Akzo Nobel Polymer Chemicals

Burt, New York

2012 Annual Monitoring Report

November 2012

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Prepared For:

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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 2012 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 seventh annual report prepared for the Site, and summarizes data collected for 2012.

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, during the First Trimester monitoring event. 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 2012 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 2012 for the 14 monitoring wells are summarized briefly below.

Well	Comparison of TCL VOCs in Groundwater with NYCRR 703.5 Groundwater Standards	
MW-1	No results above action limits.	
MW-1B	No results above action limits.	
MW-2	Benzene (5.8 µg/L versus action limit of 1 µg/L)	03/29/12
	Benzene (1.5 µg/L versus action limit of 1 µg/L)	06/28/12
	Chloroethane (56 µg/L versus action limit of 5 µg/L)	03/29/12
	Chloroethane (54 µg/L versus action limit of 5 µg/L)	06/28/12
	Chloroethane (35 µg/L versus action limit of 5 µg/L)	10/10/12
	1,2-Dichloroethane (0.98J µg/L versus action limit of 0.6 µg/L)	03/29/12
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 (310 µg/L versus action limit of 50 µg/L)	06/28/12
	Acetone (2000 µg/L versus action limit of 50 µg/L)	10/10/12
MW-9*	1,1,1-Trichloroethane (11 µg/L versus action limit of 5 µg/L)	03/29/12
	1,1,1-Trichloroethane (8.9 µg/L versus action limit of 5 µg/L)	06/28/12
	1,1,1-Trichloroethane (9.8 µg/L versus action limit of 5 µg/L)	10/10/12
MW-9B*	No results above action limits	
MW-10*	No results above action limits	
MW-10B*	No results above action limits	
MW-11*	No results above action limits	
MW-11B*	No results above action limits	

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

None of the boundary wells exhibited any exceedances during the 2012 monitoring events. MW-9 was the only downgradient monitoring well with exceedances of 6 NYCRR Part 703.5 standards during 2012. 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. Boundary well cluster MW-11 and MW-11B, located downgradient of MW-9 and depicted on Figure 2, was installed in February 2007 and was sampled during all 2012 sampling programs. 1,1,1-Trichloroethane was not detected in either MW-11 or MW-11B in 2012, and 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.

Acetone was detected in MW-5 at a concentration of 310 µg/L in June and 2000 µg/L in October, versus the 6NYCRR Part 703.5 action limit of 50 µg/L. Acetone has historically been detected within MW-5, and it will be closely evaluated during upcoming monitoring events to evaluate for any developing trends.

Interior monitoring well MW-2 has historically exhibited concentrations of several groundwater monitoring constituents above 6NYCRR Part 703.5 standards. Data for 2012, summarized below, continues to illustrate a pronounced decrease in measured concentrations of detected volatile organic compounds.

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

Parameter	Action Limits for 6NYCRR Part 703.5 (µg/L)	March 2012 (µg/L)	June 2012 (µg/L)	October 2012 (µg/L)
1,2-Dichloroethane	0.6	0.98J	<AL	ND
Benzene	1	ND	5.8	1.5
Chloroethane	5	56	54	35

<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 (source area monitoring has been discontinued as of 2012). 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 during the 2012 monitoring year confirms that the higher concentrations historically 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, continued in 2012 to 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 significant BTEX detections in the boundary monitoring wells. There were, however, limited detections of BTEX constituents monitoring well MW-2 during the 2012 monitoring year.

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 historical concentrations as high as 1,500 ug/L detected in August 2009. During the 2012 monitoring year, however, significant detections of acetone occurred at the MW-5 location, where the relevant groundwater quality criteria (50 ug/L) were exceeded in both the June and October 2012 sampling events. 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.

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 2012 and Appendix B presents the bedrock groundwater contours for 2012. Based on the assessment of 2012 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 2012. A downward vertical gradient was also observed at the MW-4/MW-4B, MW-9/MW-9B and MW-11/MW-11B clusters throughout the 2012 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 2012 are found in Appendix D.

6.0 Conclusions

The three reports issued for 2012 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 2012 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.
- Interior monitoring location MW-2 continues to exhibit benzene and chloroethane at a concentration in excess of 6 NYCRR Part 703.5 standards.
- The direction of overburden groundwater flow was generally west-northwest to westward. The direction of bedrock groundwater flow was generally to the southwest. Downward vertical gradients were observed at the, MW-4/MW-4B, MW-9/MW-9B and MW-11/MW-11B clusters throughout the 2012 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 2012 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 2012 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 each of the three 2012 sampling events with the highest concentration reported in the Third

Quarter (2000 ug/L). Acetone has been detected intermittently and, despite being a common laboratory contaminant, it 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 concentration of acetone within MW-5 will be closely evaluated during upcoming monitoring events to assess for any developing trends. If concentrations of acetone continue to increase at MW-5, an Interim Corrective Measure (ICM) may need to be developed and implemented in accordance with Module II Section 1(a)(ii).

- 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 2013.

Table 1

Summary of MNA Indicator Parameter Data

TABLE 1
SUMMARY OF MNA INDICATOR PARAMETER DATA

Well ID	ORP Millivolts 3/29/2012	ORP Millivolts 6/8/2012	ORP Millivolts 10/10/12	Average ORP Millivolts 2012	DO mg/L 3/29/2012	DO mg/L 6/8/2012	DO mg/L 10/10/12	Average DO mg/L 2012	Dissolved Iron mg/L 3/29/2012	Dissolved Iron mg/L 6/8/2012	Dissolved Iron mg/L 10/10/12	Average mg/L 2012	Dissolved Mn mg/L 3/29/2012	Dissolved Mn mg/L 6/8/2012	Dissolved Mn mg/L 10/10/12	Average mg/L 2012
MW-1	185	87	80	117	8.82	2.40	1.47	4.2	0	0.58	0.00	0.19	0.00	0.13	0.01	0.05
MW-1B	46	--	--	46	4.72	--	--	4.7	0	--	--	0.00	0.52	--	--	0.52
MW-2	-111	-119	-94	-108	1.45	1.46	1.50	1.5	0.00	2.77	2.36	1.71	0.00	2.03	1.62	1.22
MW-3	98	105	126.6	110	7.02	5.18	6.40	6.2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-3B	70	--	--	70	2.53	--	--	2.5	0.00	--	--		0.06	--	--	0.06
MW-4	100	112	135	116	7.33	5.71	5.14	6.1	0	0.00	0.00	0.00	0.01	0.03	0.05	0.03
MW-4B	99	132	119	117	2.05	4.02	2.34	2.8	0.00	0.00	0.00	0.00	0.08	0.17	0.07	0.11
MW-5	92	106	117	105	3.15	2.62	--	2.9	0.00	0.00	0.00	0.00	0.13	0.00	0.04	0.06
MW-9	125	32	155	104	2.70	5.77	4.31	4.3	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.02
MW-9B	100	101	151	117	3.32	2.27	2.31	2.6	0	0.00	0.00	0.00	0.04	0.05	0.04	0.04
MW-10	120	84	149	118	5.35	2.45	5.92	4.6	3.19	0.10	0.00	1.10	2.19	0.05	0.05	0.76
MW-10B	104	--	--	104	1.22	--	--	1.2	0.20	--	--	0.20	0.06	--	--	0.06
MW-11	119.1	4	-34	30	2.45	1.74	1.84	2.0	0.00	0.31	0.39	0.23	0.13	0.20	0.21	0.18
MW-11B	87	117	48	84	4.71	4.41	4.70	4.6	0.00	0.00	0.00	0.00	0.05	0.02	0.02	0.03
Average	88	69	87	81	4.1	3.5	3.6	3.7	0.24	0.34	0.25	0.28	0.23	0.25	0.20	0.23
Min	-111	-119	-94	-119	1.2	1.5	1.5	1.2	ND	ND	ND	ND	ND	ND	ND	ND
Max	185	132	155	185	8.8	5.8	6.4	8.8	3.19	2.77	2.36	3.19	2.19	2.03	1.62	2.19

