Eric B's 8/12/93 File Review Memo

IMA

~~Intel Corp~~

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

August 12, 1993

Mr. John Harland
Intel Corporation
MS A14-91
5200 N.E. Elam Young Parkway
Aloha, OR 97124-6497

Re: File Review Summary Memo

Dear Mr. Harland:

The DEQ has reviewed the file information regarding the Intel Corporation, Aloha Campus facility located at 3585 S.W. 198th Avenue in Aloha, Oregon. A File Review Summary Memo is enclosed. Based on our review, we have recommended a Remedial Investigation and Feasibility Study (RI/FS) to determine remedial action options for the A-dec facility. The RI/FS should focus on the following:

- Define the lateral and vertical extent of the groundwater contamination plume.
- Fully characterize the site hydrogeology.
- Evaluate the potential for additional on-site contamination sources.
- Obtain the information necessary to establish cleanup levels and design and implement a remedial action.

In order for DEQ to continue oversight, a formal agreement and statement of work for conducting an RI/FS is needed and will be prepared.

Please contact me at 229-6802 if you have any questions.

Sincerely,

Eric L. Blischke, Project Manager
Voluntary Cleanup Section
Environment Cleanup Division

EB:eb

cc: Mike Rosen, ECD/DEQ, Voluntary Cleanup Section (w/ attachment)
Tom Roick, NWR/DEQ (w/ attachment)
Russ Bunker, Emcon (w/attachment)

811 SW Sixth Avenue
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DEQ-1

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY INTEROFFICE MEMORANDUM

TO: File August 11, 1993

FROM: Eric Blischke

SUBJECT: **Intel - Aloha Campus**

Several documents were reviewed including DEQ Regional Office and Hazardous and Solid Waste files. A list is provided as Attachment 1.

SUMMARY OF AVAILABLE INFORMATION

Site Background

The Intel Aloha Campus site (Intel) is located on the southwest corner of 198th and the Tualatin Valley Highway at 3585 S.W. 198th Avenue in Aloha, Oregon. A site location map is included as Attachment 2. The site covers 37.9 acres and consists of five buildings which house various semiconductor manufacturing facilities and offices. A site layout map is included as Attachment 3. The majority of the property is either covered with buildings or paved. Several stormwater retention ponds are also present on site. The remainder of the property is landscaped. Construction of the facility began in 1974. Prior to 1974, the site was an orchard. Residential communities border the site to the east across 198th Avenue and to the south across Blanton Street. Industrial businesses border the site to the west. Commercial businesses border the site to the north along the Tualatin Valley Highway.

site & vicinity

The semiconductor chip manufacturing process involves the production of silicon wafers that are layered using various solvents and corrosives to create electrical circuits. Trace amounts of arsenic, boron and phosphorous are used because of their conductive properties. The solvents and corrosives are used for cleaning, striping and etching the wafers. Wastes produced by this process include xylene, 1,1,1-trichloroethane (1,1,1-TCA), n-butyl acetate, acid wastes, wastewater, corrosive solid wastes and arsenic contaminated wastes.

manufacturing process & wastes

All wastes generated on-site are either gravity fed or pumped to the service yard area where waste treatment or containment practices are accomplished. The service yard consists of a product storage area located in building D1, a secure hazardous waste 90 day storage area located adjacent to building D1 with a capacity of approximately 100 drums, a flammable storage area located in building FAB-4 which contains waste and product and an arsenic storage area also located in FAB-4. Waste solvents from the manufacturing process are routed to two 3000 gallon solvent waste storage tanks presently located in a below ground vault at the east end of the service yard. In addition, drain lines from the hazardous waste storage area, a solvent

waste generation process & storage

storage area and a corrosive storage area are designed to channel any chemical releases from these areas to the waste solvent tanks. All drain lines are contained within a vault system. Two decontamination pads adjacent to the caustic tanks and corrosive storage area also include a berm system. These storage areas drain to the acid waste equalization basin. Surface runoff within the service yard is routed to a lined stormwater retention pond located in the southeast corner of the site. Overflow from the pond is routed to a drainage ditch through a pipe. The overflow pipe is fitted with an automatic shutoff valve that would close in the event of a spill within the service yard.

fate of waste

With the exception of corrosive wastewater, all wastes generated at the facility are removed from the site for recycling or disposal. Corrosive wastewater is treated on-site. All plant wastewater is treated in the on-site acid waste equalization basin. The pH is adjusted with sodium hydroxide prior to discharge. An average of 235,000 gallons per day is discharged to the United Sewerage Agency.

release history

In July, 1982, failure of a PVC water main was attributed to a solvent release from a underground waste storage system. Apparently, solvents entered the trench containing the water main and weakened the PVC piping. It is uncertain whether the release was from the pipes leading to the solvent tank, the solvent tank itself or a broken vent pipe. The waste collection system was immediately taken out of service and replaced by a doubly contained pipe and tank system. Based on depositions by Intel employees present at the time of the release, the release appears to have been a single event as opposed to slow leak occurring over a long period of time. It is not known whether contaminated soils were excavated.

