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TECHNICAL MEMORANDUM

TO: Mr. Merv Wark – Yakima Steel Fabricators

cc: Mr. Clark Davis, Brown Davis Roberts

FROM: Jeffrey Kaspar, Senior Project Manager

DATE: June 9, 2004

RE: **PRELIMINARY EVALUATION OF TECHNICALLY FEASIBLE REMEDIAL ALTERNATIVES**
AGRI-TECH & YAKIMA STEEL FABRICATORS
YAKIMA, WASHINGTON
FARALLON PN: 765-001

Farallon Consulting, L.L.C. (Farallon) has prepared this technical memorandum to present a preliminary evaluation of technically feasible remedial alternatives on behalf of Yakima Steel Fabricators (YSF) and Agri-Tech Incorporated (Agri-Tech). The YSF and Agri-Tech properties are located at 6 and 10 1/2 East Washington Avenue, respectively, in Yakima, Washington and are collectively referenced herein as the Site (Figures 1 and 2). The preliminary evaluation of technically feasible remedial alternatives is being completed at the request of Washington State Department of Ecology (Ecology) but is not required under the Agreed Order No. DE 97TC-C154 (Agreed Order) between YSF, Agri-Tech, and Ecology. The objective of this evaluation is to present the involved parties with information that may be used to develop a focused scope of work for a future feasibility study (FS). Farallon has based the evaluation on the results of the recent Remedial Investigation (RI) conducted at the Site and presented in the draft Revised RI Report dated July 3, 2003.

The evaluation includes a discussion of the technical elements considered, the remedial alternatives considered, and conclusions regarding the remedial alternatives that may be applicable to the Site conditions.

TECHNICAL ELEMENTS

The following technical elements have been derived from the historic uses and past practices of the Site, the current uses of the Site and surrounding area, the results of previous investigations, the environmental setting, and the requirements of Washington State Model Toxics Control Act (MTCA). The technical elements will be used for future development of scope of work for an FS.

Land Use

The Site is located in an area of Yakima zoned for light industrial use, which appears to be consistent with Site use since the 1940s. The surrounding area also is characterized by commercial and light industrial use and is not expected to change based on growth management plans for the city of Yakima. Surrounding properties are all used for similar commercial and light industrial use or will be developed as such in the future.

< 1/2-mile away

Groundwater Use

The groundwater that has been affected by the contaminants of potential concern (COPCs) includes the shallowest portion of the Yakima Gravels aquifer system. This aquifer system is used regionally for domestic use, irrigation, and industrial purposes. The nearest potable groundwater receptor is located approximately 2,460 feet downgradient (South) of the Site and is a municipal water supply well field for the city of Union Gap. Based on the groundwater flow velocities in the Yakima Railroad Area (YRRA), groundwater from the Site could potentially reach this well. However, the analytical results for tetrachloroethene (PCE) in the groundwater samples from the YRRA located between the Site and the well field revealed levels below the drinking water standard of 5.0 micrograms per liter (µg/l) since inception of the YRRA groundwater sampling program in December 1997. This indicates that groundwater use downgradient of the Site would not likely be affected by the COPCs present in the former waste pit at the Site.

Media of Concern

The RI indicated that soil and groundwater both are confirmed media of concern. Surface water bodies proximal to the Site are limited to the pond on the southern portion of the YSF property, downgradient (South) of the former waste pit. The pond and area immediately surrounding it have been classified by the City of Yakima as a Type 3 Wetland. The results of the RI indicated that the pond has not been affected by the COPCs present in the waste pit; however, the potential for contamination attributed to the west adjacent Bay Chemical property still requires investigation to determine whether surface water is a medium of concern.

GW/SW interaction?

Air has not currently been included as a medium of concern, but may require further investigation due to the location of the highest concentrations of volatile COPCs in shallow soil beneath the Agri-Tech building. Indoor air quality within the Agri-Tech building may require further investigation.

Discussion of the preliminary remedial alternatives presented herein includes only soil and groundwater that have been affected by the compounds identified in the former waste pit as confirmed media of concern.

Indicator Hazardous Substances

The list of COPCs was reduced based on the results of the RI. A preliminary selection of indicator hazardous substances (IHSs) was performed in accordance with Chapter 173-340-703 WAC. Evaluation of the soil and groundwater analytical data for the RI indicates that the preliminary IHSs and affected media include:

- PCE (soil and groundwater)
- Trichloroethene (TCE) (soil and groundwater)
- Cis 1,2-dichloroethene (cis-DCE) (soil and groundwater)
- Vinyl chloride (groundwater)
- 1,2-dichloropropane (soil and groundwater)
- Chloromethane (groundwater)
- Aldrin (soil)
- 4,4-DDE (soil and groundwater)
- 4,4-DDD (soil and groundwater)
- Dieldrin (soil and groundwater)
- Endrin (soil)
- Heptachlor epoxide (soil)
- Alpha-chlordane (soil)
- Cadmium (soil and groundwater)
- Mercury (soil)

These compounds are present in soil and/or groundwater at concentrations that exceed the preliminary soil and groundwater screening levels selected for the RI and are presented in Table 1. The locations (borings and monitoring well) where the preliminary soil and groundwater screening levels have been exceeded are presented in Table 1. All of the boring and monitoring well locations completed during the RI are depicted on Figures 3 and 4.

Applicable or Relevant and Appropriate Requirements

The Applicable or Relevant and Appropriate Requirements (ARARs) for the Site were evaluated to determine the appropriate preliminary soil and groundwater screening levels presented in the RI. The primary ARARs are:

- MTCA Cleanup Regulations (Chapter 173-340 WAC);

- Water Quality Standards for Groundwater (WAC 173-200);
- State Water Quality Standards (173-201A WAC)
- Federal Maximum Contaminant Levels (40 CFR 141); and, →secondary MCLs?
- Dangerous Waste Regulations (Chapter 173-303 WAC).

These primary ARARs are anticipated to be the most applicable to the evaluation of future long-term remedial alternatives because they include the framework for completing the cleanup action, including applicable and relevant regulatory guidelines, methods for determining cleanup standards, waste disposal criteria, references for additional ARARs, and standards for documentation.

Other applicable ARARs are:

- Occupational Safety and Health Act (29 CFR 1910);
- Safety Standards for Construction Work (Chapter 296-155 WAC);
- Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC); and
- Accreditation of Environmental Laboratories (Chapter 174-50 WAC).

· any injection activities?
· noise?
· clean air act - EPA/WA
· const. dust control policy YRCAA

Additional ARARs may be identified during future phases of work and will be included as is applicable.

Source Characteristics

The date(s) of the release(s) of the IHSs (associated with historic Site operations) to the subsurface is not known. The present conceptual Site model indicates that the origin of the IHSs, with the exception of cadmium and mercury, was periodic deposition of wastewater and sludge into the waste pit during the time that Yakima Farmer Supply operated at the Site. The release(s) likely occurred between 1960, when the lime and sulfur mixing plant was constructed, and 1971, when Yakima Farmer Supply declared bankruptcy and ceased operations. The waste pit was filled in and the Yakima Farmer Supply improvements were removed by developers of the Site prior to occupation by either Agri-Tech or YSF. Neither YSF nor Agri-Tech is known to have used the IHSs identified in the RI, with the exception of diesel fuel that is utilized by YSF for fueling equipment such as forklifts. YSF was suspected by Ecology to have had a limited release of petroleum hydrocarbons on the southwest portion of the Site, but no evidence of a regulated release was identified during the RI.