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
	3/29/2012	*6/8/2012*	*10/10/12*	*2012*	*3/29/2012*	*6/8/2012*	*10/10/12*	*2012*	*3/29/2012*	*6/8/2012*	*10/10/12*	*2012*
MW-1	44.9	37.6	37.1	40	0	0	0	0	0	21	5.5	8.8
MW-1B	1290	--	--	1290	0	--	--	0	6	--	--	6.0
MW-2	19.5	18.9	41.3	27	0	0	0	0	9,100	12000	7100	9400
MW-3	120	111	121	117	0	0	0	0	0	0	0	0.0
MW-3B	46.9	--	--	47	0	--	--	0	33	--	--	33.0
MW-4	22.7	24.6	61.3	36	0	0	0	0	0	0	0	0.0
MW-4B	892	1100	956	983	0	0	0	0	5	6.4	5.1	5.5
MW-5	11.7	56.7	81.6	50	0	5.1	1.8	2.3	0	0	0	0.0
MW-9	57.6	52.9	56.1	56	4.1	4.9	4.6	4.5	8.2	0	1.1	3.1
MW-9B	698	684	722	701	0	0	0	0	6.9	7.5	7.3	7.2
MW-10	39.1	50	53.5	48	1.7	5.8	5.8	4.4	0	6	0	2.1
MW-10B	116	--	--	116	0	--	--	0	190	--	--	190.0
MW-11	67.3	71.6	78.9	73	0	0	0	0	5.3	220	87	104.1
MW-11B	300	86.3	220	202	0	0	0	0	31	23	11	21.7
Average	266.1	208.5	220.8	232	0.4	1.4	1.1	1.0	670	1117	656	814
Min	ND	18.9	37.1	ND	ND	ND	ND	ND	0.0	0.0	0.0	0.0
Max	1290	1100	956	1290	4.1	5.8	5.8	5.8	9100	12000	7100	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.

1000' 0 1000'
1"=1000'

Barton & Loguidice, P.C.

AKZO NOBEL POLYMER CHEMICALS LLC

SITE LOCATION MAP

TOWN OF BURT
NIAGARA COUNTY, NEW YORK

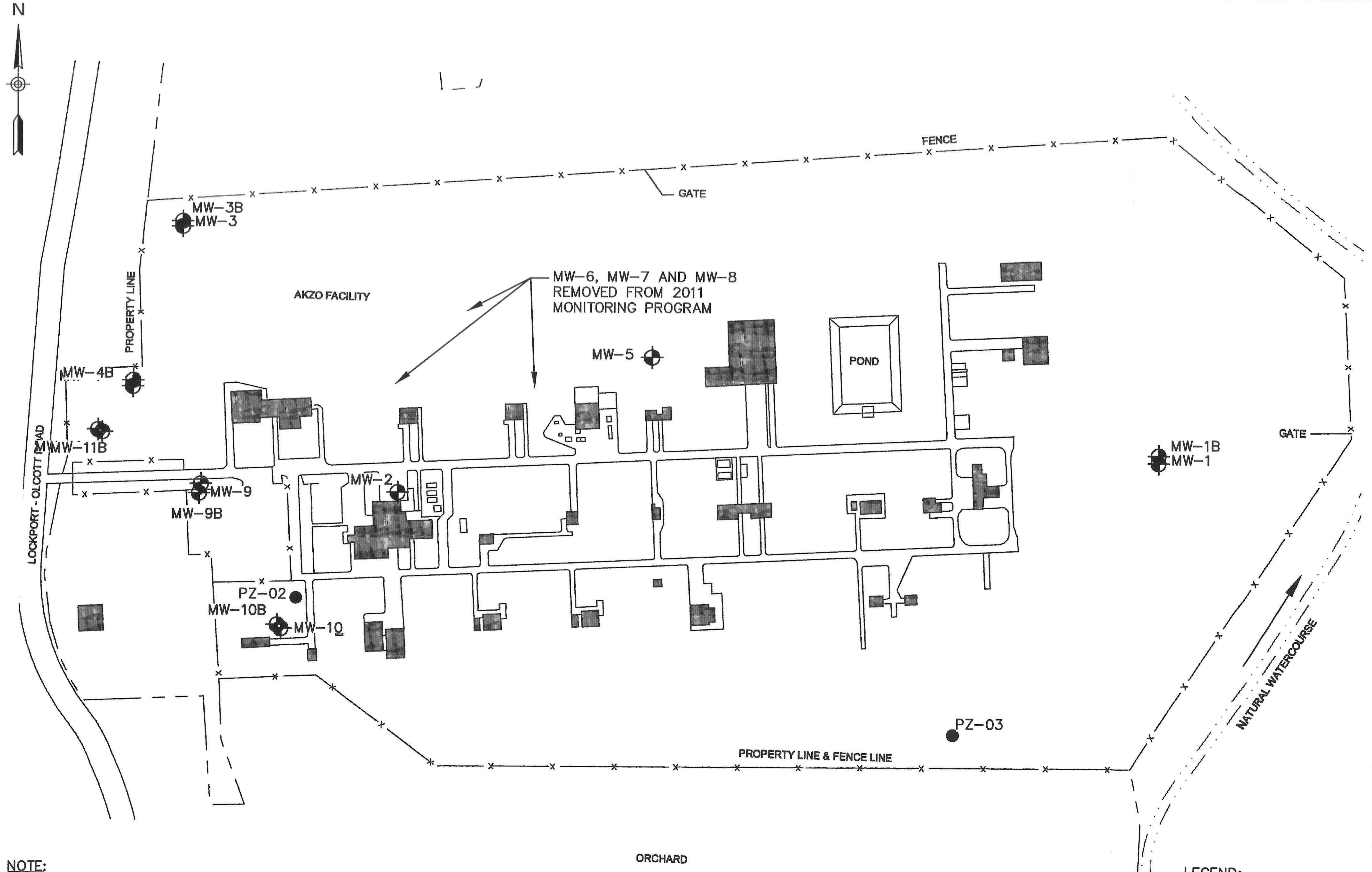
Figure Number	1
Project Number	1398.002
Date	NOVEMBER, 2012
Scale	AS SHOWN

