of the Revised Code of Washington [RCW]) and Federal (29 CFR 1910 [Code of Federal Regulations]) regulations for performing work at hazardous or potentially hazardous waste sites.

10.0 REFERENCES

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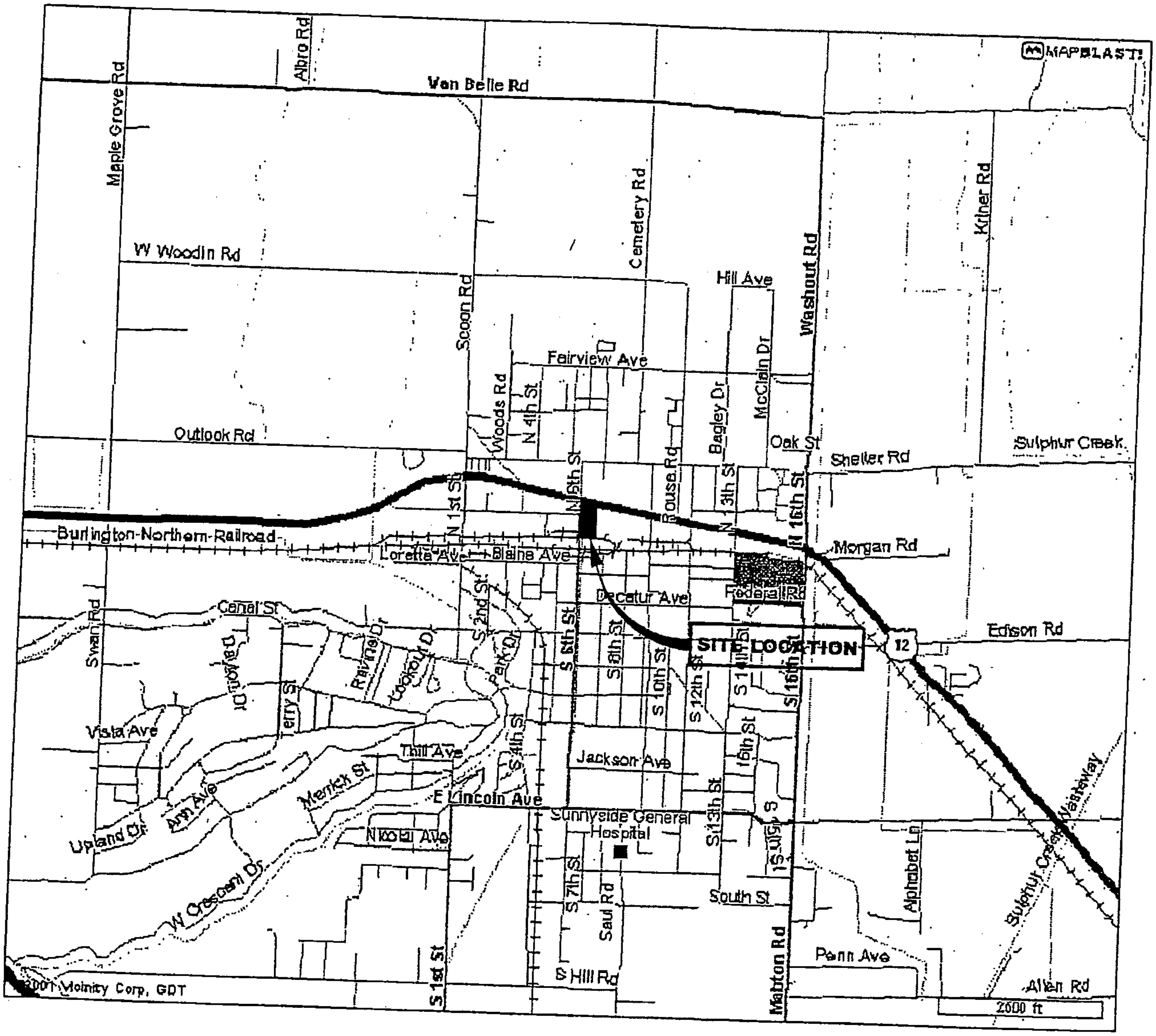
1 SECOR International Incorporated operated as Science & Engineering Analysis Corporation under the SEACOR trademark through September 1994. The legal corporate name was changed to SECOR International Incorporated with the trade name of SECOR in October 1994.



