Demonstration Program
Quarterly Progress Report #1

Administrative Order #R9-4171-94-08
Olin Niagara Falls Plant
Niagara Falls, New York

Prepared for:

OLIN CORPORATION

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August 1, 2016
Project 6107-16-0002

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ABBREVIATIONS AND ACRONYMS

Acronym	Definition
GWTS	Groundwater Treatment System
ARGC	Alundum Road-Gill Creek
NYSDEC	New York State Department of Environmental Compliance
VOC	volatile organic compound

1.0 INTRODUCTION

Olin is performing a one year Demonstration Program to evaluate effectiveness of groundwater capture within the Alundum Road-Gill Creek (ARGC) area by the Solvent pumping wells (PWs), PW-3B and PW-4B, located on Olin property.

The Demonstration Program is being performed in accordance with the November 6, 2015 *Demonstration Program Work Plan* (Amec Foster Wheeler, 2015) and the comments provided by New York Department of Environmental Conservation (NYSDEC) in their March 2, 2016 conditional approval letter.

The Demonstration Program commenced March 11, 2016 following shut-down of the Olin groundwater treatment system (GWTS). This report is the first quarterly progress report for the Demonstration Program and covers the period from March 11, 2016 through June 11, 2016. The progress report presents activities completed and data collected during the period as well as an evaluation of the data.

The Demonstration Program's first quarter results support that the Olin GWTS is redundant and that the Solvent GWTS provides hydraulic capture of A and B-Zone groundwater from the ARGC area without the Olin GWTS operating. These results are consistent with the objectives of the Olin Consent Order and Remedial Plan.

2.0 SITE ACTIVITIES

The following activities were performed during this monitoring period:

- Recovery Well Shutdown
- GWTS Lockout
- Quarterly Monitoring

2.1 Recovery Well Shutdown

The Demonstration Program was initiated on March 11, 2016 by ceasing GWTS operations.

2.2 GWTS Lockout

The GWTS equipment was placed in long term lockout in order to protect the equipment while the GWTS is shut down during the Demonstration Program. Olin removed the pumps from the recovery wells and drained the piping between the recovery wells and GWTS building. Olin also drained the piping, tanks, air stripper, and carbon vessels located in the GWTS building to prevent freezing during the winter season. The equipment and instrumentation remains in place pending conclusion of the Demonstration Program.

2.3 Quarterly Monitoring

Water quality samples were collected April 19-21, 2016 from the twelve wells listed in the *Demonstration Program Work Plan* plus the three additional wells requested by NYSDEC in their March 2, 2016 letter. Samples were collected using low flow sampling techniques. The samples were submitted to ALS Environmental Laboratory in Albany, NY for analysis. The samples were analyzed for volatile organic compound (VOCs), pesticides, and mercury in accordance with the monitoring requirements in the *Demonstration Work Plan* and the *Groundwater Treatment System Operation and Maintenance Plan* (AMEC, 2014).

Quarterly water level measurements were collected on May 3, 2016. Water levels measurements were collected from the quarterly monitoring locations listed in the *Demonstration Work Plan*.

3.0 MONITORING RESULTS

This section presents the potentiometric surface and water quality results from this reporting period.

3.1 A-Zone

Figure 3.1 shows the A-Zone potentiometric surface for May 3, 2016. A-Zone groundwater in the ARGC area is effectively captured and drained to the B-Zone by the Passive Relief (PR) wells due to the natural downward vertical gradient that exists between the A-Zone and the B-Zone. Since potentiometric heads in the B-zone are below Gill Creek, the passive relief wells are effective in preventing A-zone groundwater migration to Gill Creek.

The yellow highlighted areas represent areas that are estimated to be dewatered as defined by the bottom elevation of the A-zone. The dewatered areas also show that the A-zone is being effectively drained to the B-zone. In cases where the A zone was dewatered, the physical bottom of the fracture system was used in the interpreted potentiometric surface.

