Akzo Nobel Polymer Chemicals

Burt, New York

2011 Annual Monitoring Report

January 2012

Barton & Loguidice, P.C.

Engineers • Environmental Scientists • Planners • Landscape Architects

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Prepared For:

Akzo Nobel Polymer Chemicals
2153 Lockport-Olcott Road
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1.0 Introduction

Akzo Nobel Polymer Chemicals, LLC (Akzo Nobel) has a Part 373 Permit, Number 9-02928-00001/0003, which required a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) and a RCRA Facility Investigation (RFI) to determine the nature and extent of contamination associated with the Site (Site). These studies were conducted from 1994 to 2002. Based on the findings of the RFI, groundwater impacts were identified at the Site. A Corrective Measures Study (CMS) was conducted to evaluate remedial alternatives. Monitored Natural Attenuation (MNA) and institutional controls were selected as the final corrective measures for the Site. Akzo Nobel's Part 3 Permit was renewed in December 2005. The Permit authorized Akzo Nobel to implement corrective action measures to address the groundwater contamination at the Site.

The remedial goals of the corrective action are:

1. Eliminate the future risk to human health posed by the contaminated soil and remaining source materials present within the industrialized area of the Facility;
2. Eliminate the future risk to human health posed by the contaminated overburden groundwater present beneath the industrialized area of the Facility; and
3. Control migration of the contaminated groundwater.

The remedial criteria of the correction action are:

1. Maintain a long-term Groundwater Monitoring Program (GMP) to ensure that the concentration of contaminants continues to decline in the central area of the Facility; and

2. Continue groundwater monitoring in the perimeter wells to ensure that there is no off-Site contaminant migration.

The GMP and the effectiveness of the MNA as the selected remedy for the Site will be evaluated annually. The GMP Evaluation Report will evaluate the contaminant concentration trends and natural attenuation parameters to determine if the remedy is effective in meeting the remedial goals and permit criteria. If an annual review shows that any well or wells consistently has results of non-detect for all parameters for at last four sampling events, Akzo Nobel may request that the New York State Department of Environmental Conservation (NYSDEC) allow Akzo Nobel to modify this GMP to reduce the sampling frequency for those wells.

If concentrations of Site contaminants are observed to be increasing at any of the source area wells or contaminants are detected at any of the perimeter wells at concentrations above the 6 New York Code of Rules and Regulations (NYCRR) Part 703.5 Standards, Akzo Nobel will develop and implement an Interim Corrective Measures (ICM) as required by Module II Section 1(a)(ii).

As required in the GMP, this annual report evaluates the performance of the remedial system at the Site. This performance evaluation includes:

1. A comparison of 2011 monitoring data to determine remediation trends; and
2. An evaluation of water level data to determine overburden and bedrock groundwater flow.

On February 6, 2009 Conestoga-Rovers & Associates (CRA) was notified by Akzo Nobel that the NYSDEC had agreed to reduce groundwater monitoring from four times per year (quarterly) to three times per year. In 2010 Barton & Loguidice P.C. (B&L) was hired by Akzo Nobel to perform the groundwater monitoring and reporting.

B&L has relied on the previous CRA annual reports to generate the updated parameter summary tables that comply with the NYSDEC guidelines.

Figure 1 presents a Site Plan and Figure 2 presents the monitoring well locations. This is the sixth annual report prepared for the Site, and summarizes data collected for 2011.

2.0 Groundwater Quality Data

The existing monitoring well network consists of 14 groundwater monitoring wells. This number does not include the three monitoring wells (MW-6, MW-7, and MW-8) which NYSDEC approved for removed from the monitoring program in 2009 because the exhibited little or no contamination. Additionally, wells MW-1B, MW-3B, and MW-10B are now only sampled one time per year; these wells were included in the April 2011 monitoring and were not sampled during the July or November 2011 monitoring events. Groundwater samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), general chemistry, and specific field parameters. The TCL VOCs were analyzed by United States Environmental Protection Agency (USEPA) SW-846 Method 8260. Analyzing for the TCL VOC list of parameters indicates if the contaminants identified at the Site were decreasing in concentration as well as if daughter-products were being produced, providing an indication of degradation of contaminants by natural attenuation. Additionally, the following natural attenuation parameters were analyzed to assess whether conditions continue to be favorable for continued degradation or if enhancement of the natural attenuation may be necessary:

1. dissolved oxygen (field measurement)
2. iron (II) (field measurement)
3. dissolved iron (USEPA Method SW-846 200.7 Series)
4. manganese, dissolved (USEPA Method SW-846 200.7 Series)
5. nitrate (USEPA Method SW-846 300.0)
6. nitrite (USEPA Method SW-846 354.1)
7. sulfate (USEPA Method SW-846 300.0)
8. methane (Method RSK 175)

3.0 Comparison of 2011 TCL VOCs In Groundwater with NYCRR 703.5 Groundwater Standards

The analytical results comparing TCL VOCs in groundwater with NYCRR 703.5 Groundwater Standards obtained in 2011 for the 14 monitoring wells are summarized briefly below.

Well	Comparison of TCL VOCs in Groundwater with NYCRR 703.5 Groundwater Standards	
MW-1	1,2-Dichloroethane (0.80J µg/L versus action limit of 0.6 µg/L)	11/17/11
MW-1B	No results above action limits.	
MW-2	1,2-Dichloroethane (0.86J µg/L versus action limit of 0.6 µg/L)	07/29/11
	Benzene (22 µg/L versus action limit of 1 µg/L)	04/20/11
	Benzene (24 µg/L versus action limit of 1 µg/L)	07/29/11
	Chloroethane (69 µg/L versus action limit of 5 µg/L)	04/20/11
	Chloroethane (97 µg/L versus action limit of 5 µg/L)	07/29/11
	Chloroethane (28 µg/L versus action limit of 5 µg/L)	11/17/11
	Toluene (140 µg/L versus action limit of 5 µg/L)	07/29/11
	Trichloroethene (22 µg/L versus action limit of 5 µg/L)	04/20/11
	Xylene–m,p (5.7 µg/L versus action limit of 5 µg/L)	07/29/11
MW-3*	No results above action limits	
MW-3B*	No results above action limits	
MW-4*	No results above action limits	
MW-4B*	No results above action limits	
MW-5	Acetone (52 µg/L versus action limit of 50 µg/L)	07/29/11
MW-9*	1,1,1-Trichloroethane (11 µg/L versus action limit of 5 µg/L)	04/20/11
	1,1,1-Trichloroethane (10 µg/L versus action limit of 5 µg/L)	07/29/11
	1,1,1-Trichloroethane (14 µg/L versus action limit of 5 µg/L)	11/17/11
MW-9B*	No results above action limits	
MW-10*	No results above action limits	
MW-10B*	No results above action limits	
MW-11*	1,1,1-Trichloroethane (8.4 µg/L versus action limit of 5 µg/L)	04/20/11
MW-11B*	No results above action limits	

Notes:
* Denotes downgradient boundary well
J Estimated value
µg/L Micrograms per liter

With the exception of MW-9 and MW-11, none of the specified boundary wells exceeded 6 NYCRR Part 703.5 standards during 2011. 1,1,1-Trichloroethane was detected in MW-9 above the 6 NYCRR Part 703.5 action limit of 5 µg/L during all sampling events. A boundary well cluster designated MW-11 and MW-11B, downgradient of MW-9, depicted on Figure 2, was installed in February 2007 and was sampled during all 2011 sampling programs. 1,1,1-Trichloroethane was detected in MW-11 at a concentration of 8.4 µg/L versus the 6NYCRR Part 703.5 action limit of 5 µg/L during the April sampling event. All other sampling results for boundary wells MW-11 and MW-11B were below NYCRR 703.5 New York State groundwater standards. Performance at downgradient boundary wells, including MW-9, will continue to be tracked through scheduled monitoring programs.

1,2-Dichloroethane was detected at an estimated concentration of 0.80J ug/L in MW-1, versus the 6NYCRR Part 703.5 action limit of 0.6 µg/L, during the November sampling event.

Acetone was detected in MW-5 at a concentration of 52 µg/L, versus the 6NYCRR Part 703.5 action limit of 50 µg/L, during the July sampling event.

Interior monitoring well MW-2 has historically had concentrations of several groundwater monitoring constituents above 6NYCRR Part 703.5 standards. Data for 2011, summarized below, continues to illustrate a pronounced decrease in measured concentrations for the 2011 data.

MW-2 ANALYTICAL RESULTS HIGHER THAN 6 NYCRR PART 703.5 STANDARDS

Parameter	Action Limits for 6NYCRR Part 703.5 (µg/L)	April 2011 (µg/L)	July 2011 (µg/L)	November 2011 (µg/L)
1,2-Dichloroethane	0.6	<AL	0.86J	<AL
Benzene	1	<AL	22	14
Chloroethane	5	69	97	28
Chloroethane	5	280	45	10
Toluene	5	ND	140	ND
Trichloroethene	5	22	ND	ND
Xylene – m,p	5	ND	5.7	ND

<AL – Below action limit for sample
J – Approximated value
ND – Not detected at associated value for sample

4.0 Monitored Natural Attenuation Evaluation

Based on the findings of the RFI conducted from 1994 to 2002, groundwater impacts were identified at the Site. A CMS was conducted to evaluate remedial alternatives. MNA and institutional controls were subsequently selected as the final corrective measures at the Site.

