AP-125

2017 Annual Report

March 2018

2 of 2
(Appendix G)

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Environmental Challenges
BUSINESS SOLUTIONS ®

Roswell Station Remediation Site
Chaves County, NM

EarthCon Plume Analytics™ Services

Transwestern Pipeline Company, LLC

Date

www.earthcon.com

Groundwater Plume Analytics™ Services

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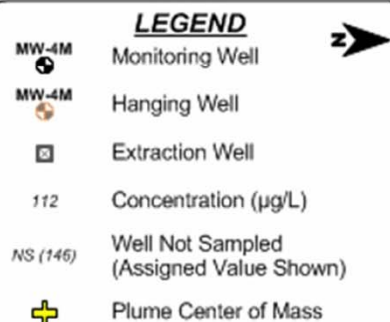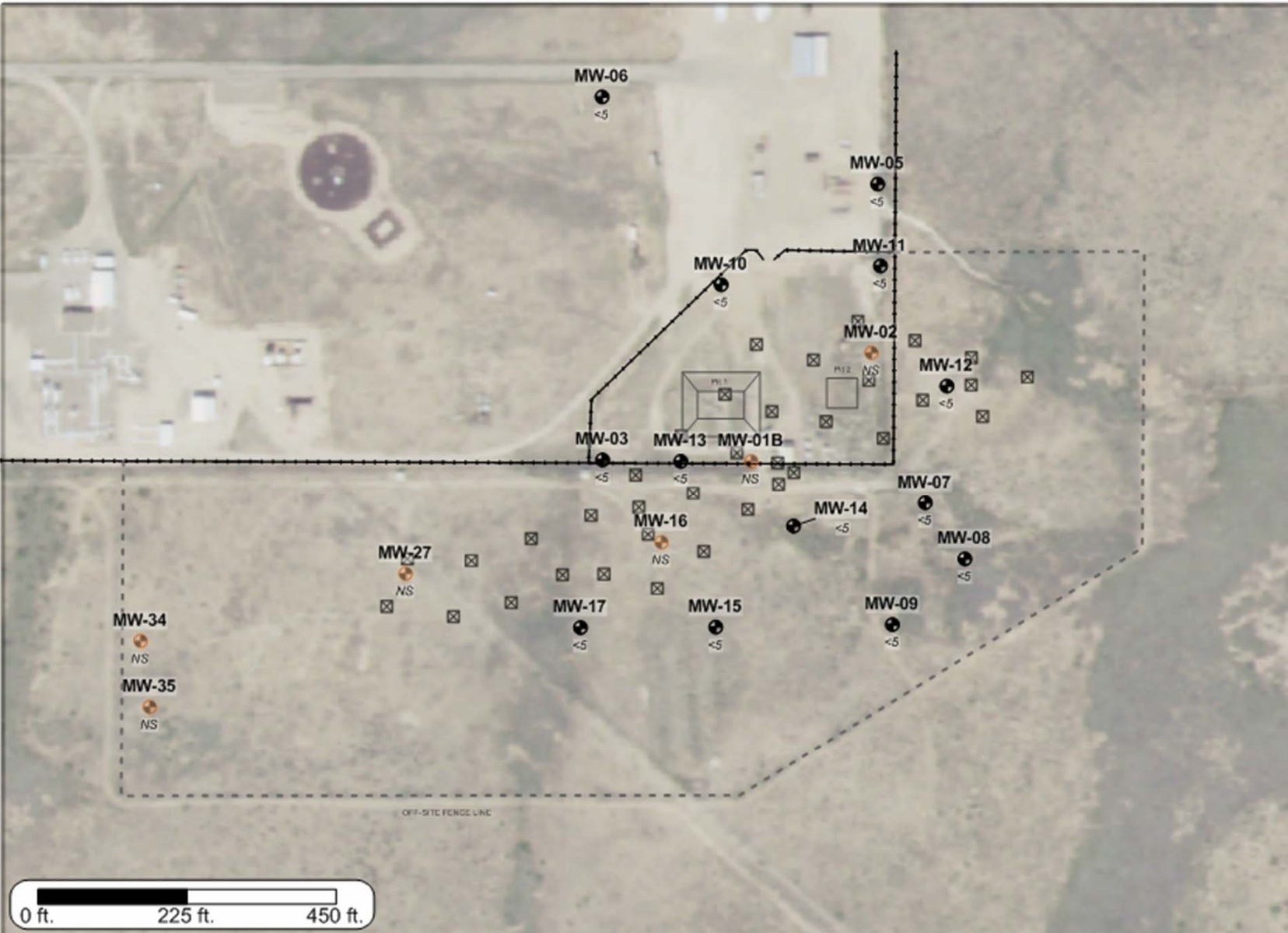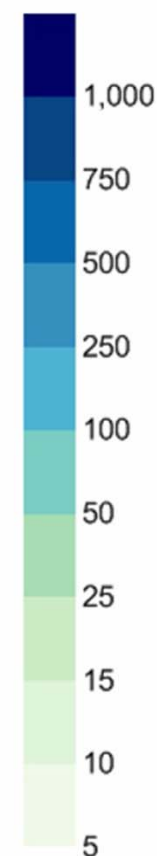
Environmental Challenges
BUSINESS SOLUTIONS ®
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Groundwater Plume Analytics™ Services

1,1-DCA

1,1-DCE

Benzene

PSH

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1,1-DCA

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Environmental Challenges
BUSINESS SOLUTIONS

1,1-DCA
Jan-1996

Concentration (µg/L)

	1,000
	750
	500
	250
	100
	50
	25
	15
	10
	5

MW-06
<5

MW-05
<5

MW-11
<5

MW-10
<5

MW-02
NS

MW-12
<5

MW-03
<5

MW-13
<5

MW-01B
NS

MW-07
<5

MW-14
<5

MW-16
NS

MW-08
<5

MW-27
NS

MW-17
<5

MW-15
<5

MW-09
<5

MW-34
NS

MW-35
NS

OFF-SITE FENCE LINE

0 ft.   225 ft.   450 ft.

LEGEND

MW-4M — Monitoring Well

MW-4M — Hanging Well

— Extraction Well

112 — Concentration (µg/L)

NS (146) — Well Not Sampled (Assigned Value Shown)

— Plume Center of Mass

Plume Characteristics

Plume Area: **0.000 acres**
Plume Average Concentration: **< 5.0 µg/L**
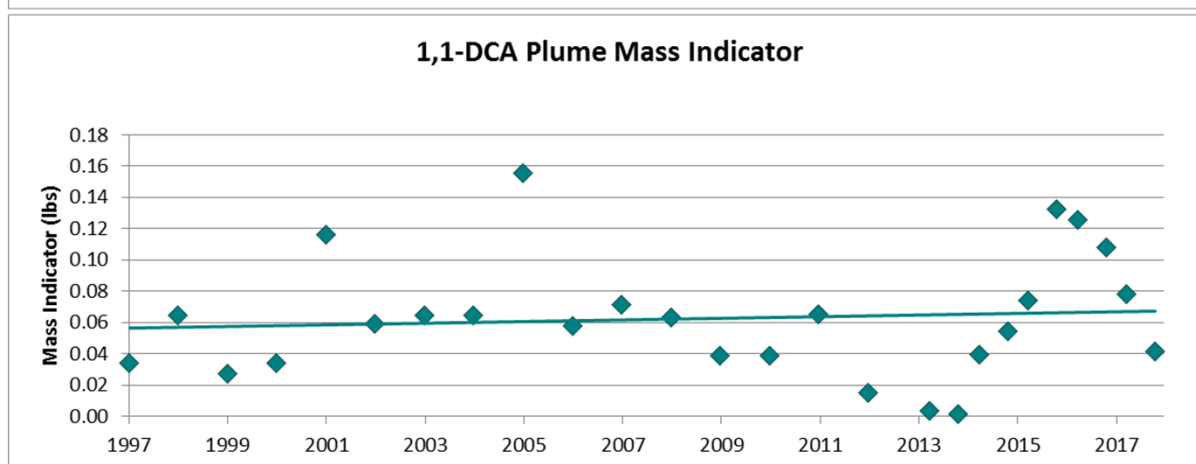Plume Mass Indicator: **0.000 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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1,1-DCA Plume Area

1,1-DCA Plume Average Concentration

1,1-DCA Plume Mass Indicator

Groundwater Elevation Correlation

Correlation: 0.75

1,1-DCA Center of Mass
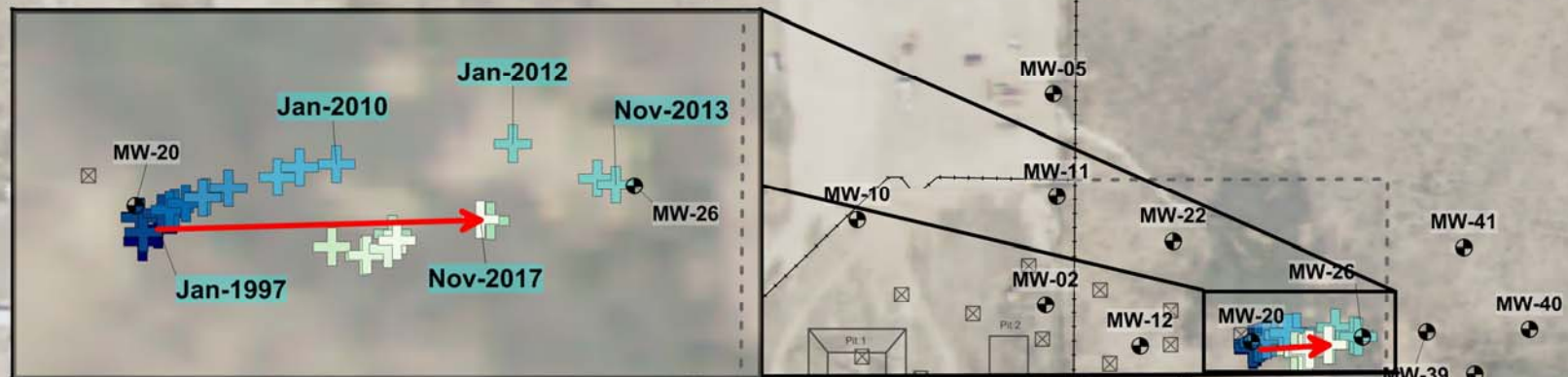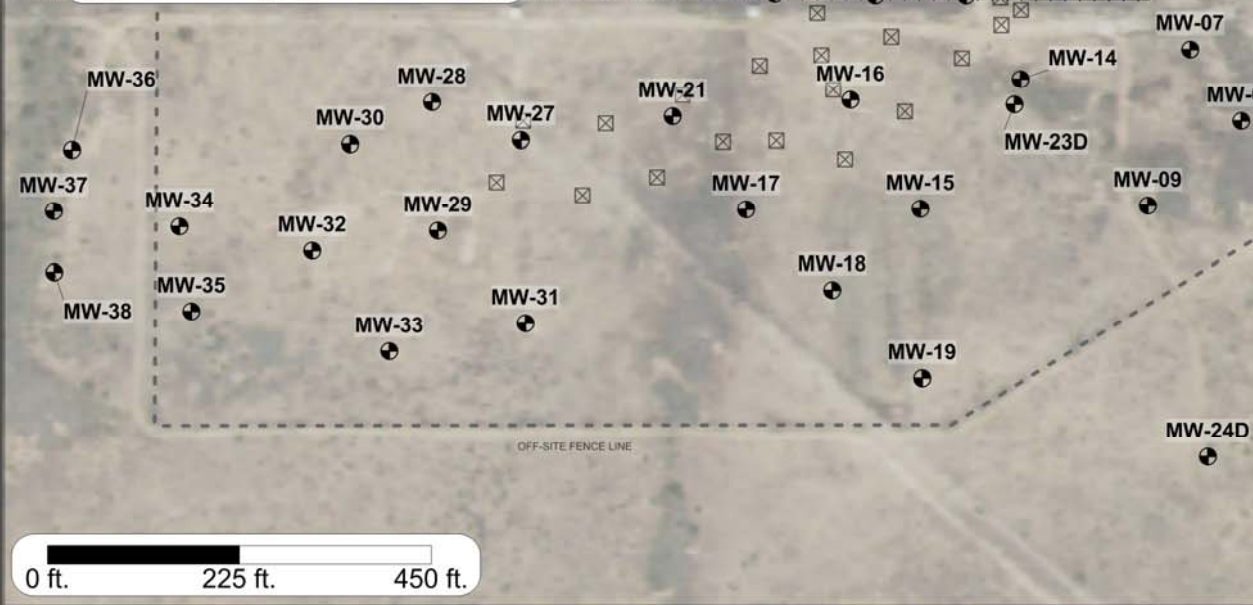
Inset labels: Jan-2012, Jan-2010, Nov-2013, MW-20, MW-26, Jan-1997, Nov-2017

Scale (inset): 0 ft. — 50 ft. — 100 ft.

Monitoring wells: MW-06, MW-05, MW-11, MW-22, MW-41, MW-10, MW-26, MW-40, MW-02, MW-12, MW-20, MW-39, MW-42, MW-03, MW-13, MW-01B, MW-07, MW-25D, MW-14, MW-16, MW-36, MW-28, MW-21, MW-23D, MW-30, MW-27, MW-17, MW-15, MW-09, MW-37, MW-34, MW-29, MW-32, MW-35, MW-31, MW-18, MW-38, MW-33, MW-19, MW-24D

Pit 1, Pit 2

OFF-SITE FENCE LINE

Scale (main): 0 ft. — 225 ft. — 450 ft.

