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December 12, 2006

Mr. Don Fritz
Alaska Dept. of Environmental Conservation
Contaminated Sites Program
43335 Kalifornsky Beach Rd, Suite 11
Soldotna, Alaska 99669

Subject: Kenai Airport Fuel Service, Spill #90230026801 at UST Facility ID #2187
October 2006 Groundwater Sampling Event

Dear Mr. Fritz,

Groundwater monitoring was conducted at the KAFS site on October 21, 2006. The enclosed letter report provides details of the sampling event and results. The monitoring event was conducted in accordance with direction from ADEC provided in a letter dated May 15, 2006 and the Remedial Action Work Plan developed for the site in 2004.

The treatment system operated until November 13, 2006 when it was shut down due to freezing soil conditions that had essentially stopped airflow in the SVE system. The AS system may be operated periodically throughout the winter in an effort to keep the aquifer aerated. However, operations will be kept to a minimum to prevent volatile gas build up within the vadose zone.

Sincerely,

Mark Prieksat, Ph.D., P.G.

cc: Dan Pitts, Dean Eichholz

Remedial Action Report #4
Kenai Airport Fuel Service
Kenai, Alaska

UST Facility ID #2187
Reckey #90230026801

October 2006

Prepared For

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Contents

Abbreviations

AS	air sparging
bgs	below ground surface
DO	dissolved oxygen
DRO	diesel-range organic
GRO	gasoline-range organic
KAFS	Kenai Airport Fuel Service
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
PID	photoionization detector
ppm	parts per million
scfm	standard cubic feet per minute
SVE	soil vapor extraction
UST	underground storage tank
VOC	volatile organic compound

SECTION 1

Introduction

1.1 Location and Description

KAFS is located inside the airport security fencing at the Kenai Municipal Airport, between the main terminal building and the air traffic control tower located north of the terminal. KAFS originally occupied three lots leased from the City of Kenai: Lot 4, Block 1, FBO Subdivision and Lots 2A1 and 3A1, Block 1, FBO Subdivision South Addition No. 2. KAFS currently occupies only two of the lots that were transferred to Yukon Fuel/Yutana Barge when they purchased the fueling facility in 1999. Lot 2A1 was retained by Dean Eichholz and Dan Pitts. Lot 1A, located down gradient of the KAFS UST facility, is leased to Dan Pitts. Lot 1A1 includes a frame office building occupied by the Alaska Flying Network, and other aviation and airfreight businesses (ERA, DHL, & Everts Air Fuel). Figure 1-1 shows the general location of the site.

Multiple investigations have occurred at the site, including a site assessment conducted in 1991 prior to removal of the USTs, an UST removal site assessment conducted in 1993, a release investigation conducted in 1993, and subsequent soil and groundwater sampling since that time. An evaporation pond was excavated in 2002 to allow volatilization of groundwater contaminants that were migrating down gradient from the tank site. A water pump and sprayer were used to disperse water into the air and accelerate the rate of volatilization.

Because sampling indicated persistent contamination in groundwater at the site, a soil vapor investigation, with associated groundwater sampling, was conducted in 2003. The results of the soil vapor investigation indicated that contaminant levels at the site had not changed significantly since 1993 and remained at levels exceeding cleanup standards.

Based on site-specific data and persistent soil and groundwater contamination at the site, a remedial remedy was selected for the site in 2003. The selected remedy was an in-situ combination of soil vapor extraction (SVE) and air sparging (AS).

Six soil vapor extraction (SVE) wells and six air-sparging (AS) wells were installed at the site in 2004. Due to well construction problems, the AS wells were extracted and replaced in 2005. The SVE and AS system are powered by separate blower systems contained within a portable trailer unit. The portable treatment unit is parked on the north side of the Alaska Flying Network (AFN) building.

1.2 Site History

The KAFS property was developed in the 1970s and was initially used as a staging area for general air cargo and fuel hauling by Woods Air Service, Northern Air Cargo, Everts Air Service, and Stratolift. Arctic Aviation, Alaska Oil Sales, Weaver Brothers, Kenai Air Service, Andy's Flying Service, and Doyle's Fuel Service used trucks to fuel aircraft at the site. Several fish hauling businesses used the area for refueling a variety of aircraft: DC-3, DC-4, DC-6, and C-130. KAFS installed the first UST system at the site in 1984 and worked

Figure 1-1. General Site Location Map.

with the other fuel delivery businesses. Everts Air Service continues to haul fuel from the site. ERA Aviation fills their fuel trucks and aircraft from the KAFS UST facility.