10 MWs

In response to the release, Intel notified DEQ and installed a system of 5 monitoring wells. Additional monitoring wells were installed in 1983 and 1992. There are currently 10 monitoring wells on-site that are being sampled on a regular basis.

Investigative History

FSI's initial investigation

In July, 1982, after the solvent release was discovered, Intel contracted the services of Foundation Sciences, Inc. (FSI) to conduct an initial investigation. The study was conducted in two phases. Phase I consisted of the installation of 25 shallow soil borings ranging in depth from 3 to 11.5 feet. Shallow boring locations were chosen based on probable solvent seepage paths such as buried water and sewer lines. Soil samples obtained from these borings were screened by odor content in order to estimate the migration path of the solvent release and determine monitoring well locations. Two soil borings (B-21 and B-25) installed immediately downgradient of the release area were found to exhibit a strong solvent odor. Laboratory analysis of soil boring samples collected further downgradient of the release area revealed low levels of xylene (0.05 - 5 mg/kg), n-butyl acetate (0.1 - 0.14 mg/kg) and 1,1,1-TCA (0.1 - 0.7 mg/kg). (See Attachment 4 for a summary of soil boring results.)

During the second phase of the investigation, 5 monitoring wells were installed to depths

FSI's Initial 1982 Investigation

Phase I - 25 shallow SB (max 11.5' bgs) at probable solvent seepage paths

Phase II - 5 MWs (TD = 39-49' bgs) at stiff gray slt
- all soil sample were ND
- GW detected 1,1,1-TCA

ranging from 39.5 to 49.0 feet. The well borings were terminated upon encountering a very stiff, grey, clayey silt layer. Each monitoring well was screened from 3 feet to the bottom of the borehole. Three soil samples from each of the five monitoring well borings were collected. Each sample was analyzed for xylene, n-butyl acetate and 1,1,1-TCA only by purge and trap gas chromatography (no method number cited). These analyses failed to detect the presence of solvents in any of the soil boring samples.

FSI's initial investigation

Groundwater samples collected from the five initial monitoring wells were also analyzed for xylene, 1,1,1-TCA and n-butyl acetate by purge and trap gas chromatography (no method number cited). In addition, a small number of other volatile peaks were tentatively identified and their concentrations estimated. Results of this initial groundwater sampling detected the presence of 1,1,1-TCA in AW-1 and AW-3 at 140 ug/l and 360 ug/l respectively. O-xylene was detected in AW-1 at 130 ug/l. AW-1 through AW-4 were resampled approximately one month later with similar results.

In 1982, Intel installed an additional monitoring well (AW-6) in the vicinity of the release area. Reportedly, AW-6 was installed in sand backfill for the reconstructed waste solvent tank. The only well construction information available for this well states that the well consists of 13.5 feet of 2 inch I.D. slotted (0.01 inch slots) PVC casing. Although AW-6 appears to be a shallow well, it is not clear to what depth this well was installed. AW-6 was sampled by FSI in May 1983 along with monitoring wells AW-1 through AW-4. Groundwater collected from this monitoring well revealed 520 ug/l of 1,1,1-TCA, 174 ug/l of xylenes, 24 ug/l of 1,1 dichloroethane (1,1-DCA), 25 ug/l of 1,1-dichloroethene (1,1-DCE), 180 ug/l of trans-1,2-dichloroethene (trans-1,2-DCE) and 20 ug/l of trichloroethene (TCE).