LEGEND

MW-4M Monitoring Well

⊠ Extraction Well

—— Center of Mass Movement

→ Net Movement

Center of Mass Scale

1997 ————→ 2017

Wind rose directions: W, NW, SW, S, SE, NE, N, E
Radial scale: 0 ft, 10 ft, 20 ft, 30 ft, 40 ft, 50 ft, 60 ft, 70 ft, 80 ft, 90 ft
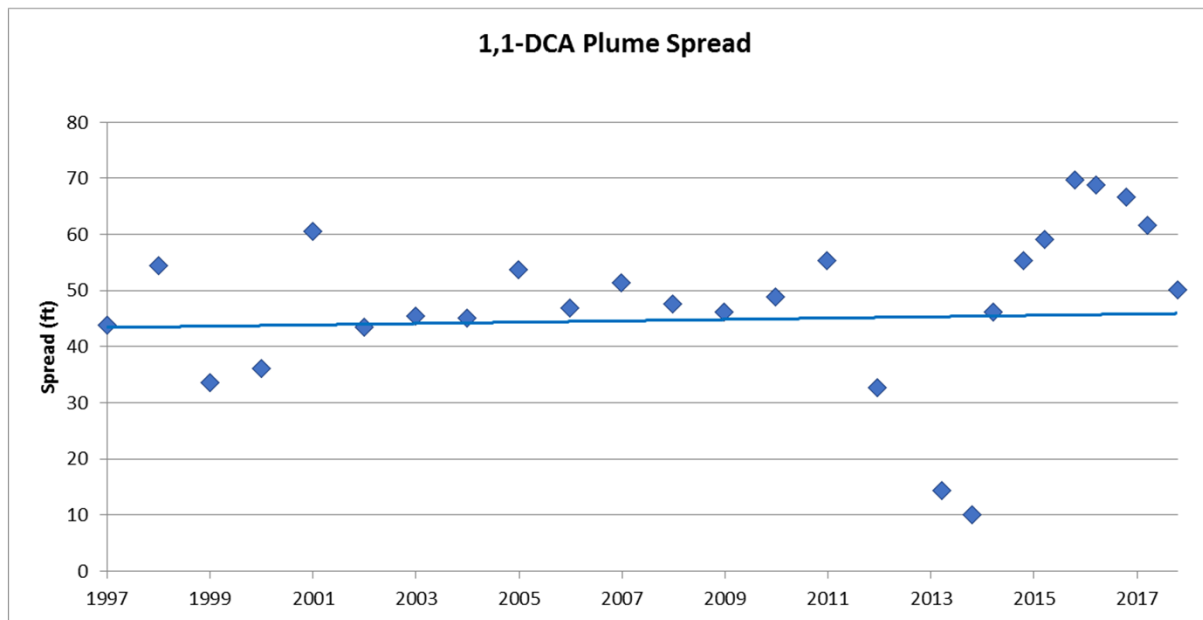
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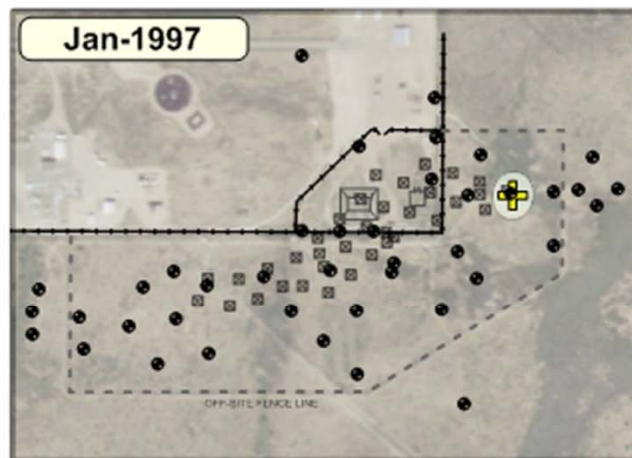
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Environmental Challenges
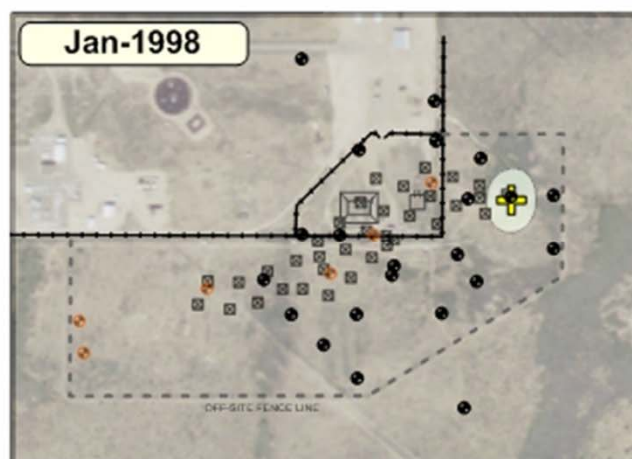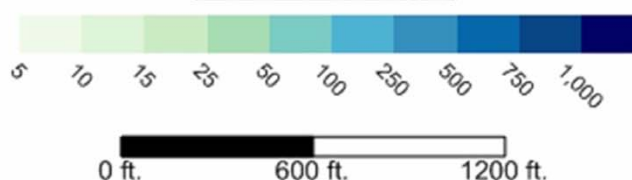**BUSINESS SOLUTIONS** ®

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1,1-DCA Plume Spread

Jan-1997 to Nov-2017
No Trend/Increasing Trend
Mann-Kendall: 99% Confidence
Regression: 69% Confidence

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Environmental Challenges
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Jan-1997

1,1-DCA   **Plume Differences Jan-1997 vs Jan-1998**

MW-06
MW-05
MW-11
MW-10   MW-22
MW-02   MW-26
MW-12   MW-20
MW-03 MW-13 MW-01B
MW-07   MW-25D
MW-14
MW-16   MW-08
MW-27   MW-21   MW-23D
MW-34   MW-17   MW-15   MW-09
MW-35   MW-18
MW-19
MW-24D

0 ft.   275 ft.   550 ft.

Concentration (μg/L)

5 10 15 25 50 100 250 500 750 1,000

0 ft.   600 ft.   1200 ft.

Jan-1998

Spatial Change Indicator

-1   0   1

LEGEND

MW-4M Monitoring Well

MW-4M Hanging Well

Extraction Well

Plume Center of Mass

Jan-1997 Plume Boundary
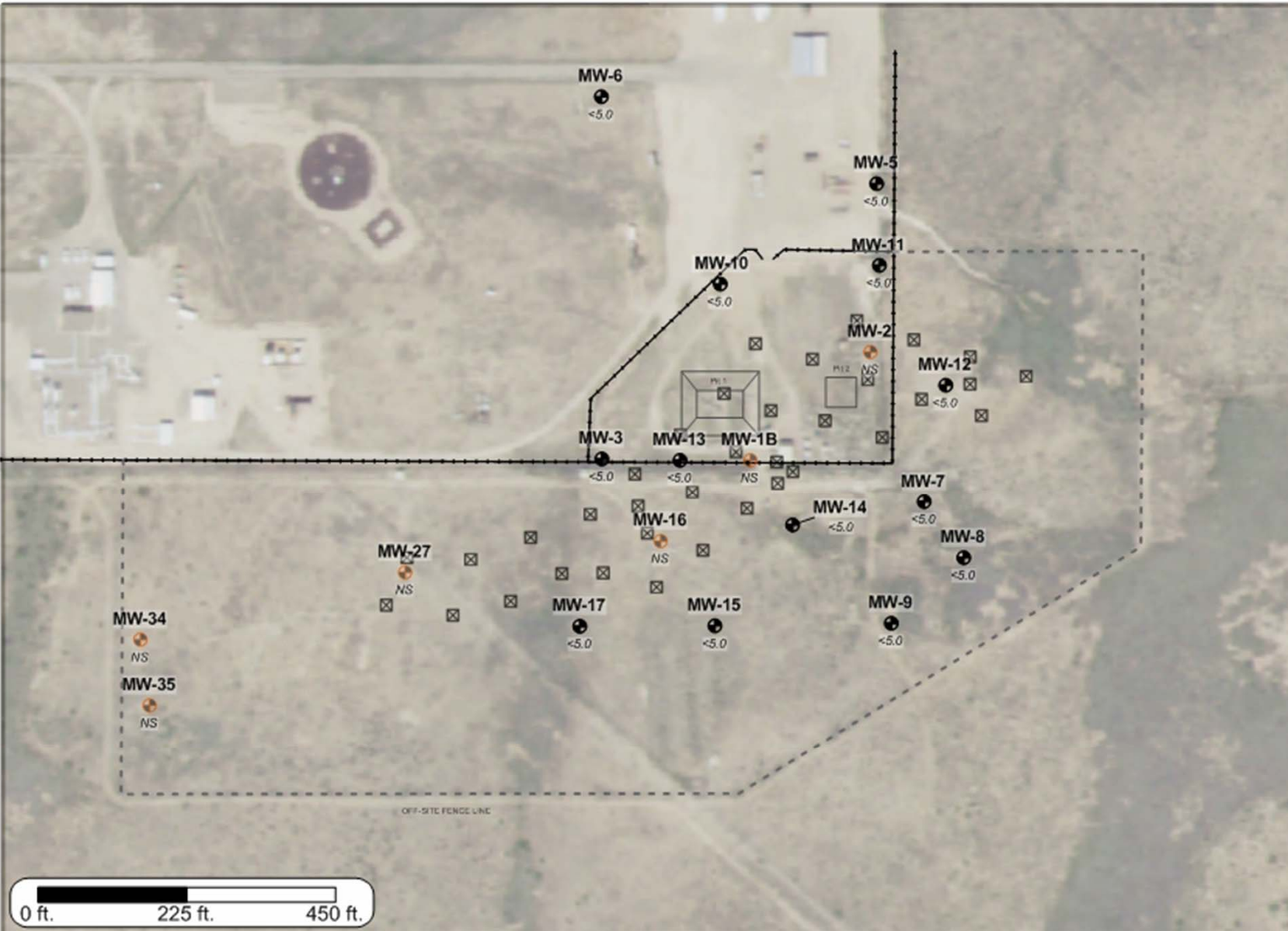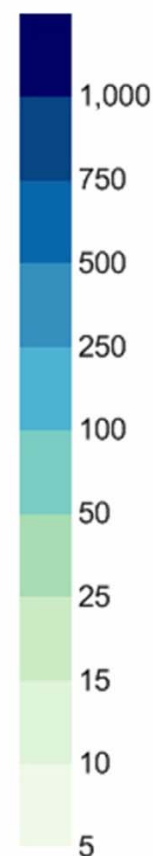
Jan-1998 Plume Boundary
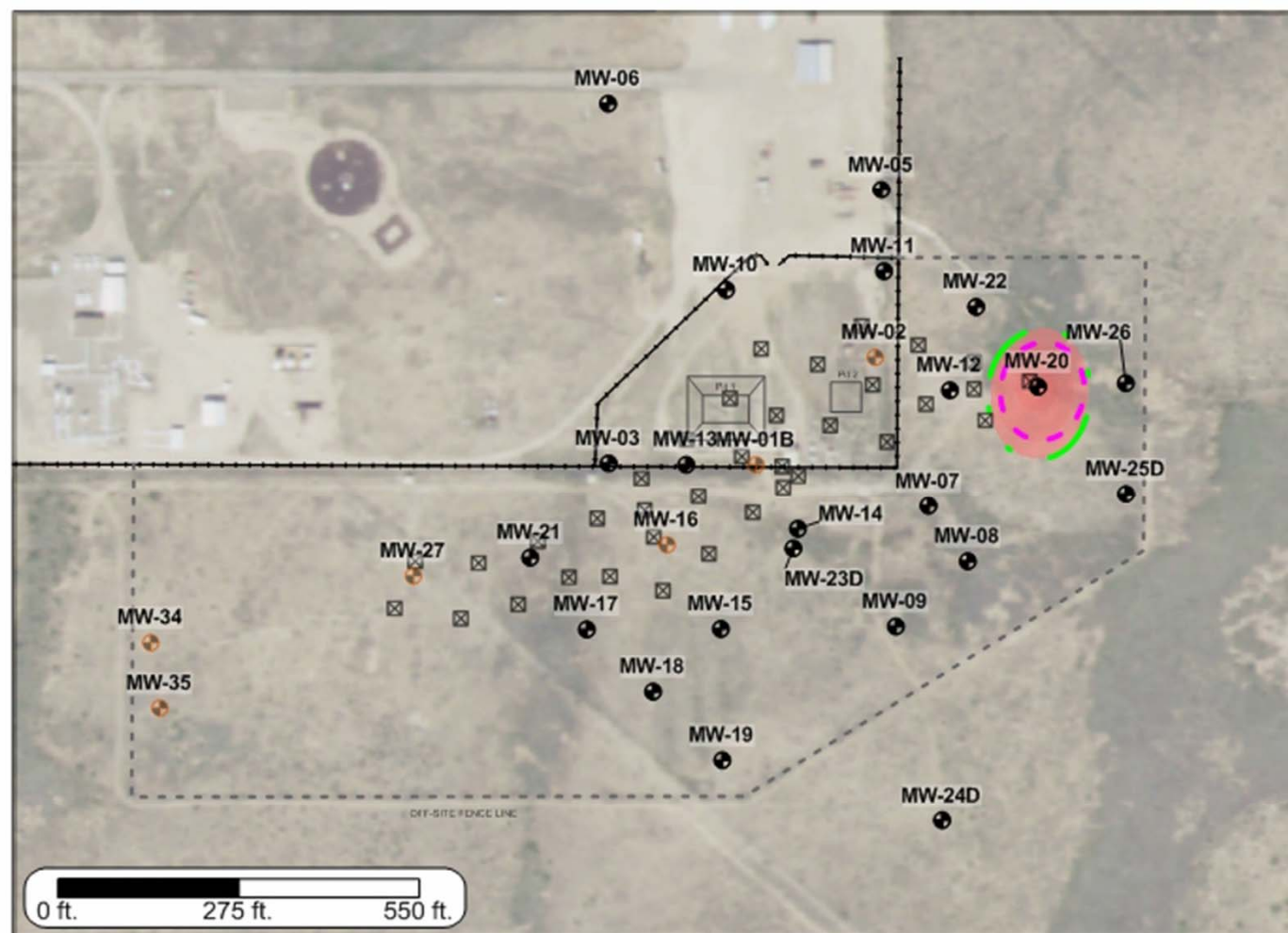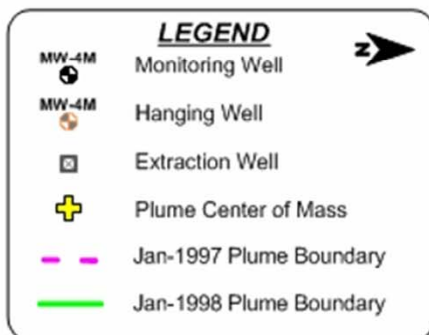
Plume Characteristics

Area: **65% Increase**

Average Concentration: **15% Increase**

Mass Indicator: **90% Increase**

Mass Increase: **0.01 lbs Increase**

Mass Decrease: **0.00 lbs Decrease**

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1,1-DCE

1,1-DCE
Jan-1996

Concentration (µg/L)

	1,000
	750
	500
	250
	100
	50
	25
	15
	10
	5

MW-6
<5.0

MW-5
<5.0

MW-11
<5.0

MW-10
<5.0

MW-2
NS

MW-12
<5.0

MW-3
<5.0

MW-13
<5.0

MW-1B
NS

MW-7
<5.0

MW-14
<5.0

MW-16
NS

MW-8
<5.0

MW-27
NS

MW-17
<5.0

MW-15
<5.0

MW-9
<5.0

MW-34
NS

MW-35
NS

OFF-SITE FENCE LINE

0 ft.	225 ft.	450 ft.

