Appendix C

Lower Duwamish Waterway
RM 4.3-4.9 East (Boeing Developmental Center)

Excerpts from BDC RCRA Reports, 2007–2009

Appendix C1 – AOC-05

AOC-05 Remedial Action Plan, November 16, 2007 (Landau 2007b)

Developmental Center Groundwater Monitoring, AOC-05 Data, May 2009 (Landau 2009c)

Technical Memorandum, Update on AOC-05 Full-Scale Bioremediation Results, September 17, 2009 (Landau 2009d)

Work Plan
AOC-05 Remedial Action Plan
Enhanced Anaerobic Biodegradation of Gasoline-Range Petroleum Hydrocarbons
Boeing Developmental Center
Tukwila, Washington

November 16, 2007

Prepared for

The Boeing Company
Seattle, Washington

LANDAU ASSOCIATES
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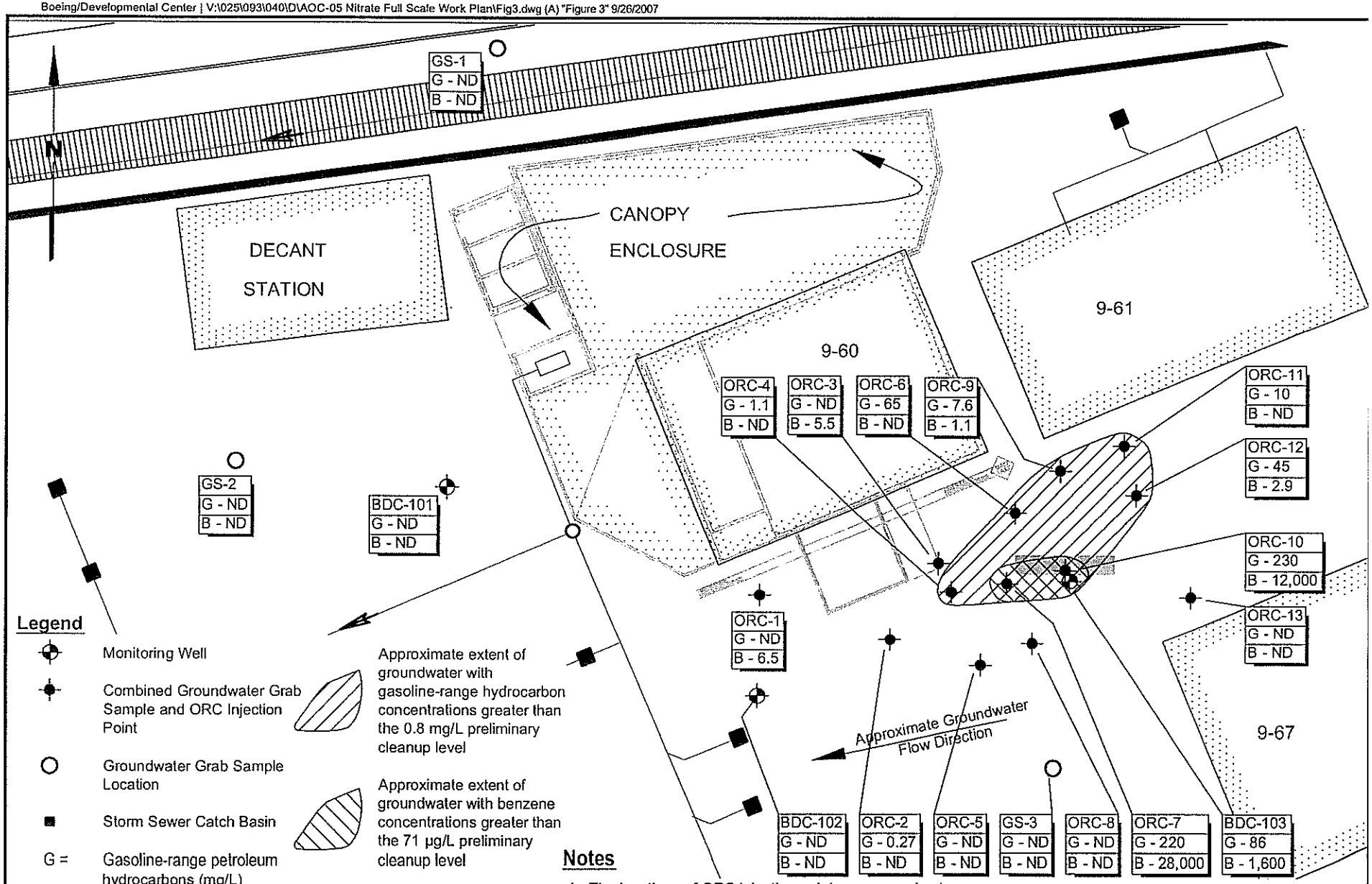

Legend

- Monitoring Well
- Combined Groundwater Grab Sample and ORC Injection Point
- Groundwater Grab Sample Location
- Storm Sewer Catch Basin
- G = Gasoline-range petroleum hydrocarbons (mg/L)
- B = Benzene (µg/L)
- ND = Not Detected

Approximate extent of groundwater with gasoline-range hydrocarbon concentrations greater than the 0.8 mg/L preliminary cleanup level

Approximate extent of groundwater with benzene concentrations greater than the 71 µg/L preliminary cleanup level

Notes

1. The locations of ORC injection points are approximate.
2. All boring data are pre-ORC injection from April 29 and May 6 & 7, 2002, and well data from baseline monitoring in May 15, 2006.

0 30 60
Scale in Feet

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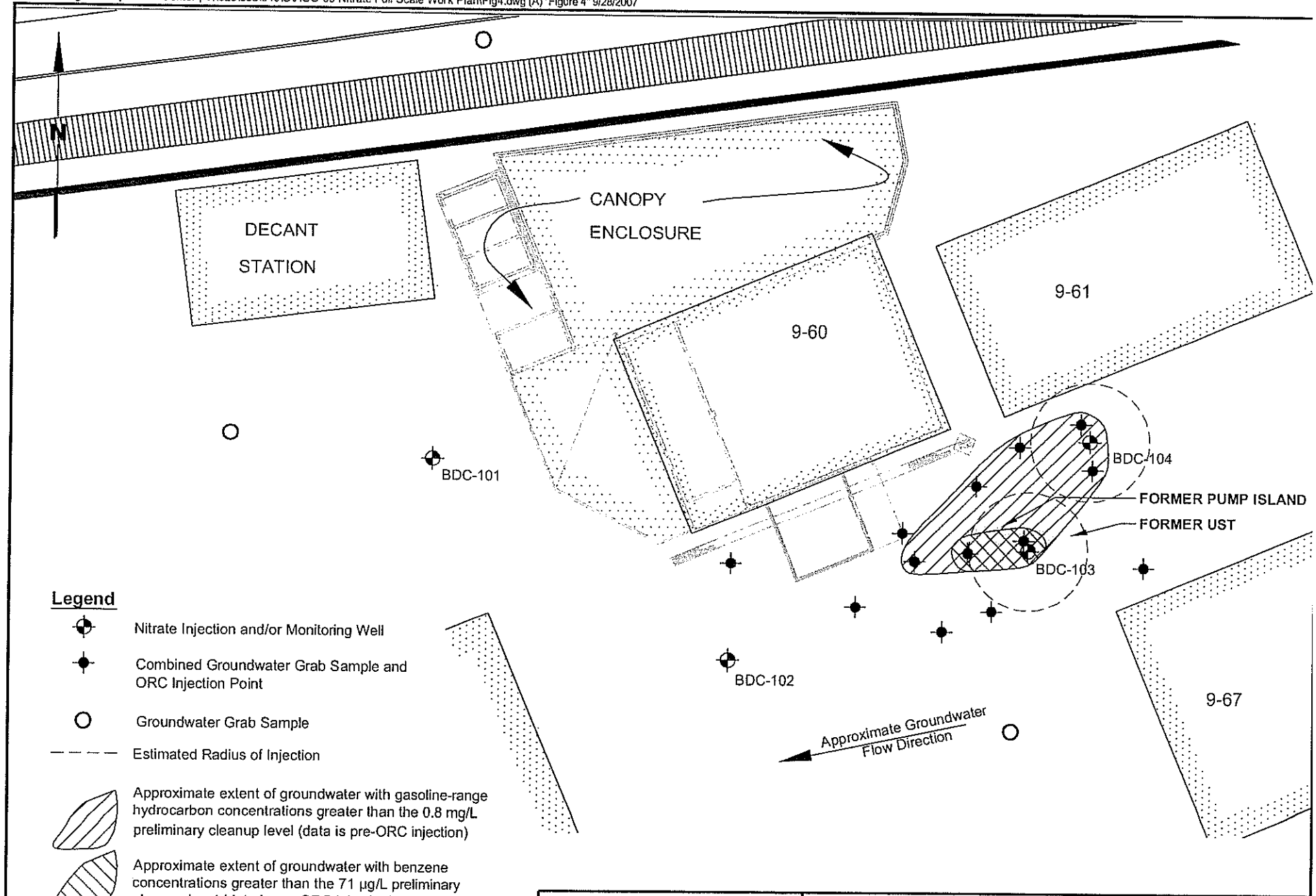
Boeing Developmental Center Tukwila, Washington	**Groundwater Characterization Data**	Figure 3



LANDAU ASSOCIATES

Boeing Developmental Center Tukwila, Washington	**Nitrate Injection and Groundwater Sample Locations**	Figure 4

TABLE 1
GROUNDWATER CONTAMINANT DATA
AOC-05
BOEING DEVELOPMENTAL CENTER

	Preliminary Groundwater Levels (a) Screening	Pre-ORC Injection (b)					Post ORC Injection (b)												
		BDC-101 06/11/01	BDC-101 09/04/01	BDC-101 12/03/01	BDC-101 03/13/02	BDC-101 EH92A 04/29/02	BDC-101 EK68A 06/03/02	BDC-101 EN04A 07/01/02	BDC-101 EP36A 08/01/02	BDC-101 FA41A 12/02/02	BDC-101 FH27A 03/10/03	BDC-101 FN40A 06/03/03	BDC-101 GB17B 11/19/03	BDC-101 GO82A 04/28/04	BDC-101 HF76A 10/18/04	BDC-101 IA83A 05/10/05	BDC-101 IS89A 11/10/05	BDC-101 JJ26B 05/15/06	BDC-101 KG20B 11/20/06
Total Petroleum Hydrocarbons (mg/L)																			
Gasoline	0.8	3	5	6.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.61	0.25 U	0.25 U	0.42 J	0.25 U	0.64	0.25 U	0.25	0.25 U	1.1
BTEX (µg/L)																			
Benzene	71	11.9	7.13 J	95	1.4	1 U	1	1 U	3.1	4.3	1	1 U	13 J	1 U	10	1 U	7.6	1.0 U	10
Toluene	200,000	1 U	10.7	1.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	29,000	113.1	50.4	750	4.4	2.2	1 U	1 U	2.4	21	4.5	1 U	15 J	1 U	15	1 U	2.6	1.0 U	15
m,p-Xylene	NA					1 U	1 U	1 U	1 U	27	3.2	1 U	35 J	1 U	43	1 U	42	1.0 U	72.0
o-Xylene	NA					1 U	1 U	1 U	1 U	6.4	1 U	1 U	1 UJ	1 U	1 U	1 U	1.0 U	1.0 U	1.0 U
Total Xylenes	NA	109.2	53.8	650	2 U	1 U	1 U	1 U	1 U	33.4	3.2	1 U	35 J	1 U	43	1 U	42	1.0 U	72

	Preliminary Groundwater Levels (a) Screening	Post-Nitrate Injection (c)			
		BDC-101 KO95A 02/20/07	BDC-101 KR82A 03/19/07	BDC-101 KV95A 04/24/07	BDC-101 KZ41A 05/17/07
Total Petroleum Hydrocarbons (mg/L)					
Gasoline	0.8	0.25 U	0.25 U	0.25 U	0.25 U
BTEX (µg/L)					
Benzene	71	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	200,000	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	29,000	1.0 U	1.0 U	1.0 U	1.0 U
m,p-Xylene	NA	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	NA	1.0 U	1.0 U	1.0 U	1.0 U
Total Xylenes	NA	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 1
GROUNDWATER CONTAMINANT DATA
AOC-05
BOEING DEVELOPMENTAL CENTER

	Preliminary Groundwater Levels (a) Screening	Pre-ORC Injection (b)					Post ORC Injection (b)												
		BDC-102 06/11/01	BDC-102 09/04/01	BDC-102 12/03/01	BDC-102 03/13/02	BDC-102 EH92B 04/29/02	BDC-102 EK68B 06/03/02	BDC-102 EN04B 07/01/02	BDC-102 EP36B 08/01/02	BDC-102 FA41B 12/02/02	BDC-102 FH27B 03/10/03	BDC-102 FN40B 06/03/03	BDC-102 GB17C 11/19/03	BDC-102 GO82B 04/28/04	BDC-102 HF76B 10/18/04	BDC-102 IA83B 05/10/05	BDC-102 IS89B 11/10/05	BDC-102 JJ26A 05/15/06	BDC-102 KG20A 11/20/06
Total Petroleum Hydrocarbons (mg/L)																			
Gasoline	0.8	0.55	0.38	1.6	0.5	0.33	0.25 U	0.25	0.25 U	0.25 U	0.26	0.25 U	0.99 J	0.40	0.33	0.25 U	0.25 U	0.25 U	0.25 U
BTEX (µg/L)																			
Benzene	71	5.33 J	1.61 J	3.7	1.3	2.6	4.4	1 U	1 U	1 U	1 U	1 U	120 J	10	1 U	1 U	1.0 U	1.0 U	1.0 U
Toluene	200,000	1 U	1.89 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	29,000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	8.5 J	1 U	1 U	1 U	1.0 U	1.0 U	1.0 U
m,p-Xylene	NA					1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	3	1 U	1 U	1.0 U	1.0 U	1.0 U
o-Xylene	NA					1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1.0 U	1.0 U	1.0 U
Total Xylenes	NA	2 U	1.87 J	3.49 J	1 U	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	3	1 U	1 U	1.0 U	1.0 U	1.0 U

	Preliminary Groundwater Levels (a) Screening	Post-Nitrate Injection (c)			
		BDC-102 K095B 02/20/07	BDC-102 KR82B 03/19/07	BDC-102 KV95B 04/24/07	BDC-102 KZ41B 05/17/07
Total Petroleum Hydrocarbons (mg/L)					
Gasoline	0.8	0.25 U	0.25 U	0.53	0.25 U
BTEX (µg/L)					
Benzene	71	5.8	18	6.1	1.8
Toluene	200,000	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	29,000	1.0 U	1.0 U	3.1	1.0 U
m,p-Xylene	NA	1.0 U	32	100	7.4
o-Xylene	NA	1.0 U	1.0 U	1.0 U	1.0 U
Total Xylenes	NA	1.0 U	32	100	7.4

