CDM

Remedial Investigation and Focused Feasibility Study LeatherCare, Inc. 901/921 Elliott Avenue W. Seattle, Washington

November 9, 2009

Prepared For:

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A Report Prepared For:
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REMEDIAL INVESTIGATION AND FOCUSED FEASIBILITY STUDY LEATHERCARE, INC. 901/921 ELLIOTT AVENUE WEST SEATTLE, WASHINGTON

November 9, 2009

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Executive Summary

This document presents the results of Camp Dresser & McKee's (CDM) remedial investigation and focused feasibility study (RI/FFS) for the LeatherCare, Inc. site (LeatherCare or LC) located at 901 Elliott Avenue West in Seattle, Washington. The RI was completed to evaluate the nature and extent of chlorinated volatile organic compounds (cVOCs), specifically tetrachloroethene (PCE) and its degradation products, in soil and groundwater. The FFS was performed to develop, evaluate, and provide recommendations for an appropriate remedial action. Site work is being conducted under the Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP). The VCP site number is NW1805.

The LeatherCare site is a large industrial dry cleaning facility. It began operations at this location in 1985. Originally LC used PCE as its dry cleaning solvent, but in 2000 began converting to a silicon-based cleaner. LeatherCare completed the conversion in 2005 and no longer uses PCE in its dry cleaning machines.

PCE and its degradation products have been identified in soil and groundwater at the LeatherCare site. However, cVOC concentrations in soil and groundwater are relatively low. The concentrations of PCE and its degradation products detected in groundwater do not indicate the presence of free phase product, otherwise known as dense nonaqueous phase liquid (DNAPL).

The existing PCE groundwater plume (currently averaging below the cleanup level) is limited to a small area situated mostly under the LC building. Most recent groundwater data did not show PCE concentrations exceeding the cleanup level at any location. The vinyl chloride plume ends within the property boundaries to the northeast and northwest. The VC plume is bounded to the southeast at the edge of W Roy Street by an impermeable shoring wall that was constructed for below grade parking on the adjacent Elliott Holding property. The VC plume likely extends just under, but not beyond, the Burlington Northern Santa Fe (BNSF) Railroad lines to the southwest.

The nature of the PCE released at this site has been characterized based on the nature and extent of contamination, distribution of bacteria associated with degradation of PCE, and historical information about site operations.

The contaminant profile across the site is indicative of small, incidental releases that may have occurred at several locations. For example, the low concentration of PCE detected in soil near a sump in the LeatherCare building may have been from residual PCE entrained in sediment that penetrated the concrete matrix, or through small fractures. The water table occurs immediately beneath the building concrete slab and so any PCE that migrated through the concrete would be immediately solubilized.

Another possible historical source area was a catch basin located adjacent to the building – this was roughly the route where hoses were brought in to fill the PCE machines. Based on the overall low concentrations observed in soil and groundwater, the total volume of these releases was probably only a few ounces of PCE.

Field monitoring data and chemical and biological testing conducted on soil and groundwater indicate that conditions are conducive for complete biological degradation of PCE. All of the biological degradation products of PCE are observed in groundwater, which empirically shows that complete degradation of PCE is occurring. Furthermore, statistical evaluation of groundwater data collected over time shows strong evidence that concentrations of PCE and all of its degradation products are declining.

CDM screened various remedial technologies and evaluated three remedial alternatives: monitored natural attenuation (MNA), enhanced anaerobic biodegradation (EAB), and in situ chemical oxidation (ISCO). CDM recommends MNA based on the following:

- Natural attenuation processes, including biological degradation, are actively occurring at this site.
- Concentrations of the contaminants of concern (COCs) are so low that this technology can reduce concentrations to Method A cleanup levels within a reasonable time frame. There is no guarantee that the other alternatives would result in a significantly reduced time frame to achieve site remediation.
- The low concentrations of residual cVOCs *in situ* do not pose a threat to human health or the environment because there are no complete exposure pathways.
- The cost for the other alternatives is unjustified considering that they may reduce the timeframe for cVOC cleanup by only a few years, or not at all.
- Interim remedial actions have already been conducted at the site.

If monitoring indicates a need to expedite reduction of cVOCs in the area where the highest vinyl chloride concentration was detected to the north of the LC building, ISCO or EAB may be effective on a limited scale.

Section 1
Introduction

This document presents the results of Camp Dresser & McKee's (CDM) remedial investigation and focused feasibility study (RI/FFS) for the LeatherCare, Inc. site (LeatherCare or LC) in Seattle, Washington. The RI was completed to evaluate the nature and extent of chlorinated volatile organic compounds (cVOCs), specifically tetrachloroethene (PCE) and its degradation products, in soil and groundwater. The FFS was performed to develop, evaluate, and provide recommendations for an appropriate remedial action.

This RI/FFS was performed in general accordance with the Washington Administrative Code (WAC) Model Toxics Control Act (MTCA) Remedial Investigation/Feasibility Study (RI/FS) requirements outlined in WAC 173-340-350. Site work is being conducted under the Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP). The VCP site number is NW1805.

1.1 Objectives

The objectives of this RI/FFS are summarized below:

- Define the nature and extent of PCE and its degradation products in soil and groundwater.
- Develop remedial action objectives (RAOs) to achieve cleanup of the site.
- Identify potential remedial technologies to attain RAOs for the site.
- Develop remedial action alternatives, which may consist of one or more remedial technologies.
- Develop conceptual level cost estimates for implementation, operation, and maintenance of the remedial action alternatives.
- Identify the most appropriate remedial action alternative for implementation at the site based on a comprehensive evaluation of the feasibility of implementation, costs, and remedial timeframe.

1.2 Report Organization

The remaining sections of this report are organized as follows:

- Section 2, Site and Vicinity Description and History, describes current land uses and features on the LeatherCare site and in the immediate vicinity. Historical land uses for the site and adjacent properties, as well as potential historical contaminant sources, are also discussed.
- Section 3, Physical Setting, describes the geologic and hydrogeologic conditions underlying the site area.

- Section 4, Remedial Investigation Findings, summarizes previous environmental investigations conducted at the site and adjacent properties. These investigation results constitute the remedial investigation and its findings. Applicable cleanup levels and contaminants of concern are discussed, and the plume limits are established based on these cleanup levels.
- Section 5, Evaluation of Intrinsic Biodegradation, discusses the natural degradation pathways of chlorinated compounds and evaluates those processes as they relate to contamination on the site.
- Section 6, RI Conclusions, provides conclusions of the Remedial Investigation.
- Section 7, Remedial Objectives and Goals, lays out the objectives and goals of site remediation and determines media of concern.
- Section 8, Remedial Technology Screening, summarizes the initial and secondary screening of remedial technologies applicable to the site.
- Section 9, Remedial Action Alternatives, describes our evaluation of three remedial alternatives for the site selected from the screening process.
- Section 10, Recommended Remedial Action, presents CDM's recommendations for site remediation.
- Section 11, References, provides detailed sources for the references cited in this document

Section 2
Site and Vicinity Description and History

2.1 Location and Setting

LeatherCare is a large commercial dry cleaning facility located at the base of Seattle's Queen Anne Hill approximately 650 feet northeast of the shoreline of Elliott Bay (**Figure 1**). The site is separated from the bay by a series of railroad tracks, a granary and the Terminal 91 bike path. The facility is situated at the intersection of Elliott Ave. W and W Roy Street (**Figure 2**).

LeatherCare and adjacent properties on the west side of Elliott Avenue W are zoned IC-45 (industrial-commercial). Properties on the east side of Elliott Avenue W across from the LeatherCare site are zoned commercial.

2.2 Site Description and Land Use

Ecology refers to the "Site" as the entire area where contaminants have been located, regardless of property lines. However, for context and clarity this report defines "site" as the LC and GTP parcels and W Roy Street, as shown on **Figure 2**.

LeatherCare occupies King County Tax Parcel 3879902235 at 901 Elliott Ave. W (referred to herein as the LC parcel). This parcel, owned by Mr. Steven Ritt, is completely covered by a 16,800 square-foot (sf), 0.39-acre concrete slab-on-grade masonry building. Current site features are shown on **Figure 3.**

The adjacent parcel to the northwest—King County Tax Parcel 7666201980 at 921 Elliott Ave. W—is occupied by Greg Thompson Productions, which designs and creates stage, screen, and studio sets for Hollywood, Broadway, and Las Vegas productions. This parcel (herein referred to as the GTP parcel) is also owned by Mr. Ritt. The GTE parcel is 27,770 sf (0.64 acre) in size and contains three wood-frame structures—10,800, 2,310, and 1,800 sf in size—that are used as office, storage, and warehouse facilities. Open areas between the buildings are asphalt and concrete-paved and contain small storage sheds.

Access and parking for LeatherCare are on W Roy Street, a dead-end road that bounds the southeast side of the LeatherCare parcel. LeatherCare has a use permit with the City of Seattle for part of W Roy Street for parking and storage.

2.3 Surrounding Area Description and Land Use

Solid wooden and chain link fencing bound the site to the west, beyond which are several Burlington Northern Santa Fe Railroad (BNSF) lines (**Figure 2**). A large grain depot is located on the BNSF property between the railroad tracks and Elliott Bay.

To the southeast beyond W Roy Street is a property recently under redevelopment by Elliott Holding. This planned development includes two four-story commercial buildings, a plaza, and an underground parking structure beneath the entire complex

(ENTRIX, 2007). We understand that the building was substantially completed on or around August 2009.

Other surrounding businesses to the east across Elliott Avenue and to the north are commercial in nature, none of which have been found to be of concern with respect to the site.

2.4 Investigation Area

To help define the site and determine the plume boundaries, CDM completed investigations on the LC/GTP parcels and W Roy Street, the Elliott Holding property, and the BNSF property. Collectively, these areas are referred to as the "Investigation Area" in this report.

2.5 Investigation Area History

The Investigation Area was originally tidelands, and Elliott Bay bordered Elliott Avenue W. Filling occurred from approximately 1910 to the early 1920s. Railroad lines constructed on trestles were in place prior to the filling. The following paragraphs provide historical information on the site and Elliott Holding property. This information is largely summarized from CDM's July 25, 2006 report entitled *"Contamination Assessment, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington."*

2.5.1 LC and GTP Parcels

The LC parcel was developed about 1924 with an apple product (cider) manufacturing factory and a dwelling. Historical data imply that the dwelling may have been occupied by a seamstress. The factory contained apple processing (paring, grating) and cold storage facilities. Several above-ground tanks (ASTs) used in cider production were located on the parcel.

American Conserving occupied the LC parcel from approximately 1938 to 1985, when LeatherCare purchased the property. LeatherCare is a retail and wholesale dry cleaning facility. LeatherCare remodeled the facility, including filling many of the concrete troughs in the floor that had been used to convey apples and water throughout the factory. Some of these concrete troughs are still used to convey wastewater to sumps, where it is pumped into the sewerline on Elliott Ave. W.

LeatherCare initially used PCE as a dry cleaning solvent. PCE use was discontinued in phases beginning in March 2000, when the PCE machine for leather was replaced. The replacement of PCE dry cleaning machines for regular clothing began in September 2003 and the conversion was completed in October 2005, when the last of the PCE machines were replaced.

The buildings on the GTP parcel were constructed at varying times. The current office building on the property, constructed in about 1926, was originally occupied by the Mars Port Building Company. The two other existing buildings appear to have been constructed between 1977 and 1985, possibly for use by the occupants in the 1926-vintage office building.

Over the years, the GTP parcel was occupied by a variety of building contractors. Sometimes there were multiple tenants, including cabinet/furniture manufacturers (1950-1970), NW Stone Products (1953-1958), a vinyl siding supplier (1965-1970), an elevator repair company (1973 - 1980), and then NW Auto Sound. Greg Thompson Productions has occupied the property since 1990.

2.5.2 Elliott Holding Property

The Elliott Holding property was previously owned and occupied by Darigold/West Farm Foods (Darigold). Elliott Holding purchased the property in July 2006. At that time, a large asphalt-paved parking area ("north parking lot") for Darigold employees was located immediately to the southeast of W Roy Street. The Darigold north parking lot was surrounded by chain link fencing and accessed by a gated entrance on W Roy Street. To the southeast of the north parking lot, beyond a concrete block wall, were the Darigold building and a "central parking lot." These historical features are shown on **Figure 4**.

The Darigold north parking lot historically had addresses of 669, 675, 711, and 717 Elliott Avenue W. The earliest known development was Pecks Wood & Coal Company (Pecks), which was addressed as 717 Elliott Avenue W. Pecks operated on the property between approximately 1921 and 1953.

Figure 4 shows the layout of buildings occupied by Pecks based on 1936 and 1946 aerial photographs. The buildings associated with Pecks' operations were concentrated in the northern half of the Darigold north parking lot, but several buildings were lined up along the edge of W Roy Street. According to a report by ENTRIX, Inc. (2001a), the Pecks facility included an 18-ton coal truck scale, two 6,500-gallon fuel ASTs and two 550-gallon underground storage tanks (USTs).

According to Sanborn maps, there was a "grease shed" located approximately midway along the property that fronts Elliott Avenue W. A photograph in the tax assessor records shows a sign on the building that reads "Mobilgas" and "Mobil oil."

After Consolidated Dairy Products Company (CDPC)purchased the property in 1956, the firm attempted to sell the two 6,500-gallon fuel ASTs, which were reportedly removed from dry sand storage pits. The two USTs were decommissioned in place.

The approximate UST locations (based on the ENTRIX's figures) are shown on **Figure 4**. They apparently extended under the sidewalk along the eastern property line. CDPC tore down the buildings and constructed the parking lot in 1957.

Section 3
Physical Setting

This section summarizes the site physical conditions, including the topography, geology, and hydrogeology. The information is based on RI subsurface investigations conducted by CDM, our review of logs of borings drilled on the former Darigold property (obtained from Darigold's legal counsel), and our review of Ecology's online well log database.

CDM's subsurface investigations were limited to the upper 15 ft. Although there have been numerous deeper subsurface investigations on the former Darigold property and in the general area, Ecology's online database of boring logs appears to be incomplete and CDM was provided only with the first page (30 ft) of boring logs for the former Darigold property. Therefore, interpretation of the subsurface lithology below the 30 ft depth could be made only from one boring log for the Elliott West Combined Sewer Overflow (CSO) Control facility located just to the south of the Elliott Holding property.

3.1 Topography

The elevation of the site and immediate area (i.e., Elliott Avenue W and the former Darigold property) ranges from approximately 13 to 20 feet above mean sea level (NAVD 88). The overall land surface in the area slopes downward from both east to west (Elliott Avenue W toward Elliott Bay) and south to north (from W Roy Street northward through the north end of the site).

The land surface sharply rises to the northeast from Elliott Ave. W up Queen Anne Hill, which reaches an elevation of about 450 feet within about one-third of a mile northeast of the site.

3.2 Site Area Geologic Conditions

The Investigation Area is located on fill that overlies filled tidelands. Fill materials may have been sluice-deposited, dump deposited, or dumped, and may consist of non-engineered fill, garbage, or debris (Galster and Laprade, 1991; ENTRIX, Inc., 2001a). Fill underlying the Investigation Area appears to be, for the most part, sluice deposited; however, there are areas where dump deposited fill soils are indicated, including along the railroad lines.

The area subsurface continues to be modified by redevelopment activities, including recent redevelopment of the adjacent former Darigold property. At least 20 feet of soil has been excavated from the entire Elliott Holding property to allow for subsurface parking.

Under the site, fill typically consists of approximately 2 to 4 feet of sandy gravel basecourse material, followed by fine to coarse-grained gray sand, which is interpreted to be sluice fill. The material typically contains sea shells interspersed with wood debris, organics, and interlayers of coarser and finer materials.

Tideflat sediments have been encountered at some site exploration locations at a depth just above 14 feet below ground surface (bgs) – the maximum depth explored (CDM, 2006a). Tideflat sediments consist of silty clay and clayey silt with occasional peat and sand lenses.

The structural and sluice fill varies between 8 and 15 ft thick, and possibly as much as 22 ft thick in some areas. The tideflat layer, a silt or sandy silt sediment, ranges between 2 and 5 ft thick when present. The tideflat layer is underlain by alluvial sediments consisting of sand with silt.

Alluvial sand sediments underlie the tideflat layer, below which are glaciolucustrine deposits and/or glacial till. Glaciolacustrine deposits (i.e., Lawton clay) consist of stiff dark gray clay. Glacial till consists of a very dense unsorted mixture of sand, silt and clay and contains interspersed gravel, rocks, and boulders.

The logs CDM reviewed indicate the top of Lawton clay layer occurs at depths between 19 and 30 ft bgs. Malcom Drilling Company reported that the top of the glacial till occurs at 40 to 57 ft bgs. According to the log of the deep boring drilled on the Elliott West CSO Control facility, the Lawton Clay appears to extend to approximately 50 ft bgs, where there is thin (7 ft) outwash sand unit followed by an approximately 37 ft glaciomarine drift deposit consisting of a clayey, silty, sandy gravel.

The glaciomarine drift is underlain by additional glaciolacustrine deposits to an unknown depth. The lower portion of glaciomarine drift deposit is apparently water bearing.

3.3 Site Area Hydrologic Conditions

Groundwater underlying the site and adjacent railroad occurs in the fill at approximately 1 to 8 ft bgs, with elevations ranging between approximately 7.7 and 12.2 ft. Because of the shallow depth to groundwater and the topographical difference of Elliott Avenue (which is higher in elevation), the water table underneath the LC building is essentially at the base of the concrete floor slab.

Historical water level measurements and groundwater elevations are provided in **Table 1**. The maximum seasonal water level variation observed is approximately 1.5 ft. The groundwater does not appear to be tidally influenced. The overall direction of groundwater flow in the Investigation Area is expected to be westerly with a generally flat gradient.

Prior to redevelopment of the former Darigold property, a groundwater divide occurred under W Roy Street and the Darigold north parking lot. This divide was apparently caused by groundwater flow coming down from the hillside where W Mercer Street enters Elliott Avenue W.

At W Roy Street, the groundwater topography is essentially flat with a westerly component. In the area underlying the LC and GTP parcels, the groundwater flow direction is toward the north—sometimes with a northwesterly or northeasterly component.

A measurable southerly gradient was observed at the south end of the Darigold north parking lot. In addition, there appeared to be a discharge that was causing the gradient to swing toward the southeast in the central parking area near the entrance to the Darigold building on Elliott Avenue W. **Figures 5a** through **5c** show the potentiometric surface of the shallow groundwater on May 10, 2006; September 5, 2006; and February 12, 2007.

Due to construction on the Elliott Holding property, groundwater level measurements have been limited to the site since June 2007. The two wells located on the southern edge of W Roy Street (LC4 and LC5) were destroyed during construction on the Elliott Holding property in early 2008, so there are no groundwater data for one or both of these wells throughout 2008 . LC4 and LC5 were reinstalled in March 2009.

Figures 5d through **5m** show the groundwater potentiometric surfaces during quarterly sampling conducted between June 2007 and September 2009. The northerly gradient under the LC and GTP parcels has been consistent throughout this time period. The gradient in W Roy Street continues to be very flat with a slight westerly gradient.

Section 4
Remedial Investigation Findings

This section summarizes the results of the investigations that were completed for the LeatherCare and former Darigold properties. The investigations were conducted to define the nature and extent of cVOC and hydrocarbon contamination on the LC and (currently) Elliott Holding properties, respectively. Hydrocarbon contamination has been known and investigated on the former Darigold property years before cVOC contamination was identified.

4.1 Investigations and Remedial Actions Completed

4.1.1 Elliott Holding (Former Darigold) Property

Remedial activities for petroleum hydrocarbon releases on the Elliott Holding (former Darigold) property have focused on potential contaminant sources, including the former Pecks fuel facility and USTs in the former Darigold central parking lot. In May 2001, ENTRIX completed a summary of environmental activities conducted since 1990. Subsequently, ENTRIX conducted a series of additional subsurface environmental investigations on the Elliott Holding property.

During a March 2001 subsurface investigation, ENTRIX identified the presence of low levels of cVOCs in a monitoring well located in the north parking lot (ENTRIX, 2001b). ENTRIX conducted additional investigations in 2003 and in December 2004, specifically to identify and delineate cVOCs in groundwater. The 2003 investigation involved collecting groundwater samples from 19 push probes located in the north end of the north parking lot (ENTRIX, 2003). The December 2004 investigation involved collecting groundwater samples from 121 push probe locations in W Roy Street and throughout the Elliott Holding property, including the north and central parking lots, under the building, and even a few within the south parking lot (ENTRIX, 2005).

The cVOCs detected during ENTRIX's investigations include the common dry cleaning solvent PCE and its degradation products trichloroethene (TCE), *cis*-1,2-dichloroethene (*c*-1,2-DCE), *trans*-1,2-dichloroethene (*t*-1,2-DCE), 1,1-dichloroethene (1,1-DCE), and vinyl chloride (VC). ENTRIX suspected that PCE had migrated from LeatherCare, resulting in cVOC contamination on the Elliott Holding property.

From 1990 to 2001, several interim remedial actions were conducted to address hydrocarbon contamination in the former Darigold north parking lot area adjacent to the LeatherCare site. However, these actions were largely unsuccessful. Ultimately, removal of hydrocarbons in soil and groundwater within the Elliott Holding property boundaries was completed, or substantially completed, in conjunction with soil excavation and dewatering to allow for the construction of subgrade parking.

4.1.2 LeatherCare Property

In 2006, LeatherCare retained CDM to investigate the nature and extent of contamination originating from former use of PCE as a dry cleaning solvent. CDM completed a series of investigations and interim remedial actions. These are summarized below.

- In May 2006, CDM installed and sampled nine monitoring wells on the LC and GTP parcels and in W Roy Street (wells LC1 through LC6 and GT1 through GT3). Nine existing wells on the Elliott Holding property (MW1 through MW8 and MW12) were also sampled (CDM, 2006a).
- On March 16, 2007, CDM oversaw the cleaning of all catch basins, sumps, and drain lines at the LeatherCare parcel (CDM, 2007a).
- In August 2007, CDM removed and replaced one catch basin located adjacent to the LeatherCare building. The catch basin was replaced because sampling conducted as a follow-up to the cleaning determined that cVOCs were continuing to leach from the concrete basin. At the time of the replacement, approximately 1 cubic yard of soil was removed. Due to access constraints (natural gas line and the building footing), residual PCE in soils was treated in situ using potassium permanganate as a chemical oxidant prior to replacing the catch basin and backfilling (CDM, 2007b).
- In January/February 2009, CDM determined the limits of the cVOC groundwater plume to the west by installing and sampling three groundwater monitoring wells (LC7 through LC9) on the adjacent BNSF railroad property (CDM, 2009a).
- CDM conducted two groundwater monitoring rounds in 2006 and has conducted quarterly groundwater monitoring throughout 2007, 2008, and 2009 (CDM, 2006a-b; CDM, 2007c-e; CDM, 2008a-c; CDM, 2009b-e). Besides the site, CDM conducted groundwater monitoring on the Elliott Holding property during the first three sampling rounds. This monitoring ceased after redevelopment activities were initiated.

4.2 Cleanup Levels

Cleanup levels are developed from an evaluation of potential receptors and exposure routes. Receptors may include humans, the terrestrial ecological environment (e.g., plants, animals, soil biota), and the aquatic environment (e.g., benthic and pelagic organisms, and fish). Exposures to contaminants may occur by the following routes: 1) direct contact (e.g., contact on skin), 2) ingestion/uptake (e.g., soil, groundwater, food chain), and 3) inhalation. Exposure can only occur where there is a complete pathway. For example, contamination located under a building is not accessible to plants or ground feeding birds and the exposure pathway is incomplete.

The following sections evaluate potential receptors and associated cleanup levels for the first two exposure routes (direct contact, ingestion/uptake). The inhalation route is evaluated and discussed in Section 7.1.1.3 and determined that the cVOC plume does not pose an unacceptable risk to human health (potential receptor). Potential human health exposures are also further evaluated in section 7.1.1.

4.2.1 Human Health

MTCA provides three approaches for determining human health-based cleanup levels: Methods A, B, and C as described below.

- Method A provides a simplified approach for routine cleanup actions using tabulated cleanup levels. Method A cleanup levels are at least as stringent as applicable state and federal laws—typically these values are the same. Method A is appropriate for routine sites as defined in WAC 173-340-130, or sites that involve relatively few hazardous substances. Method A soil cleanup levels are available for both unrestricted land use and industrial sites. Remedial actions conducted using industrial cleanup levels are less stringent than those based on unrestricted land use, but have longer term implications, such as the placement of institutional controls.

- Method B allows for development of cleanup levels for specific compounds based on evaluation of applicable state and federal laws, groundwater and surface-water protection, and risk-based concentrations calculated using the risk equations specified in the regulations (WAC 173-340-750). These cleanup levels may be more or less stringent than the Method A unrestricted land use cleanup levels.

- Method C cleanup levels represent concentrations that are protective of human health and the environment for specific-site uses (i.e., industrial sites). Method C cleanup levels are established similarly to Method B; however, because site-specific conditions are such that the potential for exposure is lower, Method C cleanup levels are higher than Method B. Just as for Method A industrial soil cleanup levels, institutional controls are required for remedial actions conducted using Method C cleanup levels.

Leathercare has elected to target achievement of Method A unrestricted land use cleanup levels, even though less restrictive (i.e., higher) concentrations could be could be appropriate for the site for the following reasons:

- The site is zoned industrial- commercial and there are no residential developments (single family homes, duplexes, apartments, or condominiums) in the site vicinity.

- There are no private or public recreational facilities that would access this site.

- Groundwater does not serve as current or potential source of drinking water because of its hydraulic connection to a surface water body that is not a suitable source of domestic water.

There are Method A cleanup levels available for PCE and two of its degradation products , TCE (soil and groundwater), and VC (groundwater). These are the most significant (i.e., toxic) of the contaminants of concern at the site. Method B cleanup levels, as provided in Ecology's online Cleanup Levels and Risk Calculations (CLARC) tables, are used as a basis of comparison for the DCE compounds in soil and groundwater and VC in soil..

4.2.2 Terrestrial Ecological

MTCA requires that existing or potential threats to terrestrial plants or animals exposed to hazardous substances also be evaluated by determining whether the site is: 1) excluded from the terrestrial ecological evaluation (TEE), 2) qualified for a simplified TEE, or 3) must undergo a site-specific TEE. CDM determined that this site is excluded from the TEE and that only human-health based cleanup levels need be considered for the following reasons:

- The site and immediately surrounding area are commercial/industrial.
- All of the area of contamination is paved, covered by buildings, or occupied by railroad tracks.
- The only area of open space, approximately 120 feet to the northeast (Kinnear Park), is segregated from the site by a busy four-lane road. As such, it is not considered "contiguous."

4.2.3 Aquatic

The nearest surface water body is approximately 650 feet away. As will be shown in Section 4.3.3, VOCs have fully attenuated to nondetectable concentrations within a distance that is over 500 feet away from the shoreline. The data empirically show that aquatic organisms are protected and thus, no further consideration of the aquatic environment is necessary.

4.3 Contaminant Distribution

4.3.1 Soil

During CDM's initial investigation, one to two soil samples were collected from each borehole for chemical analysis. CDM attempted to collect soil samples in the vadose zone for cVOC analyses, but this was nearly impossible due to the shallow groundwater conditions. In most instances, groundwater occurred immediately beneath the building concrete slab or base course material.

Soil analytical data for samples collected from the boreholes are summarized in **Table 2.** Borehole locations are shown on **Figure 3.** Low concentrations of one or more cVOCs were detected in seven of the eight samples analyzed. PCE, which was detected in seven of the eight samples, ranged from 2.2 micrograms per kilogram (µg/kg) to 110 µg/kg. TCE was detected in five of the eight samples ranging from 1.5 µg/kg to 15 µg/kg. The cVOC *c*-1,2-DCE was detected in five of the eight samples ranging from 3.4 µg/kg to 190 µg/kg. The compound *t*-1,2-DCE was detected in one sample at 9.4 µg/kg. Vinyl chloride was detected in two samples at 1.5 µg/kg and 2 µg/kg.

Table 2 also summarizes soil data collected after the catch basin located adjacent to the south side of the building was removed and replaced. One of these samples contained 540 µg/kg PCE. After chemical oxidation treatment, this area fell well below the Method A cleanup level at 12 µg/kg. In the remaining three samples, PCE concentrations ranged from 1.4 to 30 µg/kg TCE concentrations from <1.1 to 25 µg/kg, and *c*-1,2-DCE concentrations from <1.1 to 38 µg/kg; *trans*-1,2-DCE, 1,1-DCE, and vinyl chloride were not detected.

PCE exceeded the Method A cleanup level in borehole LC1, located immediately next to the sump inside the building. PCE also exceeded the Method A cleanup level in one of the catch basin samples. After chemical oxidation treatment, this area fell well below the Method A cleanup level at 12 µg/kg. No other soil cleanup levels were exceeded.

4.3.2 cVOCs in Groundwater

PCE and its degradation products detected in groundwater within the site are summarized below. Groundwater data are summarized in **Tables 3** (site) and **4** (Elliott Holding property). The most recent groundwater data for the site are shown on **Figure 6.**

Because cVOCs were not detected in wells on the BNSF property, groundwater analytical data are not discussed further for this property. Prior to redevelopment, low concentrations of cVOCs were detected on the former Darigold property and are discussed in Section 4.3.2.2. In the following sections, the cVOC data are presented in order of the successive degradation products of PCE. Degradation of PCE is discussed further in Section 5.1.

4.3.2.1 Site

PCE: Low concentrations of PCE have been detected at six of the nine monitoring wells on the site. Of the six wells where it has been detected, PCE has never exceeded the Method A cleanup level of 5 micrograms per liter (µg/L) in two of those wells, and has not exceeded the Method A cleanup level since 2006 in a third well. At a fourth location, (replacement well MW4R), PCE concentrations no longer exceed the Method A cleanup level based on three quarters of sampling.

PCE concentrations sometimes slightly exceed the Method A cleanup level in two wells, although during the most recent sampling round, PCE concentrations did not exceed the cleanup level in either well. The average concentration of PCE over the past year in those two wells is 5.0 µg/L in LC1 and 4.7 µg/L in LC3 (both of which do not exceed the Method A cleanup level). LC1 and LC3 are located under and adjacent to the LC building, respectively.

TCE: TCE has been detected in all of the site monitoring wells at one time. However, the Method A cleanup level of 5 µg/L for TCE has only been exceeded in two wells, LC1 and GT3. The concentration of TCE at LC1 (located next to the main sump inside the LC building) has not exceeded its Method A cleanup level during the three most recent sampling events; in addition, the average concentration over the past year is only 3.8 µg/L, which is less than the Method A cleanup level. The TCE concentration at GT3, immediately downgradient of LC1, has not exceeded the cleanup level since 2006.

***c*-1,2-DCE:** *c*-1,2-DCE occurs in all of the site monitoring wells, but has never exceeded its Method B cleanup level of 80 µg/L. Over the past year, c-1,2-DCE concentrations have ranged between 0.5 and 12 µg/L.