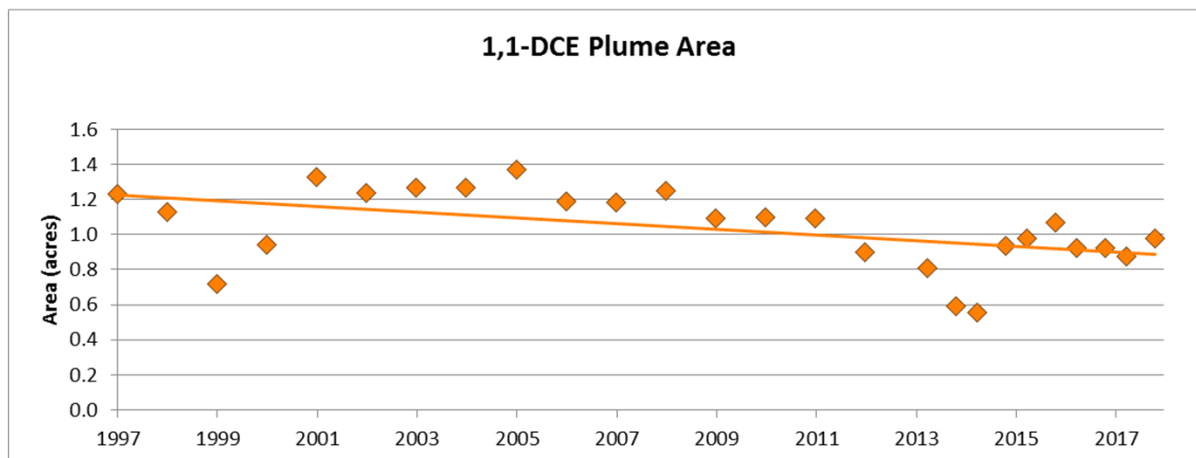**LEGEND**

MW-4M — Monitoring Well

MW-4M — Hanging Well

▣ — Extraction Well

112 — Concentration (µg/L)

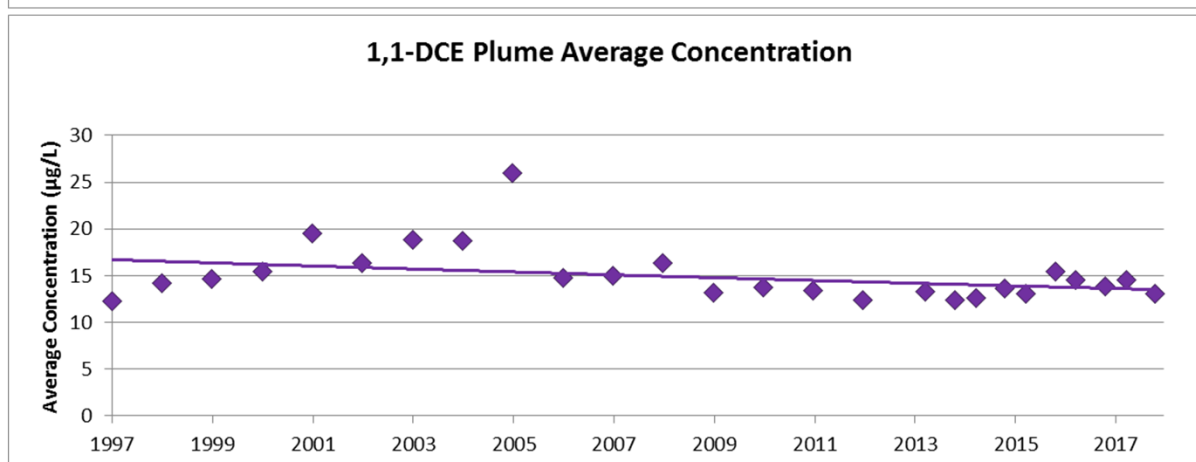NS (146) — Well Not Sampled (Assigned Value Shown)

✚ — Plume Center of Mass

Plume Characteristics

Plume Area: **0.000 acres**
Plume Average Concentration: **< 5.0 µg/L**
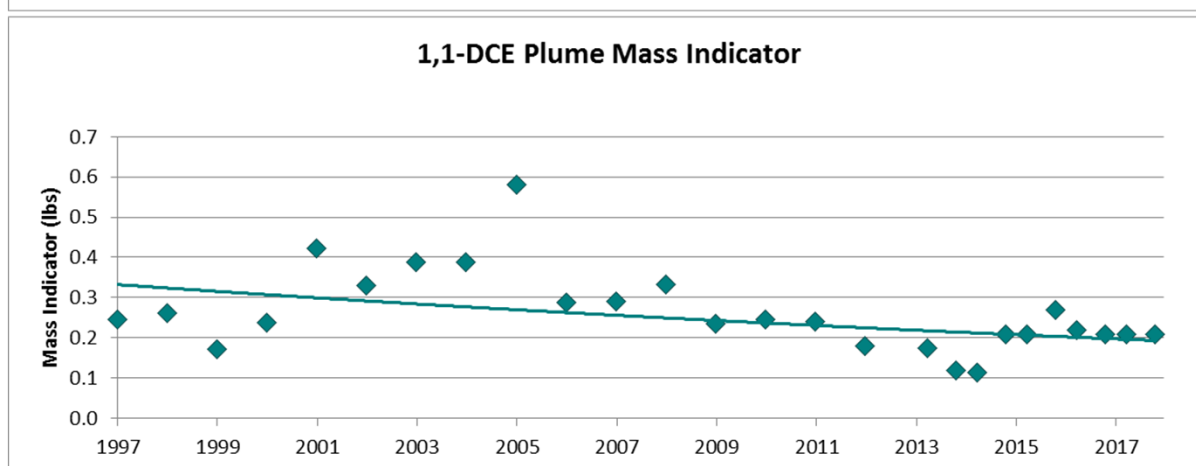Plume Mass Indicator: **0.000 lbs**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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1,1-DCE Plume Area

Jan-1997 to Nov-2017
Decreasing Trend
Mann-Kendall: 100% Confidence
Regression: 99% Confidence

1,1-DCE Plume Average Concentration

Jan-1997 to Nov-2017
Decreasing Trend
Mann-Kendall: 95% Confidence
Regression: 95% Confidence

1,1-DCE Plume Mass Indicator

Jan-1997 to Nov-2017
Decreasing Trend
Mann-Kendall: 100% Confidence
Regression: 99% Confidence

Groundwater Elevation Correlation
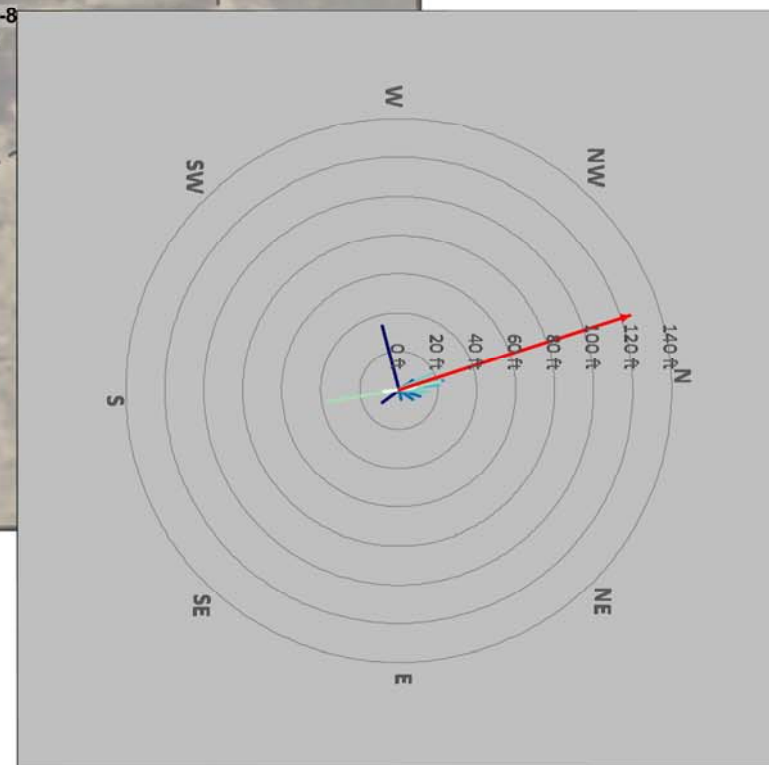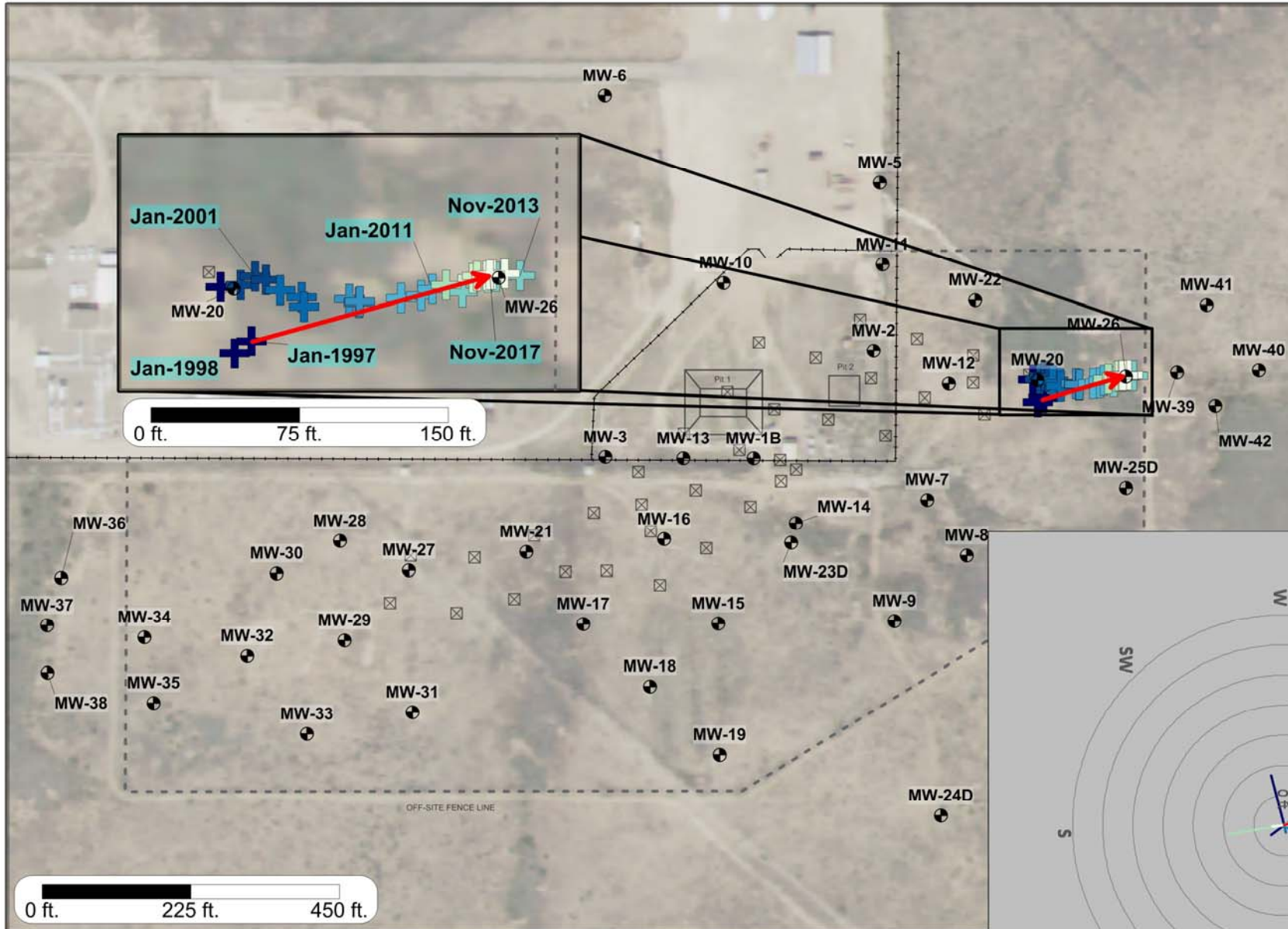
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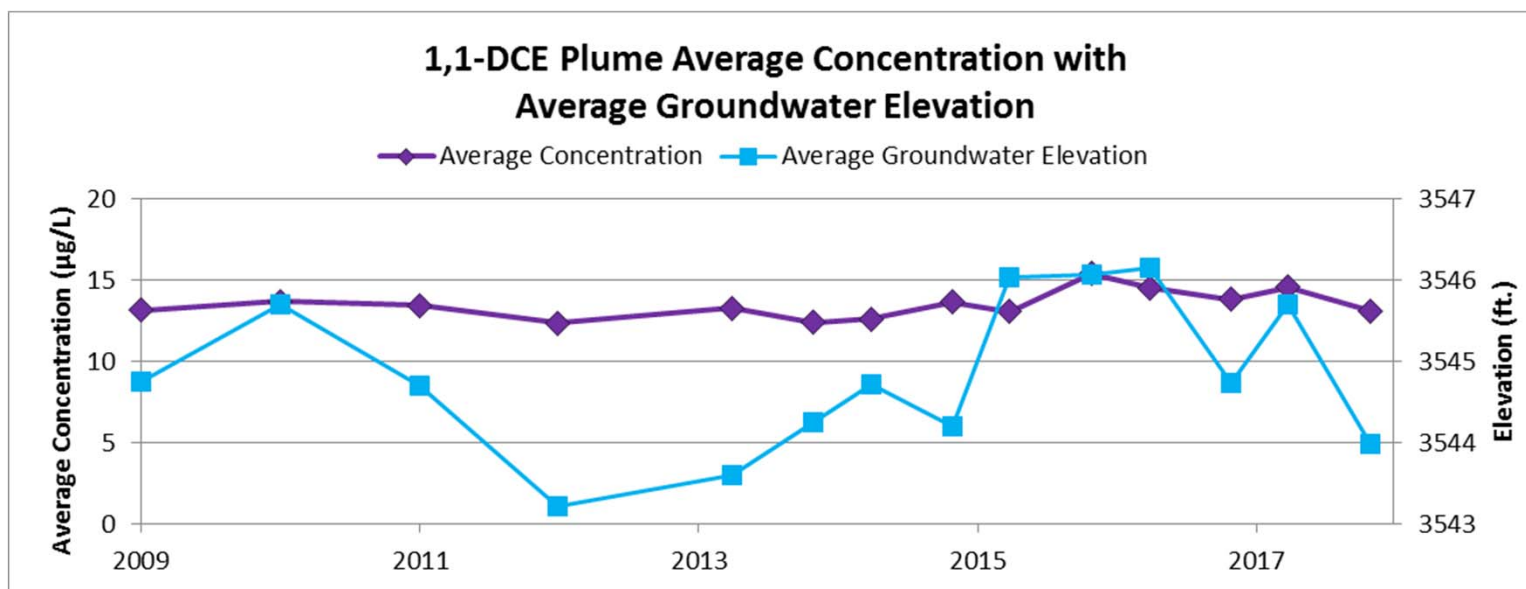
Correlation: 0.69

1,1-DCE
Center of Mass

Jan-2001   Jan-2011   Nov-2013
MW-20   Jan-1997   MW-26
Jan-1998   Nov-2017

0 ft.   75 ft.   150 ft.

MW-6
MW-5
MW-11
MW-10   MW-22   MW-41
MW-2   MW-26   MW-40
MW-12   MW-20   MW-39
MW-42
MW-3   MW-13   MW-1B   MW-25D
MW-7
MW-16   MW-14
MW-36   MW-28   MW-21   MW-23D   MW-8
MW-30   MW-27
MW-37   MW-34   MW-29   MW-17   MW-15   MW-9
MW-32
MW-35   MW-31   MW-18
MW-38   MW-33   MW-19
MW-24D

OFF-SITE FENCE LINE

0 ft.   225 ft.   450 ft.