Plotted: Jan 14, 2013 – 10:52AM SYR By: jgs
I:\Shared\1300\1398002\1398002_FIG1.dwg

Figure 2

Monitoring Well Locations

Plotted: Jan 14, 2013 – 11:49AM SYR By: jgs
I:\Shared\1300\1398002\1398002_OCTOBER_2012_FIGS.dwg



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
- ● PIEZOMETER

AKZO NOBEL POLYMER CHEMICALS LLC

WELL LOCATIONS

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date
NOVEMBER, 2012

Scale
1"=200'

Figure Number
2

Project Number
1398.001

Appendix A

Overburden Groundwater Contours – 2012

Plotted: Apr 24, 2012 – 8:54AM SYR By: jgs
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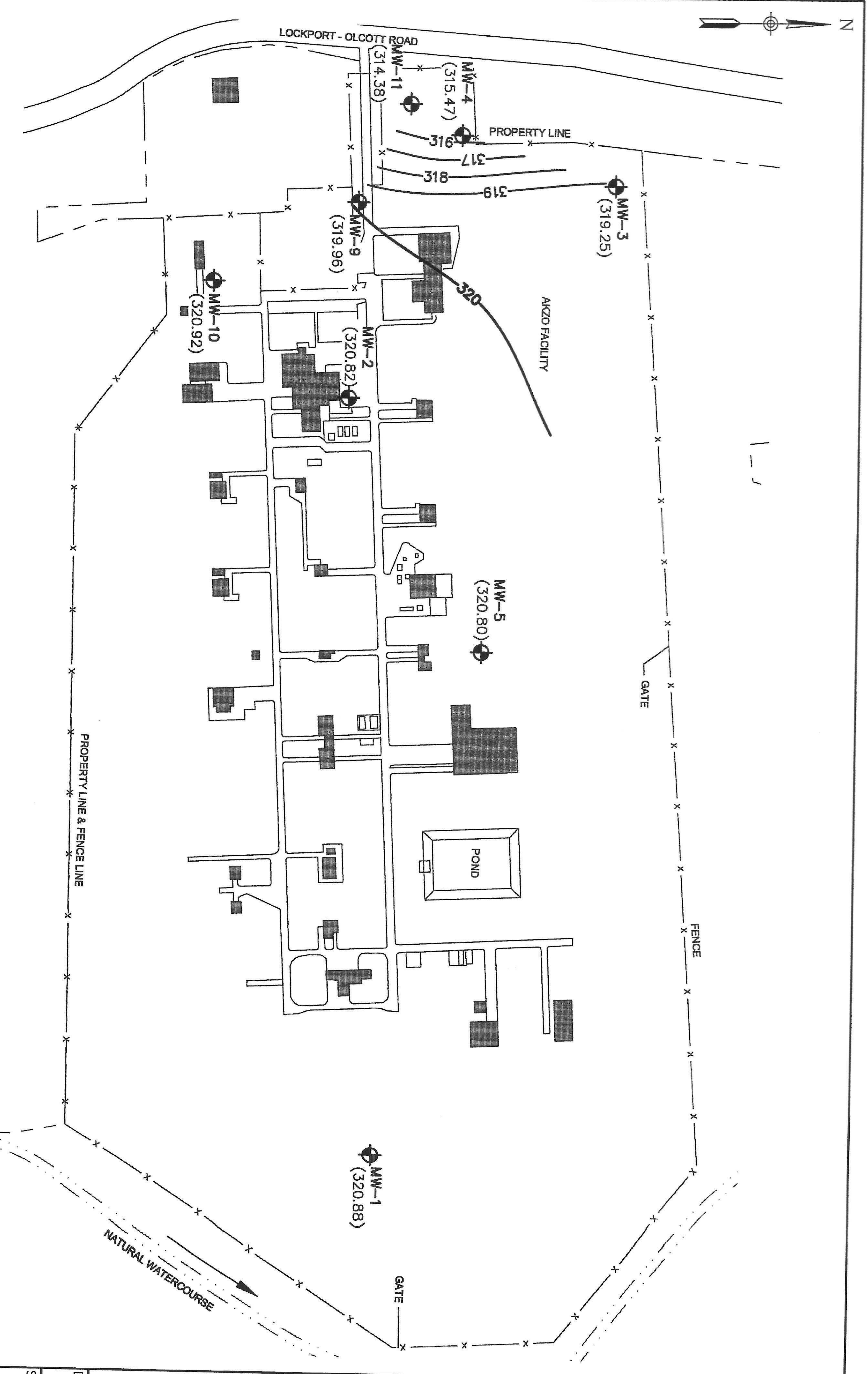

NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:
TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:
⊕ MONITORING WELL
322.02 GROUNDWATER ELEVATION (FT. AMSL)

Barton & Loguidice, P.C.

Date
APRIL, 2012

Scale
1"=200'