***t*-1,2-DCE:** *t*-1,2-DCE has been detected in seven out of the nine monitoring wells on the site, but has never exceeded its Method B cleanup level of 160 µg/L. Over the past year, *t*-1,2-DCE concentrations have ranged between 0.2 and 4.3 µg/L.

1,1-DCE: 1,1-DCE has been detected only once in one monitoring well. This was a concentration of 0.3 µg/L in GT3 in May 2006.

Vinyl Chloride: Vinyl chloride has been detected in all monitoring wells on the site, and is currently above the Method A cleanup level in seven of the nine site monitoring wells. VC has been detected only once (in September 2006) in the most downgradient well (GT1), below the Method A cleanup level of 0.2 µg/L. In LC6, on the east side of the property, VC has not exceeded the cleanup level since March 2008, and has not been detected since September 2008.

The greatest concentrations of VC have been observed in GT2 (downgradient of LC1 and GT3). In September 2006, the highest concentration of VC (35 µg/L) was observed at GT2. The average concentration of VC over the past year at GT2 has been 11.0 µg/L. It is notable that this well is the next upgradient well from GT1, where VC has not been detected since 2006. VC concentrations over the past year have averaged between 0.5 and 3.1 µg/L in the other six onsite monitoring wells.

4.3.2.2 Elliott Holding (Former Darigold) Property

Historical cVOC data for the former Darigold property are summarized in **Table 4**. These data show that very low concentrations of cVOCs were present in the north parking lot area. During the four quarterly sampling events before monitoring ceased (March 2006 to February 2007), the PCE concentration in only one of eight monitoring wells slightly exceeded the Method A cleanup level. TCE, c-1,2-DCE, t-1,2-DCE, and 1,1-DCE never exceeded their respective MTCA cleanup levels. Low concentrations of VC were present in six of the eight monitoring wells. The average VC concentrations in five of these wells ranged between 0.3 and 0.5 µg/L. One well, right next to the property line at W Roy Street, had an average VC concentration of 4 µg/L.

The data gathered by the former owner of the Darigold property and CDM demonstrated that at least as early as 2006 and continuing into 2007, the southern boundary of the cVOC plume, in particular vinyl chloride, was receding.

4.3.3 cVOC Plume Limits

Figure 6 shows CDM's interpretation of the current cVOC plume limits using the average cVOC concentrations over the past four quarterly sampling rounds. Use of the past year's worth of data was considered to be more appropriate than a single round of data because some cVOC concentrations fluctuate above and below their respective cleanup levels.

Currently, the PCE is so degraded that it is difficult to even ascertain the source area(s). We see a very limited PCE plume in the area of the main sump (near LC1), ending just beyond the southern side of the LeatherCare building. The highest VC concentrations are observed downgradient (northwest) of the main sump, although VC also appears to have migrated radially from the PCE plume as the PCE degraded.

4.3.4 cVOC Trends

CDM has tracked the trends of cVOC concentrations over time using the Mann-Kendall statistical test. The Mann-Kendall test indicates the presence or absence of a statistically significant increasing or decreasing trend in concentrations at a monitoring point. The results of the Mann-Kendall trend analysis through September 2009 are summarized in **Table 5**.

Decreasing VC concentration trends are noted at all of the wells. The probability values for a decreasing trend for VC at four of the eight wells—GT2, LC2, LC3, and LC6 (GT1 is not counted since VC is not detected)—are significant (i.e., $p \leq 0.1$).

Decreasing trends for *c*-1,2-DCE and *t*-1,2-DCE, are also noted at all wells. The probability values for these decreasing trends are significant for all wells except LC1 and LC4. A build-up of DCE concentrations is often observed at sites where conditions are not suitable for the natural degradation of this particular compound; however, these decreasing trends show that this build-up of DCE is not occurring Natural degradation on PCE and its degradation products continues to occur at the site.

The Mann-Kendall loses statistical robustness for PCE and TCE due to the lack of detections. Decreasing trends are generally noted; however, increasing trends are indicated for PCE at LC1 and LC3, but as referenced in section 4.3.2.1, neither of these wells exceed the cleanup level.. For TCE an increasing trend is indicated at LC5. PCE concentrations at LC1 and LC3 and TCE concentrations at LC1 have fluctuated around their respective Method A cleanup levels during the quarterly monitoring period from May 2006 to present. Since 2008, however, the trend has been decreasing in both LC1 and LC3 and current data show no exceedances of the Method A cleanup level. As for TCE in LC5, the probability that no real trend exists is nearly 50 percent, and the increasing trend does not appear relevant. TCE has never exceeded the Method A cleanup level at LC5.

4.4 Petroleum Hydrocarbons

4.4.1 Site

During initial monitoring rounds, groundwater was analyzed for petroleum hydrocarbons. In May 2006, a low concentration (0.32 milligrams per liter [mg/L]) of total petroleum hydrocarbons quantified as diesel (TPH-D) was detected in a monitoring well to the northwest of the LC building. Similarly, a low concentration of TPH-D (0.35 mg/L) was detected in LC5 and LC6 located in the southwest quarter of W Roy Street, which was adjacent to the Darigold hydrocarbon plume.

TPH-D was not detected in any site wells in September 2007, but was reported again in LC5 and LC6 at higher concentrations (0.42 and 0.76 mg/L, respectively) during the February 2007 sampling round. A week after the February 2007 sampling round, CDM attempted to duplicate these TPH-D concentrations at LC5 and LC5 by repurging the wells and analyzing a second set of groundwater samples. While the chromatograms for the original samples did not appear to contain naturally occurring organics, the second set of samples were run with a silica gel cleanup to remove these interferences, if any. TPH-D was not detected in either sample. TPH-D testing was subsequently dropped on the site.

4.4.2 Elliott Holding (Former Darigold) Property

TPH-D has historically been detected in all eight monitoring wells in the former Darigold north parking area. Free phase hydrocarbons, also referred to as light nonaqueous phase liquid (LNAPL), were routinely observed in two wells (MW3 and MW7). The extent of the LNAPL plume was impossible to ascertain because in most instances the well screens were below the top of the water column.

Reported TPH-D concentrations ranged as high as 209 mg/L (probably as a result of sampling water with LNAPL). The low flow sampling methods employed by CDM (ENTRIX historically used bailers) avoided capturing LNAPL. Dissolved TPH-D concentrations in samples collected by CDM ranged between 0.3 and 4.4 mg/L.

Historically, oil-range TPH (TPH-O) has been reported in six monitoring wells on the Elliott Holding property. In the year prior to Elliott Holding's property redevelopment, TPH-O was detected in three monitoring wells at concentrations ranging up to 0.77 mg/L TPH concentrations varied significantly from one sampling event to the next and higher concentrations did not necessarily correlate with the presence of LNAPL. These conditions were likely due to the relatively low solubility of this very old hydrocarbon plume as well as the sampling methods used at that time.

4.5 Conceptual Model

The concentrations of PCE and its degradation products detected in soil and groundwater are low and residual in nature. PCE concentrations are not high enough to indicate the presence of free phase product, otherwise known as dense nonaqueous phase liquid (DNAPL).

Figure 6 shows CDM's interpretation of the current vinyl chloride plume limits and summarizes the most recent (September 2009) groundwater data. PCE at the site is currently so degraded that it is difficult to even ascertain the original source area(s).

The contaminant profile across the site is indicative of small, incidental releases that may have occurred at several locations. For example, the low concentration of PCE detected in soil near a sump in the LeatherCare building may have been from residual PCE entrained in sediment that permeated the concrete matrix or through small fractures. Soil is saturated immediately beneath the building concrete slab and so any PCE that migrated through the concrete would be immediately solubilized.

A second possible source area could be a catch basin located adjacent to the building—this was roughly the route where hoses were brought in to fill the PCE machines. This catch basin could have caught any residual drips from hoses as they were pulled from the machines back to the truck. The tanker trucks were large and would have used the bulk of West Roy Street for ingress, egress, and turnaround.

Based on the overall low concentrations observed in soil and groundwater, the overall volume of these releases was probably only a few ounces of PCE.

Section 5
Evaluation of Intrinsic Biodegradation

CDM's July 25, 2006 *Contamination Assessment* presented our initial evaluation of the biological transformation of cVOCs and petroleum hydrocarbons in the Investigation Area. During this assessment, it was concluded that the 50- to 75-year-old hydrocarbon plume within the former Darigold north parking lot was recalcitrant to natural attenuation processes. The presence of free phase hydrocarbons, heavier end hydrocarbon products, and anaerobic conditions were all factors that contributed to the inhibition of hydrocarbon biodegradation.

Conversely, based on groundwater chemistry, degradation products present, and low concentrations of cVOCs, complete biodegradation of PCE was found to be occurring. Section 5.1 reviews the biodegradation pathways and processes of PCE and Section 5.2 provides a summary evaluation of PCE biodegradation at the site based on more than 3 years worth of monitoring data.

5.1 Biodegradation Processes of PCE

The primary degradation pathway for PCE is microbially mediated reductive dehalogenation, whereby its chlorine atoms are successively stripped off to form less chlorinated compounds. PCE is successively degraded to TCE, DCE, VC, ethene, and finally carbon dioxide as shown on **Figure 7**.

DCE occurs as three isomers: 1,1-DCE, *c*-1,2-DCE, and *t*-1,2-DCE. The *c*-1,2-DCE isomer is by far the most prevalent product of the degradation of PCE and TCE. The biodegradation pathways for PCE's degradation products can vary and include electron donor reactions (anaerobic oxidation and aerobic oxidation), electron acceptor reactions (reductive dehalogenation), and aerobic cometabolism (oxidation) as discussed below and shown on **Figure** 7.

5.1.1 Electron Donor Reactions (Anaerobic and Aerobic Oxidation)

Microbes need carbon to make new cellular components like proteins and enzymes, as well as for reproduction. This carbon can come from many sources, including sugars (i.e., glucose, molasses) and petroleum hydrocarbons.

Some microbes are able to use contaminant-containing carbon in the same manner, breaking down the contaminant molecule into its constituent parts and using the carbon for growth and reproduction. These carbon compounds are known as electron donors. For groundwater, contaminants that serve as electron donors during biodegradation, such as petroleum hydrocarbons, the availability of competing terminal electron acceptors (TEAs) affects the efficiency of contaminant biodegradation (Borden, 1994; Chapelle, et al., 1996). In a pristine aquifer, native organic carbon is used as an electron donor and dissolved oxygen (DO) is the first electron acceptor to be used (Wiedemeier et al., 1997). Where anthropogenic carbon (e.g., fuel hydrocarbons) is present, it also will be used as an electron donor. After the DO is consumed, anaerobic microorganisms use other electron acceptors as available in the following order of preference: nitrate, ferric iron, sulfate, and finally carbon dioxide (methanogenesis) (Wiedemeier et al., 1997). Each of these reactions creates successively stronger reducing environments.

Microorganisms are generally believed to be incapable of growth using PCE and TCE as a primary substrate (i.e., electron donor). However, under aerobic conditions and some anaerobic conditions, the less oxidized chlorinated compounds (e.g., DCE and VC) can be used as a primary substrate in biologically mediated oxidation reduction reactions. In this type of reaction, the facilitating microorganism obtains energy and organic carbon from the degraded chlorinated compound.

Bradley and Chapelle (1996) showed evidence of mineralization of VC under iron reducing conditions if there is sufficient bio-available ferric iron. VC has the greatest tendency to undergo oxidation, and rapid microbial degradation of VC (including mineralization) has been observed in aquifer samples under aerobic conditions (Chapelle et al., 2003).

Klier et al., (1998) and Bradley and Chapelle (1997) show mineralization of DCE to carbon dioxide under aerobic, Fe(III) reducing, and methanogenic conditions. While DCE has been shown to degrade aerobically, the bacteria that perform this process appear to be uncommon (Klier et al., 1999; Bradley and Chapelle, 2000; Coleman et al., 2002).

5.1.2 Electron Acceptor Reactions (Reductive Dechlorination)

Chloroethenes are relatively oxidized compounds due to the presence of electronegative chlorine atoms, and can act as electron acceptors in microbial metabolism (Vogel et al., 1987). In the presence of a suitable electron donor, hydrogen can replace a chlorine atom on a chlorinated ethene molecule (Chapelle et al., 2003). This microbially catalyzed process is called reductive dechlorination.

The tendency of chlorinated ethenes to undergo reductive dechlorination decreases with decreasing number of chlorine atoms (Chapelle et al., 2003). PCE readily undergoes reductive dechlorination to TCE, except in aerobic aquifers (Chapelle et al., 2003). Reductive dechlorination of TCE to *c*-1,2-DCE occurs under iron reducing (Fe[III]) conditions and in more strongly reducing environments. Reductive dechlorination of *c*-1,2-DCE to VC apparently requires at least sulfate-reducing conditions, but proceeds more readily in the more strongly reducing methanogenic environments (Chapelle et al., 2003).

Microorganisms that are able to grow using chloroethenes as sole terminal electron acceptors are collectively termed "halorespirers." Halorespirers capable of reducing PCE or TCE to DCE are relatively common (Chapelle et al., 2003). To date, only one type of bacteria, *Dehalococcoides spp.*, has been shown to completely degrade PCE to ethene (Maymo-Gatelle et al., 1997). Recent research has demonstrated that various strains of these bacteria have different affinities for using DCE and VC as electron acceptors. Some strains do not utilize chlorinated ethenes as electron acceptors at all.

5.1.3 Cometabolic Oxidation

Cometabolic oxidation of chloroethenes does not supply energy for microbial growth or metabolism. Rather, the responsible microorganisms contain nonspecific oxygenase enzymes that fortuitously oxidize chloroethenes to carbon dioxide, water, and chloride (Chapelle et al., 2003). A wide variety of aerobic microorganisms have been identified that can cometabolically oxidize chloroethenes, including methane, ammonia, propane, ethene, and VC oxidizers. Although cometabolic oxidation has generally not been considered a significant mechanism for intrinsic bioremediation of chloroethenes in groundwater, increasing evidence suggests that it might actually be fairly common, at slow rates (e.g., Sorenson et al., 2000; Wymore et al., 2006).

5.2 Evaluation of Onsite Biodegradation of cVOCs

Biodegradation causes measurable changes in groundwater chemistry. General patterns of geochemical changes within a plume area provide strong evidence that multiple mechanisms of biodegradation are occurring (Groundwater Services, Inc., 1997). In addition, certain environmental conditions are likely to be more conducive in supporting biodegradation processes (i.e., warmer versus colder temperatures).

During the initial May 2006 groundwater sampling, CDM evaluated parameters that indicate intrinsic biodegradation processes. Field measured parameters and dissolved gasses (methane, ethane, and ethene) during subsequent groundwater monitoring rounds have continued to provide data that support this evaluation. These data are summarized in **Tables 3** and **4.** The following sections summarize our findings.

5.2.1 Geochemical Parameters

Groundwater geochemical parameters generally indicate that groundwater conditions are conducive to contaminant biotransformation processes as discussed below.

- Groundwater pH values range from approximately 6. 1 to 7.5 standard units (su) (higher pH noted values during one sampling event may be an equipment calibration issue), within the optimal range for biological processes (i.e., 6 to 8 su).
- Temperature values in the wells sampled show significant seasonal variation. In the winter, temperatures have ranged from approximately 7.6 degrees Celsius (°C) to 13.6 °C, except under the building, where they are higher, typically not falling below 14.6 °C. Summertime temperatures are much higher, ranging between 18.7 °C and 23.1 °C. These higher temperatures, particularly the constant warmer temperatures under the building, are supportive of high metabolic activity.

- Total alkalinity concentrations ranged between 161 and 450 mg/L, which will support a moderate ability to buffer groundwater pH against changes that can inhibit intrinsic biodegradation processes.

- Oxidation Reduction Potential (ORP) values are typically in the negative range (as much as -214 millivolts [mV]), but are variable. Reductive dechlorination is supported by more negative ORP values. The only well where positive ORP values have frequently been observed is GT3.

5.2.2 Electron Acceptors (EA)

- Dissolved oxygen concentrations are generally less than 1.0 mg/L, and very often less than 0.5 mg/L, indicating that groundwater is usually under anaerobic conditions. DO concentrations over 1 mg/L are observed at times and may indicate transitory conditions of a fresh flush of water into the system.

- The metabolic byproduct of ferric iron reduction (ferrous iron) ranges between 0 and 1 mg/L in the groundwater, which indicates that biological ferric iron reduction is occurring. Vinyl chloride biodegradation by iron reduction is possible.

- Sulfate concentrations ranged from 40 to 89 mg/L. These values are not optimally low (<20 mg/L), but not high enough to stop reductive dechlorination from occurring. Biological sulfate reduction has occurred in at least parts of the site. Sulfate reduction was initially evident at LC2, which had exhibited a strong hydrogen sulfide odor.

- Methane, the metabolic byproduct of carbon reduction (e.g., carbon dioxide), ranges between 27 and 2,100 µg/L. The presence of methane at concentrations in excess of 100 µg/L indicates methanogenic conditions appropriate for reductive dechlorination of VC to ethene. Methane concentrations are fairly constant at some wells and quite variable at others. For example, methane concentrations ranged between 100 and 200 µg/L at GT1, but between 100 and 2,100 µg/L at GT2. Methane has been observed at 100 µg/L or more in all wells.

5.2.3 Reductive Dehalogenation End Products

Ethene occurs at least sporadically at all groundwater sample locations on the site. Ethene concentrations roughly correlate with the presence and relative concentrations of VC. For example, ethene concentrations are consistently the highest at GT2 (up to 1.9 µg/L), where VC concentrations are also the highest. Ethene concentrations are typically not detected or very low at GT1 and LC6, where VC has not been detected.

Ethane is similarly detected in most groundwater samples. Ethane concentrations are not as high as ethene's, based on a maximum concentration of 0.49 µg/L. Reduction of vinyl chloride under strongly reducing conditions may contribute to the ethane concentrations. The highest ethane concentrations roughly correlate with the highest methane concentrations at each well, but not with the highest VC concentrations.

5.2.4 Biological Testing

The dechlorinating bacteria *Dehalococcoides spp.* was detected in six of the wells on the site and in one of the former Darigold monitoring wells (MW6, closest to the site). *Dehalococcoides spp.*was not detected in GT1, LC2, and LC4.

The pattern of occurrence for *Dehalococcoides spp.* is what would be predicted for an older source area emanating from under the east end of the LeatherCare building, diffusing out to the north and south and dissipating as it reached the (former) hydrocarbon plume on the Elliott Holding property. This finding is consistent with the fact that PCE has almost completely degraded to less chlorinated compounds throughout the site.

It is possible that the *Dehalococcoides spp.* observed are a remnant of a more substantial PCE plume in this area that has almost completely degraded. The remaining concentrations of cVOCs are sufficient only to support a small population of *Dehalococcoides spp.*, and the population will eventually completely die off as chlorinated solvents are further reduced.

Section 6
RI Conclusions

The results of this investigation identified PCE and its degradation products in soil and groundwater at the LeatherCare site. However, cVOC concentrations in soil and groundwater are very close to MTCA Method A cleanup levels. This investigation has not identified any PCE sources that would continue to contribute to the dissolved cVOC plume to any significant degree--PCE concentrations in soils are relatively low, LeatherCare stopped using PCE onsite over 4 years ago, the floor drain system has been cleaned of residual PCE-containing sediments, the catch basin on the south side of the LeatherCare building has been removed and soil below it removed and chemical oxidation treatment applied to the residual soil in place.

The cVOC plume limits have been defined and are demonstrably receding. The existing PCE and TCE plume (based on exceedance of MTCA Method A cleanup levels) is limited to a small area under the eastern portion of the LeatherCare building, extending approximately 20 ft beyond the building's southeastern edge. The VC plume ends within the site boundaries to the northeast and northwest. To the southeast, the VC plume is bounded at the southern edge of West Roy Street. The VC plume extends under, but not beyond, the BNSF railroad lines to the southwest. **Figure 6** shows the approximate cVOC plume limits.

Field monitoring data and chemical and biological testing conducted on soil and groundwater indicate that biological degradation of PCE and associated byproducts is nearly complete. Conditions at the site continue to be conducive for biological degradation of the remaining PCE and daughter products. All of the biological degradation products of PCE (TCE, DCE, VC, and ethene) are observed in groundwater, which empirically shows that complete degradation of PCE is occurring. Furthermore, statistical evaluation of groundwater data collected over time shows strong evidence that concentrations of PCE and all of its degradation products are declining.

Section 7
Remedial Objectives and Goals

This section identifies the Remedial Objectives (ROs) and Remedial Goals (RGs) for remediation of cVOCs in site soil and groundwater.

7.1 Establishing ROs and RGs

ROs are qualitative statements of what remediation is expected to achieve to protect human health and environmental resources. The ROs then serve as the foundation for setting quantitative RGs to address contamination within the site.

7.1.1 Potential Exposure Pathways

In order to develop ROs to guide remediation, an understanding of the exposure scenario that applies to a site's circumstances is necessary. Developing an exposure scenario involves identifying the potentially exposed population (e.g., site workers, occupants, plants, animals, soil biota) and all of the ways this population might be exposed to contaminants of concern.

To develop an exposure scenario for each potentially affected population, the many potential exposure pathways by which people, plants, animals, and other living organisms might be exposed are evaluated to identify those pathways in the site that could present an actual source of exposure. By definition, exposure pathways—the ways in which a population comes into contact with environmental contamination—must include a source of chemicals, a release and transport mechanism from the source to a population, and a route of exposure (e.g., inhalation, ingestion, dermal contact).

Only "complete" exposure pathways are considered in developing ROs. An exposure pathway is deemed "complete" if all elements—source, release and transport, route of exposure, and population—are present. If any element is missing, no exposure will occur. Furthermore, although a pathway is potentially complete, in many instances exposure is expected to be too small to be significant for human health impacts.

The following sections evaluate the potential exposure scenarios for humans. The terrestrial ecological environment is not considered to be at risk because the site plume is bounded and receding, the site area is fully developed with commercial and industrial land uses, and pavement, buildings, and railroad tracks cover the impacted area. These conditions result in negligible potential exposure by plants, animals, and soil biota.

7.1.1.1 Soil

None of the cVOCs detected in site soil have exceeded the most stringent direct exposure-based cleanup levels (Method B) at any location. The Method A soil cleanup level of 50 µg/kg for PCE, which is theoretically a groundwater-protection based concentration, was only exceeded at one location. The one sample that exceeded the Method A cleanup level was saturated. The most recent groundwater data at this location showed that the groundwater cleanup level for PCE was not exceeded.

Given these saturated conditions, once groundwater cleanup levels have been met, PCE concentrations in soils will empirically have met concentrations that are protective of groundwater. Given that the most recent PCE concentration in groundwater at this location was 2.3 µg/L, below the Method A cleanup level, it appears that the PCE concentration in soil here is already attenuated. Furthermore, the site is completely capped over by asphalt and concrete, so there is no direct exposure route to soils. Therefore, residual PCE in soils are not considered a concern from the aspect of human health risk from direct exposure.

7.1.1.2 Groundwater

Ingestion of contaminated groundwater or other exposure (e.g., vapor inhalation during showering) through an impacted groundwater production well is can be ruled out because there are no groundwater supply wells within a mile of the site. However, Ecology expects that groundwater cleanup levels be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. Ecology has determined that at most sites, use of groundwater as a drinking water source is the beneficial use requiring the highest quality of groundwater, and that exposure to hazardous substances through ingestion of drinking water and other domestic uses represents the reasonable maximum exposure (WAC 173-340-720). Reduction of groundwater concentrations to less than applicable cleanup levels, therefore, is an RO.

7.1.1.3 Soil Vapor

CDM conducted a screening analysis of soil gas and ambient air equilibrium concentrations for the LC facility. A copy of this screening analysis is included in **Appendix A.**

Based on the results of this assessment, vapor concentrations emanating from the cVOC plume do not pose an unacceptable risk to human health at LeatherCare. Using groundwater as the most likely source of contamination, there were no indoor exceedances above EPA Target Air Concentrations or the CLARC Method B screening levels for both non-carcinogenic and carcinogenic risks. In addition, it should be noted that these estimated indoor vapor concentrations are significantly below the Occupational Safety and Health Administrations (OSHA) permissible exposure limit (PEL) for PCE.

7.1.1.4 Construction Workers

No future redevelopment activities are planned for the site and not within the projected timeframe for full remediation of the site.

7.1.2 Media of Concern

This FFS focuses on groundwater as the media of concern. The cVOC concentrations in soil do not exceed cleanup levels based on direct contact, and the residual concentrations in soil will inherently decline to levels that are protective of groundwater as groundwater cleanup is achieved.

7.1.3 Identification of Remedial Objectives

The remedial objective of this FFS is restoration of the impacted groundwater.

7.2 Proposed Remedial Goals

RGs are quantitative expressions of contaminant concentrations that are used in this FFS to identify areas where remediation is needed, to provide an initial indication of the amount of reduction of contamination needed, and to guide the selection of remedial actions appropriate to meet the desired reduction.

The overall goals for this site are to:

- Protect human health and the environment.
- Comply with all applicable regulations.
- Obtain a "No Further Action" status for the site.

To meet these goals, the remedial action will be implemented with the intent to reduce cVOC concentrations below applicable MTCA Method A cleanup levels.

The point of compliance for groundwater is the point(s) where groundwater cleanup levels must be attained. MTCA specifies that groundwater cleanup levels shall be attained from the point of compliance to the outer boundary of the hazardous substance plume (WAC 173-340-720(6)). The point of compliance for groundwater will be throughout the site.

Section 8
Remedial Technologies Screening

CDM conducted a preliminary screening of several technologies for remediating groundwater at the site. Containment technologies that provide no destruction or removal of mass, such as slurry walls and capping, were not considered for the screening evaluation because the objective is to remediate the entire plume. Most *ex situ* technologies (i.e., soil removal) also were not evaluated because no substantial source area has been identified and such actions would be prohibitively expensive and highly disruptive to the existing businesses. The remediation technologies considered by CDM are listed in **Table 6**.

These technologies were qualitatively evaluated against the following criteria:

Effectiveness
Effectiveness is defined as the ability of the technology to remove or destroy contaminants based on anticipated performance in general (e.g., destruction removal efficiency), the proven track record for the technology, and site-specific considerations (e.g., hydrogeology, soil lithology, contaminant composition and concentration). Effectiveness also encompasses specific criteria including protection of human health and the environment, compliance with remedial objectives, long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, and short-term effectiveness.

Implementability
Implementability is defined as the ability of the technology to be designed, permitted, constructed, and operated at the site. Considerations included regulatory requirements, depth of contamination, available space and adjacent land uses, plume extent, and above-ground infrastructure both on- and offsite.

Cost
Cost was assessed qualitatively based on experience, and included consideration of capital, operating, and maintenance elements.

8.1 Remedial Technologies Screening and Evaluation

The remediation technologies considered potentially applicable for the site from the initial screening evaluation (**Table 6**) are further discussed and evaluated below. Remedial technologies passing this secondary screening were developed into remedial alternatives for the site, which are further discussed in Section 7.

8.1.1 Monitored Natural Attenuation

For this site, monitored natural attenuation (MNA) would rely on natural processes to reduce contaminant concentrations to levels that are below at or below their respective MTCA Method A, or where applicable MTCA Method B, cleanup levels.

MNA includes a number of processes, including dilution, volatilization, dispersion, retardation, and chemical or biological degradation or transformation.

Biodegradation is typically the most effective natural attenuation process for removing contaminant mass from groundwater. At this site, there are multiple lines of evidence suggesting that biodegradation is occurring. Conditions in the groundwater are generally suitable for reductive dechlorination to occur as evidenced by low concentrations of dissolved oxygen, generally low oxidation-reduction potential, predominantly sulfate-reducing conditions, presence of methane, and presence of the dechlorinating bacteria *Dehalococcoides spp*. Further evidence of biodegradation at the site is evidenced by the presence of all of the daughter products of PCE, as well as the final non-toxic degradation product, ethene.

MNA is not suitable for sites where there is occurrence of DNAPL, which is not the case at this site. Given the lack of DNAPL, low part per billion concentrations of dissolved cVOCs throughout the site, the absence of potential sensitive receptors, and multiple lines of evidence that biodegradation is occurring, MNA was retained for further consideration as a remedial alternative for the site.

8.1.2 Groundwater Extraction

Groundwater extraction is a commonly used technology used for hydraulic containment/treatment of contaminant plumes. Vertical wells, horizontal wells, and interceptor drains are all potential options for groundwater recovery at the site.

A vertical well system would be comprised of a series of individual vertical extraction wells that are connected to a treatment system prior to discharge or reinjection by a network of process piping. A horizontal well system consists of perforated or screened piping installed above the top of an aquitard. One horizontal well typically has a much greater screened area than a vertical well and, in some cases, can be serviced by a single pump.

Interceptor drains consist of perforated pipe installed in the base of a trench that ends at the top of the aquitard. The trench is backfilled with porous media to collect contaminated water for extraction. Further site-specific hydrologic investigation (i.e., pumping tests and running a 2-D groundwater flow model) would be required prior to designing and pilot testing a groundwater extraction system.

Unfortunately, while in the past groundwater extraction was a commonly employed remedial technology, treatment has seldom resulted in complete remediation of groundwater contaminant plumes and in most instances has proved to be a very costly technology. Currently, groundwater extraction is considered to be more of a hydraulic containment technology as opposed to a remediation technology. Most often, contaminant concentrations decrease until they are in equilibrium with residual contaminants, or concentrations decrease to less than analytical detection levels until the system is turned off. After a short time without groundwater extraction, however, concentrations typically increase.

In addition, the presence of site structures and underground infrastructure (i.e., utilities) would prove challenging for the installation of a system that would provide complete capture of the plume. Finally, these systems are high maintenance and very often are non-operational more than they are operational. For these reasons, this technology was eliminated from further consideration.

8.1.3 Enhanced Anaerobic Bioremediation

Enhanced anaerobic bioremediation (EAB) is a groundwater remedial technology designed to facilitate the *in situ* biological destruction of cVOCs over a wide range of concentrations in groundwater. EAB involves injecting electron donor, nutrients, and potentially microorganisms (i.e., bioaugmentation) into the subsurface to stimulate reductive dechlorination of dissolved chlorinated VOCs to non-toxic ethene. These reactions are in part dependent on the presence of the bacterium *Dehalococcoides ethenogenes,* which is known to reductively dechlorinate vinyl chloride to ethene.

EAB offers several benefits in that it requires no infrastructure (i.e., no underground piping conveyance system and no semi-permanent treatment system) and generates no waste (i.e., there is no treated water to be disposed of and no waste soil is generated from well or trench installation). Also, it can be implemented on a limited scale to target areas where there are higher cVOC concentrations.

Biodegradation is occurring and studies to date have not identified any obvious limiting factors to natural attenuation processes at the site or demonstrated that EAB could significantly enhance the destruction of cVOCs over and above the natural conditions already in place. Commonly, c-1,2-DCE concentrations build up when complete attenuation of PCE is not occurring, and this is not observed. In addition, *Dehalococcoide spp.* has been identified at the site.