LEGEND
MW-4M   Monitoring Well
⊠   Extraction Well
———   Center of Mass Movement
→   Net Movement

Center of Mass Scale
1997   2017

W   NW
SW   N
140 ft
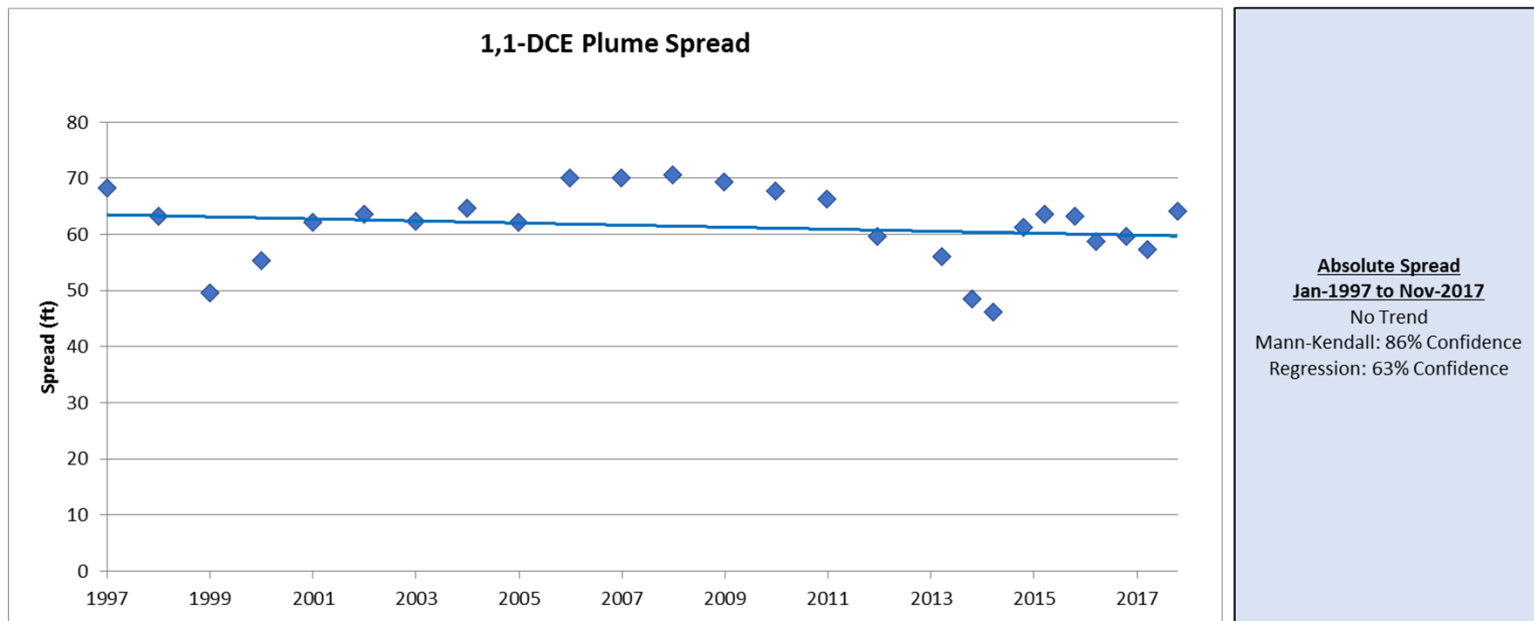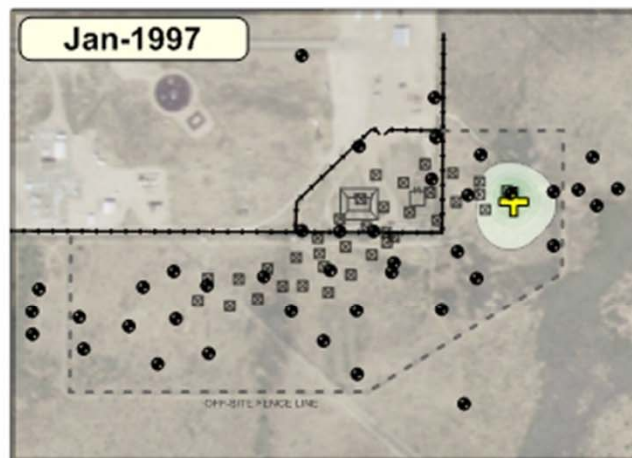120 ft
100 ft
S   20 ft 40 ft 60 ft 80 ft
SE   NE
E

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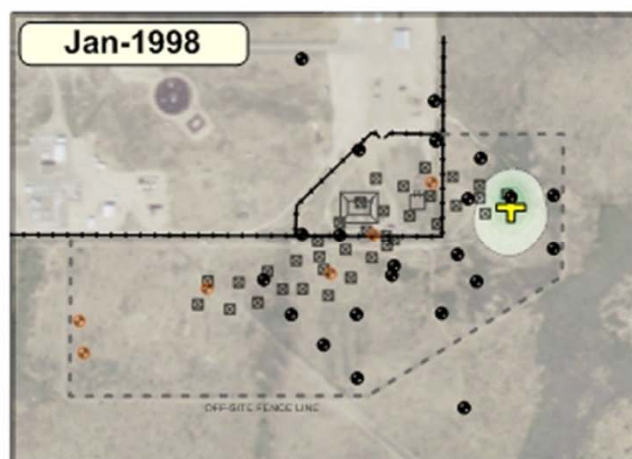
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1,1-DCE Plume Spread

Absolute Spread
Jan-1997 to Nov-2017
No Trend
Mann-Kendall: 86% Confidence
Regression: 63% Confidence

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Jan-1997

Jan-1998

Concentration (µg/L)

5 10 15 25 50 100 250 500 750 1,000

0 ft.   600 ft.   1200 ft.

1,1-DCE

Plume Differences Jan-1997 vs Jan-1998

MW-6

MW-5

MW-11

MW-22

MW-10

MW-2

MW-26

MW-12   MW-20

MW-3   MW-13 MW-1B

MW-25D

MW-7

MW-14

MW-8

MW-16

MW-27   MW-21

MW-23D

MW-17   MW-15   MW-9

MW-34

MW-18

MW-35

MW-19

MW-24D

0 ft.   275 ft.   550 ft.

Spatial Change Indicator

-1   0   1

LEGEND

MW-4M ● Monitoring Well

MW-4M ● Hanging Well

⊠ Extraction Well

✛ Plume Center of Mass

– – – Jan-1997 Plume Boundary

——— Jan-1998 Plume Boundary

Plume Characteristics

Area: **8% Decrease**

Average Concentration: **16% Increase**

Mass Indicator: **6% Increase**

Mass Increase: **0.03 lbs Increase**

Mass Decrease: **0.01 lbs Decrease**

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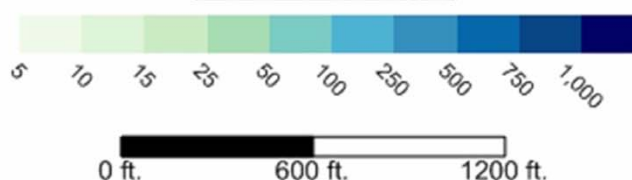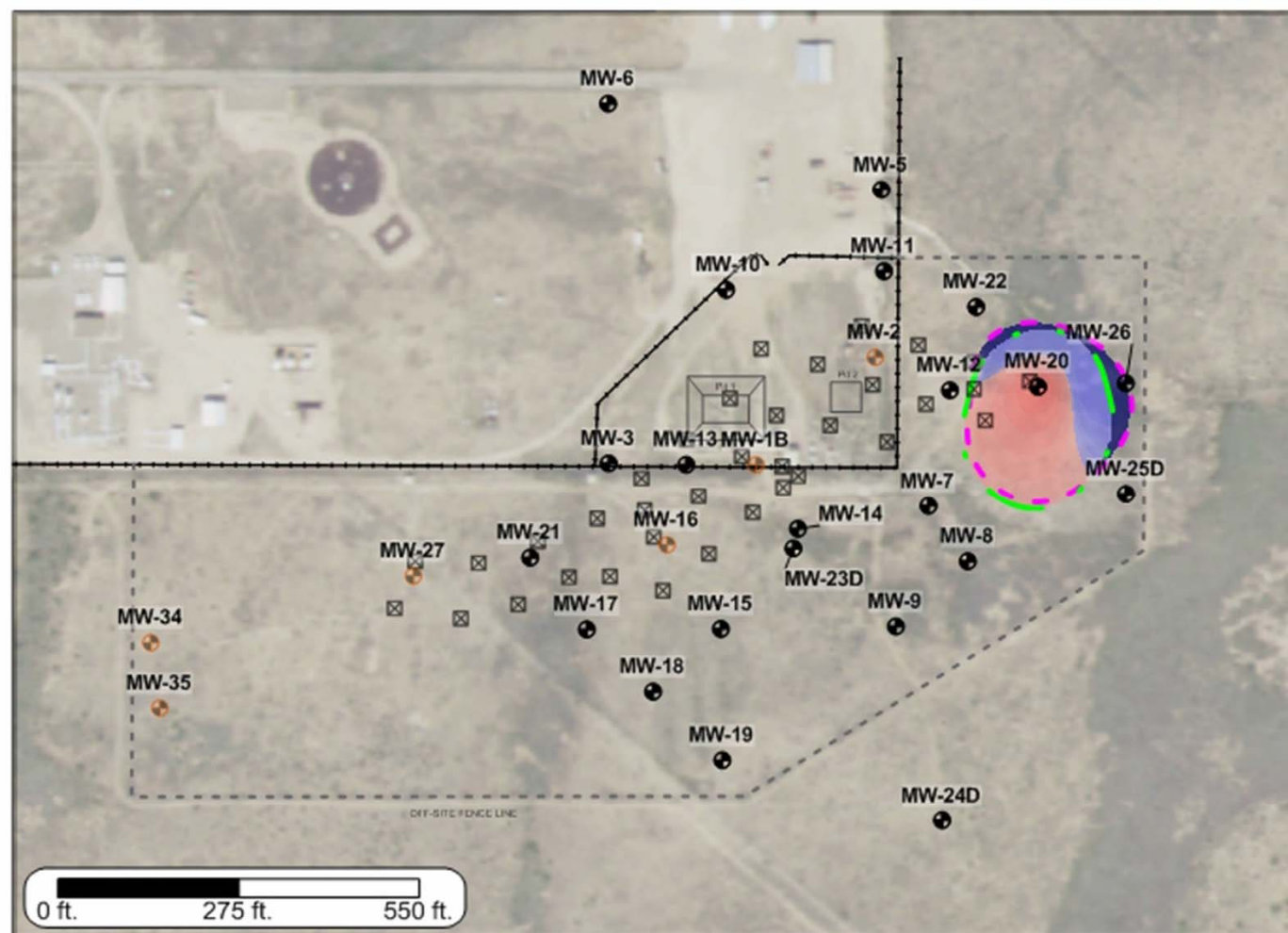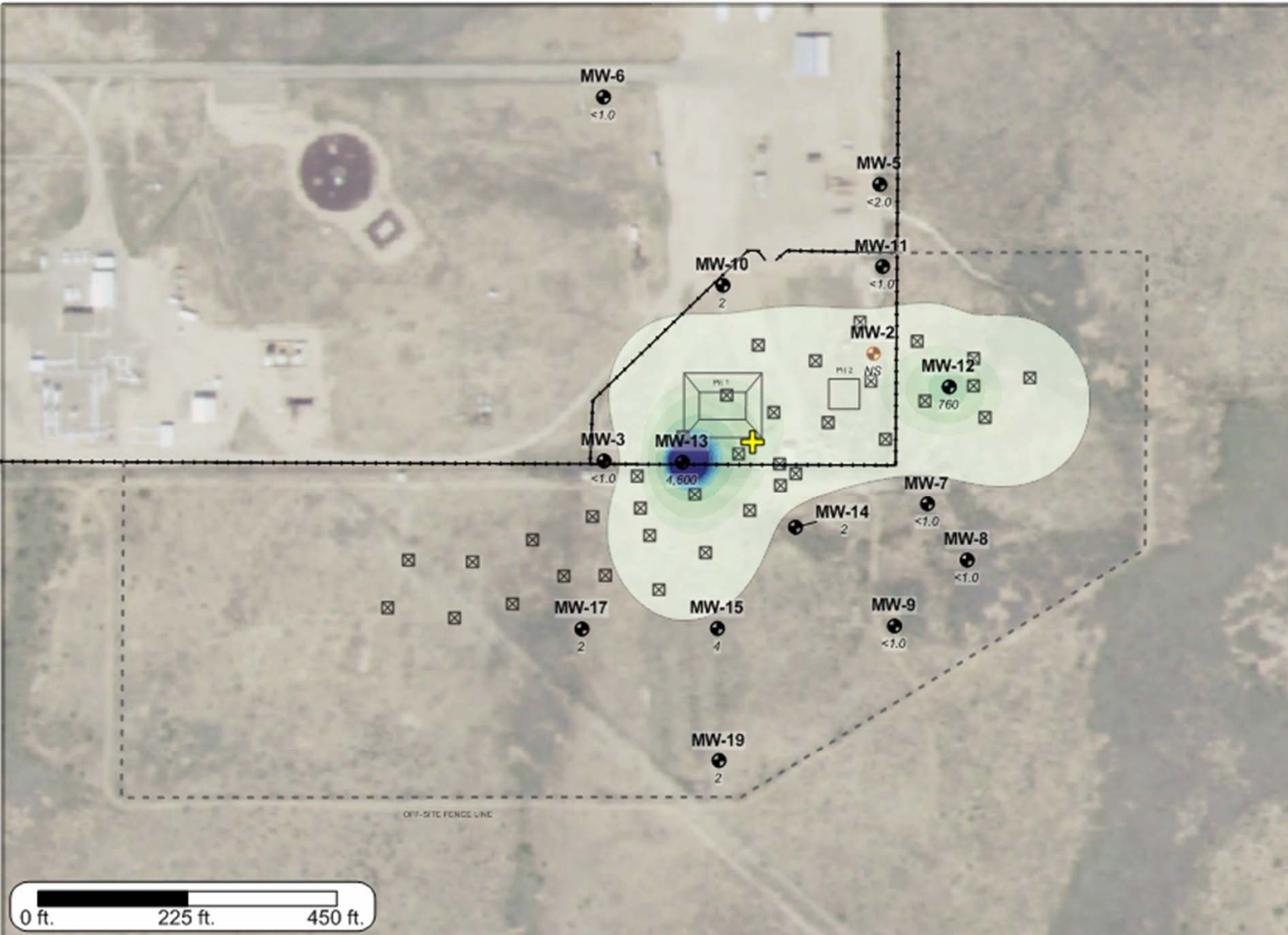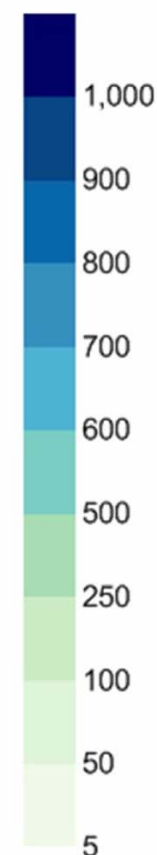
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Benzene

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Benzene
Jan-1996

Concentration (μg/L)

	1,000
	900
	800
	700
	600
	500
	250
	100
	50
	5

MW-6
<1.0

MW-5
<2.0

MW-11
<1.0

MW-10
2

MW-2
NS

MW-12
760

MW-3
<1.0

MW-13
4,600

MW-7
<1.0

MW-14
2

MW-8
<1.0

MW-17
2

MW-15
4

MW-9
<1.0

MW-19
2

OFF-SITE FENCE LINE

0 ft.   225 ft.   450 ft.