AW-6

Monitoring wells AW-1 through AW-6 were sampled approximately yearly over the next seven years. Results of these sampling events consistently detected the presence of chlorinated solvents in AW-1, AW-3 and AW-6. Total chlorinated volatile organic compound (VOC) concentrations were highest in AW-6 followed by AW-1 and AW-3. Analysis of groundwater collected from monitoring wells AW-2, AW-4 and AW-5, consistently failed to detect the presence of chlorinated or aromatic VOCs. Total chlorinated VOC concentrations decreased steadily in monitoring wells AW-3 and AW-6 through March 1992. Following an initial decrease, total VOC concentrations in AW-1 have remained relatively constant. In June, 1990, groundwater collected from monitoring well AW-2 revealed elevated levels of 2-butanone (1100 ug/l) and tetrahydrofuran (180 ug/l). However, this detection was attributed to adhesives utilized during the installation of a PVC gas line. With the exception of 31 ug/l of tetrahydrofuran in a sample collected from AW-2 in August, 1990, subsequent analysis has failed to detect the presence of these compounds. A summary of these groundwater results is presented as Attachment 5

1983-1990

In 1991, AW-4 was damaged during on-site construction activities and replaced by AW-4A. Sampling of AW-4A began in March 1992. AW-7 was also installed in March 1992. This well was installed approximately midway between monitoring wells AW-1 and AW-2, directly

AW-4 & AW-4A AW-7

downgradient from the release area. AW-7 was screened from 5 to 38 feet, terminating at the very stiff clay layer in order to be consistent with the previously installed wells. AW-7 was sampled three times in March, 1992. During each sampling event, elevated levels of chlorinated solvents were detected. The primary contaminants detected were vinyl chloride (35 - 100 ug/l), cis-1,2-dichloroethane (cis-1,2-DCA, 360 - 900 ug/l), 1,1-DCA (220 - 400 ug/l) and TCE (140 - 200 ug/l). As a result of the elevated levels of chlorinated compounds detected and the length of the well screen, monitoring well AW-7 was decommissioned in April 1992 and replaced by two shallow well/deep well clusters. Monitoring wells AW-8A and AW-8B were installed approximately 75 feet north of the former location of AW-7 while monitoring wells AW-9A and AW-9B were installed approximately 75 feet south of this location. The deep wells, AW-8A and AW-9A were screened from 25 to 33 feet while the shallow wells, AW-8B and AW-9B were screened from 3 to 11 feet. These wells were installed near the downgradient property boundary and have been sampled four times since May, 1992. Total chlorinated VOC concentrations detected in these wells were highest in AW-8A (a deep well) and AW-9B (a shallow well). Total chlorinated VOC concentrations were found to range from 56 to 160 ug/l in AW-8A and AW-9B.

AW-8A deep
AW-8B
AW-9A deep
AW-9B

Regular sampling of on-site monitoring wells on a quarterly basis began in September, 1992 and has continued through May, 1993. Groundwater results from the September, 1992 sampling revealed a marked increase in total chlorinated VOC concentrations over previous sample results. This increase was particularly noticeable in monitoring well AW-3. Subsequent groundwater sampling has indicated a continued steady decrease in total chlorinated VOC concentrations. The most recent sampling of AW-3 (May, 1993) revealed only 2.4 ug/l of chlorinated VOCs. A summary of recent groundwater results is provided as Attachment 6.

recent GW

In October, 1990, Ecology and Environment completed a Preliminary Assessment on the Intel Aloha Campus site for the USEPA Region 10. As a result of the 1982 release of chlorinated and non-chlorinated solvents, the site was given a high priority for future investigation. Specifically, it was recommended that groundwater, soil and/or soil gas sampling be conducted at the facility. In July 1991, a Screening Site Investigation was also prepared by Ecology and Environment for the USEPA Region 10 to investigate groundwater and surface water contamination resulting from the 1982 release. Despite the presence of elevated concentrations of chlorinated solvents detected in groundwater beneath the site, no further action was recommended under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) due to the lack of potential target populations in the area. An August 30, 1991 letter addressed to Intel from Debbie Flood of USEPA indicated the site was being referred to the Oregon DEQ for further consideration.

EPA

Site Hydrogeology

Native soil in the vicinity of the Aloha Campus site consists of Aloha silt loam which is described as a somewhat poorly drained soil formed in alluvium or lacustrine silt. The slope of the land near the site ranges from 0 to 3 percent. The annual precipitation in the Aloha area

ranges from 40 to 50 inches per year.

Based on boring logs prepared by Emcon, the upper 40 feet of the site consists of Willamette Silt. These silts were characterized by Emcon as layered beds of clayey silt, silt, sandy silt and silty sand. Beneath the sand layer, a very stiff, dark grey clayey silt layer was encountered. This layer has been described as the weathered top of the Troutdale formation and represents a separate water bearing zone. Soil borings are provided in Attachment 8.