3.2 B-Zone

Figure 3.2 shows the B-Zone potentiometric surface map for May 3, 2016. The B-Zone potentiometric surface map shows hydraulic capture of the B-zone on Olin property by the Solvent pumping wells located on Olin property (PW-3B and PW-4B). The drawdown observed in Solvent pumping well PW-3B creates a gradient that dominates local B-zone flow on Olin property. Additionally, groundwater elevations at PN-24B consistently show an inward gradient from Buffalo Avenue towards the site.

3.3 Water Quality Results

Tables 3.1 through 3.4 show the monitoring results for April 2016 for the following indicator parameters in the A and B-Zones:

- 1,2,4-Trichlorobenzene - Aromatic
- Trichloroethene – Aliphatic
- Gamma-BHC – Pesticide

- Total Mercury - Mercury

Results for June 2014 and June 2015 (before the Demonstration Program) are included on the tables for comparison. Figures 3.3 through 3.10 show the constituent distributions for the indicator parameters. The tables and figures show that constituent concentrations and distribution are consistent with conditions prior to the Demonstration Program implementation. 1,2,4-Trichlorbenzene was detected in PN-20A at 11 ug/L, and historically has been detected at this location sporadically. Since 2006, 1,2,4-Trichlorobenzene has been detected twice at PN-20A at concentrations of 1.6 ug/L and 0.43 ug/L. The 1,2,4-Trichlorbenzene concentration at this location will continue to be evaluated based on continued monitoring during the demonstration program. A-zone groundwater migration near PN-20A is controlled by PR-3 which drains to the B-Zone for capture by the Solvent GWTS.

4.0 CONCLUSIONS

The Demonstration Program's first quarter results support that the Olin GWTS is redundant and that the Solvent GWTS provides hydraulic capture of A and B-Zone groundwater from the ARGC area without the Olin GWTS operating. These results are consistent with the objectives of the Olin Consent Order and Remedial Plan.

5.0 REFERENCES

AMEC, 2014. *Groundwater Treatment System – Operations and Maintenance Plan.* Kennesaw, GA. AMEC Environment & Infrastructure, Inc. August 15, 2014.

Amec Foster Wheeler, 2015. *Demonstration Program Work Plan.* Kennesaw, GA. Amec Foster Wheeler Environment & Infrastructure, Inc. November 6, 2015

TABLES

Table 3.1: 1,2,4-Trichlorobenzene Results

1,2,4-Trichlorobenzene Concentration - ug/L						
Date	**June 2014**		**June 2015**		**April 2016**	
A-Zone Wells						
OBA-4A	1.0	U	1.0	U	1.0	U
OBA-24A	1.0	U	1.0	U	1.0	U
OBA-25A	1.0	U	1.0	U	2.9	
OBA-26A	1.0	U	1.0	U	1.0	U
PN-20A	1.0	U	1.0	U	11	
B-Zone Wells						
OBA-2B	180		170		230	
OBA-4B	1.0	U	1.0	U	1.5	
OBA-5B	8100		10000		8500	
OBA-6B	100		200		150	
OBA-24B	520		840		280	
OBA-25B	1.0	U	1.0	U	4	
OBA-26B	1.0	U	3		5.0	U
PN-5B	8300		8000		8300	
PN-20B	210		55	J	130	
PN-24B	NA		NA		7.7	

Notes:

U- constituent not detected- reporting limit shown

ug/L - micrograms per liter

NA - not applicable

Prepared By: A. Bolden 06/01/2016

Checked By: T. Englund 6/9/2016

Table 3.2: Trichloroethene Results

Trichloroethene Concentration - ug/L			
Date	**June 2014**	**June 2015**	**April 2016**
A-Zone Wells			
OBA-4A	16	12	9.9
OBA-24A	26	20	15
OBA-25A	22	20	16
OBA-26A	1.0 U	1.0 U	1.0 U
PN-20A	11	16	7.3
B-Zone Wells			
OBA-2B	55	28	20
OBA-4B	1.2	1.9	1.4
OBA-5B	20000	20000	10000
OBA-6B	22	27	23
OBA-24B	2000	7500	7400
OBA-25B	1.0 U	1.0 U	1.0 U
OBA-26B	1.0 U	1.0 U	5.0 U
PN-5B	5600	8300	3400
PN-20B	4900	1600	3800
PN-24B	NA	NA	6.4