Site groundwater MNA data were evaluated to assess current groundwater conditions, including potential trends of selected Site constituents of concern.

The 111-TCA previously present in the source area appears to have been fully degraded to chloroethane, and the parent compound was no longer detected in the source area during the 2011 monitoring year. The by-product chloroethane continues to degrade under anaerobic conditions in the source area or degrades aerobically as it migrates towards the Site boundary. The absence of CA in the boundary wells confirms that the higher concentrations that are present in the vicinity of the source are themselves degraded during their migration from the source area towards the boundary wells.

111-TCA is already present in the aerobic boundary area. Low-level detections of 111-TCA in boundary wells MW-9 and MW-11 in recent years, however, demonstrate trends of declining concentrations. Unlike wells in or near the source area, degradation by-products are infrequently detected at concentrations that typically do not exceed regulatory criteria. Degradation is undoubtedly occurring at the boundary locations, particularly at MW-11, based on the observed redox conditions. However, the starting concentrations of the parent 111-TCA are sufficiently low to yield by-product concentrations that are very low and often below the method detection limits.

Anaerobic degradation of the BTEX constituents present in the source area is also likely occurring. As the flow of groundwater approaches the more aerobic areas to the west, however, BTEX constituents not degraded in the source area will likely be degraded aerobically. Accordingly, off-site migration of BTEX is not likely to occur. This hypothesis is supported by the historic absence of BTEX detections in the boundary monitoring wells. As in prior years, there were no detections of BTEX constituents in the boundary wells during the 2011 monitoring year.

On balance, the data indicate that monitored natural attenuation is achieving the objective of reducing concentrations of the organic constituents below relevant groundwater quality standards in the boundary monitoring wells. Please see Appendix C of this report for the detailed evaluation of MNA.

5.0 Groundwater Hydraulics

Appendix A presents the overburden groundwater contours for 2011 and Appendix B presents the bedrock groundwater contours for 2011. Based on the assessment of 2011 groundwater monitoring data, the direction of overburden groundwater flow was generally west-northwest to west. The direction of bedrock groundwater flow was generally westward.

A downward vertical gradient was observed at the MW-1/MW-1B and MW-3/MW-3B clusters in April 2011. A downward vertical gradient was also observed at theMW-4/MW-4B, MW-9/MW-9B and MW-11/MW-11B clusters throughout the 2011 monitoring year. Historically, an upward vertical gradient has been observed at the MW-1/MW-1B cluster and a downward vertical gradient at the MW-3/MW-3B cluster; however, with the approved reduction in monitoring at wells MW-1B and MW-3B, water level measurements were not recorded at these locations after the 1st Trimester 2011. The downward vertical gradient observed on the western boundary of the Site may be the result of a nearby bedrock groundwater discharge area (Eighteen Mile Creek northwest of the Site).

The Site monitoring wells were initially surveyed in 2006 with a reference elevation of 100.00'. The wells were resurveyed in the spring of 2007 in State Plane NY West NAD83, Vertical Datum NAVD88. Water level measurements used to assess groundwater hydraulics for 2011 are found in Appendix D.

6.0 Conclusions

The three reports issued for 2011 included a summary of groundwater monitoring field activities, a summary of the analytical data compared to the New York State Groundwater Standards in 6NYCRR 703.5, groundwater contour maps for both the overburden groundwater and bedrock groundwater, and an interpretation of the data.

A review of the 2011 data indicates that:

- Concentrations of TCL VOC analytes in groundwater collected from the Site monitoring well network in most cases were either not detected or detected below NYCRR 703.5 Groundwater Standards.
- During the April 2011 monitoring event, 1,1,-trichloroethane was detected in boundary monitoring well MW-11, slightly above groundwater standards, but it was not detected in MW-11B and was not detected in MW-11 or 11-B during the July and November sampling events.
- The direction of overburden groundwater flow was generally west-northwest to westward. The direction of bedrock groundwater flow was generally westward. Downward vertical gradients were measured at the MW-1/MW-1B and MW-3/MW-3B clusters in April 2011. Historically, an upward vertical gradient has been observed at the MW-1/MW-1B cluster and a downward vertical gradient at the MW-3/MW-3B cluster; however, with the approved reduction in monitoring at wells MW-1B and MW-3B, water level measurements were not recorded at these locations after the 1st Trimester 2011. Downward vertical gradients were observed at the, MW-4/MW-4B, MW-9/MW-9B and MW-11/MW-11B clusters throughout the 2011 monitoring year. The downward vertical gradient observed on the western boundary of the Site may be the result of a nearby bedrock groundwater discharge area (Eighteen Mile Creek northwest of the Site).

- The 111-TCA previously present in the source area appears to have been fully degraded to chloroethane, and the parent compound was no longer detected in the source area during the 2011 monitoring year. The by-product chloroethane continues to degrade under anaerobic conditions in the source area or degrades aerobically as it migrates towards the Site boundary. The absence of CA in the boundary wells confirms that the higher concentrations that are present in the vicinity of the source are themselves degraded during their migration from the source area towards the boundary wells.

  111-TCA is already present in the aerobic boundary area. Low-level detections of 111-TCA in boundary wells MW-9 and MW-11 in recent years, however, demonstrate trends of declining concentrations. Unlike wells in or near the source area, degradation by-products are infrequently detected at concentrations that typically do not exceed regulatory criteria. Degradation is undoubtedly occurring at the boundary locations, particularly at MW-11, based on the observed redox conditions. However, the starting concentrations of the parent 111-TCA are sufficiently low to yield by-product concentrations that are very low and often below the method detection limits.

  Anaerobic degradation of the BTEX constituents present in the source area is also likely occurring. As the flow of groundwater approaches the more aerobic areas to the west, however, BTEX constituents not degraded in the source area will likely be degraded aerobically. Accordingly, off-site migration of BTEX is not likely to occur. This hypothesis is supported by the historic absence of BTEX detections in the boundary monitoring wells. As in prior years, there were no detections of BTEX constituents in the boundary wells during the 2011 monitoring year.

On balance, the data indicate that monitored natural attenuation is achieving the objective of reducing concentrations of the organic constituents below relevant groundwater quality standards in the boundary monitoring wells.

- Acetone was detected at well MW-5 during the July 2011 sampling event. Acetone has been detected intermittently and, despite being a common laboratory contaminant, appears likely that acetone is present at the Site. Acetone readily degrades under the aerobic conditions present in the area of well MW-5.
- The remedial goals of the corrective action that continue to be addressed are:
    - Eliminate the future risk to human health posed by the contaminated soil and remaining source materials present within the industrialized area of the Facility;
    - Eliminate the future risk to human health posed by the contaminated overburden groundwater present beneath the industrialized area of the Facility; and
    - Control migration of the contaminated groundwater.

Groundwater monitoring will continue to be performed three times per year with the next event scheduled to occur in the Spring of 2012.

Table 1

Summary of MNA Indicator Parameter Data

TABLE 1
SUMMARY OF MNA INDICATOR PARAMETER DATA

Well ID	ORP Millivolts	ORP Millivolts	ORP Millivolts	Average ORP Millivolts	DO mg/L	DO mg/L	DO mg/L	Average DO mg/L	Dissolved Iron mg/L	Dissolved Iron mg/L	Dissolved Iron mg/L	Average mg/L	Dissolved Mn mg/L	Dissolved Mn mg/L	Dissolved Mn mg/L	Average mg/L
	4/20/2011	*7/29/2011*	*11/17/11*	*2011*	*4/20/2011*	*7/29/2011*	*11/17/11*	*2011*	*4/20/2011*	*7/29/2011*	*11/17/11*	*2011*	*4/20/2011*	*7/29/2011*	*11/17/11*	*2011*
MW-1	62	87	80	76	7.02	2.12	2.48	3.9	0	0.32	0.02	0.11	0	74	44	39
MW-1B	46	--	--	46	4.36	--	--	4.4	0.02	--	--	0.02	282	--	--	282
MW-2	-111	-119	-94	-108	1.1	0.99	3.62	1.9	3.30	2.33	1.62	2.42	2170	1810	1400	1793
MW-3	98	105	126.6	110	6.99	5.24	5.38	5.9	0.04	0.24	0.11	0.13	12	0	0	4
MW-3B	70	--	--	70	1.65	--	--	1.7	0.07	--	--		62	--	--	62
MW-4	100	112	135	116	8.45	5.29	6.12	6.6	0	0.14	0.32	0.15	0	51	50	34
MW-4B	99	132	119	117	4.74	3.49	4.89	4.4	0.03	0.25	0.00	0.09	88	70	56	71
MW-5	92	106	117	105	1.95	1.76	2.81	2.2	0.02	0.00	0.06	0.03	255	0	0	85
MW-9	125	32	155	104	2.54	1.68	5.01	3.1	0.14	0.10	0.11	0.12	36	13	16	22
MW-9B	100	101	151	117	1.94	2.21	3.86	2.7	0	0.36	0.00	0.12	30	41	37	36
MW-10	120	84	149	118	2.98	3.00	4.05	3.3	0.01	0.00	0.50	0.17	18	48	726	264
MW-10B	104	--	--	104	1.96	--	--	2.0	0.01	0.01	0.01	0.01	49	--	--	49
MW-11	119.1	4	-34	30	5.79	1.08	4.41	3.8	0.05	0.72	0.46	0.41	0	260	188	224
MW-11B	87	117	48	84	2.84	4.38	4.40	3.9	0.01	0.19	0.00	0.07	23	15	32	23
Average	79	69	87	78	3.9	2.8	4.3	3.7	0.26	0.39	0.27	0.31	216	217	232	221
Min	-111	-119	-94	-119	1.1	1.0	2.5	1.0	ND	ND	ND	ND	ND	ND	ND	ND
Max	125	132	155	155	8.5	5.3	6.1	8.5	3.30	2.33	1.62	3.30	2170	1810	1400	2170

Note: Boxed cells indicate results consistent with more reducing conditions;
highlighted cells indicate results consistent with more oxidizing conditions.