The initial UST system included three 10,000-gallon USTs that contained Jet A, aviation gasoline, and 100 low-lead gasoline, two dispensers, and underground piping. There was also a 1,000-gallon tank that contained 80/87 aviation-gasoline. The 1000-gallon tank was converted to regular unleaded gasoline several years later. This UST system was removed in October 1993 and replaced with a new UST system in 1994. The new system is comprised of two 12,000-gallon double wall tanks and a reel dispenser, located about 75 feet north of the location where the original system had been installed.

1.3 Geohydrology

The entire site is underlain by Kenai sand that comprises the upper unconfined aquifer. The sands contain intermittent lenses of gravel and cobbles, but are in general fairly homogeneous to a depth of at least 20 feet below ground surface. Vertical hydraulic conductivity averages about 12 ft/day and horizontal hydraulic conductivity is in the range of about 30 ft/day. Groundwater is generally found at depths of less than 10 feet below ground surface at the airport site. Groundwater flow direction is generally towards the south southwest with a gradient of about 0.0025 ft/ft. General hydrogeological characteristics of the KAFS site are summarized in Table 1-1.

Site Feature	Characteristic
Saturated soil type	Kenai Sand
Depth to groundwater	approximately 7 to 10 feet
Estimated saturated thickness	approximately 50 feet
Hydraulic conductivity	30 feet/day (horizontal), 12 feet/day (vertical)
Groundwater flow direction	south southwest with gradient of about 0.0025 ft/ft
Contaminant type and sources	subsurface release of gasoline from a former UST

Table 1-1. Site characteristics.

SECTION 2

Remediation System Operation

2.1 System Operation – October 2006

The SVE/AS system operated from 15 April 2006 through 13 November, 2006 for a total of 225 days in 2006. With the exception of failure of one air-sparge blower during initial startup, the system operated normally throughout the season. Gas monitoring indicated that contaminant concentrations in the exhaust stack ranged from about 92 to 110 ppm, well within the normal range. A PID was used to monitor downwind vapor concentrations emitted from the exhaust stack. Measurements taken during the October monitoring event at locations 25 and 50 feet downwind from the exhaust stack did not indicate detectable concentrations of volatile vapors were present above background levels. PID readings at 25 feet downwind were in the range of about 2 ppm, and readings at 50 feet downwind were also in the range of about 2 ppm. Crosswind readings were taken west of the AFN building near the tarmac and ranged from 0 to about 4 ppm, depending upon whether or not aircraft were operating in the area. Volatile vapors can be detected at various locations around the site and are attributable to fuel handling operations and operation of aircraft.

2.2 Treatment System Evaluation

System Operation

The SVE/AS system was inspected during the October monitoring event. The inspection revealed that an unusual amount of water was present in the SVE exhaust and that the gas sensor cell was full of water. The drain at the bottom of the exhaust stack had plugged and water had backed up into all the components. The system was shut down and drained. A larger drain plug will be installed in the exhaust stack prior to startup in the spring. The AS system was operating within normal ranges and was generating about 9 psi of pressure at the well heads.

System airflow measurements were recorded and compared to average values measured during previous treatment cycles. Airflow values were recorded from magnehelic gauges installed in the SVE treatment system. Estimated vapor concentrations were calculated from gas monitor readings as percentage of the lower explosive limit (LEL) of gasoline. LEL readings were converted to part per million values for gasoline. Table 2-1 lists measurements of airflow, vapor concentration, days of operation, and estimated mass removal (based on gasoline).

The total estimated mass of contaminants removed from the system during the period of operation from June 2004 through November 2006 is about 11,158 lbs or as comparison about 1,1785 gallons of gasoline. These values are based on the weight of gasoline at about 6.25 lbs/gallon, and the average airflow and concentration values recorded during system operations. Actual mass removal rates could vary depending upon the actual constituents and concentrations in the emission exhaust.

Date	Airflow (scfm)	Concentration (ppm)	Days of Operation	Estimated Mass Removal (lbs)
2004 Average	210	142	126	3368
2005 Average	228	112	158	3617
April to June 2006	235	110	56	1298
June to Nov 2006	222	92	157	2874

Table 2-1. Estimated Mass Removal Rates.