Figure Number
4

Project Number
1398.002

AKZO NOBEL POLYMER CHEMICALS LLC

OVERBURDEN GROUNDWATER CONTOURS
MARCH, 2012

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Plotted: Aug 23, 2012 – 8:26AM SYR By: mj
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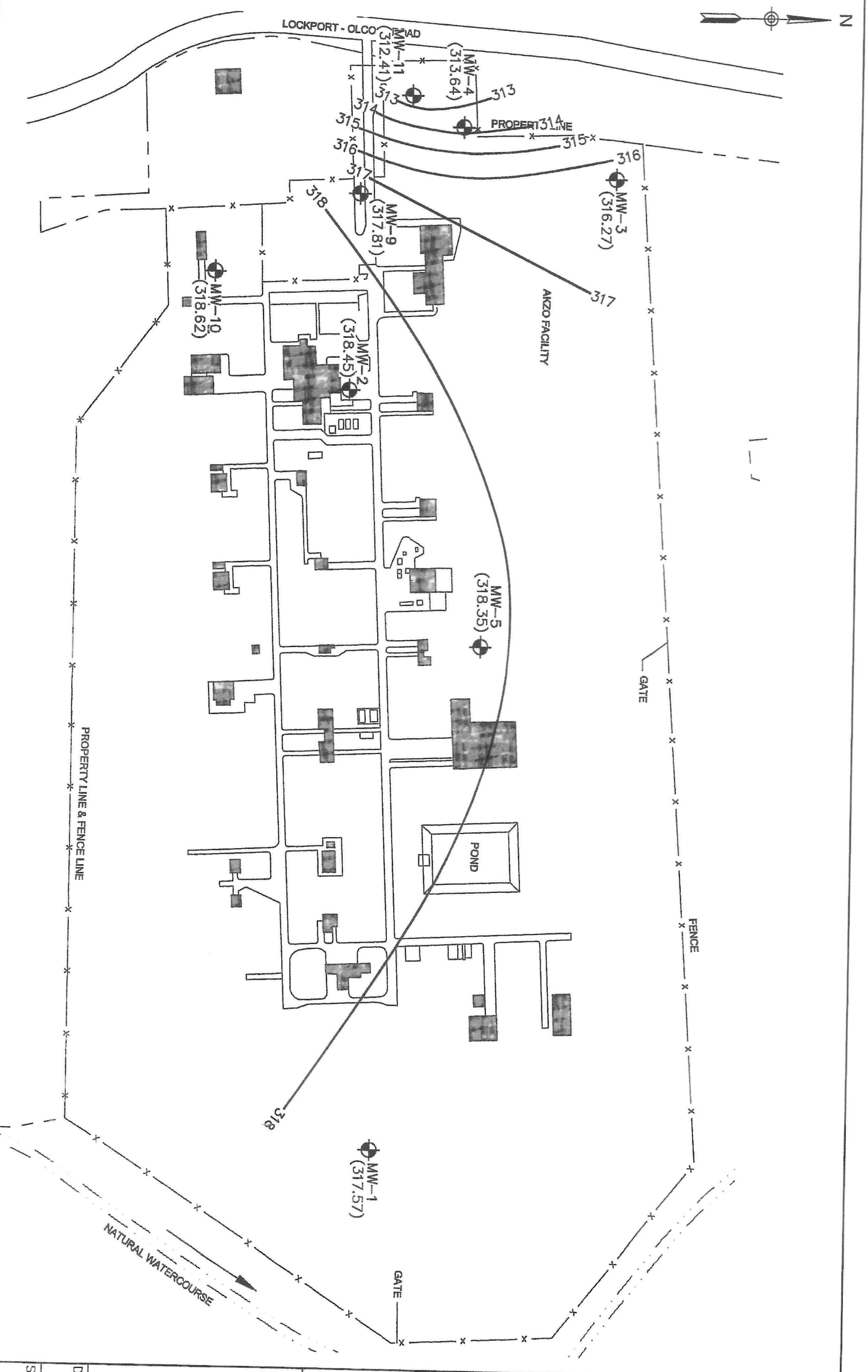

NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

SOURCE:
TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:

⊕	MONITORING WELL
322.02	GROUNDWATER ELEVATION (FT. AMSL)

AKZO NOBEL POLYMER CHEMICALS LLC

OVERBURDEN GROUNDWATER CONTOURS
JUNE, 2012

TOWN OF BURT
NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date: AUGUST, 2012
Scale: 1"=200'
Figure Number: 4
Project Number: 1398.002

Plotted: Jan 08, 2013 – 12:51PM SYR By: jgs
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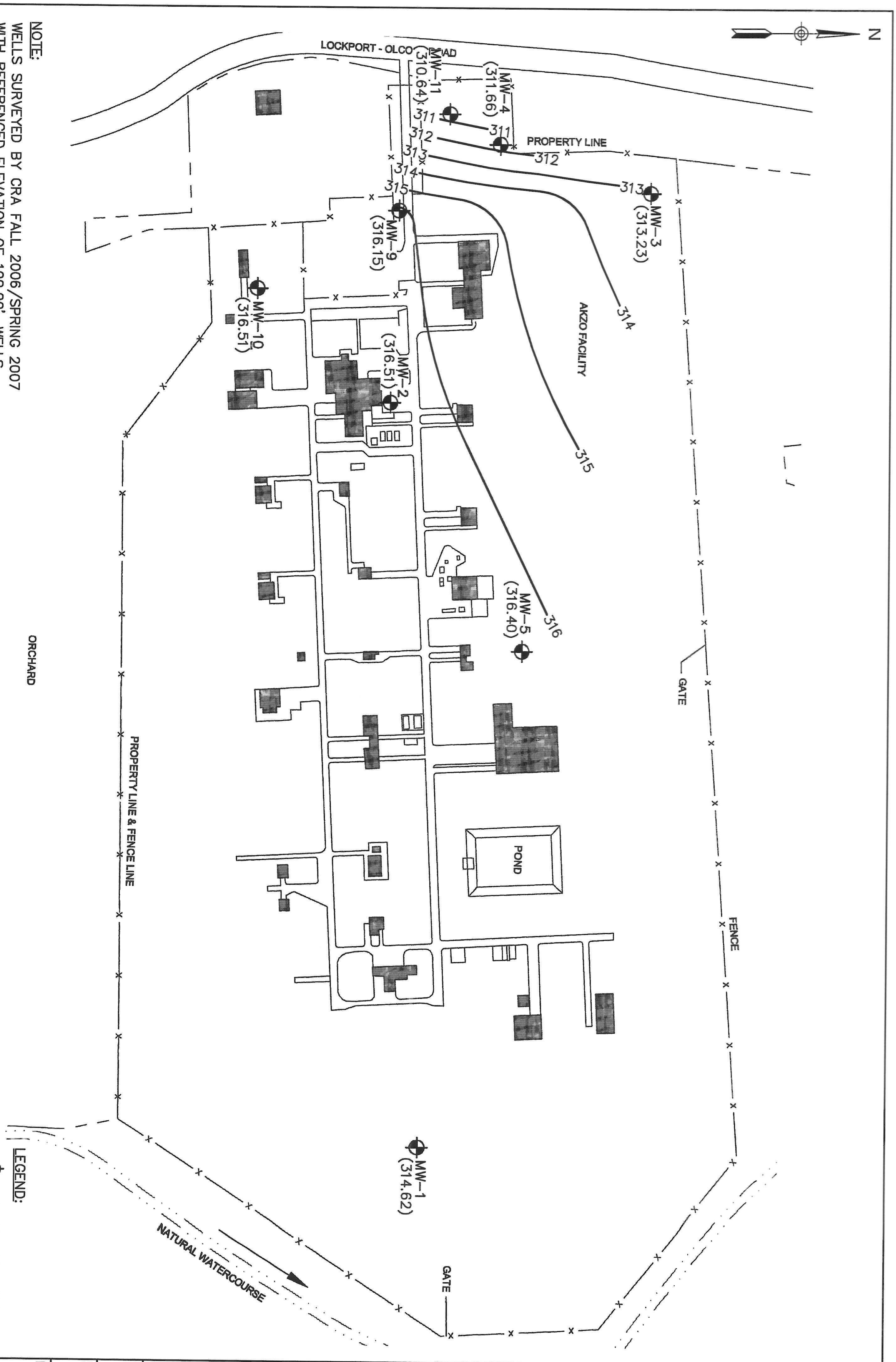


NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007
WITH REFERENCED ELEVATION OF 100.00'. WELLS
RESURVEYED SPRING 2007 IN STATE PLANE NY WEST
NAD83 VERTICAL DATUM NAVD88.

