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September 28, 2006

Mr. Paul Horwath
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
June 2006 Groundwater Sampling Event

Dear Mr. Horwath,

Groundwater monitoring was conducted at the KAFS site on June 9, 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 was inspected and operation began on 15 April 2006. The system was inspected again during the June sampling event and the AS system was not operating. After a complete inspection we determined that one of the blower units has malfunctioned and caused a system shutdown. The inoperable blower was removed and the system reconfigured to operate using the other two blowers. The SVE system did not shut down and was operating normally.

Sincerely,

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

cc: Dan Pitts, Dean Eichholz

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Kenai Area Office

Remedial Action Report #3
Kenai Airport Fuel Service
Kenai, Alaska

UST Facility ID #2187
Reckey #90230026801

June 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 (Figures 1-1 and 1-2). 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).

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. 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 have not changed significantly over the past several years and remain at levels exceeding cleanup standards.

Based on site data that indicated persistent soil and groundwater contamination at the site, in-situ remediation using a combination of soil vapor extraction (SVE) and air sparging (AS) was selected as the remedial strategy for the site. Figure 1-1 shows the location of the treatment system installed at the site.

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 with the other fuel delivery businesses. Everts Air Service continues to haul fuel from the site. ERA Aviation fills their fuel truck 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 old system.

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 to southeast with a gradient of about 0.002 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 to southeast with gradient of about 0.002 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 Startup and Operation - 2006

The SVE/AS system was inspected and treatment operations began on 15 April 2006. The system was functioning normally and airflow values were within operating ranges. The piping was intact and no leaks were detected in the system. The gas monitor indicated that contaminant concentrations in the exhaust stack averaged about 110 ppm, well within the normal range. A PID was used to monitor downwind vapor concentrations emitted from the exhaust stack. Measurements taken at 25 and 50 feet downwind from the exhaust did not indicate detectable concentrations of volatile vapors were present. Additionally, solvent odor was not detected downwind of the exhaust stack.

2.2 Treatment System Evaluation

System Operation

A system evaluation was completed during the June 2006 groundwater sampling event. The inspection indicated that the AS blower system was continually shutting down and that the AS system was not operating properly. After a complete inspection we determined that one of the blower units had malfunctioned and the impeller had shattered within the blower casing. The inoperable blower was removed and the system reconfigured to operate using the other two blowers. The AS system was restarted and was operating normally.

The AS blower has not been replaced and calculations indicate that it isn't necessary for proper operation of the system. The max airflow through the six AS wells is calculated to be about 72 scfm. The two Fugi blowers connected in series will generate over 300 scfm at 8.6 psi of pressure. Thus, the two blowers produce more than adequate airflow at a pressure high enough to force air into the aquifer. In general, it has been necessary to pressure-vent excess air to prevent the blowers from overheating.

The SVE system did not shut down and was operating normally. System airflow measurements were recorded and compared to average values measured during previous treatment cycles. Airflow values were recorded from magnahelic 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 June 2006 is about 7424 lbs. This value is based on molecular weight for weathered gasoline and the average airflow and concentration values recorded during operation. Actual mass removal rates could vary depending upon the concentration and constituents in the emission exhaust.

Date	Airflow (scfm)	Concentration (ppm)	Days of Operation	Estimated Mass Removal (lbs)
2004 Average	210	142	126	2670
2005 Average	228	112	158	3756
April to June 2006	235	110	56	998

Table 2-1. Estimated Mass Removal Rates.

Air Pressure/Vacuum

Soil pressure/vacuum measurements were recorded at 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 (see Table 2-2). There was a lot of rain during the early part of the treatment period in 2006 and wet conditions generally inhibit the ability of a SVE system to extract vapors. Water infiltrating through the asphalt will fill pores, alter flow paths, and result in a large volume of water being extracted along with the vapor. It also takes time for the system to get back to optimal operating conditions after each rainfall event.

how much infiltration was shed off?