TABLE 1
GROUNDWATER CONTAMINANT DATA
AOC-05
BOEING DEVELOPMENTAL CENTER

	Preliminary Groundwater Levels (a) Screening	Pre-ORC Injection (b)					Post ORC Injection (b)													
		BDC-103 06/11/01	BDC-103 09/04/01	BDC-103 (d) 12/03/01	BDC-103 03/13/02	BDC-103 EH92C 04/29/02	BDC-103 EK68C 06/03/02	BDC-103 EN04C 07/01/02	BDC-103 EP36C 08/01/02	BDC-103 FA41C 12/02/02	BDC-103 FH27C 03/10/03	BDC-103 FN40C 06/03/03	BDC-103 GB17D 11/19/03	BDC-103 GO82C 04/28/04	BDC-103 HF76C 10/18/04	BDC-103 IA83C 05/10/05	BDC-103 IS89C 11/10/05	BDC-103 JJ26C 05/15/06	BDC-103 JJ26H 05/15/06	BDC-103 KG20C 11/20/06
Total Petroleum Hydrocarbons (mg/L)																				
Gasoline	0.8	177	123	120	200	200	200	240	270	250	180	220	180	160	140	110	90	84	86	51
BTEX (µg/L)																				
Benzene	71	875 J	494 J	5,100	1,700	980	960	1,300	4,600	1,400	780	900	850 J	1,600	2,100	2,200	2,200	1,600	1,600	2,000
Toluene	200,000	12,010	3,760	2,300,000	17,000	16,000	17,000	16,000	18,000	15,000	13,000	10,000	8,300 J	6,600	5,500	5,500	3,500	3,800	3,800	730
Ethylbenzene	29,000	1,985 J	419 J	10,000	4,900	5,400	5,100	5,200	5,200	5,000	5,200	5,000	4,500 J	3,900	3,700	3,800	3,700	3,100	3,100	2,200
m,p-Xylene	NA					20,000	20,000	20,000	19,000	22,000	20,000	20,000	18,000 J	16,000	15,000	14,000	12,000	10,000	10,000	3,900
o-Xylene	NA					7,000	7,100	6,800	6,600	6,900	6,700	6,600	5,500 J	5,100	4,400	3,200	2,500	2,200	2,200	1,000
Total Xylenes	NA	11,430	2,636	3,400,000	26,400	27,000	27,100	26,800	25,600	28,900	26,700	26,600	23,500 J	21,100	19,400	17,200	15,000	12,000	12,000	4,900

	Preliminary Groundwater Levels (a) Screening	Post-Nitrate Injection (c)			
		BDC-103 KO95C 02/20/07	BDC-103 KR82C 03/19/07	BDC-103 KV95C 04/24/07	BDC-103 KZ41C 05/17/07
Total Petroleum Hydrocarbons (mg/L)					
Gasoline	0.8	26	30	36	77
BTEX (µg/L)					
Benzene	71	460	490	820	1,400
Toluene	200,000	420	88	440	4,300
Ethylbenzene	29,000	140	130	220	1,100
m,p-Xylene	NA	3,600	3,500	3500	8,300
o-Xylene	NA	1,600	1,700	1800	3,200
Total Xylenes	NA	5,200	5,200	5300	11,500

NA = no preliminary cleanup level available.
U = compound was not detected at given reporting limit.
J = indicates the analyte was positively identified, and the concentration listed is an estimate.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

-- = Not Measured.
Boxed value indicates concentration above preliminary cleanup level.

(a) Landau Associates 2002.
(b) ORC injection in April and May 2002.
(c) Ammonium nitrate solution injected to well on 1/17-18/07.
(d) BTEX data questionable for this event. Concentrations inconsistent with TPH-G data for indicated event and BTEX data from other events.