Still, the addition of an electron donor, and possibly nutrients, may speed up the already naturally occurring processes. Thus, this technology was retained for further consideration.

8.1.4 In Situ Chemical Oxidation

In situ chemical oxidation (ISCO) involves introducing chemical oxidants into the subsurface to destroy organic contaminants in soil and groundwater. A number of factors affect the performance of this technology—in particular, the ability to uniformly deliver an effective dose of the oxidant to contaminants in the subsurface target zone. Oxidant demand of the soil, type of contamination present, and choice of oxidant all affect the performance of this technology.

Typically, several applications of the oxidant are required to achieve cleanup levels. Potentially applicable oxidants for PCE, TCE, *c*-1,2-DCE, and VC include permanganate, persulfate, Fenton's reagent (i.e., iron-catalyzed hydrogen peroxide), and ozone.

ISCO offers similar benefits to EAB in that it requires no permanent infrastructure, generates no waste, and can be implemented on a limited scale to target areas where there are higher cVOC concentrations. Similar to groundwater extraction, however, ISCO applications are often followed by a sharp decrease in contaminant concentrations followed by a gradual increase to an equilibrium concentration.

ISCO will also reduce the presently active natural attenuation reactions following implementation; however, natural attenuation would likely continue after a time. Nevertheless, the rapid effectiveness of ISCO necessitates its consideration and therefore this technology is retained for further consideration as a remedial alternative for the site.

8.1.5 Air Sparging

Air sparging involves injecting air into the groundwater, which can promote a phase transfer of contaminants from water to the air. In this technology, VOCs in contaminated groundwater are transferred from the water to air bubbles that rise to the soil vadose zone. The vapor phase contaminants are then drawn off with a soil vapor extraction system.

The technology's effectiveness is limited when soils are not relatively homogeneous and the saturated interval is not very thick. At this site, groundwater is relatively shallow and the vadose zone is too thin throughout most of the site to install a proper soil vapor extraction system. Air sparging was eliminated from further consideration for this reason.

8.1.6 Permeable Reactive Barrier

Permeable reactive barriers (PRBs) are *in situ* trenches that are backfilled with reactive iron or biological materials, which enhance the chemical or biological degradation or transformation of the contaminants as they move through the trench. Both iron and biological barrier systems would be primarily groundwater plume containment technologies rather than an active remediation system.

PRBs are not effective for controlling further migration of the contaminant plume (i.e., to eliminate offsite migration). This technology was not retained for the following reasons: 1) the plume has already migrated offsite; 2) there is no apparent continuing expansion of the plume; 3) the plume is documented to have reached equilibrium and already is receding; 4) given the very shallow (flat) gradient on the site, the PRB would remove a relatively low volume of contaminants compared to the cost of installing such a system; and, 5) it would not provide any faster removal of cVOCs onsite other than what is already occurring by natural attenuation. In addition, the most commonly implemented permeable reactive barrier wall, which is reactive iron, is not particularly effective in the treatment of VC.

Section 9 Remedial Action Alternatives

The remedial approach selected for a site can consist of one or a combination of technologies. Combined remedial technologies should complement each other. For example, volatilization technologies work well when implemented together; however, with the introduction of oxygen, volatilization is not compatible with anaerobic technologies. Whenever possible, remedial actions should also consider compatibility with existing and future site development plans, if any.

With these considerations in mind, CDM developed three remedial alternative approaches, those technologies that were not eliminated during the screening process. This section describes the remedial action alternatives, presents CDM's conceptual level cost estimates for each of the alternatives, and provides an overall evaluation of the alternatives.

9.1 Description of Remedial Action Alternatives

9.1.1 Alternative 1 - Monitored Natural Attenuation

This alternative involves MNA for remediation throughout the site. A groundwater monitoring program would be implemented throughout the site to track and evaluate progression of cVOC degradation over time. Should conditions change (i.e., decreasing concentrations cannot be documented), another, secondary alternative can be implemented.

MNA is anticipated to be a viable technology for this site based on CDM's evaluation of groundwater data. The aquifer is typically under reducing conditions, and reductive dechlorination is occurring as evidenced by the presence of TCE, *c*-1,2-DCE, and VC. There is no apparent "build up" of *c*-1,2-DCE and VC concentrations, suggesting that natural degradation processes for these two daughter products are being retarded. Other evidence of active MNA includes the presence of ethene and the dechlorinating bacteria *Dehalococcoides spp.*, a statistically significant decrease in VC concentration over time, and an apparent seasonally anoxic condition at some locations.

There are already 4 years worth of groundwater data; the past 3 years have been conducted on a quarterly basis. We believe this is sufficient data to support our recommendation to reduce the frequency of sampling. CDM recommends annual monitoring for the next 5 years. After this, wells with one or more exceedances of MTCA cleanup levels would be sampled every 5 years until MTCA cleanup levels are not exceeded. The progress of MNA would be re-evaluated as new data are generated.

9.1.2 Alternative 2 - EAB

Alternative 2 involves injecting an emulsified vegetable oil (EVO) to provide an additional food source, stimulate microbial activity, and thereby induce faster biodegradation of cVOCs. A treatability study and pilot study would be conducted to help determine if this alternative is appropriate and identify the appropriate injection rate.

For purposes of this FFS, we anticipate that the EVO would be direct-injected throughout the property using push probes. Follow-up groundwater monitoring would be required. For purposes of this FFS, we estimate that groundwater monitoring would be conducted quarterly for 1 year, and then annually for 3 years.

9.1.3 Alternative 3 -ISCO

Alternative 3 involves injecting a chemical oxidant to induce reductive dehalogenation of cVOCs. A treatability study and pilot study would be conducted to help determine the type of chemical oxidant and exact amount to be applied at each location. Several applications of chemical oxidant are typically required to achieve MTCA cleanup levels.

For purposes of this FFS, CDM assumes the chemical oxidant would be direct-injected throughout the property using push probes. At this time we consider permanganate to be an appropriate chemical oxidant for this site.

Groundwater monitoring following each injection event allows the effectiveness of the chemical oxidant to be evaluated and provides the appropriate timing for subsequent applications. CDM estimates two applications will be required, each followed by groundwater sampling and at least four quarterly sampling rounds to check for rebound over the longer term.

9.2 Conceptual Level Cost Estimates

This section discusses CDM's conceptual level cost estimates for the three remedial action alternatives. **Tables B1** through **B3** in **Appendix B** include detailed cost breakdowns of the three remedial action alternatives. Total estimated costs and some of the assumptions assigned to each alternative when calculating these costs are as follows:

Remedial Action Alternative 1 - MNA **$125,000**

Alternative 1 specific assumptions:

- Annual monitoring for 5 years (9 wells)
- Two monitoring rounds at 5-year intervals beyond the last annual monitoring round (9 wells).
- One additional confirmation sampling round, if required.

Remedial Action Alternative 2 - EAB $263,000

Alternative 2 specific assumptions:

- Small treatability study and an onsite pilot study with one injection point
- Emulsified edible oil is the injected food source
- Application across the site on approximately 20 to 25 ft centers.
- Seven groundwater monitoring rounds total, including four quarterly rounds, and three annual rounds, with nine wells monitored during each round.

Remedial Action Alternative 3 - ISCO $384,000

Alternative 3 specific assumptions:

- Small treatability study to determine chemical oxidant demand and onsite pilot study with one injection point.
- Permanganate is the chemical oxidant.
- Initial application across the site on approximately 20 to 25 ft centers.
- Second application, slightly reduced in scope.
- Six groundwater monitoring rounds (1 yr quarterly confirmation monitoring), nine wells monitored during each round.

Additional assumptions are presented in the cost estimates in **Appendix B.**

9.3 Evaluation of Remedial Action Alternatives

9.3.1 Method of Evaluation

MTCA requires that all cleanup action alternatives meet certain minimum requirements as listed below.

1. **Compliance with Cleanup Standards:** This is the ability of the alternative to meet or exceed cleanup levels established in accordance with MTCA requirements.

2. **Compliance with Applicable State and Federal Laws:** Cleanup actions must comply with existing state or federal laws. All applicable or relevant and appropriate requirements (ARARs) that may apply to implementation of the alternatives must be identified and satisfied. If a given law cannot be satisfied, it may be possible to obtain a waiver.

3. **Protecting Human Health and the Environment:** This is the degree to which existing risks are reduced, of the time required to reduce risks and attain cleanup

levels, of site impacts resulting from the alternative, of the degree to which the alternative may perform to a higher level than the cleanup standards, and of overall improvement of environmental quality.

4. **Compliance Monitoring:** The cleanup action must provide for monitoring to verify that the cleanup action achieves cleanup or other performance standards and that it remains effective over time.

5. **Using Permanent Solutions to the Maximum Extent Practicable:** Permanent solutions are actions in which cleanup standards can be met without further action being required, such as monitoring or institutional controls. To select the most practicable permanent solution from the alternatives requires conducting a disproportionate cost analysis. This analysis involves comparing the cost and benefits of alternatives and selecting the alternative whose incremental costs are not disproportionate to the incremental benefits.

6. **Providing a Reasonable Restoration Time Frame:** To meet this MTCA requirement, a cleanup action shall provide a reasonable restoration time considering several factors. These factors include potential risks posed to human health and the environment, practicability of achieving restoration in a shorter time, current use of the site, future use of the site, costs associated with using alternatives with shorter restoration times, and others.

In addition, CDM has added a seventh criteria for evaluation:

7. **Implementability.** This includes an evaluation regarding difficulty in implementing the remedial alternative considering site constraints. The alternatives considered are evaluated against these criteria in the following section.

9.3.2 Comparison Evaluation

1. **Compliance with Cleanup Standards:** All three alternatives have demonstrated the ability to meet MTCA Method A cleanup levels for the cVOCs at other sites.

2. **Compliance with Applicable State and Federal Laws:** MTCA, the primary ARAR for this site, should be met with any of the alternatives. Alternatives 2 and 3 will have additional ARARs to comply with, including permitting for the work within the road and registration with the Underground Injection Control (UIC) Program.

3. **Protecting Human Health and the Environment:** As has already been demonstrated, the low concentrations of residual cVOCs *in situ* do not pose a threat to human health or the environment because there are no complete exposure pathways (i.e., no risk from direct exposure, air intrusion, or drinking water).

Exposure to site contaminants of concern may occur during the implementation of all of the alternatives during groundwater sampling. This exposure is controlled by implementing a Health and Safety Plan (HASP) and through proper use of field procedures. However, given that all site contaminants are 2 to 4 orders of magnitude lower than current OSHA PELs[1], and the duration of exposure is much less than the 8 hour day that the PELs are based on, exposure does not equate to a human health risk.

ISCO or EAB creates a short term physical risk. Accidents, even catastrophic ones, have been known to happen during application of chemical oxidants. These accidents have resulted in injuries to personnel applying the chemicals and even others in the surrounding area. The use of heavy equipment during the application of ISCO or EAB also carries inherent risk from physical hazards. These risks are minimized through proper planning, engineering controls, and field procedures, as well as implementation of a HASP.

4. **Compliance Monitoring:** Compliance monitoring requirements would be met with a regular groundwater monitoring program for all three alternatives.

5. **Using Permanent Solutions to the Maximum Extent Practicable:** All three alternatives offer permanent solutions to meet the goal of achieving cleanup levels through the complete destruction of contaminants.

6. **Providing a Reasonable Restoration Time Frame:** The estimated restoration time for the three alternatives ranges from 3 to 13 years. If designed and applied correctly, Alternatives 2 and 3 would have the shortest restoration time frame, which is estimated at 3 to 5 years. MNA typically requires a longer time frame; at this site this technology is estimated to take between 3 and 13 years.

   Given that the cleanup level for VC is essentially the detection limit, the breakdown of any minute residual concentration of PCE could result in exceedances, however minor, of the VC cleanup level. There is simply no guarantee that ISCO or EAB would reduce all cVOC concentrations to below detection limits in soil and groundwater everywhere on the site, which is what may be required, for example, to reduce concentrations of VC from 0.4 µg/L to 0.2 µg/L or less. Therefore, final completion of site remediation may be the use of MNA, in all events.

7. **Implementability:** Alternative 1 is the easiest to implement; it requires no further infrastructure or disruption to the existing businesses. Alternatives 2 and 3 rely on the effective delivery of the product(s), navigating existing site structures and significant below grade infrastructure, and significant business disruption.

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[1] OSHA PEL for PCE is 25 parts per million (ppm);TCE is 50 ppm,; VC is 1 ppm. Parts per million is equivalent to 1,000 parts per billion (ppb). The units used throughout this report for the cVOCs are in terms of µg/L and µg/kg, which is essentially equivalent to ppb.

There would be several challenges to product delivery. First is the high groundwater table, which will limit the rate that any liquid product can be applied to the subsurface. Second, delivery of the product underneath the buildings would be challenging and imperfect. Third, work within the road would be highly disruptive to not only LeatherCare, but also the Elliott Holding property because the only entrance to the parking garage for two office buildings is from W Roy Street.

Section 10
Recommended Remedial Action

CDM recommends Alternative 1 - Monitored Natural Attenuation. Our recommendation is based on the following:

- Natural attenuation processes, including biological degradation, are actively occurring at this site.
- Concentrations of the contaminants of concern are so low that this technology can reduce concentrations to Method A cleanup levels within a reasonable time frame. There is no guarantee that other alternatives would result in a significantly reduced time frame to achieve site remediation.
- The low concentrations of residual cVOCs *in situ* do not pose a threat to human health or the environment because there are no complete exposure pathways.
- The cost for Alternatives 2 and 3 are unjustified considering that the time for cleanup of the cVOCs may be reduced by only a few years, if effective at all.
- Interim remedial actions have already been conducted at the site.

If monitoring indicates a need to expedite reduction of cVOCs in the area where the highest vinyl chloride concentration was detected to the north of the LC building, ISCO or EAB may be effective on a limited scale.

Section 11
References

11.1 Published Documents

Borden, R.C., 1994. Natural bioremediation of hydrocarbon contaminated groundwater, *in* Matthews, J.E., ed., Handbook of Bioremediation: Boca Raton Fla., Lewis Publishers. P. 177-199.

Bradley, P.M., and F.H. Chapelle. 1996. Anaerobic mineralization of vinyl chloride in Fe(III)-reducing aquifer sediments: Environ. Sci. Technol. v. 40 p. 2084-2086.

Bradley, P.M., and F.H. Chapelle. 1997. Kinetics of DCE and VC mineralization under methanogenic and Fe(III)-reducing conditions: Environ. Sci. Technol. v. 31: p. 2692-2696.

Bradley, P. M., and F. H. Chapelle, 2000. *Environmental Science and Technology, 34*:221-223.

Chapelle, F.H., P.M. Bradley, D.R. Lovley, and D.A. Vroblesky. 1996. Measuring rates of biodegradation in a contaminated aquifer using field and laboratory methods: Ground Water v. 34. p. 691-698.

Chapelle, Francis H., Mark A. Widdowson, J. Steven Brauner, Eduardo Mendez III, and Clifton C. Casey. 2003. Methodology for Estimating Times of Remediation Associated with Monitored Natural Attenuation. U.S. Geological Survey Water Resources Investigations Report 03-4057.

Coleman, N. V., T. E. Mattes, J. M. Gossett, and J. C. Spain, 2002. Applied and Environmental Microbiology, 68(6):2726-2730.

Ecology. 2001a. Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC. Washington State Department of Ecology Toxics Cleanup Program. Publication No. 94-06. 1994, Revised January 2003, Amended February 12, 2001.

Groundwater Services, Inc. 1997. BioScreen, Intrinsic Remediation Decision Support System. Developed for Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division.

Klier, N.J., R.J., West, and P.A. Donberg. 1998. Aerobic biodegradation of dichloroethylenes in surface and subsurface soils: Chemosphere.

Klier, N. J., R. J. West, and P. A. Donberg, 1999. *Chemosophere, 38*:1175-1188.

Maymo-Gatelle, X., Y-T Chien, J. M. Gossett, S.H. Zinder. 1997. Isolation of a bacterium that reductively dechlorinates tetrachloroethene to ethene. Science. V 276-p. 1568-1571.

Sorenson, K. S., L. N. Peterson, R. E. Hinchee, and R. L. Ely, 2000. "An Evaluation of Aerobic Trichloroethene Attenuation Using First-Order Rate Estimation." Bioremediation Journal, 4(4):337-357.

Vogel, T.M., C.S. Criddle, P.L, McCarty. 1987. Transformation of halogenated aliphatic compounds: Environmental Science and Technology. v. 1, p. 722-736. .

Wiedemeier, Todd H., Matthew A. Swanson, and David E. Moutoux of Parsons Engineering Science, Inc.; John T. Wilson and Donald H. Kampbell, U.S. Environmental Protection Agency, National Risk Management Research Laboratory, and; Jerry E. Hansen and Patrick Haas, U.S. Air Force Center for Environmental Excellence, Technology Transfer Division. 1997. Overview of the Technical Protocol for Natural Attenuation of Chlorinated Aliphatic Hydrocarbons in Ground Water Under Development for the U.S. Air Force Center for Environmental Excellence. In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water. EPA/540/R-97/504. May 1997.

Wymore, R. A., L. N. Peterson, L. O. Nelson, and K. S. Sorenson, Jr., 2006. "Monitored Natural Attenuation for an Aerobic TCE Plume." Radwaste Solutions, 13(2):50-57.

11.2 Other Documents and Information Sources

CDM. 2006a. Contamination Assessment, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. July 25. CDM Project No. 38057-47522.

CDM. 2006b. September 2006 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. November 3. CDM Project No. 38057-47522.

CDM. 2007a. Catch Basin, Sump, Drain Cleaning, LeatherCare, Inc., 901 Elliott Avenue W. Seattle, Washington. CDM Project No. 56498-59679. September 6.

CDM. 2007b. Catch Basin Replacement - LeatherCare, Inc., 901 Elliott Ave. Seattle, Washington. CDM Project No. 56498-59679. November 15.

CDM. 2007c. February 2007 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. CDM Project No. 38057-47522. June 15. .

CDM. 2007d. June 2007 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue West, Seattle, Washington . CDM Project No. 56498-59679. August 3.

CDM. 2007e. September 2007 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue West, Seattle, Washington. CDM Project No. 56498-59679. November 1.

CDM. 2008a. December 2007 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. March 11.

CDM. 2008b. March 2008 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. June 2.

CDM. 2008c. June 2008 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. September 12.

CDM. 2009a. Off-Site Investigation Report, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. CDM Project No. 56498-59679. March 31, 2009.

CDM. 2009b. September 2008 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. January 15.

CDM. 2009c. December 2008 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. February 25.

CDM. 2009d. March 2009 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. July 6.

CDM. 2009e. June/September 2009 Groundwater Monitoring, LeatherCare, Inc., 901/921 Elliott Avenue, Seattle, Washington. VCP# NW1805. CDM Project No. 56498-59679. October 27.

ENTRIX, Inc. 2001a. Environmental Data Summary From Previous Studies and Reports, WestFarm Foods Site. Prepared for WestFarm Foods. May 10.

ENTRIX, Inc. 2001b. WestFarm Foods Field Investigation Data Summary Report. Prepared for WestFarm Foods. May 10.

ENTRIX, Inc. 2003. WestFarm Foods 2003 Phase III Field Investigation Data Summary Report. Prepared for WestFarm Foods. November 6.

ENTRIX, Inc. 2005. LeatherCare Groundwater Investigation Data Summary Report. P prepared for WestFarm Foods. August 31, 2005.

ENTRIX, Inc. 2007. Cleanup Action Plan, Darigold Facility - VCP NW 1267, 635 Elliott Avenue, West, Seattle, WA. Prepared for Elliott Holding Company, L.L.C. July 2007.

ENTRIX, Inc. 2009. Letter. Revised Estimate of Remedial Costs to Address On-Site Petroleum Hydrocarbon and Chlorinated Compound Plume from LeatherCare During Redevelopment of 635 Elliott Avenue West Property. August 20, 2009.

Malcom Drilling Company. 2008. Soil Mixing Systems. http://www.malcolmdrilling.com/images/printable_pdfs/soilmixing.pdf

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Tables

Table 1
Groundwater Elevation Data
LeatherCare, Inc./RI and FS
Seattle, Washington

Monitoring Well I.D.	Date Measured	Time (hours)	Top of Casing Elevation [a] (feet)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (feet)
GT1	05/10/06	0912	12.74	1.84	10.90
	09/05/06	0955		2.46	10.28
	02/12/07	0918		1.69	11.05
	06/20/07	0857		2.13	10.61
	09/19/07	0904		2.46	10.28
	12/19/07	0940		1.20	11.54
	03/19/08	0908		1.80	10.94
	06/18/08	0825		1.95	10.79
	09/24/08	1005		2.22	10.52
	12/29/08	0758		1.49	11.25
	02/11/09	--		--	--
	03/25/09	0837		1.58	11.16
	06/29/09	0757		1.97	10.77
	09/09/09	1012		2.39	10.35
GT2	05/10/06	0910	12.45	1.23	11.22
	09/05/06	1000		1.99	10.46
	02/12/07	0920		1.09	11.36
	06/20/07	0853		2.56	9.89 NU
	09/19/07	0911		1.94	10.51
	12/19/07	0936		0.67	11.78
	03/19/08	0904		1.18	11.27
	06/18/08	0822		1.35	11.10
	09/24/08	1015		1.63	10.82
	12/29/08	0802		0.84	11.61
	02/11/09	--		--	--
	03/25/09	0850		0.95	11.50
	06/29/09	0759		1.35	11.10
	09/09/09	1010		1.78	10.67
GT3	05/10/06	0909	13.36	2.18	11.18
	09/05/06	1004		2.91	10.45
	02/12/07	0922		1.95	11.41
	06/20/07	0851		2.49	10.87
	09/19/07	0907		2.94	10.42
	12/19/07	0916		1.64	11.72
	03/19/08	0914		2.12	11.24
	06/18/08	0820		2.21	11.15
	09/24/08	1020		2.54	10.82
	12/29/08	0804		1.80	11.56
	02/11/09	--		--	--
	03/25/09	0820		1.87	11.49
	06/29/09	0803		2.24	11.12
	09/09/09	1006		2.79	10.57
LC1	05/10/06	0916	13.17	1.57	11.60
	09/05/06	1010		2.43	10.74
	02/12/07	0941		1.40	11.77
	06/20/07	0844		1.99	11.18
	09/19/07	0904		2.46	10.71
	12/19/07	0954		1.01	12.16
	03/19/08	0857		1.54	11.63
	06/18/08	0836		1.55	11.62
	09/24/08	1034		1.89	11.28
	12/29/08	0809		1.20	11.97
	02/11/09	--		--	--
	03/25/09	0811		1.28	11.89
	06/29/09	0753		1.63	11.54
	09/09/09	0956		2.10	11.07

Table 1
Groundwater Elevation Data
LeatherCare, Inc./RI and FS
Seattle, Washington

Monitoring Well I.D.	Date Measured	Time (hours)	Top of Casing Elevation [a] (feet)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (feet)
LC2	05/10/06	0919	13.41	2.01	11.40
	09/05/06	1012		2.74	10.67
	02/12/07	0943		1.80	11.61
	06/20/07			2.35	11.06
	09/19/07	0901		2.75	10.66
	12/19/07	0948		1.23	12.18
	03/19/08	0859		1.90	11.51
	06/18/08	0832		2.05	11.36
	09/24/08	1030		2.30	11.11
	12/29/08	0812		1.59	11.82
	02/11/09	--		--	--
	03/25/09	0807		1.87	11.54
	06/29/09	0750		2.13	11.28
	09/09/09	1001		2.57	10.84
LC3	05/10/06	0925	14.16	2.56	11.60
	09/05/06	1014		3.41	10.75
	02/12/07			2.37	11.79
	06/20/07	0837		2.98	11.18
	09/19/07	0853		3.48	10.68
	12/19/07	0906		1.99	12.17
	03/19/08	0847		2.55	11.61
	06/18/08	0839		2.58	11.58
	09/24/08	1038		2.84	11.32
	12/29/08	0815		2.21	11.95
	02/11/09	--		--	--
	03/25/09	0802		2.28	11.88
	06/29/09	0742		2.67	11.49
	09/09/09	0950		3.14	11.02
LC4	05/10/06	0921	14.72	3.16	11.56
	09/05/06	1026		3.99	10.73
	02/12/07			2.93	11.79
	06/20/07	0832		3.59	11.13
	09/19/07	0845		4.09	10.63
	12/19/07	0856		2.48	12.24
	03/19/08 [b]	--		--	--
	12/29/08	--		--	--
	02/11/09	--		--	--
LC4R	03/25/09	0957	14.77	3.03	11.74
	06/29/09	0840		3.45	11.32
	09/09/09	1050		3.85	10.92
LC5	05/10/06	0922	14.13	2.57	11.56
	09/05/06	1030		3.46	10.67
	02/12/07			2.37	11.76
	06/20/07	0834		2.97	11.16
	09/19/07	0858		3.48	10.65
	12/19/07	0901		1.89	12.24
	03/19/08	1114		2.49	11.64
	06/18/08 [b]	--		--	--
	12/29/08	--		--	--
	02/11/09	--		--	--
LC5R	03/25/09	1125	14.34	2.46	11.88
	06/29/09	1000		2.93	11.41
	09/09/09	1230		3.39	10.95

Table 1
Groundwater Elevation Data
LeatherCare, Inc./RI and FS
Seattle, Washington

Monitoring Well I.D.	Date Measured	Time (hours)	Top of Casing Elevation [a] (feet)	Depth to Groundwater (ft below TOC)	Groundwater Elevation (feet)
LC6	05/10/06	0928	16.85	5.26	11.59
	09/05/06	1022		6.10	10.75
	02/12/07	0933		5.03	11.82
	06/20/07	0839		5.68	11.17
	09/19/07	0850		6.19	10.66
	12/19/07	0911		4.67	12.18
	03/19/08	0852		5.24	11.61
	06/18/08	0844		5.22	11.63
	09/24/08	1042		5.55	11.30
	12/29/08	0819		4.89	11.96
	02/11/09	--		--	--
	03/25/09	0759		4.93	11.92
	06/29/09	0742		5.33	11.52
	09/09/09	0952		5.78	11.07
LC7	02/11/09	0912	15.34	7.64	7.70
LC8	02/11/09	0910	15.50	7.10	8.40
LC9	02/11/09	0909	15.27	6.67	8.60

Notes:

a) Top of casing elevations in feet relative to a brass monument located at the south corner of Elliot Avenue W. and W. Roy Street, marked as Elevation 19.78 feet. No verifiable City of Seattle datum could be found in the site area.
b) Well believed to have been destroyed by construction on adjacent property.
ft bgs - feet below ground surface.
-- not measured.
NU - Data not used; measurement believed to have been misread.
TOC - top of casing.