TABLE 1
SUMMARY OF MNA INDICATOR PARAMETER DATA

Well ID	Sulfate mg/L	Sulfate mg/L	Sulfate mg/L	Average SO_4 mg/L	Nitrate mg/L	Nitrate mg/L	Nitrate mg/L	Average NO_3 mg/L	Methane ug/L	Methane ug/L	Methane ug/L	Average CH_4 ug/L
	4/20/2011	*7/29/2011*	*11/17/11*	*2011*	*4/20/2011*	*7/29/2011*	*11/17/11*	*2011*	*4/20/2011*	*7/29/2011*	*11/17/11*	*2011*
MW-1	39.4	34.6	34.7	36	0	0	0	0.0	3.3	28	7.8	13.0
MW-1B	1360	--	--	1360	0	--	--	0.0	0	--	--	0.0
MW-2	0	13.3	55.8	23	0	0	0	0.0	10,000	12000	7300	9767
MW-3	164	170	175	170	0	0	0	0.0	0	0	0	0.0
MW-3B	52.7	--	--	53	0	--	--	0.0	35	--	--	35.0
MW-4	22.5	30.4	42.8	32	0	0	0	0.0	0	0	3.3	1.1
MW-4B	1080	1100	854	1011	0	0	0	0.0	3.9	3.9	5.3	4.4
MW-5	5.5	58.1	75.4	46	0	4.5	2.8	2.4	0	0	0	0.0
MW-9	73.3	68.7	67	70	3.1	3.1	3.4	3.2	11	9.9	0	10.5
MW-9B	671	834	643	716	0	0	0	0.0	7.5	7.0	7.3	7.3
MW-10	41.3	44.3	44.3	43	2.8	8.4	7.6	6.3	0	0	0	0.0
MW-10B	106	--	--	106	0	--	--	0.0	120	--	--	120.0
MW-11	60.7	74.5	76.6	71	1.4	0	0	0.5	0	230	180	136.7
MW-11B	164	92.5	379	212	0	0	0	0.0	30	37	27	31.3
Average	274.3	229.1	222.5	242	0.5	1.5	1.3	1.1	729	1120	685	845
Min	ND	13.3	34.7	ND	ND	ND	ND	ND	0.0	0.0	0.0	0.0
Max	1360	1100	854	1360	3.1	8.4	7.6	8.4	10000	12000	7300	12000

Note: Boxed cells indicate results consistent with more reducing conditions;
highlighted cells indicate results consistent with more oxidizing conditions.

Figure 1

Site Location Map

SOURCE REFERENCE:
NEW YORK STATE GIS CLEARINGHOUSE, 2008.

Barton & Loguidice, P.C.

AKZO NOBEL POLYMER CHEMICALS LLC

SITE LOCATION MAP

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Figure Number	1
Project Number	1398.001
Date	JUNE, 2011
Scale	AS SHOWN

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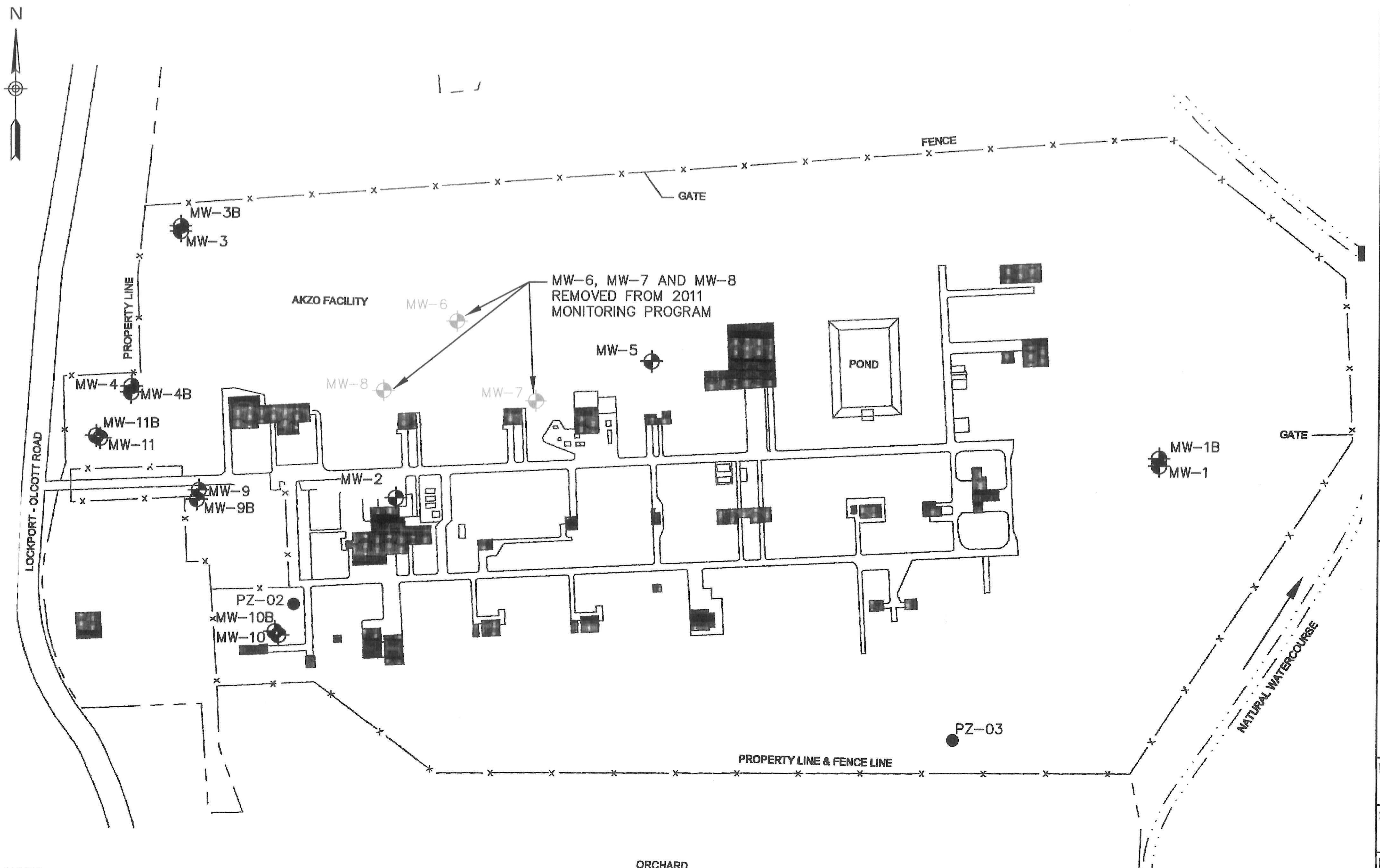
Figure 2

Monitoring Well Locations



LEGEND:

⊕ MONITORING WELL

● PIEZOMETER

NOTE:

WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:

TRC FIGURE FACILITY LOCATION MAP PJ.#19045

NIAGARA COUNTY, NEW YORK

AKZO NOBEL POLYMER CHEMICALS LLC

WELL LOCATIONS

TOWN OF BURT

Barton & Loguidice, P.C.

Date
JUNE, 2011

Scale
1"=200'