Another source of soil and groundwater contamination is the west adjacent Bay Chemical property. The Bay Chemical property has confirmed releases of metals including antimony, arsenic, cadmium, copper, chromium, lead, manganese, mercury, and zinc associated with former operation of the property as a formulation plant for zinc sulfate-based soil amendments for local agricultural use. Subsurface investigations performed through 2003 indicate a significant potential for these metals to have been deposited on the Site. Insufficient soil and groundwater analytical data were collected during the RI to confirm whether the former Bay Chemical property operations have affected Site soil, groundwater, or surface water.

The quantity and initial concentrations of the waste products released in the waste pit are not known, but the overall contaminant mass is estimated to be low, based on the results of the RI. The concentrations of PCE in soil and groundwater do not indicate the presence of dense nonaqueous phase liquid (DNAPL) in the waste pit.

The lateral and vertical limits of the IHSs were estimated during the RI. The highest concentrations of IHSs that also exceed the preliminary soil screening levels are located beneath the Agri-Tech building where the former lime and sulfur mixing plant and northern portion of the waste pit were located. The borings performed in the building were inadequate to determine the vertical limits of contamination due to limitations of the drilling technology, but contamination was confirmed to extend to at least 7 feet below the ground surface (bgs). The lateral limits of contamination beneath the building may be estimated using the RI soil analytical data, but may require refinement to focus implementation of remedial alternatives.

The soil analytical data indicated that only two boring locations, SP-8 and SP-10 (Figure 3), located outside the Agri-Tech building, contained concentrations of IHSs above the preliminary soil screening levels. The analytical data from the surrounding borings indicate that these hot spots are limited in lateral extent. The vertical limit of contamination outside the Agri-Tech building is confirmed to be less than 10 feet bgs, based on soil analytical data from borings B-1 and B-2, located in the central portion of the waste pit (Figure 3). None of the soil samples collected near or beneath the YSF building contained concentrations of IHSs above the preliminary soil screening levels.

The contaminants are adsorbed or entrained in the waste pit soil matrix and may therefore be relatively stable unless disturbed. The RI indicated that the contribution of contamination from the waste pit soil matrix to groundwater is minimal and does not exceed the preliminary groundwater screening levels beyond the Site boundaries.

The groundwater analytical data from the RI indicate the presence of an off-Site contributing source of dissolved phase PCE passing beneath the Site. The exact source of the dissolved-phase PCE is unknown, but is suspected to be associated with one or more of the upgradient subfacilities within the YRRA located north of the Site.

Soil and Groundwater Characteristics

The soil types encountered at the boring locations across the Site were generally consistent, with the exception of the borings located in the waste pit area. Soil outside of the waste pit area consisted of medium- to coarse-grained sand and gravel with a variable silt content. A silt layer with some organic material was encountered between 3 and 5 feet below grade across the Site. Soil beneath a depth of 6 to 7 feet bgs consisted of medium to coarse sand, gravel, and cobbles to the maximum depth drilled of 31.5 feet bgs.

The soil in the waste pit area is capped by the YSF building, the Agri-Tech building, and asphalt in the area between the buildings. The floor of the Agri-Tech building consists of approximately 2 inches of concrete over medium-grained sand and gravel fill. The floor in the central and eastern portions of the YSF building consists of 2 inches of asphalt over silty, medium-grained sand and gravel fill. The floor in the western portion of the YSF building consists of approximately 4 inches of concrete over silty, medium-grained sand and gravel fill. The asphalt surface between the buildings consists of approximately 2 inches of asphalt with an uneven surface due to differential settling.

The soil encountered below the paved surfaces in the waste pit area consisted of sand and gravel with variable silt content. Granular, yellow, sulfur-bearing soil was encountered in borings SP-2, SP-4, SP-5, SP-7, SP-8, and SP-16 (Figure 3) at an approximate depth of 2 to 3 feet bgs. The sulfur-bearing soil appeared to be mixed with sand and gravel and was not a homogenous layer. The thickness of the sulfur-bearing soil was up to approximately 2 feet. Some man-made wood debris also was observed in the upper 5 feet of soil within the waste pit area and beneath the Agri-Tech building. A yellow to gray to white substance with the consistency of caulking material was encountered in borings SP-4, SP-7, SP-8, and SP-16 at an approximate depth of 5 feet bgs, immediately below the sulfur-bearing soil. The thickness of this material is generally less than 2 feet, and is inferred to be composed of the lime and sulfur residue that drained into the waste pit. The underlying soil from 5 to 8 feet bgs consisted of black to gray, medium- to coarse-grained sand and gravel. The black soil appeared to be organic in nature, and may be associated with former vegetation at the base of the waste pit. The underlying soil consisted of medium- to coarse-grained sand and gravel to 31.5 feet bgs.

The granular sulfur and lime-sulfur material was not laterally continuous across the waste pit area. Therefore, this material would not act as a lining for the base of the waste pit and prohibit the migration of IHSs to the underlying soil and groundwater, as was suggested during previous investigations. However, the presence of the lime-sulfur and organic materials in the former waste pit may retard the migration of the IHSs through sorption of the contaminants into the soil matrix.

The groundwater elevation data from the RI indicate that the seasonal high groundwater conditions occurred in September 1998, near the conclusion of the regional irrigation season for the Yakima Basin. The seasonal low groundwater conditions occurred in March 1998, when there was no regional irrigation being performed. The average seasonal flux in groundwater elevation observed during the RI monitoring was 3.21 feet. The average groundwater elevation at the Site, based on water level measurements in all monitoring wells between December 1997 and December 2002, was 997.07 feet above mean sea level. The average depth to water at the time of drilling was approximately 5 feet bgs.

The direction of groundwater flow for all five groundwater monitoring events was to the southeast. The average hydraulic gradient across the Site has been consistently between 0.003 and 0.004 feet per foot. The vertical head difference between the shallow and deep well pair MW-7A and MW-7B was –0.32 feet for the December 2002 groundwater monitoring event. The vertical gradient is estimated to be –0.018 feet per foot, indicating a slight downward vertical gradient. Groundwater velocities are typically hundreds to thousands of feet per day in the vicinity of the Site, according to information on the YRRA presented in the RI.

Points of Compliance

The point of compliance is defined in MTCA (WAC 173-340-200) as the location(s) where cleanup levels established in accordance with WAC 173-340-720 through WAC 173-340-760 will be attained to meet the requirements of MTCA. The point of compliance is discussed for soil and groundwater to assist in the preliminary evaluation of long-term remedial alternatives for the Site.

The point of compliance for soil for the soil-to-groundwater leaching pathway is defined under MTCA as all soil within the Site boundary throughout the soil profile, including saturated soil beneath the water table, where analytical results of in situ soil samples have detected concentrations of one or more of the IHSs above the appropriate and relevant cleanup levels for soil. The point of compliance for soil will not exceed the boundary of the Site, as defined by the legal site descriptions for the YSF and Agri-Tech properties. The soil analytical data from the RI indicate that the lateral limits of soil with concentrations above the preliminary soil screening levels are restricted to the waste pit located on the YSF and Agri-Tech properties.