Stratigraphy

Hydraulic conductivity measurements were conducted on two samples of Willamette Silt by FSI. One sample, collected from soil boring B-25 at a depth of 3 - 5 feet exhibited a hydraulic conductivity on the order of 10^{-4} cm/sec. This sample was described as light brown silt with root holes. The other sample, collected from soil boring S-2, WB-5 (AW-5) at a depth of 7.5 - 9.5 feet was described as light brown silt with traces of clay and fine sand. This sample exhibited a hydraulic conductivity ranging from 3×10^{-6} to 6×10^{-6} cm/sec. The greater hydraulic conductivity of the 10^{-4} sample was attributed to root holes, consequently a hydraulic conductivity on the order of 10^{-6} cm/sec appears to be representative of the Willamette Silt formation underlying the site.

K

Water level measurements indicate that the depth to groundwater ranges from 16.87 feet in the northwest corner of the site (AW-4A) to 1.66 feet along the eastern property boundary (AW-9A). (Site topography drops approximately 20 feet across the site from northwest corner of the site to the eastern property boundary.) Water level fluctuations range from 1.9 to 10.2 feet with an average fluctuation of 4.6 feet. Water level fluctuations are greatest upgradient of the release area (AW-5) and smallest along the eastern property line (AW-9B). Water level measurements collected from the two deep well/shallow well clusters indicate a general upward gradient near the AW-8 cluster and a general downward gradient near the AW-9 cluster. However the vertical gradients are not consistent and have apparently reversed on occasion. A summary of water level measurements is provided as Attachment 9.

Depth to GW

Groundwater usage in the area is low. Few wells are known to exist in the immediate vicinity of the site and little or none of the land is irrigated. Water is provided to the site and surrounding areas by the Wolf Creek Highway Water District. This water district obtains water from the Bull Run watershed through the City of Portland and serves approximately 25,000 accounts in the unincorporated areas between Portland, Hillsboro and Beaverton. During the winter months, the water table rises to the point of flooding in low-lying areas within the Aloha unincorporated area. Flooding is particularly present along the south side of the Tualatin Valley highway where the Aloha Campus site is located.

Wells in area + Seasonal GW

The two closest wells identified in a beneficial use survey conducted for Intel by Emcon, were located 700 and 1,000 feet downgradient of the site. One well was identified as abandoned while the other well was identified as used for irrigation. The static depth to water is listed as 25 feet in the well logs for both wells.

nearby wells

The Intel Aloha Campus site is located near the divide between the Butternut Creek and Beaverton Creek drainages. Both creeks flow west to the Tualatin River and eventually the Willamette River. Runoff from the site collects in several on-site gravel bed stormwater retention ponds. With the exception of the lined pond in located in the southeast corner of the site, the retention ponds are unlined. Although stormwater is allowed to infiltrate from these ponds, they are fitted with overflow drains which allows excess surface runoff to eventually drain into Beaverton Creek through a drainage ditch located east of the site.

Surface waters

Waste Characteristics

Wastes generated at the Intel Aloha Campus facility include solid and liquid wastes containing halogenated and/or non-halogenated organic solvents, corrosive solids and liquids, and arsenic contaminated solids, oil, wastewater, and chlorofluorocarbons (Freon). Xylene, n-butyl acetate and 1,1,1-TCA were released in the 1982 solvent spill. Other organic contaminants identified in soil and groundwater samples include aromatic compounds such as benzene, ethylbenzene, and xylene, chlorinated aliphatic compounds such as 1,1-dichloroethane (DCA) and trichloroethene (TCE), and various chlorofluorocarbons.

The contaminants identified at the site are classified as volatile organic compounds (VOC's). They tend to volatilize quickly, and are relatively soluble, and therefore, mobile in groundwater. Chlorinated VOC's tend to persist in soil and water. High concentrations of these compounds in soil and/or groundwater may indicate the presence of dense non-aqueous phase liquids (DNAPLs)

Concentrations of the identified compounds in groundwater have varied over time. Trichloroethylene (TCE), total TCA, n-butyl acetate and total aromatic concentrations including xylene have generally decreased, possibly as a result of degradation and dissolution. Other compounds such as vinyl chloride, previously unidentified, have increased in detectable concentrations possibly being the daughter products of degraded compounds. Trichloroethene, for example, has been shown to biodegrade under anaerobic conditions to dichloroethene, then to vinyl chloride, and finally to ethylene. Groundwater monitoring results from the site have shown decreases in TCE and total TCA concentrations, and variable increases and decreases in DCA and DCE isomers, chloroethane and vinyl chloride.