SOURCE:
TRC FIGURE FACILITY LOCATION MAP PJ.#19045

LEGEND:
⊕ MONITORING WELL
322.02 GROUNDWATER ELEVATION (FT. AMSL)

Date	NOVEMBER, 2012
Scale	1"=200'
Figure Number	4
Project Number	1398.002

Barton & Loguidice, P.C.

AKZO NOBEL POLYMER CHEMICALS LLC

OVERBURDEN GROUNDWATER CONTOURS
OCTOBER, 2012

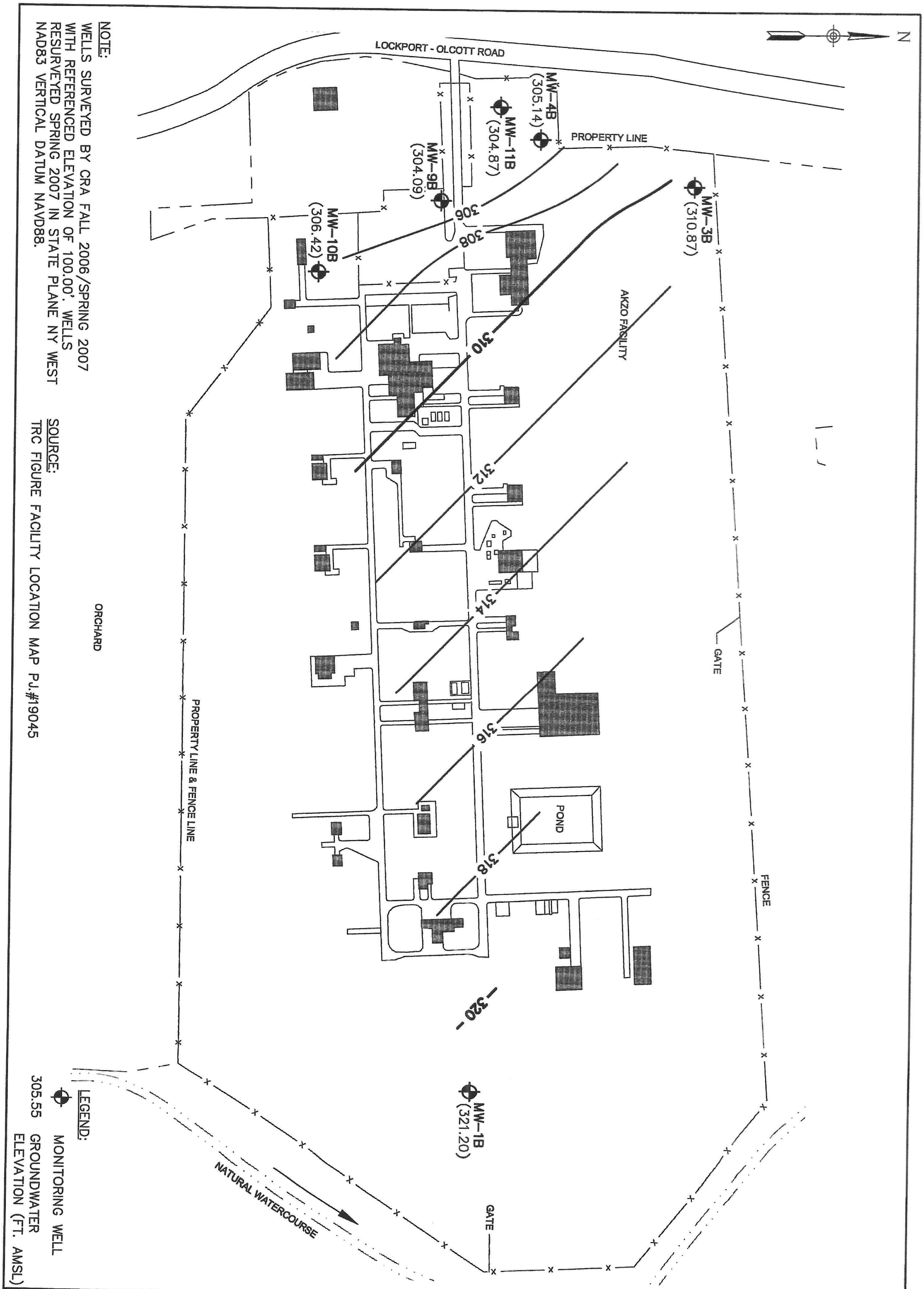
TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Appendix B

Bedrock Groundwater Contours – 2012

Plotted: May 03, 2012 – 8:43AM SYR By: jgs
I:\Shared\1300\1398002\1398002_MARCH_2012_FIGS.dwg



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
MARCH, 2012

TOWN OF BURT
NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date
MAY, 2012

Scale
1"=200'

Figure Number
5

Project Number
1398.002

Plotted: Aug 23, 2012 – 8:28AM SYR By: mj
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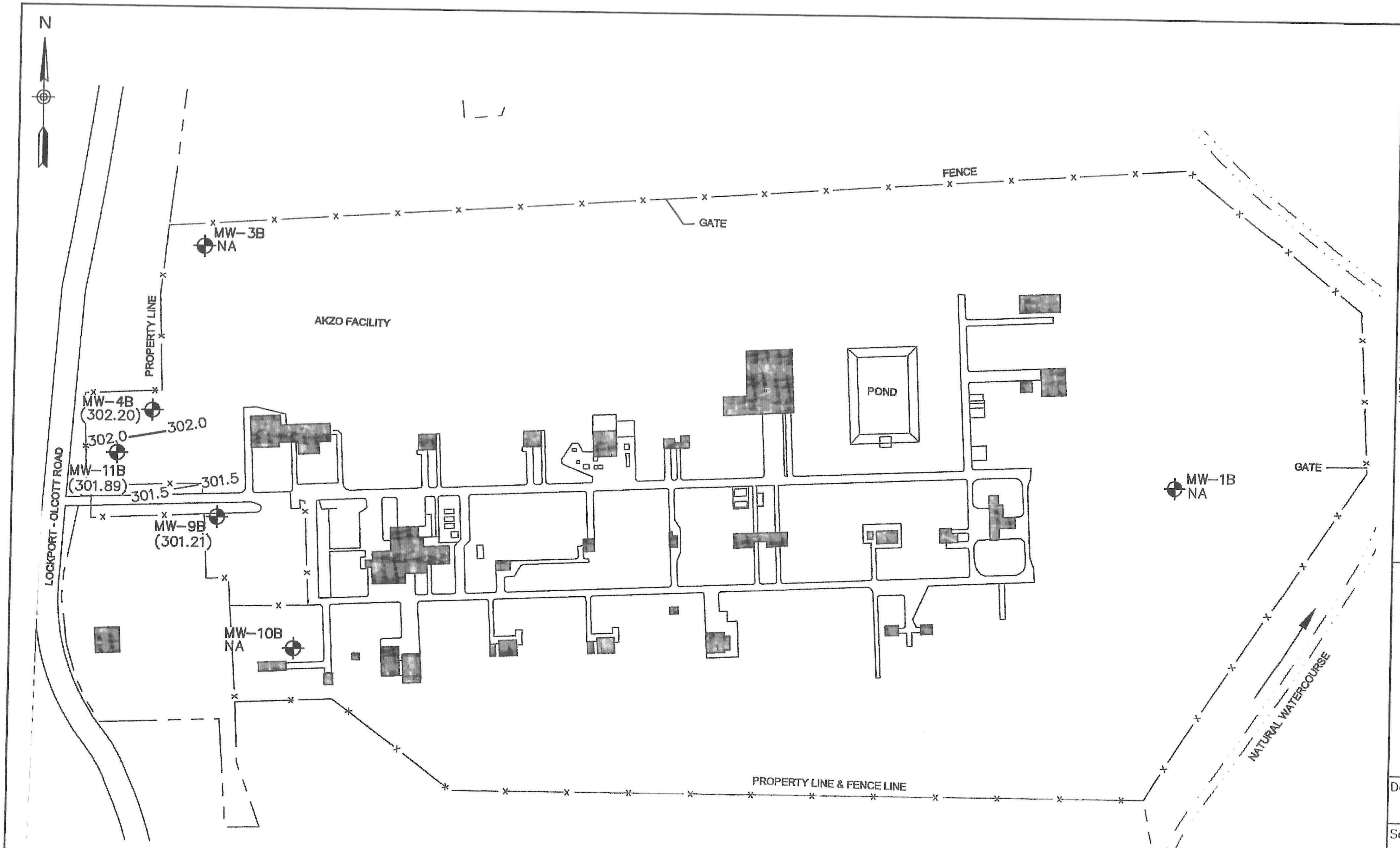

NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007 WITH REFERENCED ELEVATION OF 100.00'. WELLS RESURVEYED SPRING 2007 IN STATE PLANE NY WEST NAD83 VERTICAL DATUM NAVD88.

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
JUNE, 2012

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	AUGUST, 2012
Scale	1"=200'
Figure Number	5
Project Number	1398.002

Plotted: Jan 08, 2013 – 12:50PM SYR By: jgs
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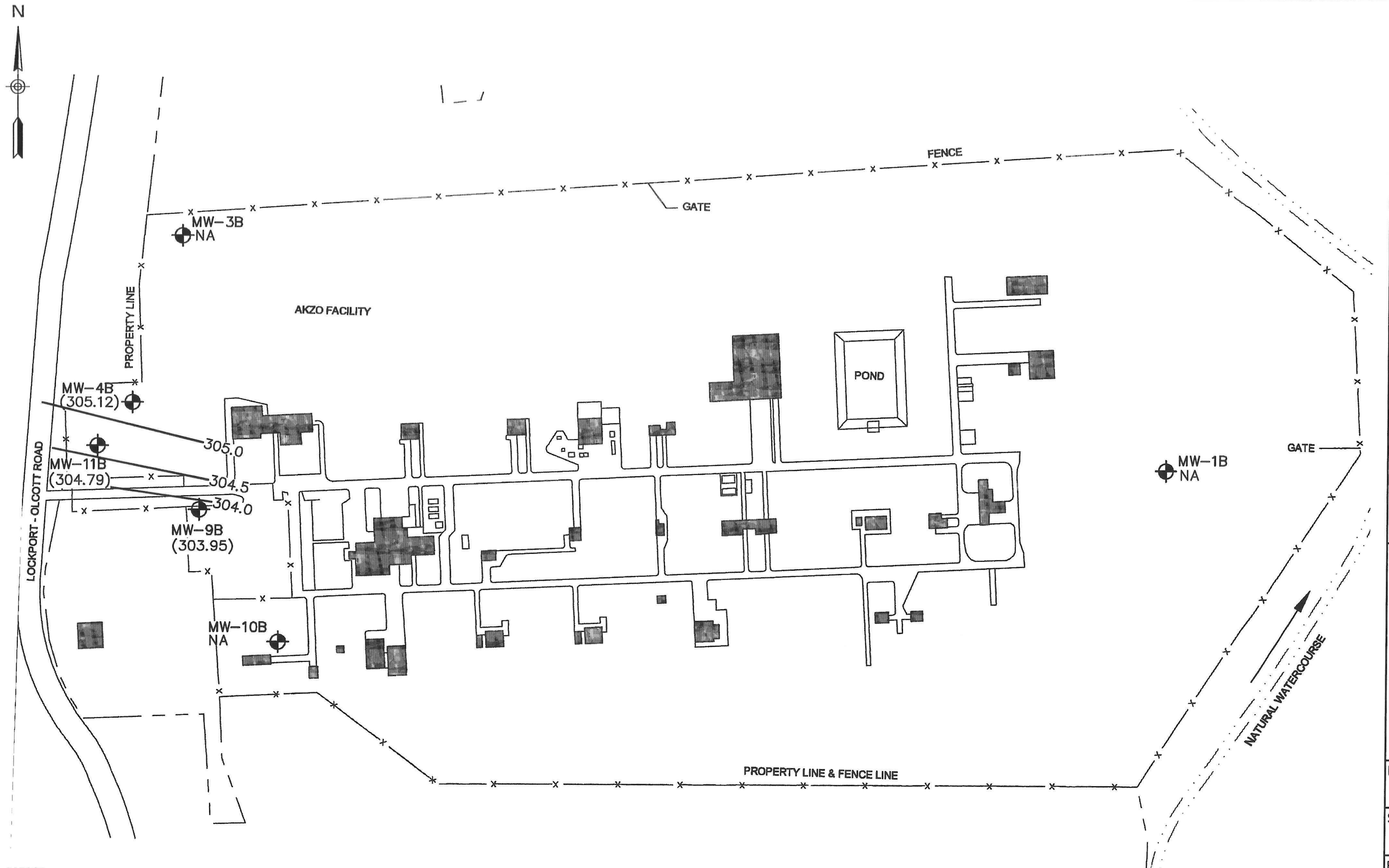


NOTE:
WELLS SURVEYED BY CRA FALL 2006/SPRING 2007
WITH REFERENCED ELEVATION OF 100.00'. WELLS
RESURVEYED SPRING 2007 IN STATE PLANE NY WEST
NAD83 VERTICAL DATUM NAVD88.

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
OCTOBER, 2012

TOWN OF BURT

NIAGARA COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	NOVEMBER, 2012
Scale	1"=200'
Figure Number	5
Project Number	1398.002

Appendix C

Evaluation of Natural Attenuation Data

Barton & Loguidice, P.C.

Memo to: File **Date:** January 15, 2013

From: Michael R. Brother **File:** 1398.002.001

Subject: MNA Memo

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 2012 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 2012 monitoring year (Table 1). Average ORP values ranged from -119 mV at MW-2 to 185 mV at MW-1, with an average of 81 mV. DO concentrations ranged from 1.22 mg/L at MW-10B to 8.82 mg/L at MW-1, with an average DO concentration of 3.7. DO is relatively depleted in wells MW-2, MW-3B, MW-4, MW-5, MW-9, MW-9B, MW-10B, and MW-11 (average = 2.3 mg/L), although ORP levels suggest that marginally oxidizing conditions continue to exist at these locations (average = 53 mV). At MW-2, on the other hand, the average DO concentration is 1.5 mg/L, with an average ORP of -108 mV.