The point of compliance for groundwater is defined under MTCA as the groundwater throughout the Site boundary from the uppermost level of the saturated zone extending vertically to the lowest depth that is affected by the IHSs. The point of compliance for groundwater will be the Site boundary, as defined by the legal site descriptions for the YSF and Agri-Tech properties. The uppermost level of the saturated zone is approximately 2.5 feet bgs. The lowest depth that could be affected by the IHSs has not been confirmed everywhere at the Site, but is expected to be between 25 and 30 feet bgs. Groundwater monitoring wells that may be used as point of compliance wells include monitoring wells MW-3, MW-4, MW-5, MW-7A, and MW-7B (Figure 4).

Not by MTCA

Evaluation of Cleanup Levels

Preliminary screening levels for soil and groundwater were selected during completion of the RI. The preliminary screening levels were based on criteria specified by Ecology that indicated that comparison of the standard MTCA Method B and modified MTCA Method B soil and groundwater cleanup levels should be performed. The modified Method B soil and groundwater cleanup levels were calculated using Ecology's 2001 *Worksheet for Calculating Soil Cleanup Levels for Unrestricted and Industrial Land Use*. The selected preliminary soil and groundwater screening levels are presented in Table 1.

The Site and surrounding land use specified by city of Yakima growth management planning is light industrial and commercial use. MTCA Method C cleanup levels typically are used when a site meets the criteria for an industrial property under Chapter 173-340-200 WAC and Chapter 173-340-745 WAC. MTCA Method C cleanup levels for all media of concern should therefore be considered during preparation of the scope of work for the FS and in the subsequent Cleanup Action Plan (CAP), since they may be more applicable for Site and surrounding land use.

must meet all criteria (EC)

The modified MTCA B and C cleanup levels presented in the RI may be revised following completion of the FS. The conservative Ecology default values for fraction organic carbon (foc), effective porosity, soil bulk density, and volumetric water content were used for the calculations completed for the RI, since Site-specific values for these parameters were not collected in accordance with the revisions to MTCA. The FS should include a scope of work for limited Site investigation to determine Site-specific values for foc at a minimum, and additionally for effective porosity, soil bulk density, and volumetric water content, since these parameters also have the potential to affect the final cleanup level calculations.

PRELIMINARY EVALUATION OF FEASIBLE REMEDIAL ALTERNATIVES

This section presents the results of the evaluation of preliminary remedial alternatives for soil and groundwater. The original evaluation of remedial alternatives presented in the RI Work Plan by Maxim Technologies, Inc., dated April 1997 did not consider the information collected during the completion of the RI. The original evaluation was modified herein based on the data from the RI and more recent technical information on treatment of the IHSs. The remedial alternatives discussed consider the requirements for selection of cleanup actions presented under Chapter 173-340-360 WAC.

SOIL

This section presents a discussion of technically feasible remedial alternatives for soil in the waste pit area. The discussion assumes that select IHS concentrations in soil will exceed the final selected soil cleanup levels and are leaching to groundwater.

The discussion addresses only IHSs associated with on-Site sources of contamination and not scenarios for potential contribution of contaminants associated with the west adjacent Bay Chemical property. Additional Site investigation work may be completed as a component of the FS to assess the potential Site impacts to soil, groundwater, and/or surface water/sediments from the Bay Chemical Property. Additional assessment was being performed at the Bay Chemical property and south adjacent property to YSF on behalf of the Bay Chemical potentially liable parties (PLP) group at the time of completion of the RI. The assessment data should be reviewed as it becomes available to the general public.

In Situ Remedial Alternatives

In situ remedial technologies such as soil vapor extraction (SVE), air sparging, soil washing, or other conventional in situ remedial technologies would not be effective for all IHSs in the waste pit soil matrix. The pesticides would not likely be affected, due to their strong adsorptive properties, resistance to biodegradation, and low volatility. The soil matrix in the waste pit is not ideal for either soil washing or SVE technologies, due to the silt and caulk-like lime-sulfur residue present. Air sparging techniques would not affect IHSs in shallow soil above the water table where the highest concentrations of IHSs have been observed. Further, air sparging in the shallow saturated zone may result in increased mobility of the contaminants by altering migration pathways and/or freeing adsorbed contaminants from the soil matrix, allowing IHSs to migrate downgradient. The groundwater velocities in the area are sufficiently high that contaminants desorbed from the waste pit soil matrix by air sparging may migrate downgradient at a faster rate than treatment can occur without downgradient hydraulic controls or additional treatment system components.

Enhanced bioremediation, the application of a chemical oxidant, or application of ozone as an oxidant may have a positive effect on the IHSs, but the effect may be limited where the IHSs are entrained in the caulk-like lime and sulfur residue or are present in the unsaturated zone. The limiting factor is the introduction of the oxidant or bioremediation-enhancing agent in a manner that disperses the agent throughout the soil matrix. The lime-sulfur residue does not appear sufficiently porous or permeable to allow effective dispersion of an oxidant or bioremediation-enhancing agent; however, these remedial alternatives may be effective in the other soil types within the waste pit. These remedial alternatives should be retained for further evaluation using bench scale testing to determine their potential effectiveness and whether any adverse reactions occur. Bioremediation techniques may have little effect on the pesticides present; however, oxidants may have some positive effect on reducing pesticide concentrations.

Source Removal Alternatives

Limited source removal actions in specific areas of the waste pit can significantly reduce the timeframe for final cleanup. However, the results of the RI indicate there is a relatively high risk associated with disturbing the soil matrix of the waste pit, which could result in significant mobilization of the adsorbed contaminants into groundwater. Any remedial alternative that includes disturbance of the soil matrix would need to be carefully evaluated, and additional engineering controls to capture and/or treat dissolved phase IHSs that are mobilized would need to be considered.

A downgradient hydraulic control that may also be a potential remedial alternative for treatment of dissolved phase concentrations of IHSs from the waste pit is a permeable reactive barrier. This technology consists of installation of a subsurface barrier wall, typically constructed with a reactive treatment media such as zero valent iron or granular activated carbon. The barrier is placed downgradient of the source area and is designed such that contaminated groundwater passing through the barrier is treated by the reactive media. This alternative may be implemented with other remedial technologies and should be retained for further evaluation.

The results of the RI indicate that the highest concentrations of IHSs in soil are located beneath the Agri-Tech building. Evaluation of the technical feasibility of a limited source removal action beneath the Agri-Tech building would require additional investigation. The structural stabilization and repair requirements for the building to allow soil excavation would require further evaluation. Limited source removal would also require evaluation of whether interim or permanent downgradient hydraulic controls to capture and/or treat releases of IHSs mobilized by the disturbance of the soil matrix are required.

The soil analytical data inside the Agri-Tech building have not completely defined the limits of the IHSs. The soil analytical data collected for the RI indicate that an area measuring approximately 80 feet by 100 feet and up to 8 feet bgs could potentially be targeted for excavation. The estimated volume of soil in this area is approximately 2,370 cubic yards. The estimated soil tonnage is 4,265 tons, based on a conversion factor of 1.8 times the soil volume. Additional investigation inside the Agri-Tech building may be warranted to ensure that the lateral and vertical limits of the IHSs have been established, and that the estimated area of affected soil is accurate.