Analytical results have been summarized in Attachment 7 to tabulate trends in concentration changes. The following table lists the maximum concentrations of compounds detected in AW-7 and during the most recent round of groundwater sampling (collected in May 1993). The corresponding MCL is also presented:

Compound	AW-7 Result (ug/l)	5/93 Result (ug/l)	MCL (ug/l)
Vinyl Chloride	100	3.2 (AW-6)	2
Chloroethane	48	0.9 (AW-3)	NA
1,1-DCE	48	15 (AW-8A)	7
Carbon Disulfide	41	ND	NA
cis-1,2-DCE	900	24 (AW-8A)	70
trans-1,2-DCE	8.2	ND	100
1,1-DCA	400	57 (AW-8A)	NA
1,2-DCA	4.7	ND	5
1,1,1-TCA	35	11 (AW-6)	200
1,1,2-TCA	0.6	ND	5
TCE	200	11 (AW-9B)	5
PCE	2.4	0.9 (AW-9B)	5
Freon 12	NA	190 (AW-8A)	NA

Many of the chlorinated compounds detected in groundwater at the Aloha Campus site have been classified by the USEPA as known, probable or possible human carcinogens. Of the compounds listed above, vinyl chloride is classified as a Class A or known human carcinogen, TCE, PCE and 1,2-DCA are classified as Class B2 or probable human carcinogens, and 1,1-DCE, 1,1-DCA and 1,1,2-TCA are classified as Class C or possible human carcinogens. Chloroethane, cis-1,2-DCE, trans-1,2-DCE, 1,1,1-TCA and Freon 12 (dichlorodifluoromethane) have not been determined to be carcinogenic.

Carcinogens

Of the four compounds listed above for which MCLs are not available, health-based drinking water limits may be calculated based on the oral reference dose values for 1,1-DCA, carbon disulfide and Freon 12. The calculated health-based levels are as follows: 1,1-DCA - 3.5 mg/l; carbon disulfide - 3.5 mg/l; Freon 12 - 7 mg/l. Although an oral reference dose is not available for chloroethane, an inhalation reference concentration of 10 mg/m^3 has been established.

Exposure Pathways

The primary route of exposure for the site is groundwater. Contaminants appear to have originated from a subsurface source which is expected to limit the potential for exposure via dust inhalation, surface water or direct contact. Although on-site personnel may be exposed due to the inhalation of volatiles migrating upward through the vadose zone, the majority of the surface area in the vicinity of the release is either landscaped or covered with asphalt or concrete which is expected to limit the potential for exposure via volatile inhalation. Therefore, the primary exposure pathway of concern is via groundwater usage. Exposure to contaminants present in groundwater may occur as a result of ingestion, inhalation while showering or cooking or direct contact with irrigation water obtained from contaminated wells. However, the site facility and

most surrounding areas are supplied with municipal water from the City of Portland.

In October, 1992, a beneficial use survey was conducted for Intel by Emcon. The survey was conducted in two phases. The first phase identified the location of nearby water wells by reviewing Oregon Water Resources Department records. The second phase identified addresses that were not listed in water district customer records. The survey identified 21 water well locations which are not connected to the Tualatin Valley Water District. These locations were presumed to obtain domestic water from a private well. The two nearest downgradient wells are located approximately 1,000 and 700 feet from the site. The first is reportedly used for irrigation, and the second appears to be unused. The closest water well used for domestic purposes was not identified.

EMCON's 1992 Beneficial Use Survey

The Intel Aloha Campus site is located near the divide between Butternut and Beaverton Creeks. Surface water at the site drains to the southeast and eventually reaches Beaverton Creek. No known drinking water or irrigation intakes exist along Beaverton or Butternut Creeks downstream of the site. Reportedly, both creeks support a Cutthroat trout population, although no annual production counts have been recorded.

(?)

RCRA Considerations

The Intel Aloha Campus facility uses large volumes of acids and solvents and is a fully regulated generator of hazardous wastes. Since Intel does not store waste for more than 90 days, their waste storage tanks are exempt from the RCRA permitting process. As a result, the 1982 release was not from a RCRA unit and is not subject to the requirements of corrective action. If Intel is able to "clean close" the site, (i.e achieve risk based clean-up levels) a RCRA post closure permit will not be required. If risked-based clean-up levels are not achievable, the substantive requirements of RCRA post closure may be applicable.

