

**KAFB-ST105-EX01**



KAFB-ST105-EX01



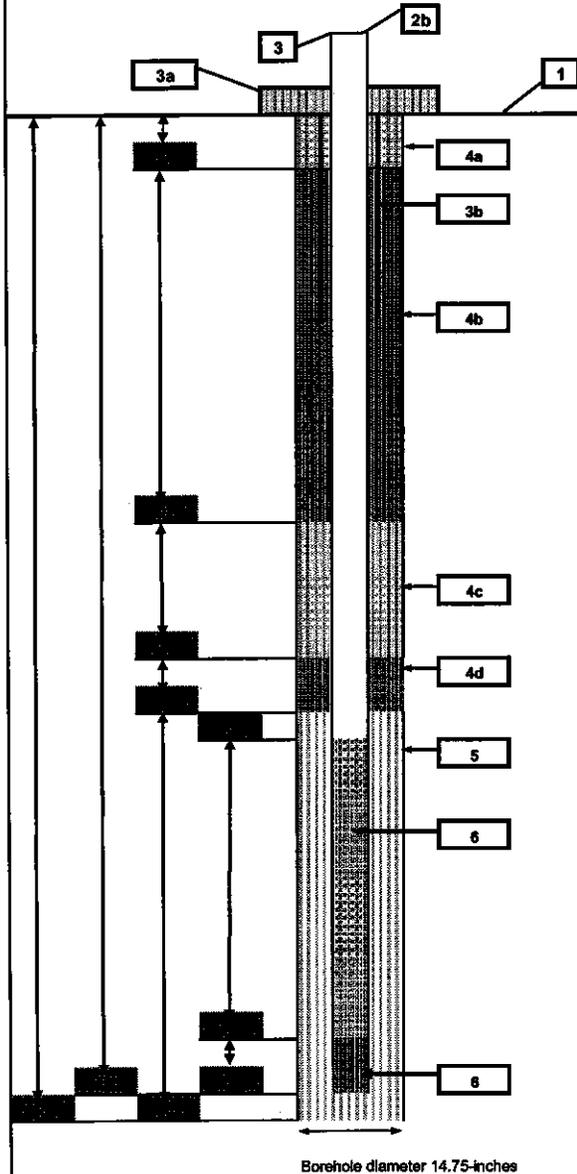
PROJECT NUMBER  
3970009

WELL NUMBER

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT NAME: Extraction Well Pilot Study	WELL COMPLETION DATE: 4/6/2007
DRILLING CONTRACTOR: WDC	EASTING (X): 404,500.82
DRILLING METHOD/EQUIP: ARCH and Mud Rotary/Star 50K	NORTHING (Y): 1470463.43
DRILLING START DATE: 27 March 2007	BOREHOLE DEPTH: 595
LOGGER: Bill Bragdon, P.G.	CASING DEPTH: 585.5



1- Ground elevation at well	5348.45 feet above MSL
2- a) Well casing	585.5 feet bgs to +3 feet 10-inch welded steel casing
b) Top of well casing elevation	5351.42 feet above MSL
3- Wellhead protection	Locking cover welded to well casing
a) Concrete pad dimensions	Temporary 4 feet x 4 feet x 1 foot
b) Protective steel 18" casing	0 -20 feet bgs 18 -inch steel casing
4- Well Seal	
a) Open hole	Open to 6 feet bgs to allow future connections
b) Cement/bentonite 94#/3% wt	6 to 431 feet bgs
c) 3/8 inch bentonite chips	431 to 478.5 feet bgs
d) Sugar sand	478.5 to 484.5 feet bgs
Method of placement	Tremmie pipe
5- Filter Pack 10/20 silica sand	484.5 to 585 feet bgs
6- Type/slot size of screen	505-575 (70-feet) 0.020-inch slot wire-wrap stainless
7- Sump	575-585 (10-feet) steel with welded 0.5 foot end cap
Development method	Surge/Bail/Pump/NuWell dosing
Development time	4/10/07 through 4/16/07, Appx. 76 hours
Estimated purge volume	20,920 gallons

Comments: The boring was drilled with 11 3/4 inch ARCH to 300 feet, 9 5/8 inch ARCH to 580 and overdrilled using 14 3/4-inch mud rotary to 595 feet bgs. Prior to well development, the well was surged and bailed with a 6.75-inch by 18 foot long bailer to remove sediment. Bentonite mud remover (BMR), an organic salt, was added to the well on 5 April 2007 to breakup bentonite in the well. The BMR was removed by bailing from the well the following day.