A limited source removal action at the hot spot identified in the central area of the waste pit near soil boring SP-10, where the second highest concentrations of PCE were identified during the RI, also may be considered. The extent of contamination to the east of this soil boring is still uncertain and would require better definition to accurately estimate the volume of affected soil prior to implementing any source-removal activities. Excavation near the other hot spot at boring SP-8 may be performed, but is not recommended since contamination was limited to the pesticides dieldrin and 4,4-DDD, which have not been significant sources of contamination to groundwater outside the waste pit and are limited in extent.

Any soil excavated would be transported off-Site and would require profiling to determine where it could be disposed. The soil analytical results for the RI indicate that the excavated soil may meet the pretreatment requirements for disposal at Waste Management, Inc.'s Subtitle C landfill facility located in Arlington, Oregon. The soil could be pretreated by Waste Management to reduce concentrations of halogenated volatile organic compounds (HVOCs) and pesticides to levels that would allow the material to be disposed of in the landfill facility. This disposal alternative would require further evaluation if a limited source removal action is retained as a technically feasible remedial alternative.

Engineering and Institutional Controls

Engineering and institutional controls will be retained for all future remedial alternatives, since residual contamination will likely remain beneath the YSF and Agri-Tech properties. Engineering controls are defined under MTCA to include containment or treatment alternatives that are designed and constructed to prevent or limit the movement and/or exposure to hazardous substances. Paving materials such as asphalt and concrete placed over the affected soil would be applicable engineering controls that are accepted for limiting exposures through the direct contact and inhalation pathways. These controls also limit surface water infiltration that may mobilize contaminant migration downward towards groundwater. Additional engineering controls that may require consideration are the downgradient hydraulic controls to capture and/or treat releases of IHSs associated with disturbing the existing soil matrix if soil excavation is selected as a technically feasible remedial alternative.

Institutional controls are defined under MTCA as measures undertaken to limit or prohibit activities that may interfere with the integrity of a cleanup action or result in exposure to hazardous substances at the Site. Institutional controls may include:

- Fences or other non-engineered methods of preventing contact with the hazardous substances;

- Limitations on the use of the property or resources such as soil and groundwater beneath the property;
- Requirements for cleanup actions to occur if engineering controls or structures are disturbed or removed;
- Maintenance requirements for engineering controls such as inspection and repairs of pavement caps or monitoring wells;
- Educational programs such as posted signs, public notices, and/or mailings to alert Site workers, visitors, and the local general public to the locations of hazardous substances and to suggest steps to prevent exposure; and
- Financial assurances to ensure that funds are available for the length of time the institutional controls must remain in place.

EC

The application of institutional controls will be necessary until the concentrations of the residual IHSs in soil and groundwater are below the final cleanup levels or standards negotiated for the Site. Institutional controls may include restrictions on soil and groundwater use at the Site, including provisions for procedures associated with any subsurface excavation required in the waste pit area. Other institutional controls may include inspection and maintenance requirements for the existing building slabs and pavement cap. These institutional controls may be required to inform Site workers and visitors of the presence and locations of the contamination; to mitigate the risk of exposure through the dermal, ingestion, and inhalation pathways; to mitigate the risk of vapor transport to the interior of the Agri-Tech building; and to prevent surface water infiltration that may mobilize contaminants in the underlying soil. The specific institutional controls that would be required would need to be negotiated with Ecology and would be specific to the YSF property and the Agri-Tech property, in the event that one of these properties was transferred to another party.

GROUNDWATER

This section presents a discussion of technically feasible remedial alternatives for groundwater. The discussion assumes that remediation may be necessary at the Site to reduce concentrations of IHSs, although at this time, the only IHS exceeding the preliminary groundwater screening levels at the proposed point of compliance is PCE. Although concentrations of other IHSs have exceeded preliminary groundwater screening levels at monitoring wells MW-2, MW-6, and WDOE-6, located in and immediately downgradient of the waste pit, these concentrations attenuate rapidly to concentrations below the preliminary screening levels at the point of compliance. The discussion assumes that no significant active remediation of groundwater at the Site is required, based on the RI analytical data. The discussion focuses on potential remedial alternatives for IHSs at the waste pit.

In Situ Remedial Alternatives

Conventional in situ remedial alternatives such as air sparging, enhanced bioremediation, ozone sparging, or chemical oxidation in the waste pit have the potential for reducing concentrations of

IHSs. The application of these remedial technologies may have limited effect, due to the soil matrix and the resilience of the pesticides present, as discussed previously.

Air sparging or other conventional technologies that physically disturb the soil and groundwater may mobilize adsorbed contaminants into groundwater, resulting in an increase in concentrations of IHSs that could migrate beyond the point of compliance, unless downgradient engineering controls are implemented to either capture or treat the mobilized IHSs. Air sparging technologies are not recommended for further evaluation without application of hydraulic controls such as a permeable reactive barrier. If air sparging was retained as a remedial alternative, SVE also would require further evaluation. SVE would be required to capture contaminant vapors that would result from the air sparging process and to prevent vapor migration and accumulation.

The use of oxidants has the potential to reduce concentrations of HVOCs and other volatile contaminants in the waste pit area, but may have a limited effect on the pesticides present. As stated previously, the limiting factor is the introduction of the oxidant in a manner that disperses it throughout the soil matrix and to affected groundwater. The lime-sulfur residue may not be sufficiently porous or permeable to effectively disperse a chemical oxidant. The application of ozone through ozone sparging techniques may be more effective than chemical oxidation, since ozone is a gas and may disperse through the soil matrix more effectively than a chemical oxidant. However, the use of oxidants may destroy the existing bacterial colonies that currently are biodegrading the HVOCs in the waste pit. The alternative of chemical oxidants should be retained for further evaluation using bench scale testing to determine its effectiveness and whether adverse reactions would occur.

Enhanced bioremediation is an alternative that may be applicable, based on preliminary indications of reductive dechlorination occurring within the waste pit area. Concentrations of PCE and daughter products through vinyl chloride have been observed in groundwater in and near the waste pit, indicating that some degree of anaerobic biodegradation is occurring. Concentrations of the daughter products rapidly decrease outside the waste pit area and appear to be degrading aerobically as the dissolved phase IHSs disperse across the Site. Enhancing anaerobic degradation in the waste pit has the potential to accelerate reduction of PCE in the saturated media. The limiting factor, as with the application of chemical oxidants, is dispersion of the enhancing agents. This remedial alternative also should be retained for further evaluation.

Monitored Natural Attenuation

Monitored natural attenuation is a remedial alternative that would be combined with other remedial technologies as a component of the final cleanup strategy. The groundwater analytical data collected for the RI indicate that concentrations of IHSs in groundwater at monitoring well WDOE-6, located in the central area of the waste pit, have been decreasing consistently between 1997 and 2002 without corresponding increases in concentrations at the downgradient monitoring wells, indicating that the IHSs are naturally attenuating. The presence of PCE and all of its daughter products at monitoring well WDOE-6 is further evidence that natural attenuation is occurring.