Table 2
Soil Analytical Summary
LeatherCare, Inc./RI and FS
Seattle, Washington

Analytes and Test Methods	Method A Cleanup Levels	Soil Boring Location, Sample Depths, and Date Sampled: GT1 6' 5/5/2006	GT2 2' 5/5/2006	LC1 2' 5/5/2006	LC1 8' 5/3/2006	LC2 4.5' 5/3/2006	LC3 2.5' 5/4/2006	LC4 6' 5/4/2006	LC5 2.5' 5/4/2006	LC5 8-11' 5/4/2006	LC6 2.5' 5/4/2006	LC6 8' 5/4/2006	Catch Basin, Sample Depths, and Date Sampled: North-2.2 26" 8/24/2007	East-2 24" 8/24/2007	South-32 32" 8/24/2007	2-CB-SW [c] 38" 9/20/2007
Detected Volatile Organic Compounds (EPA SW8260B) (µg/kg)																
Tetrachloroethene	50 [a]	<1.1	2.4	**110**	--	<86/4.0J	2.2	12	19	--	2.5	--	1.4	30	**540**	12
Trichloroethene	30 [a]	<1.1	14	15	--	<86/1.5J	<1.1	7.0	3.4	--	<1.2	--	1.6	6.5	25	<1.1
cis-1,2-Dichloroethene	800,000 [b]	<1.1	24	5.1	--	190/7.6J	<1.1	3.4	6.2	--	<1.2	--	5.8	5.5	38	<1.1
trans-1,2-Dichloroethene	1,600,000 [b]	<1.1	9.4	<1.1	--	<86/<1.2J	<1.1	<1.3	<1.1	--	<1.2	--	<1.0	<0.9	<1.1	<1.1
1,1-Dichloroethene	1,670 [b]	<1.1	<1.0	<1.1	--	<86/<1.2J	<1.1	<1.3	<1.1	--	<1.2	--	<1.0	<0.9	<1.1	<1.1
Vinyl Chloride	667 [b]	<1.1	<1.0	<1.1	--	<86/<1.2J	<1.1	2.0 M	1.5	--	<1.2	--	<1.0	<0.9	<1.1	<1.1
Metals (BAFeIII) (mg/kg)																
Bio-Available Ferric Iron		--	--	--	<5.0	--	--	--	--	1,350	--	<5.0	--	--	--	--
Bio-Available Manganese		--	--	--	<5.0	--	--	--	--	<5.0	--	<5.0	--	--	--	--
Oxidized Iron		--	--	--	238	--	--	--	--	<5.0	--	533	--	--	--	--
Total Organic Carbon (Plumb, 1981) (Percent)		0.129	--	0.150	--	0.230	--	0.136	--	--	--	--	--	--	--	--

Notes:

Bold and boxed values exceed Method A/B cleanup level.
a) Washington Administrative Code Chapter 173-340, Model Toxics Control Act Cleanup Regulation, Method A suggested soil cleanup level; promulgated August 15, 2001.
b) Method B cleanup level from Washington Dept. of Ecology's Cleanup Levels and Risk Calculations (CLARC) tables. Soil cleanup levels based on direct contact (ingestion); not to be used for protection of groundwater.
c) Sample 2-CB-SW is the followup sample for South-32 after chemical oxidation treatment. Therefore, concentrations in shaded sample have been removed.
µg/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram
J - value from sample out of holding time; estimated value
M - Estimated amount of analyte found and confirmed by analyst but with low GC/MS spectral match.
N/A - not applicable
-- not analyzed
< - analyte not detected at or greater than the listed concentration

Table 3

Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties

LeatherCare, Inc./RI and FS
Seattle, Washington

Analyte	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D. [b] GT1	GT2	GT3	LC1	LC2	LC3	LC4 [i]/LC4R	LC5 [i]/LC5R	LC6	LC7	LC8	LC9	Field Blank	Trip Blank
Field-Measured Parameters																
pH	05/06	N/A	7.23	7.03	7.10	7.05	7.43	6.95	7.18	6.95	6.99	--	--	--	--	--
	09/06		7.33	7.19	7.13	7.19	7.26	7.07	7.03	7.05	7.07	--	--	--	--	--
	02/07		6.77	6.64	6.57	6.46	6.42	6.62	6.06	6.43	6.70	--	--	--	--	--
	06/07		7.15	7.01	6.95	6.99	7.23	7.00	6.97	6.91	6.90	--	--	--	--	--
	09/07		7.11	7.00	6.88	7.00	7.16	6.92	6.83	6.88	6.91	--	--	--	--	--
	12/07		7.47	7.42	7.30	6.50	7.36	7.45	6.42	6.59	7.02	--	--	--	--	--
	03/08		7.75	7.77	7.51	7.67	8.04	8.36	--	8.42	8.19	--	--	--	--	--
	06/08		7.23	6.89	6.97	**	6.96	6.70	--	--	6.96	--	--	--	--	--
	09/08		**	6.59	6.55	6.62	6.72	6.58	--	--	6.66	--	--	--	--	--
	12/08		7.06	6.75	6.79	6.98	7.54	6.82	--	--	6.95	--	--	--	--	--
	02/09		--	--	--	--	--	--	--	--	--	**	**	**	--	--
	03/09		7.26	6.96	6.92	7.07	7.13	6.99	6.96	6.97	7.07	--	--	--	--	--
	06/09		7.44	7.18	7.16	7.27	7.07	7.18	7.37	7.25	7.19	--	--	--	--	--
	09/09		7.37	7.11	7.03	7.06	7.19	7.05	7.12	7.08	7.07	--	--	--	--	--
ORP [d] (mV)	05/06	N/A	-33	-27	-56	-72	-152	-33	-50	-82	-50	--	--	--	--	--
	09/06		-119	-97	-68	-113	-90	-71	-50	-107	-78	--	--	--	--	--
	02/07		-33	-2	17	-60	-32	56	80	-30	31	--	--	--	--	--
	06/07		-211	-171	-38	-61	-162	-183	-116	-214	-111	--	--	--	--	--
	09/07		-96	-95	-71	-125	-132	-83	-75	-126	-95	--	--	--	--	--
	12/07		**	**	**	**	**	**	**	**	**	--	--	--	--	--
	03/08		-54	-27	10	-28	-30	-59	--	-107	-43	--	--	--	--	--
	06/08		-57	-49	142	**	112	-17	--	--	-17	--	--	--	--	--
	09/08		--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/08		-52	-16	43	-22	40	-44	--	--	0.7	--	--	--	--	--
	02/09		--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/09		**	**	**	**	**	**	**	**	**	--	--	--	--	--
	06/09		-90	-78	13	-57	-78	-42	-92	-80	-50	--	--	--	--	--
	09/09		-148	-140	-73	-188	-115	-89	-130	-136	-103	--	--	--	--	--
Temperature (°C)	05/06	N/A	16.0	16.2	15.1	18.3	18.2	15.9	14.1	13.8	14.2	--	--	--	--	--
	09/06		20.0	21.3	20.8	23.1	22.6	22.6	22.2	22.5	20.6	--	--	--	--	--
	02/07		13.6	9.3	10.0	16.8	16.2	11.4	9.7	10.0	11.8	--	--	--	--	--
	06/07		17.8	20.2	18.7	20.7	20.0	19.3	18.6	18.0	17.6	--	--	--	--	--
	09/07		19.3	19.4	19.2	22.3	21.7	22.2	20.2	20.4	20.0	--	--	--	--	--
	12/07		11.9	8.8	9.3	17.3	15.5	11.6	12.3	11.4	12.6	--	--	--	--	--
	03/08		13.0	10.3	9.5	15.9	16.3	11.8	--	11.3	12.4	--	--	--	--	--
	06/08		16.1	17.0	17.2	18.3	19.8	16.4	--	--	16.3	--	--	--	--	--
	09/08		18.7	17.9	17.8	22.1	21.8	19.6	--	--	17.6	--	--	--	--	--
	12/08		11.2	7.6	6.9	14.6	15.0	9.8	--	--	11.5	--	--	--	--	--
	02/09		--	--	--	--	--	--	--	--	--	13.0	11.0	9.7	--	--
	03/09		13.0	9.0	9.0	14.6	16.5	10.9	8.7	9.0	10.5	--	--	--	--	--
	06/09		17.9	21.5	19.2	20.8	20.5	19.9	16.7	17.3	17.3	--	--	--	--	--
	09/09		19.3	18.4	19.0	22.2	21.4	20.1	17.8	18.2	19.3	--	--	--	--	--
Specific Conductivity (µS/cm)	05/06	N/A	1,243	1,283	1,264	1,190	1,183	1,345	1,360	1,322	1,281	--	--	--	--	--
	09/06		811	856	864	866	736	870	853	856	856	--	--	--	--	--
	02/07		831	971	915	951	519	1,020	496	795	948	--	--	--	--	--
	06/07		786	813	833	836	678	820	808	804	842	--	--	--	--	--
	09/07		808	844	879	873	622	841	737	824	828	--	--	--	--	--
	12/07		732	706	829	1,017	181	778	553	543	920	--	--	--	--	--
	03/08		637	915	926	928	518	902	--	114 [j]	970	--	--	--	--	--
	06/08		998	1,701	1,471	1,561	1,490	1,493	--	--	1,363	--	--	--	--	--

CDM

Table 3
Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties
LeatherCare, Inc./RI and FS
Seattle, Washington

Analyte	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D. [b]													
			GT1	GT2	GT3	LC1	LC2	LC3	LC4 [l]/LC4R	LC5 [l]/LC5R	LC6	LC7	LC8	LC9	Field Blank	Trip Blank
Specific Conductivity (µS/cm) (cont.)	09/08		774	1,236	798	1,318	963	1,269	--	--	1,353	--	--	--	--	--
	12/08		**	**	**	**	671	**	--	--	**				--	--
	02/09		--	--	--	--	--	--	--	--	--	836	1,090	1,828	--	--
	03/09		587	861	824	864	648	825	**	**	**	--	--	--	--	--
	06/09		748	1,006	991	993	875	995	856	914	1,007	--	--	--	--	--
	09/09		636	947	944	966	629	986	976	997	1,002	--	--	--	--	--
Dissolved Oxygen (mg/L)	05/06	N/A	0.70	0.34	0.70	0.24	0.40	0.42	0.43	0.33	0.39	--	--	--	--	--
	09/06		0.15	0.17	0.14	0.20	0.35	0.23	0.19	0.09	0.09	--	--	--	--	--
	02/07		0.31 [g]	0.13 [g]	-- [g]	-- [g]	-- [g]	1.18 [g]	1.14 [g]	0.14 [g]	0.28 [g]	--	--	--	--	--
	06/07		0.19	0.22	0.24	0.34	0.91	0.35	0.47	0.39	1.13	--	--	--	--	--
	09/07		0.41	0.34	0.27	0.24	0.25	0.58	0.78	0.55	0.58	--	--	--	--	--
	12/07		0.33	0.47	0.17	0.72	3.05	1.44	1.00	0.29	0.28	--	--	--	--	--
	03/08		0.34	0.34	1.28	0.31	1.12	0.44	--	0.37	0.34	--	--	--	--	--
	06/08		0.20	1.09	0.71	0.29	0.35	0.71	--	--	0.28	--	--	--	--	--
	09/08		1.32	1.12	1.06	0.08	0.84	1.36	--	--	1.34	--	--	--	--	--
	12/08		0.90	2.11	2.17	0.61	2.47	1.60	--	--	0.87	--	--	--	--	--
	02/09		--	--	--	--	--	--	--	--	--	4.74	4.73	8.05	--	--
	03/09		0.19	0.13	0.42	0.10	0.11	0.71	0.25	0.33	0.17	--	--	--	--	--
	06/09		0.23	0.13	0.28	0.15	0.14	0.27	0.52	0.33	0.21	--	--	--	--	--
	09/09		0.42	0.20	0.37	0.22	0.21	0.31	0.35	0.36	0.29	--	--	--	--	--
Turbidity (NTU)	05/06	N/A	1.76	0.83	0.66	5.76	62 [c]	1.05	1.79	2.82	2.01	--	--	--	--	--
	09/06		*	0.47	0.70	0.7	*	5.5	2.4	1.8	*	--	--	--	--	--
	02/07		3.1 [h]	0.0 [h]	>999 [h]	0.0 [h]	0.0 [h]	22.4 [h]	0.0 [h]	16.3 [h]	26 [h]	--	--	--	--	--
	06/07		0.7	1.1	2.2	0.9	1.9	2.6	1.8	0.2	3.8	--	--	--	--	--
	09/07	N/A	0.9	0.9	1.6	*	0.5	2.3	6.5	0.14	3.8	--	--	--	--	--
	12/07		--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/08		16.9	8.8	168 [k]	2.3	0.7	20.9	--	9.6	4.4	--	--	--	--	--
	06/08		0.7	1.8	34.5/227 [k]	0.5	0.0 [m]	1.1	--	--	-- [m]	--	--	--	--	--
	09/08		54.8 [h]	53.2 [h]	187 [h]	18.2 [h]	48.2 [h]	179 [h]	--	--	-- [h]	--	--	--	--	--
	12/08		2.90	39.6 [k]	10.29 [k]	0.0 [m]	0.0 [m]	-- [m]	--	--	--	--	--	--	--	--
	02/09		--	--	--	--	--	--	--	--	--	7.40	5.69	7.90	--	--
	03/09		0.0	0.0	0.0	0.0	0.0	0.2	9.3	1.5	0.0	--	--	--	--	--
	06/09		2.6	1.5	1.4	0.1	1.7	3.1	1.9	23	0.95	--	--	--	--	--
	09/09		4.2	2.1	1.3	1.2	0.93	0.87	0.98	0.92	1.1	--	--	--	--	--
Ferrous Iron (ppm)	05/06	N/A	0.1	0.2	0.2	0.5	0.3	0.3	0.2	1	0.5	--	--	--	--	--
	09/06		0.3	0.2	0.6	--	0.1	0.6	0.4	1	1	--	--	--	--	--
	02/07		0.4	0.6	0.3	0.6	--	0.2	0.1	1	0.4	--	--	--	--	--
	06/07		0.3	0.4	0.2	0.5	0	0.2	0.6	0.1	0.3	--	--	--	--	--
	09/07		0.2	0.3	0.2	0.4	0.2	0.4	0.6	0.8	0.8	--	--	--	--	--
	12/07		0.1	0	0	0.6	0	0.2	0.1	0.8	0.3	--	--	--	--	--
	03/08		0.3	0.8	0.4	0.4	0.1	0.4	--	0.8	0.4	--	--	--	--	--
	06/08		0.2	1	0	0.6	0	1	--	--	0.6	--	--	--	--	--
	09/08		--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/08		0.2	0.3	0.1	0.4	0	1	--	--	0.3	--	--	--	--	--
	02/09		--	--	--	--	--	--	--	--	--	--	--	--		
	03/09		--	0.4	--	--	--	0.2	--	--	--	--	--	--	--	--
	06/09		0.4	0.6	0	0.4	0.8	0.6	0.4	0.6	0.6	--	--	--	--	--
	09/09		0	0.4	0.2	0.6	0.8	0.6	1.0	0.6	0.6	--	--	--	--	--
Manganese (ppm)	06/07	N/A	0	0	0	0	0	0	0	0	0	--	--	--	--	--
Sulfide (ppm)	06/07	N/A	0	0	0	0	0	0	0	0	0	--	--	--	--	--

Table 3
Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties
LeatherCare, Inc./RI and FS
Seattle, Washington

Analyte	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D. [b]													
			GT1	GT2	GT3	LC1	LC2	LC3	LC4 [f]/LC4R	LC5 [f]/LC5R	LC6	LC7	LC8	LC9	Field Blank	Trip Blank
General Groundwater Chemistry																
Chloride (EPA Method 325.2) (mg/L)	05/06	N/A	7.4	7.9	16.5	20.5	8.8	16.1	6.8/6.7	14.0	17.5	--	--	--	--	--
Sulfate (EPA Method 375.2) (mg/L)	05/06	N/A	62.3	64.4	77.8	88.9	52.7	69.7	39.3/39.5	39.5	54.2	--	--	--	--	--
Chemical Oxygen Demand (EPA Method 410.4) (mg/L)	05/06	N/A	6.18	5.68	9.29	12.8	12.4	7.71	10.1/6.87	10.1	12.8	--	--	--	--	--
Alkalinity (SM 2320) (mg/L CaCO3)	05/06	N/A	336	406	358	368	309	398	233/233	372	401	--	--	--	--	--
Carbonate (SM 2320) (mg/L CaCO3)	05/06	N/A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0/<1.0	<1.0	<1.0	--	--	--	--	--
Bicarbonate (SM 2320) (mg/L CaCO3)	05/06	N/A	336	406	358	368	309	398	233/233	372	401	--	--	--	--	--
Hydroxide (SM 2320) (mg/L CaCO3)	05/06	N/A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0/<1.0	<1.0	<1.0	--	--	--	--	--
Dehalococcoides spp. **(QCPR)** [e]	05/06	N/A	-	+	+	+	-	+	-/-	+	+	--	--	--	--	--
Reductive Dechlorination End Products (µg/L)																
Methane	05/06	N/A	98	140	100	110	590	33	98/87	220	77	--	--	--	--	--
	09/06	N/A	160	1,400	140/130	94	310	28	130	170	92	--	--	--	--	--
	02/07	N/A	150	510	51/50	45	710	96	88	140	150	--	--	--	--	--
	06/07	N/A	150	200	110	46	870	24	100/140	310	99	--	--	--	--	--
	09/07	N/A	130	2,100	120	86	520	100	130/130	500	28	--	--	--	--	--
	12/07	N/A	110	100	91	51	58	16	94/99	530	360	--	--	--	--	--
	03/08	N/A	170	120	76/56	33	73	23	--	160	120	--	--	--	--	--
	06/08	N/A	180	170	27	110	20	140	--	--	370	--	--	--	--	--
	09/08	N/A	150	260	73	150	260	120	--	--	370	--	--	--	--	--
	12/08	N/A	200	110	34/33	200	40	86	--	--	450	--	--	--	--	--
	02/09	N/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/09	N/A	150	140	34/36	240	200	86	390	330	300	--	--	--	--	--
	06/09	N/A	160	230	140/150	260	340	110	430	220	400	--	--	--	--	--
	09/09	N/A	210	170	270/270	220	480	120	390	340	610					
Ethane	05/06	N/A	<12	<12	<12	<12	<12	<12	<12/<12	<12	<12	--	--	--	--	--
	09/06	N/A	0.49	0.34	0.05/0.045	0.24	0.22	0.04	0.11	0.21	0.097	--	--	--	--	--
	02/07	N/A	0.18	0.37	0.088/0.087	0.093	0.42	0.078	0.054	0.14	0.12	--	--	--	--	--
	06/07	N/A	0.24	0.30	0.054	0.034	0.32	0.033	0.10/0.11	0.21	0.088	--	--	--	--	--
	09/07	N/A	0.3	0.29	0.034	0.33	0.21	<0.025	0.052/0.052	0.22	<0.025	--	--	--	--	--
	12/07	N/A	0.22	0.15	0.059	0.091	<0.025	0.030	0.081/0.084	0.28	0.058	--	--	--	--	--
	03/08	N/A	0.098	0.23	0.052/0.045	0.040	0.038	0.026	--	0.16	0.065	--	--	--	--	--
	06/08	N/A	0.22	0.29	0.037	0.087	0.053	0.044	--	--	0.067	--	--	--	--	--
	09/08	N/A	0.18	0.27	0.068	0.11	0.073	0.064	--	--	0.11	--	--	--	--	--
	12/08	N/A	0.12	0.12	<0.025/0.028	0.13	<0.025	0.044	--	--	0.11	--	--	--	--	--
	02/09	N/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/09	N/A	0.096	0.17	0.032/0.034	0.14	0.037	0.048	0.240	0.14	0.092	--	--	--	--	--
	06/09	N/A	0.11	0.20	0.070/0.068	0.17	0.11	0.059	0.290	0.099	0.16	--	--	--	--	--
	09/09	N/A	0.22	0.15	0.12/0.15	0.17	0.15	0.089	0.250	0.14	0.20					

Table 3
Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties
LeatherCare, Inc./RI and FS
Seattle, Washington

Analyte	Date Sampled	Method A Cleanup Levels[a]	Monitoring Well I.D.[b]												Field Blank	Trip Blank
			GT1	GT2	GT3	LC1	LC2	LC3	LC4[i]/LC4R	LC5[i]/LC5R	LC6	LC7	LC8	LC9		
Ethene	05/06	N/A	<11	<11	<11	<11	<11	<11	<11/<11	<11	<11	--	--	--	--	--
	09/06	N/A	0.041	1.8	0.21/0.19	0.82	0.46	<0.025	0.05	0.31	<0.025	--	--	--	--	--
	02/07	N/A	0.031	1.2	0.079/0.072	0.034	0.92	0.035	0.046	0.21	0.046	--	--	--	--	--
	06/07	N/A	0.083	1.4	0.15	0.11	0.29	0.10	0.15/0.080	0.29	0.094	--	--	--	--	--
	09/07	N/A	<0.025	1.9	0.08	0.35	0.35	0.051	0.039/0.036	0.23	<0.025	--	--	--	--	--
	12/07	N/A	<0.025	0.81	0.51	0.027	<0.025	0.22	0.029/0.034	0.18	<0.025	--	--	--	--	--
	03/08	N/A	<0.025	0.9	0.16/0.13	0.028	<0.025	<0.025	--	0.12	<0.025	--	--	--	--	--
	06/08	N/A	<0.025	0.65	0.1	<0.025	0.079	<0.025	--	--	<0.025	--	--	--	--	--
	09/08	N/A	0.035	1.0	0.14	0.11	0.071	0.044	--	--	0.034	--	--	--	--	--
	12/08	N/A	<0.025	0.5	0.1/0.085	0.039	<0.025	<0.025	--	--	<0.025	--	--	--	--	--
	02/09	N/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/09	N/A	<0.025	0.51	0.066/0.070	<0.025	0.035	<0.025	0.072	0.12	<0.025	--	--	--	--	--
	06/09	N/A	<0.025	0.71	0.12/0.13	<0.025	0.072	0.026	0.15	0.19	0.026	--	--	--	--	--
	09/09	N/A	0.026	0.68	0.25/0.28	0.37	0.150	0.035	0.16	0.24	0.048					
<u>Petroleum Hydrocarbons (NWTPH-Dx) (mg/L)</u>												--	--	--		
Diesel	05/06	0.50	<0.25	0.32	<0.25	<0.25	<0.25	<0.25	<0.25/<0.25	0.35	0.35	--	--	--	--	--
	09/06	0.50	<0.25	<0.25	<0.25/<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--	--	--	--	--
	02/07	0.50	--	--	--	--	--	0.28	<0.25	0.42/<0.25 [i]	**0.76/<0.25** [i]	--	--	--	--	--
	02/09	0.50	--	--	--	--	--	--	--	--	--	<0.25	<0.25	<0.25	--	--
Motor Oil	05/06	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50/<0.50	<0.50	<0.50	--	--	--	--	--
	09/06	0.50	<0.50	<0.50	<0.50/0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--
	02/07	0.50	--	--	--	--	--	<0.50	<0.50	<0.50/<0.5 [i]	<0.50/<0.5 [i]	--	--	--	--	--
	02/09	0.50	--	--	--	--	--	--	--	--	--	<0.50	<0.50	<0.50	--	--

Table 3
Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties
LeatherCare, Inc./RI and FS
Seattle, Washington

Analyte	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D. [b] GT1	GT2	GT3	LC1	LC2	LC3	LC4 [l]/LC4R	LC5 [l]/LC5R	LC6	LC7	LC8	LC9	Field Blank	Trip Blank
Detected Volatile Organic Compounds (EPA SW8260B) (µg/L)																
Tetrachloroethene	05/06	5	<0.2	<0.2	0.4	2.0	**9.4**	2.9	**14/14**	0.4	<0.2	--	--	--	<0.2	<0.2
	09/06	5	<0.2	<0.2	<0.2/<0.2	4.4	**9.3**	2.8	**8.6**	<0.2	<0.2	--	--	--	--	--
	02/07	5	<0.2	<0.2	0.4/0.4	2.2	2.5	**5.9**	**20** D	0.3	<0.2	--	--	--	--	<0.2
	06/07	5	<0.2	<0.2	<0.2	1.4	1.5	2.6	**9.8/9.9**	0.2	<0.2	--	--	--	--	--
	09/07	5	<0.2	<0.2	<0.2	**5.2**	1.9	3.0	**7.9/7.4**	<0.2	<0.2	--	--	--	--	--
	12/07	5	<0.2	<0.2	<0.2	4.5	2.7	**6.8**	**25/23** D	1.0	<0.2	--	--	--	--	--
	03/08	5	<0.2	<0.2	<0.2/<0.2	3.6	2.6	3.0	--	<0.2	<0.2	--	--	--	--	--
	06/08	5	<0.2	<0.2	<0.2	**6.2**	3.3	**6.8**	--	--	<0.2	--	--	--	--	--
	09/08	5	<0.2	<0.2	<0.2/<0.2	**5.8**	3.2	**5.1**	--	--	<0.2	--	--	--	--	--
	12/08	5	<0.2	<0.2	<0.2/<0.2	**8.2**	1.3	4.2	--	--	<0.2	--	--	--	--	--
	02/09	5	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	--	--
	03/09	5	<0.2	<0.2	<0.2/<0.2	**6.0**	1.0	**5.6**	0.4	<0.2	<0.2	--	--	--	--	--
	06/09	5	<0.2	<0.2	<0.2/<0.2	2.3	1.1	**5.6**	<0.2	<0.2	<0.2	--	--	--	--	--
	09/09	5	<0.2	<0.2	<0.2/<0.2	3.4	0.2	3.3	<0.2	<0.2	<0.2	--	--	--	--	--
Trichloroethene	05/06	5	0.4	0.6	**11**	2.8	4	0.6	2.4/2.4	0.5	<0.2	--	--	--	<0.2	<0.2
	09/06	5	0.3	0.6	1.2/1.2	**6.5**	3	1.2	2.9	0.4	0.3	--	--	--	--	--
	02/07	5	0.4	0.4	**6.3/6.9**	2.8	1.4	1.2	3.8	1.0	0.2	--	--	--	--	<0.2
	06/07	5	0.2	0.5	2.8	3.2	2.5	1.0	4.8/5.0	0.4	0.3	--	--	--	--	--
	09/07	5	<0.2	0.5	0.6	4.8	1.7	1.8	3.2/3.1	0.4	0.2	--	--	--	--	--
	12/07	5	<0.2	0.5	1.4	**6.1**	0.5	2.2	1.8/1.8	1.2	<0.2	--	--	--	--	--
	03/08	5	<0.2	0.6	2.6/2.6	4.6	1.3	0.8	--	0.8	<0.2	--	--	--	--	--
	06/08	5	<0.2	0.6	1.5	4.8	4.1	1.6	--	--	0.3	--	--	--	--	--
	09/08	5	<0.2	0.5	1.1/1.0	**5.1**	2.2	1.2	--	--	0.2	--	--	--	--	--
	12/08	5	<0.2	0.3	0.6/0.6	**5.6**	0.4	1.2	--	--	0.3	--	--	--	--	--
	02/09	5	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	--	--
	03/09	5	<0.2	0.3	0.8/0.9	3.9	0.7	1.0	0.7	0.4	0.2	--	--	--	--	--
	06/09	5	<0.2	0.5	1.0/1.1	2.8	1.0	0.8	0.9	0.5	0.2	--	--	--	--	--
	09/09	5	<0.2	0.4	0.8/0.8	2.7	0.9	0.7	0.6	0.5	<0.2	--	--	--	--	--
cis-1,2-Dichloroethene	05/06	80 [f]	4.2	16	49 D	5.9	14	2.4	7.6/7.9	3.4	2.4	--	--	--	<0.2	<0.2
	09/06	80 [f]	3.7	24 D	13/13	15	15	4.3	10	2.5	2.6	--	--	--	--	--
	02/07	80 [f]	4.9	10	35/34 D	6.3	8.4	2.4	7.7	4.9	2.5	--	--	--	--	<0.2
	06/07	80 [f]	3.0	22 D	16	7.6	5.0	2.4	8.6/9.0	1.6	1.8	--	--	--	--	--
	09/07	80 [f]	2.3	18 D	5.0	9.7	6.9	6.4	11/11	1.7	1.7	--	--	--	--	--
	12/07	80 [f]	1.8	12	14	9.9	1.2	8.0	7.7/7.7	4.6	1.7	--	--	--	--	--
	03/08	80 [f]	1.8	18 D	19/19	6.6	2.5	2.1	--	3.3	1.5	--	--	--	--	--
	06/08	80 [f]	2.0	11	15	4.6	7.0	2.7	--	--	1.3	--	--	--	--	--
	09/08	80 [f]	2.1	8.2	20	7.9	5.2	2.9	--	--	1.0	--	--	--	--	--
	12/08	80 [f]	1.9	6.4	9.2/9.8	6.2	1.2	1.6	--	--	0.8	--	--	--	--	--
	02/09	80 [f]	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	--	--
	03/09	80 [f]	1.7	8.4	6.7/6.8	3.6	1.4	1.0	2.3	1.2	0.5	--	--	--	--	--
	06/09	80 [f]	1.7	12	8.8/9.0	4.1	2.9	1.4	2.6	1.5	0.6	--	--	--	--	--
	09/09	80 [f]	0.9	5.2	7.1/7.4	8.4	4.4	1.8	2.6	1.7	0.7	--	--	--	--	--
trans-1,2-Dichloroethene	05/06	160 [f]	<0.2	5	9.4	<0.2	0.9	<0.2	0.4/0.4	0.2	<0.2	--	--	--	<0.2	<0.2
	09/06	160 [f]	<0.2	6.9	5.4/5.4	0.4	1.3	<0.2	0.5	<0.2	<0.2	--	--	--	--	--
	02/07	160 [f]	0.2	3.3	5.1/5.2	<0.2	0.5	<0.20	0.3	0.3	<0.2	--	--	--	--	<0.2
	06/07	160 [f]	<0.2	4.8	4.5	<0.2	0.6	<0.2	0.4/0.5	<0.2	<0.2	--	--	--	--	--
	09/07	160 [f]	<0.2	5.3	2.4	<0.2	0.5	<0.2	0.3/0.4	<0.2	<0.2	--	--	--	--	--
	12/07	160 [f]	<0.2	2.9	4.2	<0.2	<0.2	<0.2	0.2/0.2	0.3	<0.2	--	--	--	--	--
	03/08	160 [f]	<0.2	3.1	3.3/3.1	<0.2	<0.2	<0.2	--	<0.2	<0.2	--	--	--	--	--
	06/08	160 [f]	<0.2	3.9	4.6	<0.2	<0.2	<0.2	--	--	<0.2	--	--	--	--	--

Table 3
Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties
LeatherCare, Inc./RI and FS
Seattle, Washington

Analyte	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D. [b]												Field Blank	Trip Blank
			GT1	GT2	GT3	LC1	LC2	LC3	LC4 [i]/LC4R	LC5 [i]/LC5R	LC6	LC7	LC8	LC9		
trans-1,2-Dichloroethene	09/08	160 [f]	<0.2	2.9	5.9/5.2	0.4	0.3	<0.2	--	--	<0.2	--	--	--	--	--
(cont.)	12/08	160 [f]	<0.2	1.8	2.3/2.6	0.2	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
	02/09	160 [f]	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	--	--
	03/09	160 [f]	<0.2	2.0	1.9/2.0	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	--	--	--	--	--
	06/09	160 [f]	<0.2	3.2	4.2/4.3	<0.2	0.2	<0.2	0.2	<0.2	<0.2	--	--	--	--	--
	09/09	160 [f]	<0.2	1.7	3.9/3.9	<0.2	0.3	<0.2	0.3	<0.2	<0.2	--	--	--	--	--
1,1-Dichloroethene	05/06	0.073 [f]	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	<0.2	<0.2
	09/06	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--
	02/07	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	--	--	--	--	<0.2
	06/07	0.073 [f]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	--	--
	09/07	0.073 [f]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2<0.2	<0.2	<0.2	--	--	--	--	--
	12/07	0.073 [f]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	--	--
	03/08	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	--	<0.2	<0.2	--	--	--	--	--
	06/08	0.073 [f]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
	09/08	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
	12/08	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	--	--	<0.2	--	--	--	--	--
	02/09	0.073 [f]	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	--	--
	03/09	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--
	06/09	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--
	09/09	0.073 [f]	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--
Vinyl Chloride	05/06	0.2	<0.2	19 D	9.7	1.1	2.8	2	2.6/2.6	4.8	1.2	--	--	--	<0.2	<0.2
	09/06	0.2	0.2	35 D	5.7/5.4	3.0	3.8	1.6	1.6	2.4	1.0	--	--	--	--	--
	02/07	0.2	<0.2	14	1.9/1.6	0.7	3.1	1.8	1.2	3.3	1.9	--	--	--	--	<0.2
	06/07	0.2	<0.2	12	2.3	0.9	1.8	0.6	1.2/1.2	1.5	0.7	--	--	--	--	--
	09/07	0.2	<0.2	22 D	2.1	1.4	1.4	1.0	0.8/0.8	1.3	0.3	--	--	--	--	--
	12/07	0.2	<0.2	13	16	1.4	<0.2	5.6	1.2/1.1	3.5	1.8	--	--	--	--	--
	03/08	0.2	<0.2	12	2.8/2.4	0.7	0.3	0.8	--	1.9	1.1	--	--	--	--	--
	06/08	0.2	<0.2	18	4.8	0.3	0.5	0.9	--	--	0.2	--	--	--	--	--
	09/08	0.2	<0.2	16	5.2/4.6	0.9	1.1	0.9	--	--	0.2	--	--	--	--	--
	12/08	0.2	<0.2	11	1.7/1.8	0.6	<0.2	0.8	--	--	<0.2	--	--	--	--	--
	02/09	0.2	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	--	--
	03/09	0.2	<0.2	9.2	1.0/1.0	0.4	0.3	0.3	1.3	1.6	<0.2	--	--	--	--	--
	06/09	0.2	<0.2	17	3.8/4.7	0.8	1.0	0.3	1.5	2.2	<0.2	--	--	--	--	--
	09/09	0.2	<0.2	6.9	4.9/4.9	1.6	1.2	0.6	1.4	2.4	<0.2	--	--	--	--	--
1,1,1-Trichloroethane	05/06	200	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	<0.2	<0.2
1,1,2-Trichloroethane	05/06	0.77 [f]	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	<0.2	<0.2
1,1-Dichloroethane	05/06	800 [f]	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	0.4/0.4	<0.2	<0.2	--	--	--	<0.2	<0.2
Benzene	05/06	5	<0.2	1.5	1.4	<0.2	0.4	<0.2	0.7/0.6	<0.2	<0.2	--	--	--	<0.2	<0.2
Toluene	05/06	1,000	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	0.4	<0.2
Dibromochloromethane	05/06	0.52 [f]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	<0.2	<0.2
tert-Butylbenzene	05/06	N/A	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	--	--	--	<0.2	<0.2
Acetone	05/06	800 [f]	3.4 M	5.3 M	<1.0	1.5	2.3	1.3	1.5/1.7	2.1	1.7	--	--	--	5.2	1.5
Methylene Chloride	05/06	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3/<0.3	<0.3	<0.3	--	--	--	<0.3	0.4

Table 3
Groundwater Analytical Summary - LeatherCare, Greg Thompson Productions, and W. Roy Street Properties
LeatherCare, Inc./RI and FS
Seattle, Washington

Notes:

Bold and boxed values exceed Method A/B cleanup level.
* Turbidity meter malfunctioned; judged to be <10 NTU prior to sampling based on clarity of water.
** Data not usable due to meter malfunction.
a) Washington Administrative Code Chapter 173-340, Model Toxics Control Act Cleanup Regulation, promulgated August 15, 2001. Method A suggested groundwater cleanup level used when available.
b) Second set of concentrations are from blind duplicate samples.
c) Water in LC2 had a strong hydrogen sulfide odor and would not clear up fully; suspect turbidity is suspended organics.
d) Silver-silver chloride reference electrode.
e) + means dehalococcoides detected; - means dehalococcoides not detected.
f) Method B cleanup level from Washington Dept. of Ecology's Cleanup Levels and Risk Calculations (CLARC) tables.
g) Dissolved oxygen meter not working correctly. Measurements, when provided, were taken on 2/20/07 and were in situ down hole measurements.
h) Turbidity readings taken from flow-cell and high turbidity readings influenced by biofloc.
i) Resampled and reanalyzed for TPH on February 20, 2007. The TPH analyses were run with a silica gel cleanup to remove interference by potential naturally occurring organics.
j) Value believed to be incorrect.
k) Turbidity influenced by biofloc.
l) Destroyed by construction.
m) "10" standard was checked and confirmed the correct instrument reading.