Borehole diameter 14.75-inches

Diagram is not to scale

AR 3245

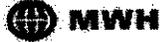


Field Boring Log

Facility/Project Name: <u>Kirtland Extraction Well Pilot Study</u>		Boring No. <u>KAFB-ST105-EX01</u>
Location: <u>ST-105, northwest of Pad 5 and south of South Gate Road</u>		Project No. <u>3970009.6130501</u>
Drilling Co: <u>WDC</u>	Driller's Name: <u>Mark Green</u>	Drill Rig: <u>Star 50K-CH</u>
Drill Method: <u>Air Rotary Casing Hammer and Mud Rotary</u>	Date: <u>3/27/07 to 4/1/07</u>	Logged By: <u>B. Bragdon</u>
Water Level Below TOC (ft): <u>-500</u>	Date Measured: <u>3/29/2007</u>	Ground Surface Elevation (ft): <u>5348.45</u>
		Measuring Point elevation (ft): <u>5351.42</u>
		(top of well casing)
		Borehole Diameter: <u>0-300' 11 3/4", 300 - 580' 9 5/8", reamed with 14-inch to 595'</u>
		Borehole Depth: <u>595 feet below ground surface</u>

Depth (feet)	Grain Size			Blows (6 inches)	Sample Type	Sample Recovery	USCS/ASTM Classification	Lith. Code (ERPIMS)	Lithologic Description
	% Gravel	% Sand	% Fines						
0	0	30	70	NA	Grab	NA	ML	SDSL	0 to 8 feet: Sandy Silt. Sand is fine to medium grained. Moderate yellowish brown 10YR 5/4, slightly moist, no odors
5									
10	50	20	30	NA	Grab	NA	GM	SLGV	8 to 24 feet: Silty Gravel. Some fine to coarse grained sand. Gravel is limestone and quartzite - subrounded. Trace metamorphic gravel. Moderate yellowish brown 10YR 5/4 to moderate brown 5 YR 4/4, slightly moist, no odors.
15									
20									
25	10	40	50	NA	Grab	NA	ML	SDSL	24 to 44 feet: Sandy Silt. Trace Gravel. Gravel is fine grained. Slightly moist and slightly plastic. Moderate brown 5YR 4/4.
30									
35									
40									42 feet: ML as above with trace clay locally, medium plasticity.
45	10	60	30	NA	Grab	NA	SM	SLSD	44 to 52 feet: Silty Sand. Trace gravel. Sand and gravel are fine to coarse grained. Moderate brown 5YR 4/4, dry to slightly moist, no odors.
50	0	50	50	NA	Grab	NA	SM/ML	SMML	52 to 54 feet: grades to Sand and Silt. Sand is fine grained. Moderate brown 5YR 4/4, slightly moist, no odors.
55	0	40	60	NA	Grab	NA	ML	SDSL	54 to 64 feet: Sandy Silt. Sand is fine grained. Moderate brown 5YR 4/4. Occasional interbedded clay that is light brown 5 YR 5/6 and medium plasticity, slightly moist, no odors.
60									
65	10	80	10	NA	Grab	NA	SP	SD	64 to 68 feet: Sand. Trace Silt and Gravel. Sand and gravel are fine to coarse grained. Moderate yellowish brown 10YR 5/4, dry to slightly moist, no odors.
70	<5	60	40	NA	Grab	NA	SM	SLSD	68 to 74 feet: Silty Sand. Trace Gravel. Sand is fine to coarse grained. Moderate brown 5YR 4/4. slightly plastic, slightly moist.
75	0	50	50	NA	Grab	NA	SM/ML	SMML	74 to 82 feet: Sand and Silt. Sand is fine to coarse grained. Moderate brown 5YR 4/4, slightly moist.