Notes:
U- constituent not detected- reporting limit shown
ug/L - micrograms per liter
NA - not applicable

Prepared By: A. Bolden 06/01/2016
Checked By: T. Englund 6/9/2016

Table 3.3: Gamma-BHC Results

Gamma-BHC Concentration - ug/L						
Date	**June 2014**		**June 2015**		**April 2016**	
A-Zone Wells						
OBA-4A	0.047	U	0.047	U	0.047	U
OBA-24A	0.047	U	0.047	U	0.047	U
OBA-25A	0.047	U	0.047	U	0.13	
OBA-26A	0.047	U	0.047	U	0.047	U
PN-20A	0.047	U	0.047	U	0.047	U
B-Zone Wells						
OBA-2B	0.051		0.047	U	0.048	
OBA-4B	0.047	U	0.047	U	0.047	U
OBA-5B	630		460		200	
OBA-6B	0.047	U	0.047	U	0.047	U
OBA-24B	59		78		21	
OBA-25B	0.047	U	0.047	U	0.047	U
OBA-26B	0.047	U	0.047	U	0.047	U
PN-5B	1100		1300		1000	
PN-20B	0.27		0.23		0.34	
PN-24B	NA		NA		0.047	U

Notes:
U- constituent not detected- reporting limit shown
ug/L - micrograms per liter
NA - not applicable

Prepared By: A. Bolden 06/01/2016
Checked By: T. Englund 6/9/2016

Table 3.4: Total Mercury Results

Total Mercury Concentration - ug/L						
Date	**June 2014**		**June 2015**		**April 2016**	
A-Zone Wells						
OBA-4A	0.2	U	0.2	U	0.2	U
OBA-24A	0.2	U	0.2	U	0.2	U
OBA-25A	0.2	U	5.01		4.87	
OBA-26A	0.2	U	0.2	U	0.2	U
PN-20A	0.2	U	0.26		0.2	U
B-Zone Wells						
OBA-2B	0.2	U	0.2	U	0.2	U
OBA-4B	0.2	U	0.2	U	0.2	U
OBA-5B	0.2	U	0.2	U	0.34	
OBA-6B	3.37		1.92		0.2	U
OBA-24B	0.2	U	0	U	0.2	U
OBA-25B	0.2	U	0.2	U	0.2	U
OBA-26B	0.2	U	0.2	U	0.2	U
PN-5B	0.2	U	1.62		0.2	U
PN-20B	0.2	U	0.2	U	0.2	U
PN-24B	NA		NA		0.2	U

Notes:
U- constituent not detected- reporting limit shown
ug/L - micrograms per liter
NA - not applicable

Prepared By: A. Bolden 06/01/2016
Checked By: T. Englund 6/9/2016

FIGURES

Buffalo Avenue

OBA-2A 561.32
PN-10A 561.51
OBA-23A 562.26
PR-2 561.17
PN-2A 562.83
RW-2-PZ 559.03
PN-9A 560.68
PN-20A 561.85
OBA-15A 556.89
OW-21A 563.71
OW-5A 561
OBA-3A 556.68
OW-22A 563.71
OW-20A 560.61
OW-6A 562.4
PR-3 557.65
OBA-16A 562.68
PN-3A 562.93
RW-3-PZ 557.19
RW-1-PZ 560.93
PN-19A 563.35
PN-18A 563.39
PN-1A 563.12
PN-16A 562.46
PN-4A 561.79
PN-17A 564.9
PR-1 563.84
PR-4-PZ 557.14
PR-13 559.15
PN-5A 562.12
OBA-4A 560.71
OBA-14A 557.23
PN-15A 563.67
PR-6 559.35
RW-4-PZ 557.05
PR-7 561.07
PR-14 561.65
PN-14A 565.17
OBA-6A 564.81
PN-6A 561.81
PN-13A 564.76
PR-8 560.08
OBA-26A 563.74
PR-5 558.47
PR-9 560.97
PN-12A 565.38
PN-7A 561.74
PR-10 560.66
RW-5-PZ 557.41
PR-11 563.91
PN-21A 564.77
PN-8A 564.08
PN-11A 562.84
OBA-5A 564.23
OBA-24A 562.68
OBA-25A 563.91
PR-12 558.37
OBA-9A 561.63
OBA-9AR 562.77
OBA-10A 563.21
Gill Creek Stilling Well 561.83