LEGEND

Z

MW-4M ⊕ Monitoring Well

MW-4M ⊕ Hanging Well

☒ Extraction Well

112 Concentration (μg/L)

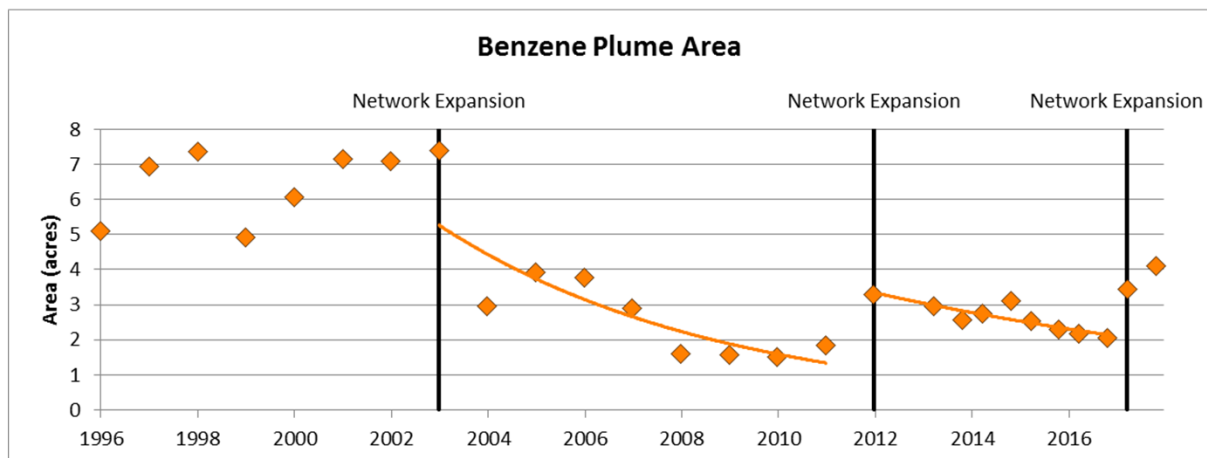NS (146) Well Not Sampled
(Assigned Value Shown)

✛ Plume Center of Mass

Plume Characteristics

Plume Area: **5.1 acres**
Plume Average Concentration: **82.8 μg/L**
Plume Mass Indicator: **6.9 lbs**

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area for the purposes of assessing relative changes
of area, average concentration, and mass indicator
over time. Therefore, any created isopleth maps are
not intended to be a depiction or model of the actual
plume but rather is meant to show conceptual behavior
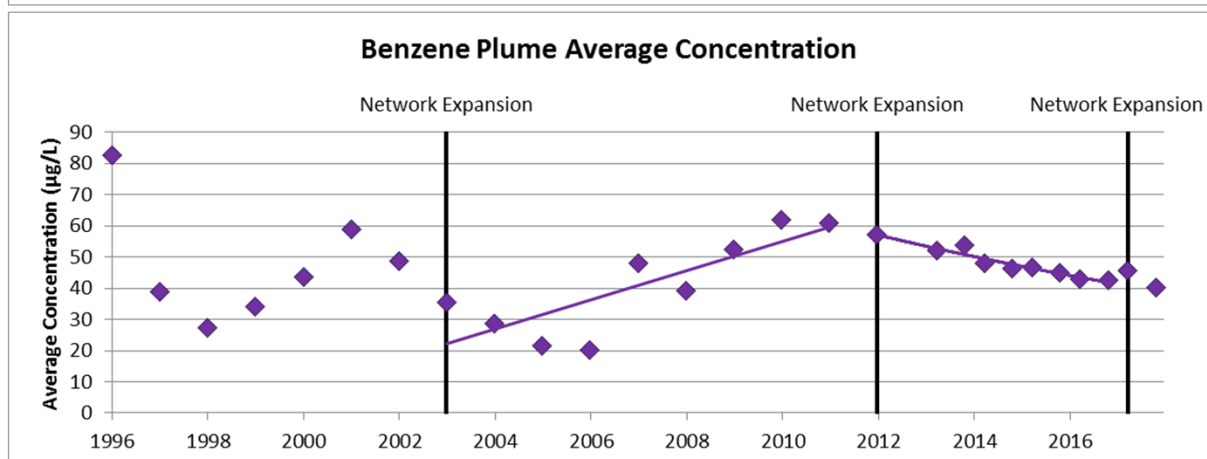of the aforementioned metrics over time.
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Benzene Plume Area

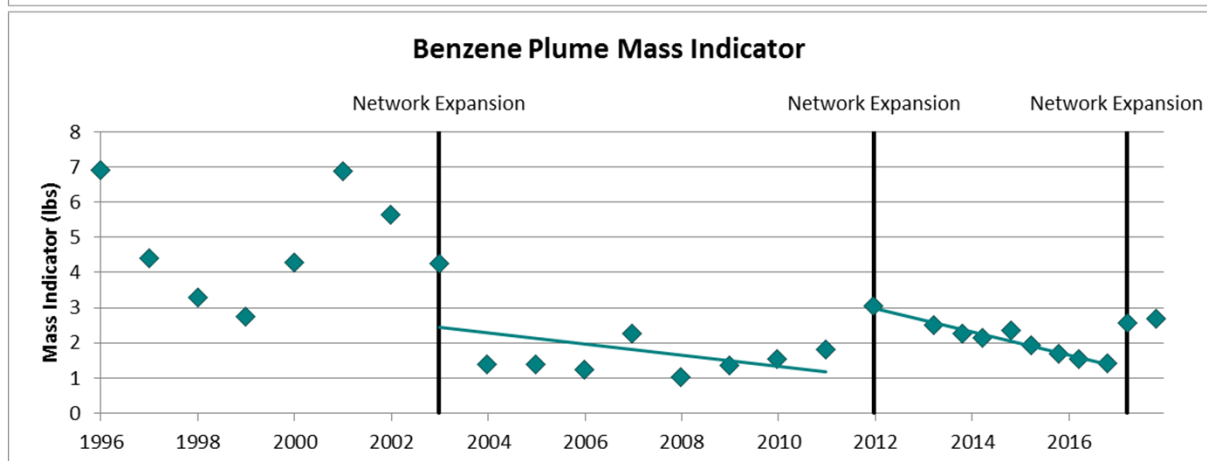Network Expansion | Network Expansion | Network Expansion

Jan-2003 to Jan-2011
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

Jan-2012 to Nov-2016
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

Benzene Plume Average Concentration

Network Expansion | Network Expansion | Network Expansion

Jan-2003 to Jan-2011
Increasing Trend
Mann-Kendall: 98% Confidence
Regression: 99% Confidence

Jan-2012 to Nov-2016
Decreasing Trend
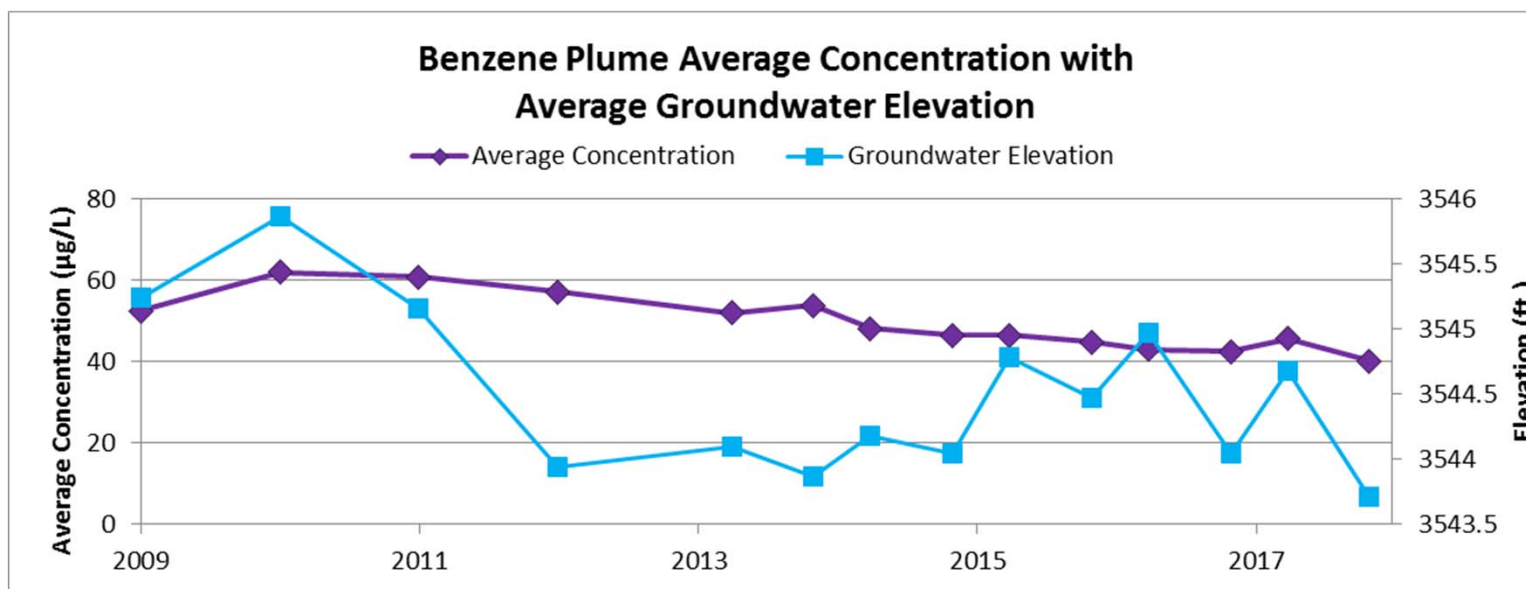Mann-Kendall: >99% Confidence
Regression: >99% Confidence

Benzene Plume Mass Indicator

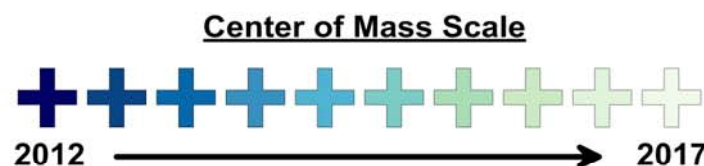Network Expansion | Network Expansion | Network Expansion
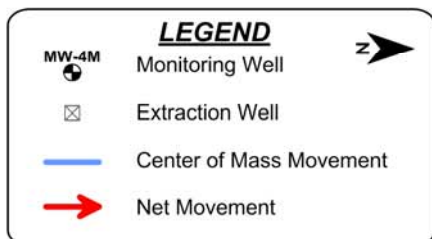
Jan-2003 to Jan-2011
No Trend
Mann-Kendall: 54% Confidence
Regression: 77% Confidence

Jan-2012 to Nov-2016
Decreasing Trend
Mann-Kendall: >99% Confidence
Regression: >99% Confidence

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Benzene Plume Average Concentration with Average Groundwater Elevation

**Benzene
Center of Mass**

Nov-2016

Jan-2012

Nov-2014

0 ft.　　75 ft.　　150 ft.

MW-6

MW-5

MW-11

MW-10

MW-22

MW-41

MW-2

MW-26

MW-40

MW-12

MW-20

MW-39

MW-42

MW-3　　MW-13　　MW-1B

MW-25D

MW-7

MW-14

MW-36

MW-28

MW-8

MW-30

MW-27

MW-21

MW-16

MW-23D

MW-9

MW-37

MW-34

MW-29

MW-17

MW-15

MW-32

MW-35

MW-31

MW-18

MW-38

MW-33

MW-19

MW-24D

OFF-SITE FENCE LINE

0 ft.　　225 ft.　　450 ft.

LEGEND

MW-4M　Monitoring Well

⊠　Extraction Well

———　Center of Mass Movement

→　Net Movement

Center of Mass Scale

2012　　　　　　　　　　2017

W

NW

SW

N

S

NE

SE

E

0 ft.　20 ft.　40 ft.　60 ft.　80 ft.　100 ft.　120 ft.　140 ft.　160 ft.　180 ft.　200 ft.

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Benzene Plume Spread

Jan-2003 to Jan-2011
Decreasing Trend
Mann-Kendall: 99% Confidence
Regression: 99% Confidence