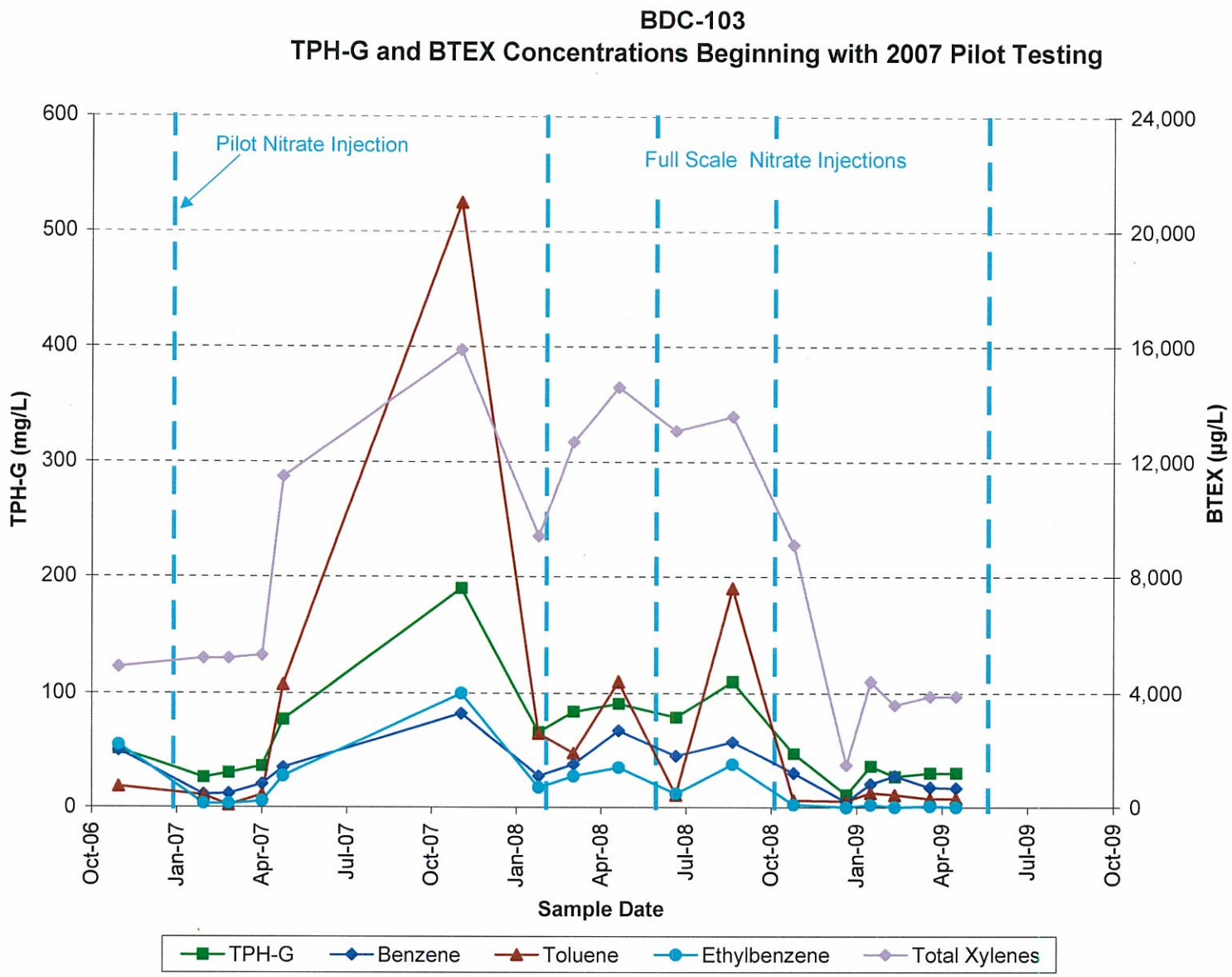
DEVELOPMENTAL CENTER

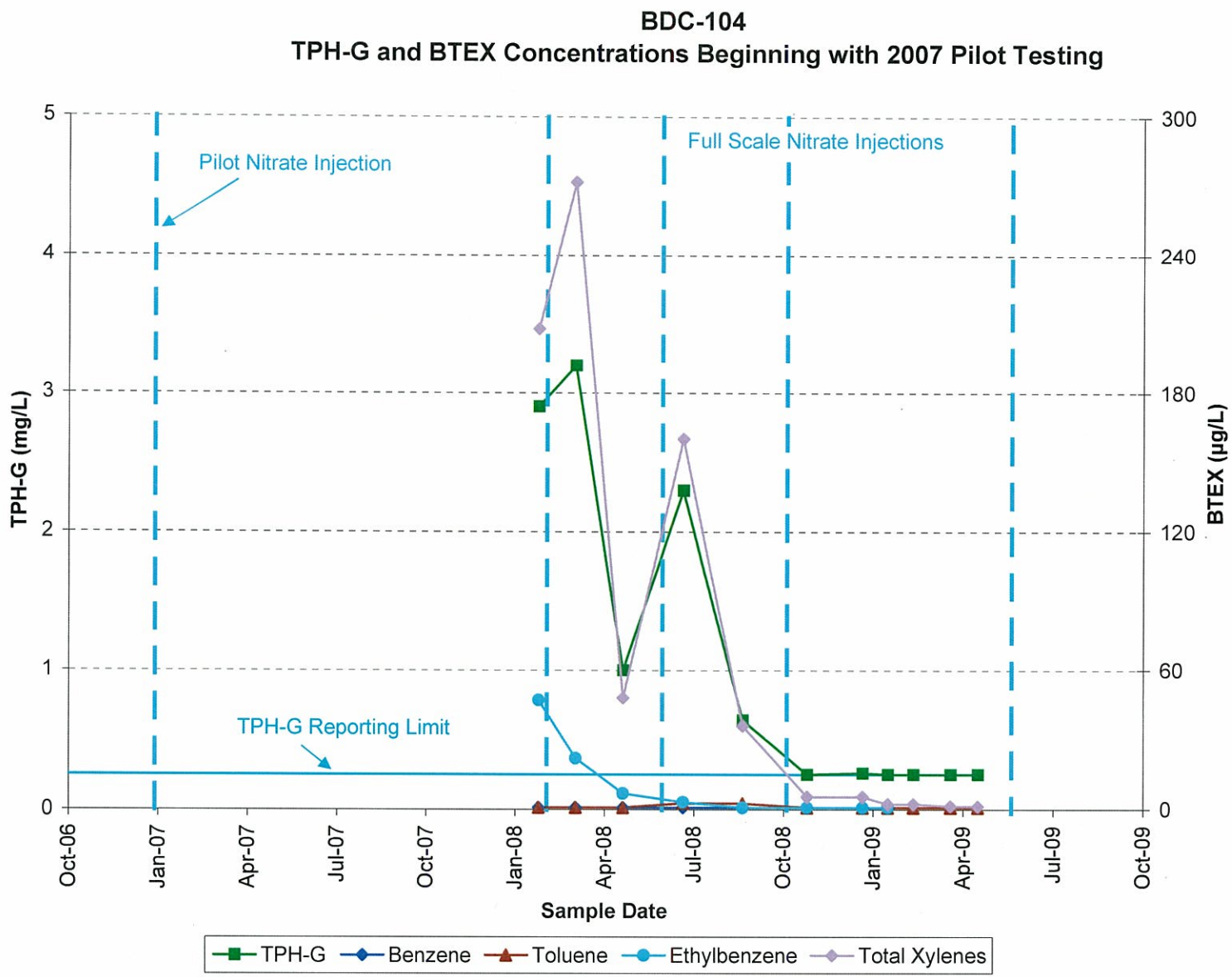
GROUNDWATER MONITORING

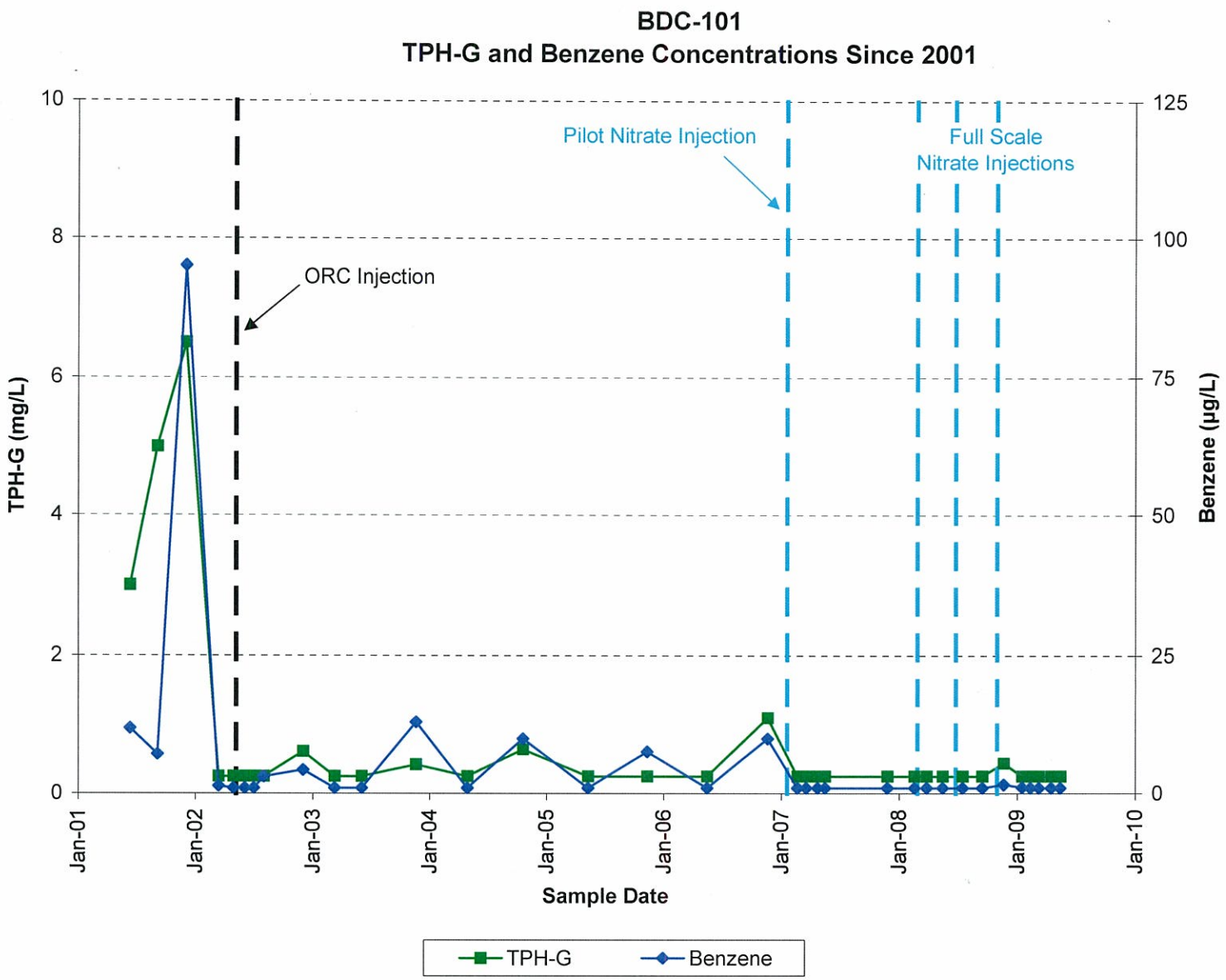
MAY 2009

AOC-05 DATA

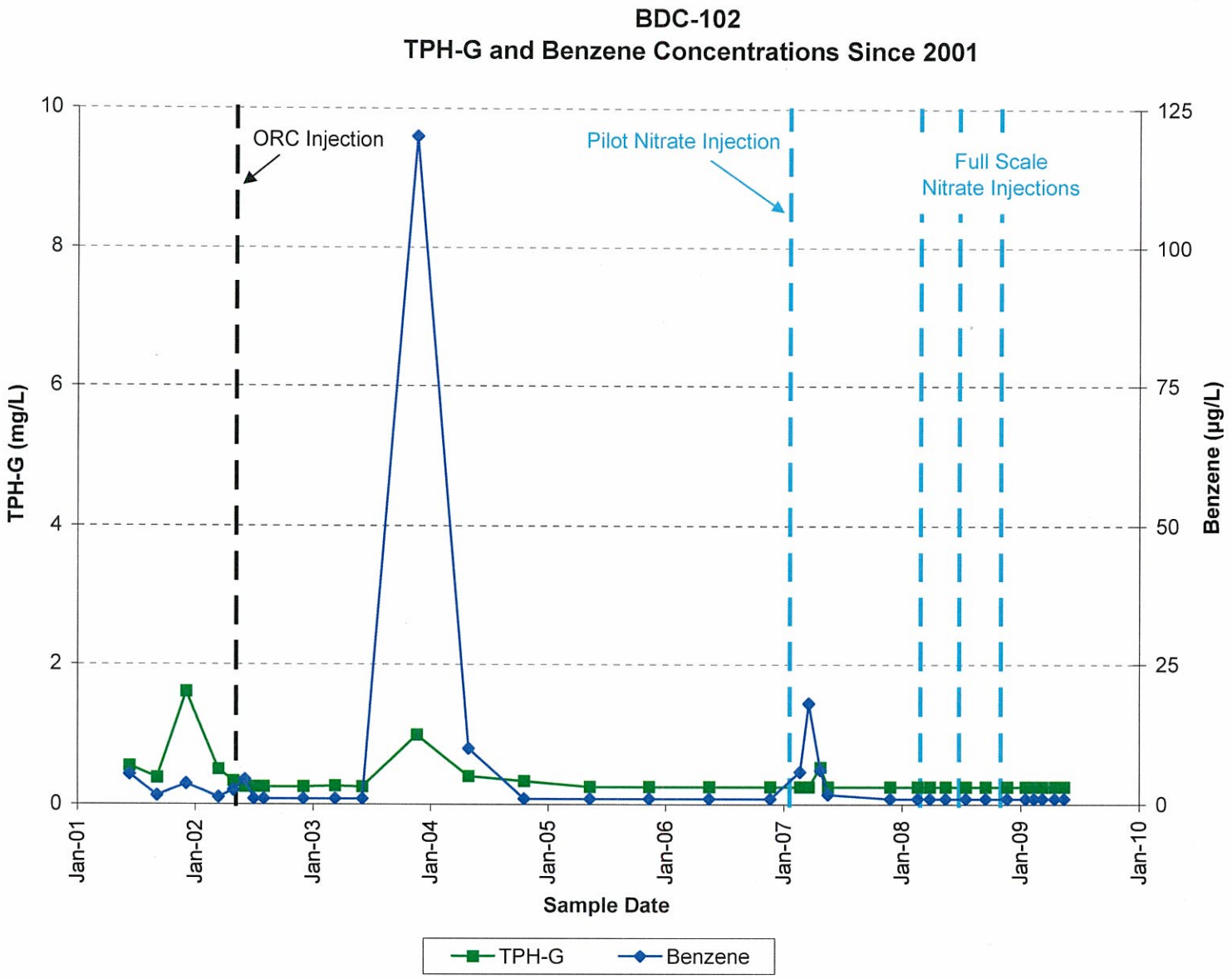
- **AOC-05 Data Table**
- **AOC-05 TPH-G and Benzene Concentration Trend Charts (June 2001 through Present)**


BDC-103
TPH-G and BTEX Concentrations Beginning with 2007 Pilot Testing
Pilot Nitrate Injection
Full Scale Nitrate Injections
TPH-G (mg/L)
BTEX (µg/L)
600
500
400
300
200
100
0
24,000
20,000
16,000
12,000
8,000
4,000
0
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Sample Date
TPH-G
Benzene
Toluene
Ethylbenzene
Total Xylenes

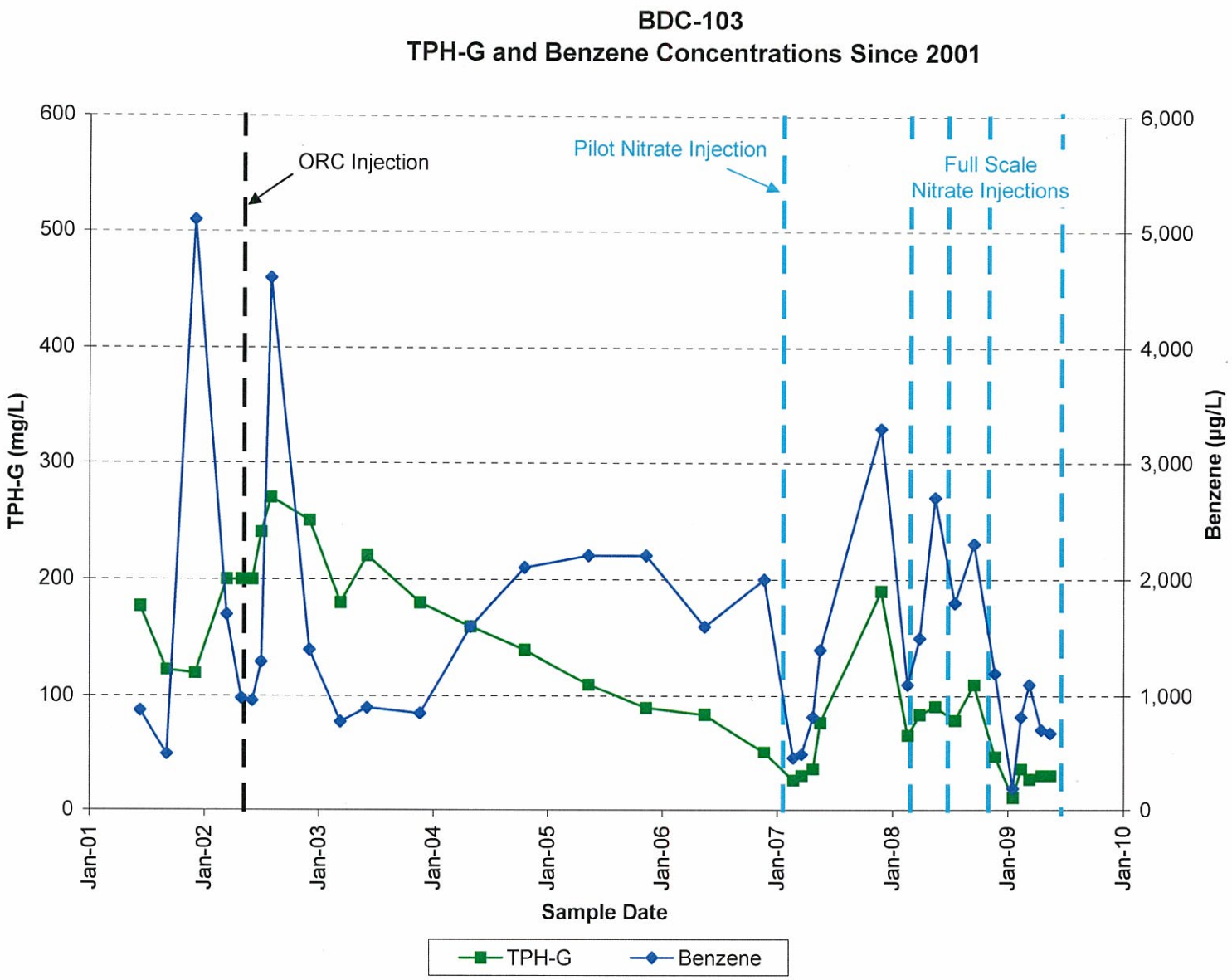

BDC-104
TPH-G and BTEX Concentrations Beginning with 2007 Pilot Testing
Pilot Nitrate Injection
Full Scale Nitrate Injections
TPH-G Reporting Limit
TPH-G (mg/L)
BTEX (µg/L)
Sample Date
0
1
2
3
4
5
0
60
120
180
240
300
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
TPH-G
Benzene
Toluene
Ethylbenzene
Total Xylenes

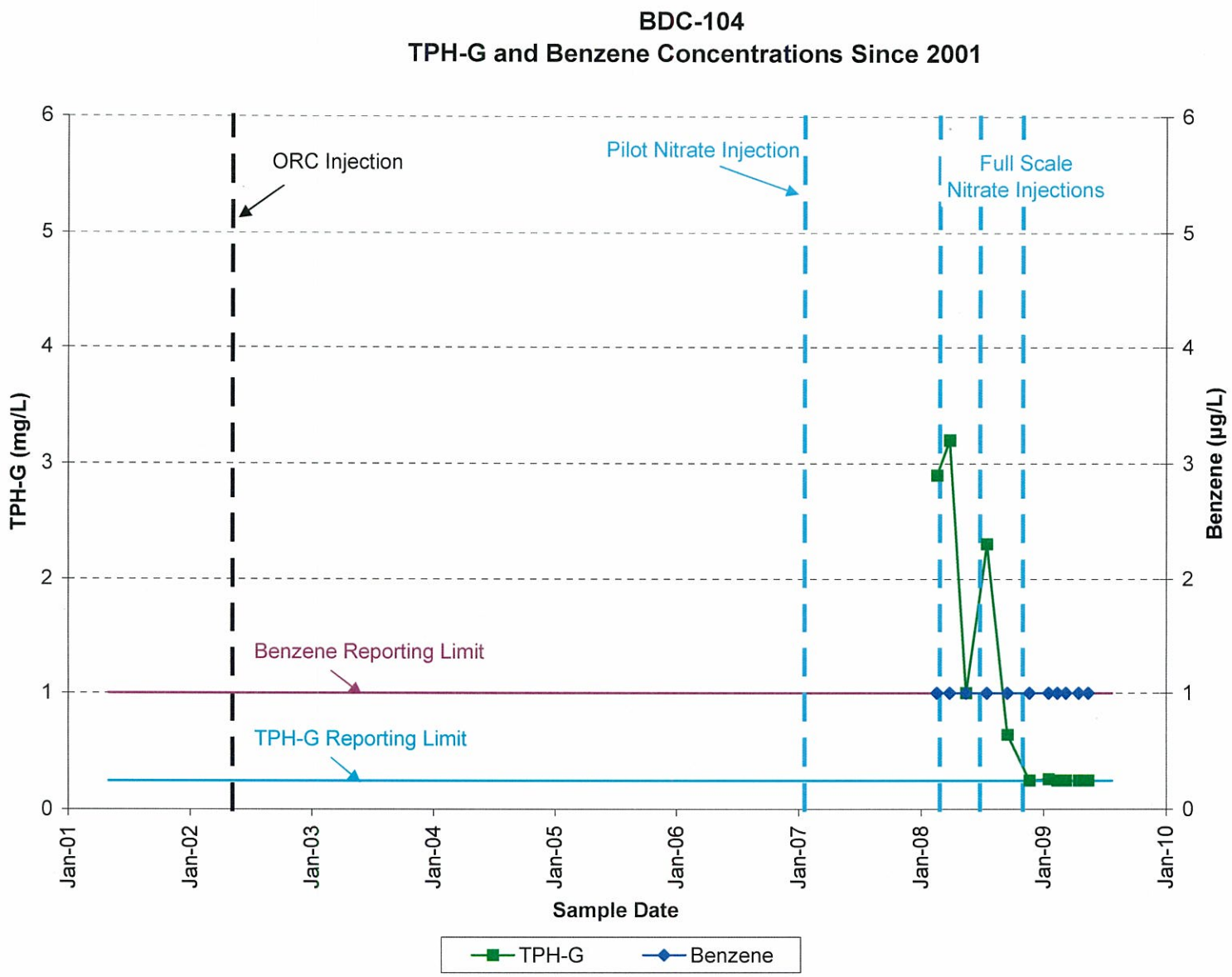


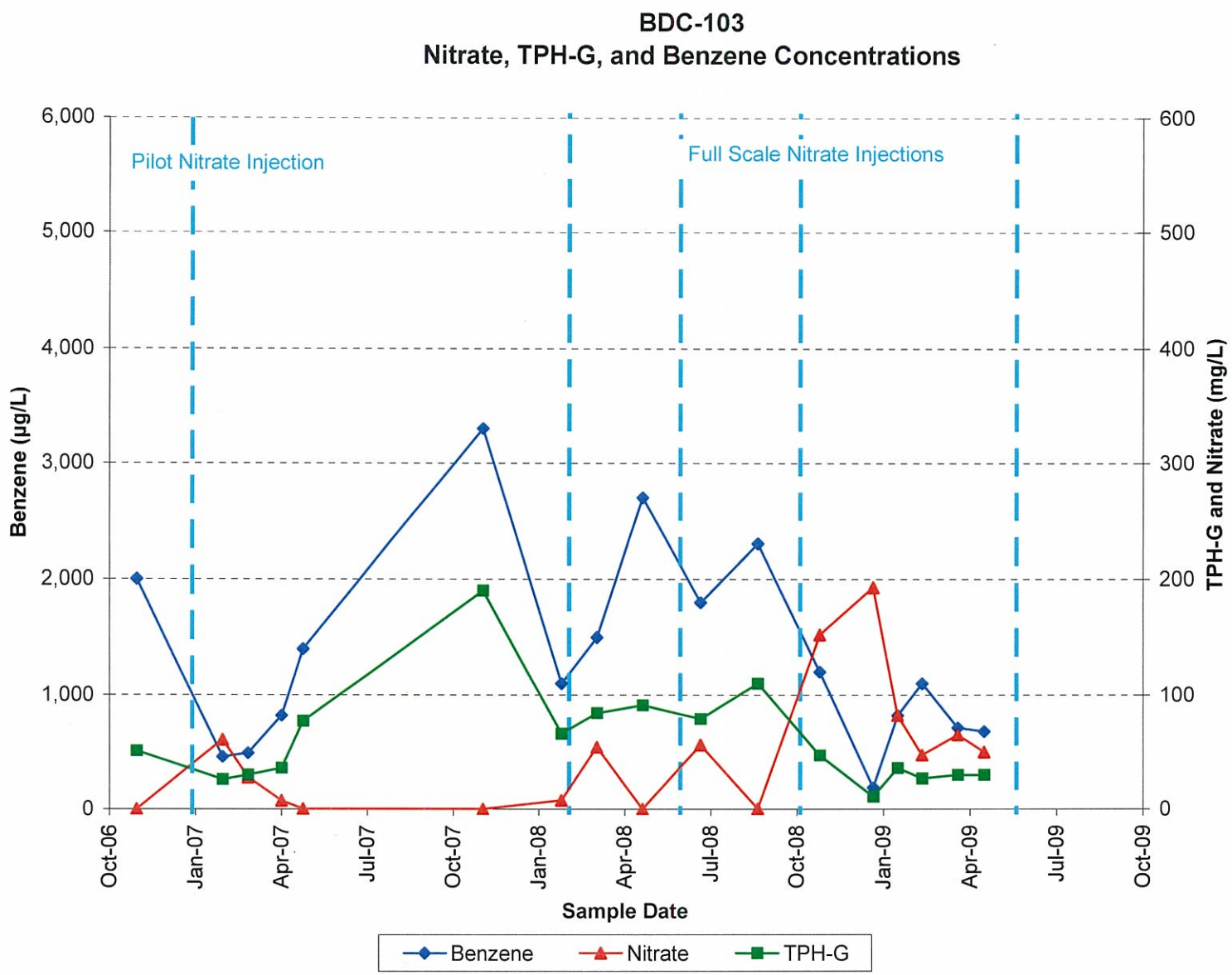
7/8/2009\\Edmdata\projects\025\093\FileRm\R\Semiann\May 09 semiann\09 May Semiann AOC-5 Summary Tb Fig 5 - BDC-101 plot