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

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

Soil Gas Monitoring

Contaminant concentrations in soil gas at the site were measured in 2003 and again in 2004 during installation of monitoring points for the SVE pilot test. Initial measurements indicated that contaminants were persistent in the area immediately down gradient from the former location of the tanks. Measurements taken in 2004

after the SVE system operation began indicated that soil gas contaminant levels had decreased significantly. Levels have remained relatively low since system operation began, but indicate that contaminants are still present in the shallow unsaturated zone. Soil gas data are presented in Table 2-3. The data clearly show the reduction in contaminated vapor at this site.

Location	Initial Soil Vapor Monitoring, July 03 and April 04	July 04	October 2005	June 06
MP-1	5300	164	114	87
MP-4	2052	391	238	198

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

Soil gas contaminant levels are decreasing over time, showing that the SVE system is working properly. However, groundwater levels are fluctuating and contaminants are continually being smeared across the unsaturated zone. As the water table rises, contaminants are submerged, are no longer physically available to extraction by means of SVE, and the treatment process slows. When the water table drops, contaminants are smeared across the soil-water interface, creating a smear zone. The SVE system can then be used to strip away those contaminants, but it is a continual and slow process at this point.

Evaporation Pond

A low volume blower was connected to perforated tubing installed in the bottom of the evaporation pond. The blower was attached to a timer that operates the blower during alternating 30-minute intervals. The blower system was connected in April 2006 and was operating as designed when inspected during the June sampling event. The bubbler system will be operated until the pond starts to freeze up.

SECTION 3

Groundwater Monitoring

Groundwater monitoring was conducted at the KAFS site on June 9, 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.

3.1 Groundwater Monitoring – June 2006

Groundwater Monitoring

Groundwater samples were collected from the KAFS site on June 9, 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 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.

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 BTEX by EPA method 8021B and GRO by method AK101. 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: Analytical results from the October 2005 sampling event indicated that the levels of all the fuel constituents had decreased dramatically. However, sample results from the June 2006 event showed that GRO contaminant levels in groundwater were similar to contaminant levels recorded in 2000 and constituent concentrations were significantly greater than cleanup levels. The concentration of benzene was 11.6 ppm and has decreased from levels recorded in 2000 through 2004. Groundwater elevations were similar to conditions in October 2005 and the water table was about 1 foot higher than normal conditions.

rebound or. out result not relevant

Table 1 – Groundwater Analytical Results for MW-1

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
No ID #	5/30/02	91.3	NS	NS	NS	NS	NS	NS
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
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

(results are reported in mg/l or ppm)

MW-6: Sample results from the June 2006 monitoring event indicated that the concentration of GRO had increased since the October 2005 event. Contaminant levels were similar to those recorded in 2003 and 2004. There was definitely a noticeable odor emanating from the groundwater, especially during the initial stages of purging. There were significant levels of sediment and fine sand in the well that caused the pump to plug several times. Organics sorbed to sediments in well could be causing some of the strange fluctuations in contaminant concentrations measured at this site. The relative ratio of contaminants does appear to be changing slightly over time, indicating that contaminants are degrading.

Table 2 – Groundwater Analytical Results for MW-6

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
Not sampled	5/30/02	91.3	NS	NS	NS	NS	NS	NS
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
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

(results are reported in mg/l or ppm)

MW-8: MW-8 was installed in 1999 during the initial remedial action. Analytical test results from the June 2006 monitoring event show that none of the fuel constituents were detected at concentrations greater than cleanup levels.

Table 4 - Groundwater Analytical Results at MW-8

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
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

(results are reported in mg/l or ppm)

MW-9: MW-9 was installed in 2002. Analytical test results indicate most of the contamination levels have declined since the well was installed. The June 2006 sample results indicate that benzene levels have declined again, but are still above cleanup levels. All other constituents were measured at concentrations less than cleanup levels.