Jan-2012 to Nov-2016
Decreasing Trend
Mann-Kendall: >99% Confidence
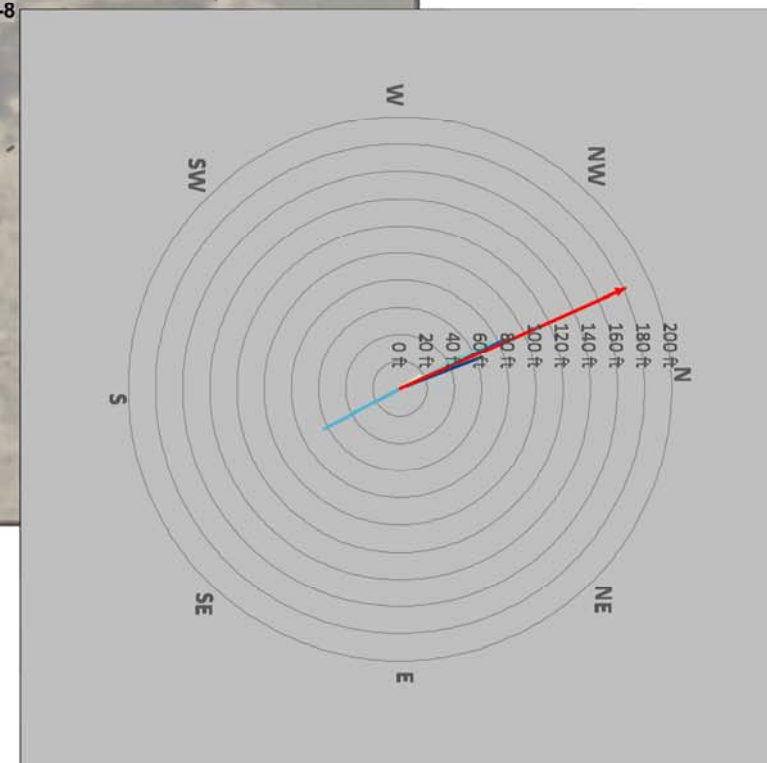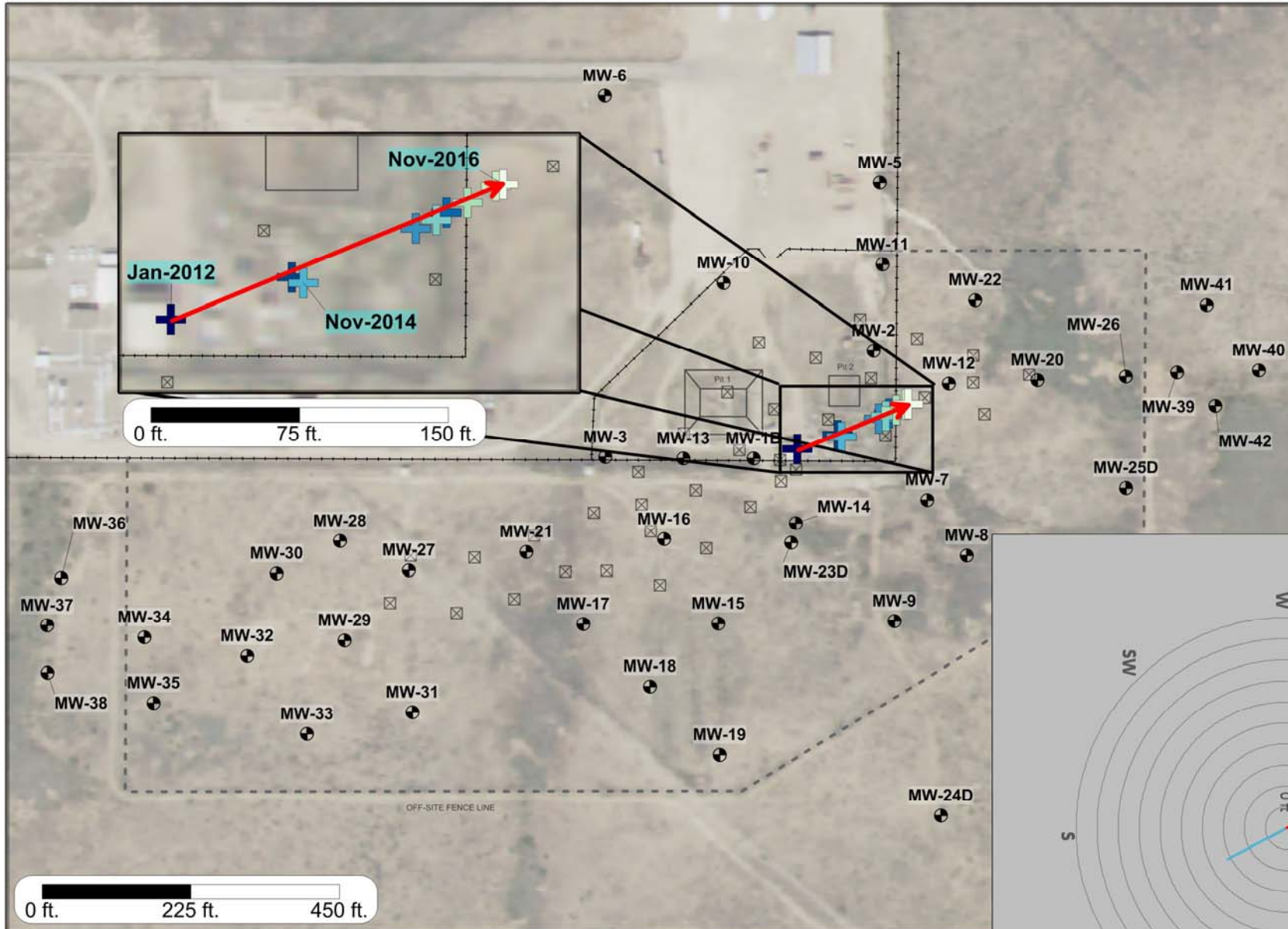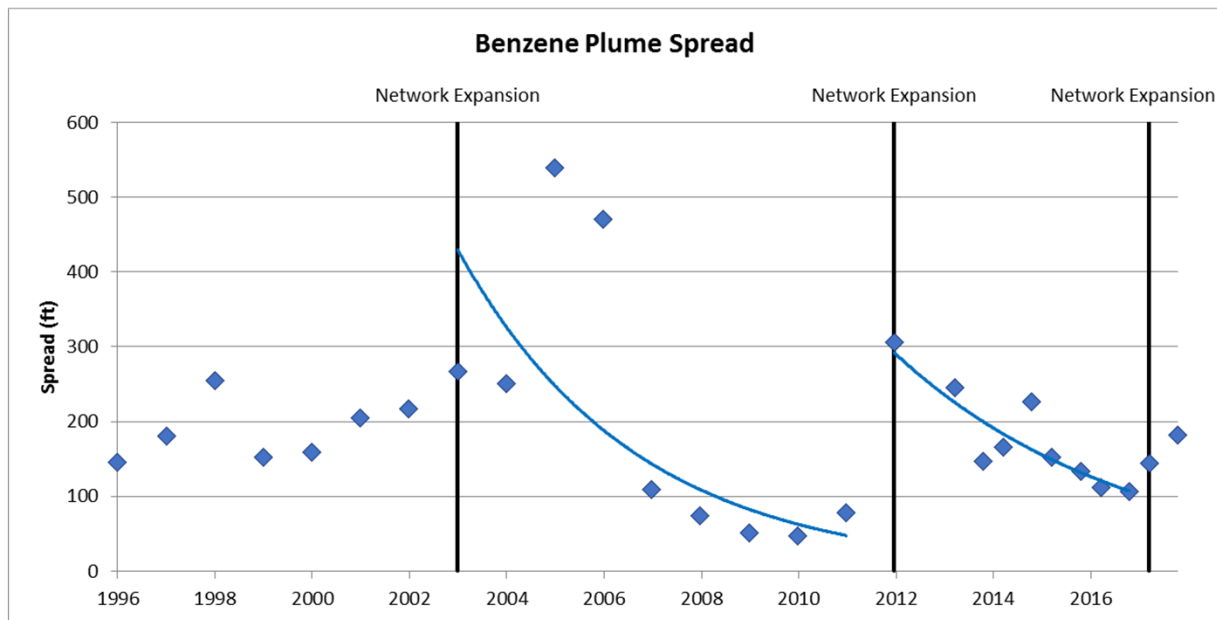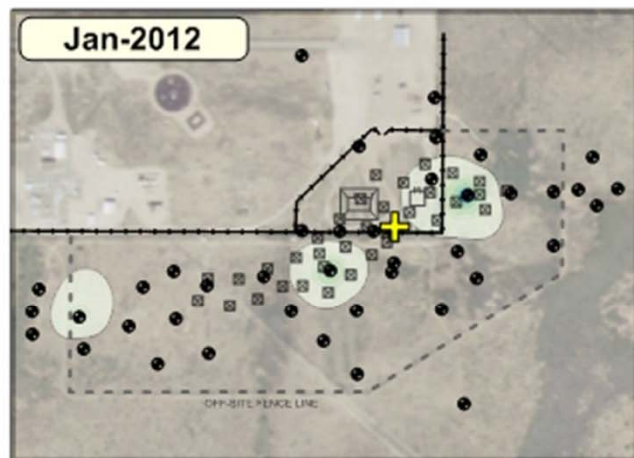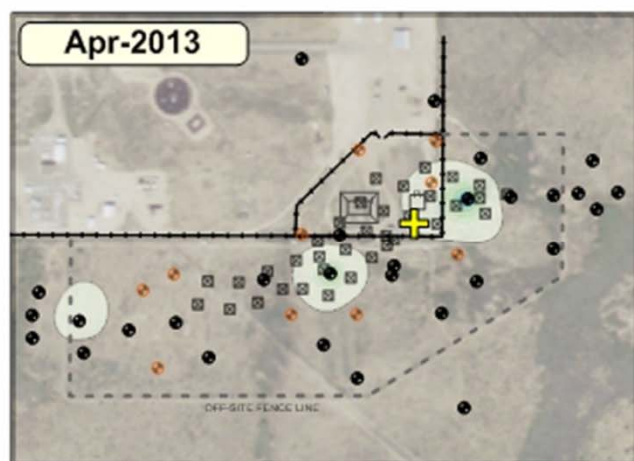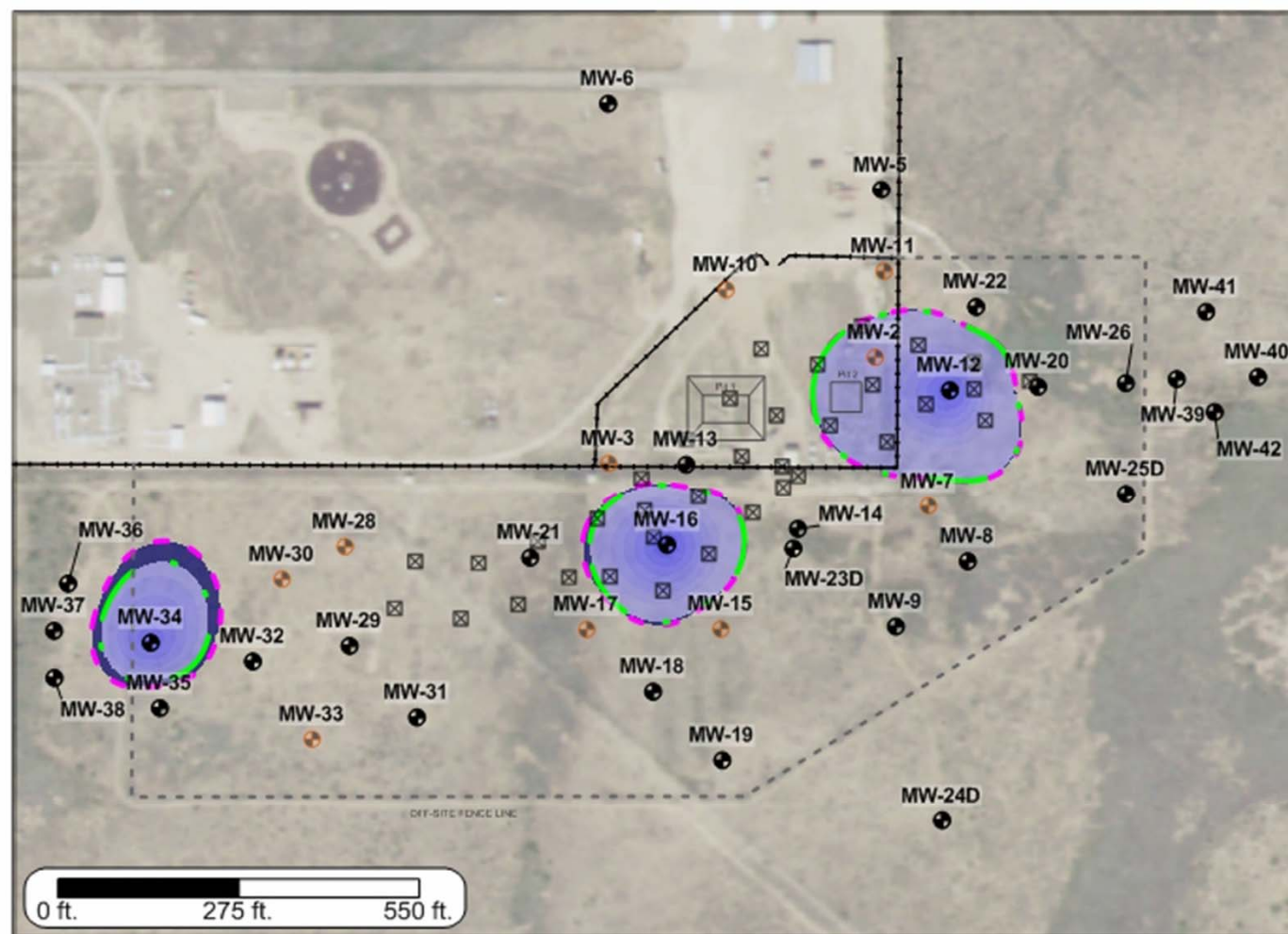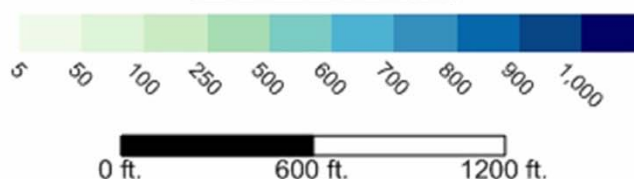Regression: >99% Confidence
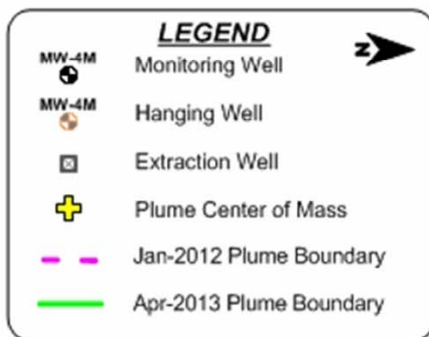
Jan-2012

Concentration (µg/L)

5 50 100 250 500 600 700 800 900 1,000

0 ft.   600 ft.   1200 ft.

Apr-2013

Benzene

Plume Differences Jan-2012 vs Apr-2013

MW-6

MW-5

MW-11

MW-10

MW-22

MW-41

MW-2

MW-26

MW-40

MW-12

MW-20

MW-39

MW-3 MW-13

MW-7

MW-25D

MW-42

MW-36

MW-28

MW-14

MW-8

MW-30

MW-21

MW-16

MW-23D

MW-9

MW-37

MW-34

MW-17

MW-15

MW-32

MW-29

MW-18

MW-35

MW-31

MW-38

MW-33

MW-19

MW-24D

0 ft.   275 ft.   550 ft.

Spatial Change Indicator

-1   0   1

LEGEND

MW-4M Monitoring Well

MW-4M Hanging Well

Extraction Well

Plume Center of Mass

Jan-2012 Plume Boundary

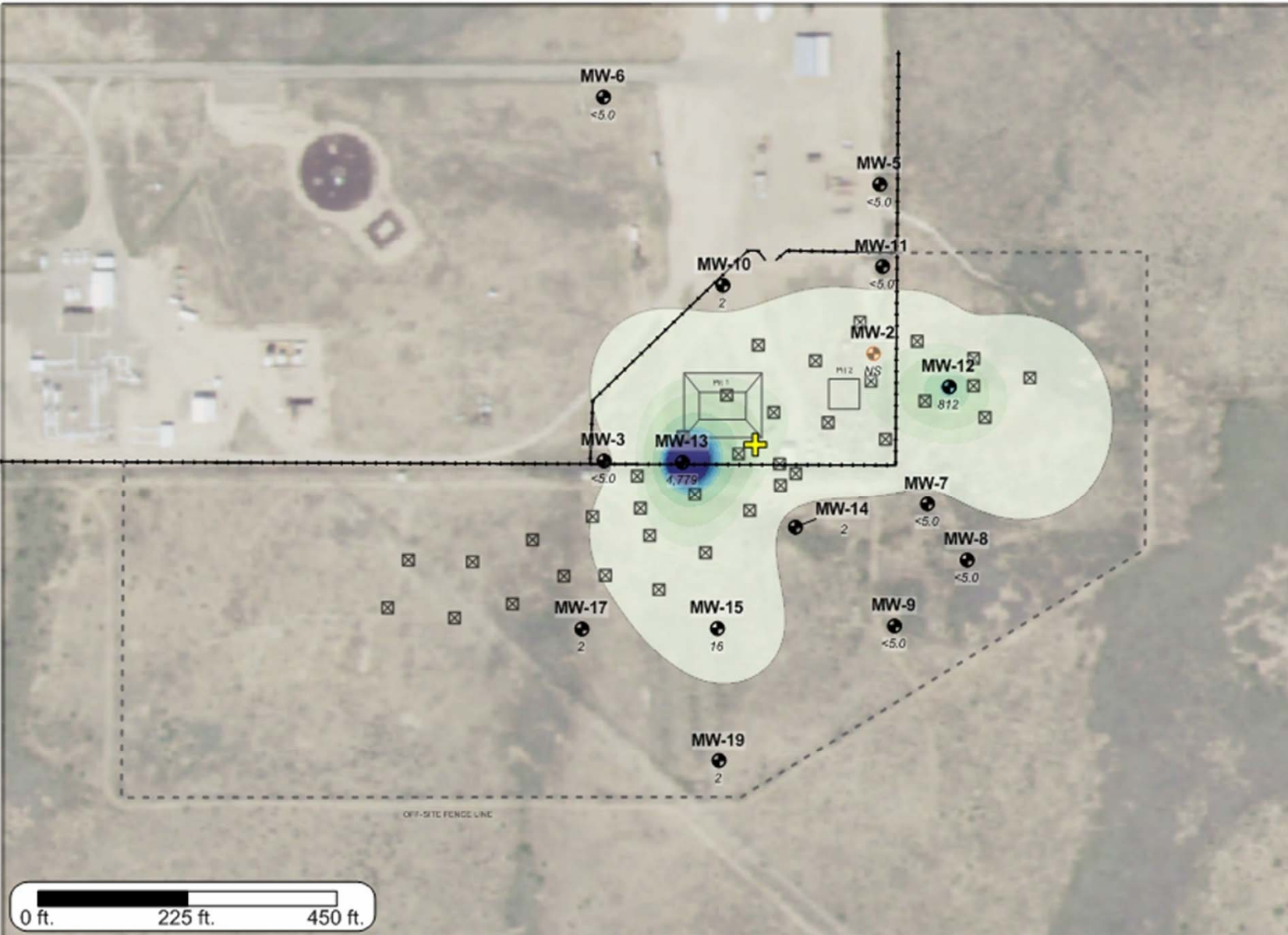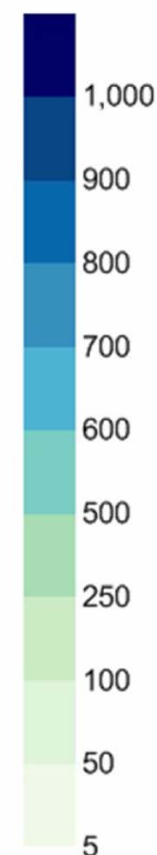Apr-2013 Plume Boundary