°C - degrees Celsius.
mV - millivolts.
NTU - Nephelometric turbidity units.
ORP - oxidation reduction potential.
N/A - not applicable.
µS/cm - microsiemens per centimeter.
µg/L - micrograms per liter.
mg/L - milligrams per liter.
ppm - parts par million.
J - estimated value.
D - value from a diluted sample.
M - estimated amount of analyte found and confirmed by analyst but with low GC/MS spectral match.
-- not analyzed or not measured.
< - analyte not detected at or greater than the listed concentration.

Table 4
Groundwater Analytical Summary - Former Darigold Property
Ryan, Swanson & Cleveland, PLLC/LeatherCare, Inc.
Seattle, Washington

Analytes and Test Methods	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D.								
			MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8	MW12
Field-Measured Parameters											
pH	05/06	N/A	7.39	7.31	7.09	6.99	7.01	7.03	6.93	6.89	7.20
	09/06		7.31	7.16	7.14	7.09	7.08	7.05	7.07	7.04	--
	02/07		6.10	6.45	6.34	6.28	6.39	6.59	6.47	6.51	--
ORP [b] (mV)	05/06	N/A	97	-32	-156	-38	-95	-76	-94	-84	-17
	09/06		-28	-57	-223	-152	-125	-96	-115	-105	--
	02/07		117	-53	-54	-7	-84	-56	-54.0	-59.0	--
Temperature (°C)	05/06	N/A	15.2	16.1	14.7	15.3	15.6	13.8	14.2	14.2	12.4
	09/06		22.8	24.3	20.9	22.8	20.9	22.0	22.5	20.8	--
	02/07		9.8	9.7	12.8	11.3	11.2	10.2	10.2	12.8	--
Specific Conductivity (µS/cm)	05/06	N/A	1,322	1,244	1,277	1,251	1,261	1,332	1,296	1,302	1,358
	09/06		557	742	947	906	869	832	910	884	--
	02/07		348	430	943	1,110	904	702	926	852	--
Dissolved Oxygen (mg/L)	05/06	N/A	0.89	0.17	0.22	0.38	0.32	0.26	0.52	0.32	0.58
	09/06		0.30	0.12	0.07	0.14	0.18	0.13	0.10	0.17	--
	02/07		-- [f]	-- [f]	-- [f]	-- [f]	-- [f]	-- [f]	-- [f]	-- [f]	--
Turbidity (NTU)	05/06	N/A	0.89	1.06	0.86	1.54	1.47	3.54	2.43	2.46	0.47
	09/06		0.50	1.50	0.25	0.81	3.25	0.52	*	*	--
	02/07		0.0	0.0	0.0	0.0	58.6	0.0	0.0	0.0	--
Ferrous Iron (ppm)	05/06	N/A	0	0.1	0.5	0.9	2	0.9	0.6	0.8	0
	09/06		0	0.2	0.2	2	3	1	0.2	0.8	--
	02/07		0	0.1	0.1	0.1	2.5	1.5	1	1	--
General Groundwater Chemistry											
Chloride (EPA Method 325.2) (mg/L)	05/06	N/A	4.8	7.7	19.7	14.3	17.6	13.3	15.5	12.7	10.2
Sulfate (EPA Method 375.2) (mg/L)	05/06	N/A	30.0	32.1	56.1	47.4	48.7	42.8	13.6	24.1	31.7
Chemical Oxygen Demand (EPA Method 410.4) (mg/L)	05/06	N/A	7.56	<5.0	28.6	57.1	17.2	12.7	41.4	36.2	11.7
Alkalinity (SM 2320) (mg/L $CaCO_3$)	05/06	N/A	161	190	416	407	405	344	450	427	296
Carbonate (SM 2320) (mg/L CaCO3)	05/06	N/A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bicarbonate (SM 2320) (mg/L CaCO3)	05/06	N/A	161	190	416	407	405	344	450	427	296
Hydroxide (SM 2320) (mg/L CaCO3)	05/06	N/A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
***Dehalococcoides spp.* (QCPR) [d]**		N/A	-	-	-	-	-	+	-	-	-
Reductive Dechlorination End Products (µg/L)											
Methane	05/06	N/A	12	10	250	250	190	120	700	540	180
	09/06		45	200	330	490	150	230	870	650	--
	02/07		8.8	15	140	61	290	130	790	710	--
Ethane	05/06	N/A	<12	<12	<12	<12	<12	<12	<12	<12	<12
	09/06		0.044	0.088	0.16	0.16	0.22	0.21	0.17	0.17	--
	02/07		<0.025	<0.025	<0.082	0.034	0.20	0.12	0.19	0.150	--
Ethene	05/06	N/A	<11	<11	<11	<11	<11	<11	<11	<11	<11
	09/06		<0.025	0.088	<0.025	0.063	0.035	0.58	0.049	0.076	--
	02/07		<0.025	<0.025	<0.025	<0.025	<0.025	0.14	0.038	0.028	--

Table 4
Groundwater Analytical Summary - Former Darigold Property
Ryan, Swanson & Cleveland, PLLC/LeatherCare, Inc.
Seattle, Washington

Analytes and Test Methods	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D. MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8	MW12
Petroleum Hydrocarbons (NWTPH-Dx) (mg/L)											
Diesel	03/01	0.50	<0.25	<0.25	**6.44**	<0.25	<0.25	<0.25	**19.6**	<0.25	<0.25
	05/03	0.50	0.325	**0.789**	**12.9** FP	**0.954**	**0.765**	**0.752**	**8.0**	**6.43**	**1.76**
	10/03	0.50	0.317	0.488	**209** FP	**2.7**	<0.25	0.289	**2.31**	**0.82**	**1.34**
	05/04	0.50	0.271	0.498	**NS** FP	**2.83**	0.381	0.394	**4.37**	**4.0**	**0.626**
	11/04	0.50	<0.25	<0.25	**NS** FP	<0.25	0.27	<0.25	**1.4**	**0.75**	0.48
	03/05	0.50	<0.25	<0.25	**4.7**	**1.0**	0.43	0.37	**3.7**	**1.8/1.8**	<0.25
	08/05	0.50	0.390	**0.86**	**13** FP	**1.9**	**0.68**	0.28	**2.1**	**1.3**	<0.25
	10/05	0.50	0.310	**0.52**	**4.1**	**1.4/1.7**	**0.64**	0.42	**2.8**	**1.7**	0.27
	12/05	0.50	<0.25/<0.25	--	**13**	**3.4**	**1.1**	0.38	**2.6**	**1.8**	0.33
	03/06	0.50	0.330	**0.59**	**4.4**	**1.3**	**1.2**	**1.2**	0.30	**0.52**	<0.25
	05/06	0.50	<0.25	<0.25	**0.61**	**2.3**	**0.66**	0.5	**2.6**	**1.6**	<0.25
	09/06	0.50	<0.25	**0.65**	**0.55** FP	**1.3**	<0.25	<0.25	**2.4**	**1.8**	--
	02/07	0.50	<0.25	<0.25	**0.70** FP	**4.0**	**0.72**	**0.71**	**2.4** FP	**1.1**	--
Motor Oil	03/01	0.50	<0.50	<0.50	**15.4** FP	<0.50	<0.50	<0.50	**3.51**	<0.50	<0.50
	05/03	0.50	<0.50	<0.50	**26.2** FP	<0.50	<0.50	<0.50	**1.05**	**0.538**	<0.50
	10/03	0.50	<0.50	<0.50	**705** FP	<0.50	<0.50	0.289	**0.71**	<0.50	<0.50
	05/04	0.50	<0.50	<0.50	**NS** FP	**0.501**	<0.50	<0.50	**0.89**	<0.50	<0.50
	11/04	0.50	<0.50	<0.50	**NS** FP	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	03/05	0.50	<0.50	<0.50	**15**	<0.50	<0.50	<0.50	**0.90**	<0.50/<0.50	<0.50
	08/05	0.50	<0.50	0.68	**49** FP	**0.98**	<0.50	<0.50	**0.54**	<0.50	<0.50
	10/05	0.50	<0.50	<0.50	**16**	**0.68/0.92**	<0.50	<0.50	**0.82**	<0.50	<0.50
	12/05	0.50	<0.50/<0.50	--	**50**	**0.95**	<0.50	<0.50	<0.50	<0.50	<0.50
	03/06	0.50	<0.50	0.68	**17**	<0.50	<0.50	<0.50	**1.4**	<0.50	<0.50
	05/06	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	09/06	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--
	02/07	0.50	<0.50	<0.50	**0.77**	<0.50	<0.50	<0.50	<0.50	<0.50	--
Detected Volatile Organic Compounds (EPA SW8260B) (µg/L)											
Tetrachloroethene	03/01	5	--	--	<0.1	--	<0.1	2.48	<0.1	--	--
	05/03	5	**12.8**	--	--	--	--	2.25	--	--	--
	10/03	5	4.84	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	11/04	5	**12**	<0.2	<0.2	<0.2	<0.2	2.1/0.3	<0.2	<0.2	<0.2
	03/05	5	**19**	<0.2	<0.2	<0.2	<0.2	1.5	<0.2	<0.2/<0.2	0.3/0.4 [c]
	08/05	5	**18**	<0.2	<0.6	<0.2	<0.2	0.8	<0.2	<0.2	<0.2
	10/05	5	**8.2**	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2
	12/05	5	**17**	--	<0.2	<0.2	<0.2	0.6	<0.2	<0.2	0.2 J
	03/06	5	2.6	<0.2	<0.2	<0.2	<0.2	0.7	<0.2	<0.2	<0.2
	05/06	5	4.1	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2
	09/06	5	**6.5**	<0.2	<0.2	<0.2	<0.2	0.6	<0.2	<0.2	--
	02/07	5	1.9	<0.2	<0.2	<0.2	<0.2	0.7	<0.2	<0.2	--
Trichloroethene	03/01	5	--	--	<0.1	--	<0.1	1.37	<0.1	--	--
	05/03	5	2.59	--	--	--	--	1.23	--	--	--
	10/03	5	2.79	1.08	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	11/04	5	2.4	0.8	<0.2	<0.2	<0.2	0.7/0.3	<0.2	<0.2	<0.2
	03/05	5	2.4	0.8	<0.2	<0.2	0.2 J	0.4	0.2 J	<0.2/<0.2	<0.2/<0.2 [c]
	08/05	5	3.3	0.8	<0.6	<0.2	<0.2	0.5	<0.2	<0.2	<0.2
	10/05	5	3.0	1.0	<0.2	<0.2	0.2	0.4	<0.2	<0.2	<0.2
	12/05	5	2.5	--	<0.2	<0.2	0.1 J	0.3	0.1 J	<0.2	<0.2
	03/06	5	1.1	0.3	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2
	05/06	5	1.5	0.3	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2
	09/06	5	2.6	0.6	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	--
	02/07	5	0.9	0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	--

Table 4
Groundwater Analytical Summary - Former Darigold Property
Ryan, Swanson & Cleveland, PLLC/LeatherCare, Inc.
Seattle, Washington

Analytes and Test Methods	Date Sampled	Method A Cleanup Levels [a]	Monitoring Well I.D.								
			MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8	MW12
cis-1,2-Dichloroethene	03/01	80 [e]	--	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	05/03	80 [e]	7.62	--	--	--	--	7.4	--	--	--
	10/03	80 [e]	13.8	12	<0.1	<0.1	1.17	13	<0.1	1.55	<0.1
	11/04	80 [e]	6.8	6.8	<0.2	<0.2	3.0	4.2/2.4	1.4	1.8	<0.2
	03/05	80 [e]	4.2	6.2	0.2 J	0.2	1.4	3.0	1.8	1.4/1.3	<0.2/<0.2 [c]
	08/05	80 [e]	5.6	7.1	<0.6	<0.2	1.3	3.7	0.6	1.0	<0.2
	10/05	80 [e]	8.6	7.4	0.2	<0.2	3.1	3.6	2.2	1.4	0.2
	12/05	80 [e]	4.7/4.5	--	0.2 J	0.1 J	1.9	2.9	1.6	1.4	0.1
	03/06	80 [e]	2.4	2.6	<0.2	<0.2	1.5	4.0	1.0	1.4	0.2
	05/06	80 [e]	3.1	2.4	0.2	0.3	0.8	2.7	0.7	1.3	<0.2
	09/06	80 [e]	6.4	6.2	0.2	<0.2	0.9	3.6	0.8	1.0	--
	02/07	80 [e]	1.9	1.7	<0.2	<0.2	0.6	2.6	1.1	1.2	--
trans-1,2-Dichloroethene	03/01	160 [e]	--	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	05/03	160 [e]	<0.1	--	--	--	--	0.5	--	--	--
	10/03	160 [e]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	11/04	160 [e]	0.2	0.3	<0.2	<0.2	<0.2	0.3/0.2	<0.2	<0.2	<0.2
	03/05	160 [e]	0.2	0.4	<0.2	<0.2	<0.2	0.3	<0.2	<0.2/<0.2	<0.2/<0.2 [c]
	08/05	160 [e]	0.4	0.4	<0.6	<0.2	<0.2	0.3	<0.2	<0.2	<0.2
	10/05	160 [e]	0.6	0.4	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2
	12/05	160 [e]	0.3/0.3	--	<0.2	<0.2	<0.2	0.3	1.1 J	<0.2	<0.2
	03/06	160 [e]	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	05/06	160 [e]	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	09/06	160 [e]	0.5	0.3	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	--
	02/07	160 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	--
1,1-Dichloroethene	03/01	0.073 [e]	--	--	<0.1	--	<0.1	2.02	<0.1	--	--
	05/03	0.073 [e]	<0.1	--	--	--	--	<0.1	--	--	--
	10/03	0.073 [e]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	11/04	0.073 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2	<0.2	<0.2
	03/05	0.073 [e]	**0.2** J	**0.1** J	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/<0.2	<0.2/<0.2 [c]
	08/05	0.073 [e]	<0.4	<0.2	<0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	10/05	0.073 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	12/05	0.073 [e]	<0.2/<0.2	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	03/06	0.073 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	05/06	0.073 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	09/06	0.073 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--
	02/07	0.073 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--

Table 4
Groundwater Analytical Summary - Former Darigold Property
Ryan, Swanson & Cleveland, PLLC/LeatherCare, Inc.
Seattle, Washington

Analytes and Test Methods	Date Sampled	Method A Cleanup Levels[a]	Monitoring Well I.D. MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8	MW12
Vinyl Chloride	03/01	0.20	--	--	<0.1	--	<0.1	**3.21**	<0.1	--	--
	05/03	0.20	**0.665**	--	--	--	--	**11.1**	--	--	--
	10/03	0.20	**1.21**	**20.4**	<0.1	<0.1	<0.1	**41.2**	**1.74**	**1.38**	<0.1
	11/04	0.20	**0.5**	**5.8**	<0.2	<0.2	**2.1**	**7.9/8.8**	**1.4**	**1.7**	<0.2
	03/05	0.20	**0.5**	**3.3**	<0.2	<0.2	**0.4**	**6.1**	**1.6**	**1.3/1.1**	<0.2/<0.2 [c]
	08/05	0.20	**0.7**	**2.0**	<0.6	<0.2	**0.3**	**7.7**	0.2	**0.4**	<0.2
	10/05	0.20	**2.1**	**4.1**	<0.2	<0.2	**1.3**	**9.2**	**1.4**	**0.8**	<0.2
	12/05	0.20	**1.2/1.0**	--	<0.2	<0.2	**0.6**	**11**	**1.0**	**1.0**	<0.2
	03/06	0.20	**0.3**	0.2	<0.2	<0.2	**0.8**	**3.5**	**0.7**	**0.7**	<0.2
	05/06	0.20	**0.4**	0.2	<0.2	<0.2	0.2	**3.2**	**0.4**	**0.4**	<0.2
	09/06	0.20	**1.4**	**1.4**	<0.2	<0.2	<0.2	**6.6**	0.2	**0.3**	--
	02/07	0.20	0.2	<0.2	<0.2	<0.2	0.2	**2.9**	**0.7**	**0.4**	--
1,1,1-Trichloroethane	03/01	200	--	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	05/03	200	<0.1	--	--	--	--	<0.1	--	--	--
	10/03	200	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	05/06	200	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-Trichloroethane	05/06	0.77 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane	05/06	800 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzene	05/06	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	05/06	1,000	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane	05/06	0.52 [e]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
tert-Butylbenzene	05/06	N/A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Acetone	05/06	800 [e]	<1.0	<1.0	1.2	2	<1.0	1.4	3.3	<1.0	1.8
Methylene Chloride	05/06	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Notes:

Bold and boxed values exceed Method A/B cleanup level.
* Turbidity meter malfunctioned; judged to be <10 NTU prior to sampling based on clarity of water.
a) Washington Administrative Code Chapter 173-340, Model Toxics Control Act Cleanup Regulation, promulgated August 15, 2001. Method A suggested groundwater cleanup level used when available.
b) Silver-silver chloride reference electrode.
c) MW12 was resampled on 4/4/05.
d) + means *Dehalococcoides spp*. detected; - means *Dehalococcoides spp*. not detected.
e) Method B cleanup level from Washington Dept. of Ecology's Cleanup Levels and Risk Calculations (CLARC) tables.
f) Dissolved oxygen meter not working correctly.
°C - degrees Celsius.
D - value from a diluted sample.
NS - not sampled.
FP - free product measured or indicated.
J - estimated value.
M - Estimated amount of analyte found and confirmed by analyst but with low GC/MS spectral match.
mV - millivolts.
NTU - nephelometric turbidity units.
ORP - oxidation reduction potential.
µS/cm - microsiemens per centimeter.
µg/L - micrograms per liter.
ppm - parts per million.
mg/L - milligrams per liter.
-- not analyzed.
< - analyte not detected at or greater than the listed concentration.

Table 5
Mann-Kendall Statistical Summary
LeatherCare, Inc./RI and FS
Seattle, Washington

		GT1 Monitoring Well	GT2 Monitoring Well	GT3 Monitoring Well	LC1 Monitoring Well	LC2 Monitoring Well	LC3 Monitoring Well	LC4 Monitoring Well	LC5 Monitoring Well	LC6 Monitoring Well
1,1-Dichloroethene	Count (data)	13	13	13	13	13	13	9	10	13
	Count (nondetects)	13	13	12	13	13	13	9	10	13
	S Statistic	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Var(S)	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Trend	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Probability (of no real trend)	NC	NC	NC	NC	NC	NC	NC	NC	NC
cis-1,2-Dichloroethene	Count (data)	13	13	13	13	13	13	9	10	13
	Count (nondetects)	0	0	0	0	0	0	0	0	0
	S Statistic	-58	-42	-32	-18	-35	-29	-12	-16	-67
	Var(S)	267	267	269	269	268	265	90	124	268
	Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing
	Probability (of no real trend)	0.02%	0.60%	2.93%	14.98%	1.88%	4.27%	12.31%	8.90%	0.00%
Tetrachloroethene	Count (data)	13	13	13	13	13	13	9	10	13
	Count (nondetects)	13	13	11	0	0	0	2	6	13
	S Statistic	NC	NC	NC	24	-42	21	-19	NC	NC
	Var(S)	NC	NC	NC	269	269	266	91	NC	NC
	Trend	NC	NC	NC	Increasing	Decreasing	Increasing	Decreasing	NC	NC
	Probability (of no real trend)	NC	NC	NC	8.03%	0.62%	10.99%	2.96%	NC	NC
trans-1,2-Dichloroethene	Count (data)	13	13	13	13	13	13	9	10	13
	Count (nondetects)	12	0	0	10	5	13	0	7	13
	S Statistic	NC	-48	-35	NC	-39	NC	-19	NC	NC
	Var(S)	NC	267	268	NC	238	NC	84	NC	NC
	Trend	NC	Decreasing	Decreasing	NC	Decreasing	NC	Decreasing	NC	NC
	Probability (of no real trend)	NC	0.20%	1.88%	NC	0.69%	NC	2.45%	NC	NC
Trichloroethene	Count (data)	13	13	13	13	13	13	9	10	13
	Count (nondetects)	9	0	0	0	0	0	0	0	4
	S Statistic	NC	-26	-39	-8	-34	-14	-18	2	-8
	Var(S)	NC	241	266	264	269	258	92	113	168
	Trend	NC	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing
	Probability (of no real trend)	NC	5.38%	0.99%	33.33%	2.20%	20.92%	3.82%	46.25%	29.46%
Vinyl Chloride	Count (data)	13	13	13	13	13	13	9	10	13
	Count (nondetects)	12	0	0	0	2	0	0	0	4
	S Statistic	NC	-37	-12	-17	-32	-44	-3	-8	-45
	Var(S)	NC	268	269	266	267	265	88	124	240
	Trend	NC	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing
	Probability (of no real trend)	NC	1.39%	25.11%	16.31%	2.88%	0.41%	41.57%	26.48%	0.23%

Table 6
Remedial Technology Screening
LeatherCare, Inc./RI and FS
Seattle, Washington

Remediation Technology	Description	Effectiveness	Implementability	Cost	Applicability to Site Conditions
Natural Attenuation					
Monitored Natural Attenuation (MNA)	Structured monitoring program designed to verify contaminant attenuation through naturally occurring processes is achieving cleanup levels.	High	High	Moderate/Low	Potentially applicable. Complete reductive dechlorination to ethene is occurring. There is no DNAPL and dissolved concentrations are currently in the low part per billion range.
Groundwater and Product Extraction					
Groundwater Extraction Using Wells	Installation of a series of vertical wells to extract contaminated groundwater.	Moderate/Low	Moderate	High	Potentially Applicable. Formerly commonly used as a remedial technology for dissolved contaminants, but more recently considered more of a containment, rather than treatment technology. Applicability over other extraction methods depends on site conditions.
Multi-Phase Extraction	Applying a high vacuum to wells located within the contaminated zone and screened across the water table, thereby inducing two phase flow: soil vapor and groundwater.	Moderate	Moderate	High	Not Applicable. Typically is used as a source removal technology, and is effective for addressing LNAPL contaminants. LeatherCare does not have LNAPL.
Horizontal Extraction Wells	Installation of horizontal extraction wells to collect and extract contaminated groundwater.	Moderate	Moderate	High	Potentially Applicable. Commonly used remedial technology for dissolved contaminants. Applicability over other extraction methods depends on site conditions.
Interceptor Drains	Perforated pipe in trenches backfilled with porous media to collect contaminated water for extraction.	Moderate	Moderate	Moderate/ High	Potentially Applicable. Commonly used remedial technology that is especially effective for groundwater systems with a short saturated interval and low hydraulic conductivity.
In Situ Treatment					
Enhanced Anaerobic Bioremediation (EAB)	Enhance microbial activity by injecting electron donor compounds, nutrients, and potentially microorganisms (i.e., bioaugmentation) into the subsurface.	Moderate	Moderate	Moderate	Potentially Applicable. The cVOCs are currently biodegrading. EAB may increase the rate of biodegradation.
Chemical Oxidation (ISCO)	Inject chemical oxidizing agents to destroy contaminants in place.	High	Moderate	Moderate/ High	Potentially Applicable. The technology produces rapid results whereby cVOCs are completely destroyed. Typically

Table 6
Remedial Technology Screening
LeatherCare, Inc./RI and FS
Seattle, Washington

Remediation Technology	Description	Effectiveness	Implementability	Cost	Applicability to Site Conditions
					requires multiple injections as rebound often occurs.
In Situ Thermal Treatment	Groundwater is heated to near boiling temperatures using either electrical resistance heating, thermal conductive heating, or steam injection to promote contaminant volatilization and/or hydrolysis.	High	Low	High	Not Applicable. The high cost of installation and heating large amounts of groundwater and aquifer materials. Also, the above-ground infrastructure at the site would seriously complicate or impede implementation.
Air Sparging	System of wells to inject air into groundwater to remove volatiles by air stripping into vadose zone for capture.	Moderate	Moderate	Moderate/ High	Potentially Applicable. Effective at removing volatiles.
In-Well Aeration or Vacuum Vaporization Well	Inject air into groundwater to strip volatile contaminants inside the well casing. Involves two screens to recirculate groundwater vertically inside the well. A vacuum is imposed to collect VOCs and clean groundwater is pumped back into the aquifer.	Low	Moderate	High	Not Applicable. The actual radius of influence (as implemented) is often much less than the predicted influence, making the technology minimally attractive.
Permeable Reactive Barrier	A permeable "wall" of iron or biological materials that dechlorinate contaminants as they migrate through.	Low	Moderate	High	Potentially Applicable. Mitigates offsite migration, but does not remediate the plume.
Ex Situ Treatment (used in conjunction with other treatment methods)					
Air Stripping	Air forced through liquid in a packed column or shallow tray system to promote transfer of volatile contaminants into vapor.	High	High	Moderate	Potentially Applicable. Relatively inexpensive and effective technology. Treatment of stripped off vapors not likely required because of such low VOC concentrations.
Activated Carbon Adsorption	Adsorption of organic contaminants onto activated carbon.	Moderate	Moderate	Moderate/ High	Potentially Applicable. Effective at removing PCE and TCE. VC may require polishing with the permanganate impregnated zeolite beads.
Permanganate impregnated zeolites	Adsorption of organic contaminants onto permanganate impregnated zeolites	High	High	Moderate/ High	Potentially Applicable. Effective at treating vinyl chloride.