Air Pressure/Vacuum

After the system was drained of water and brought back on-line, soil-vacuum was measured at monitoring points MP-1 and MP-4. The data indicates that the SVE system is still producing a strong vacuum across the treatment zone. These results are consistent with data collected in 2004 and 2005, and indicate that the SVE is effectively extracting vapors from the unsaturated zone above the groundwater table. The SVE wellhead seals were checked by removing a bolt from each wellhead cover and measuring the vacuum within the wellhead chamber. Readings from the magnehelic gauges did not show a negative pressure within the wellhead, indicating that the well seals were not leaking.

Location	June 06	October 06	Comment
MP-1	3.2	2.8	MP-1 is located 12 feet from extraction well SVE-1
MP-4	2.6	2.3	MP-4 is located 43 feet from extraction well SVE-1

Table 2-2. Soil vacuums measured in inches of water vacuum within the treatment zone.

Soil Gas Monitoring

Soil gas contaminant concentrations have been recorded at monitoring points MP-1 and MP-4 since 2003 when the SVE pilot tests were conducted. Measurements indicate that soil gas concentrations have decreased dramatically since 2003 and have been affected by treatment. Soil gas measurements will be recorded in the spring of 2007 prior to system startup to determine to what degree soil gas contaminant levels rebound when the treatment system has been shut down. Measurements recorded in the spring of 2007 will help determine how affective the treatment system has been at removing sorbed fuel contaminants from the soil and provide a better assessment when compared to the measurements recorded in 2003 before treatment began.

Location	Jul 03 and Apr 04	Jul 04	Oct 05	Jun 06	Oct 06
MP-1	5300	164	114	87	53
MP-4	2052	391	238	198	88

Table 2-3. Soil vapor concentrations measured using a PID (all values are in ppm).

Evaporation Pond

A low volume blower was connected to perforated tubing installed in the bottom of the evaporation pond. The blower system is operated on a timed circuit set to alternate on and off over 30-minute intervals. The blower system was connected in April 2006 and operated through the early part of November. The bubbler system was removed when the pond began to freeze over. When coupled with the AS treatment the evaporation pond definitely plays an important role in reducing contaminant levels in groundwater at the site. The free water surface in the pond allows the transfer of volatile contaminants from groundwater into the atmosphere, and even low level air injection into the pond accelerates that process.

SECTION 3

Groundwater Monitoring

Groundwater monitoring was conducted at the KAFS site on October 21, 2006. The monitoring event was conducted in accordance with direction from ADEC provided in a letter dated May 15, 2006 and the Remedial Action Work Plan developed for the site in 2004. Weather conditions were clear and warm during the sampling event and temperatures were in the mid 40 degrees. A slight south wind was blowing at about 5 mph.

3.1 Groundwater Monitoring – October 2006

Groundwater Monitoring

Groundwater samples were collected from the KAFS site on October 21, 2006. Water samples were collected from 5 existing monitor wells located at the site. The wells sampled during this event were MW-1, MW-6, MW-8, MW-9, and MW-12. Static water levels in the wells were measured prior to collection of groundwater samples. Static water levels were measured as the distance from the top of the PVC well riser to the groundwater surface.

Each groundwater well was purged prior to sampling by pumping water from the well until the water was clear and free of sediment. The wells were purged using a Keck Model 19 submersible pump with a flow rate of 1.5 gallons per minute. At least 3 well volumes were removed from each well prior to sample collection. Figure 3-1 shows the pump being deployed prior to sampling at MW-6. MW-1 can be seen in the background. From the photo you can see that all the bushes and alders have been cleared from inside the fenced enclosure around the evaporation pond, presumable because of FFA regulatory requirements. Figure 3-2 shows the MW-9 sampling location, immediately north of the airport terminal building with the pump inserted into the well. A five gallon bucket was used to measure pumping rate and purge volumes at each well location. The pump was decontaminated using an alconox solution and successive washes with clean tap water retrieved from the AFN building.

Analytical Testing of Groundwater Samples

Groundwater samples collected from wells at the site were taken to SGS Laboratory for testing to determine the presence of GRO and BTEX by AK101 or EPA method 8021B. Analytical results are presented in the following tables and results are reported in mg/l or ppm. Shaded cells indicate concentrations that exceed the cleanup levels listed in Table C of 18AAC75.345.

MW-1: MW-1 was installed in 1994 during the initial release investigation. Analytical results from the October 2006 sampling event indicate that the levels of all the fuel constituents had decreased again and contaminant concentrations were similar to those measured in October 2005. Benzene concentration in groundwater is greater than the cleanup standard, but has dropped significantly since the spring event. The purge water did not have a noticeable hydrocarbon odor and the water samples were clear of sediment.