Table 3 - Groundwater Analytical Results for MW-9

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
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

(results are reported in mg/l or ppm)

MW-12: MW-12 was installed in 2004 during initial testing for installation of the treatment system. Analytical test results from the April 2004 monitoring event show that benzene, toluene, and GRO were detected at concentrations greater than cleanup levels. Results from the September 2004 sampling event indicate that none of the analytes were detected at concentrations exceeding cleanup levels. However, since that time, contaminants have been detected at levels exceeding cleanup standards. Sampling conducted in October 2005 and again in June 2006 showed that the concentration of GRO, benzene, toluene, and ethylbenzene all exceeded cleanup

standards. Contaminant levels have decreased slightly since October 2005. During the June sampling event, a large stained area was noted on the asphalt adjacent to MW-12 and next to the AFN building. The stained area was covered with a mix of charcoal and oil, and emanated a strong petroleum odor. It appeared that charcoal from a grill located next to the building was used to absorb a fuel spill, probably from fuel containers stored at the site.

Table 4 - Groundwater Analytical Results at MW-12

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 DUPLICATE	06/09/06	92.48	78	3.22	23.9	2.19	10.17	NS
Cleanup Level			*1.3*	*0.005*	*1.00*	*0.70*	*10.0*	*0.000050*

(results are reported in mg/l or ppm)

Interpretation of Groundwater Monitoring Results

Groundwater levels were measured in several other wells that were not sampled during this event. Groundwater elevations were also measured at MW-4 and MW-13. Measured elevations were 92.91 and 92.46, respectively. Elevations were used to generate a contour map of the site shown in Figure 3-1. Groundwater elevations measured as part of this sampling event were consistent with previous results. The direction of flow was south towards the Kenai Airport Terminal and the location of MW-8 and MW-9. This is also consistent with results from the last sampling event. The calculated gradient was 0.0016 ft/ft measured from MW-4 to MW-9 (659 foot distance).

Groundwater contaminant levels at MW-8 are below cleanup levels for the first time since installation of the well in 1999. The concentration of benzene was greater than cleanup levels at MW-9, but the concentration has decrease since installation of the well in 2002. Sample results from these two down-gradient wells indicate that significant contaminant migration is not occurring at this site and contaminant concentrations are actually dropped in down gradient areas.

However, sample results from MW-1, MW-6 and MW-12 indicate that contaminant concentrations in groundwater remain elevated at levels well above cleanup standards. Contaminant levels detected at MW-1 and MW-6 are consistent with levels measured since 2000, but are significantly greater than levels measured in October 2005.

Contaminant concentrations seem to fluctuate with changes in water level. Typically, contaminant concentrations have been greatest when the water table elevation has fluctuated, releasing contaminants trapped in submerged pore spaces. The higher contaminant levels detected during the June 2006 sampling event are also believed to be a result that the AS system was not operating normally during April/May 2006. We are unsure when the blower malfunctioned, causing the AS system to shut down, but we suspect that it happened in early May. The system is now being inspected on a weekly basis to ensure that system failures are detected and fixed in a timely manner.

Conclusions and Recommendations

Reduced contaminant concentrations measured at MW-1 and MW-6 during the October 2005 sampling event was a promising sign and seemed to indicate that the treatment system was effectively reducing contamination at this site. However, sample results from the June 9, 2006 monitoring event indicate that elevated levels of GRO and benzene remain in groundwater immediately down gradient from the location of the former USTs. Contaminant levels have gone back to concentrations consistent with measurements taken since 2004.

One good sign is that contaminant concentrations measured at down gradient wells MW-8 and MW-9 indicate that contaminants are naturally attenuating in the area between the AFN Building and the Kenai Airport Terminal. The evaporation pond appears to be having the greatest affect in reducing contaminant concentrations at the site. Other indicators, such as reduced soil gas concentrations, do indicate that the treatment system is working and measurements of the concentration of volatiles in treatment exhaust gases indicate that the system is removing contaminants. The progress of treatment appears to be slower than anticipated during system design. The results do indicate that significant down gradient migration is not occurring and down gradient groundwater concentrations have decreased or remained stable.

Another groundwater sampling event will be conducted in October 2006 and will provide insight as to whether or not a functioning treatment system is reducing contaminant concentrations at this site. Additional tests will be conducted during the October 2006 event to determine methods to enhance the AS system and determine the air injection rate into the aquifer. Equipment is being designed to measure the air injection rate and to do permeability tests on the aquifer. In addition, the treatment system will be operated until conditions indicate that the soil has frozen to a depth where continued operation of the SVE system is no longer feasible. That condition will be indicated by a significant drop in air flow within the SVE system.