Figures

Source: USGS SEATTLE NORTH, 7.5 MIN. QUADRARANGLE, 1973

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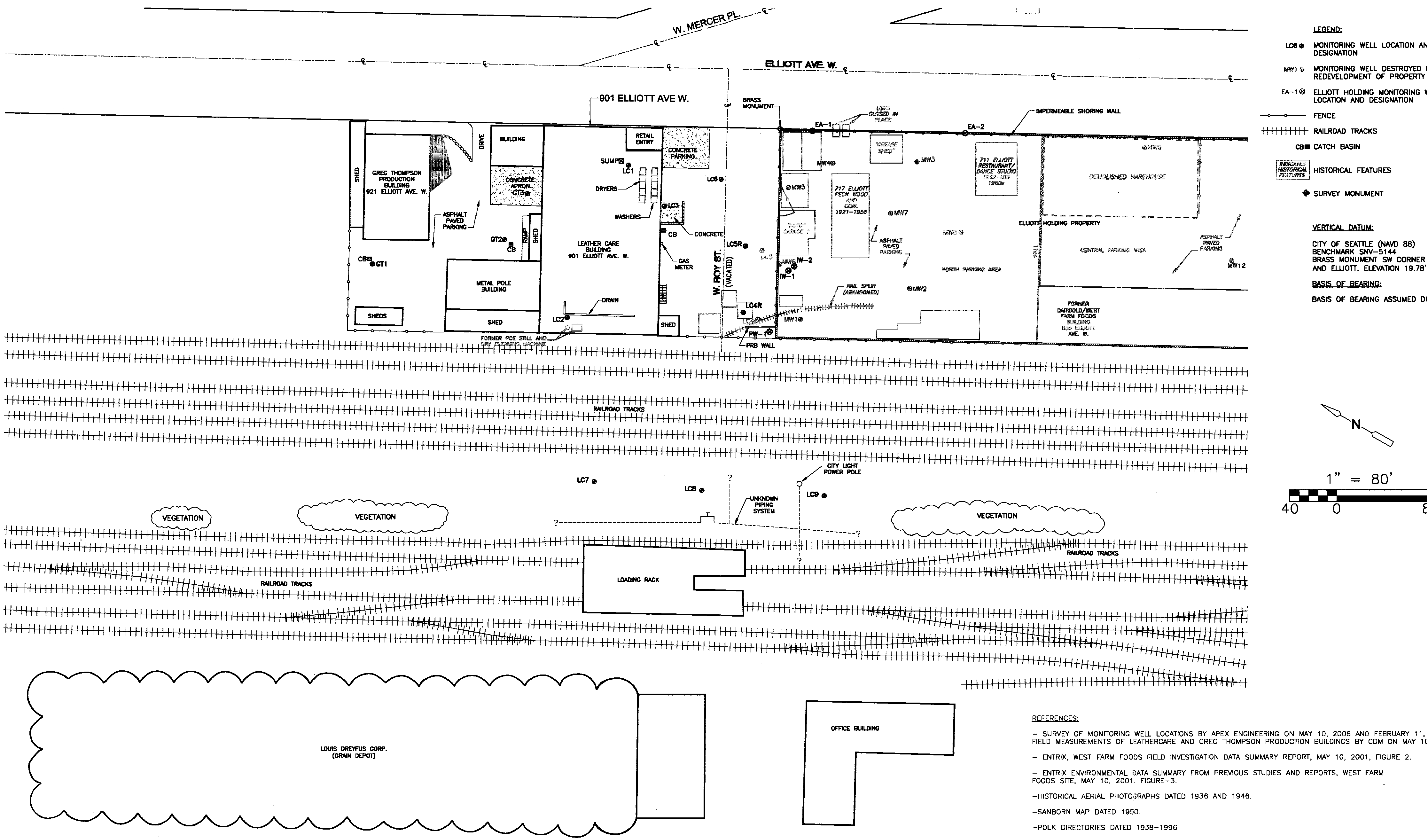
LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 1
Site Location



LEGEND:

- LC6 ● MONITORING WELL LOCATION AND DESIGNATION
- MW1 ⊕ MONITORING WELL DESTROYED FOR REDEVELOPMENT OF PROPERTY
- EA-1 ⊗ ELLIOTT HOLDING MONITORING WELL LOCATION AND DESIGNATION
- FENCE
- RAILROAD TRACKS
- CB CATCH BASIN
- INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES
- ◆ SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

REFERENCES:

- SURVEY OF MONITORING WELL LOCATIONS BY APEX ENGINEERING ON MAY 10, 2006 AND FEBRUARY 11, 2009. FIELD MEASUREMENTS OF LEATHERCARE AND GREG THOMPSON PRODUCTION BUILDINGS BY CDM ON MAY 10, 2006.
- ENTRIX, WEST FARM FOODS FIELD INVESTIGATION DATA SUMMARY REPORT, MAY 10, 2001, FIGURE 2.
- ENTRIX ENVIRONMENTAL DATA SUMMARY FROM PREVIOUS STUDIES AND REPORTS, WEST FARM FOODS SITE, MAY 10, 2001. FIGURE-3.
- HISTORICAL AERIAL PHOTOGRAPHS DATED 1936 AND 1946.
- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938–1996

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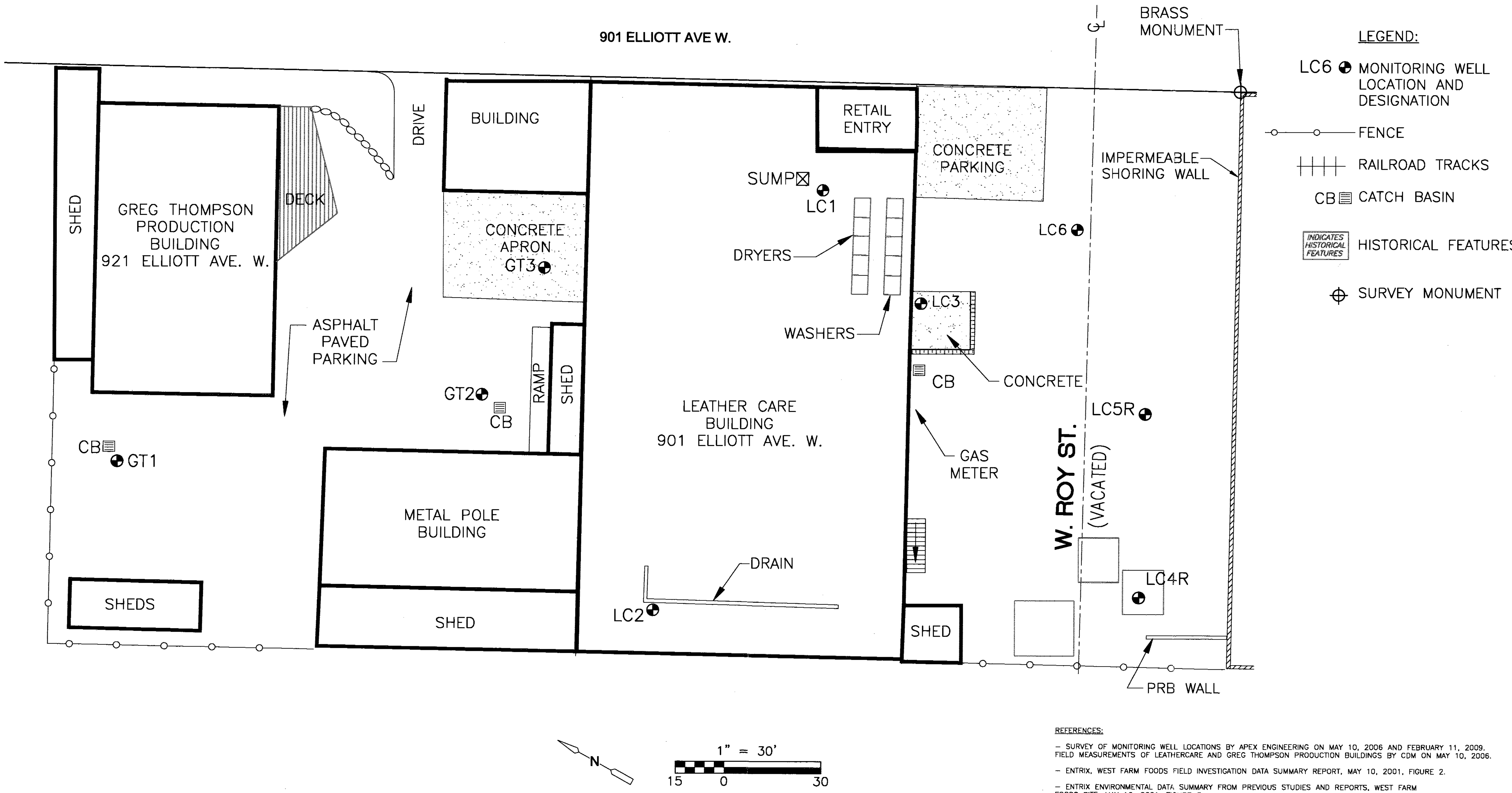
LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 2
Site and Vicinity Map



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- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938-1996

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LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 3
Site Plan

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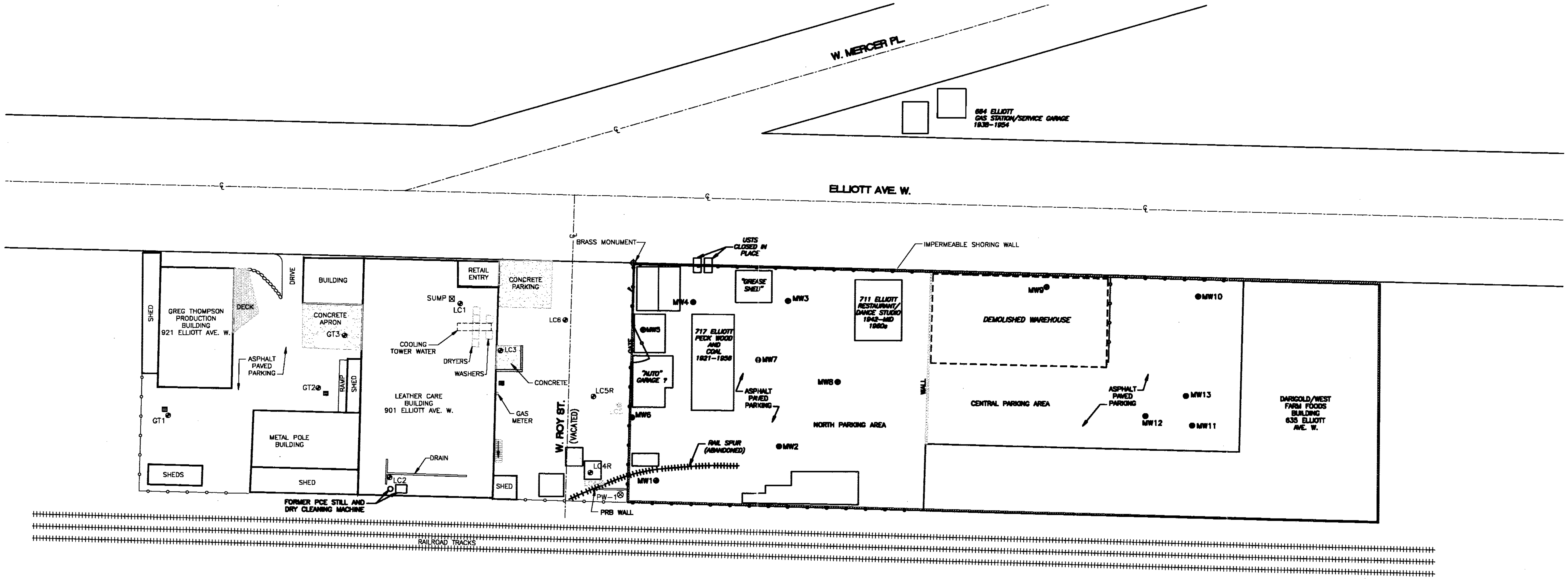

REFERENCES:

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–HISTORICAL AERIAL PHOTOGRAPHS DATED 1936 AND 1946.

–SANBORN MAP DATED 1950.

–POLK DIRECTORIES DATED 1938–1996

N

1" = 80'

40 0 80

LEGEND:

LC6 – MONITORING WELL LOCATION AND DESIGNATION

MONITORING WELL DESTROYED FOR REDEVELOPMENT OF PROPERTY

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES – HISTORICAL FEATURES

SURVEY MONUMENT

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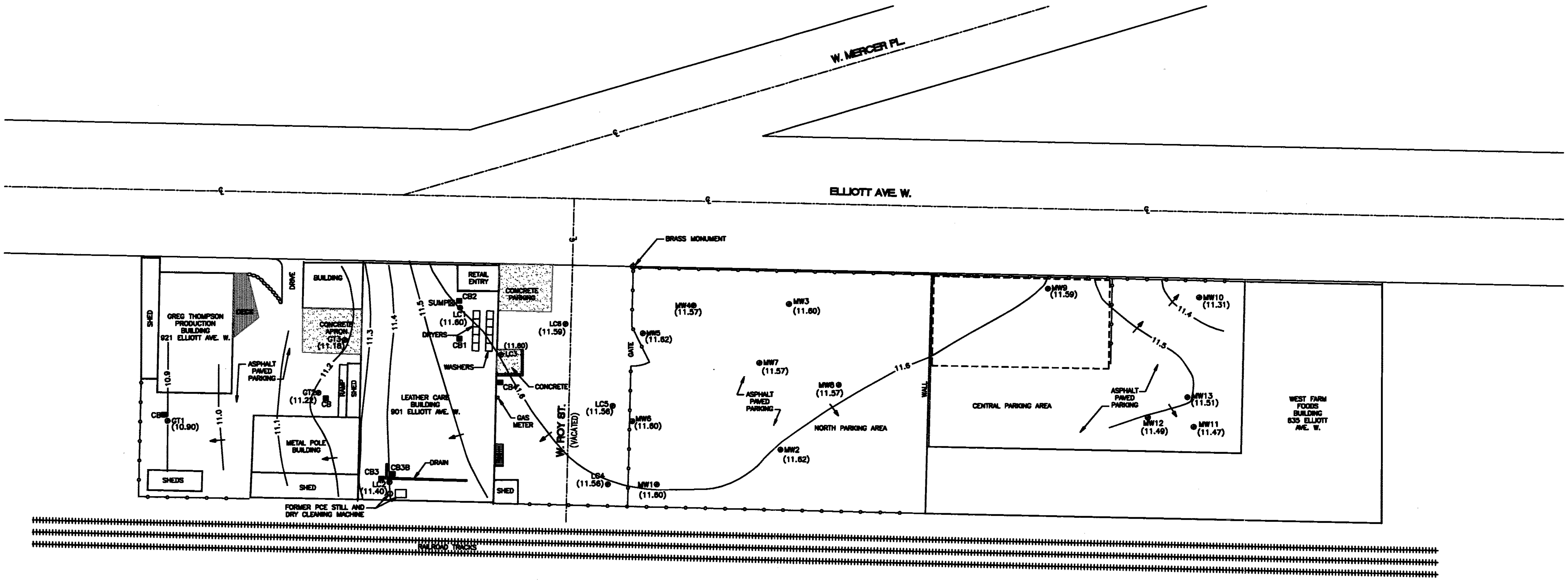
LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 4
Former Darigold Property Historical Features



REFERENCES:

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- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938-1996

SITE PLAN

N

1" = 80'

40 0 80

LEGEND:

MW1 ● (11.60) MONITORING WELL LOCATION AND DESIGNATION AND ELEVATION IN FEET

—11.6— POTENTIOMETRIC CONTOUR, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE)

→ DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CB■ CATCH BASIN

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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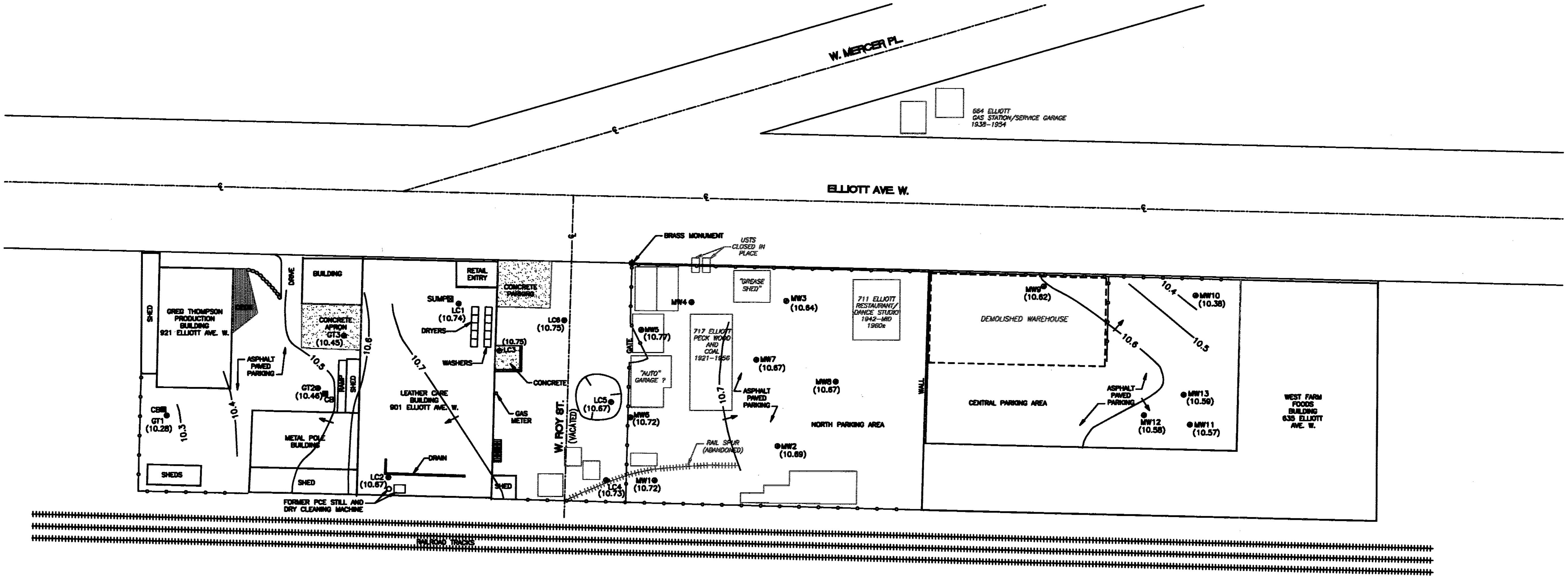
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5a
POTENTIOMETRIC SURFACE MAP
MAY 10, 2006



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- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938–1996

SITE PLAN

N

1" = 80'

40 0 80

LEGEND:

MW1 (10.72) MONITORING WELL LOCATION AND DESIGNATION AND ELEVATION IN FEET

10.6 POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT (AVERAGE)

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CB CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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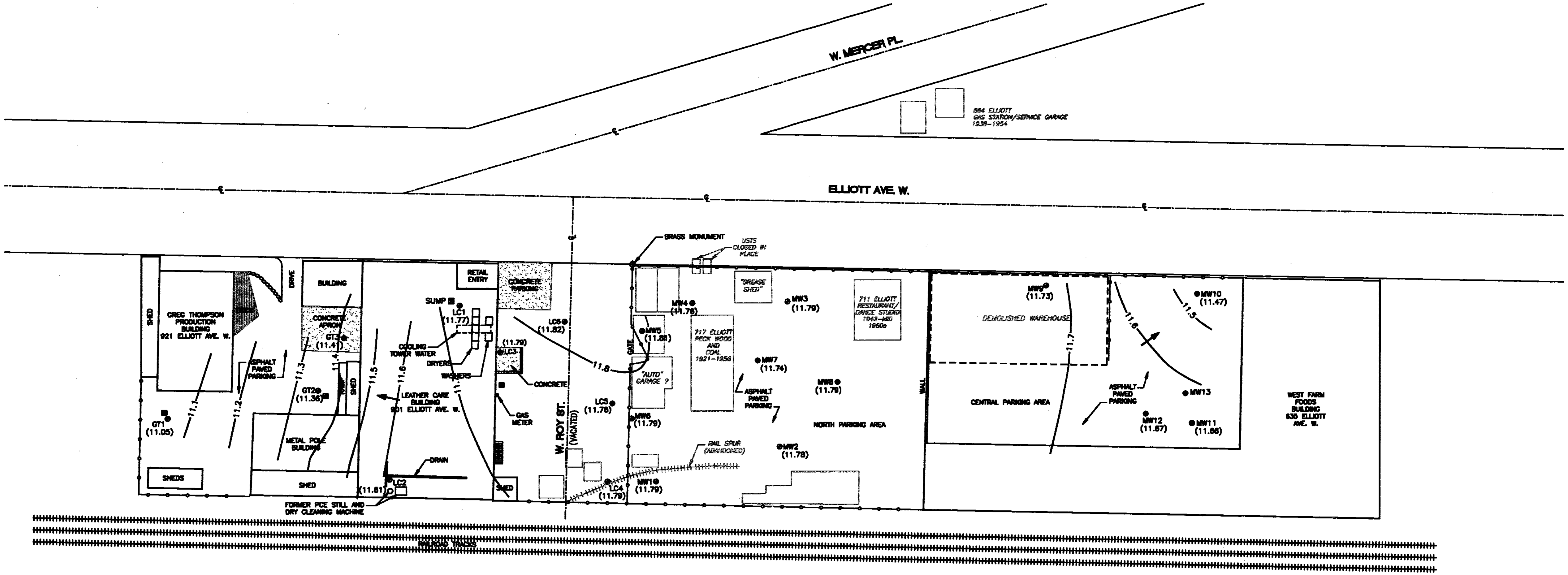
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5b
POTENTIOMETRIC SURFACE MAP
SEPTEMBER 5, 2006



REFERENCES:

- SURVEY OF MONITORING WELL LOCATIONS BY APEX ENGINEERING ON MAY 10, 2006 AND FEBRUARY 11, 2009. FIELD MEASUREMENTS OF LEATHERCARE AND GREG THOMPSON PRODUCTION BUILDINGS BY CDM ON MAY 10, 2006.
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- POLK DIRECTORIES DATED 1938-1996

SITE PLAN

N

1" = 80'

40 0 80

LEGEND:

MW1 (11.79) MONITORING WELL LOCATION AND DESIGNATION AND ELEVATION IN FEET

11.2 POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT (AVERAGE)

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CB CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88) BENCHMARK SNV-5144 BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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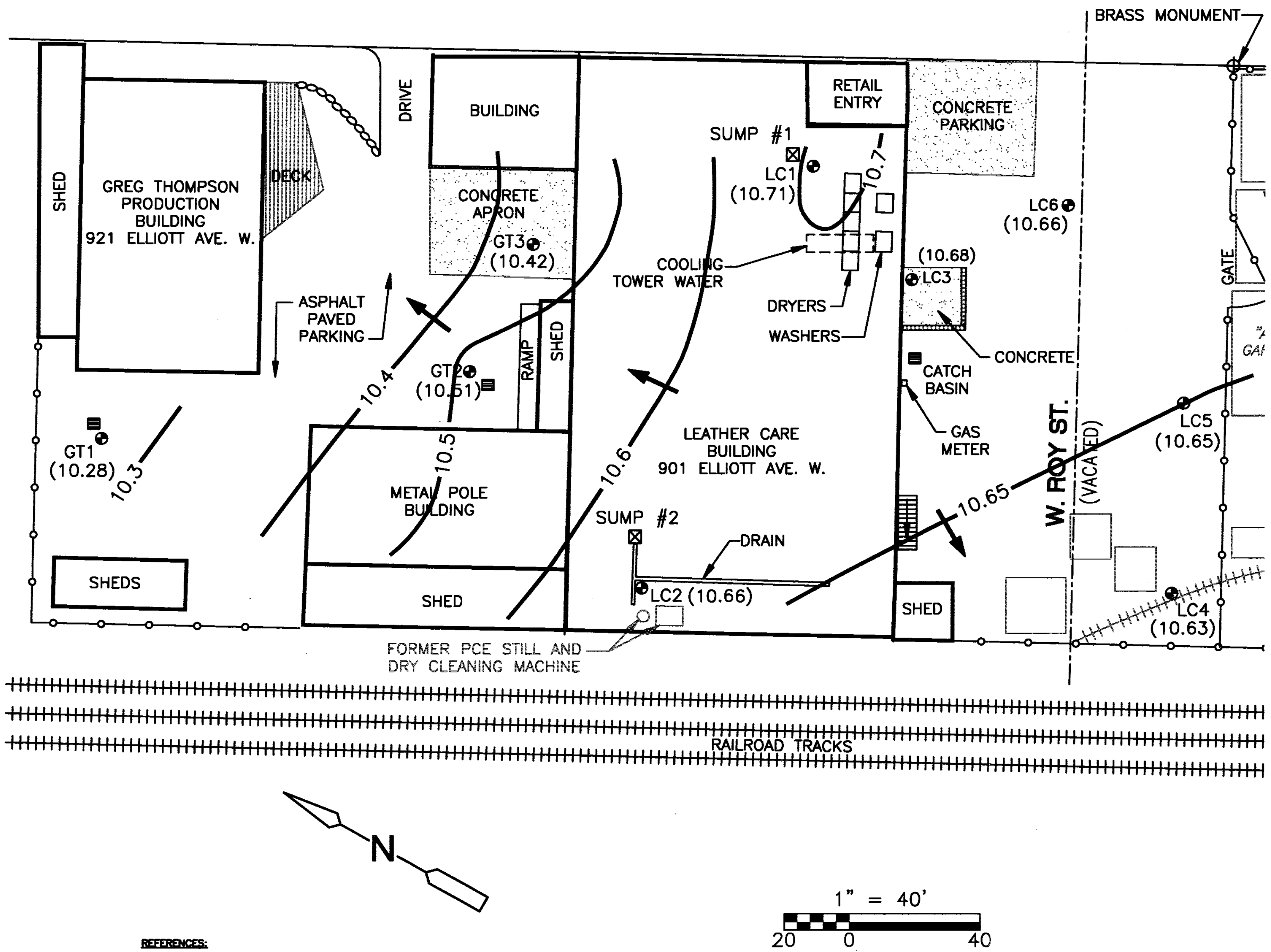
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5c
POTENTIOMETRIC SURFACE MAP
FEBRUARY 12, 2007



LEGEND:

LC6 (10.66)	MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET
10.5	POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.
	DIRECTION OF GROUNDWATER FLOW
	FENCE
	RAILROAD TRACKS
	CATCH BASIN
INDICATES HISTORICAL FEATURES	HISTORICAL FEATURES
	SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

REFERENCES:

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- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938-1996

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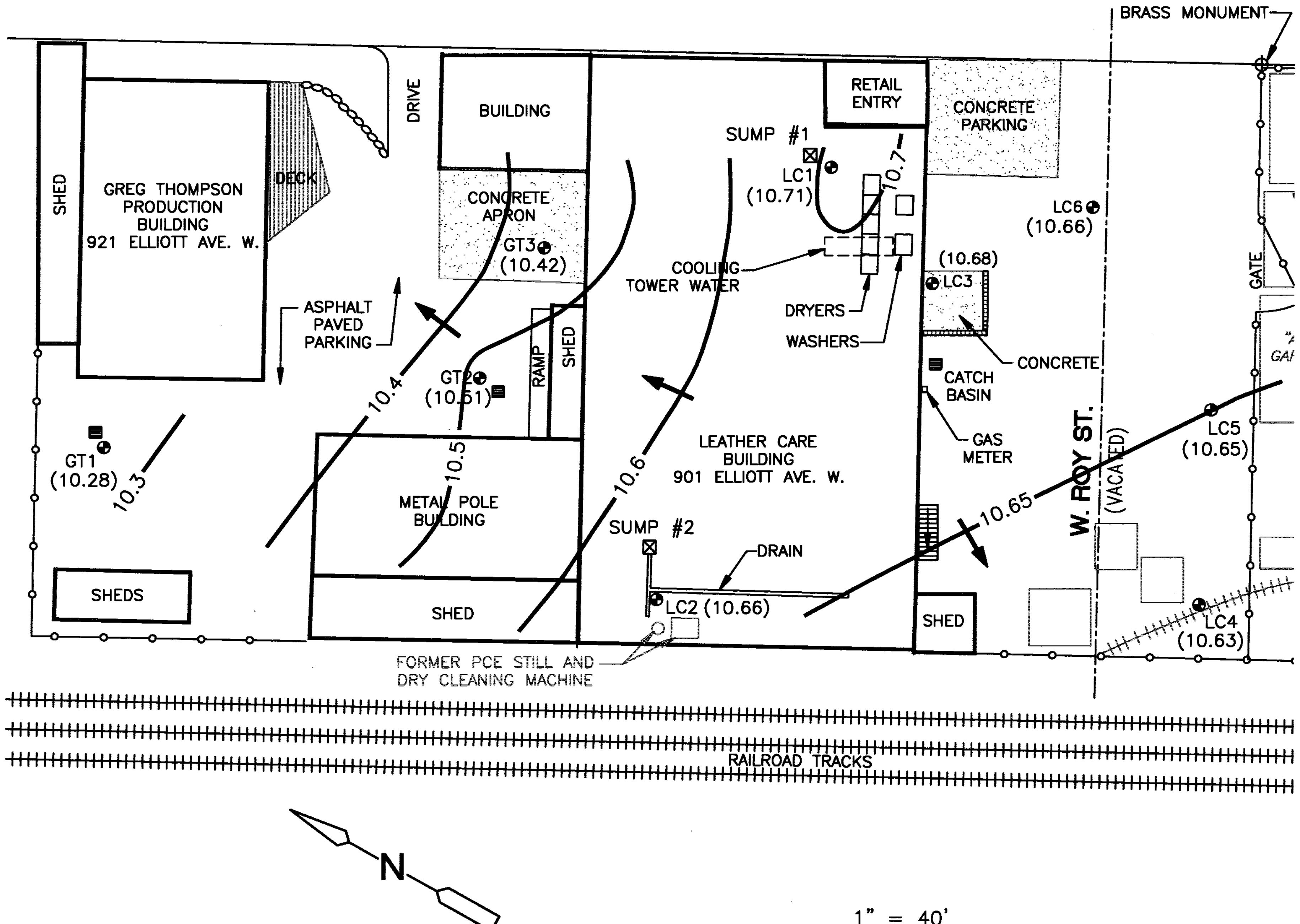
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5e
Potentiometric Surface Map
September 19, 2007



1" = 40'

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REFERENCES:

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- HISTORICAL AERIAL PHOTOGRAPHS DATED 1936 AND 1946.
- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938-1996

LEGEND:

LC6 ⊕ (10.66) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

— 10.5 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.

→ DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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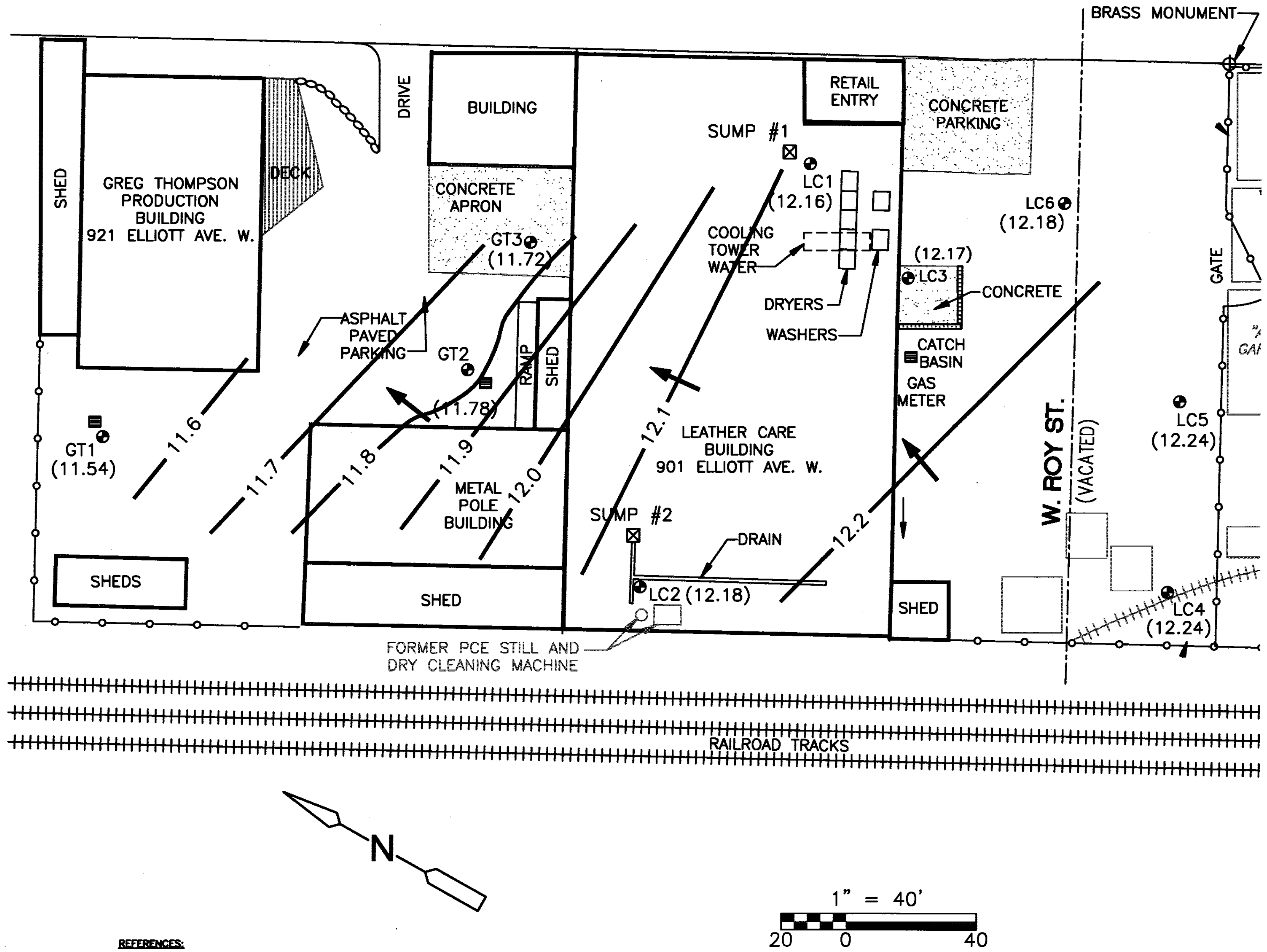
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5e
Potentiometric Surface Map
September 19, 2007



LEGEND:

LC6 (12.18) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

11.9 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

REFERENCES:

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- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938-1996

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CDM

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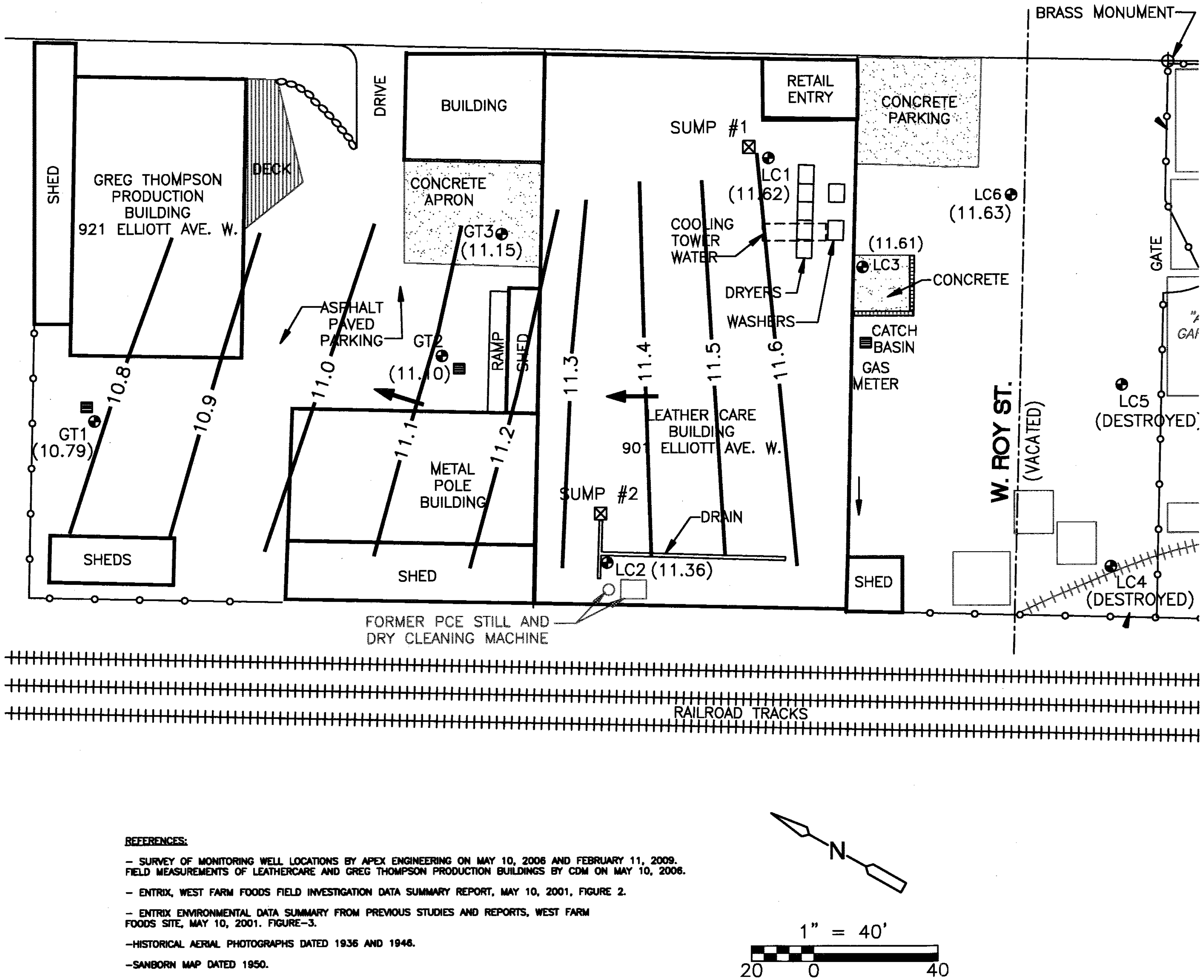
Figure No. 5f
Potentiometric Surface Map
December 19, 2007



REFERENCES:

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- POLK DIRECTORIES DATED 1938-1996

LEGEND:

- LC6 (11.63) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET
- 11.9 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.
- DIRECTION OF GROUNDWATER FLOW
- FENCE
- RAILROAD TRACKS
- CATCH BASIN
- INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES
- SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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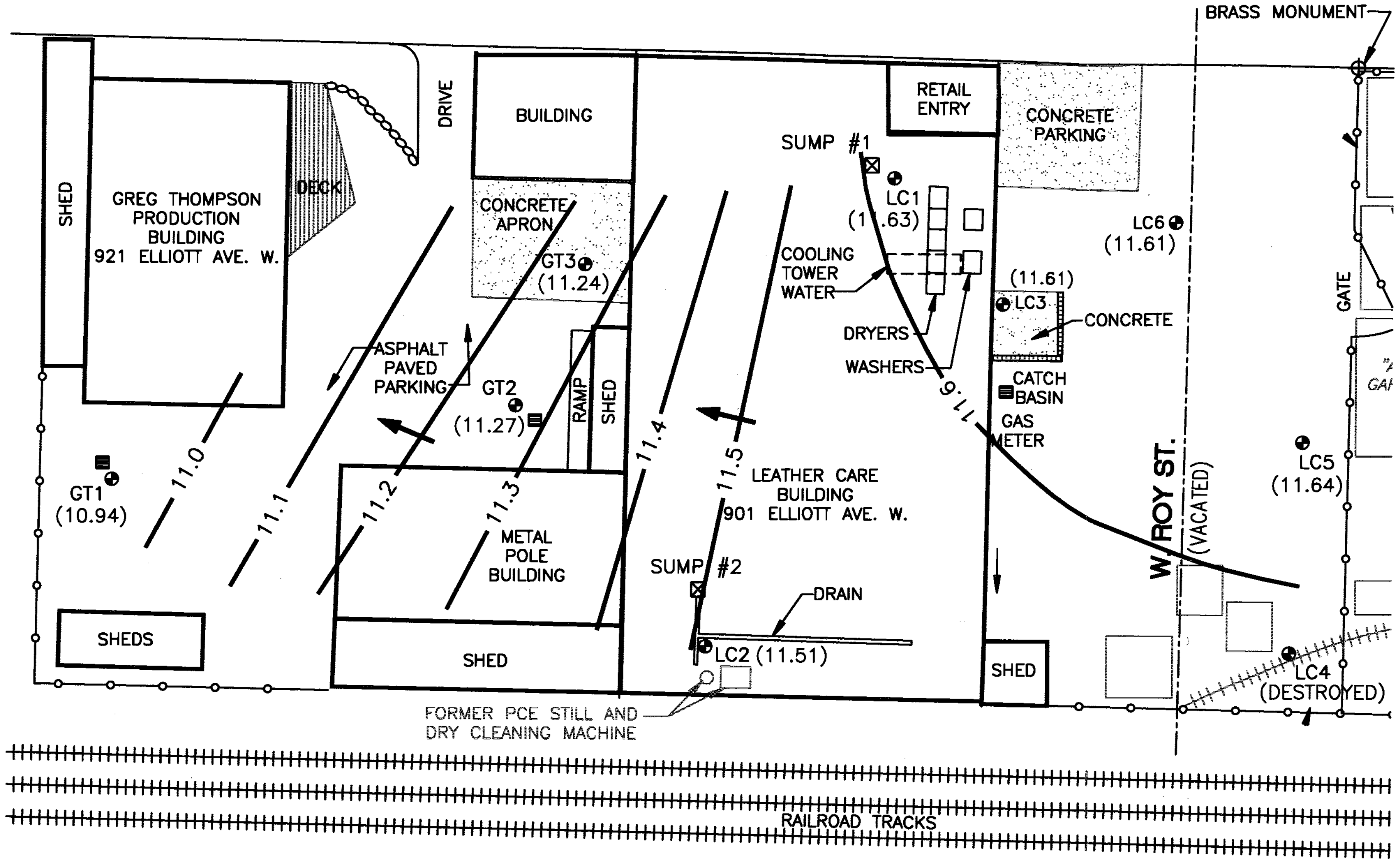
LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5h
Potentiometric Surface Map
June 18, 2008



REFERENCES:

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- POLK DIRECTORIES DATED 1936-1996

LEGEND:

LC6 (12.18)	MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET
11.9	POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.
	DIRECTION OF GROUNDWATER FLOW
	FENCE
	RAILROAD TRACKS
	CATCH BASIN
INDICATES HISTORICAL FEATURES	HISTORICAL FEATURES
	SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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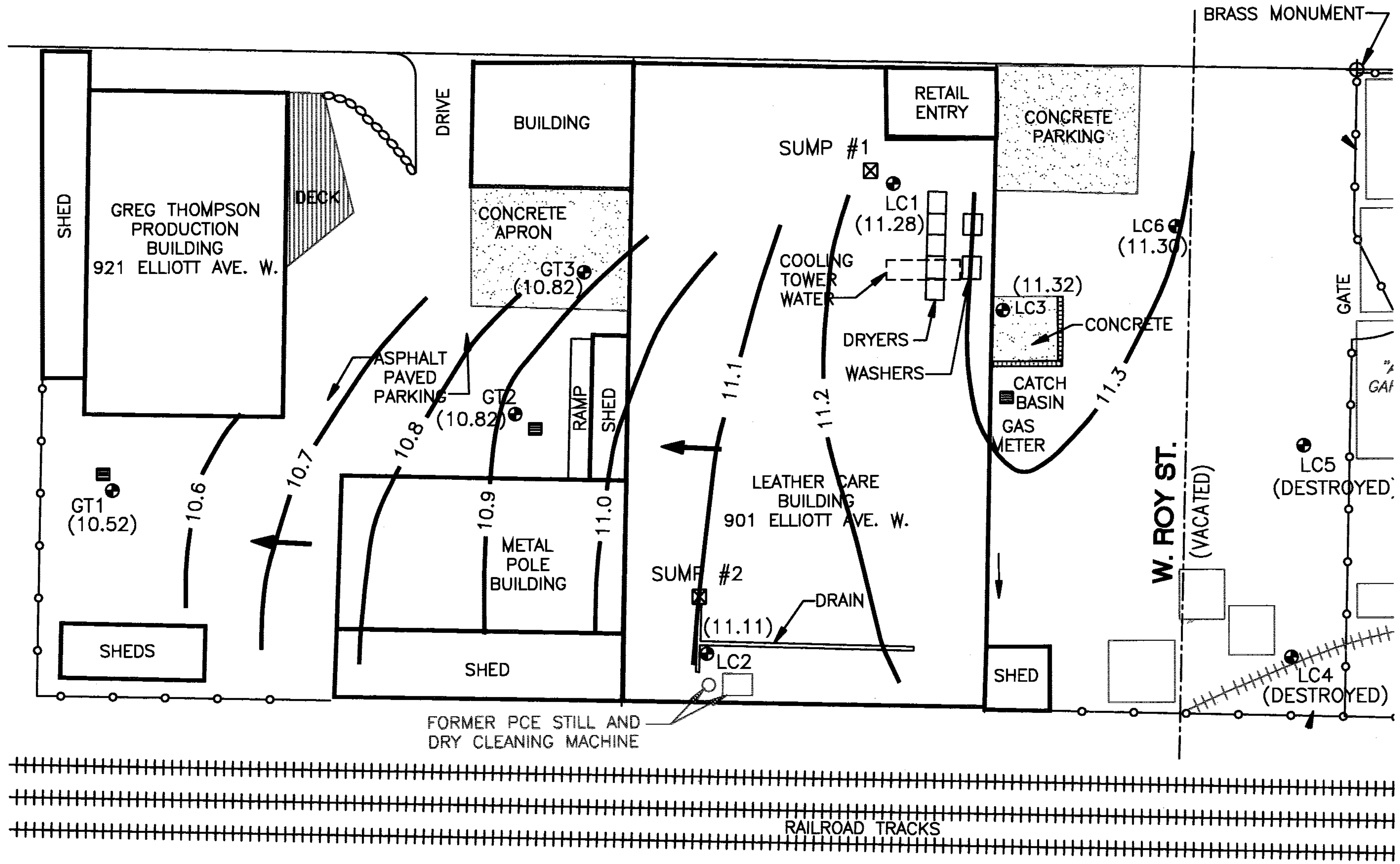
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5g
Potentiometric Surface Map
March 19, 2008



LEGEND:

LC6 (11.30) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

10.7 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

REFERENCES:

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- POLK DIRECTORIES DATED 1938–1996

N

1" = 40'

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CDM

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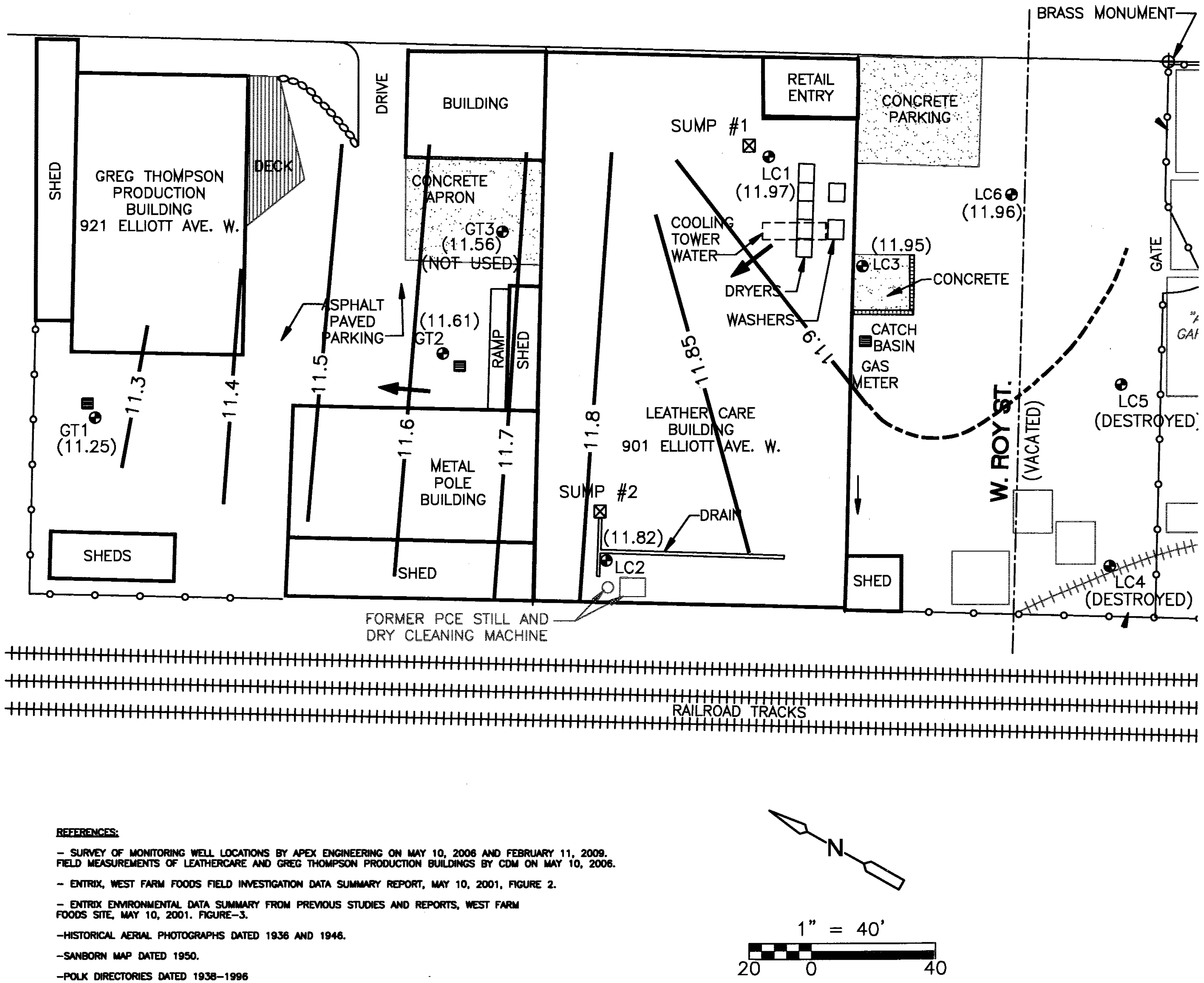
Figure No. 5i
Potentiometric Surface Map
September 24, 2008



LEGEND:

LC6 (11.96) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

11.8 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

REFERENCES:

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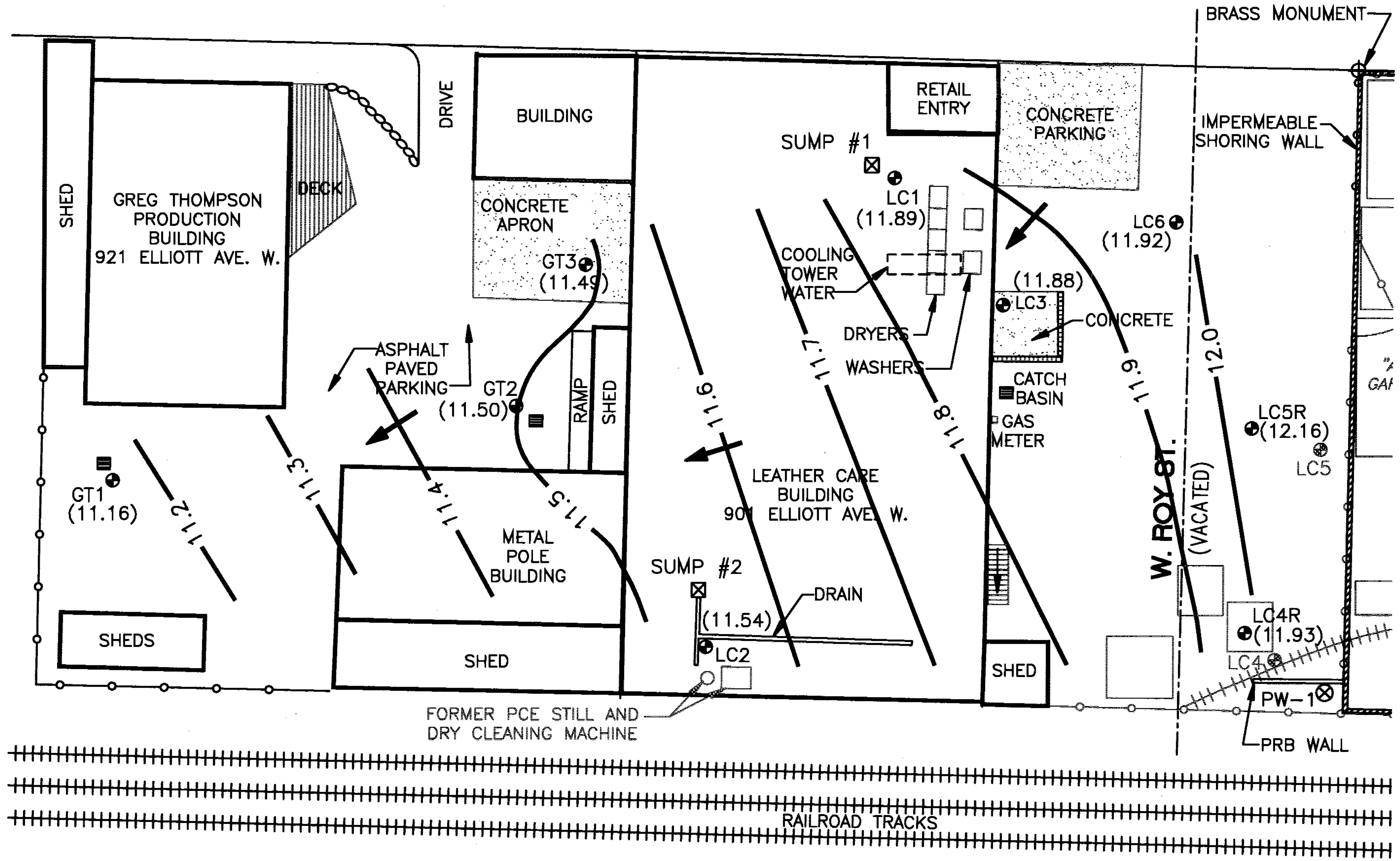
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5j
Potentiometric Surface Map
December 29, 2008



LEGEND:

LC6 (11.92) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

LC5 — MONITORING WELL DESTROYED

11.2 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT.

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

CSM IMPERMEABLE WALL

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

REFERENCES:

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- SANBORN MAP DATED 1950.
- POLK DIRECTORIES DATED 1938-1996

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LEATHERCARE INC. RI/FS
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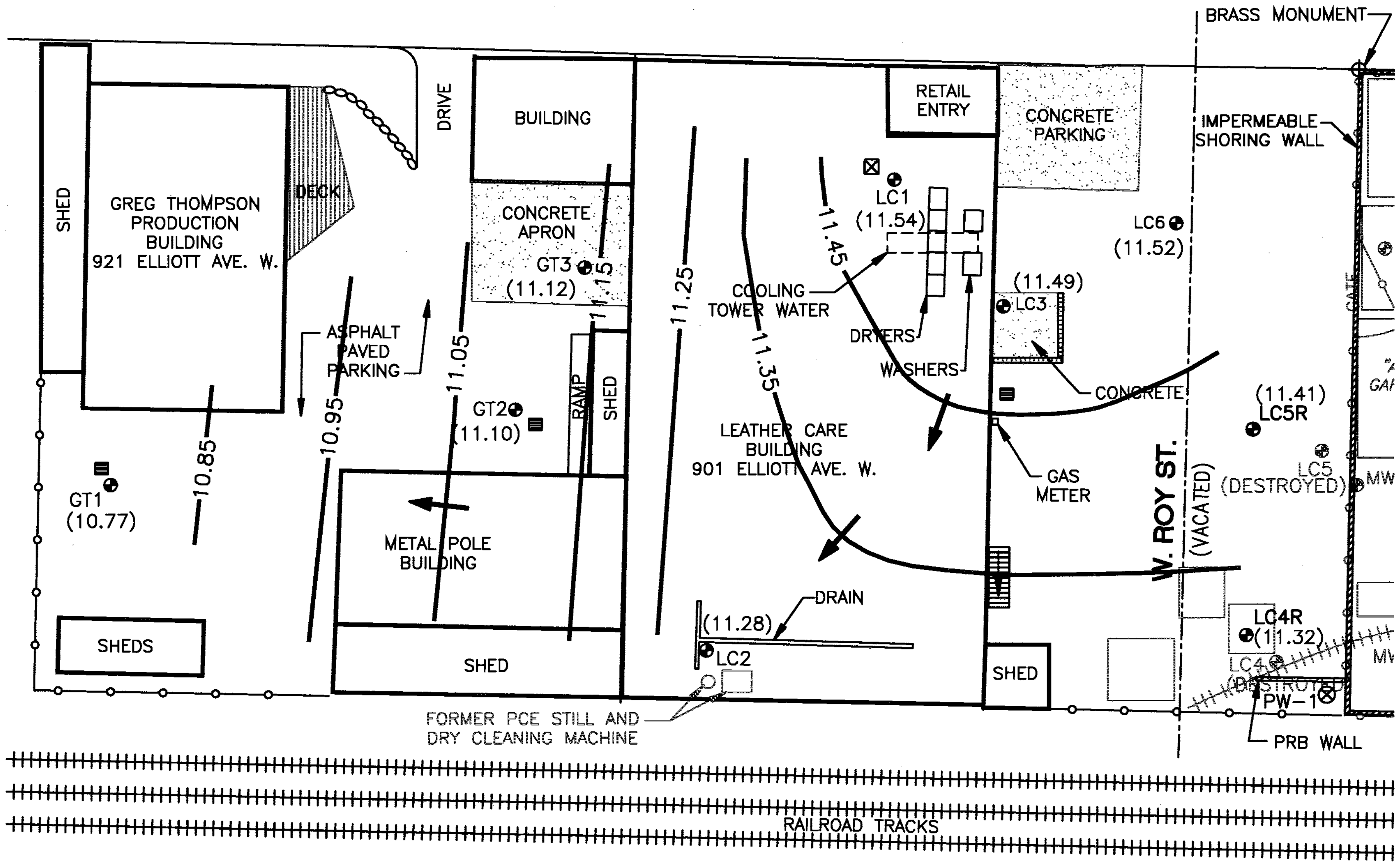
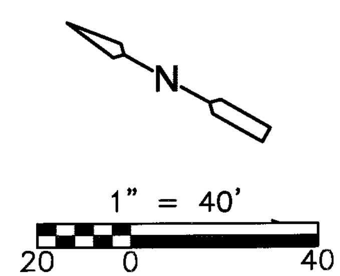
Figure No. 5k
Potentiometric Surface Map
March 25, 2009





REFERENCES:

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- POLK DIRECTORIES DATED 1938-1996

LEGEND:

LC6 (11.52) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

11.05 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

CSM IMPERMEABLE WALL

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

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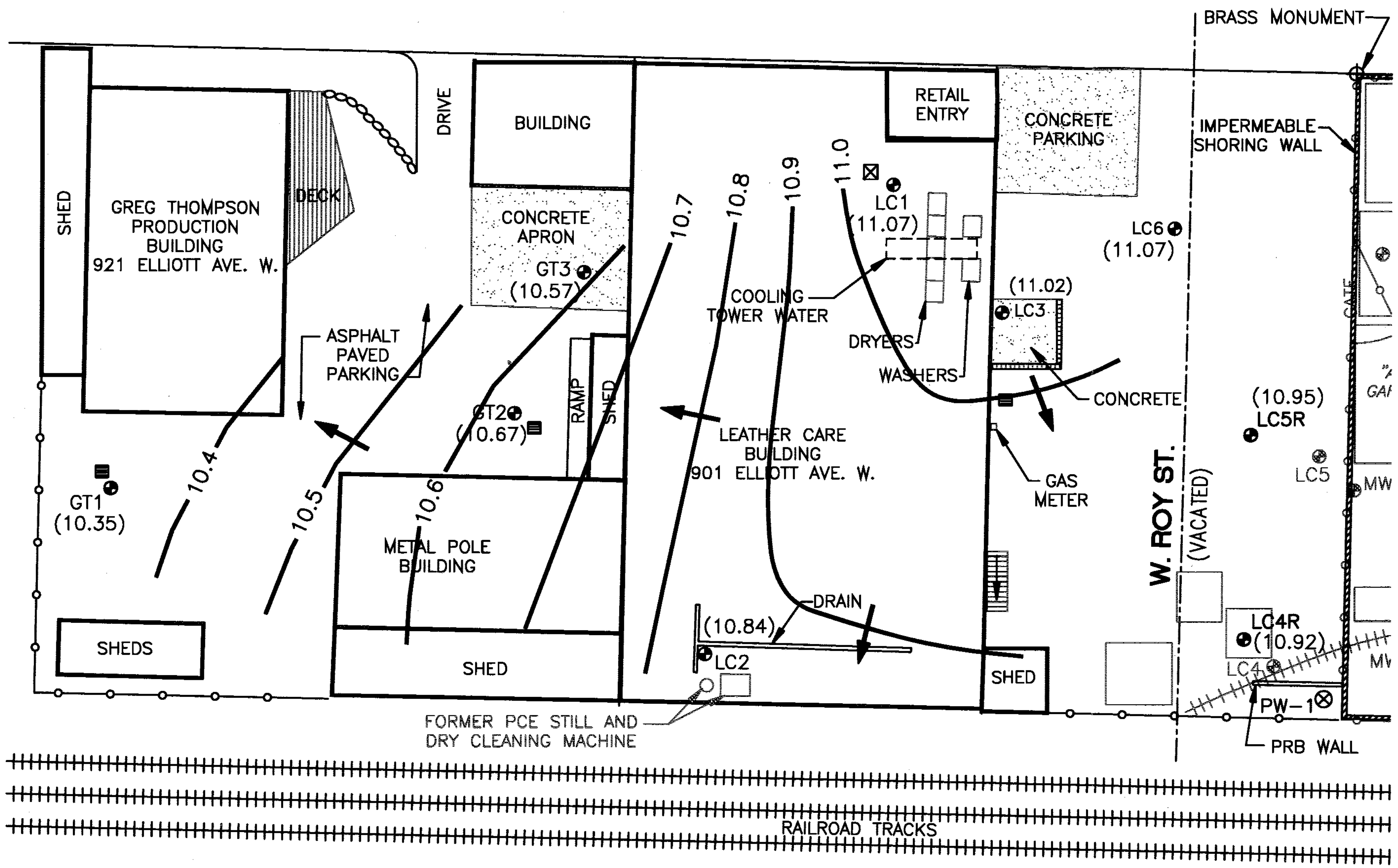
CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5I
Potentiometric Surface Map
June 29, 2009



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REFERENCES:

- SURVEY OF MONITORING WELL LOCATIONS BY APEX ENGINEERING ON MAY 10, 2006 AND FEBRUARY 11, 2009. FIELD MEASUREMENTS OF LEATHERCARE AND GREG THOMPSON PRODUCTION BUILDINGS BY CDM ON MAY 10, 2006.
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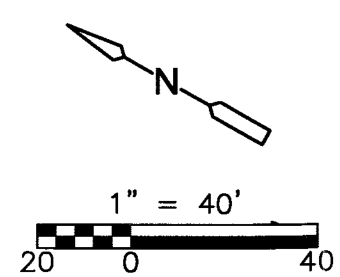


LEGEND:

LC6 (11.07) — MONITORING WELL LOCATION AND DESIGNATION WITH GROUNDWATER ELEVATION IN FEET

11.5 — POTENTIOMETRIC CONTOURS, CONTOUR INTERVAL IS 0.1 FT. (AVERAGE) OR 0.05 FT.