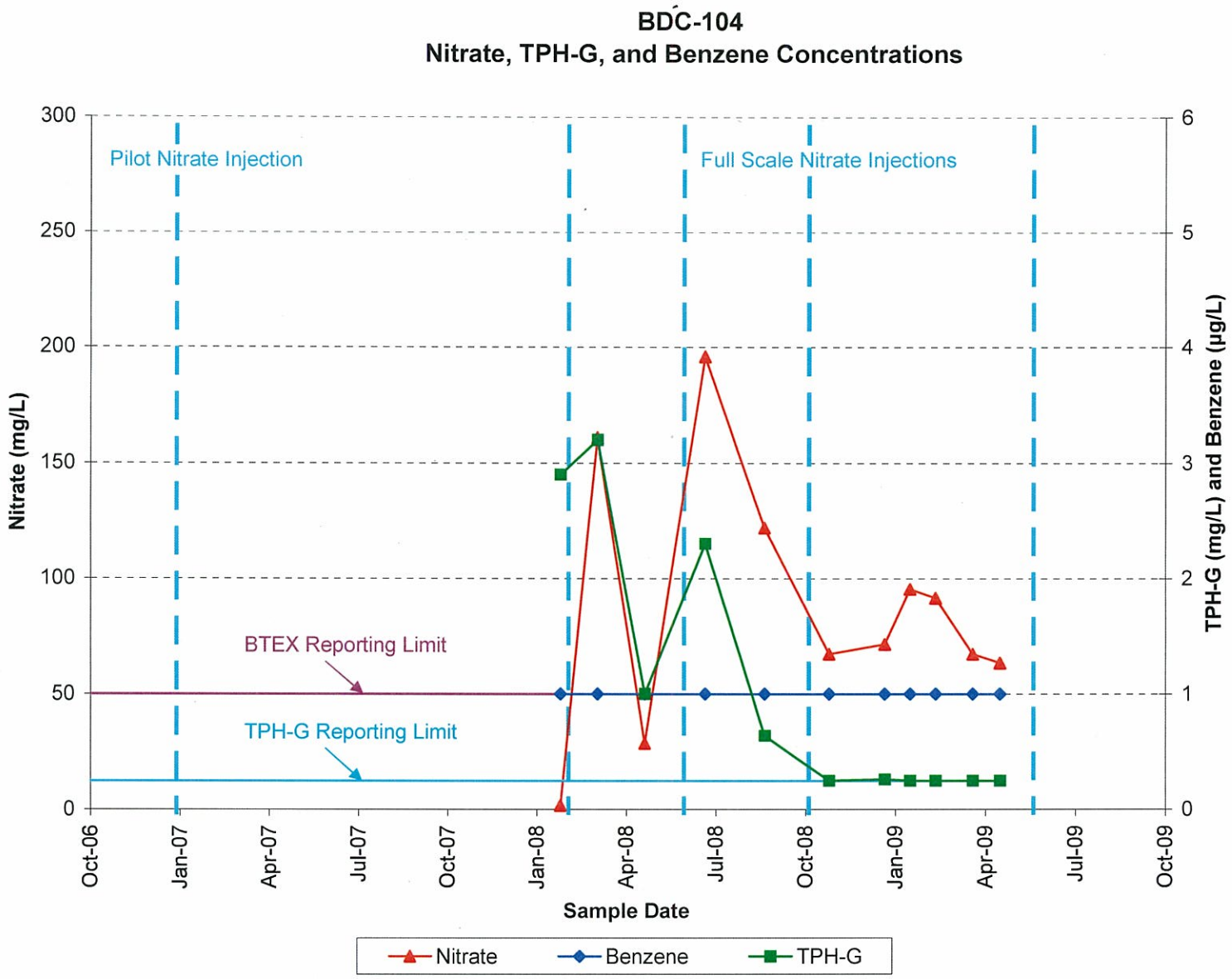


7/8/2009\\Edmdata\projects\025\093\FileRm\R\Semiann\May 09 semiann\09 May Semiann AOC-5 Summary Tb Fig 6 - BDC-102 plot


BDC-103
TPH-G and Benzene Concentrations Since 2001
ORC Injection
Pilot Nitrate Injection
Full Scale
Nitrate Injections
TPH-G (mg/L)
Benzene (µg/L)
600
500
400
300
200
100
0
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Sample Date
TPH-G
Benzene


BDC-104
TPH-G and Benzene Concentrations Since 2001
ORC Injection
Pilot Nitrate Injection
Full Scale
Nitrate Injections
Benzene Reporting Limit
TPH-G Reporting Limit
TPH-G (mg/L)
Benzene (µg/L)
0
1
2
3
4
5
6
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Sample Date
TPH-G
Benzene


BDC-103
Nitrate, TPH-G, and Benzene Concentrations
Pilot Nitrate Injection
Full Scale Nitrate Injections
Benzene (µg/L)
TPH-G and Nitrate (mg/L)
6,000
5,000
4,000
3,000
2,000
1,000
0
600
500
400
300
200
100
0
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Sample Date
Benzene
Nitrate
TPH-G


BDC-104
Nitrate, TPH-G, and Benzene Concentrations
Pilot Nitrate Injection
Full Scale Nitrate Injections
BTEX Reporting Limit
TPH-G Reporting Limit
Nitrate (mg/L)
TPH-G (mg/L) and Benzene (µg/L)
Sample Date
300
250
200
150
100
50
0
6
5
4
3
2
1
0
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Nitrate
Benzene
TPH-G

TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: James Bet, The Boeing Company

FROM: Clint Jacob, P.E., L.G., and David M. Buser, L.G.

DATE: September 17, 2009

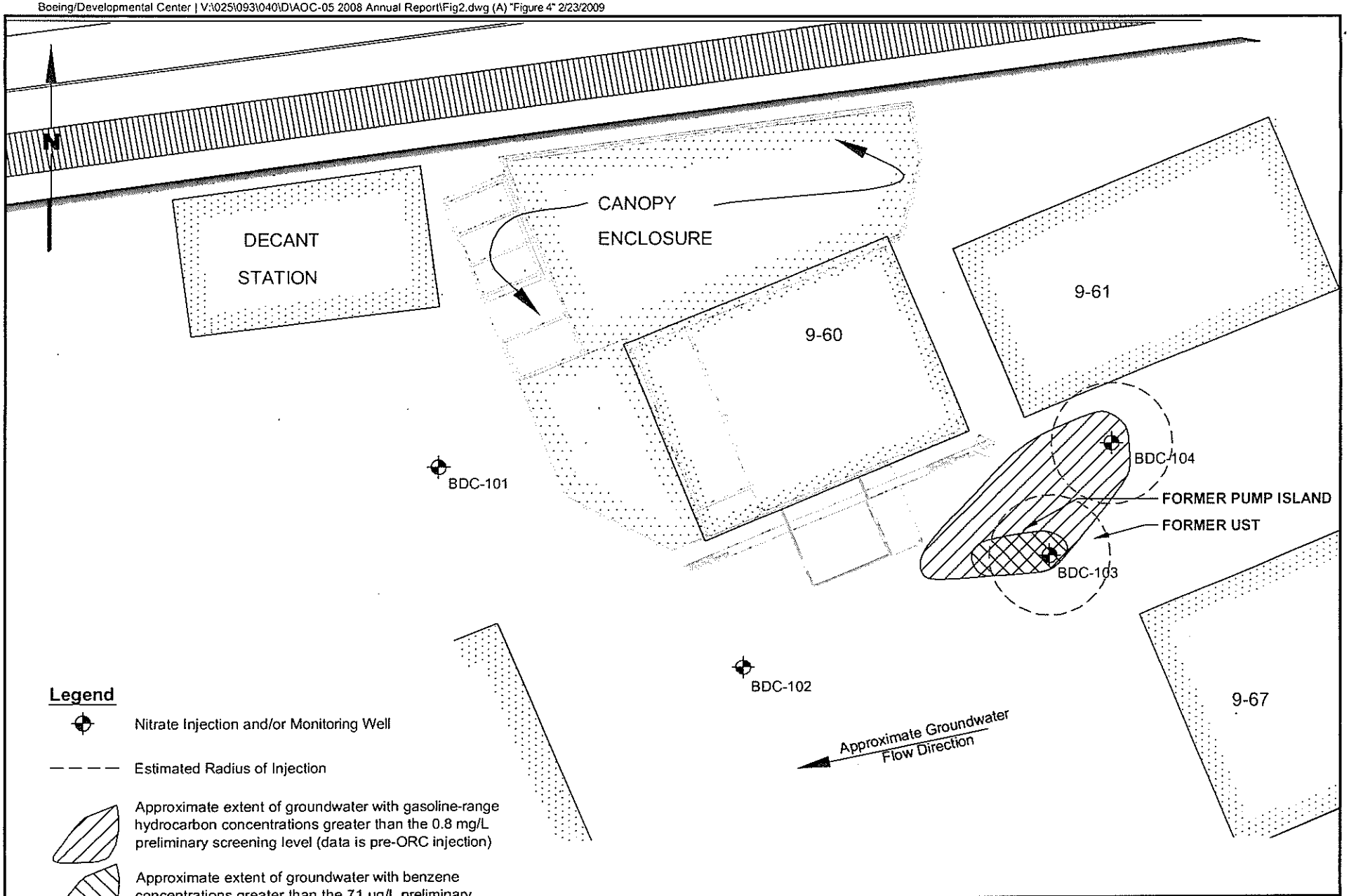
RE: UPDATE ON AOC-05 FULL-SCALE BIOREMEDIATION RESULTS ENHANCED ANAEROBIC BIODEGRADATION OF PETROLEUM HYDROCARBONS BOEING DEVELOPMENTAL CENTER 9725 EAST MARGINAL WAY SOUTH TUKWILA, WASHINGTON

This technical memorandum summarizes the results of recent bioremediation performance monitoring performed at Area of Concern (AOC)-05 of The Boeing Company (Boeing) Developmental Center (DC) in Tukwila, Washington (Figure 1). This work is being performed in accordance with the *Work Plan, AOC-05 Remedial Action Plan, Enhanced Anaerobic Biodegradation of Gasoline-Range Petroleum Hydrocarbons, Boeing Developmental Center, Tukwila, Washington* prepared by Landau Associates, Inc. (Landau) and dated November 16, 2007 (Work Plan). Enhanced bioremediation is being implemented to address concentrations of total petroleum hydrocarbons as gasoline (TPH-G) as well as benzene, toluene, ethylbenzene, and total xylenes (BTEX) released from a former underground storage tank (UST) in 1985 located near monitoring well BDC-103. As explained in the Work Plan, AOC-05 corresponds to the former UST location. Full-scale anaerobic bioremediation at AOC-05 involves aquifer amendment using electron acceptors (e.g., nitrate) as well as performance groundwater monitoring.

NUTRIENT INJECTIONS

The nitrate injections have been successful in remediating TPH-G and BTEX concentrations in groundwater at monitoring wells BDC-103 and BDC-104; however, a diminished rate of degradation was observed during monitoring performed following the October 2008 injection (third full-scale injection event). Observations, including slower depletion of injected nitrate and partial rebound in the concentrations of petroleum hydrocarbons, suggest that biodegradation in AOC-05 had become nutrient-limited to some degree. It has been concluded at other sites using a similar treatment approach that biotreatment has been inhibited by the inadequate availability of phosphorous, a macronutrient that is required along with nitrogen for microorganisms to proliferate.

Boeing notified the Washington State Department of Ecology (Ecology) of the intent to include ammonium phosphate (in addition to the ammonium nitrate specified in the Work Plan) as part of the fourth aquifer amendment (Bet 2009). On June 16-17, 2009, both mono-ammonium phosphate and ammonium nitrate were injected in monitoring wells BDC-103 and BDC-104. In accordance with the



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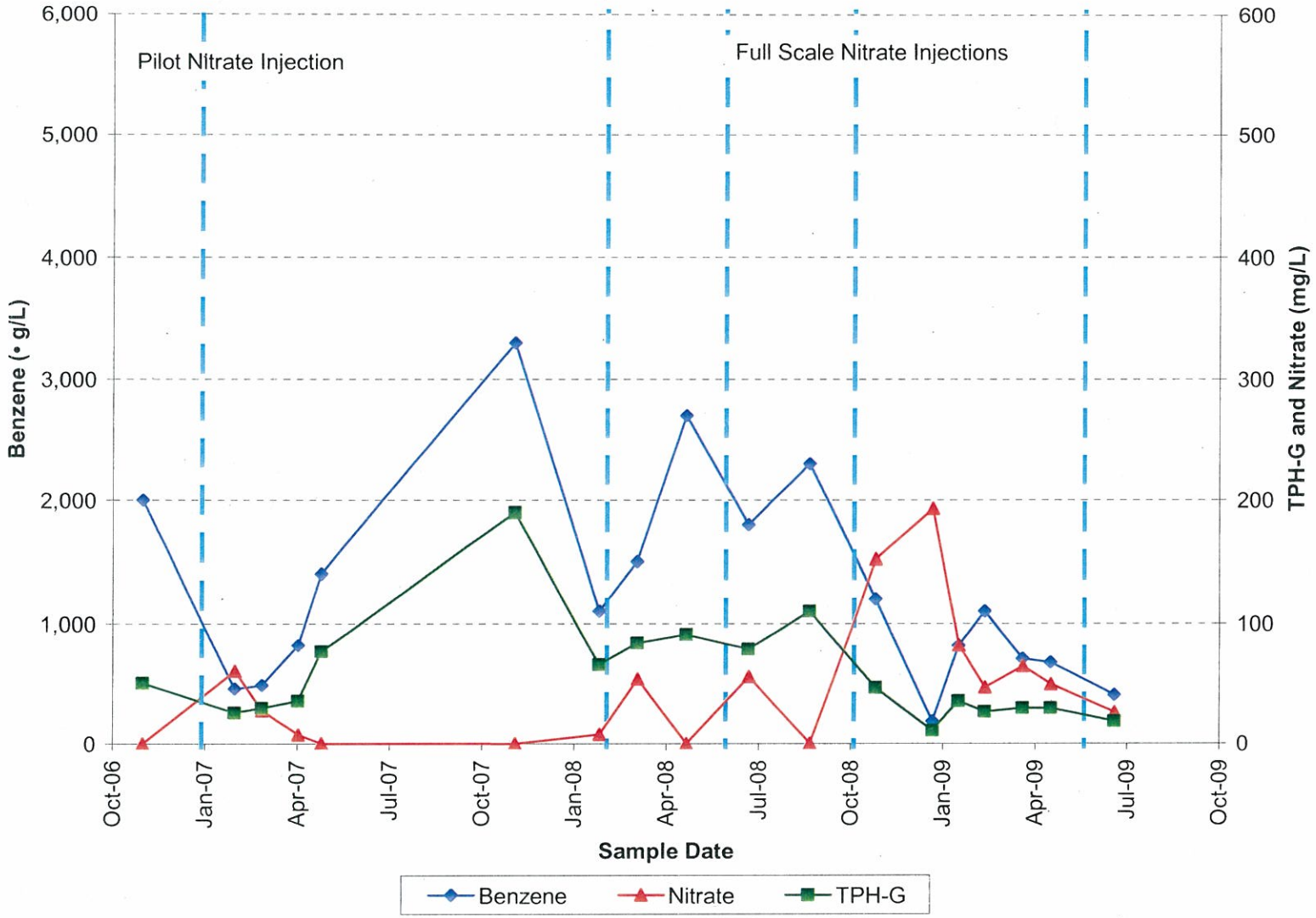
Boeing Developmental Center
Tukwila, Washington