Figure Number
2

Project Number
1398.001

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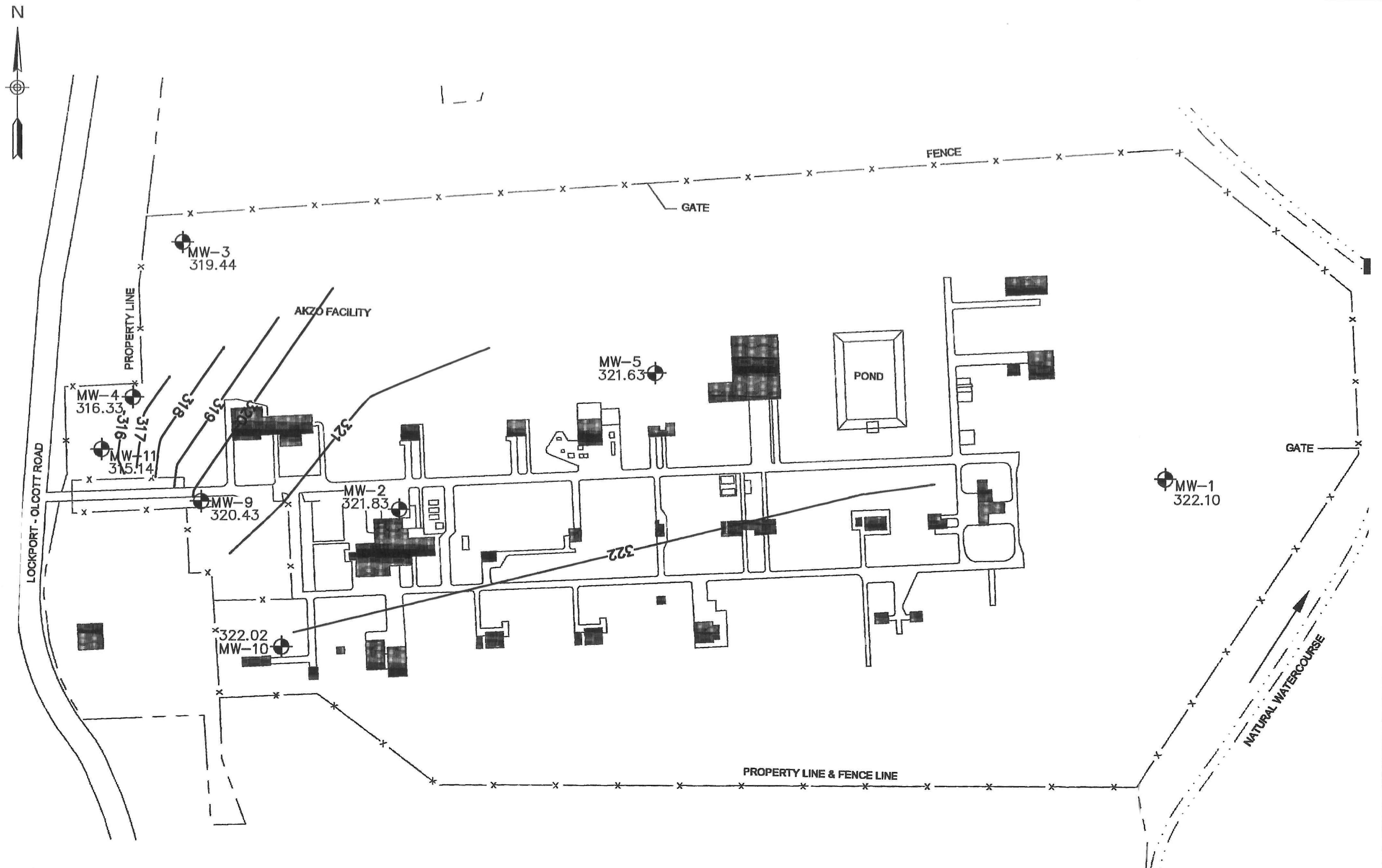
Appendix A

Overburden Groundwater Contours – 2011



NOTE:

WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:

TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⊕ MONITORING WELL

322.02 GROUNDWATER ELEVATION (FT. AMSL)

AKZO NOBEL POLYMER CHEMICALS LLC

OVERBURDEN GROUNDWATER CONTOURS
APRIL 2011

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date
JUNE, 2011

Scale
1"=200'

Figure Number
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Project Number
1398.001

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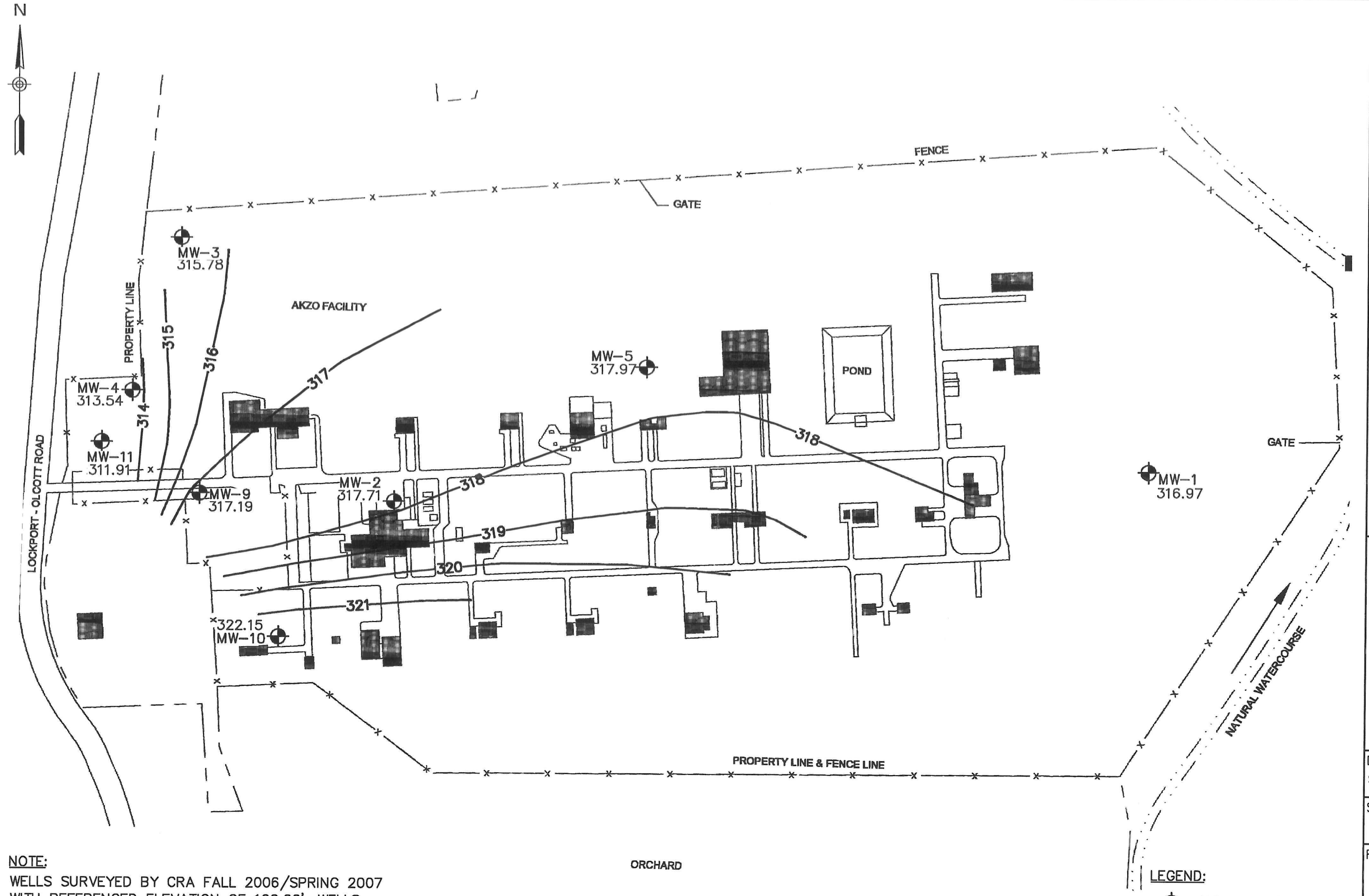

NOTE:

WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:

TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⌖ MONITORING WELL

322.02 GROUNDWATER ELEVATION (FT. AMSL)

AKZO NOBEL POLYMER CHEMICALS LLC

OVERBURDEN GROUNDWATER CONTOURS
JULY 2011

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

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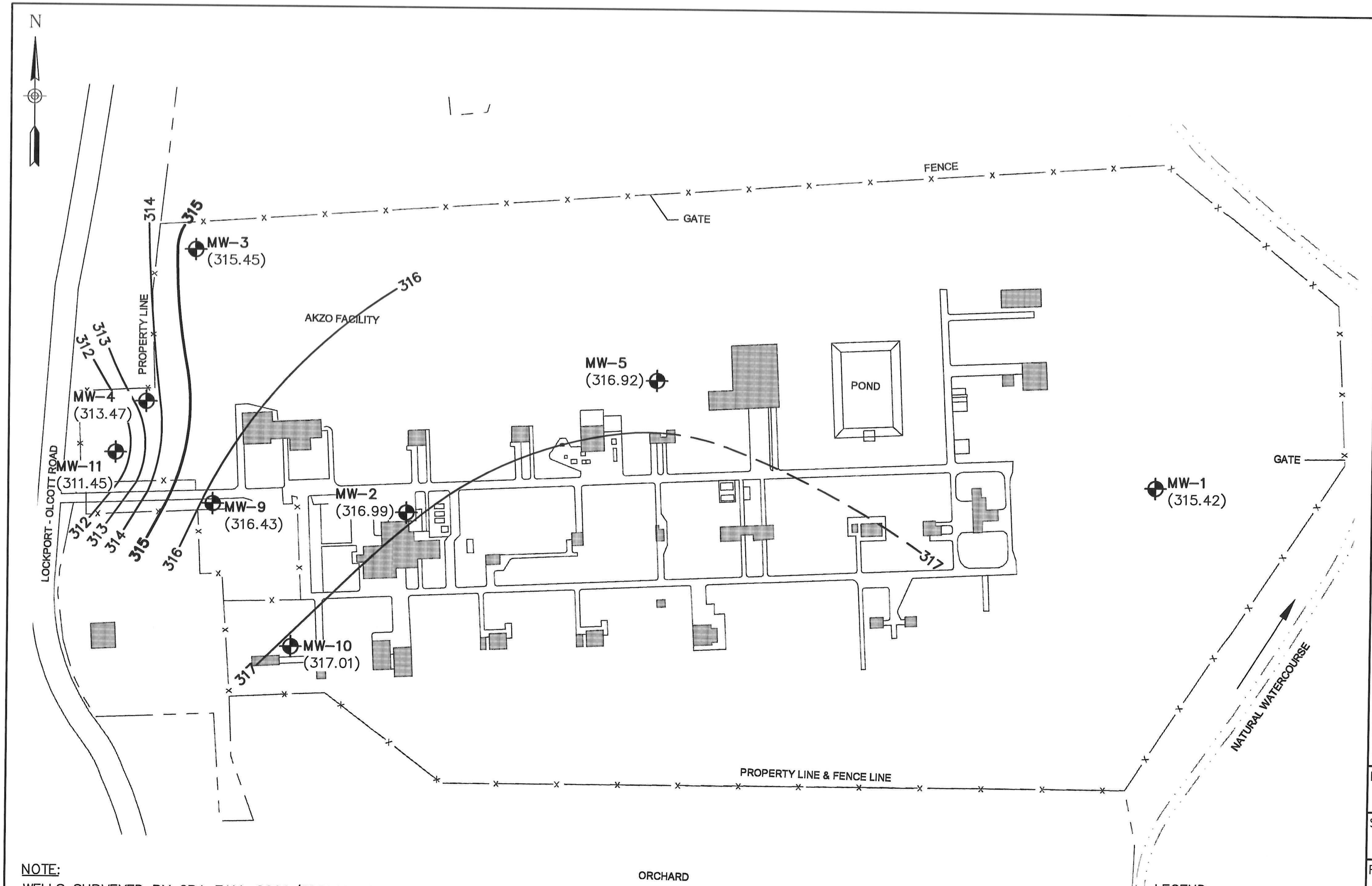