The preliminary screening of the natural attenuation parameters during the RI indicates that there is a potential for reductive dechlorination in the waste pit, and for direct oxidation outside the waste pit. This combination of conditions is conducive to reduction of PCE and all of its daughter products at the Site. However, if the contaminant velocity exceeds the rate of biodegradation, the dissolved phase PCE and TCE in the waste pit would migrate downgradient and attenuate only through dispersion and dilution. The results of the RI indicate that the concentrations of PCE and TCE attributable to the waste pit at the downgradient monitoring wells are minimal and have generally been below the preliminary groundwater screening levels, indicating that monitored natural attenuation should be retained as a feasible remedial alternative.

A limiting aspect of monitored natural attenuation is that it is a long-term remedial alternative that typically must be combined with engineering and/or institutional controls to be accepted by Ecology. A monitored natural attenuation remedy also would require periodic groundwater monitoring and sampling at a frequency that would need to be negotiated with Ecology. Further, Ecology may require financial assurances to ensure that the monitoring and sampling program is continued in the future, if the predicted length of time for attenuation of the IHSs is sufficiently long to warrant such assurances.

Engineering and Institutional Controls

Engineering and institutional controls have been described previously and will be a component of any groundwater remedial alternative selected. The pavement cap in the waste pit area will need to be maintained, and restrictions on groundwater use throughout the Site will likely be required by Ecology. These alternatives should be retained for further evaluation of their application in conjunction with other remedial alternatives.

CONCLUSIONS

The results of the RI investigation indicated that cleanup actions may be necessary at the former waste pit located at the Site. The target media affected by the IHSs in the waste pit include soil and groundwater. The soil and groundwater analytical data do not support a requirement for remediation elsewhere at the Site, since the contribution of PCE from an off-Site contributing source is recognized by Ecology. The potential for contamination associated with the west adjacent Bay Chemical property requires further investigation prior to determining what additional actions are required with respect to metals that may be present in soil, groundwater, surface water, and or the pond sediments.

The preliminary evaluation of technically feasible remedial alternatives for the Site indicates that a combination of alternatives would likely be included in selection of a long-term cleanup action to address the IHSs present in the waste pit. The alternatives that should be retained for future evaluation include those that may be effective in the soil matrix of the waste pit, are effective for groundwater, and meet the minimum requirements under Chapter 173-340-360 WAC for selection of cleanup actions. The alternatives that should be retained for future evaluation include:

- Limited source removal by excavation with off-Site disposal of soil;
- Application of chemical oxidants or ozone;
- Enhanced bioremediation;
- Monitored natural attenuation;
- Air sparging with SVE;
- Institutional and engineering controls; and
- Permeable reactive barriers.

Once the potential remedial alternatives have been evaluated during an FS, a CAP may be developed that would include the selected combination of remedial alternatives. The scope of work for the FS should also include provisions for refinement of the calculation of Site-specific cleanup levels initiated during the RI, so that selection of the final cleanup levels for the affected media may be included in the CAP. The timeframe for completion of an FS could range from six to nine months, and includes preparation of an FS report. The cost for completing the FS could range from $60,000 to $100,000, depending upon the complexity of the bench scale and/or field scale pilot testing completed.

This information should be sufficient to develop a work plan for an FS. The FS work plan should include any additional Site investigation work necessary to address data gaps identified during completion of the RI.

Farallon hopes this memorandum has provided sufficient information for your needs at this time. If you have any questions, please contact Jeffrey Kaspar at (425) 427-0061.

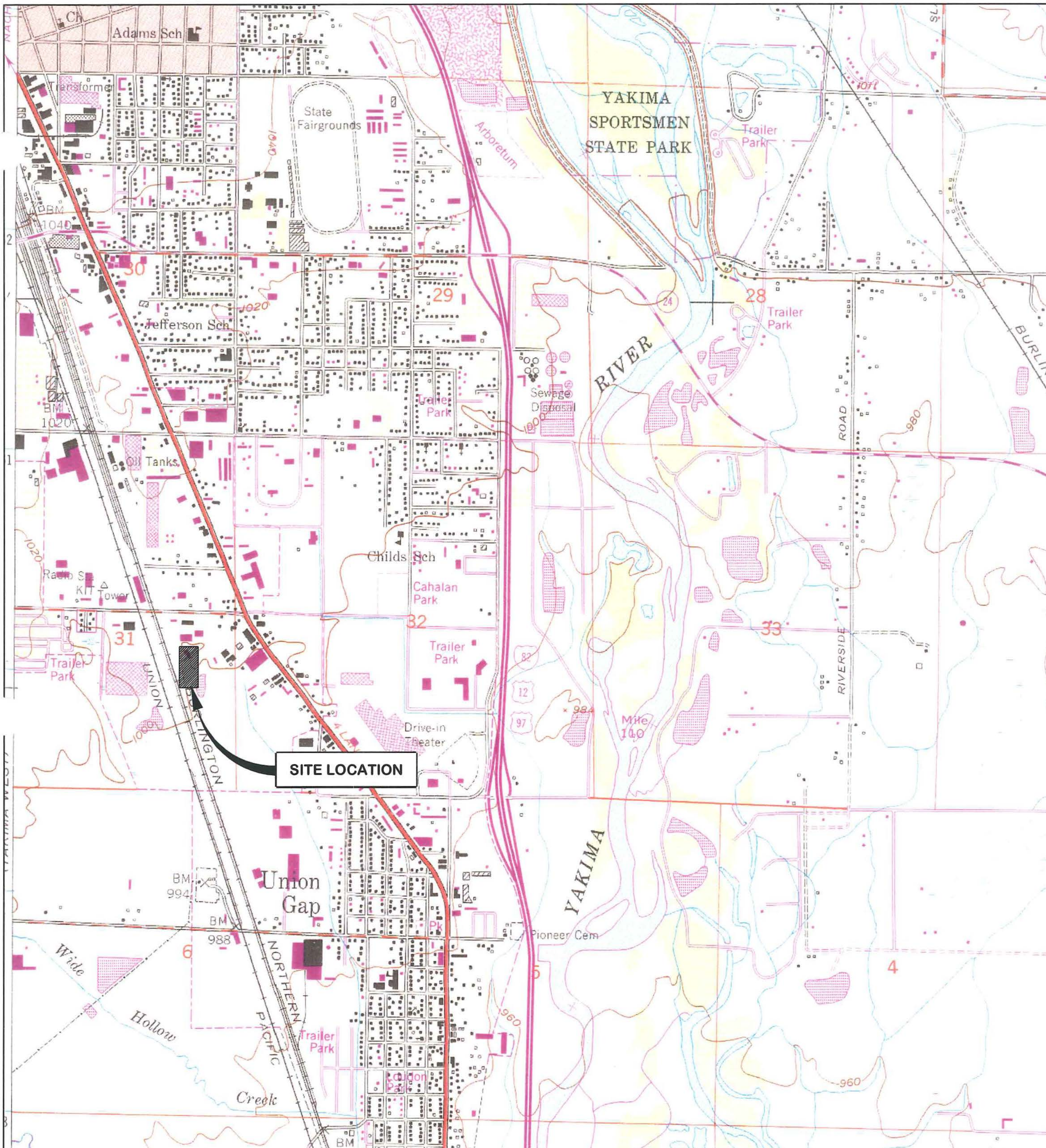
Attachments: Figure 1, Site Location and Regional Topographic Map
Figure 2, Site Plan
Figure 3, Site Plan with Soil Boring Locations
Figure 4, Site Plan with Groundwater Monitoring Well Locations
Table 1, Locations that Exceed Preliminary Soil and Groundwater Screening Levels