Nitrate Injection and Groundwater Sample Locations

Figure
2



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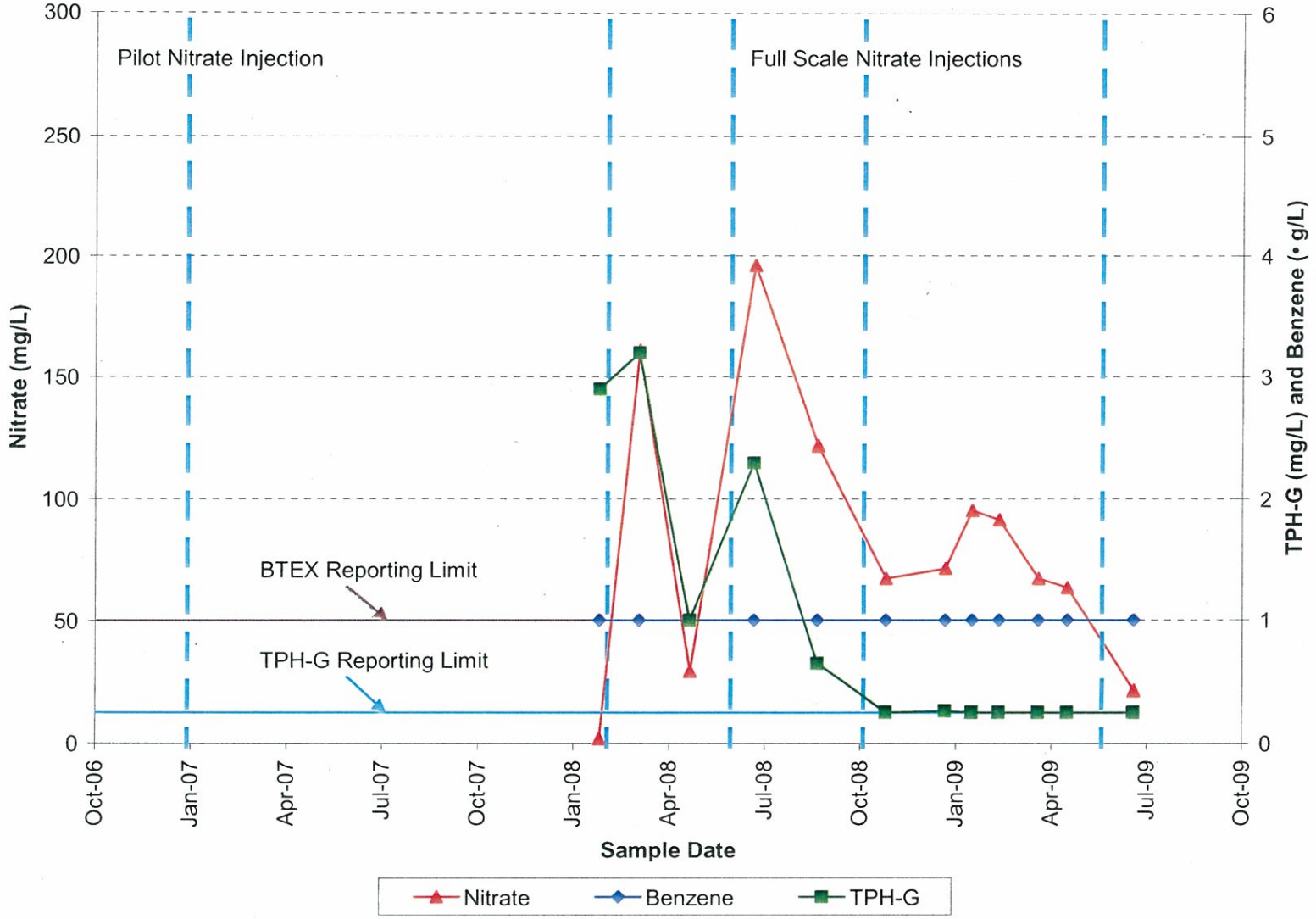
Boeing Developmental Center
Tukwila, Washington

BDC-103: Nitrate, TPH-G, and Benzene Concentrations

Figure
3

Source: S:\Projects\025\093\WIP\T\AOC-5\AOC-5 Cleanup Action Tables MASTER Fig 10 – BDC-104 plot nitrate



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Boeing Developmental Center
Tukwila, Washington

BDC-104: Nitrate, TPH-G, and Benzene Concentrations

Figure 4

TABLE 1
DATA SUMMARY TABLE
AOC-05 ANAEROBIC BIOREMEDIATION REMEDIAL ACTION
BOEING DEVELOPMENTAL CENTER

Well	Date	ORC Injection Elapsed Time from Injection (a) (days)	Pilot Injection Elapsed Time from Injection (a) (days)	Full Scale Injection 1 Elapsed Time from Injection (a) (days)	Full Scale Injection 2 Elapsed Time from Injection (a) (days)	Full Scale Injection 3 Elapsed Time from Injection (a) (days)	Full Scale Injection 4 Elapsed Time from Injection (a) (days)	Volatile Organic Compounds (all units in ug/L) TPH-G (mg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)	Total Xylenes (µg/L)	Aquifer Redox Conditions DO (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Iron II (mg/L)	Sulfate (mg/L)	Methane (µg/L)	ORP (mV)	Donor Indicators TOC (mg/L)	pH	Comments
Preliminary Groundwater Screening Levels (a								0.8	71	200,000	29,000	NA (b)	NA (b)	NA (b)										
BDC-101	6/11/2001							3.0	11.9	<1.0	113.1			109.2										
BDC-101	9/4/2001							5.0	7.13	10.7	50.4			53.8										
BDC-101	12/3/2001							6.5	95	1.6	750			650										
BDC-101	3/13/2002							<0.25	1.4	<1.0	4.4			<1.0										
BDC-101	4/29/2002							<0.25	<1.0	<1.0	2.2	<1.0	<1.0	<1.0										
BDC-101	6/3/2002	27						<0.25	1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-101	7/1/2002	55						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-101	8/1/2002	86						<0.25	3.1	<1.0	2.4	<1.0	<1.0	<1.0										
BDC-101	12/2/2002	209						0.61	4.3	<1.0	21	27	6.4	33.4										
BDC-101	3/10/2003	307						<0.25	1.0	<1.0	4.5	3.2	<1.0	3.2										
BDC-101	6/3/2003	392						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-101	11/19/2003	561						0.42	13	<1.0	15	35	<1.0	35	0.36	1.1	0.010	0.2	16	240	120.3			
BDC-101	4/28/2004	722						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-101	10/18/2004	895						0.64	10	<1.0	15	43	<1.0	43										
BDC-101	5/10/2005	1099						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-101	11/10/2005	1283						0.25	7.6	<1.0	2.6	42	<1.0	42	0.96	4.4			34.3		259	2.05		
BDC-101	5/15/2006	1469						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.78	17.8	0.059	0	64.1		80			
BDC-101	11/20/2006	1658						1.1	10	<1.0	15	72.0	<1.0	72	0.92	0.122	0.016	2.4	8.7		174			
BDC-101	2/20/2007	1750	33					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.39	15.0	0.047	0.2	50.0		277		6.63	
BDC-101	3/19/2007	1777	60					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.97	8.83	0.037	0.5	38.5		213		6.60	
BDC-101	4/24/2007	1813	96					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.09	9.59	0.041	0.5	34.1		136		6.46	
BDC-101	5/17/2007	1836	119					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.35	9.95	0.046	0.4	35.7		297		6.55	
BDC-101	11/26/2007	2029	312					<0.25	<1.0	<1.0	2.1	6.5	<1.0	6.5	2.30	5.88	0.032	0	26.8		287			
BDC-101	2/18/2008	2113	396					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.55	8.10	0.040	0	31.5		341		6.29	
BDC-101	3/27/2008	2151	434	30				<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.19	9.3	<0.10	0.2	40.0		506			
BDC-101	5/15/2008	2200	483	79				<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.57	6.8	<0.10	0	24.6		176		6.44	
BDC-101	7/16/2008	2262	545	141	22			<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.34	5.3	<0.10	0	21.8		-232		6.52	
BDC-101	9/15/2008	2323	606	202	83			<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.22	5.33	0.023	0	28.7		153			
BDC-101	11/20/2008	2389	672	268	149	21		0.44	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	1.45	2.9	0.1	0.8	17.1		-22		6.65	
BDC-101	1/16/2009	2446	729	325	206	78		<0.25	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	0	4.40	0.042	0.4	29.5		-245		6.50	
BDC-101	2/11/2009	2472	755	351	232	104		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.62	8.5	<0.1	0.4	39.6		-16		6.43	
BDC-101	3/9/2009	2498	781	377	258	130		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.93	9.4	<0.1	0	46.8		54		6.54	
BDC-101	4/16/2009	2536	819	415	296	168		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.69	9.0	<0.1	0	36.0		131		6.61	
BDC-101	5/14/2009	2564	847	443	324	196	-34	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.00	13.0	<0.1	0	44.4		68		6.81	
BDC-101	7/17/2009	2628	911	507	388	260	30	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.80	12.6	<0.1	0	49.0		19		7.17	
BDC-102	6/11/2001							0.55	5.33	<1.0	<1.0			<1.0										
BDC-102	9/4/2001							0.38	1.61	1.89	<1.0			1.87										
BDC-102	12/3/2001							1.6	3.7	<1.0	<1.0			3.49										
BDC-102	3/13/2002							0.50	1.3	<1.0	<1.0			<1.0										
BDC-102	4/29/2002							0.33	2.6	<1.0	<1.0	1.1	<1.0	1.1										
BDC-102	6/3/2002	27						<0.25	4.4	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	7/1/2002	55						0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	8/1/2002	86						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	12/2/2002	209						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	3/10/2003	307						0.26	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	6/3/2003	392						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	11/19/2003	561						0.99	120	<1.0	8.5	<1.0	<1.0	<1.0	0.38	0.19	0.011	5.5	46	1100	122.2			
BDC-102	4/28/2004	722						0.40	10	<1.0	<1.0	3.0	<1.0	3.0										
BDC-102	10/18/2004	895						0.33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	5/10/2005	1099						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0										
BDC-102	11/10/2005	1283						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.82	4.4			34.0		122	18.4		
BDC-102	5/15/2006	1469						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.21	4.72	0.175	2.2	35.7		-11			
BDC-102	11/20/2006	1658						<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.25	<0.250	<0.250	2.2	9.2		163			

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TABLE 1
DATA SUMMARY TABLE
AOC-05 ANAEROBIC BIOREMEDIATION REMEDIAL ACTION
BOEING DEVELOPMENTAL CENTER