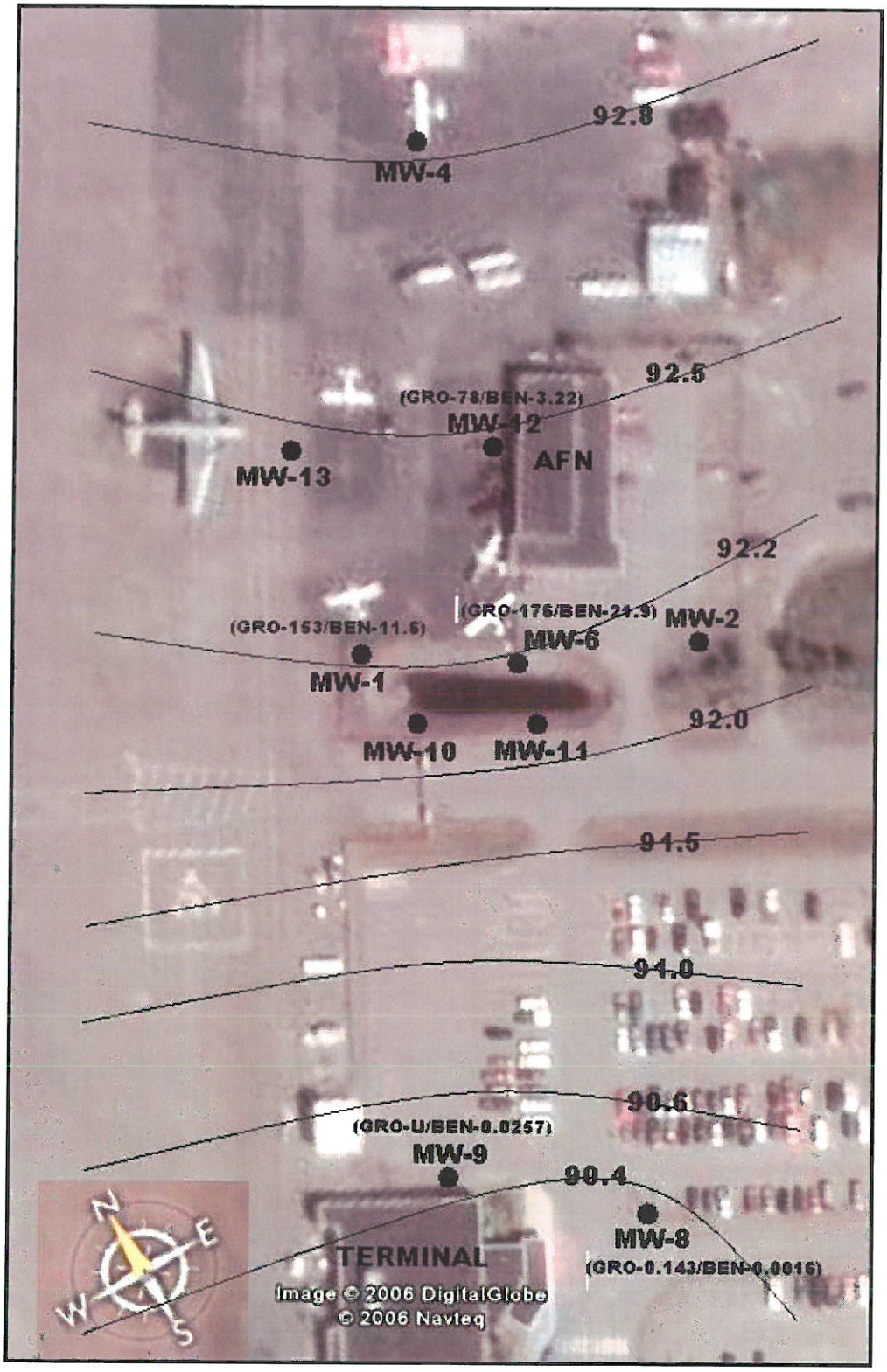

Figure 3-1. Groundwater flow contours for the KAFS site, June 2006.