JK: syh

FIGURES

PRELIMINARY EVALUATION OF TECHNICALLY FEASIBLE REMEDIAL ALTERNATIVES

Agri-Tech & Yakima Steel Fabricators
Yakima, Washington
Farallon PN: 765-001



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FARALLON CONSULTING
320 3rd Ave. NE
Issaquah, WA 98027

FIGURE 1

SITE LOCATION AND REGIONAL TOPOGRAPHIC MAP
YSF/AGRI-TECH REMEDIAL INVESTIGATION
6 & 10 1/2 EAST WASHINGTON AVNUE.
YAKIMA, WASHINGTON

FARALLON PN: 765-001

Drawn By: DEW	Checked By: RM	Date:2/28/03	Disk Reference: 765001

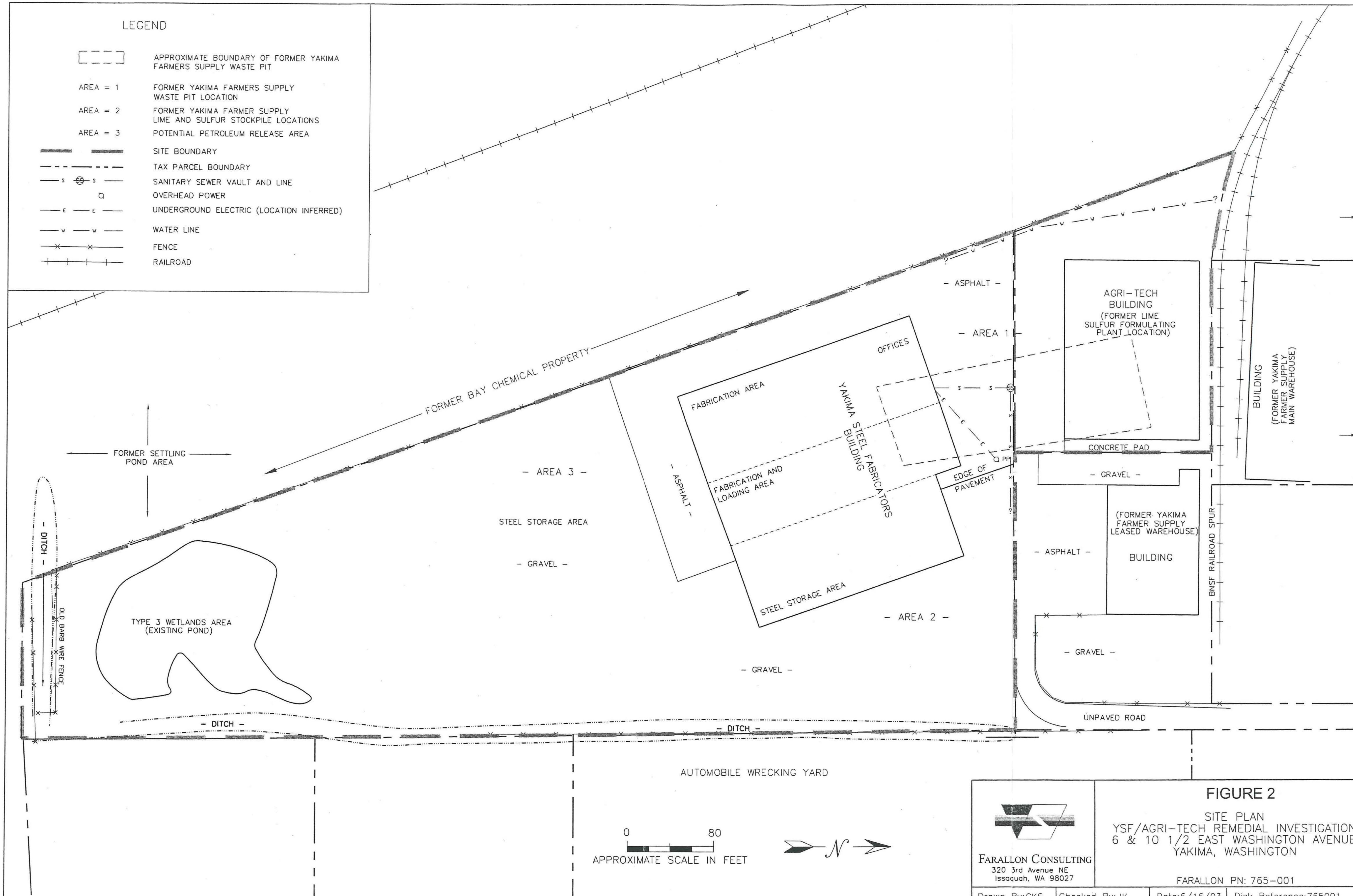


FIGURE 2

SITE PLAN
YSF/AGRI-TECH REMEDIAL INVESTIGATION
6 & 10 1/2 EAST WASHINGTON AVENUE
YAKIMA, WASHINGTON

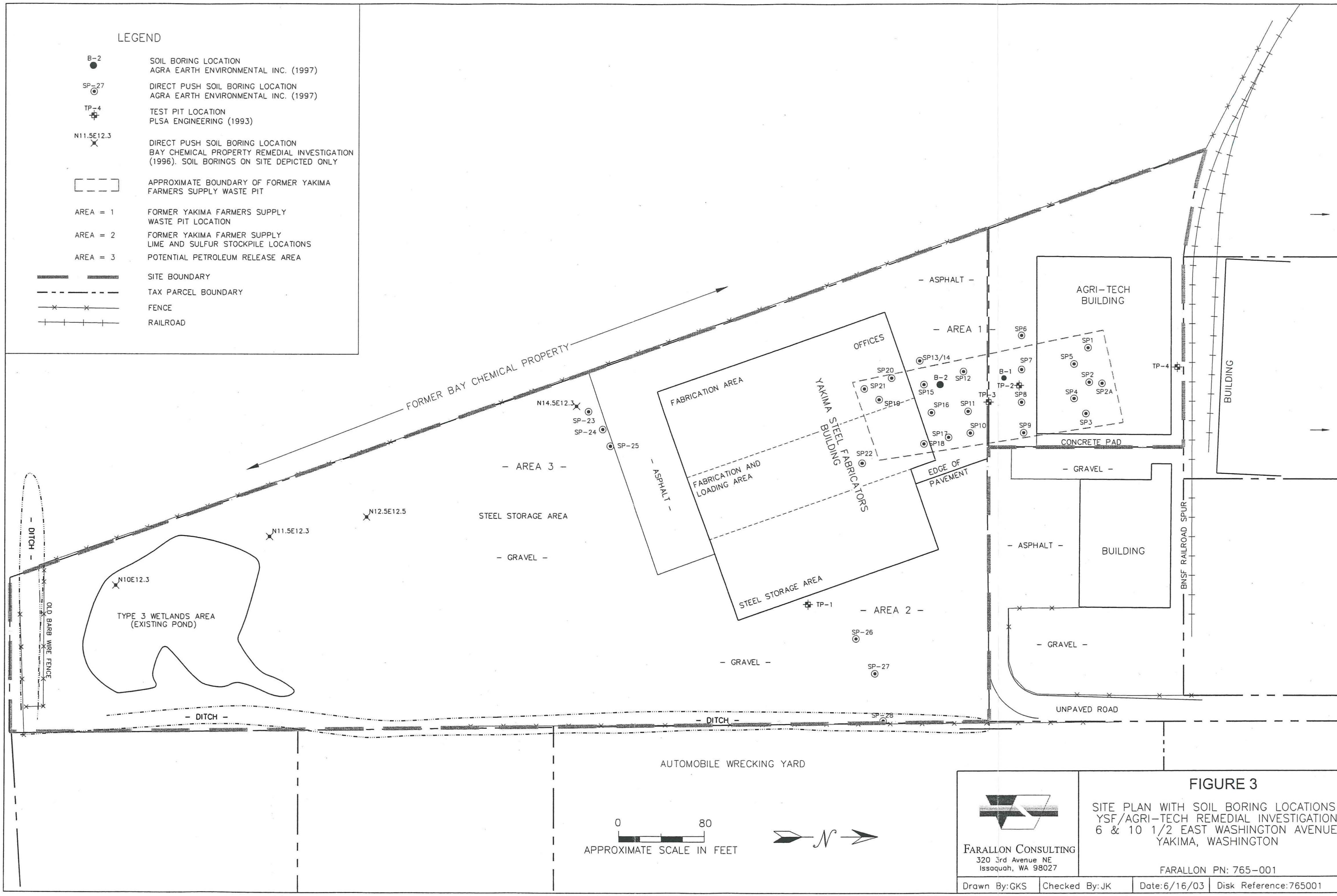
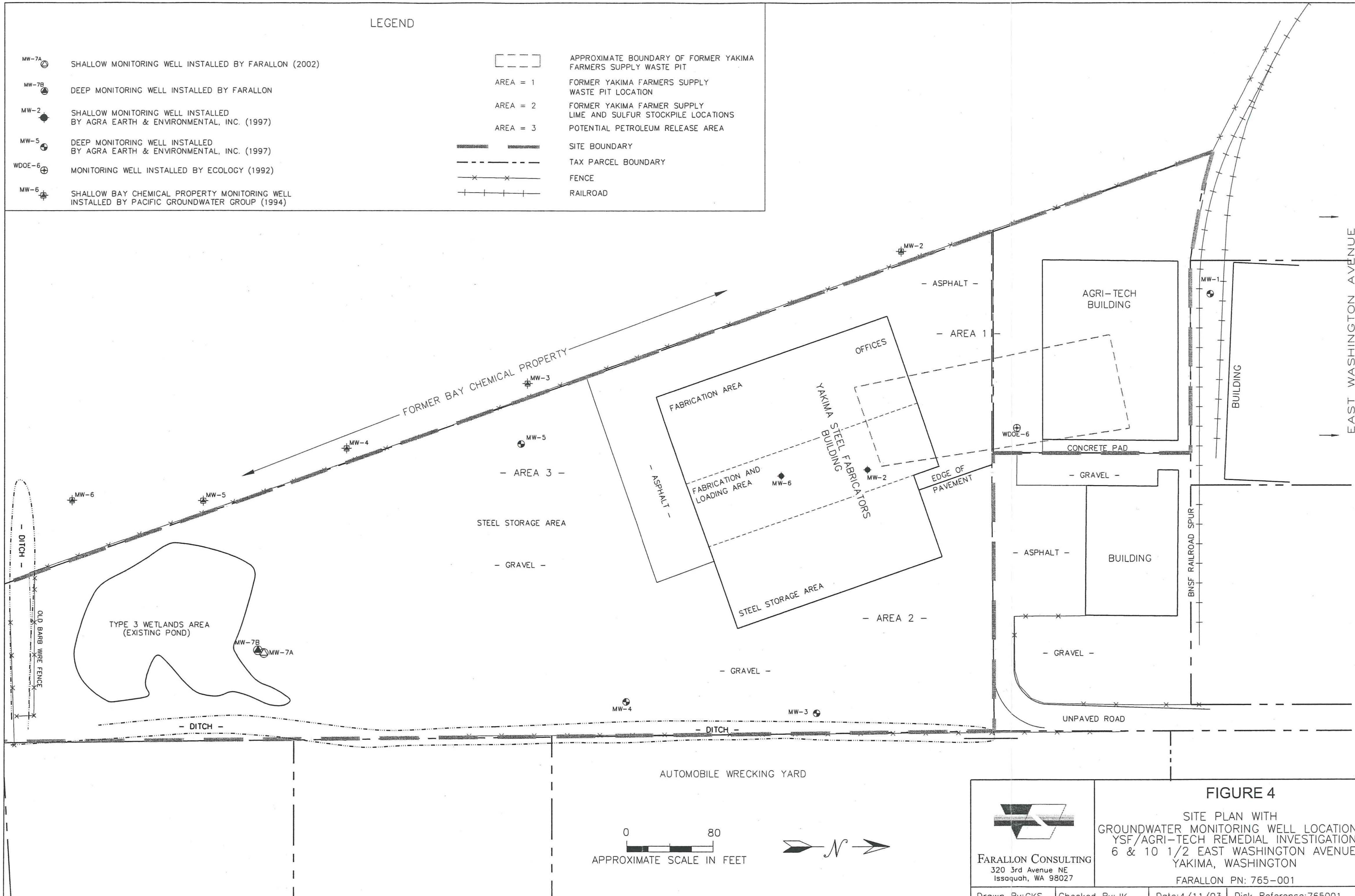


FIGURE 3

SITE PLAN WITH SOIL BORING LOCATIONS
YSF/AGRI-TECH REMEDIAL INVESTIGATION
6 & 10 1/2 EAST WASHINGTON AVENUE
YAKIMA, WASHINGTON

FARALLON PN: 765-001

Drawn By: GKS	Checked By: JK	Date: 6/16/03	Disk Reference: 765001


LEGEND
MW-7A SHALLOW MONITORING WELL INSTALLED BY FARALLON (2002)
MW-7B DEEP MONITORING WELL INSTALLED BY FARALLON
MW-2 SHALLOW MONITORING WELL INSTALLED BY AGRA EARTH & ENVIRONMENTAL, INC. (1997)
MW-5 DEEP MONITORING WELL INSTALLED BY AGRA EARTH & ENVIRONMENTAL, INC. (1997)