DIRECTION OF GROUNDWATER FLOW

FENCE

RAILROAD TRACKS

CATCH BASIN

INDICATES HISTORICAL FEATURES — HISTORICAL FEATURES

SURVEY MONUMENT

CSM IMPERMEABLE WALL

VERTICAL DATUM:

CITY OF SEATTLE (NAVD 88)
BENCHMARK SNV-5144
BRASS MONUMENT SW CORNER OF ROY AND ELLIOTT. ELEVATION 19.78'

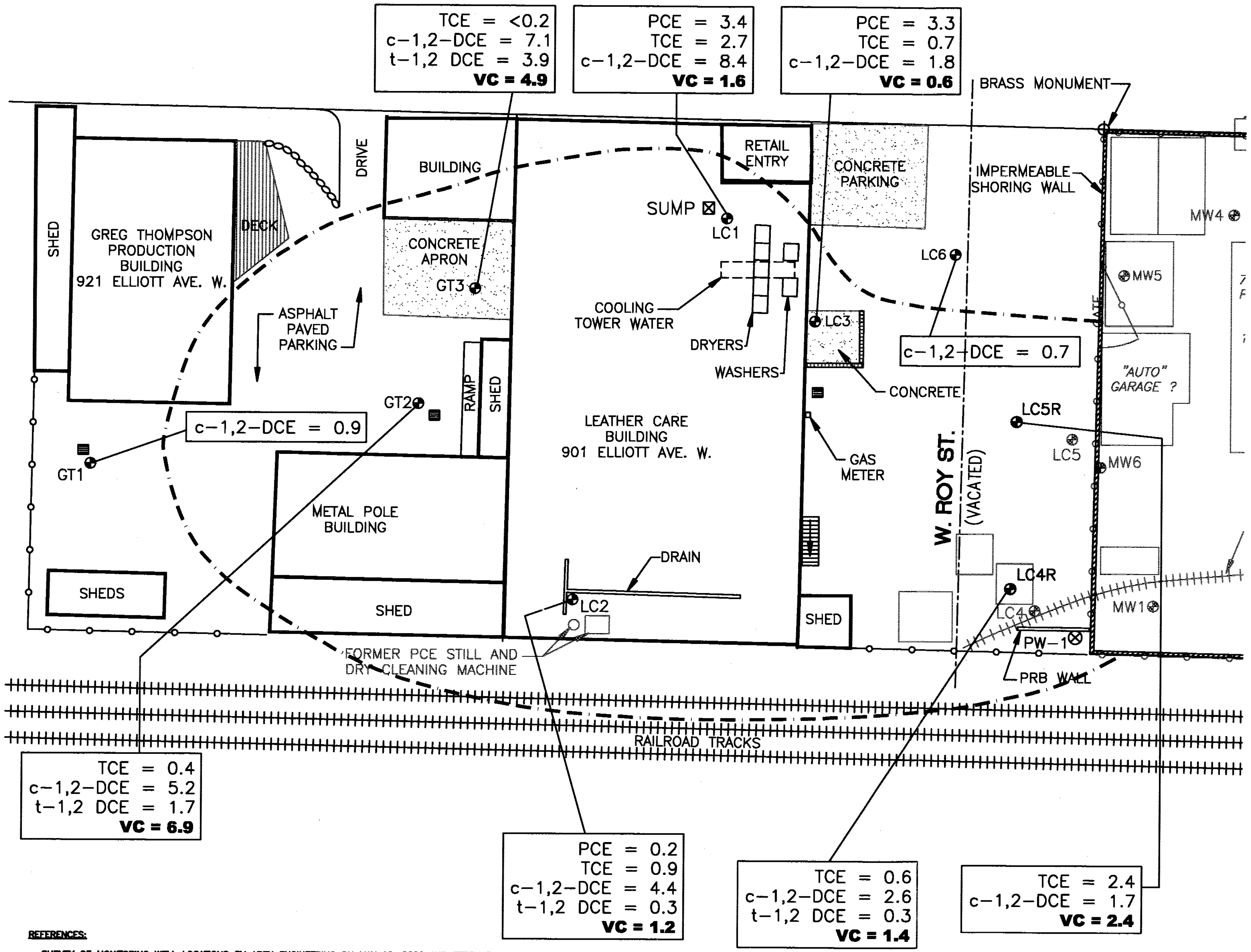
BASIS OF BEARING:

BASIS OF BEARING ASSUMED DUE WEST

CDM

LEATHERCARE INC. RI/FS
SEATTLE, WASHINGTON

Figure No. 5m
Potentiometric Surface Map
September 23, 2009



LEGEND:

LC6 ⊕	MONITORING WELL LOCATION AND DESIGNATION
PCE	TETRACHLOROETHENE CONCENTRATION IN MICROGRAMS PER LITER (ug/L)
TCE	TRICHLOROETHENE CONCENTRATION IN (ug/L)
c-1,2-DCE	CIS-1.2 DICHLOROETHENE CONCENTRATION IN (ug/L)
t-1,2-DCE	TRANS 1,2 DICHLOROETHENE CONCENTRATION IN (ug/L)
VC	VINYL CHLORIDE CONCENTRATION IN (ug/L)
0.0	BOLDED VALUES EXCEED THE MODEL TOXICS CONTROL ACT METHOD A CLEANUP LEVEL
	APPROXIMATE EXTENT OF VC EXCEEDING 0.2 ug/L
	FENCE
	RAILROAD TRACKS
	CATCH BASIN
INDICATES HISTORICAL FEATURES	HISTORICAL FEATURES
	SURVEY MONUMENT
	CSM IMPERMEABLE WALL
	SUMP

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- POLK DIRECTORIES DATED 1938-1996

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1" = 40'

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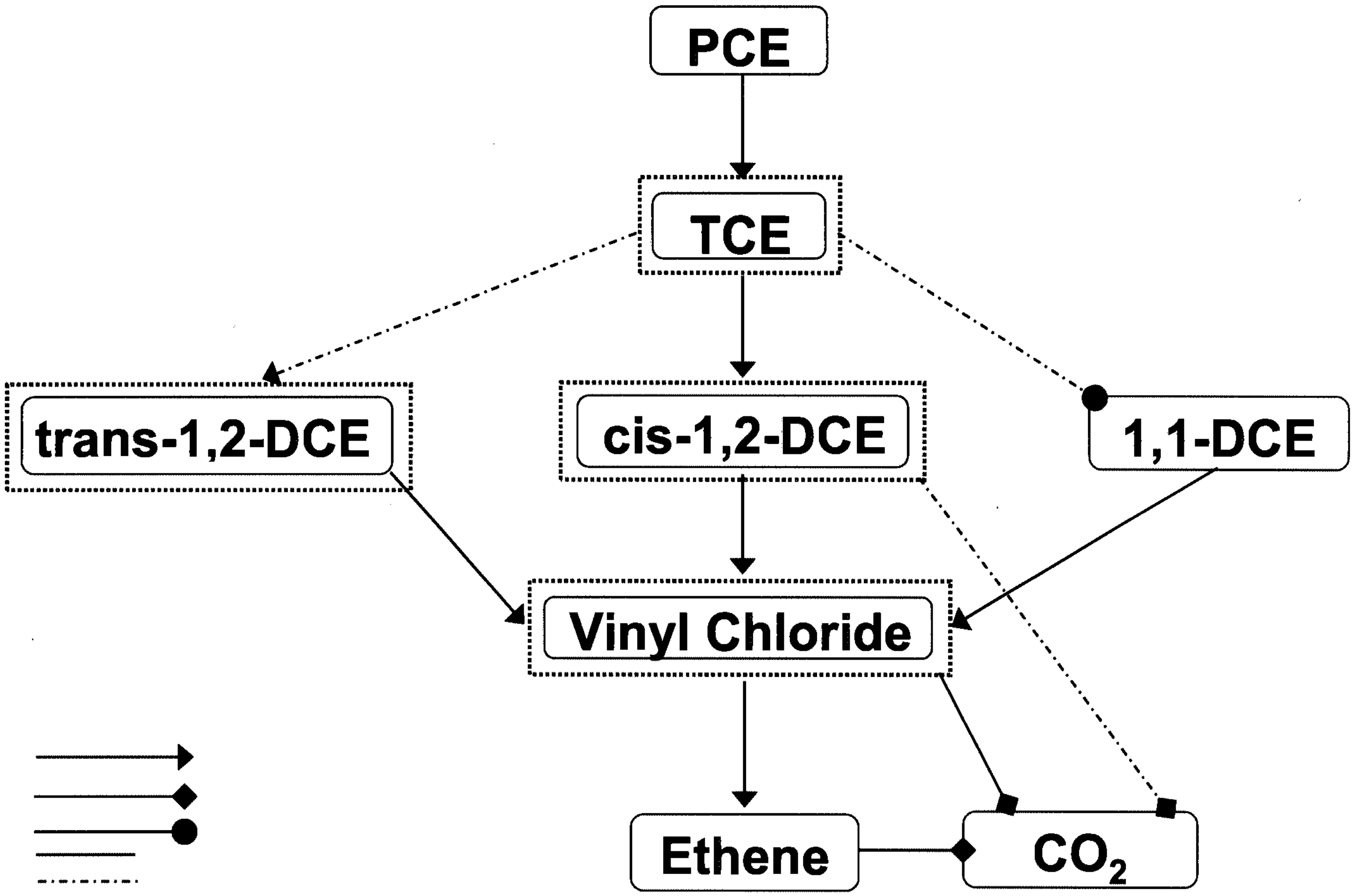
SEATTLE, WASHINGTON

Figure No. 6
Summary of cVOCs in Groundwater
September 23, 2009



Legend
Anaerobic
Aerobic
Abiotic
Major Pathway
Minor Pathway
Aerobic cometabolism to CO_2 in the presence of toluene

LEATHERCARE, INC./RI and FS
SEATTLE, WASHINGTON

Figure 7
Common Degradation Pathways of PCE

CDM

Q:\50000-59999\56498 LeatherCare\68247\RI-FS\Final RI-FS\Figure 7 Biodegradation.xls

Appendix A

Appendix A
Screening Analysis of Soil Gas and Ambient Air Equilibrium Concentrations

Table A1
Soil Gas and Ambient Air Equilibrium Calculations
Leather Care, Inc./RI and FS
Seattle, Washingtoin

Date	Average Concentration in Groundwater (µg/L) [a]	Equilibrium Concentration in Indoor Air (µg/L) groundwater as the source [b]	Indoor air Screening Limits (µg/L) Method B Carcinogenic [c]	Method B Non-Carcinogenic [d]	EPA Target Indoor Air [d]
		PCE			
May-06	3.0	2.2E-05	4.2E-04	1.6E-02	8.1E-04
Sep-06	3.3	2.5E-05			
Feb-07	2.2	1.6E-05			
Jun-07	1.1	8.5E-06			
Sep-07	2.1	1.5E-05			
Dec-07	2.8	2.1E-05			
Mar-08	1.9	1.4E-05			
Jun-08	3.3	2.5E-05			
Sep-08	2.9	2.1E-05			
Dec-08	2.8	2.1E-05			
Mar-09	2.6	1.9E-05			
Jun-09	1.8	1.4E-05			
		TCE			
May-06	3.8	1.6E-05	1.0E-04	1.6E-02	2.2E-05
Sep-06	2.5	1.1E-05			
Feb-07	2.5	1.1E-05			
Jun-07	2.0	8.6E-06			
Sep-07	1.9	8.1E-06			
Dec-07	2.1	9.2E-06			
Mar-08	2.0	8.6E-06			
Jun-08	2.5	1.1E-05			
Sep-08	1.0	4.4E-06			
Dec-08	1.6	7.0E-06			
Mar-09	1.4	5.9E-06			
Jun-09	1.2	5.4E-06			
		Vinyl Chloride			
May-06	6.9	8.8E-05	2.8E-04	4.6E-02	2.8E-04
Sep-06	9.8	1.3E-04			
Feb-07	4.3	5.5E-05			
Jun-07	3.5	4.5E-05			
Sep-07	5.6	7.1E-05			
Dec-07	7.2	9.2E-05			
Mar-08	3.3	4.3E-05			
Jun-08	4.9	6.3E-05			
Sep-08	4.8	6.2E-05			
Dec-08	2.9	3.7E-05			
Mar-09	2.2	2.9E-05			
Jun-09	4.8	6.1E-05			

Notes:
a) The average concentrations in wells LC1, LC2, LC3, GT2, and GT3 were used for this analysis. One-half the detection limits used in nondetects.
b) Ambient air calculations obtained using groundwater as the source: Used an attentuation factor of 7.5E-06 for PCE, 4.3E-06 for TCE, and 1.3E-05 for VC, as calculated from building specific vapor intrusion calculations (see calculation spreadsheets).
c) Method B Screening limits obtained from Washington Model Toxics Control Act "CLARC" Method C Standard Formula Values. Data downloaded September 24, 2009.
d) EPA Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index [R=10-6, HI=1) from OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathways from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). EPA 530-D-OC-004. November 2002

µg/L - micrograms per liter

Example Scientific Notation Equivents: 8.5E-06 = 0.0000085
2.2E-05 = 0.000022
1.3E-04 = 0.00013
4.6E-02 = 0.046

Vapor Intrusion Calculations for PCE in Groundwater
Leather Care Building

The subject building is of slab-on-grade construction. Saturated soil is present at the base of the foundation slab. There is no unsaturated zone or capillary fringe between the bottom of the foundation slab and groundwater. Groundwater is impacted with PCE, TCE, and vinyl chloride.
The concentrations of PCE, TCE, and vinyl chloride in the vapor phase at the groundwater/slab interface can be approximated using Henry's Law.
The concentration of PCE, TCE, and vinyl chloride expected to be present in indoor air can be approximated by calculating a flow rate of soil gas into the building through the concrete floor slab and estimating the dilution by natural building ventilation.

Henrys Law:

$$C_{sg} = H(C_{gw})$$

Soil Vapor Flow Rate:

$$Q_{SOIL} = \frac{2(3.14)(\Delta P)(k)(X_{CRACK})}{\mu[\ln(2(Z_{CRACK}/r_{CRACK})]}$$

Mass Balance:

$$(C_{IA})(Q_T) = (C_{sg})(Q_{SOIL})$$

$$(C_{IA}) = \frac{(C_{sg})(Q_{SOIL})}{(QT)}$$

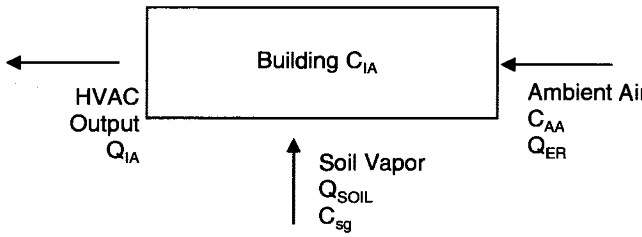
$$(C_{IA}) = \frac{H(C_{gw})(Q_{SOIL})}{(QT)}$$

$$\frac{(C_{IA})}{(C_{gw})} = \frac{H(Q_{SOIL})}{(QT)}$$

Groundwater to Indoor Air Attenuation Factor

$$K_{ai} = \frac{(C_{IA})}{(C_{gw})}$$

$$K_{ai} = \frac{H(Q_{SOIL})}{(QT)}$$



Parameter	Symbol	Value	Unit	Data Source Description
Total Flow Rate	$Q_T = Q_{ER} + Q_{SOIL}$	1,621,999	cm^3/s	Calculated
Air Exchange Rate (assume 0.5 Bld Vol/hr)	Q_{ER}	1,621,977	cm^3/s	Typical for non-ventilated bldg.
Soil Vapor Flow Rate	Q_{SOIL}	22	cm^3/s	Calculated
Indoor Air Concentration	C_{IA}		ug/L	Calculated
Soil Gas Concentration	C_{sg}		ug/L	Henrys Law
Groundwater Concentration	C_{gw}		ug/L	Site specific sample data
Henrys Constant at 19°C	H	0.55	unitless	J&E Lite lookup for 19 degree C
Differential Pressure (Bldg/Ambient)	ΔP	40	$g/cm\text{-}s^2$	Default from J&E Advanced
Soil Permeability (sandy loam)	k	6.22E-09	cm^2	Default for sandy loam J&E
Vapor Viscosity	μ	1.78E-04	g/cm-s	Default from J&E Advanced
Crack Length (perimeter of bldg)	X_{CRACK}	17,024	cm	Measured from bldg. plans
Vertical Crack Length (Slab Thickness)	Z_{CRACK}	45.72	cm	Assume 1.5 ' slab thickness
Crack Radius (J&E default)	r_{CRACK}	0.1	cm	Default from J&E Lite
Temperature	T	19	°C	Site specific data
Building Volume	V	412,413	ft2	Measured from bldg. plans
Groundwater to Indoor Air Attenuation Factor	Kia	7.5E-06	unitless	Calculated

Vapor Intrusion Calculations for TCE in Groundwater
Leather Care Building

The subject building is of slab-on-grade construction. Saturated soil is present at the base of the foundation slab. There is no unsaturated zone or capillary fringe between the bottom of the foundation slab and groundwater. Groundwater is impacted with PCE, TCE, and vinyl chloride.
The concentrations of PCE, TCE, and vinyl chloride in the vapor phase at the groundwater/slab interface can be approximated using Henry's Law.
The concentration of PCE, TCE, and vinyl chloride expected to be present in indoor air can be approximated by calculating a flow rate of soil gas into the building through the concrete floor slab and estimating the dilution by natural building ventilation.

<u>Henrys Law:</u>

$$C_{sg} = H(C_{gw})$$

<u>Soil Vapor Flow Rate:</u>

$$Q_{SOIL} = \frac{2(3.14)(\Delta P)(k)(X_{CRACK})}{\mu[\ln(2(Z_{CRACK}/r_{CRACK})]}$$

<u>Mass Balance:</u>

$$(C_{IA})(Q_T) = (C_{sg})(Q_{SOIL})$$

$$(C_{IA}) = \frac{(C_{sg})(Q_{SOIL})}{(QT)}$$

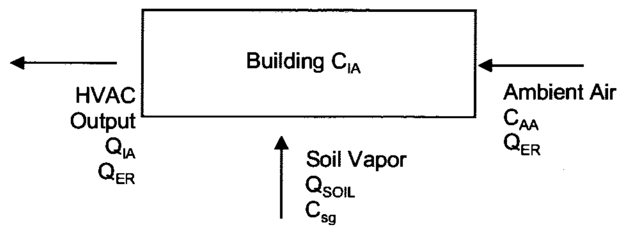
$$(C_{IA}) = \frac{H(C_{gw})(Q_{SOIL})}{(QT)}$$

$$\frac{(C_{IA})}{(C_{gw})} = \frac{H(Q_{SOIL})}{(QT)}$$

<u>Groundwater to Indoor Air Attenuation Factor</u>

$$K_{ia} = \frac{(C_{IA})}{(C_{gw})}$$

$$K_{ia} = \frac{H(Q_{SOIL})}{(QT)}$$



Parameter	Symbol	Value	Unit	Data Source Description
Total Flow Rate	$Q_{T} = Q_{ER} + Q_{SOIL}$	1,621,999	cm^3/s	Calculated
Air Exchange Rate (assume 0.5 Bld Vol/hr)	Q_{ER}	1,621,977	cm^3/s	Typical for non-ventilated bldg.
Soil Vapor Flow Rate	Q_{SOIL}	22	cm^3/s	Calculated
Indoor Air Concentration	C_{IA}		ug/L	Calculated
Soil Gas Concentration	C_{sg}		ug/L	Calculated by Henrys Law
Groundwater Concentration	C_{gw}		ug/L	Site specific sample data
Henrys Constant at 19°C	H	0.32	unitless	J&E Lite lookup for 19 degree C
Differential Pressure (Bldg/Ambient)	ΔP	40	$g/cm\text{-}s^2$	Default from J&E Advanced
Soil Permeability (sandy loam)	k	6.22E-09	cm^2	Default for sandy loam J&E
Vapor Viscosity	μ	1.78E-04	g/cm-s	Default from J&E Advanced
Crack Length (perimeter of bldg)	X_{CRACK}	17,024	cm	Measured from bldg. plans
Vertical Crack Length (Slab Thickness)	Z_{CRACK}	45.72	cm	Assume 1.5 ' slab thickness
Crack Radius (J&E default)	r_{CRACK}	0.1	cm	Default from J&E Lite
Temperature	T	19	°C	Site specific data
Building Volume	V	412,413	ft2	Measured from bldg. plans
Groundwater to Indoor Air Attenuation Factor	Kia	4.3E-06	unitless	Calculated

Vapor Intrusion Calculations for Vinyl Chloride in Groundwater
Leather Care Building

The subject building is of slab-on-grade construction. Saturated soil is present at the base of the foundation slab. There is no unsaturated zone or capillary fringe between the bottom of the foundation slab and groundwater. Groundwater is impacted with PCE, TCE, and vinyl chloride.
The concentrations of PCE, TCE, and vinyl chloride in the vapor phase at the groundwater/slab interface can be approximated using Henry's Law.
The concentration of PCE, TCE, and vinyl chloride expected to be present in indoor air can be approximated by calculating a flow rate of soil gas into the building through the concrete floor slab and estimating the dilution by natural building ventilation.

Henrys Law:
$$C_{sg} = H(C_{gw})$$

Soil Vapor Flow Rate:
$$Q_{SOIL} = \frac{2(3.14)(\Delta P)(k)(X_{CRACK})}{\mu[\ln(2(Z_{CRACK}/r_{CRACK})]}$$

Mass Balance:
$$(C_{IA})(Q_T) = (C_{sg})(Q_{SOIL})$$

$$(C_{IA}) = \frac{(C_{sg})(Q_{SOIL})}{(QT)}$$

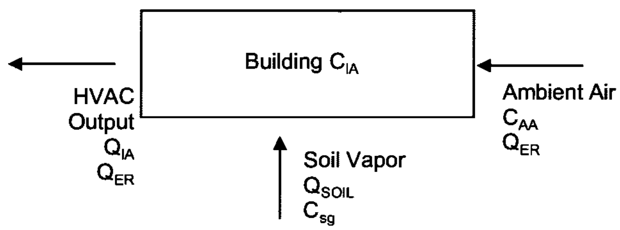
$$(C_{IA}) = \frac{H(C_{gw})(Q_{SOIL})}{(QT)}$$

$$\frac{(C_{IA})}{(C_{gw})} = \frac{H(Q_{SOIL})}{(QT)}$$

Groundwater to Indoor Air Attenuation Factor

$$K_{ia} = \frac{(C_{IA})}{(C_{gw})}$$

$$K_{ia} = \frac{H(Q_{SOIL})}{(QT)}$$



Parameter	Symbol	Value	Unit	Data Source Description
Total Flow Rate	$Q_T = Q_{ER} + Q_{SOIL}$	1,621,999	cm^3/s	Calculated
Air Exchange Rate (assume 0.5 Bld Vol/hr)	Q_{ER}	1,621,977	cm^3/s	Typical for non-ventilated bldg.
Soil Vapor Flow Rate	Q_{SOIL}	22	cm^3/s	Calculated
Indoor Air Concentration	C_{IA}		ug/L	Calculated
Soil Gas Concentration	C_{sg}		ug/L	Calculated by Henrys Law
Groundwater Concentration	C_{gw}		ug/L	Site specific sample data
Henrys Constant at 19°C	H	0.95	unitless	J&E Lite lookup for 19 degree C
Differential Pressure (Bldg/Ambient)	ΔP	40	$g/cm\text{-}s^2$	Default from J&E Advanced
Soil Permeability (sandy loam)	k	6.22E-09	cm^2	Default for sandy loam J&E
Vapor Viscosity	μ	1.78E-04	g/cm-s	Default from J&E Advanced
Crack Length (perimeter of bldg)	X_{CRACK}	17024	cm	Measured from bldg. plans
Vertical Crack Length (Slab Thickness)	Z_{CRACK}	45.72	cm	Assume 1.5 ' slab thickness
Crack Radius (J&E default)	r_{CRACK}	0.1	cm	Default from J&E Lite
Temperature	T	19	°C	Site specific data
Building Volume	V	412,413	ft2	Measured from bldg. plans
Groundwater to Indoor Air Attenuation Factor	Kia	1.3E-05	unitless	Calculated

Appendix B

B Appendix

Appendix B
Conceptual Level Cost Estimates

CDM

Summary
LeatherCare, Inc.

Project Name: FS-LeatherCare
Project #: 56498-68247
Project Manager: PJM

Alternate 1	Estimated Cost for Alternative 1 - MNA	$125,138
Alternate 2	Estimated Cost for Alternative 2 - EAB	$263,380
Alternate 3	Estimated Cost for Alternative 3 - ISCO	$384,460

Assumptions for the FS Options
LeatherCare, Inc.

Project Name: FS
Project #: 56498-68247
Project Manager: PJM

Issues:

- Buried utilities
- Buildings covering contaminated areas
- Shallow vadoze zone
- Traffic
- Soil adsorptive capacity and natural carbon drive amount of oil/oxidant, as opposed to contaminant levels.

Assumptions:

Use 26,000 lb pemanganate chemical oxidant over 2 injection cycles			
Use 70 drums of edible oil over 1 injection cycle			
Length of Plume		300	ft
Width of Plume		110	ft
Average thickness of saturated zone		12	ft
Permangante chemical costs	$	2.00	lb
Edible Oil costs	$	220	drum
Porosity @ 35%			
Push probe spacing on 25-foot centers			

Table B1
Estimated Cost for Alternative 1 - MNA
LeatherCare, Inc./RI and RS
Tacoma, Washington

Project Name: FS-Monitored Natural Attenuation
Project #: 56498-68247
Project Manager: PJM

Cost Summary	Cont.	Cost	Incl. Cont	Unit Price	QTY
1. Work Plan/Project Management	5%	54,950	**57,698**	57,697.50	1 est
2. Monitored Natural Attenuation	20%	56,200	**67,440**	5.02	13444 yd^3
Subtotal		**111,150**			
Contingencies		13,988			
Total Project			**$125,138**	9.31	13444 yd^3

		Quantity	Unit Cost	Cost	Subtotal	Incl. Cont.
1. Work Plan/Project Management					**$54,950**	**$57,698**
Personnel						
	Personnel	320 hrs	160.00	51,200		
Material						
	Ecology Oversight/Review	30 hr	125.00	3,750		
2. Monitored Natural Attenuation					**$56,200**	**$67,440**
Personnel						
	Personnel	350 hrs	110.00	38,500		
Equipment						
	Sampling Equipment	8 rounds	900.00	7,200		
Outside Services						
	Analytical	70 ea	150.00	10,500		
Project Subtotal					**$111,150**	
				Contingencies:	$13,988	

Total Project Cost	**$125,138**

Table B2
Estimated Cost for Alternative 2 - EAB
LeatherCare, Inc./RI and RS
Tacoma, Washington

Project Name: FS-Enhanced Bio
Project #: 56498-68247
Project Manager: PJM

Cost Summary	Cont.	**Cost**	**Incl. Cont**	Unit Price	QTY
1. Treatability/Pilot Study	10%	24,120	**24,120**	24,120.00	1 est
2. Work Plan and Permitting	10%	28,500	**31,350**	31,350.00	1 est
3. Install Edible Oil	20%	105,150	**126,180**	9.39	13444 yd^3
4. Compliance Monitoring/Reporting	10%	43,700	**48,070**	48,070.00	1 est
5. Project Management	10%	30,600	**33,660**	33,660.00	1 est
Subtotal		**232,070**			
Contingencies		31,310			
Total Project			**$263,380**	19.59	13444 yd^3

	Quantity	**Unit Cost**	**Cost**	Subtotal	**Incl. Cont.**
1. Treatability/Pilot Study				$24,120	**$24,120**
Personnel					
Personnel	160 hrs	110.00	17,600		
Equipment					
Field Equipment	1 est	1,600.00	1,600		
Supplies	1 drum	220.00	220		
Lab Suppies	1 ea	1,000.00	1,000		
Outside Services					
Push Probe Contractor	1 ls	2,500.00	2,500		
Lab Analysis	8 ea	150.00	1,200		
2. Work Plan and Permitting				$28,500	**$31,350**
Personnel					
Personnel	250 hrs	110.00	27,500		
Equipment					
Field Equipment	0 day	0.00	0		
Material					
Misc.	1 ls	1,000.00	1,000		
3. Install Edible Oil				$105,150	**$126,180**
Personnel					
Personnel	350 hrs	110	38,500		
Equipment					
Field Equipment	10 dy	250	2,500		
Monitoring Equipment	10 dy	125	1,250		
Material					
Misc.	1 ls	20,000	20,000		
EVO	70 drum	220.00	15,400		
Outside Services					
Pushprobe Subcontractor	10 dy	2,500.00	25,000		
Utility Locate	1 ls	2,500.00	2,500		

Table B2
Estimated Cost for Alternative 2 - EAB
LeatherCare, Inc./RI and RS
Tacoma, Washington

Project Name: FS-Enhanced Bio
Project #: 56498-68247
Project Manager: PJM

	Quantity	Unit Cost	Cost	Subtotal	Incl. Cont.
4. Compliance Monitoring/Reporting				$43,700	**$48,070**
Personnel					
Personnel	245 hrs	110.00	26,950		
Outside Services					
Misc.	0 ls	0.00	0		
Analytical	72 ea	150.00	10,800		
Material					
Sampling Equipment	7 ls	850.00	5,950		
5. Project Management				$30,600	**$33,660**
Personnel					
Personnel	160 hrs	160.00	25,600		
Material					
Ecology Review	40 ls	125.00	5,000		
Project Subtotal				**$232,070**	
			Contingencies:	$31,310	

Total Project Cost	**$263,380**

Table B3
Estimated Cost for Alternative 3 - ISCO
LeatherCare, Inc./RI and RS
Tacoma, Washington

Project Name: FS-Chemox
Project #: 56498-68247
Project Manager: PJM

Cost Summary	Cont.	**Cost**	**Incl. Cont**	Unit Price	QTY	
1. Treatability/Pilot Study	10%	27,300	**30,030**	30,030.00	1	est
2. Work Plan and Permitting	10%	39,500	**43,450**	43,450.00	1	est
3. Install Chemical Oxidant	20%	197,000	**236,400**	17.58	13444	yd^3
4. Compliance Monitoring and Reporting	10%	37,200	**40,920**	40,920.00	1	est
5. Project Management	10%	30,600	**33,660**	33,660.00	1	est
Subtotal		**331,600**				
Contingencies		52,860				
Total Project			**$384,460**	28.60	13444	yd^3

	Quantity		**Unit Cost**	**Cost**	Subtotal	**Incl. Cont.**
1. Treatability/Pilot Study					$27,300	**$30,030**
Personnel						
Personnel	160	hrs	110.00	17,600		
Equipment						
Field Equipment	1	est	1,600.00	1,600		
Supplies	450	lb	2.00	900		
Lab Supplies	1	est	1,000.00	1,000		
Outside Services						
Push Probe Contractor	2	ls	2,500.00	5,000		
Lab Analysis	8	ea	150.00	1,200		
2. Work Plan and Permitting					$39,500	**$43,450**
Personnel						
Personnel	350	hrs	110.00	38,500		
Equipment						
Field Equipment	0	day	0.00	0		
Material						
Misc.	1	ls	1,000.00	1,000		

Table B3
Estimated Cost for Alternative 3 - ISCO
LeatherCare, Inc./RI and RS
Tacoma, Washington

Project Name: FS-Chemox
Project #: 56498-68247
Project Manager: PJM

	Quantity		Unit Cost	Cost	Subtotal	Incl. Cont.
3. Install Chemical Oxidant					$197,000	**$236,400**
Personnel						
Personnel	500	hrs	110	55,000		
Equipment						
Field Equipment	20	dy	750	15,000		
Monitoring Equipment	20	dy	125	2,500		
Material						
Misc.	1	ls	20,000	20,000		
Permaganate	26,000	lbs	2.00	52,000		
Outside Services						
Pushprobe Subcontractor	20	dy	2,500.00	50,000		
Utility Locate	1	ls	2,500.00	2,500		
4. Compliance Monitoring and Reporting					$37,200	**$40,920**
Personnel						
Personnel	210	hrs	110.00	23,100		
Outside Services						
Misc.	0	ls	0.00	0		
Analytical	60	ea	150.00	9,000		
Material						
Sampling Equipment	6	ls	850.00	5,100		
5. Project Management					$30,600	**$33,660**
Personnel						
Personnel	160	hrs	160.00	25,600		
Material						
Ecology Review	40	hr	125.00	5,000		
Project Subtotal					**$331,600**	
				Contingencies:	$52,860	

Total Project Cost	**$384,460**

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