NOTE:

WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:

TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⊕	MONITORING WELL
322.02	GROUNDWATER ELEVATION (FT. AMSL)

AKZO NOBEL POLYMER CHEMICALS LLC

OVERBURDEN GROUNDWATER CONTOURS
NOVEMBER, 2011

NIAGARA COUNTY, NEW YORK

TOWN OF BURT

Barton & Loguidice, P.C.

Date	DECEMBER, 2011
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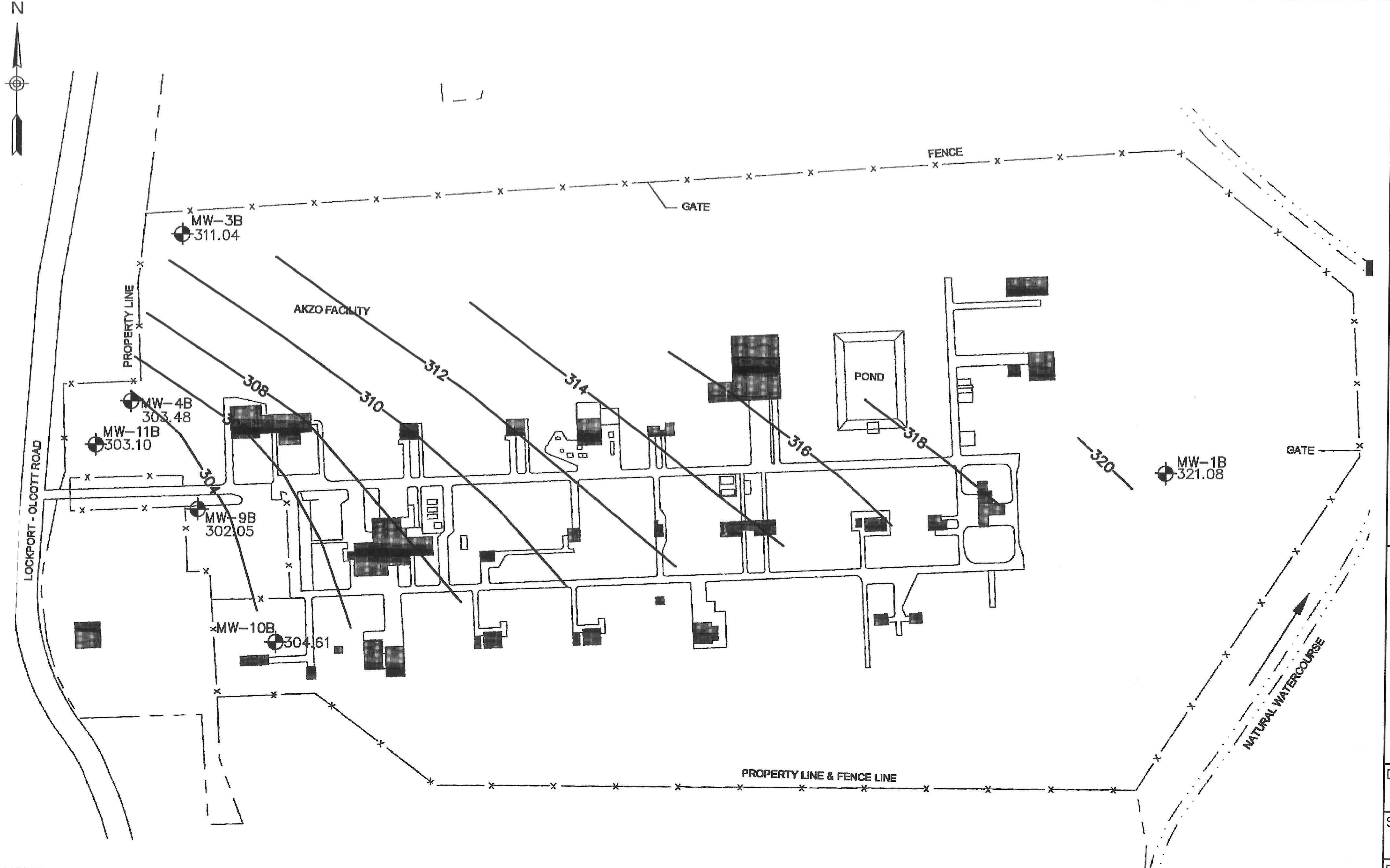
Appendix B

Bedrock Groundwater Contours – 2011



AKZO NOBEL POLYMER CHEMICALS LLC

BEDROCK GROUNDWATER CONTOURS
APRIL 2011

NIAGARA COUNTY, NEW YORK

TOWN OF BURT

Barton & Loguidice, P.C.

Date JUNE, 2011

Scale 1"=200'

Figure Number 5

Project Number 1398.001

NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:
TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⊕	MONITORING WELL
322.02	GROUNDWATER ELEVATION (FT. AMSL)

Plotted: Jun 08, 2011 - 9:03AM SYR By: mj
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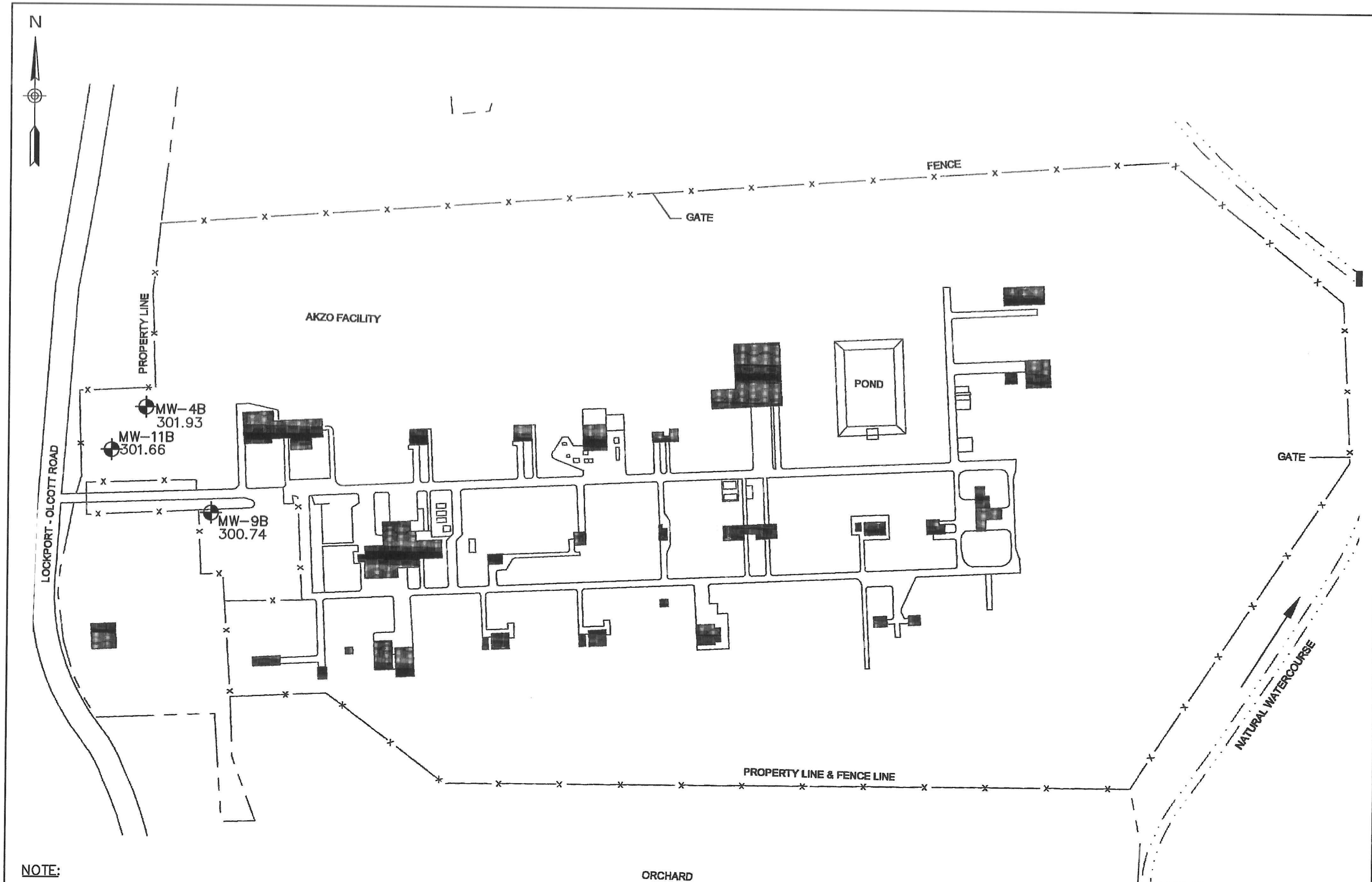

NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:
TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⊕ MONITORING WELL

322.02 GROUNDWATER ELEVATION (FT. AMSL)

AKZO NOBEL POLYMER CHEMICALS LLC

BEDROCK GROUNDWATER CONTOURS
JULY 2011

NIAGARA COUNTY, NEW YORK

TOWN OF BURT

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	1"=200'
Figure Number	5
Project Number	1398.001

Plotted: Sep 22, 2011 – 7:49AM SYR By: mj
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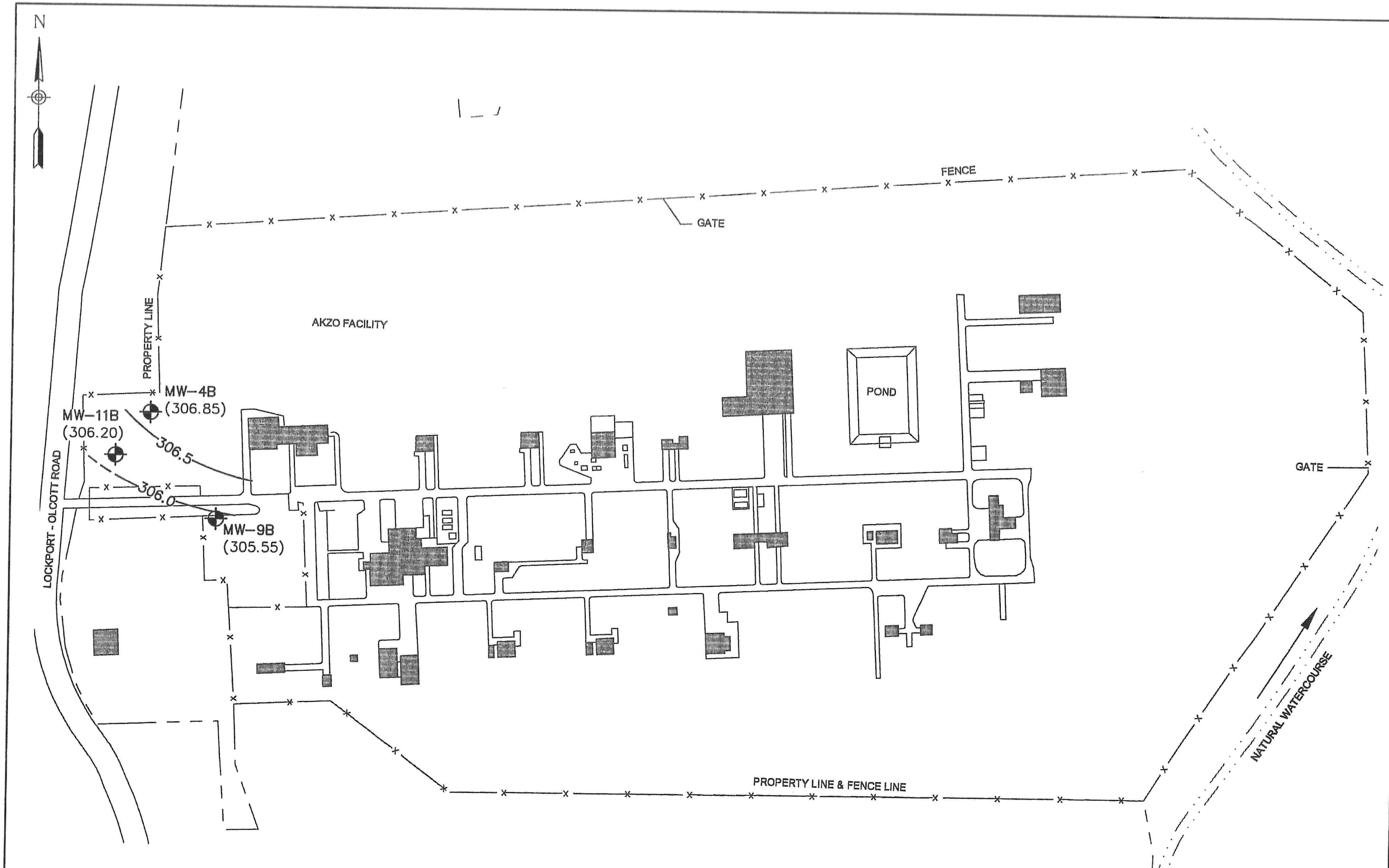


NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:
TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⊕	MONITORING WELL
305.55	GROUNDWATER ELEVATION (FT. AMSL)

AKZO NOBEL POLYMER CHEMICALS LLC

BEDROCK GROUNDWATER CONTOURS
NOVEMBER, 2011

NIAGARA COUNTY, NEW YORK

TOWN OF BURT

Barton & Loguidice, P.C.

Date
DECEMBER, 2011

Scale
1"=200'

Figure Number
5

Project Number
1398.001

Plotted: Jan 11, 2012 - 9:53AM SYR By: jgs
I:\Shared\1300\1398001\1398001_NOVEMEBER_2011_FIGs.dwg

Appendix C

Evaluation of Natural Attenuation Data

Barton & Loguidice, P.C.

Memo to: File **Date:** January 31, 2012

From: Michael R. Brother **File:** 1398.001.001

Subject: Evaluation of Natural Attenuation Data

Introduction

The Akzo Nobel site is located at 2153 Lockport-Olcott Road in Burt, NY. The facility formerly produced chemical peroxides. Production was discontinued in April 2003; however, the Facility remains in operation as a warehouse and distribution center. The property is 350 acres in size, of which the former production portion of the Site comprises 30 acres.

The Site is subject to the requirements of 6NYCRR Part 373 – Hazardous Waste Management Facilities. Akzo Nobel has a Part 373 Permit, which required them to conduct a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) and a RCRA Facility Investigation (RFI) to determine the nature and extent of contamination associated with the Facility. These studies were conducted from 1994 to 2002. Based on the findings of the RFI, groundwater impacts were identified at the Site.

A corrective Measure Study (CMS) was conducted to evaluate remedial alternatives. Monitored natural attenuation (MNA) and institutional controls were selected as the final corrective measures for the Site. Akzo Nobel's Part 373 Permit Number 9-02928-00001/00003 was renewed in December 2005. The Permit authorizes Akzo Nobel to implement the selected corrective action measures to address the groundwater contamination at the Site.

This memorandum was prepared to review the 2011 MNA data and to assess current groundwater conditions, including potential trends of selected Site constituents of concern.

Background

Monitored natural attenuation is defined as:

> "Reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The 'natural attenuation processes' that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants." (U.S. Environmental Protection Agency, 1999)

The primary natural attenuation processes at work at the site include both aerobic and anaerobic biodegradation. The principal constituents of concern at the Site are 1,1,1-trichloroethane (111-TCA), chloroethane (CA), and benzene. 111-TCA degrades primarily under anaerobic conditions via reductive dechlorination to form 1,1-dichloroethane (11-DCA), then CA (although degradation under aerobic conditions may also occur in the presence of certain rarely encountered bacterial strains). Abiotic degradation of 111-TCA via dehydrochlorination may also occur, with 1,1-dichloroethene (11-DCE) a resultant by-product (USGS, 2006). Chloroethane degrades via anaerobic processes, including degradation to acetaldehyde via dehydrochlorination and to ethane via microbe-catalyzed dechlorination (USGS, 2006), as well as by aerobic processes.

Benzene is readily biodegraded under aerobic conditions provided dissolved oxygen levels remain above about 2 to 3 mg/l. Benzene may also be degraded under anaerobic conditions, particularly under sulfate-reducing conditions. The degradation end-points in each case are carbon dioxide and water.

A variety of indicator parameters, both field and laboratory, are useful for assessing the redox state of the groundwater system at the Site and determining whether natural attenuation is occurring. These parameters include dissolved oxygen (DO), oxidation-reduction potential (ORP), nitrate/nitrite, dissolved iron and manganese, and methane.

DO is a direct measurement of the oxygen present in the groundwater, and background DO concentrations in shallow groundwater are typically on the order of 5 to 8 mg/l. The aerobic biodegradation process consumes dissolved oxygen; accordingly, lower concentrations of DO indicate that aerobic degradation has taken place.

ORP measurements can be used to interpret the redox state of the groundwater system. Negative ORP values indicate that reducing (anaerobic) conditions are present, while positive ORP values indicate that oxidizing conditions prevail. Under anoxic conditions, anaerobic microbes will sequentially utilize nitrate, iron, sulfate, and finally carbon dioxide (methanogenesis) as electron acceptors (USGS, 2006). As the concentration of each electron acceptor decreases, the redox potential of the ground water becomes more negative, favoring reductive dechlorination at ORP values less than -200 mV.

In the absence of oxygen, nitrate is converted to nitrite and then to nitrogen gas at ORP levels less than +750 mV (ITRC, 2002). Accordingly, under anaerobic conditions favorable for reductive dechlorination nitrate is unlikely to be present since the nitrate previously present has likely been converted to nitrogen gas.