Well	Date	ORC Injection Elapsed Time from Injection (a) (days)	Pilot Injection Elapsed Time from Injection (a) (days)	Full Scale Injection 1 Elapsed Time from Injection (a) (days)	Full Scale Injection 2 Elapsed Time from Injection (a) (days)	Full Scale Injection 3 Elapsed Time from Injection (a) (days)	Full Scale Injection 4 Elapsed Time from Injection (a) (days)	Volatile Organic Compounds (all units in ug/L) TPH-G (mg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)	Total Xylenes (µg/L)	Aquifer Redox Conditions DO (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Iron II (mg/L)	Sulfate (mg/L)	Methane (µg/L)	ORP (mV)	Donor Indicators TOC (mg/L)	pH	Comments
Preliminary Groundwater Screening Levels (a								0.8	71	200,000	29,000	NA (b)	NA (b)	NA (b)										
BDC-102	2/20/2007	1750	33					<0.25	5.8	<1.0	<1.0	<1.0	<1.0	<1.0	0.47	0.749	0.027	3.0	25.3		-145		6.54	
BDC-102	3/19/2007	1777	60					<0.25	18	<1.0	<1.0	32	<1.0	32	0.88	0.938	0.072	3.0	31.0		-98		6.67	
BDC-102	4/24/2007	1813	96					0.53	6.1	<1.0	3.1	100	<1.0	100	1.20	1.94	0.051	2.8	40.4		-93		6.51	
BDC-102	5/17/2007	1836	119					<0.25	1.8	<1.0	<1.0	7.4	<1.0	7.4	0.84	2.78	0.108	2.6	33.9		286		6.52	
BDC-102	11/26/2007	2029	312					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.29	1.03	0.247	3.0	55.7		46			
BDC-102	2/18/2008	2113	396					<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.51	3.91	0.054	2.8	42.8		431		5.97	
BDC-102	3/27/2008	2151	434	30				<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.85	1.3	<0.10	2.5	17.9		233			
BDC-102	5/15/2008	2200	483	79				<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.40	3.0	<0.10	3.5	19.2		-115		6.56	
BDC-102	7/16/2008	2262	545	141	22			<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.46	2.5	<0.10	3.2	13.7		-312		6.67	
BDC-102	9/15/2008	2323	606	202	83			<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.22	4.28	0.056	3.0	31.6		191			
BDC-102	11/20/2008	2389	672	268	149	21		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.70	0.40	<0.10	2.0	5.6		-70		6.69	
BDC-102	1/16/2009	2446	729	325	206	78		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.00	<0.100	0.200	2.5	8.3		-235		6.70	
BDC-102	2/11/2009	2472	755	351	232	104		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.65	2.4	<0.1	3.0	20.4		-70		6.61	
BDC-102	3/9/2009	2498	781	377	258	130		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.00	0.9	<0.1	3.0	8.7		-46		6.65	
BDC-102	4/16/2009	2536	819	415	296	168		<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.30	0.6	<0.1	3.0	8.3		-7		6.66	
BDC-102	5/14/2009	2564	847	443	324	196	-34	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.29	0.9	<0.1	3.4	9.8		-35		6.78	
BDC-102	7/17/2009	2628	911	507	388	260	30	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.66	4.9	<0.1	2.2	28.6		-11		6.46	
BDC-103	6/11/2001							177	875	12,010	1,985			11,430										
BDC-103	9/4/2001							123	494	3,760	419			2,635										
BDC-103 (c)	12/3/2001							120	5,100	2,300,000	10,000			3,400,000										
BDC-103	3/13/2002							200	1,700	17,000	4,900			26,400										
BDC-103	4/29/2002							200	980	16,000	5,400	20,000	7,000	27,000										
BDC-103	6/3/2002	27						200	960	17,000	5,100	20,000	7,100	27,100										
BDC-103	7/1/2002	55						240	1,300	16,000	5,200	20,000	6,800	26,800										
BDC-103	8/1/2002	86						270	4,600	18,000	5,200	19,000	6,600	25,600										
BDC-103	12/2/2002	209						250	1,400	15,000	5,000	22,000	6,900	28,900										
BDC-103	3/10/2003	307						180	780	13,000	5,200	20,000	6,700	26,700										
BDC-103	6/3/2003	392						220	900	10,000	5,000	20,000	6,600	26,600										
BDC-103	11/19/2003	561						180	850	8,300	4,500	18,000	5,500	23,500	0.38	0.012	0.011	5.5	53	630	-75.9			
BDC-103	4/28/2004	722						160	1,600	6,600	3,900	16,000	5,100	21,100										
BDC-103	10/18/2004	895						140	2,100	5,500	3,700	15,000	4,400	19,400										
BDC-103	5/10/2005	1099						110	2,200	5,500	3,800	14,000	3,200	17,200										
BDC-103	11/10/2005	1283						90	2,200	3,500	3,700	12,000	2,500	15,000	0.72	<1.0			11.9		147	15.4		
BDC-103	5/15/2006	1469						84	1,600	3,800	3,100	10,000	2,200	12,000	0.92	<0.010	0.054	3.5	15.2		106			
BDC-103	11/20/2006	1658						51	2,000	730	2,200	3,900	1,000	4,900	1.23	<0.10	<0.10	2.4	28.3		202			
BDC-103	2/20/2007	1750	33					26	460	420	140	3,600	1,600	5,200	0.31	60.8	11.1	0.5	99.2		109		6.54	
BDC-103	3/19/2007	1777	60					30	490	88	130	3,500	1,700	5,200	0.63	27.9	8.28	0.4	141		4		6.79	
BDC-103	4/24/2007	1813	96					36	820	440	220	3500	1800	5300	0.84	7.54	3.56	2.4	59.2		-14		6.70	
BDC-103	5/17/2007	1836	119					77	1,400	4,300	1,100	8,300	3,200	11,500	0.61	0.138	0.079	3.6	169		244		6.82	
BDC-103	11/26/2007	2029	312					190	3,300	21,000	4,000	11,000	4,900	15,900	3.37	0.063	0.049	3.6	49.1		-118			
BDC-103	2/18/2008	2113	396					66	1,100	2,600	700	7,500	1,900	9,400	2.06	7.75	0.134	2.8	163		552		5.97	
BDC-103	3/27/2008	2151	434	30				84	1,500	1,900	1,100	9,700	3,000	12,700	1.60	54.1	18	4.0	115.0		182			
BDC-103	5/15/2008	2200	483	79				91	2,700	4,400	1,400	11,000	3,600	14,600	1.38	<0.10	<0.10	3.2	192		-138		7.11	
BDC-103	7/16/2008	2262	545	141	22			79	1,800	440	490	10,000	3,100	13,100	1.61	56.1	16.6	2.8	149		-226		6.72	
BDC-103	9/15/2008	2323	606	202	83			110	2,300	7,600	1,500	10,000	3,600	13,600	0.48	0.330	0.218	3.2	218		189			
BDC-103	11/20/2008	2389	672	268	149	21		47	1,200	260	110	7,000	2,100	9,100	0.21	152	12.5	2.0	120		-1.2		6.66	
BDC-103	1/16/2009	2446	729	325	206	78		11	190	220	12	1,000	480	1,480	0.24	193	2.32	0.6	62.5		-181		6.19	
BDC-103	2/11/2009	2472	755	351	232	104		36	820	510	<100	2,900	1,500	4,400	1.66	82.0	6.7	0.8	178		-65		6.69	
BDC-103	3/9/2009	2498	781	377	258	130		27	1100	440	18 J	2,400	1,200	3,600	0	47.3	2.4	0.4	192		17		6.80	
BDC-103	4/16/2009	2536	819	415	296	168		30	710	310	<50	2,700	1,200	3,900	0.95	64.8	5.6	0.2-0.4	194		62		6.77	
BDC-103	5/14/2009	2564	847	443	324	196	-34	30	680	320	20	2,400	1,500	3,900	0.48	49.8	4.8	0.8	222		20		6.85	
BDC-103	7/17/2009	2628	911	507	388	260	30	19	410	280	32	630	1,000	1,630	2.60	26.6	2.0	1.0	104		29		6.98	

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TABLE 1
DATA SUMMARY TABLE
AOC-05 ANAEROBIC BIOREMEDIATION REMEDIAL ACTION
BOEING DEVELOPMENTAL CENTER

Well	Date	ORC Injection Elapsed Time from Injection (a) (days)	Pilot Injection Elapsed Time from Injection (a) (days)	Full Scale Injection 1 Elapsed Time from Injection (a) (days)	Full Scale Injection 2 Elapsed Time from Injection (a) (days)	Full Scale Injection 3 Elapsed Time from Injection (a) (days)	Full Scale Injection 4 Elapsed Time from Injection (a) (days)	Volatile Organic Compounds (all units in ug/L) TPH-G (mg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	m,p-Xylene (µg/L)	o-Xylene (µg/L)	Total Xylenes (µg/L)	Aquifer Redox Conditions DO (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Iron II (mg/L)	Sulfate (mg/L)	Methane (µg/L)	ORP (mV)	Donor Indicators TOC (mg/L)	pH	Comments
Preliminary Groundwater Screening Levels (a								0.8	71	200,000	29,000	NA (b)	NA (b)	NA (b)										
BDC-104	2/18/2008	2113	396					2.9	<1.0	<1.0	47	180	28	208	2.09	1.63	0.072	3.0	16.7		598			
BDC-104	3/27/2008	2151	434	30				3.2	<1.0	<1.0	22	220	52	272	1.34	161	0.1	0.5	52.2		259			
BDC-104	5/15/2008	2200	483	79				1.0	<1.0	<1.0	7.0	26	22	48	1.24	28.7	0.7	0.4	26.6		94		6.69	
BDC-104	7/16/2008	2262	545	141	22			2.3	<1.0	2.9	3.3	110	50	160	1.56	196	0.4	0	74.7		-221		7.17	
BDC-104	9/15/2008	2323	606	202	83			0.64	<1.0	2.6	<1.0	20	16	36	0.06	122	0.729	0	38.4		191			
BDC-104	11/20/2008	2389	672	268	149	21		<0.25	<1.0	<1.0	<1.0	1.4	4.1	5.5	0.98	67.2	<0.10	0.2	24.3		-27		7.46	
BDC-104	1/16/2009	2446	729	325	206	78		0.26	<1.0	<1.0	<1.0	<1.0	5.5	5.5	0.05	71.4	0.204	0.6	34.6		-164		6.86	
BDC-104	2/11/2009	2472	755	351	232	104		<0.25	<1.0	<1.0	<1.0	1.3	1.1	2.4	1.78	95.4 J	0.1	0.2	20.1		-75		6.68	
BDC-104	3/9/2009	2498	781	377	258	130		<0.25	<1.0	<1.0	<1.0	1.3	1.1	2.4	0	91.5	<0.1	0	19.2		20		6.67	
BDC-104	4/16/2009	2536	819	415	296	168		<0.25	<1.0	<1.0	<1.0	<1.0	1.6	1.6	0.34	67.2	<0.1	0	21.6		67		6.63	
BDC-104	5/14/2009	2564	847	443	324	196	-34	<0.25	<1.0	<1.0	<1.0	<1.0	1.4	1.4	0.51	63.4	<0.1	0	20.1		6		6.70	
BDC-104	7/17/2009	2628	911	507	388	260	30	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.41	21.0	0.5	1.0	30.8		-3		7.30	

Notes:
(a) Landau Associates 2002a.
(b) NA = no preliminary cleanup level available.
(c) BTEX data questionable for this event. Concentrations inconsistent with TPH-G data for indicated event and BTEX data from other events.

Injection dates	
5/7/2002	ORC
1/18/2007	Pilot -scale nitrate
2/26/2008	Full-scale nitrate
6/24/2008	Full-scale nitrate
10/30/2008	Full-scale nitrate
6/17/2009	4th full scale injdection

Appendix C2 – SWMU-17

Work Plan, SWMU-17 Pilot Test, October 2, 2008 (Landau 2008b)

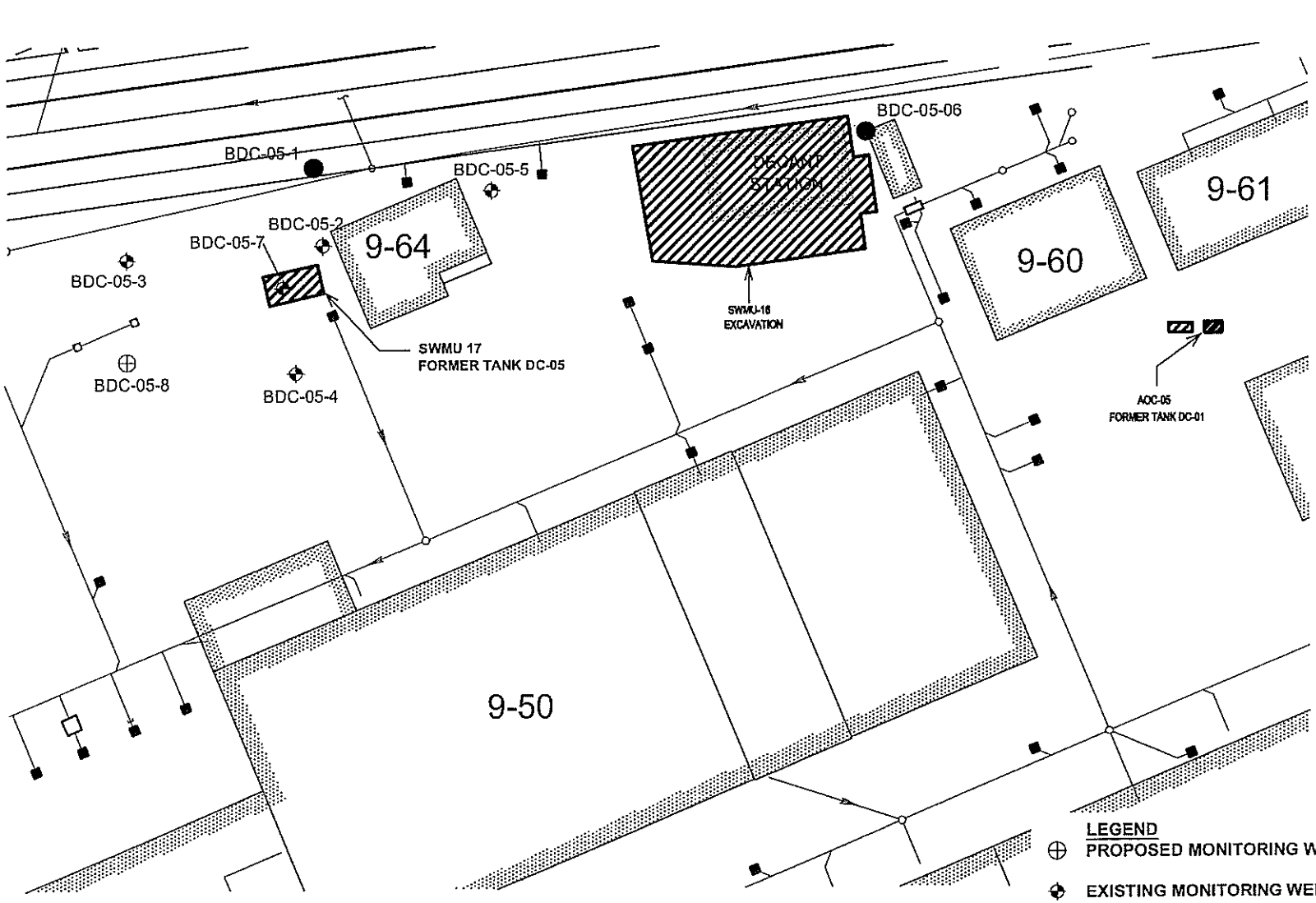
Work Plan
SWMU-17 Pilot Test
Boeing Developmental Center
Tukwila, Washington