Data Gaps

Although investigation of the solvent release at the Intel Aloha Campus site has occurred since 1982 and now includes a 10 well monitoring well network, further investigation is necessary to fully delineate the extent of soil and groundwater contamination and obtain the necessary information to determine remedial action options for the site. Specifically, the following areas require further investigation:

- Although recent sampling has indicated a groundwater plume centered near the former location of monitoring well AW-7 surrounded by fairly uniform levels of total chlorinated VOCs, the current monitoring well network has not fully evaluated the horizontal extent of contamination and direction of groundwater flow south of the former release area.

more ~~hor~~ horizontal characterization + GW flow direction

- Although two deep well/shallow well monitoring well clusters have been installed near the down gradient property boundary, the vertical extent of groundwater contamination has not been determined elsewhere on site due to the large screen intervals in monitoring wells AW-1, AW-3 and AW-7 and the lack of a deep well near the former release area.

needs more horizontal characterization

- Despite the presence to the two deep well/shallow well monitoring well clusters, discrepancies in the measurement of the vertical gradient and the lack of surveyed well head elevations has prevented full evaluation of vertical contaminant migration.

need to evaluate vertical communication

- Although soil boring data was obtained during the 1982 FSI investigation, this data is inadequate to characterize current site conditions. Consequently, the collection of soil data to evaluate residual soil contamination and aid in the location of potential source areas is recommended. Potential source areas include the former tank location, the former location of AW-7 and secondary source areas located along preferential groundwater migration pathways.

FSI's soil data is inadequate

- Although the original release reportedly contained only xylene, n-butyl acetate and 1,1,1-TCA, contaminants currently present in groundwater are not consistent with the release. Degradation processes have likely eliminated xylene and n-butyl acetate and resulted in the formation of 1,1,1-TCA breakdown products (dichloroethanes and chloroethane). However, other compounds not associated with the release have also been detected (Chlorofluorocarbons, TCE and TCE breakdown products). A source and/or explanation for the other identified contaminants is required.

Nature of contamination needs to be better addressed

- Investigation in the source area is required to determine the extent of residual contamination remaining and whether dense non-aqueous phase liquids (DNAPLs) are present. It is recommended that the surface of the upper zone of the troutdale formation be mapped to aid in the determination of depressions or other low areas where DNAPLs may accumulate.

needs more data in source area

- Further investigation of the results obtained from AW-7 is recommended. It should be determined whether this zone of contamination is anomalous or marks the center of the groundwater contaminant plume. In addition, elevated levels of TCE (140 - 200 ug/l) were detected in groundwater collected from AW-7. As a result, the area in the vicinity of AW-7 should be investigated as a potential source of TCE contamination. Since AW-7 was located relatively close to the downgradient site boundary, the potential for off-site migration of the contaminant plume requires evaluation.

AW-7

Recommendations

In order to develop plan for remediating the Intel Aloha Campus site, a focused remedial investigation (RI), Risk Assessment and Feasibility Study (FS) is recommended. The RI should include further investigation of potential source areas and additional characterization of the site hydrogeology and extent of groundwater contamination. The area near the location of the former AW-7 and the downgradient site boundary requires particular focus. In addition to fully characterizing the site, the RI should obtain the necessary information for designing and implementing a remedial action. A feasibility study is required in order to evaluate potential remedial options.

RI/FS

Specific investigative activities which should be included in the first phase of the RI include:

- Install a deep monitoring well downgradient of the former tank location. This well should be screened near the bottom of the conductive zone in the Willamette Silt formation similar to monitoring wells AW-8A and AW-9A.

deep MW down gradient from former tank

- Obtain soil data in the vicinity of the release area (soil boring samples may be collected during the installation of the above monitoring well). Soil samples should be analyzed for VOCs (USEPA Method 8260). Additional soil data is required down gradient of the source ares in the vicinity of monitoring wells AW-8A/8B, AW-9A/9B and AW-7.

Soil data near release

- A monitoring well should be installed south of FAB-5 to evaluate potential southward contaminant migration and obtain additional groundwater flow direction information.

MW by FAB-5

- Further evaluate the vertical gradient in the vicinity of the two deep well/shallow well clusters and determine the impact of vertical gradients on contaminant migration. This evaluation should include surveying the AW-8A/8B and AW-9A/9B well heads and labeling the wells.

Vertical gradient

- Map the location of the former solvent lines and all utility lines which may affect contaminant migration.