Figure 3-1. Pump being deployed prior to sampling MW-6. View is to the west towards the airport tarmac and runway.

Figure 3-2. Photo showing sample location MW-9.

Table 1 – Groundwater Analytical Results for MW-1 (ppm or mg/l)

Sample ID#	Date	SWL	GRO	Benz	Tol	E-Benz	Xylenes	EDB
KA-42	8/03/94	90.8	NA	64.2	62.7	2.46	11.6	NA
KAFS-99-2	6/16/99	91.5	79	12.6	21.5	1.45	7.1	0.010000
KAFS-99-21W	9/13/99	91.6	3.4	0.5	0.7	0.13	0.4	NA
KAFS-99-24W	11/29/99	91.6	64	12.8	12.1	0.06	2.5	NA
KAFS-00-32W	7/06/00	91.6	200	32.4	45.5	2.64	12.7	NA
KAFS-00-38	12/13/00	91.1	170	34.6	45.2	2.14	10.1	NA
KAFS-02-13	10/31/02	92.6	0.5	0.054	0.07	0.01	0.04	0.000022
KAFS-03-07	8/06/03	91.0	157	28.2	48.3	3.58	17.2	NA
KAFS91104W-1	9/11/04	91.0	137	16.5	37	2.41	8.97	NS
KAFS20051026MWSW05	10/26/05	92.04	U	0.031	0.029	0.011	0.048	NS
KAFS6-9-06GW4	06/09/06	92.24	153	11.6	49.5	3.04	18.17	NS
KASFS102106GWMW1	10/21/06	92.12	U	0.0293	U	U	U	NS
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

MW-6: MW-6 was installed in 1999 as part of a site characterization effort for this site. Analytical results from the October 2006 sampling event indicate that the levels of all the fuel constituents had decreased dramatically from the June 2006 sampling event and contaminant concentrations were similar to those measured during the October 2005 event. The purge water was clear of sediment and did not have a solvent smell that was detected during the June sampling event. Benzene concentration in groundwater still exceeds the cleanup level at this location.

Table 2 – Groundwater Analytical Results for MW-6 (ppm or mg/l)

Sample ID#	Date	SWL	GRO	Benz	Tol	E-Benz	Xylenes	EDB
KAFS-99-25W	11/29/99	91.6	75	11.2	14.7	1.08	4.5	NA
KAFS-00-32W	7/06/00	91.1	55	9.41	12.1	0.79	3.2	NA
KAFS-00-37	12/13/00	91.1	163	30.2	41.5	2.57	11.5	NA
KAFS-02-14	10/31/02	92.6	0.1	0.003	0.002U	0.004	0.018	0.00002U
KAFS-03-08	8/06/03	90.9	94.9	22.2	30.2	2.63	11.6	0.00150
KAFS91104W-6	9/11/04	91.0	136	21.2	35.1	2.05	6.11	NS
KAFS20051026MWSW04	10/26/05	92.01	U	0.0055	0.0099	U	0.013	NS
KAFS6-9-06GW3	06/09/06	92.2	176	21.9	52.2	2.72	15.26	NS
KASFS102106GWMW6	10/21/06	92.06	U	0.0178	0.00212	0.00345	0.0121	NS
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

MW-8: MW-8 was installed in 1999 during assessment work designed to fully characterize the site and determine down gradient flow and contaminant transport. Analytical test results collected since 1999 show that low levels of contaminants were initially detected, but contaminant levels have not exceeded cleanup standards since June 2006.

Table 3 - Groundwater Analytical Results at MW-8 (ppm or mg/l)

Sample ID#	Date	SWL	GRO	Benz	Tol	E-Benz	Xylenes	EDB
KAFS-99-22W	11/29/99	90.8	0.64	0.239	U	U	U	NS
KAFS-00-28W	07/06/00	90.3	3.9	1.80	U	U	U	NS
KAFS-00-38	12/13/00	90.3	1.6	0.83	0.023	0.002	U	NS
KAFS-02-04	05/30/02	90.1	0.4	0.207	U	U	U	0.000061
KAFS-02-09	10/30/02	91.5	0.5	0.182	U	U	U	U
KAFS-03-04	08/06/03	90.2	U	0.018	0.004	U	U	U
KAFS6-9-06GW2	06/09/06	90.37	0.143	0.00162	0.0209	0.00333	0.01705	NS

KASFS102106GWMW8	10/21/06	91.18	U	U	U	U	0.00205	NS
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

MW-9: MW-9 was installed in 2002, at the same time the evaporation pond was excavated at the site. MW-9 was installed to provide a more comprehensive characterization of the site. Analysis of groundwater from MW-9 also allowed determination whether or not groundwater contaminants were migrating underneath the Kenai Airport Terminal at concentrations that could potentially cause concern for indoor air quality problems. Analytical test results indicate that contamination levels have declined since the well was installed. Benzene concentration in groundwater at MW-9 does exceed cleanup standards, but levels continue to decrease and do not pose any potential to cause indoor air quality problems at the airport terminal.