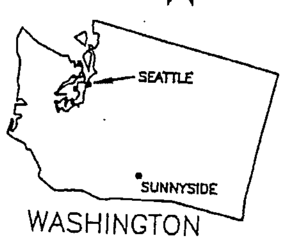


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FIGURE 1

SITE LOCATION MAP
MANHOLE 34 FACILITY

6TH AND MAIN
SUNNYSIDE, WASHINGTON

FARALLON PN: 617-002

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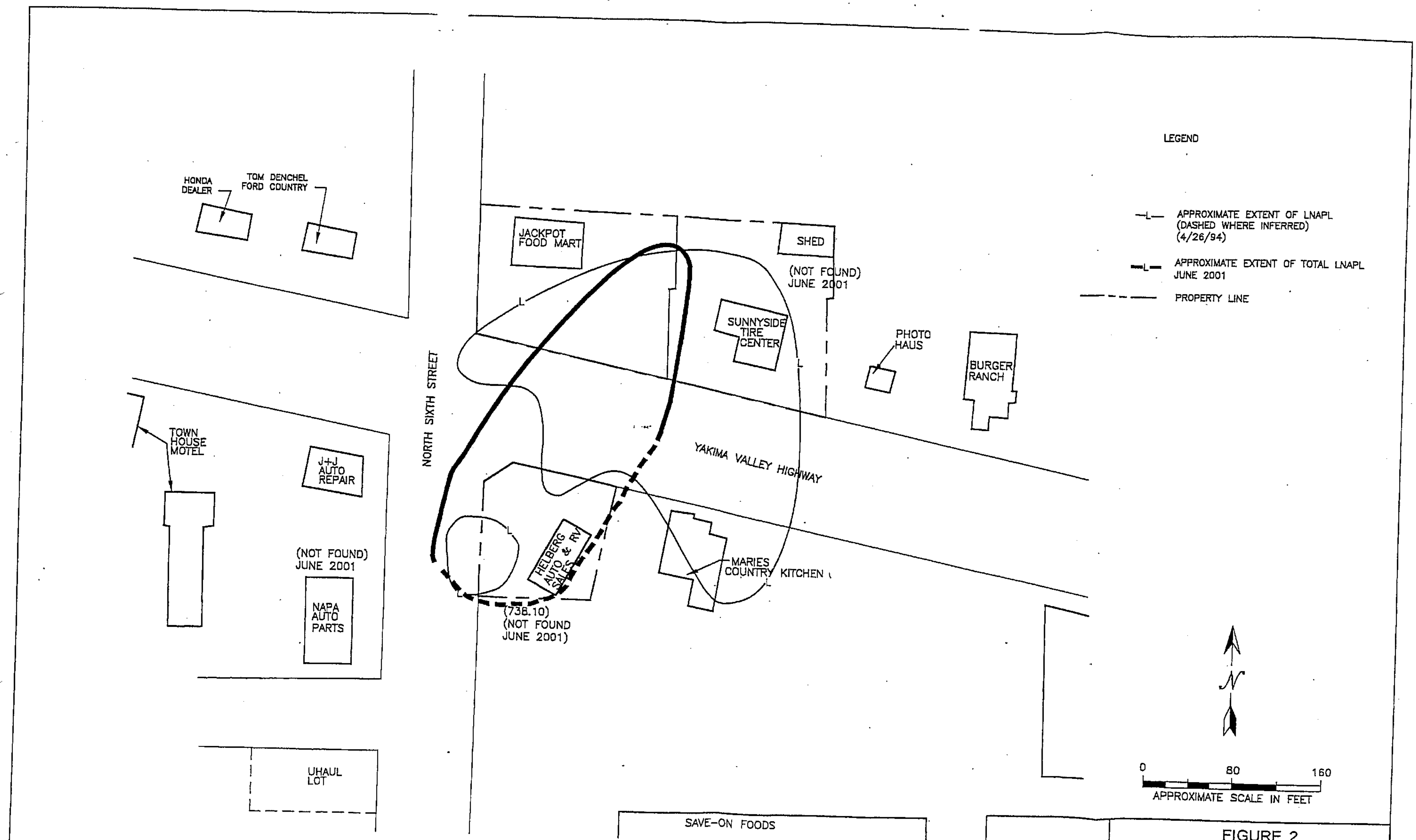