80	0	30	70	NA	Grab	NA	ML	SDSL	82 to 88 feet: Sandy Silt. Sand is fine to medium grained. Moderate brown 5YR 4/4, slightly moist, slightly plastic.
85									
90	10	60	30	NA	Grab	NA	SP	SLSD	88 to 94 feet: Silty Sand. Trace fine grained gravel and clay locally. Sand is fine to coarse grained. Moderate yellowish brown 10YR 5/4, slightly moist.
95	0	30	70	NA	Grab	NA	ML	SDSL	94 to 98 feet: Sandy Silt. Trace clay. Sand is fine grained. Moderate brown 5YR 5/4, slightly moist, non plastic to slightly plastic where clayey.
	20	20	60	NA	Grab	NA	ML	GVSL	98 to 100 feet - ML as above with some fine to coarse gravel.
100	0	30	70	NA	Grab	NA	ML/CL	MLCL	100 to 106 feet - Clayey Silt with Sand. Sand is fine to medium grained. Moderate brown 5YR 5/4, low plasticity, slightly moist.
105	0	60	40	NA	Grab	NA	SM	SLSD	106 to 114 feet: Sandy Silt. Trace Clay. Sand is fine to medium grained. Non plastic to low plasticity locally, moderate brown 5YR 5/4, slightly moist
110									
115	0	30	70	NA	Grab	NA	SM	SLSD	114 to 118 feet: Sandy Silt. Sand is fine to coarse grained. Moderate yellowish brown 10YR 5/4, slightly moist, no odors.
120	0	60	40	NA	Grab	NA	SC	CLSD	118 to 124 feet: Clayey Sand. Sand is fine grained. Light brown 5YR 5/6, low plasticity, slightly moist to moist, no odors.
125	50	10	40	NA	Grab	NA	GC	CLGV	124 to 131 feet: Clayey Gravel. Gravel is fine grained. Light brown 5YR 5/6, low plasticity, slightly moist, no odors.
130	<5	60	40	NA	Grab	NA	SM	SLSD	131 to 134 feet: Silty Sand. Trace Clay. Sand is fine to coarse grained. Moderate yellowish brown 10 YR 5/4, slightly moist.
135	<5	50	50	NA	Grab	NA	SM/ML	SMML	134 to 148 feet: Silt and Sand. Sand is fine grained. Moderate brown 5YR 3/4, slightly moist, slightly plastic locally, no odors.
140									
145									
150	10	60	30	NA	Grab	NA	SM	SLSD	148 to 154 feet: Silty Sand with Gravel. Sand is fine to medium grained. Gravel is fine to coarse grained. Moderate yellowish brown 10YR 5/4, slightly moist.

AR 3245



Field Boring Log

Facility/Project Name: Kirtland Extraction Well Pilot Study Boring No. KAFB-ST105-EX01  
 Location: ST-105, northwest of Pad 5 and south of South Gate Road Project No. 3970009.6130501

Drilling Co: WDC Northing: 1,470,463.43 Easting: 404,500.82  
 Driller's Name: Mark Green  
 Drill Rig: Star 50K-CH Ground Surface Elevation (ft): 5348.45  
 Drill Method: Air Rotary Casing Hammer and Mud Rotary Measuring Point elevation (ft): 5351.42  
 Date: 3/27/07 to 4/1/07 (top of well casing)  
 Logged By: B. Bragdon Borehole Diameter: 0-300' 11 3/4", 300 - 580' 9 5/8", reamed with 14-inch to 595'  
 Water Level Below TOC (ft): -500 Date Measured: 3/29/2007 Borehole Depth: 595 feet below ground surface