Table 4 - Groundwater Analytical Results for MW-9 (ppm or mg/l)

Sample ID#	Date	SWL	GRO	Benz	Tol	E-Benz	Xylenes	EDB
KAFS-02-06	5/30/02	90.2	29.1	5.48	6.92	0.38	0.8	0.000069
KAFS-02-10	10/31/02	91.6	5.1	0.74	0.85	0.90	0.3	0.000186
KAFS-03-09	8/06/03	90.2	0.14	0.042	0.006	0.014	0.021	0.000034
KAFS91104W-9	9/11/04	90.1	U	0.0232	U	U	0.00507	NS
KAFS20051026MWSW01	10/26/05	91.05	0.360	0.1	0.0016	0.0084	0.020	NS
KAFS6-9-06GW1	06/09/06	90.42	U	0.0257	0.00457	U	.0082	NS
KASFS102106GWMW9	10/21/06	91.16	U	0.0194	U	U	0.0054	NS
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

MW-12: MW-12 was installed in 2004 during initial testing for installation of the treatment system. Contaminant concentrations for GRO, benzene, toluene, and ethylbenzene are greater than cleanup standards, but have decreased steadily since treatment began in 2004. The decreasing contaminant concentration trend is a clear indicator of treatment system effectiveness.

Table 5 - Groundwater Analytical Results at MW-12 (ppm or mg/l)

Sample ID#	Date	SWL	GRO	Benz	Tol	E-Benz	Xylenes	EDB
KAFS-04-05W	4/11/04	92.6	71	3.19	14.8	U	4.48	NS
KAFS91104W-12	9/11/04	91.4	U	0.0006083	U	U	U	NS
KAFS20051026MWSW03	10/26/05	93.3	130	3.9	28	1.5	9.8	NS
KAFS6-9-06GW5	06/09/06		75.4	3.25	23.8	2.19	10.21	NS
KAFS6-9-06GW6	06/09/06	92.48	78	3.22	23.9	2.19	10.17	NS

DUPLICATE								
KASFS102106GWMW12	10/21/06	93.41	35.8	2.3	14.8	1.46	7.15	NS
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

Interpretation of Groundwater Monitoring Results

Groundwater levels were measured at MW-2, MW-4 and MW-13, but these wells were not sampled during this event. Measured elevations were 92.41, 94.25 and 93.38, respectively. Groundwater elevation data were input into the software program Surfer which was used to generate the elevation contour map shown in Figure 3-3. Groundwater elevations measured as part of this sampling event were consistent with previous results. The direction of flow is south southwest towards the Kenai Airport Terminal and the location of MW-8 and MW-9. This is consistent with past sampling events. The calculated gradient was 0.0046 ft/ft measured from MW-4 to MW-9 (659 foot distance). The gradient measured in October 2006 was greater than the typical gradient of about 0.0016 to 0.0025 ft/ft measured during past sampling events. This could be due to excessive rainfall during August and September 2006.

Groundwater contaminant levels measured at MW-8 remained less than cleanup levels. The concentration of benzene measured at MW-9 decreased slightly, but is still greater than cleanup levels. However, no other contaminants have been detected at MW-9 or MW-8, indicating that significant contaminant migration is not occurring at this site. Contaminant levels at MW-1 and MW-6 decreased again to nearly undetectable levels, similar to conditions measured in October 2005. A similar trend of decreasing contaminant levels was also observed at MW-12 and results provide positive feedback that treatment is effectively removing contaminants from the ground.

The treatment system operated for about 213 days in 2006, 55 days longer than in 2005 and 87 days longer than in 2004. Additionally, a problem with the AS wells being plugged effectively limited treatment to SVE until 2005. As stated in the June 2006 monitoring report, elevated contaminant levels detected during the June sampling event are believed to be a result of the AS system not operating normally during April/May 2006. However, high concentrations of contaminants detected at MW-1 and MW-6 during the June sampling event did not result in elevated levels of contaminants at down gradient locations.