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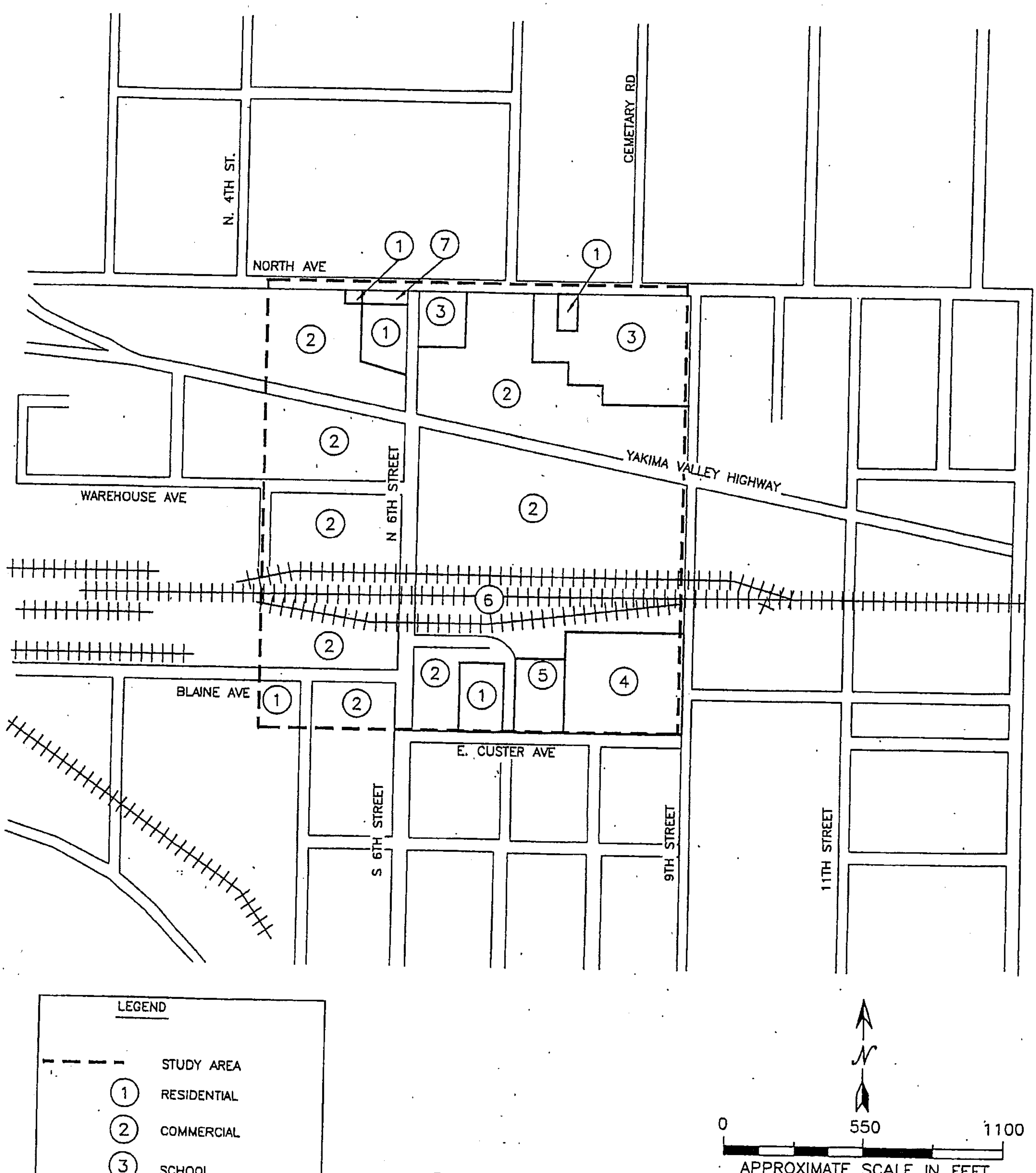
FIGURE 2

SITE PLAN
MANHOLE 34 FACILITY

6TH AND MAIN
SUNNYSIDE, WASHINGTON

FARALLON PN: 617-002

Drawn By: DEW	Checked By:	Date: 6/08/01	Disk Reference: 002



LEGEND

- - - - STUDY AREA
(1) RESIDENTIAL
(2) COMMERCIAL
(3) SCHOOL
(4) GOVERNMENT OFFICES
(5) CITY WELL FIELD
(6) RAILROAD
(7) ELECTRICAL SUBSTATION