Iron and manganese occur naturally in most aquifer materials, with their concentrations in groundwater limited by the relative insolubility of the Fe^{3+} and Mn^{4+} forms. Under reducing conditions, however, the more soluble Fe^{2+} and Mn^{2+} forms prevail; accordingly, elevated concentrations of dissolved iron and manganese indicate the presence of reduced (anaerobic) conditions.

The production of methane gas as a by-product of degradation occurs under highly reducing conditions where ORP values are less than -200 mV. Accordingly, the presence of methane indicates that conditions are favorable for reductive dechlorination.

Evaluation of Site MNA Data

Redox Conditions

Modestly oxidizing (aerobic) conditions were present at all of the bedrock monitoring wells and in the majority of the overburden monitoring well locations during the 2011 monitoring year (Table 1). Average ORP values ranged from -125 mV at MW-7 to 155 mV at MW-9, with an average of 45.9 mV. DO concentrations ranged from 1 mg/L at MW-2 to 8.5 mg/L at MW-4, with an average DO concentration of 3.7. DO is relatively depleted in wells MW-5, MW-9, MW-9B, MW-10, and MW-11 (average = 2.9 mg/L), although ORP levels suggest that marginally oxidizing conditions continue to exist at these locations (average = 96 mV). At MW-2, on the other hand, the average DO concentration is 1.9 mg/L, with an average ORP of -108 mV.

Dissolved iron concentrations ranged from non-detect (multiple locations) to 3.3 mg/L (MW-2), with an average dissolved iron concentration of 0.46 mg/L. There were only limited dissolved iron detections in the bedrock monitoring wells. Dissolved manganese ranged from non-detect (multiple locations) to 2,170 mg/L (MW-2). MW-11 was the only well other than MW-2 to have multiple detections of both dissolved iron and dissolved manganese during the 2011 monitoring year.

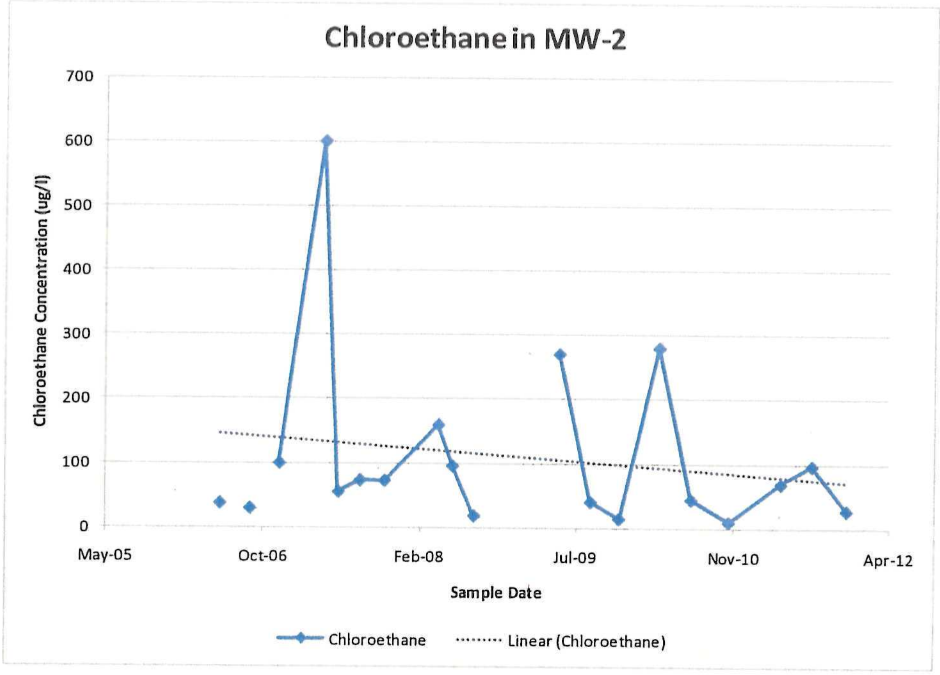
Nitrate was detected at only four locations (MW-5, MW-9, MW-10, and MW-11), all of which are screened in the overburden. In the wells with nitrate detections at least once during 2011, the concentrations ranged from non-detect (two locations) to 8.4 mg/L (MW-10). These observations suggest that the denitrification process is incomplete at these locations.

Methane concentrations were greatest at monitoring well MW-2, averaging 9,767 ug/L during the 2011 monitoring year. These methane concentrations confirm that strongly reducing conditions favoring reductive dechlorination are present in the vicinity of this well. Modestly elevated methane concentrations were also noted at monitoring well MW-11, where methane concentrations averaged 136.7 ug/L during the 2011 monitoring year. Methane concentrations at these locations appear to be elevated compared to the available historical data.

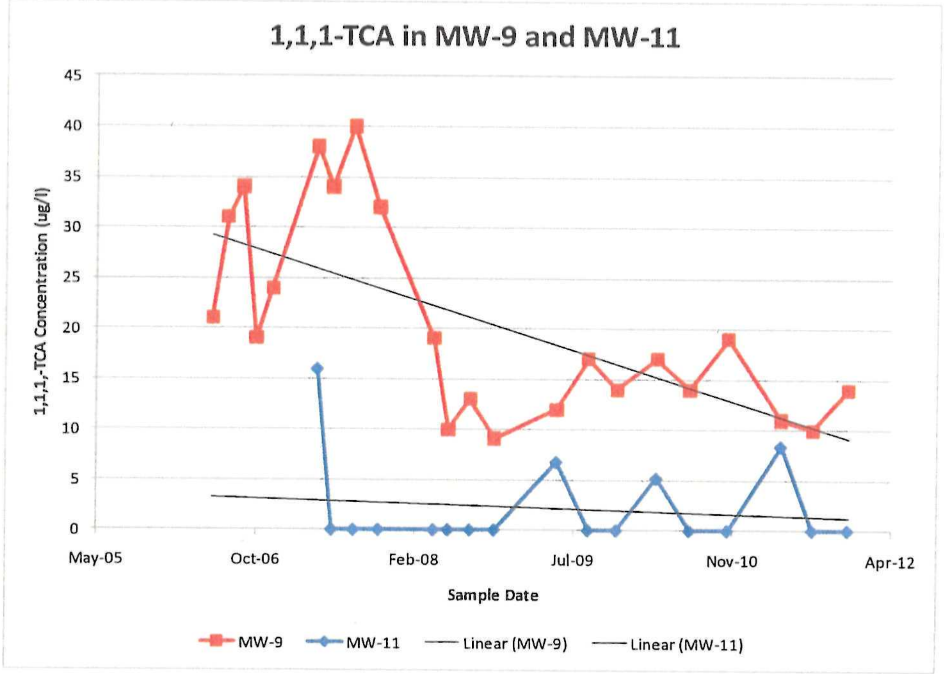
In general, the MNA indicator data are consistent with the results from prior monitoring years. Strongly reducing conditions favoring reductive dechlorination are present in the vicinity of well MW-2. A zone where oxygen levels have been reduced, but conditions remain moderately aerobic (as evidenced by positive ORP values; significant nitrate detections; and infrequent methane, dissolved iron and dissolved manganese detections) encompasses wells MW-5, MW-9, MW-10, and MW-11. A third zone has near background DO (> 5 mg/L); positive ORP values; infrequent, low-concentration dissolved iron and manganese; and no detectable methane. This latter area encompasses monitoring wells MW-3 and MW-4.

Degradation Products

The degradation of 111-TCA via reductive dechlorination yields two principal by-products: 11-DCA and CA, both of which have detected in monitoring well MW-2 during previous sampling events. During the 2011 monitoring year, however, only CA was detected in MW-2. The absence of both 111-TCA and 11-DCA suggests that the majority of the 111-TCA in the source area has been degraded to CA. In addition, as shown on the graph below, CA has been declining in the source area in recent years, consistent with the principles of natural attenuation.



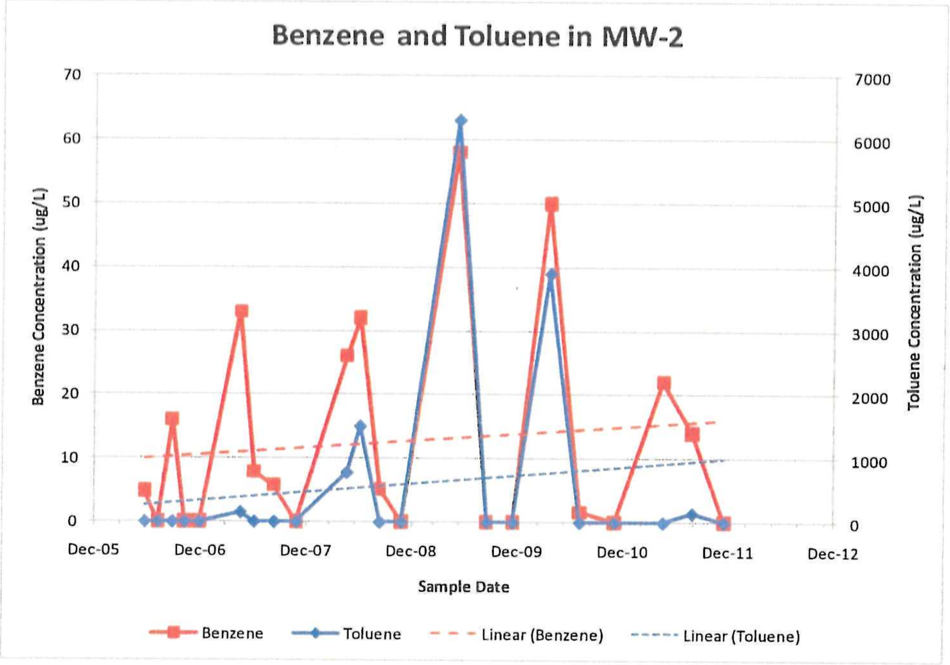
Similarly, low-level detections of 111-TCA in boundary wells MW-9 and MW-11 in recent years also demonstrate trends of declining concentrations (see graph below). Unlike wells in or near the source area, however, degradation by-products are infrequently detected at concentrations that typically do not exceed regulatory criteria. Degradation is undoubtedly occurring at the boundary locations, particularly at MW-11, based on the observed redox conditions. However, the starting concentrations of the parent 111-TCA are sufficiently low to yield by-product concentrations that are very low and often below the method detection limits.