Conclusions and Recommendations

Contaminant levels have fluctuated at MW-1 and MW-6, but overall there appears to be a general trend in decreasing contaminant concentrations at the site. Soil gas concentrations measured at MP-1 and MP-4 show a decreasing trend as well, indicating that the treatment system is working. Calculations of mass removal indicate that about 11,158 pounds of contaminants have been removed from soil and groundwater at the site. This would represent removal of about 1,785 gallons of gasoline. The treatment system will be operated again in 2007 and startup will begin as soon as conditions allow. The AS system will be

operated periodically during the winter months to aerate the aquifer and provide bio-available oxygen.

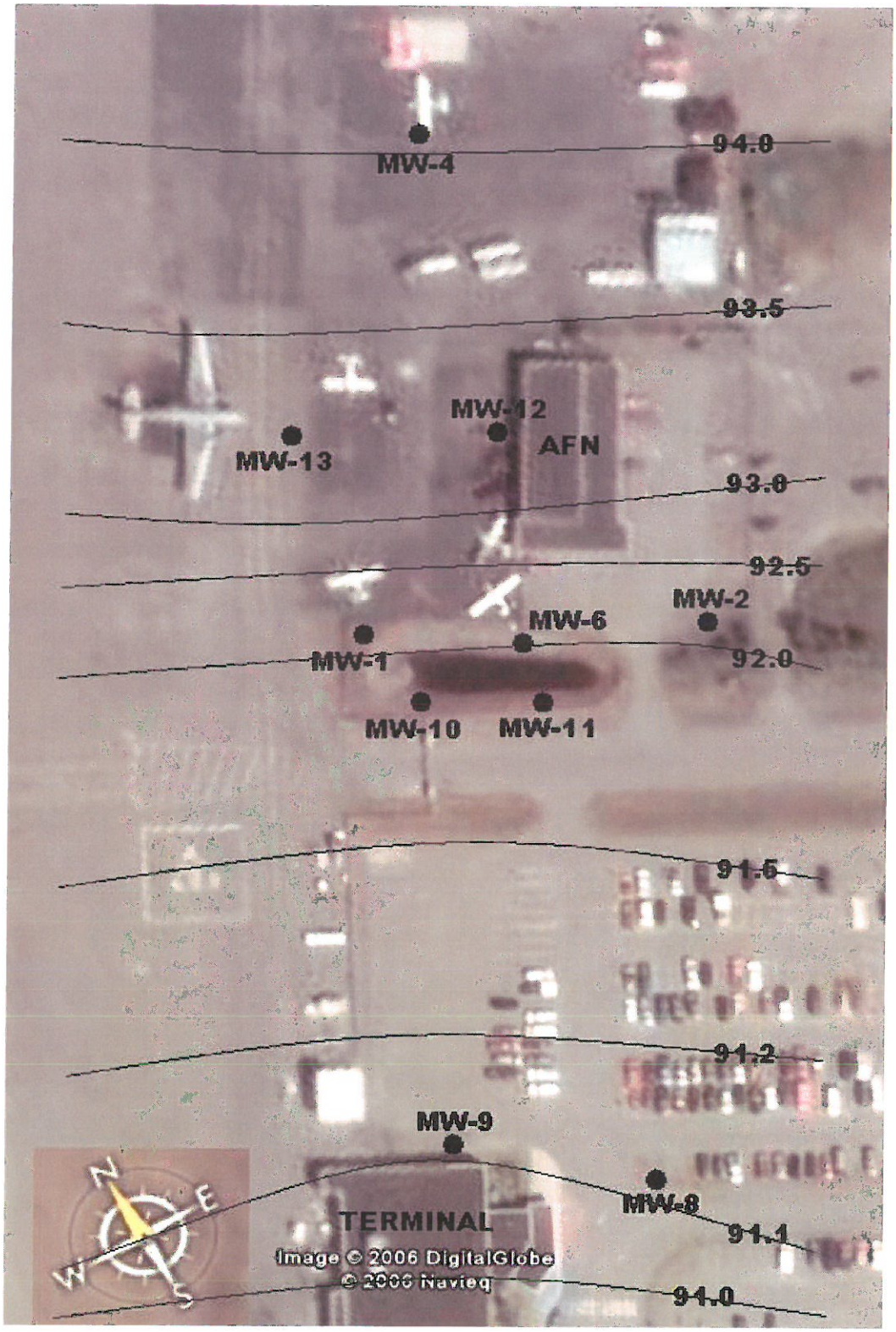

Figure 3-3. Groundwater flow contours for the KAFS site, June 2006

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