WDOE-6 MONITORING WELL INSTALLED BY ECOLOGY (1992)
MW-6 SHALLOW BAY CHEMICAL PROPERTY MONITORING WELL INSTALLED BY PACIFIC GROUNDWATER GROUP (1994)
APPROXIMATE BOUNDARY OF FORMER YAKIMA FARMERS SUPPLY WASTE PIT
AREA = 1 FORMER YAKIMA FARMERS SUPPLY WASTE PIT LOCATION
AREA = 2 FORMER YAKIMA FARMER SUPPLY LIME AND SULFUR STOCKPILE LOCATIONS
AREA = 3 POTENTIAL PETROLEUM RELEASE AREA
SITE BOUNDARY
TAX PARCEL BOUNDARY
FENCE
RAILROAD
FORMER BAY CHEMICAL PROPERTY
MW-2
MW-3
MW-4
MW-5
MW-6
- ASPHALT -
- AREA 1 -
- AREA 2 -
- AREA 3 -
OFFICES
FABRICATION AREA
YAKIMA STEEL FABRICATORS BUILDING
FABRICATION AND LOADING AREA
STEEL STORAGE AREA
EDGE OF PAVEMENT
- GRAVEL -
TYPE 3 WETLANDS AREA (EXISTING POND)
MW-7B
MW-7A
- DITCH -
OLD BARB WIRE FENCE
AGRI-TECH BUILDING
WDOE-6
MW-1
CONCRETE PAD
BUILDING
BNSF RAILROAD SPUR
EAST WASHINGTON AVENUE
UNPAVED ROAD
AUTOMOBILE WRECKING YARD
0 80
APPROXIMATE SCALE IN FEET
N
FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027
FIGURE 4
SITE PLAN WITH GROUNDWATER MONITORING WELL LOCATIONS
YSF/AGRI-TECH REMEDIAL INVESTIGATION
6 & 10 1/2 EAST WASHINGTON AVENUE
YAKIMA, WASHINGTON
FARALLON PN: 765-001
Drawn By:GKS
Checked By:JK
Date:4/11/03
Disk Reference:765001