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FIGURE 3

LAND USE
MANHOLE 34 FACILITY

6TH AND MAIN
SUNNYSIDE, WASHINGTON

FARALLON PN: 617-002

Drawn By: DEW	Checked By:	Date: 6/8/01	Disk Reference: 003

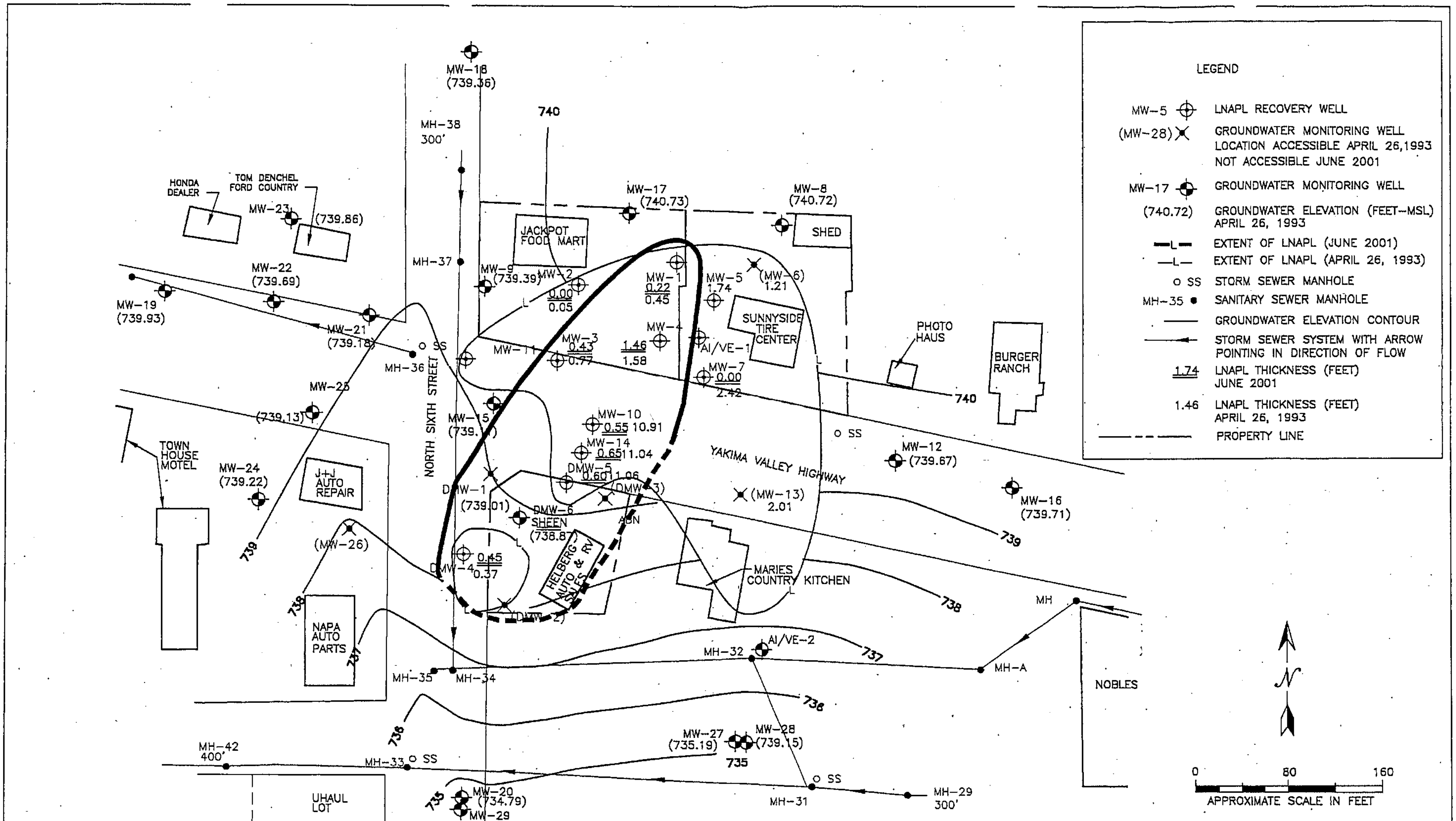

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FIGURE 4

SITE PLAN
GROUNDWATER ELEVATION CONTOURS
MANHOLE 34 FACILITY
6TH AND MAIN
SUNNYSIDE, WASHINGTON