October 2, 2008

Prepared for

The Boeing Company
Seattle, WA

LANDAU ASSOCIATES
130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907



LEGEND
- PROPOSED MONITORING WELL
- EXISTING MONITORING WELL
- STORM SEWER CATCH BASIN
- ABANDONED MONITORING WELL

0 60 120
Scale in Feet

LANDAU ASSOCIATES

Boeing Developmental Center Tukwila, Washington	SWMU-17	Figure 2

TABLE 1
CUMULATIVE DATA SUMMARY
SWMU-17
BOEING DEVELOPMENTAL CENTER

	Method B Preliminary Screening Level Marine Surface Water	Method B Preliminary Screening Level Fresh Surface Water	Jun-02	Dec-02	Jun-03	Nov-03	Apr-04	Oct-04	May-05	Nov-05	May-06	Nov-06	May-07	Nov-07	May-08
TOTAL ARSENIC (mg/L)	0.005	0.005													
BDC-05-2			0.05 U	0.05 U	0.001 U	0.001 U	**0.002**	**0.002**	**0.001**	**0.002**	**0.001**	**0.002**	**0.003**	**0.001**	**0.002**
BDC-05-3			0.05 U	0.05 U	**0.004**	0.001 U	**0.002**	**0.002**	0.001 U	**0.002**	**0.007**	**0.002**	**0.003**	**0.002**	**0.002**
BDC-05-4			0.05 U	0.05 U	**0.011**	**0.018**	**0.019**	**0.016**	**0.008**	**0.018**	**0.018**	**0.002**	**0.018**	**0.009**	**0.018**
BDC-05-5			0.05 U	0.05 U	**0.002**	**0.001**	**0.003**	**0.007**	**0.003**	**0.006**	**0.009**	**0.001**	**0.002**	0.001 U	**0.002**
BDC-05-7			0.05 U	0.05 U	**0.002**	0.001 U	**0.001**	**0.001**	**0.001**	**0.002**	**0.002**	**0.001**	**0.003**	0.001 U	**0.002**
DISSOLVED ARSENIC (mg/L)	0.005	0.005													
BDC-05-2			0.05 U	0.05 U	0.001 U	0.001 U	**0.001**	0.001 U	**0.001**	**0.001**	**0.001**	**0.001**	**0.003**	0.001 U	**0.002**
BDC-05-3			0.05 U	0.05 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	**0.001**
BDC-05-4			0.05 U	0.05 U	0.001 U	**0.001**	**0.001**	0.001 U	0.001 U	**0.001**	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U
BDC-05-5			0.05 U	0.05 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.001**	0.001 U	0.001 U
BDC-05-7			0.05 U	0.05 U	0.001 U	0.001 U	**0.001**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U
TOTAL COPPER (mg/L)	0.0034	0.0089													
BDC-05-2			0.002 U	**0.002**	**0.002**	0.002 U	**0.003**	**0.002**	**0.003**	**0.003**	**0.004**	0.002 U	**0.006**	0.002 U	**0.004**
BDC-05-3			0.002 U	**0.003**	**0.004**	**0.002**	**0.003**	**0.003**	**0.003**	**0.004**	**0.010**	**0.002**	**0.004**	**0.002**	**0.002**
BDC-05-4			0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	**0.004**	0.002 U	**0.002**	0.002 U	0.002 U	0.002 U	0.002 U
BDC-05-5			**0.003**	**0.004**	**0.004**	**0.003**	**0.004**	**0.006**	**0.005**	**0.007**	**0.014**	0.002 U	**0.003**	0.002 U	**0.003**
BDC-05-7			**0.004**	**0.007**	**0.008**	**0.011**	**0.008**	**0.010**	**0.012**	**0.012**	**0.018**	**0.008**	**0.016**	**0.014**	**0.016**
DISSOLVED COPPER (mg/L)	0.0034	0.0089 (a)													
BDC-05-2			0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	**0.002**	0.002 U	0.002 U	0.002 U	0.002 U
BDC-05-3			0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	**0.003**	**0.003**	0.002 U	0.002 U	0.002 U
BDC-05-4			0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
BDC-05-5			0.002 U	**0.002**	**0.007**	0.002 U	0.002 U	0.002 U	0.002 U	**0.004**	**0.002**	**0.002**	0.002 U	0.002 U	**0.003**
BDC-05-7			**0.003**	**0.004**	**0.004**	**0.005**	**0.006**	**0.007**	**0.007**	**0.008**	**0.009**	**0.009**	**0.012**	**0.009**	**0.010**
TETRACHLOROETHENE (µg/L)	9	9													
BDC-05-2			**23**	**4.7**	**17**	**6.5**	**32**	**9.2**	**22**	**10**	**30**	**6.2**	**20**	**12**	**14**
BDC-05-3			**4.1**	**4.4**	**3.3**	**4.5**	**3.4**	**5.1**	**2.3**	**3.8**	**3.2**	**1.7**	**3.5**	**2.3**	**3.8**
BDC-05-4			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.4**	1.0 U	1.0 U	**1.5**
BDC-05-5			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.8**	1.0 U	1.0 U	**0.3**
BDC-05-7			**13**	**12**	**15**	**20**	**23**	**27**	**25**	**31**	**29**	**24**	**30**	**28**	**33**
TRICHLOROETHENE (µg/L)	81														
BDC-05-2			**38**	**7.2**	**30**	**10**	**45**	**15**	**28**	**16**	**31**	**8.2**	**24**	**14**	**20**
BDC-05-3			**11**	**11**	**9.9**	**12**	**8.6**	**11**	**5.3**	**6.7**	**6.4**	**2.4**	**8.1**	**4.4**	**8.5**
BDC-05-4			**1.2**	**1.1**	1.0 U	**1.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.0**	1.0 U	1.0 U	**0.9**
BDC-05-5			**1.6**	**1.4**	**1.7**	**1.5**	**1.5**	**1.3**	**1.4**	**1.5**	**1.4**	**1.1**	1.0 U	1.0 U	**0.8**
BDC-05-7			**28**	**26**	**29**	**41**	**31**	**37**	**31**	**34**	**23**	**29**	**22**	**25**	**32**

U = Indicates compound was analyzed for, but was not detected at the reported sample detection limit.
Bold indicates detected compound.
Box indicates exceedance of screening level.

Appendix C3 – SWMU-20

Developmental Center Groundwater Monitoring, AOC-05 Data, May 2009 (Landau 2009c)

DEVELOPMENTAL CENTER

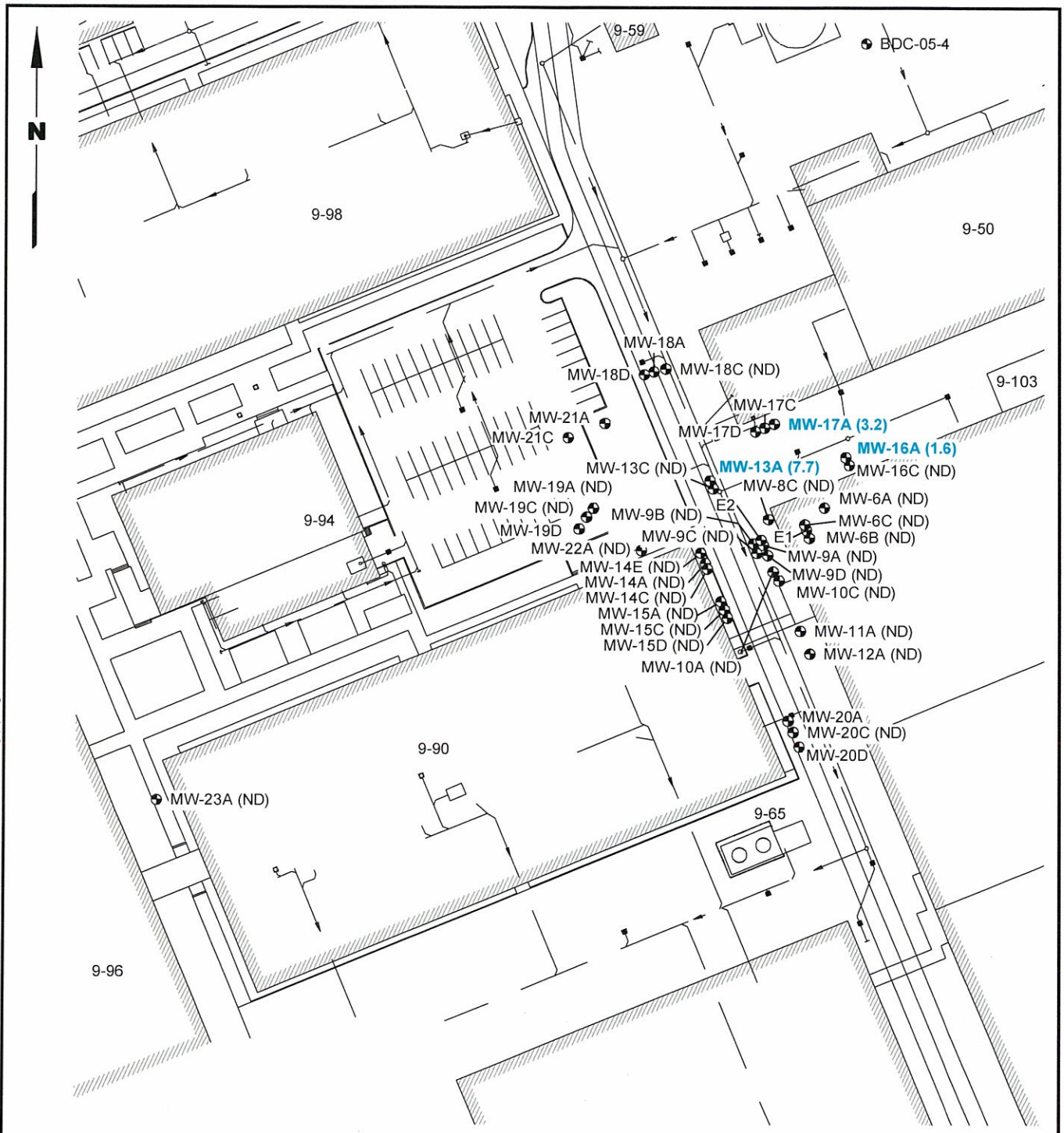
GROUNDWATER MONITORING

MAY 2009

SWMU-20 VOA/CONVENTIONALS DATA TABLES

SWMU-20 SUMMARY DATA

- **SWMU-20 VOC SUMMARY MAPS**
- **SWMU-20 ANALYTICAL RESULTS SUMMARY (January 1994 through Present)**
- **SWMU-20 VOC CONCENTRATION TREND CHARTS (January 1994 through Present)**
- **SWMU-20 CLEANUP ACTION SUMMARY – SOURCE ZONE**
- **SWMU-20 CLEANUP ACTION SUMMARY – NON-SOURCE ZONE**



Legend

⊕	Monitoring Well Location
(ND)	Tetrachloroethene Not Detected at 1.0 µg/L, 3.0 µg/L or 5.0 µg/L Detection Limit
(1.5)	Tetrachloroethene Groundwater Concentration in µg/L

0 100 200
Scale in Feet

Boeing/Developmental Center/Summary Report | V:\025\093\020\Semiannual GW Report May 2009\Figs1-6.dwg (A) "Figure 1" 6/29/2009

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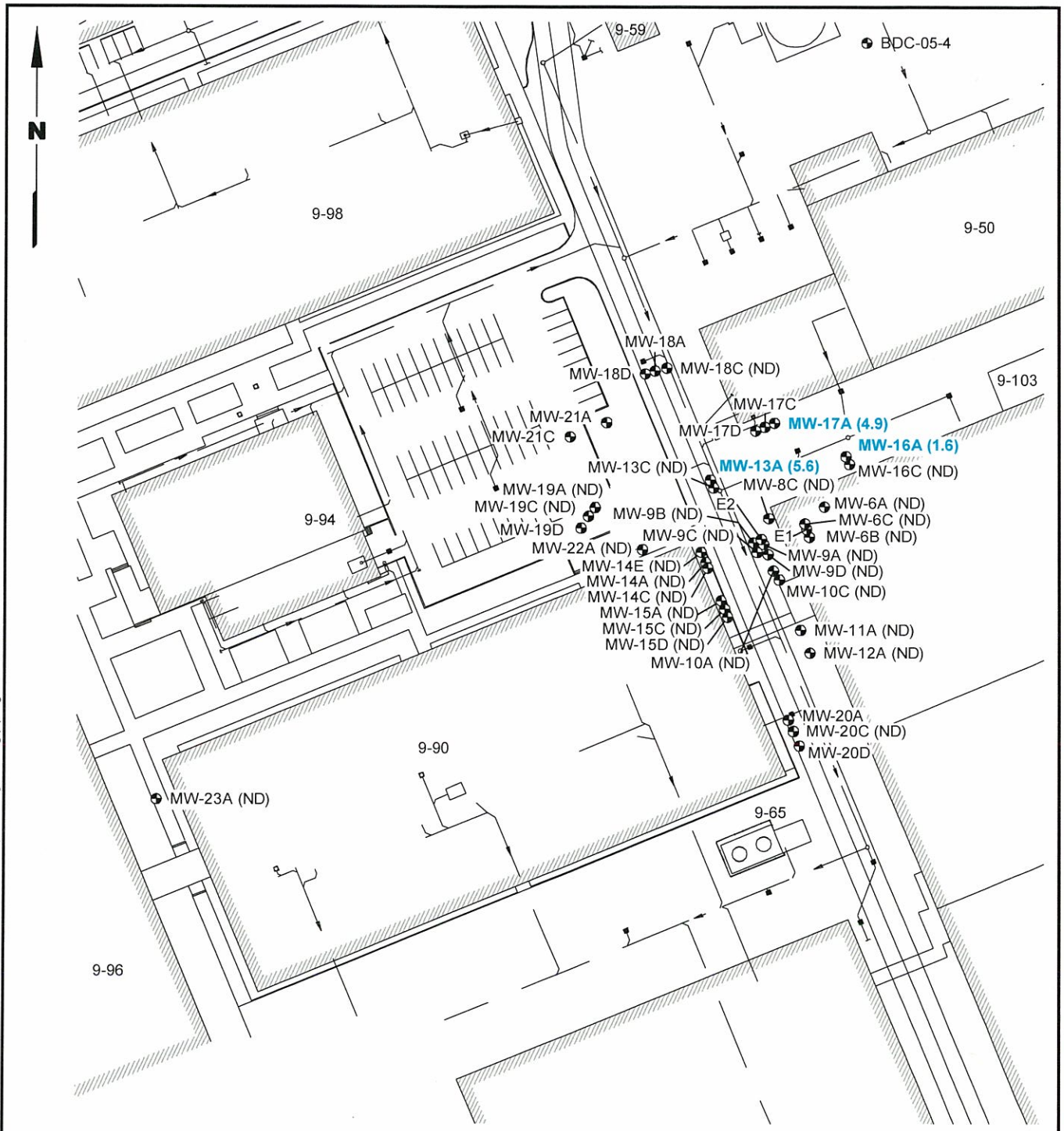
Boeing Developmental Center Tukwila, Washington	**SWMU-20 Tetrachloroethene May 2009 Groundwater Concentrations**	Figure **1**



Legend

⊕	Monitoring Well Location
(ND)	Trichloroethene Not Detected at 1.0 µg/L or 5.0 µg/L Detection Limit
(1.4)	Trichloroethene Groundwater Concentration in µg/L

0 100 200
Scale in Feet

Boeing/Developmental Center/Summary Report | V:\025\093\020\Semiannual GW Report May 2009\Figs1-6.dwg (A) "Figure 2" 6/29/2009

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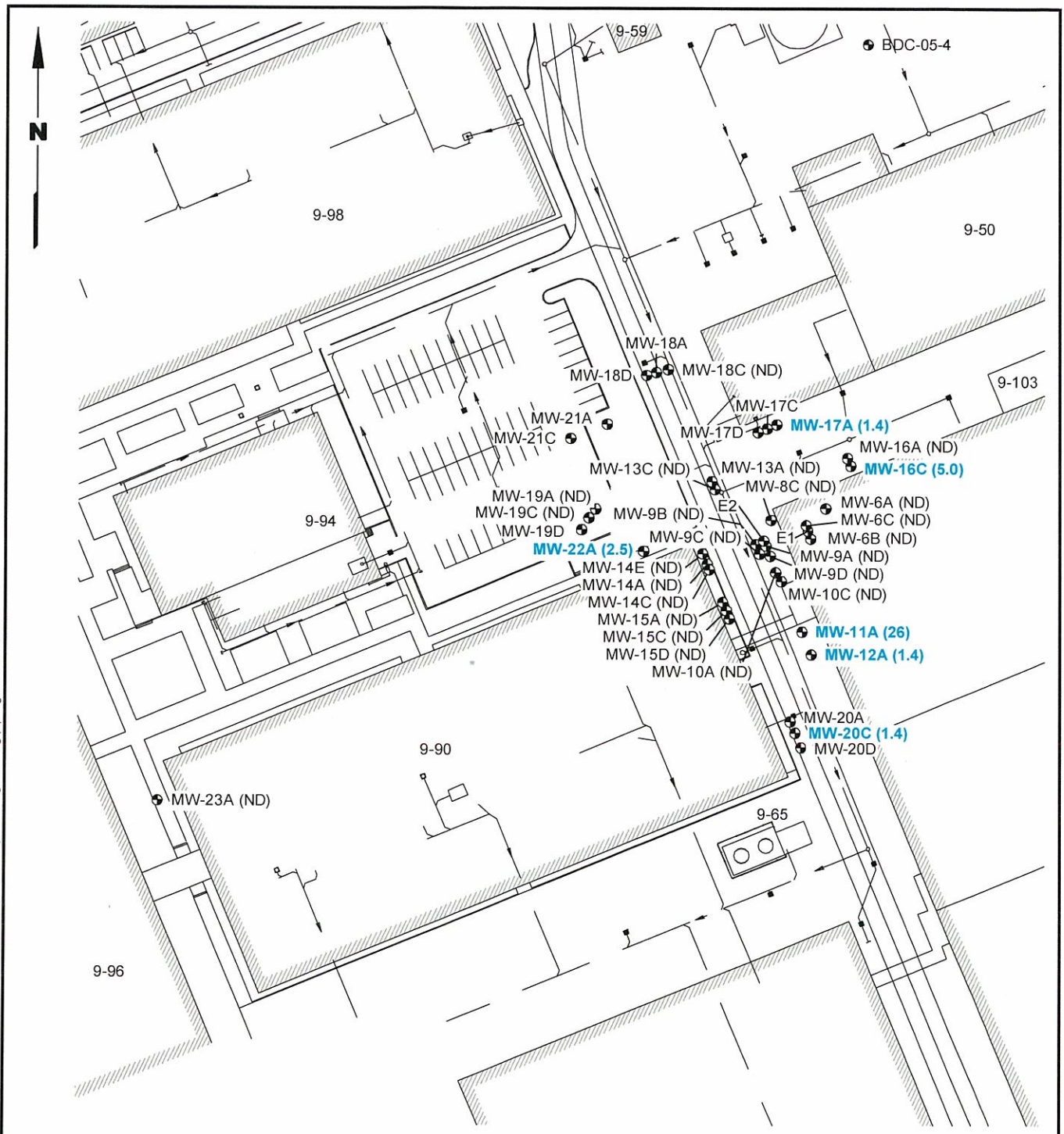
Boeing Developmental Center Tukwila, Washington	**SWMU-20 Trichloroethene May 2009 Groundwater Concentrations**	Figure **2**