Depth (feet)	Grain Size			Blows (6 inches)	Sample Type	Sample Recovery	USCS/ASTM Classification	Lith. Code (ERPIMS)	Lithologic Description
	% Gravel	% Sand	% Fines						
155	<5	60	40	NA	Grab	NA	SM	CLSD	154 to 165 feet - SM as above with decreasing gravel and trace thinly bedded clay; light brown 5YR 6/4, low to medium plasticity, slightly moist.
160									
165	0	70	30	NA	Grab	NA	SC	CLSD	165 to 171 feet: Clayey Sand. Sand is fine to medium grained. Moderate yellowish brown 10YR 5/4, low to medium plasticity, slightly moist.
170	0	60	40	NA	Grab	NA	SM	SLSL	171 to 177 feet: Silty Sand. Sand is fine grained. Moderate yellowish brown 10YR 5/4, non to slightly plastic, slightly moist, no odors.
175	0	60	40	NA	Grab	NA	SC	CLSD	177 to 191 feet: Clayey Sand. Trace Silt. Sand is fine to medium grained. Moderate yellowish brown 10YR 5/4, low to medium plasticity, slightly moist.
180									
185	0	80	20	NA	Grab	NA	SC	CLSD	186 feet: decrease in clay and an increase in fine to medium sand.
190	20	70	10	NA	Grab	NA	SP	GVSD	191 to 201 feet: Sand with Gravel. Trace Silt. Sand is fine to coarse grained. Gravel is fine grained. Pale yellowish brown 10YR 6/2, dry to slightly moist.
195									
200	0	60	40	NA	Grab	NA	SC	CLSD	201 to 221 feet: Clayey Sand. Sand is fine to medium grained. Dark yellowish brown 10YR 4/2, low to medium plasticity, moist, no odors.
205									
210									
215									
220	10	80	10	NA	Grab	NA	SP	SD	221 to 257 feet: Sand. Trace Silt and Gravel. Sand is fine to coarse grained. Gravel is fine grained. Pale yellowish brown 10YR 6/2, slightly moist, no odors.
225									
230	20	70	10	NA	Grab	NA	SP	GVSD	SP as above with an increase in fine to coarse grained gravel, grades to moist to very moist but no visible water.
235	<5	90	10	NA	Grab	NA	SP	SD	As above, 237 feet decrease in gravel and grading to slightly moist.
240	10	80	10	NA	Grab	NA	SP	SD	SP as above with an increase in fine grained gravel.
245									
250	20	70	10	NA	Grab	NA	SP	GVSD	As above, increase in fine gravel 249 feet
255	0	70	30	NA	Grab	NA	SC	CLSD	257 to 265 feet: Clayey Sand. Sand is fine grained. Light brown 5YR 6/4 to dark yellowish brown 10YR 4/4, low to medium plasticity, slightly moist, no odors.
260									
265	0	90	10	NA	Grab	NA	SP	SD	265 to 299 feet: Sand. Trace Silt. Sand is fine to medium grained. Pale yellowish brown 10YR 6/2, slightly moist, no odors, 268 feet grades to light yellowish gray 5YR 6/1.
270									
275									
280									
285									
290	0	90	10	NA	Grab	NA	SP	SD	289 feet SP as above grades to fine to coarse sand with trace silt, light brownish gray 5YR 6/1, slightly moist, no odors.
295									
300	30	60	10	NA	Grab	NA	SP	GVSD	299 to 310 feet: Gravelly Sand. Trace Silt. Sand and gravel are fine to coarse grained. Gravel is subrounded to subangular. Light brownish gray 5YR 6/1, slightly moist, no odors.
305	10	50	40	NA	Grab	NA	SP/CL	SDCL	306 to 309 feet SP as above with interbedded silty clay, light brown 5YR 6/4, medium plasticity, dry to slightly moist.
310	0	90	10	NA	Grab	NA	SP	SD	310 to 321 feet: Sand. Trace Silt. Sand is fine grained. Light brown 10YR 8/3, dry to slightly moist, no odors.
315	0	90	10	NA	Grab	NA	SP	SD	317 feet: SP as above grading to fine to medium sand with trace silt, pale yellowish brown 10YR 6/2 to moderate yellowish brown 10YR 5/4, slightly moist.
320	0	70	30	NA	Grab	NA	SP/CL	SDCL	319 to 321 feet SP as above with thinly bedded silty clay.
325	20	80	0	NA	Grab	NA	SP	GVSD	323 to 359 feet: Sand with Gravel. Sand and gravel are fine to coarse grained; subrounded. Pale yellowish brown 10 YR 6/2, dry to slightly moist.
330	20	80	<5	NA	Grab	NA	SP	GVSD	332 feet: SP as above with trace silt.