Plume Characteristics

Area: **10% Decrease**

Average Concentration: **9% Decrease**

Mass Indicator: **18% Decrease**

Mass Increase: **0.00 lbs Increase**

Mass Decrease: **0.52 lbs Decrease**

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BTEX

BTEX
Jan-1996

Concentration (µg/L)

1,000
900
800
700
600
500
250
100
50
5

MW-6
<5.0

MW-5
<5.0

MW-11
<5.0

MW-10
2

MW-2
NS

MW-12
812

MW-3
<5.0

MW-13
4,779

MW-7
<5.0

MW-14
2

MW-8
<5.0

MW-17
2

MW-15
16

MW-9
<5.0

MW-19
2

OFF-SITE FENCE LINE

0 ft.   225 ft.   450 ft.

LEGEND

MW-4M Monitoring Well

MW-4M Hanging Well

☒ Extraction Well

112 Concentration (µg/L)

NS (146) Well Not Sampled (Assigned Value Shown)

✚ Plume Center of Mass

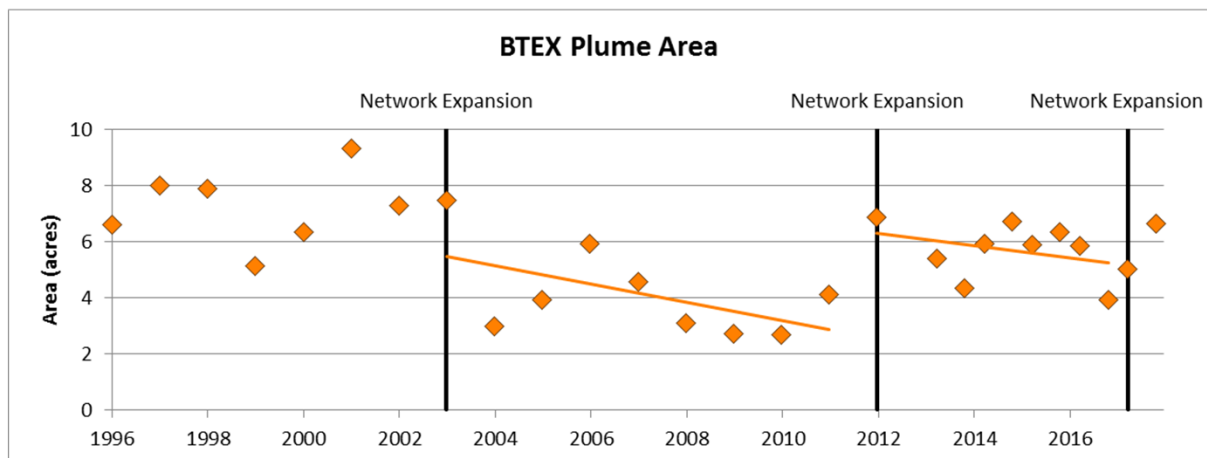## Plume Characteristics

Plume Area: **6.6 acres**
Plume Average Concentration: **76.6 µg/L**
Plume Mass Indicator: **8.3 lbs**

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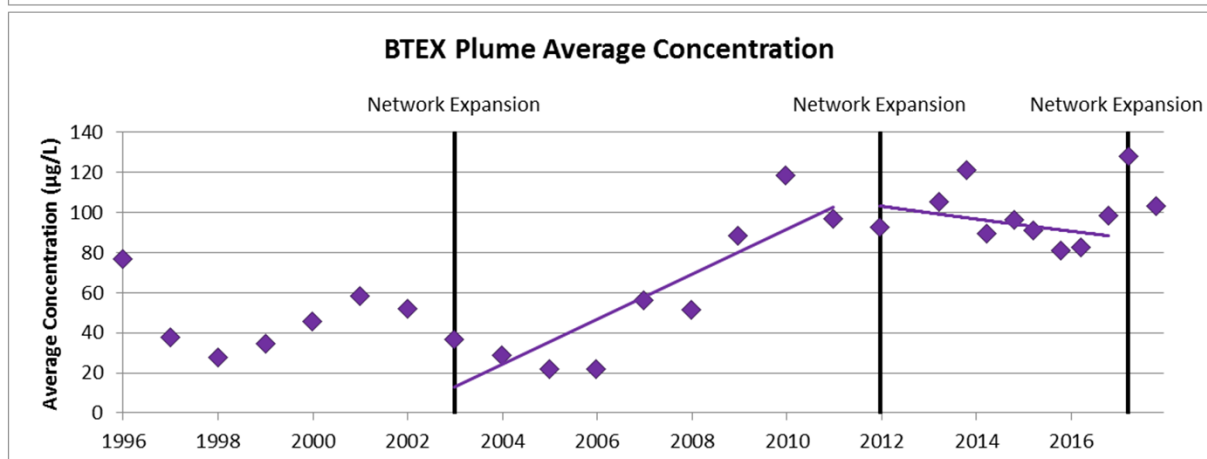
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BTEX Plume Area

Area (acres) vs. year

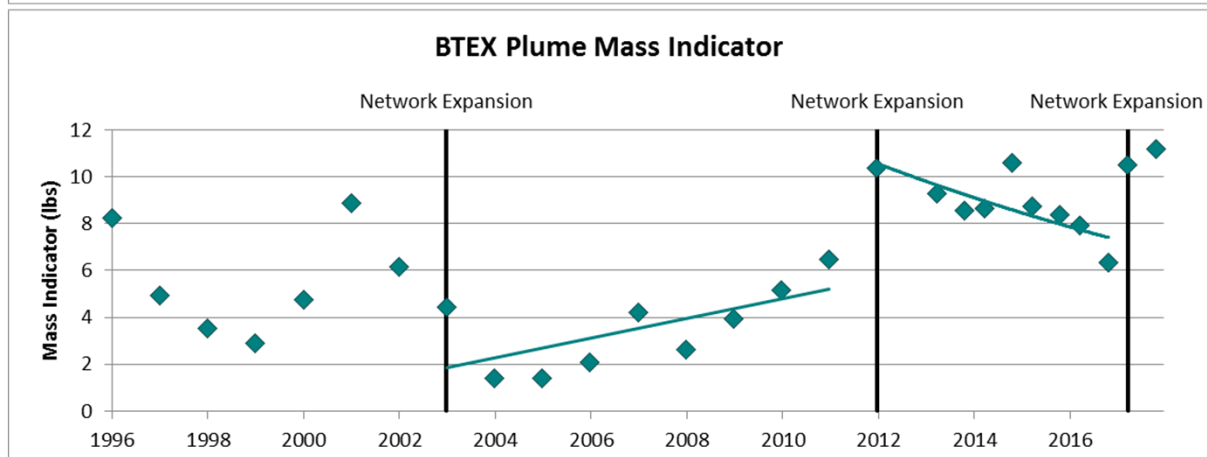Network Expansion | Network Expansion | Network Expansion

Jan-2003 to Jan-2011
No Trend/Decreasing Trend
Mann-Kendall: 91% Confidence
Regression: 88% Confidence

Jan-2012 to Nov-2016
No Trend
Mann-Kendall: 82% Confidence
Regression: 62% Confidence

BTEX Plume Average Concentration

Average Concentration (µg/L) vs. year

Network Expansion | Network Expansion | Network Expansion

Jan-2003 to Jan-2011
Increasing Trend
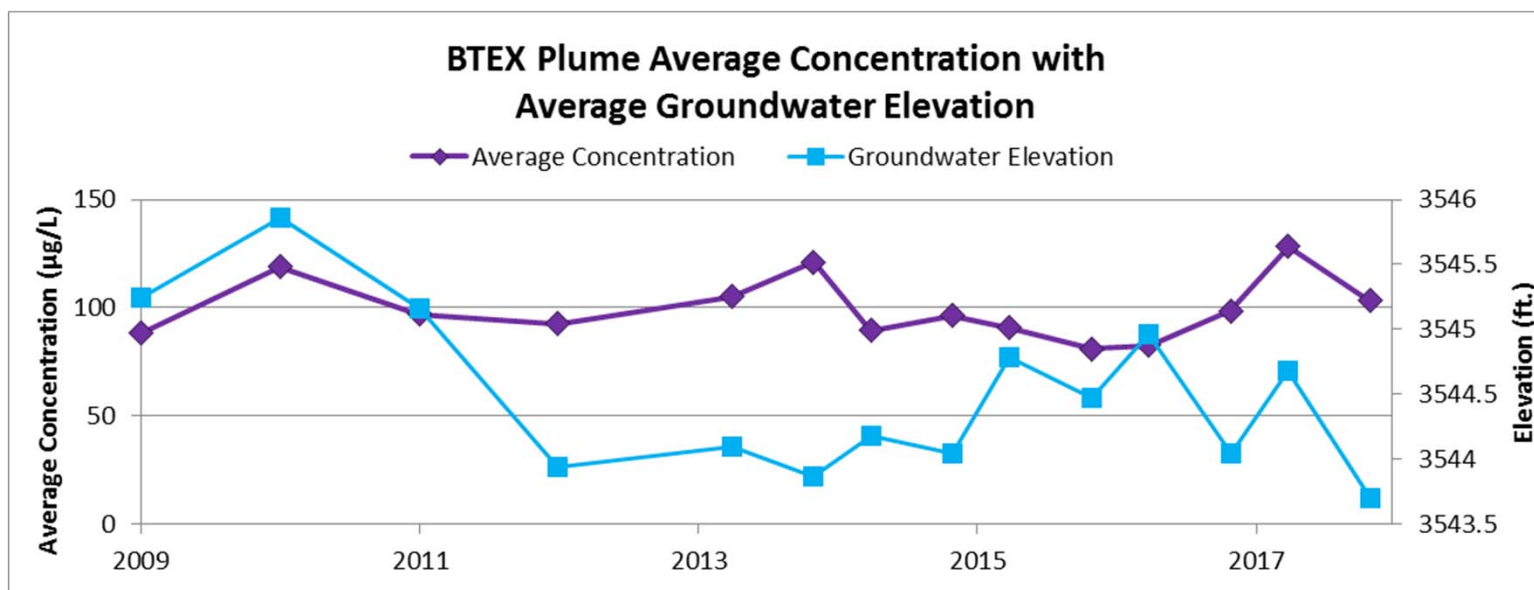Mann-Kendall: 98% Confidence
Regression: >99% Confidence

Jan-2012 to Nov-2016
No Trend
Mann-Kendall: 82% Confidence
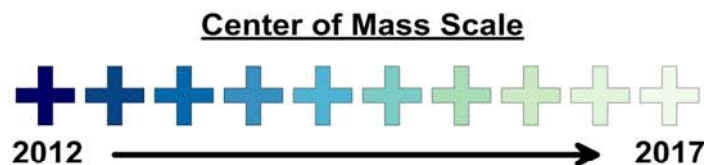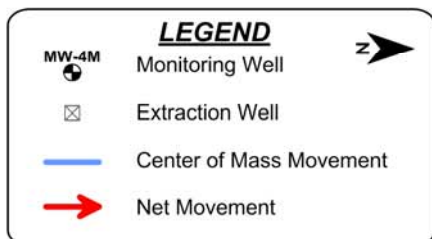Regression: 71% Confidence