TABLE

PRELIMINARY EVALUATION OF TECHNICALLY FEASIBLE REMEDIAL ALTERNATIVES

Agri-Tech & Yakima Steel Fabricators
Yakima, Washington
Farallon PN: 765-001

Table 1
Locations that Exceed Preliminary Soil and Groundwater Screening Levels
YSF/Agri-Tech
Yakima, Washington
Farallon PN: 765-001

Sample Number	Depth[1] (feet)	Indicator Hazardous Substance[2]													
		Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis 1,2-dichloroethene	Vinyl Chloride	1,2-dichloropropane	Chloromethane	4,4-DDE	4,4-DDD	Dieldrin	Endrin	Heptachlor epoxide	Alpha-chlordane	Cadmium	Mercury
Area 2: Former Yakima Farmer Supply Lime and Sulfur Stockpile Locations															
SP23-8	4.0-8.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP24-7.5	4.0-7.5	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP25-4	0.5-4.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
Area 3: Potential Petroleum Release Area															
SP26-6.5	4.0-6.5	No	No	No	No	No	No	No	No	No	No	No	No	No	No
SP27-7.5	4.0-7.5	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**
SP28-7.5	4.0-7.5	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	No
Type 3 Wetlands Area															
Drum 1 (MW-7A)	0 -15	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
Drum 3 (MW-7B)	15-25	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
Drum 4 (MW-7B)	25-32	0	No	No	No	No	No	No	No	No	No	No	No	NA	NA
Preliminary Screening Level (milligrams per kilogram)		0.05038	0.02631	0.35	0.0001838	0.00305	76.9	0.4459	0.3354	0.002817	0.0404	0.01605	0.2576	2	2
GROUNDWATER															
MW-1	Deep	**Yes**	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW-2	Shallow	No	No	No	**Yes**	No	**Yes**	No	No	**Yes**	No	No	No	NA	NA
MW-3	Deep	**Yes**	No	No	No	No	**Yes**	No	No	No	No	No	No	NA	NA
MW-4	Deep	**Yes**	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW-5	Deep	**Yes**	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW-6	Shallow	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No	No	NA	NA
WDOE-6	Shallow	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	No	No	No	NA	NA
MW-7A	Shallow	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW-7B	Deep	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
Preliminary Screening Level (microgams per liter)		5.0	3.98	70	0.0292	0.643	3.37	0.257	0.365	0.0055	2.0	0.0096	0.250	5.0	2.0

NOTE:

Deep denotes the groundwater monitoring well was designed to monitor deeper regional groundwater up to a depth of 33 feet bgs.

NA denotes that the soil or groundwater sample was not analyzed for this substance.

No denotes compound has not been detected at a concentration above the preliminary screening level selected for the Remedial Investigation.

Shallow denotes the groundwater monitoring well was designed to monitor shallow groundwater in direct contact with the waste pit materials.

Yes denotes that the compound has been detected at a concentration above the preliminary screening level selected for the Remedial Investigation.

[1]Depth below ground surface in feet.

[2]Indicator Hazarous Substances represent those constituents of potential concern that have been detected in two or more soil samples or have been detected at a minimum frequency of one groundwater sampling event for groundwater samples. The concentrations of these substances have also exceeded the preliminary screening level selected for the Remedial Investigation.

Table 1
Locations that Exceed Preliminary Soil and Groundwater Screening Levels
YSF/Agri-Tech
Yakima, Washington
Farallon PN: 765-001

Sample Number	Depth[1] (feet)	Indicator Hazardous Substance[2]													
		Tetrachloroethene (PCE)	Trichloroethene (TCE)	cis 1,2-dichloroethene	Vinyl Chloride	1,2-dichloropropane	Chloromethane	4,4-DDE	4,4-DDD	Dieldrin	Endrin	Heptachlor epoxide	Alpha-chlordane	Cadmium	Mercury
SOIL															
Area 1: Former Yakima Farmer Supply Waste Pit Area															
468110 (WDOE-6)	10	**Yes**	**Yes**	No	No	No	No	No	No	No	No	No	No	NA	NA
YSF-1 (TP-1)	4	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
YSF-2 (TP-1)	5	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
YSF-3 (TP-1)	8	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
YSF-4 (TP-2)	4.5	**Yes**	No	No	No	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	NA	NA
YSF-5 (TP-3)	6	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
YSF-6 (TP-4)	7.5	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP1-4	0.5-4.0	**Yes**	**Yes**	No	No	No	No	No	No	No	No	No	No	NA	NA
SP2-4	0.5-4.0	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	NA	NA
SP2A-6.5	4.0-6.5	**Yes**	No	No	No	No	No	No	No	**Yes**	No	No	No	NA	NA
SP3-4	0.5-4.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP4-7	4.0-7.0	**Yes**	**Yes**	**Yes**	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	NA	NA
SP5-6.5	4.0-6.5	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No	No	No	NA	NA
SP6-5.5	4.0-5.5	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP7-7	4.0-7.0	**Yes**	No	No	No	**Yes**	No	No	No	No	No	No	No	NA	NA
SP8-7	4.0-7.0	No	No	No	No	No	No	**Yes**	No	**Yes**	No	No	No	NA	NA
SP9-7.5	4.0-7.5	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP10-4	0.5-4	**Yes**	**Yes**	No	No	No	No	No	**Yes**	**Yes**	**Yes**	No	No	NA	NA
SP11-6	4.0-6.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP12-8	4.0-8.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP13/14-6	4.0-6.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP15-6	4.0-6.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP16-8	4.0-8.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP17-4	0.5-4.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP18-4	0.5-4.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP19-7	4.0-7.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP20-8	4.0-8.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP21-5	1.0-5.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
SP22-7	4.0-7.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW1-5	5.0-6.5	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW1-10	10.0-11.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
MW6-6	6.0-8.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
B1-10	10.0-11.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
B1-30	30.0-31.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
B2-10	10.0-11.0	No	No	No	No	No	No	No	No	No	No	No	No	NA	NA
Preliminary Screening Level (milligrams per kilogram)		**0.05038**	**0.02631**	**0.35**	**0.0001838**	**0.00305**	**76.9**	**0.4459**	**0.3354**	**0.002817**	**0.0404**	**0.01605**	**0.2576**	**2**	**2**