Field Boring Log

Facility/Project Name <u>Kirtland Extraction Well Pilot Study</u>		Boring No. <u>KAFB-ST105-EX01</u>
Location <u>ST-105, northwest of Pad 5 and south of South Gate Road</u>		Project No. <u>3970009.6130501</u>
Drilling Co <u>WDC</u>	Northing: <u>1,470,463.43</u>	Easting: <u>404,500.82</u>
Driller's Name <u>Mark Green</u>	Ground Surface Elevation (ft) <u>5348.45</u>	
Drill Rig <u>Star 50K-CH</u>	Measuring Point elevation (ft) <u>5351.42</u> (top of well casing)	
Drill Method <u>Air Rotary Casing Hammer and Mud Rotary</u>	Borehole Diameter: <u>0-300' 11 3/4", 300 - 580' 9 5/8", reamed with 14-inch to 595'</u>	
Date <u>3/27/07 to 4/1/07</u>	Borehole Depth: <u>595 feet below ground surface</u>	
Logged By <u>B. Bragdon</u>		
Water Level Below TOC (ft): <u>~500</u>	Date Measured: <u>3/29/2007</u>	

Depth (feet)	Grain Size			Blows (6 inches)	Sample Type	Sample Recovery	USCS/ASTM Classification	Lith. Code (ERPIMS)	Lithologic Description
	% Gravel	% Sand	% Fines						
335									
340									
345	30	70	<5	NA	Grab	NA	SP	GVSD	343 feet: SP as above with increasing fine gravel.
350									
355									
360	50	50	<5	NA	Grab	NA	SP/GP	SPGP	359 to 381 feet: Sand and Gravel. Sand is fine to coarse grained. Gravel is fine grained; subrounded to subangular. Light brownish gray 5YR 6/1, dry to slightly moist, no odors.
365									
370									
375	50	50	<5	NA	Grab	NA	SP/GP	SPGP	Increasing medium-grained gravel.
380	30	70	<5	NA	Grab	NA	SP	GVSD	381 to 475 feet: Gravelly Sand. Sand and gravel are fine to coarse grained; subangular to subrounded. Light brownish gray 5YR 6/1 to moderate yellowish brown 10YR 5/4, dry.
385									
390									
395									
400									
405									
410	30	70	<5	NA	Grab	NA	SP	GVSD	412 feet: SP as above grading to light brownish gray 5YR 6/1 with some moderate yellowish brown 10YR 5/4.
415									
420									
425	20	70	10	NA	Grab	NA	SP	GVSD	425 to 427 feet: SP as above with thinly interbedded silty clay, slightly moist to moist, some gravel coated with moist soil.
430									
435									
440									
445	40	60	<5	NA	Grab	NA	SP	GVSD	444 feet: Increasing gravel.
450									
455	20	80	<5	NA	Grab	NA	SP	GVSD	447 feet: SP as above with decrease in gravel to approximately 20%
460									
465	20	80	<5	NA	Grab	NA	SP	GVSD	469 feet: SP as above grades to light brownish gray 5YR 6/1, dry.
470									
475	<5	90	10	NA	Grab	NA	SP	SD	475 to 482 feet: Sand. Trace Silt and Gravel. Sand is fine to medium grained. Moderate yellowish brown, slightly moist, no odors.
480	20	80	<5	NA	Grab	NA	SP	GVSD	482 to 504 feet grading to Sand with Gravel. Sand is fine to coarse grained with some fine grained gravel, light brownish gray 5YR 6/1, slightly moist.
485									
490									
495	20	50	30	NA	Grab	NA	SP/SC	SPSC	496 to 497 feet: SP as above with some thinly interbedded silty clay. Light brown 5YR 5/6, low to medium plasticity, moist to wet.
500	20	80	<5	NA	Grab	NA	SP	SD	Wet at 500 feet. SP as above with increasing sand and decreasing silt. Groundwater grab sample KAFB-EX0001-GW-(500 to 505)-1 was reported at 25 mg/l Nitrate and <0.10 mg/l Nitrite
505	40	60	<5	NA	Grab	NA	SP/GP	GVSD	504 to 520 feet: Gravelly Sand. Sand is fine to coarse grained; gravel is fine grained. Gravel and coarse sand is subangular to angular. Wet, dark yellowish brown 10YR 6/2, no odors.
510									
515	30	70	<5	NA	Grab	NA	SP	GVSD	514 feet: SP/GP as above, gravel decreasing to approximately 30%.
520	20	80	<5	NA	Grab	NA	SP	GVSD	520 to 528 feet: Sand. Some Gravel. Trace silt. Sand is coarse grained with some fine to coarse gravel. Dark yellowish brown 10YR 4/2 to moderate yellowish brown 10YR 5/4, wet.
525	10	80	10	NA	Grab	NA	SP	SD	528 to 547 feet: Sand. Trace Silt and Gravel. Sand is fine to coarse grained. Gravel is fine grained. Dark yellowish brown 10YR 4/2 to moderate yellowish brown 10YR 5/4, moist to wet (not much water), no odors.
530									Groundwater grab sample KAFB-EX0001-GW-(530 to 532)-2 was reported at 33 mg/l Nitrate and <0.10 mg/l Nitrite