Dissolved iron concentrations ranged from non-detect (multiple locations) to 3.19 mg/L (MW-10), with an average dissolved iron concentration of 0.28 mg/L. There were only limited dissolved iron detections in the bedrock monitoring wells. Dissolved manganese ranged from non-detect (multiple locations) to 2.19 mg/L (MW-10). MW-11 was the only well other than MW-2 to have multiple detections of both dissolved iron and dissolved manganese during the 2012 monitoring year.

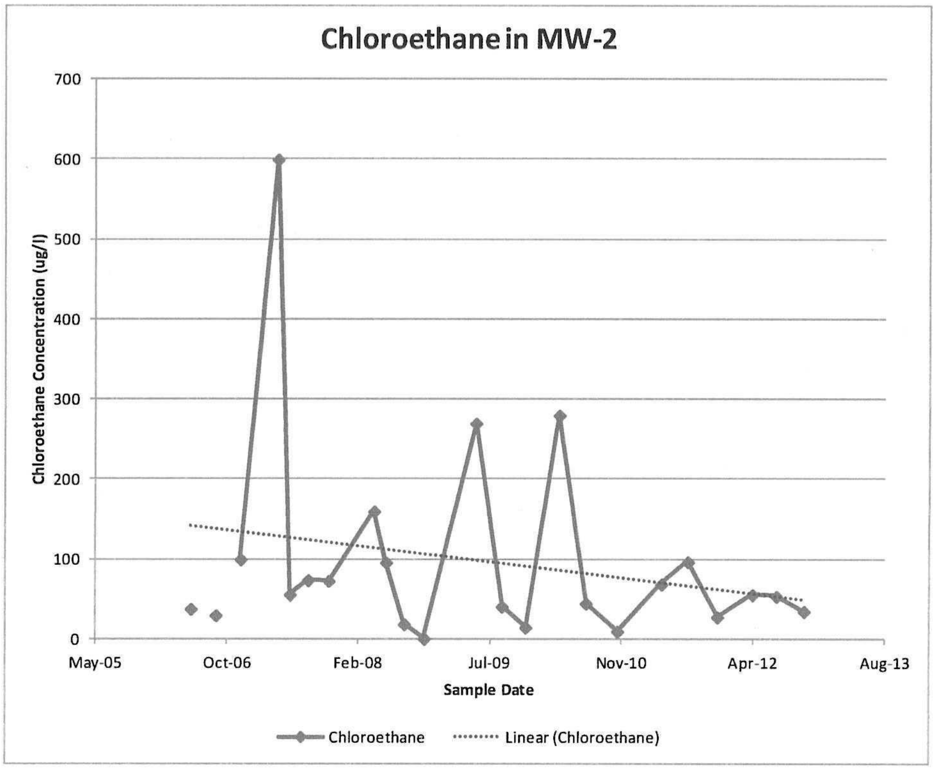
Nitrate was detected at only four locations (MW-5, MW-9, and MW-10), all of which are screened in the overburden. In the wells with nitrate detections at least once during 2012, the concentrations ranged from non-detect (MW-5) to 5.8 mg/L (MW-10). These observations suggest that the denitrification process is incomplete at these locations.

Methane concentrations were greatest at monitoring well MW-2, averaging 9,767,400 ug/L during the 2012 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 wells MW-10 (March 2012 only) and MW-11, where methane concentrations averaged 104.1 ug/L during the 2012 monitoring year. Methane concentrations at these locations appear to be elevated compared to the available historical data.

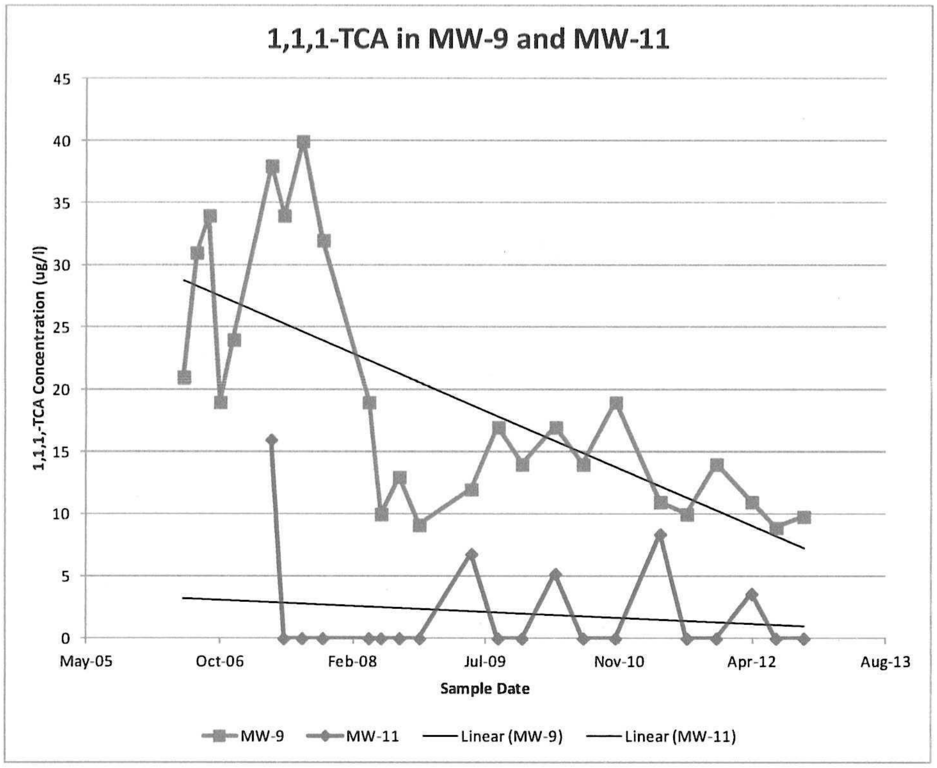
In general, the MNA indicator data are consistent with the results from prior monitoring years. Strongly reducing conditions favoring reductive dechlorination are present in the vicinity of well MW-2. A zone where oxygen levels have been reduced, but conditions remain moderately aerobic (as evidenced 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 2012 monitoring year, both CA and 11-DCA were again detected in MW-2. Low-level concentrations of 11-DCA were also detected at monitoring wells MW-9, MW-10B, and MW-11.The absence of 111-TCA and the presence of only low concentrations of 11-DCA suggest 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.