564 563.5 563 562.5 562 561.5 561 560.5 560 559.5 559 558.5 558 557.5 565 564.5

0 100 200 Feet

Legend

- Monitoring Well
- Passive Relief Well
- Recovery Well
- Solvent Monitoring Well
- Surface Water Location
- May 2016 Potentiometric Surface Contour
- Gill Creek
- Approximate Olin Boundary
- Interpreted A Zone Dewatered Area (WL < 0.5 feet)

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Demonstration Program Quarterly Report #1

Olin Chemicals Plant Niagara Falls, NY

A-Zone Potentiometric Contours
May 3, 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.1**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

Buffalo Avenue

OBA-2B 557.05
PN-24B 557.68
PN-10B 558.16
OBA-23B 558.31
PN-2B 557.18
RW-2-PZ 557.08
PN-9B 557.08
PN-20B 557
OW-14B 556.78
OW-31B 557.13
OW-15B 557.26
OW-32B 557.14
OW-22B 557.66
OW-25B 557.04
OW-24B 557.09
OW-33B 556.8
PW-3B 553.61
OW-23B 556.88
PW-4B 555.89
OW-4B 557.4
PN-19B 561.87
RW-1-PZ 558.38
PN-18B 558.57
OBA-16B 557.6
PN-3B 559.04
RW-3-PZ 557.19
PN-1B 558.39
PN-4B 557.12
PN-17B 557.92
PR-4-PZ 557.14
OBA-4B 558.22
OBA-14B 556.86
PN-5B 557.06
PN-15B 557.74
RW-4-PZ 557.03
PN-6B 557.05
PN-13B 557.87
OBA-26B 557.81
PN-7B 557.35
PN-12B 557.93
RW-5-PZ 557.41
PN-21B 559.17
PN-8B 557.01
OBA-5B 559.76
OBA-24B 557.8
OBA-25B 557.65
PN-11B 557.75
PR-12 557.34

0 100 200 Feet

Legend

- Olin Monitoring Well
- Olin Recovery Well
- Solvent Monitoring Well
- Solvent Recovery Well
- B Zone May 2016
- Gill Creek
- Approximate Olin Boundary

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Olin Chemicals Plant Niagara Falls, NY

B-Zone Potentiometric Contours
May 3, 2016

Prepared By-Date: JRM - 7/27/2016	amec foster wheeler	Figure: 3.2
Checked By-Date: AWE - 7/27/2016		
Project Number: 6107160002		

PN-20A
11

Buffalo Avenue

OBA-4A
1.0U

OBA-26A
1.0U

OBA-24A
1.0U

OBA-25A
2.9

Legend

1,2,4-Trichlorobenzene (µg/L)

- 0.5 - 5
- 5 - 50
- 50 - 500
- 500 - 5000
- 5000 - 50000
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

0 100 200 Feet

Path: G:\olin_niagra\April 2016 Constituent Figures\mxds\A_Zone_trichlorobenzene.mxd

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Olin Chemicals Plant Niagara Falls, NY

1,2,4-Trichlorobenzene Concentrations - A-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.3**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