Field Boring Log

Facility/Project Name <u>Kirtland Extraction Well Pilot Study</u>		Boring No. <u>KAFB-ST105-EX01</u>
Location <u>ST-105, northwest of Pad 5 and south of South Gate Road</u>		Project No. <u>3970009.6130501</u>
Drilling Co <u>WDC</u>	Northing: <u>1,470,463.43</u>	Easting: <u>404,500.82</u>
Driller's Name <u>Mark Green</u>	Ground Surface Elevation (ft) <u>5348.45</u>	
Drill Rig <u>Star 50K-CH</u>	Measuring Point elevation (ft) <u>5351.42</u> (top of well casing)	
Drill Method <u>Air Rotary Casing Hammer and Mud Rotary</u>	Borehole Diameter: <u>0-300' 11 3/4", 300 - 580' 9 5/8", reamed with 14-inch to 595'</u>	
Date <u>3/27/07 to 4/1/07</u>	Borehole Depth: <u>595 feet below ground surface</u>	
Logged By <u>B. Bragdon</u>	Water Level Below TOC (ft): <u>-500</u> Date Measured: <u>3/29/2007</u>	

Depth (feet)	Grain Size			Blows (6 inches)	Sample Type	Sample Recovery	USCS/ASTM Classification	Lith. Code (ERPIMS)	Lithologic Description
	% Gravel	% Sand	% Fines						
535									
540									
545	10	60	30	NA	Grab	NA	SP/SM	SPSM	547 to 551 feet: Silty Sand. Trace gravel. Sand is fine to coarse grained. Gravel is fine grained. Moderate yellowish brown 10YR 5/4, wet.
550	<5	50	50	NA	Grab	NA	SM/ML	SMML	551 to 564 feet: Sand and Silt. Sand is fine to coarse grained. Dark yellowish brown, 10YR 4/2, wet.
555									Groundwater grab sample KAFB-EX0001-GW-(555 to 557)-3 was reported at 15 mg/l Nitrate and <0.50 mg/l Nitrite
560									
565	<5	40	60	NA	Grab	NA	ML	SDSL	564 to 567 feet: Interbedded Sand and Silt. Sand is fine grained. Dark yellowish brown 10YR 4/2, moist to wet, non-plastic to slightly plastic locally.
570	50	50	<5	NA	Grab	NA	GP/SP	GPSP	567 to 595 feet: Sand and Gravel. Trace silt. Sand and gravel are fine to coarse grained. Dark yellowish brown 10YR 4/2 to moderate yellowish brown 10YR 5/4, wet.
575									Groundwater grab sample KAFB-EX0001-GW-575 to 577-4 was reported at 3.8 mg/l Nitrate and <0.50 mg/l Nitrite
580									Groundwater grab sample KAFB-EX001-577-5 was reported at 3.7 mg/l Nitrate and <0.10 mg/l Nitrite
585	60	40	<5	NA	Grab	NA	GP	GPSP	587 feet: Increasing fine to coarse grained gravel, more difficult drilling and drill bit is binding up in gravel from 587 to 595 feet.
590									
595									Total Depth of Soil Boring 595 feet below ground surface.