Legend

◉	Monitoring Well Location
(ND)	Cis-1,2-Dichloroethene Not Detected at 1.0 µg/L Detection Limit
(1.0)	Cis-1,2-Dichloroethene Groundwater Concentration in µg/L

0 100 200
Scale in Feet

Boeing/Developmental Center/Summary Report | V:\025\093\020\Semiannual GW Report May 2009\Figs1-6.dwg (A) "Figure 3" 6/29/2009

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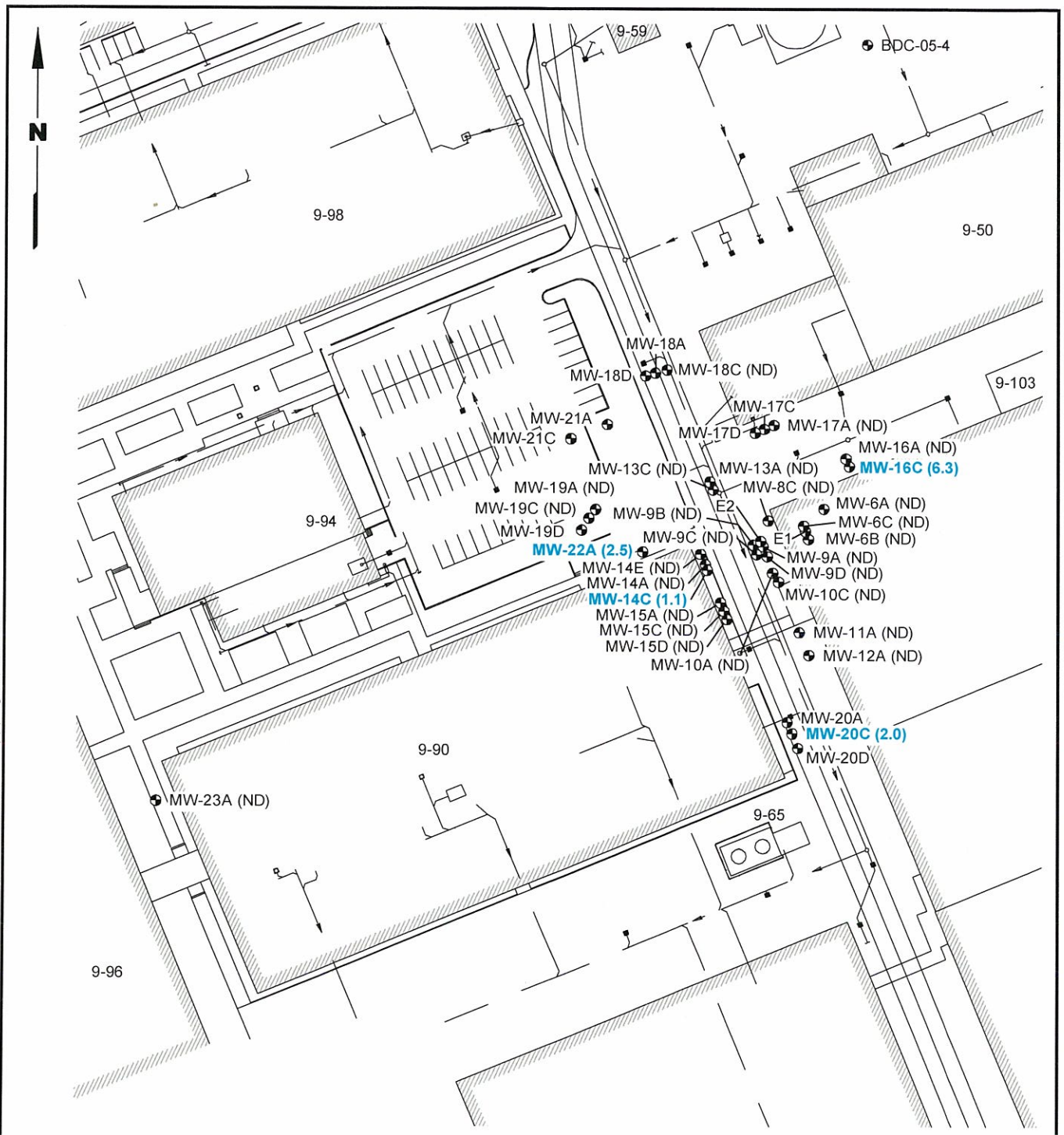
Boeing Developmental Center Tukwila, Washington	**SWMU-20 Cis-1,2-Dichloroethene May 2009 Groundwater Concentrations**	Figure 3



Boeing/Developmental Center/Summary Report | V:\025\093\020\Semiannual GW Report May 2009\Figs1-6.dwg (A) "Figure 4" 6/29/2009

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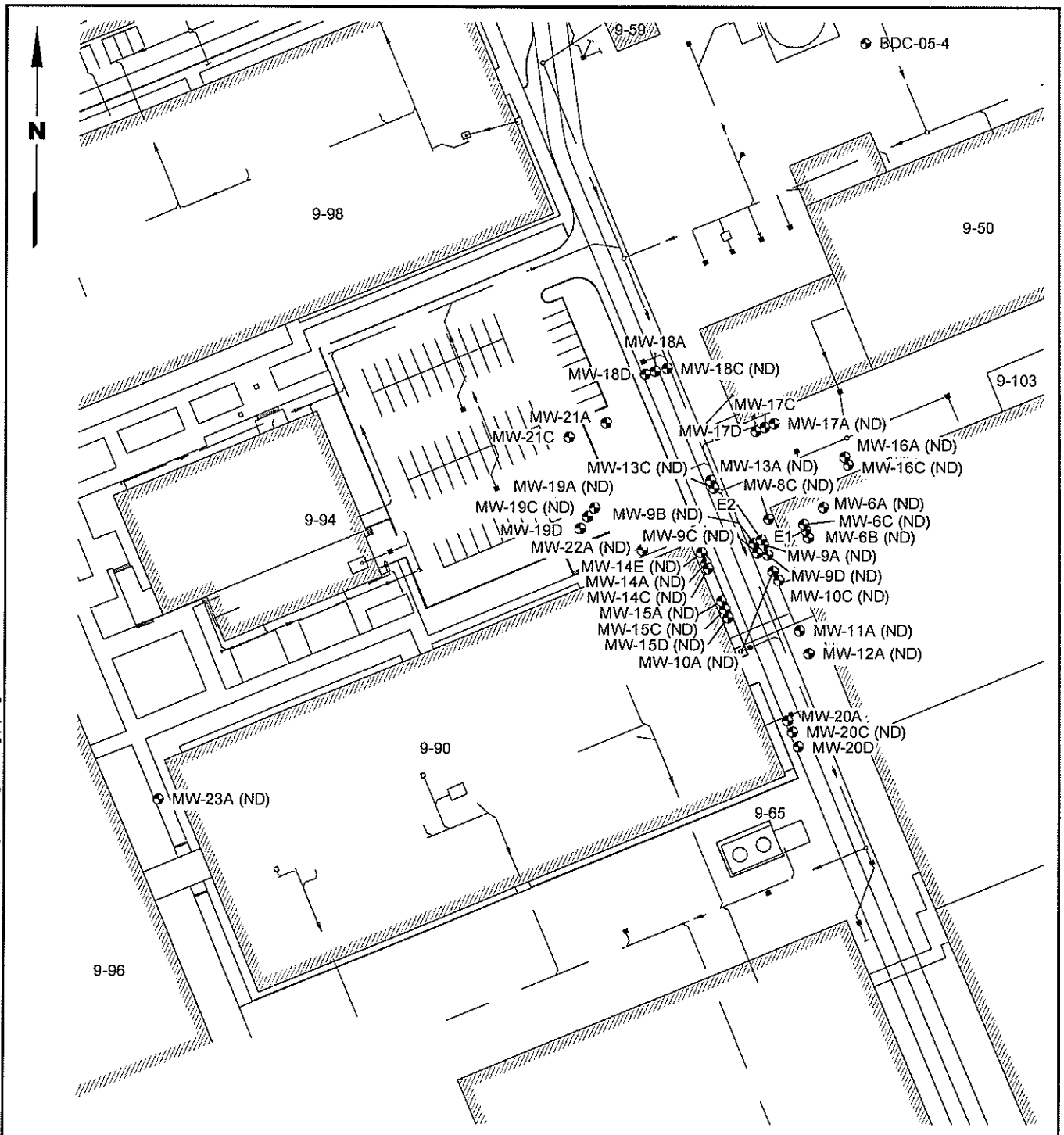
Boeing Developmental Center
Tukwila, Washington

SWMU-20 Vinyl Chloride
May 2009
Groundwater Concentrations

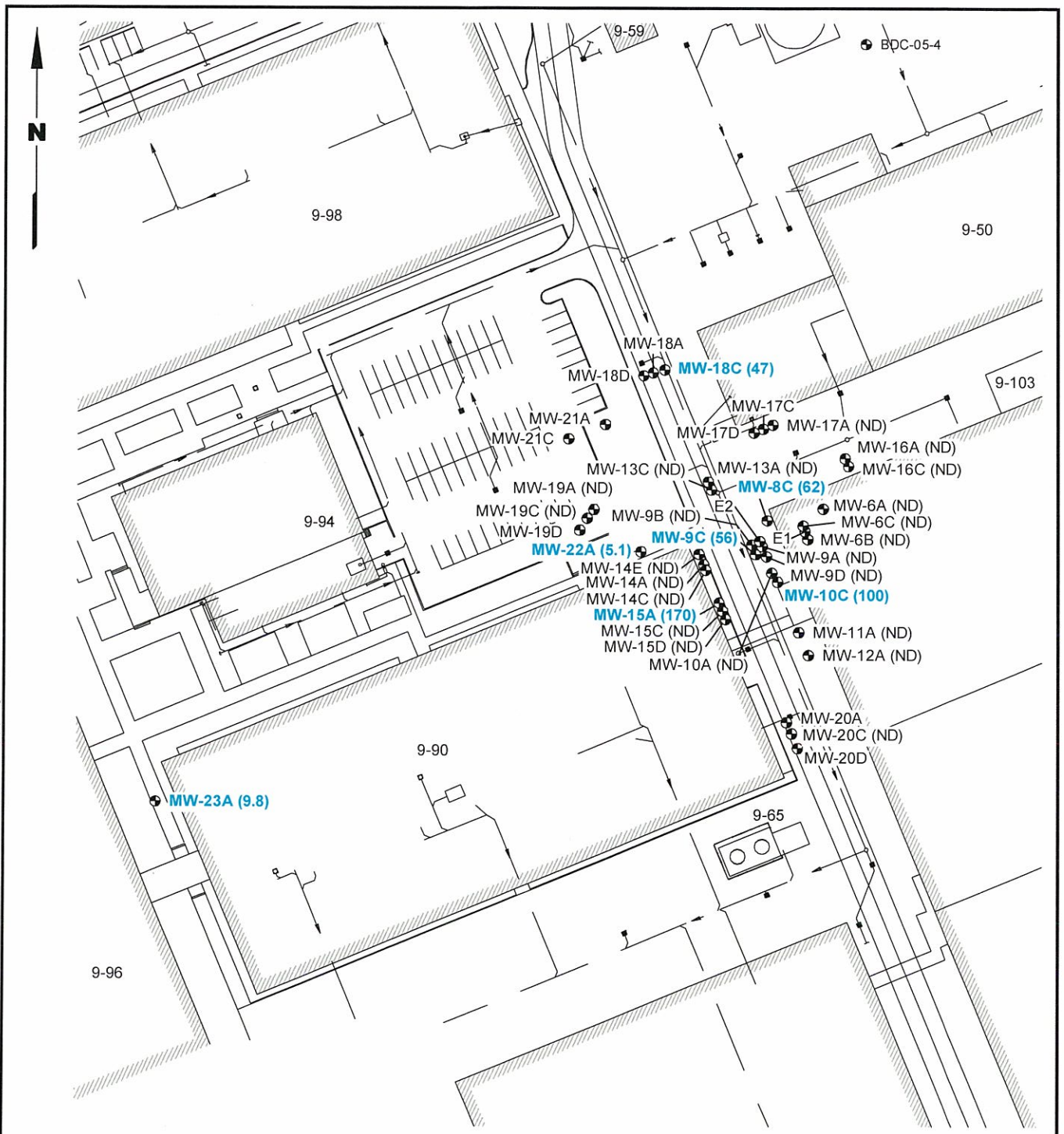
Figure
4



Boeing/Developmental Center/Summary Report | V:\0251093\020\Semiannual GW Report May 2009\Figs1-6.dwg (A) "Figure 5" 6/29/2009

LANDAU ASSOCIATES

Boeing Developmental Center Tukwila, Washington	**SWMU-20 Benzene May 2009 Groundwater Concentrations**	Figure 5



Legend

◉	Monitoring Well Location
(ND)	Naphthalene Not Detected at 5.0 µg/L, 15.0 µg/L or 100 µg/L Detection Limit
(32)	Naphthalene Groundwater Concentration in µg/L

0 100 200
Scale in Feet

Boeing/Developmental Center/Summary Report | V:\025\093\020\Semiannual GW Report May 2009\Figs1-6.dwg (A) "Figure 6" 6/29/2009

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Boeing Developmental Center Tukwila, Washington	**SWMU-20 Naphthalene May 2009 Groundwater Concentrations**	Figure **6**