PN-24B
7.7

OBA-2B
230

PN-20B
130

Buffalo Avenue

PN-5B
8300

OBA-4B
1.5

OBA-6B
150

OBA-26B
5.0U

OBA-5B
8500

OBA-24B
280

OBA-25B
4

Legend

Gamma BHC (µg/L)

- 0.5 - 5
- 5 - 50
- 50 - 500
- 500 - 5000
- 5000 - 50000
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

0 100 200 Feet

Path: G:\olin_niagra\April 2016 Constituent Figures\mxds\B_Zone_trichlorobenzene.mxd

Demonstration Program Quarterly Report #1

Olin Chemicals Plant Niagara Falls, NY

1,2,4-Trichlorobenzene Concentrations - B-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.4**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

PN-20A
7.3

OBA-4A
9.9

OBA-26A
1.0U

OBA-24A
15

OBA-25A
16

Buffalo Avenue

0 100 200 Feet

Legend

Trichloroethene (µg/L)

- 0.5 - 5
- 5 - 50
- 50 - 500
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

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Olin Chemicals Plant Niagara Falls, NY

Trichloroethene Concentrations - A-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.5**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

PN-24B
6.4

OBA-2B
20

PN-20B
3800

Buffalo Avenue

PN-5B
3400

OBA-4B
1.4

OBA-6B
23

OBA-26B
5.0U

OBA-5B
10000

OBA-24B
7400

OBA-25B
1.0U

N

0 100 200 Feet

Legend

Trichloroethene (µg/L)

- 0.5 - 5
- 5 - 50
- 50 - 500
- 500 - 5000
- 5000 - 50000
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

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Demonstration Program Quarterly Report #1

Olin Chemicals Plant Niagara Falls, NY

Trichloroethene Concentrations - B-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.6**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

PN-20A
0.047U

Buffalo Avenue

OBA-4A
0.047U

OBA-26A
0.047U

OBA-24A
0.047U

OBA-25A
0.13

Legend

Gamma BHC (µg/L)

- 0.005 - 0.05
- 0.05 - 0.5
- 0.5 - 5
- 5 - 50
- 50 - 500
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

0 100 200 Feet

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Olin Chemicals Plant Niagara Falls, NY

Gamma-BHC Concentrations - A-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.7**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

PN-24B
0.047U

OBA-2B
0.048

PN-20B
0.34

Buffalo Avenue

PN-5B
1000

OBA-4B
0.047U

OBA-6B
0.047U

OBA-26B
0.047U

OBA-5B
200

OBA-24B
21

OBA-25B
0.047U

Legend

Gamma BHC (µg/L)

- 0.005 - 0.05
- 0.05 - 0.5
- 0.5 - 5
- 5 - 50
- 50 - 500
- 500 - 5000
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