Map solvent lines

- Identify the location of the nearest water wells used for domestic purposes.

id nearest DWW

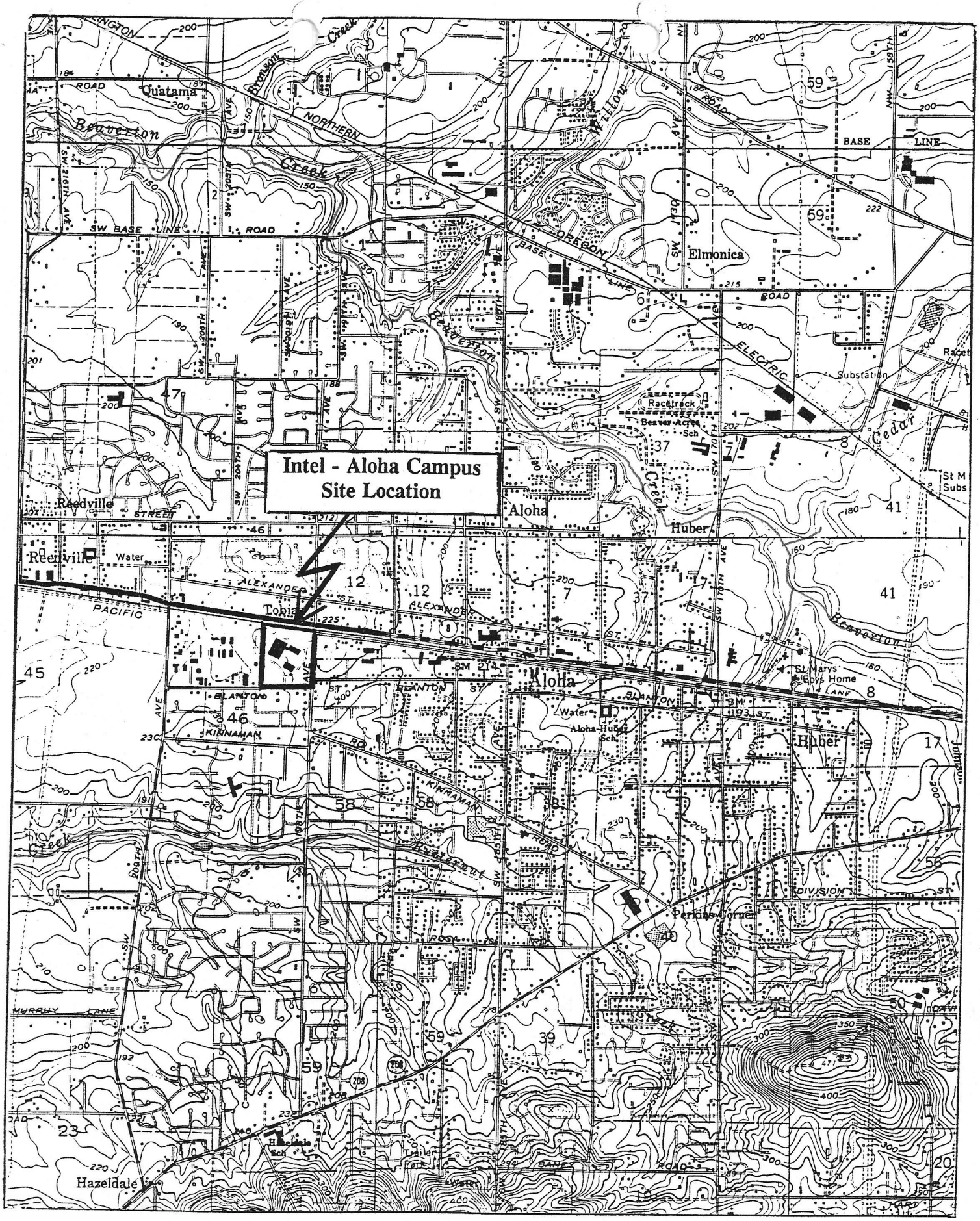
Based on the results of first phase of the RI, additional investigative phases may be required. Specifically, the following areas may require further investigation:

- Obtain additional soil data near the former release area and any potential secondary source areas discovered.