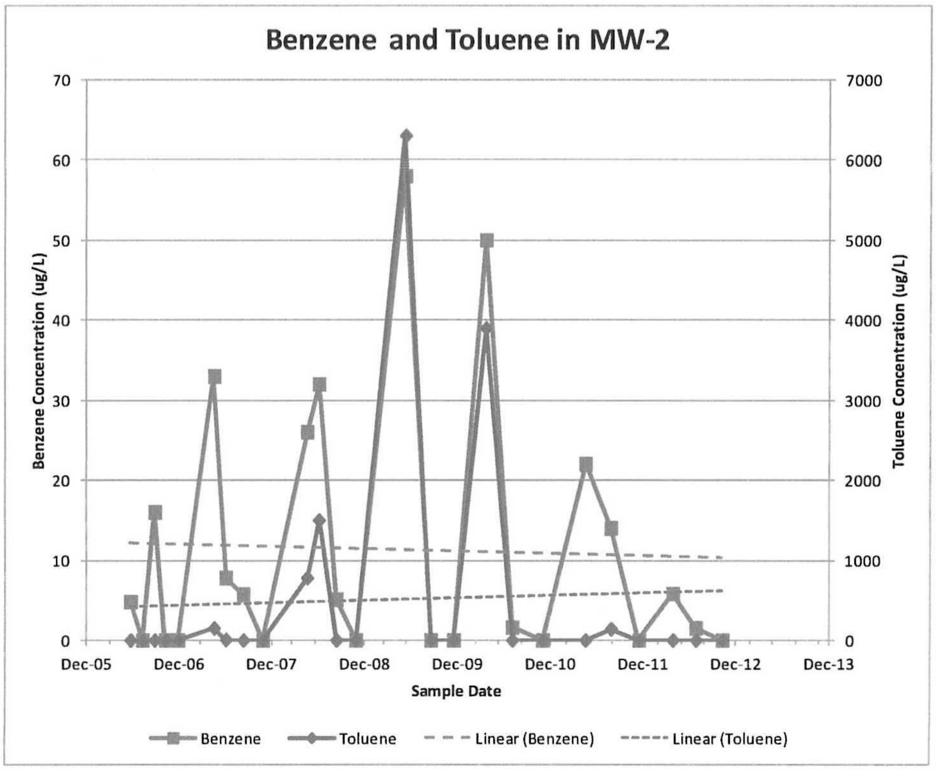
Similarly, low-level detections of 111-TCA in boundary wells MW-9 and MW-11 in recent years also demonstrate trends of declining concentrations (see graph below). Unlike wells in or near the source area, however, degradation by-products are infrequently detected at concentrations that typically do not 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

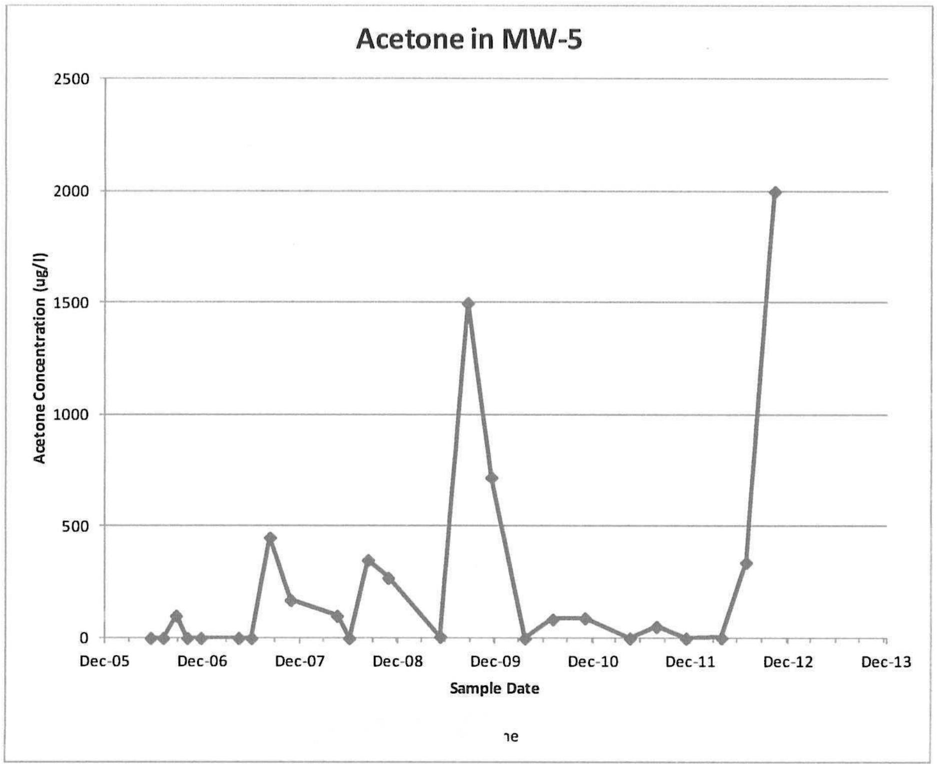
Benzene, toluene, ethylbenzene, and xylenes (BTEX) have historically been detected in the source area, including in well MW-2. Unlike the results for chloroethane discussed above, however, benzene and toluene concentrations in MW-2 have modestly increased in recent years, with the more significant detections 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 2011-2012 monitoring years generally demonstrate lower concentrations than historically observed. The results for ethylbenzene and xylenes are also generally lower in 2012 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 2012 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 historical concentrations as high as 1,500 ug/L detected in August 2009. During the 2012 monitoring year, however, significant detections of acetone occurred at the MW-5 location, where the relevant groundwater quality criteria (50 ug/L) was exceeded in both the June and October 2012 sampling events. 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 2012 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 2012 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.

MRB/akg

Appendix D

Water Level Measurements - 2012

Akzo Nobel Polymer Chemicals LLC
WATER LEVEL ELEVATION DATA
2012

	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
3/28/2012	7.63	320.88	7.09	321.20	6.76	320.82	3.33	319.25	10.98	310.87	7.65	315.47
6/27/2012	10.94	317.57	-	-	9.13	318.45	6.31	316.27	-	-	9.48	313.64
10/9/2012	13.89	314.62	-	-	11.07	316.51	9.35	313.23	-	-	11.46	311.66

	Akzo Nobel Polymer Chemicals LLC WATER LEVEL ELEVATION DATA 2012											
	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
3/28/2012	18.52	305.14	3.88	320.80	-	-	-	-	-	-	5.07	319.96
6/27/2012	21.46	302.20	6.33	318.35	-	-	-	-	-	-	7.22	317.81
10/9/2012	18.54	305.12	8.28	316.40	-	-	-	-	-	-	8.88	316.15

Akzo Nobel Polymer Chemicals LLC
WATER LEVEL ELEVATION DATA
2012

	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		
3/28/2012	21.12	304.09	7.47	320.92	21.70	306.42	11.38	314.38	20.45	304.87		
6/27/2012	24.00	301.21	9.77	318.62	-	-	13.35	312.41	23.43	301.89		
10/9/2012	21.26	303.95	11.88	316.51	-	-	15.12	310.64	20.53	304.79		