0 100 200 Feet

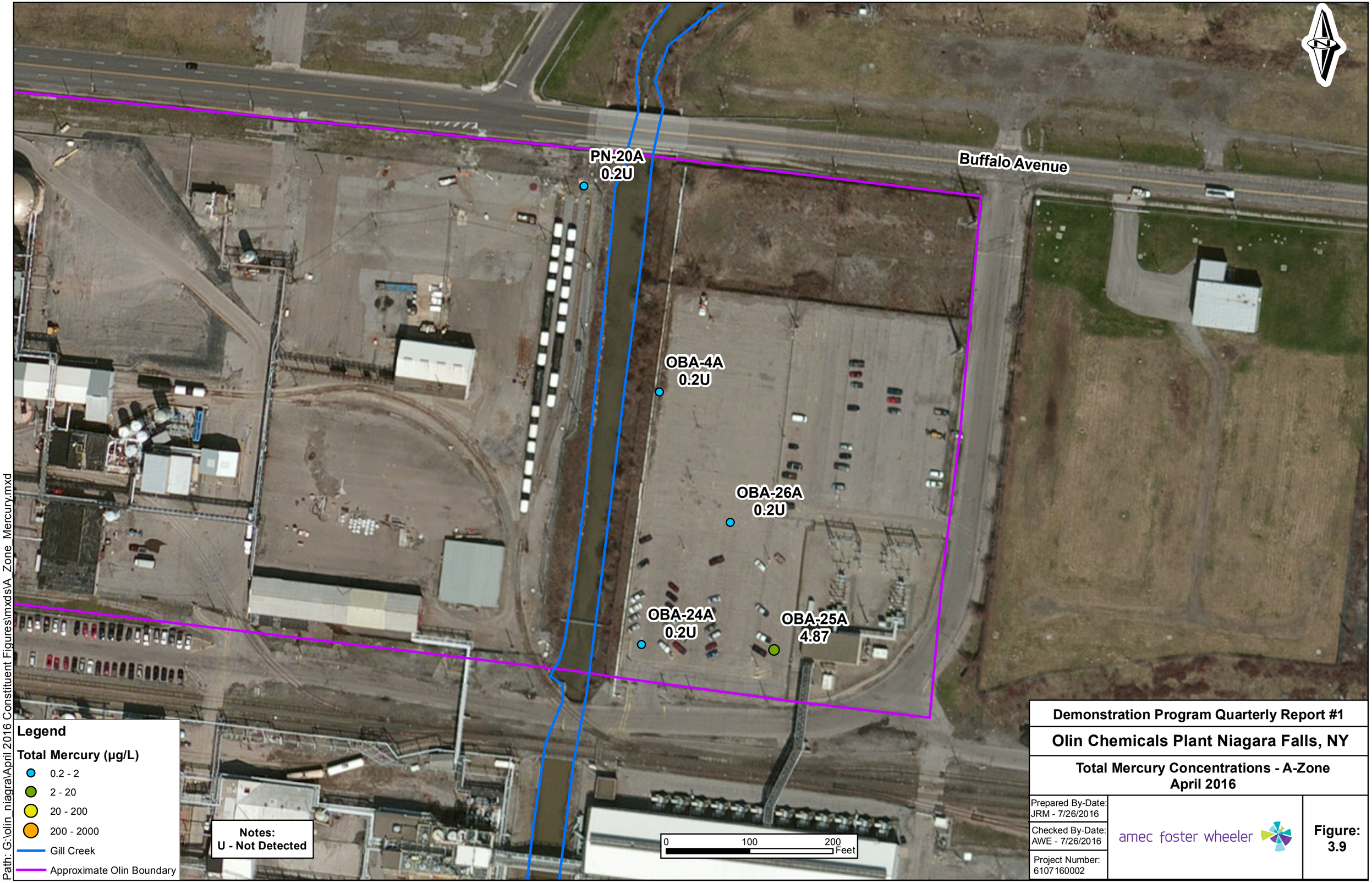
Path: G:\olin_niagra\April 2016 Constituent Figures\mxds\B_Zone_Gamma.mxd

Demonstration Program Quarterly Report #1

Olin Chemicals Plant Niagara Falls, NY

Gamma-BHC Concentrations - B-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.8**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		



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Olin Chemicals Plant Niagara Falls, NY

Total Mercury Concentrations - A-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.9**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		

PN-24B
0.2U

OBA-2B
0.2U

PN-20B
0.2U

Buffalo Avenue

PN-5B
0.34

OBA-4B
0.2U

OBA-6B
0.5

OBA-26B
0.2U

OBA-5B
0.2U

OBA-24B
0.2U

OBA-25B
0.2U

Legend

Total Mercury (µg/L)

- 0.2 - 2
- 2 - 20
- 20 - 200
- Gill Creek
- Approximate Olin Boundary

Notes:
U - Not Detected

0 100 200 Feet

Path: G:\olin_niagra\April 2016 Constituent Figures\mxds\B_Zone_Mercury.mxd

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Olin Chemicals Plant Niagara Falls, NY

Total Mercury Concentrations - B-Zone
April 2016

Prepared By-Date: JRM - 7/26/2016	amec foster wheeler	**Figure: 3.10**
Checked By-Date: AWE - 7/26/2016		
Project Number: 6107160002		