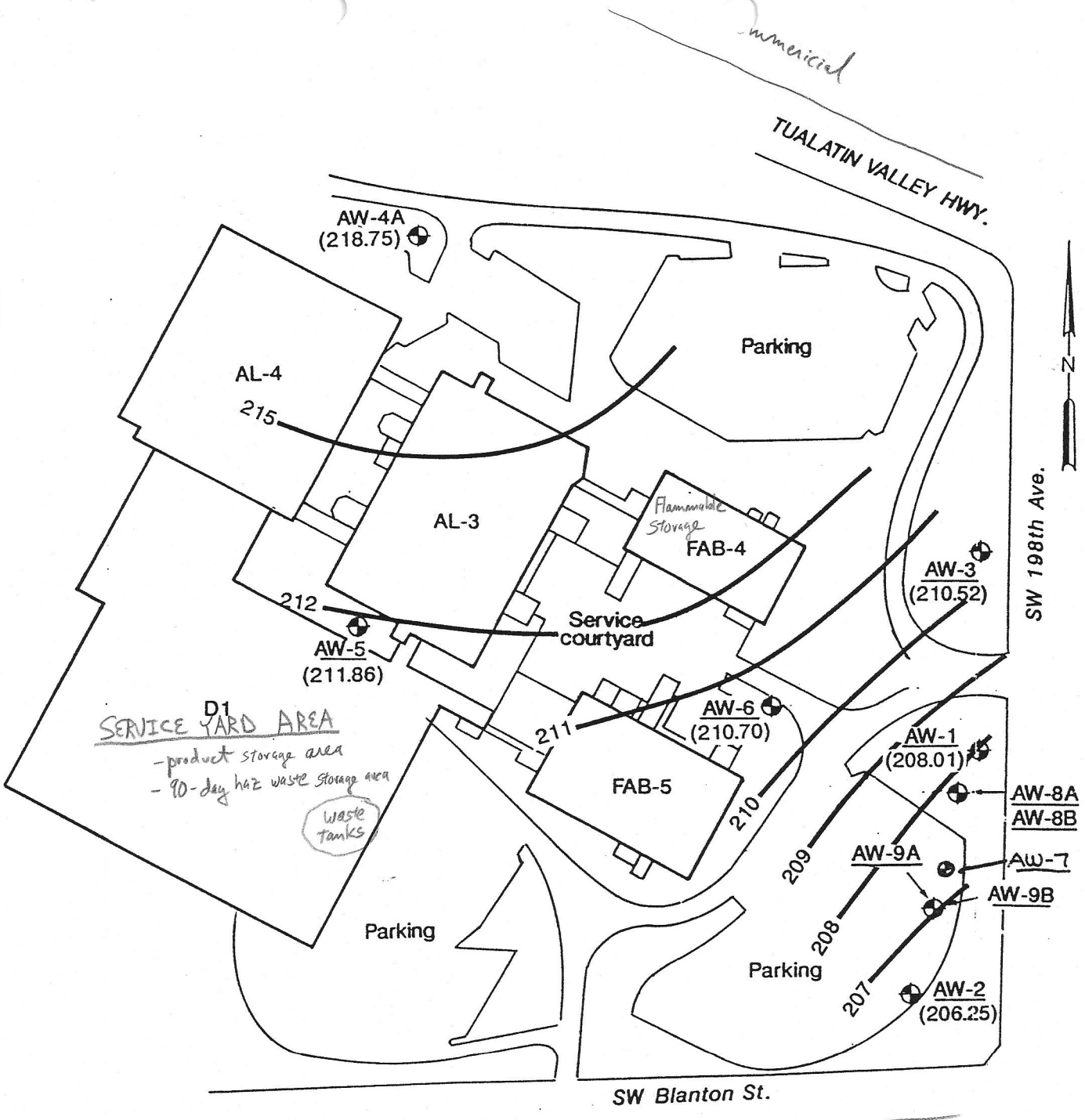
- Install an off-site well to investigate the potential for off-site contaminant migration.

- Evaluate the potential for soil and groundwater contamination within the upper portion of the Troutdale clay layer.

In order to complete the characterization of the Intel Aloha Campus site, and develop remedial action options for addressing contamination at the site a more formal stipulated Agreement and Statement of Work (SOW) for conducting an RI/FS will be needed.



ATTACHMENT 2
Site location Map



EXPLANATION

206 —— Water level elevation contour in feet. Contours based on linear interpolation between wells.

AW-7 (201.00) Monitoring well location with water level elevation in feet inside parentheses. Water levels measured February 26, 1993.

0 200 400

Scale in Feet

emcon Northwest, Inc.

Base map modified from site plan prepared by Geotechnical Resources, Inc.