FARALLON PN: 617-002

Drawn By:DEW	Checked By:	Date:6/08/01	Disk Reference:002

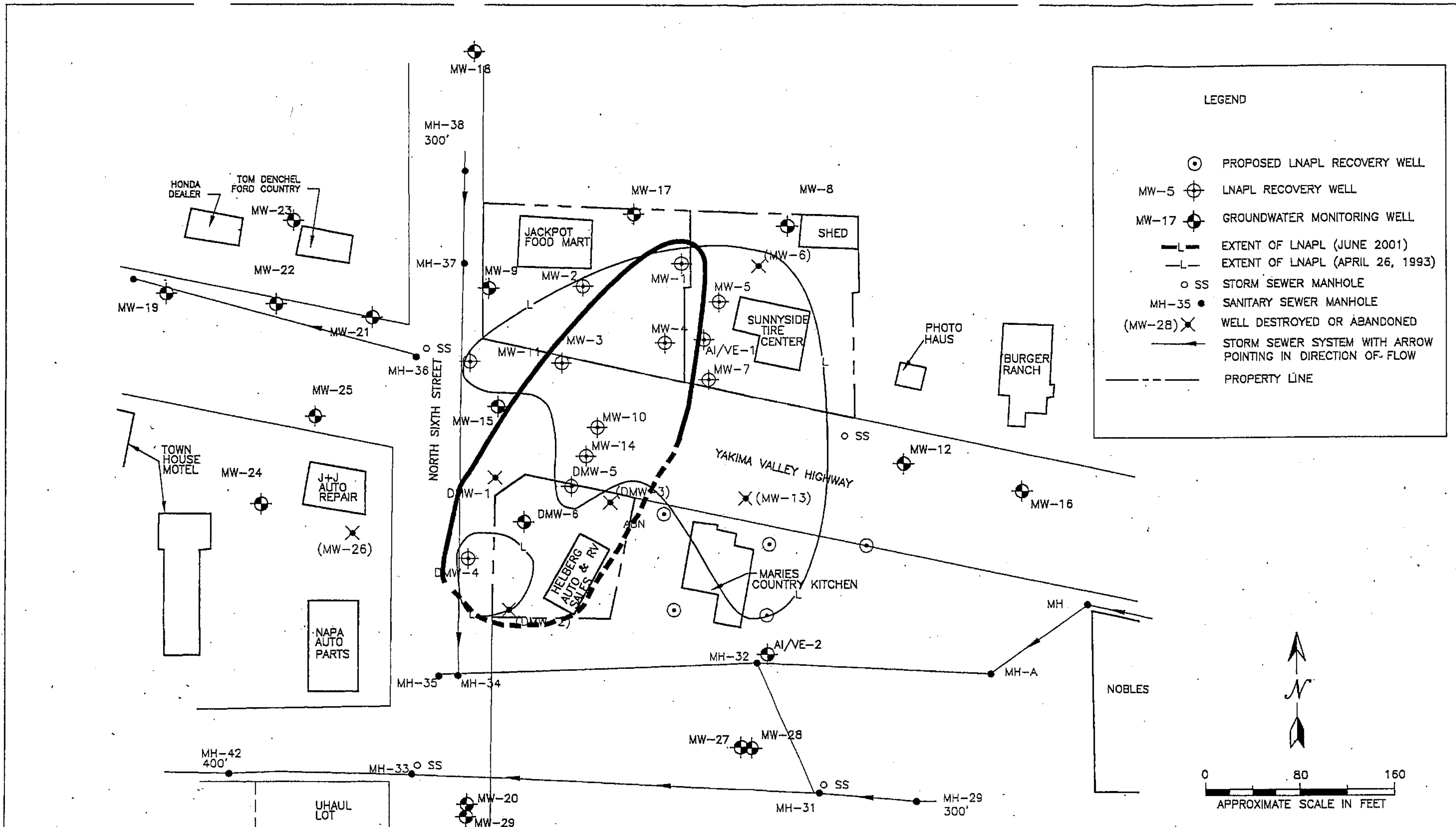

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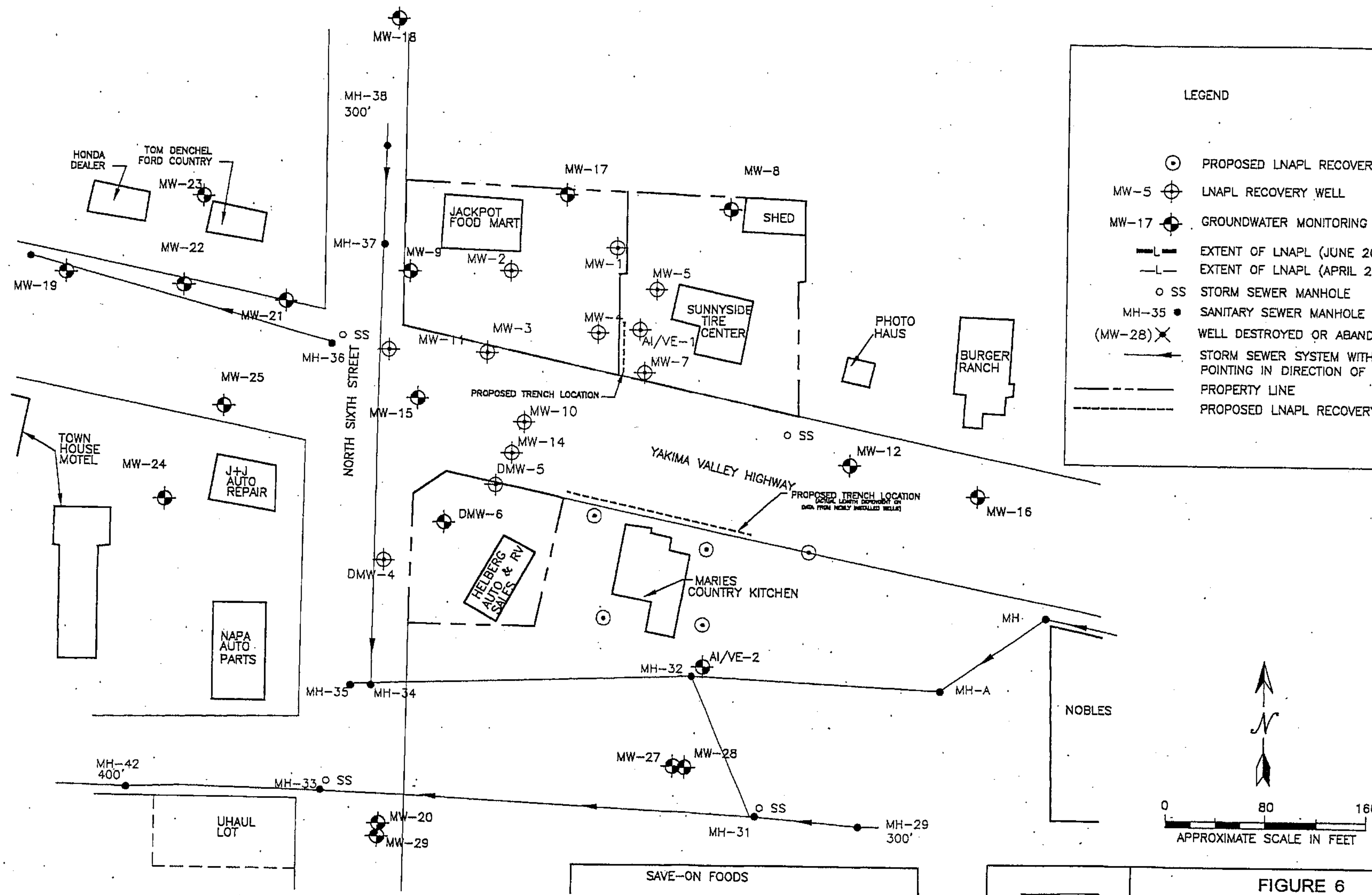
FIGURE 5

SITE PLAN
LNAPL RECOVERY WELL LOCATION
MANHOLE 34 FACILITY
6TH AND MAIN
SUNNYSIDE, WASHINGTON
FARALLON PN: 617-002

Drawn By:DEW	Checked By:	Date:6/08/01	Disk Reference:002



LEGEND

⊙	PROPOSED LNAPL RECOVERY WELL
MW-5 ⌖	LNAPL RECOVERY WELL
MW-17	GROUNDWATER MONITORING WELL
—L— (bold)	EXTENT OF LNAPL (JUNE 2001)
—L—	EXTENT OF LNAPL (APRIL 26, 1993)
o SS	STORM SEWER MANHOLE
MH-35 •	SANITARY SEWER MANHOLE
(MW-28) ✕	WELL DESTROYED OR ABANDONED
——◄	STORM SEWER SYSTEM WITH ARROW POINTING IN DIRECTION OF FLOW
— — - —	PROPERTY LINE
- - - - - -	PROPOSED LNAPL RECOVERY TRENCH