As noted in previous reports prepared by Conestoga-Rovers & Associates (CRA), the anaerobic degradation of CA is a relatively slow process; accordingly, by-product CA would be expected to migrate from the source area with the groundwater flow, degrading anaerobically over time. As the flow of groundwater approaches the more aerobic areas to the west, however, it is likely that the CA will be degraded more rapidly via aerobic mechanisms. Since aerobic degradation of CA is a faster process, it is likely that CA will not reach the boundary wells, and the analytical data supports this conclusion. The absence of CA in the boundary wells confirms that the higher concentrations that are present in the vicinity of the source are themselves degraded during their migration from the source area towards the boundary wells.

BTEX Constituents

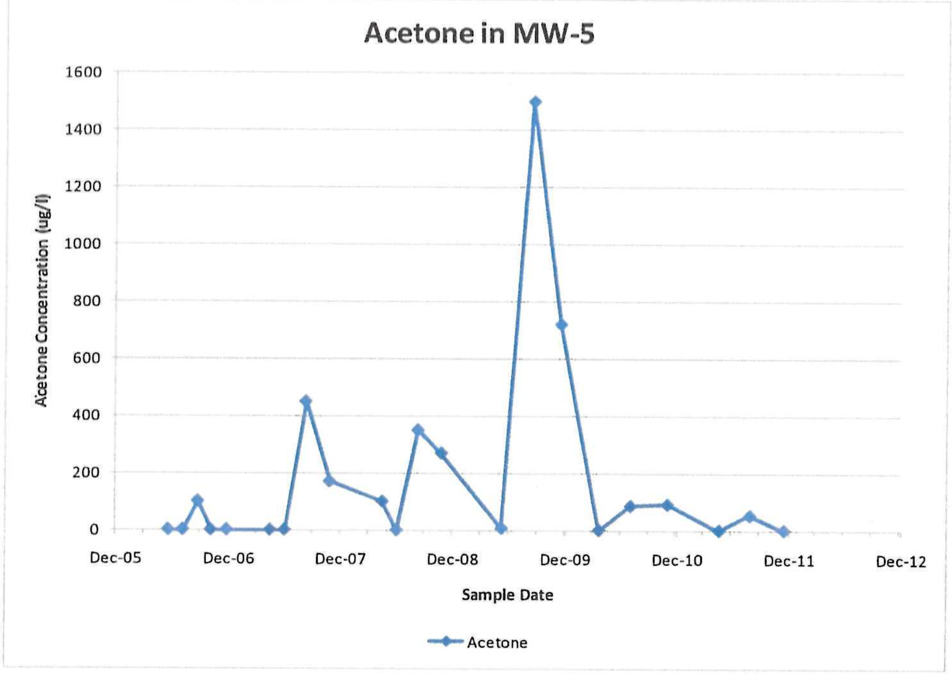
Benzene, toluene, ethylbenzene, and xylenes (BTEX) have historically been detected in the source area, including in well MW-2. Unlike the results for chloroethane discussed above, however, benzene and toluene concentrations in MW-2 have modestly increased in recent years, with the more significant detections typically occurring in the spring months (March, April, May, and June; see figure below) and declining through the remainder of the year. This suggests that the BTEX source may be associated with a water table smear zone that becomes seasonally saturated during periods of relatively higher groundwater levels. It should be noted that the trend of increasing concentration is driven by the results for 2009 and 2010; the results for the 2011 monitoring year generally demonstrate lower concentrations than historically observed. The results for ethylbenzene and xylenes are also generally lower in 2011 compared to prior years.



Some anaerobic degradation of the BTEX constituents present in the source area is likely occurring. As the flow of groundwater approaches the more aerobic areas to the west, however, BTEX constituents not degraded in the source area will likely be degraded aerobically. Accordingly, off-site migration of BTEX is not likely to occur. This hypothesis is supported by the historic absence of BTEX detections in the boundary monitoring wells. As in prior years, there were no detections of BTEX constituents in the boundary wells during the 2011 monitoring year.

Acetone

Acetone has frequently been detected in Site monitoring wells at low concentrations that may be associated with laboratory artifacts. More significant detections of acetone have been noted in monitoring well MW-5, with concentrations as high as 1,500 ug/L detected in August 2009. During the 2011 monitoring year, however, acetone was detected only once at the MW-5 location, at a concentration of 52 ug/L, exceeding the relevant groundwater quality criteria (50 ug/L). However, with the exception of 2009, concentrations have generally been declining since 2007 (see graph below). Acetone is readily biodegradable under aerobic conditions and is likely to be fully degraded within a relatively short distance downgradient of monitoring well MW-5.



Conclusions

The 111-TCA previously present in the source area appears to have been fully degraded to chloroethane, and the parent compound was no longer detected in the source area during the 2011 monitoring year. The by-product chloroethane continues to degrade under anaerobic conditions in the source area or degrades aerobically as it migrates towards the Site boundary. The absence of CA in the boundary wells confirms that the higher concentrations that are present in the vicinity of the source are themselves degraded during their migration from the source area towards the boundary wells.

111-TCA is already present in the aerobic boundary area. Low-level detections of 111-TCA in boundary wells MW-9 and MW-11 in recent years, however, demonstrate trends of declining concentrations. Unlike wells in or near the source area, degradation by-products are infrequently detected at concentrations that typically do not exceed regulatory criteria. Degradation is undoubtedly occurring at the boundary locations, particularly at MW-11, based on the observed redox conditions. However, the starting concentrations of the parent 111-TCA are sufficiently low to yield by-product concentrations that are very low and often below the method detection limits.

Anaerobic degradation of the BTEX constituents present in the source area is also likely occurring. As the flow of groundwater approaches the more aerobic areas to the west, however, BTEX constituents not degraded in the source area will likely be degraded aerobically. Accordingly, off-site migration of BTEX is not likely to occur. This hypothesis is supported by the historic absence of BTEX detections in the boundary monitoring wells. As in prior years, there were no detections of BTEX constituents in the boundary wells during the 2011 monitoring year.

On balance, the data indicate that monitored natural attenuation is achieving the objective of reducing concentrations of the organic constituents below relevant groundwater quality standards in the boundary monitoring wells.

WFD/akg

Appendix D

Water Level Measurements - 2011

Akzo Nobel Polymer Chemicals LLC
WATER LEVEL ELEVATION DATA
2011

	MW-1		MW-1B		MW-2		MW-3		MW-3B		MW-4	
TOP OF CASING ELEVATION		328.51		328.29		327.58		322.58		321.85		323.12
DATE	water level	elevation	water level	elevation	water level	elevation	water level	elevation	water level	elevation	water level	elevation
4/19/2011	6.41	322.10	7.21	321.08	5.73	321.85	3.14	319.44	10.81	315.42	6.79	316.33
7/28/2011	11.54	316.97	-	-	9.87	317.71	6.80	315.78	-	-	9.58	313.54
11/17/2011	13.09	315.42	7.21	321.08	10.59	316.99	7.13	315.45	10.81	311.04	9.65	313.47

Akzo Nobel Polymer Chemicals LLC
WATER LEVEL ELEVATION DATA
2011

	MW-4B		MW-5		MW-6		MW-7		MW-8		MW-9	
TOP OF PVC PIPE ELEVATION	323.66		324.68		325.31		324.10		326.23		325.03	
DATE	water level	elevation	water level	elevation	water level	elevation	water level	elevation	water level	elevation	water level	elevation
4/19/2011	20.18	303.48	8.05	316.63	-	-	-	-	-	-	4.60	320.43
7/28/2011	21.73	301.93	6.71	317.97	-	-	-	-	-	-	7.84	317.19
11/17/2011	16.81	306.85	7.76	316.92	7.79	317.52	6.53	317.57	8.81	317.42	8.60	316.43

Akzo Nobel Polymer Chemicals LLC
WATER LEVEL ELEVATION DATA
2011

	MW-9B		MW-10		MW-10B		MW-11		MW-11B		-	
TOP OF PVC PIPE ELEVATION		325.21		328.39		328.12		325.76		325.32		
DATE	water level	elevation	water level	elevation	water level	elevation	water level	elevation	water level	elevation		
4/19/2011	23.16	302.05	6.37	322.02	23.51	304.61	10.62	315.14	22.22	303.10		
7/28/2011	24.47	300.74	6.24	322.15	-	-	13.85	311.91	23.66	301.66		
11/17/2011	19.66	305.55	11.38	317.01	23.51	304.61	14.31	311.45	19.12	306.20		