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FIGURE 6

PROPOSED GOUNDWATER MONITORING WELL AND APPROXIMATE RECOVERY TRENCH
MANHOLE 34 FACILITY
6TH AND MAIN
SUNNYSIDE, WASHINGTON
FARALLON PN: 617-002

Drawn By:DEW	Checked By:	Date:6/08/01	Disk Reference:002

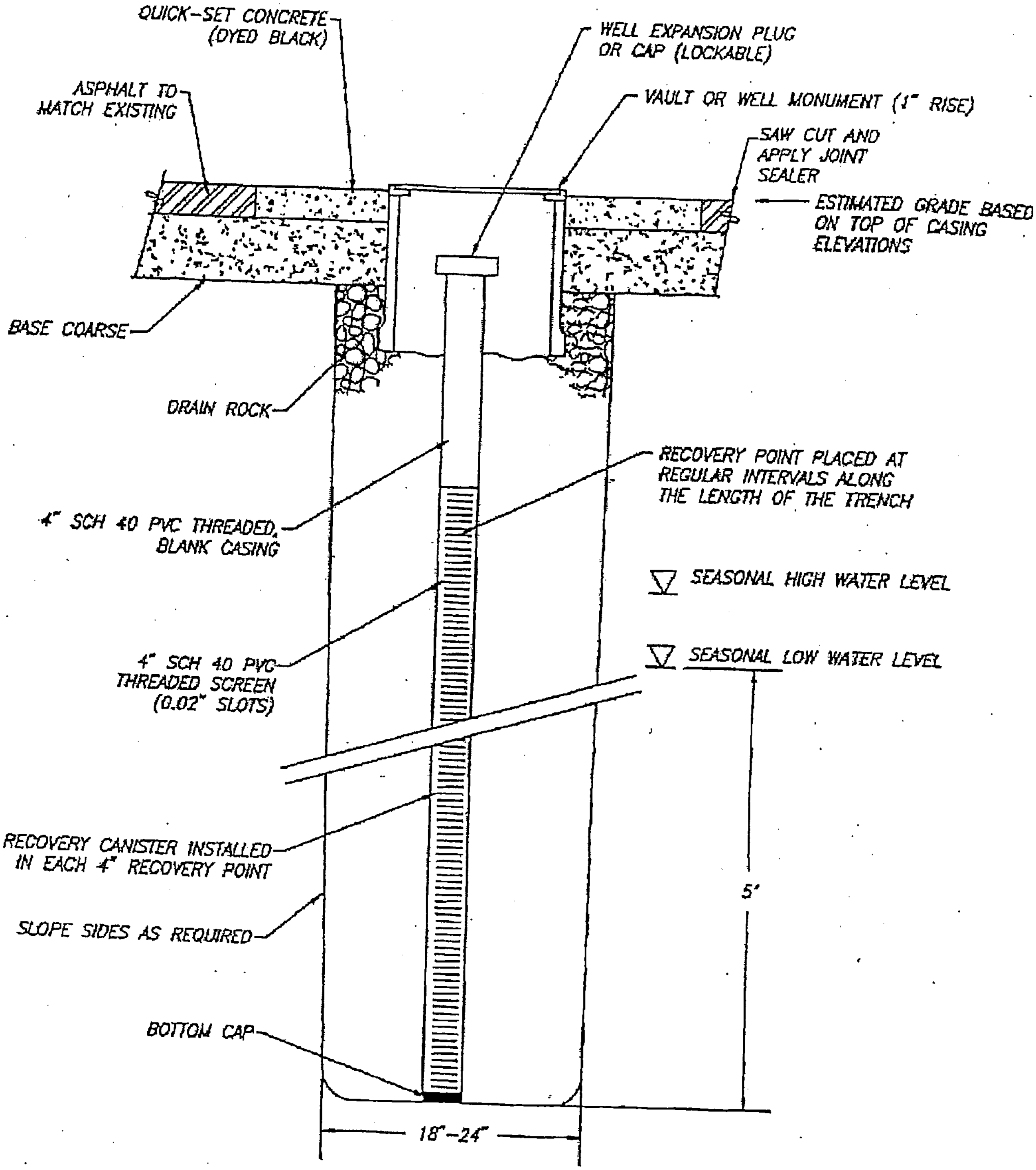

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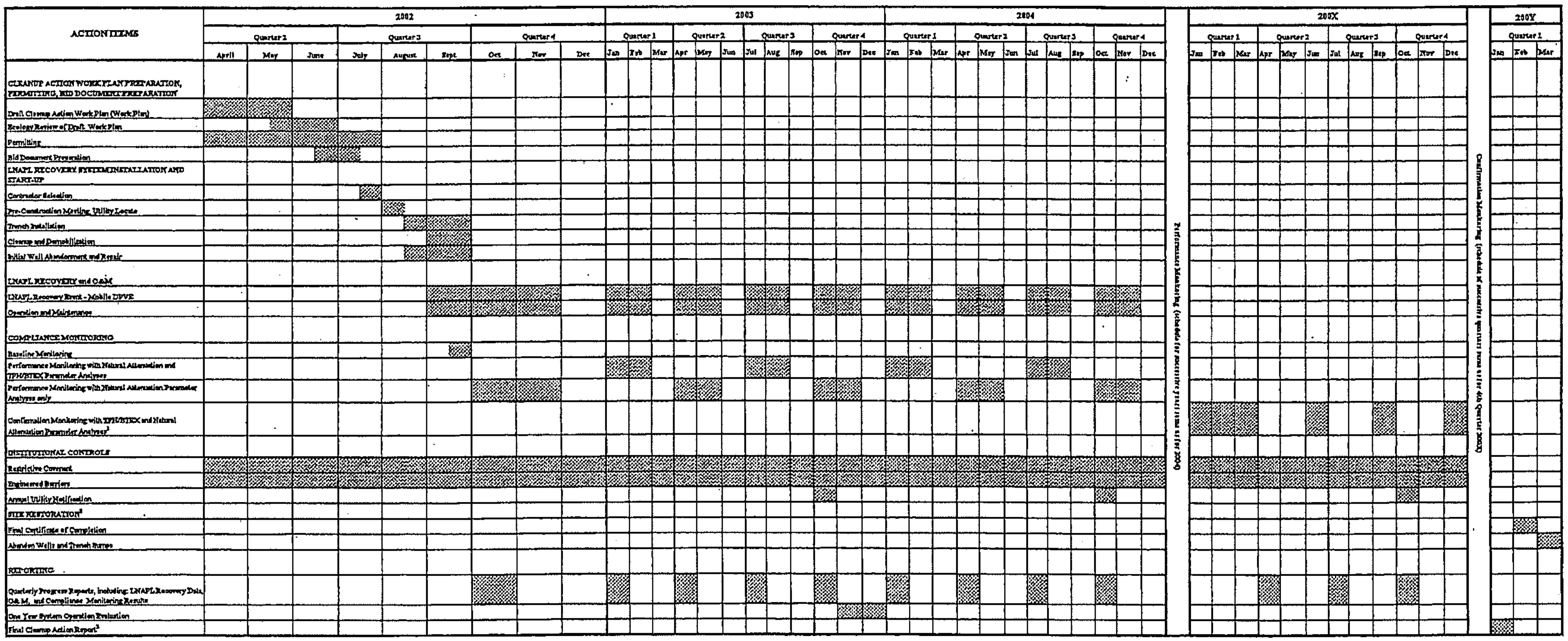
FIGURE 7

CONCEPTUAL RECOVERY TRENCH
CONSTRUCTION CROSS-SECTION
MANHOLE 34 FACILITY
6TH AND MAIN
SUNNYSIDE, WASHINGTON

FARALLON PN: 217-002

Drawn By: DEW	Checked By:	Date: 6/8/01	Disk Reference: 007

Figure 1
Cleanup Action Schedule
Manhole 34 Facility
Sunnyside, Washington
Farallon PN: 617-002



Note:

1 - Confirmation Monitoring will be initiated when the thickness of LNAPL has been maintained at a maximum thickness at the Facility for one quarter with no active LNAPL recovery. Compliance monitoring will be at an initial frequency of of 3 months, followed by quarterly monitoring thereafter for a minimum period of one year.

2 - Site restoration will be conducted upon completion of the Confirmation Monitoring program, and issuance of the Final Certificate of Completion from the Washington State Department of Ecology.

3 - The Final Cleanup Action Report will be prepared following completion of the Confirmation Monitoring program.

LNAPL = light non-aqueous phase liquid
DPVE = dual phase vacuum extraction
TPH = total petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene and xylenes