BTEX Plume Mass Indicator

Mass Indicator (lbs) vs. year

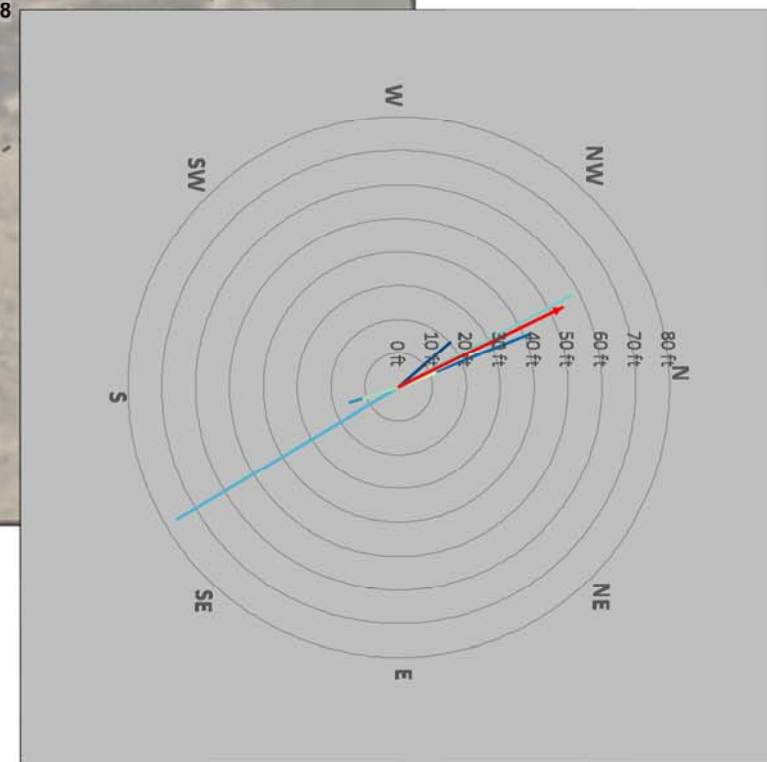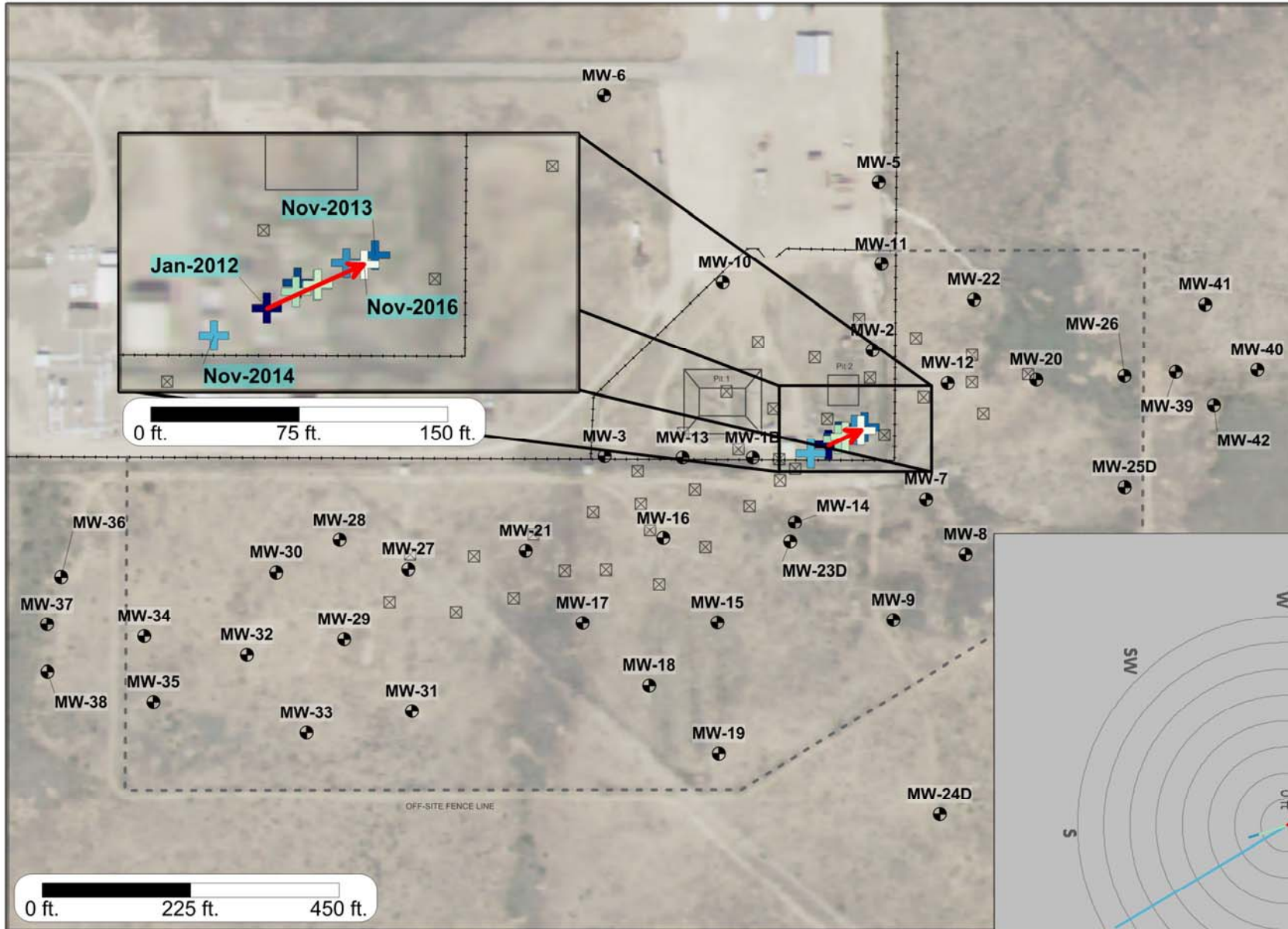Network Expansion | Network Expansion | Network Expansion

Jan-2003 to Jan-2011
Increasing Trend
Mann-Kendall: 98% Confidence
Regression: 94% Confidence

Jan-2012 to Nov-2016
Decreasing Trend
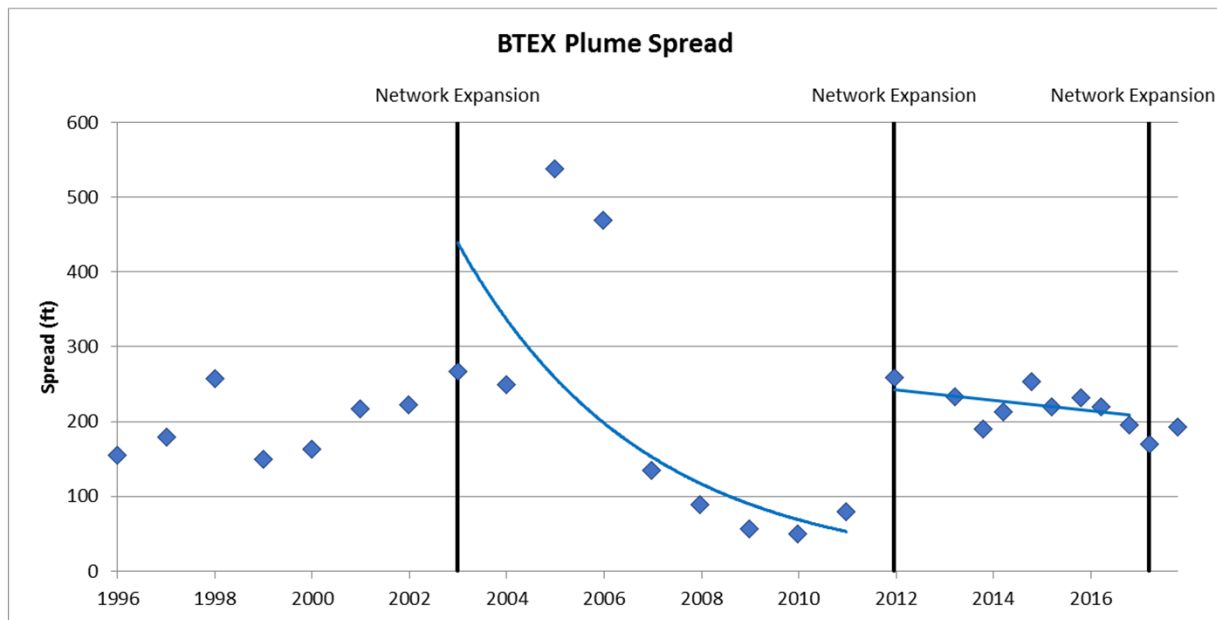Mann-Kendall: 99% Confidence
Regression: 98% Confidence

Groundwater Elevation Correlation

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BTEX Plume Average Concentration with Average Groundwater Elevation

BTEX
Center of Mass

Nov-2013
Jan-2012
Nov-2016
Nov-2014

0 ft. 75 ft. 150 ft.

MW-6
MW-5
MW-11
MW-22
MW-41
MW-10
MW-2
MW-26
MW-40
MW-12
MW-20
MW-39
MW-42
MW-3
MW-13
MW-1B
MW-7
MW-25D
MW-14
MW-8
MW-16
MW-36
MW-28
MW-21
MW-30
MW-27
MW-23D
MW-37
MW-34
MW-29
MW-17
MW-15
MW-9
MW-32
MW-35
MW-31
MW-18
MW-38
MW-33
MW-19
MW-24D

OFF-SITE FENCE LINE

0 ft. 225 ft. 450 ft.

LEGEND
MW-4M Monitoring Well
⊠ Extraction Well
—— Center of Mass Movement
→ Net Movement

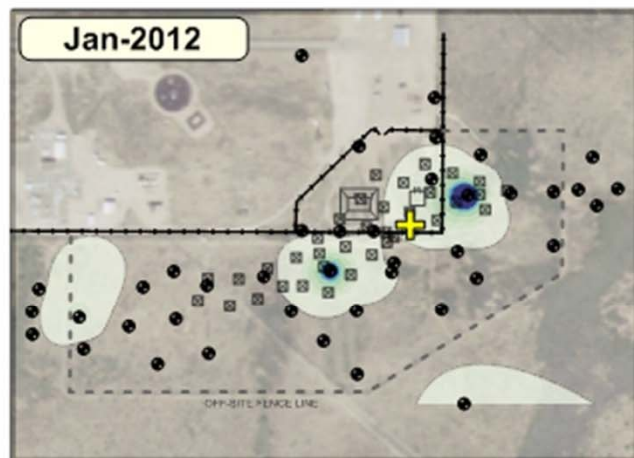Center of Mass Scale

2012   2017

This analysis requires fixed data points within a fixed
area for the purposes of assessing relative changes
of area, average concentration, and mass indicator
over time. Therefore, any created isopleth maps are
not intended to be a depiction or model of the actual
plume but rather is meant to show conceptual behavior
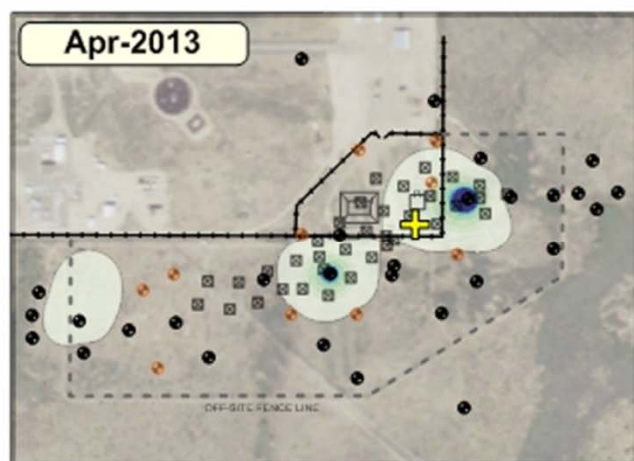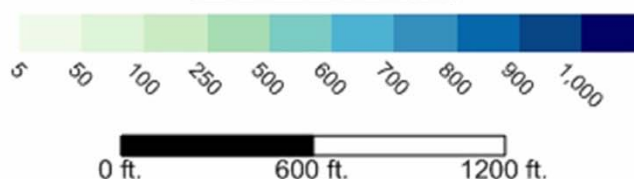of the aforementioned metrics over time.

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BTEX Plume Spread

Network Expansion   Network Expansion   Network Expansion

Spread (ft)

Jan-2003 to Jan-2011
Decreasing Trend
Mann-Kendall: 99% Confidence
Regression: 99% Confidence

Jan-2012 to Nov-2016
No Trend
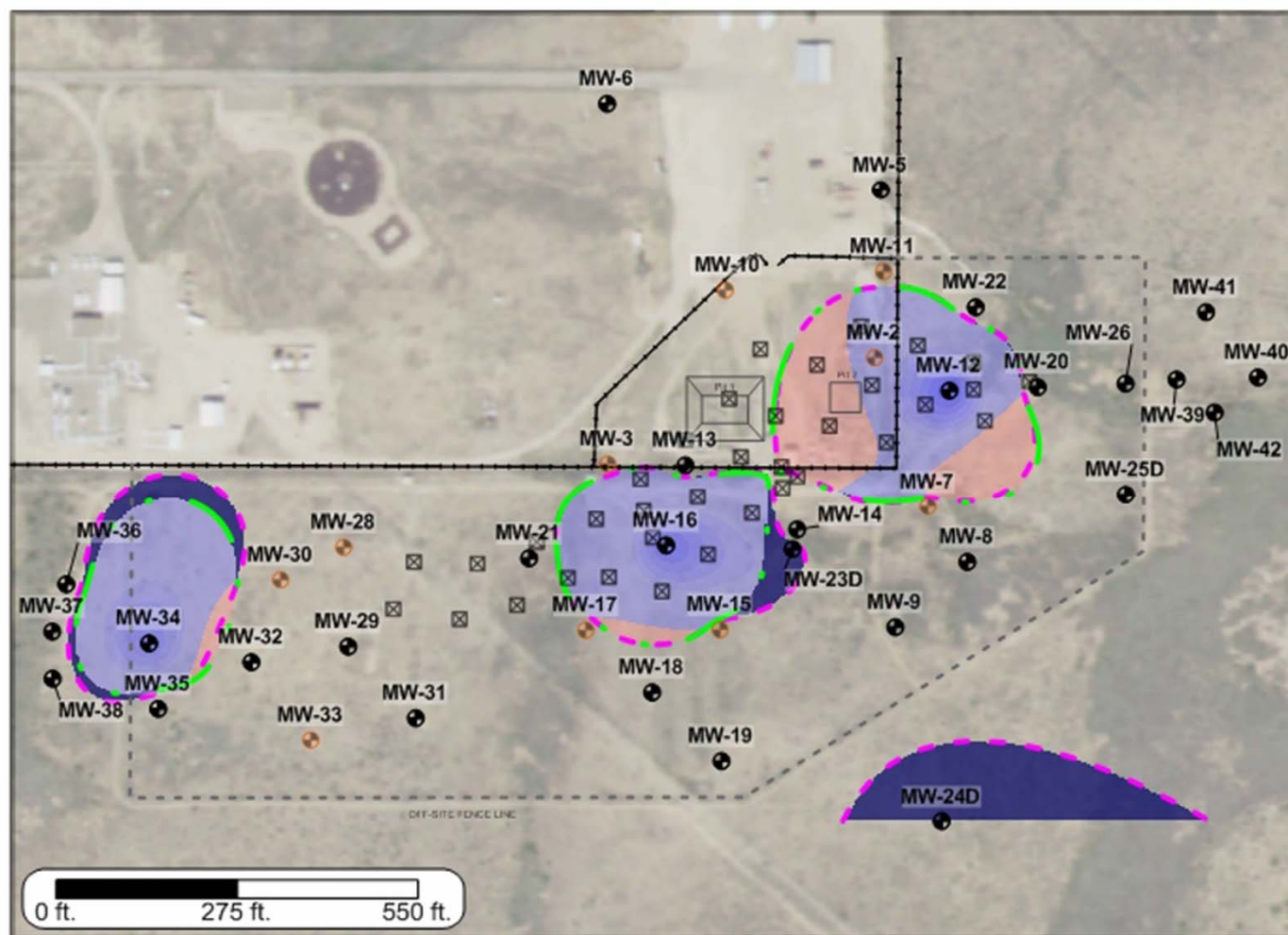Mann-Kendall: 87% Confidence
Regression: 78% Confidence

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Jan-2012

Apr-2013

Concentration (µg/L)

5 50 100 250 500 600 700 800 900 1,000

0 ft. 600 ft. 1200 ft.

BTEX

Plume Differences Jan-2012 vs Apr-2013

MW-6
MW-5
MW-11
MW-10
MW-22
MW-41
MW-2
MW-26
MW-40
MW-12
MW-20
MW-39
MW-42
MW-3
MW-13
MW-7
MW-25D
MW-14
MW-8
MW-36
MW-28
MW-21
MW-16
MW-30
MW-37
MW-34
MW-17
MW-15
MW-9
MW-32
MW-29
MW-23D
MW-35
MW-18
MW-38
MW-31
MW-33
MW-19
MW-24D

0 ft. 275 ft. 550 ft.

Spatial Change Indicator

-1　　　　0　　　　1

LEGEND

MW-4M　Monitoring Well

MW-4M　Hanging Well

⊠　Extraction Well

✛　Plume Center of Mass

- - - Jan-2012 Plume Boundary

──　Apr-2013 Plume Boundary

Plume Characteristics

Area: **21% Decrease**

Average Concentration: **14% Increase**

Mass Indicator: **11% Decrease**

Mass Increase: **0.01 lbs Increase**

Mass Decrease: **1.02 lbs Decrease**

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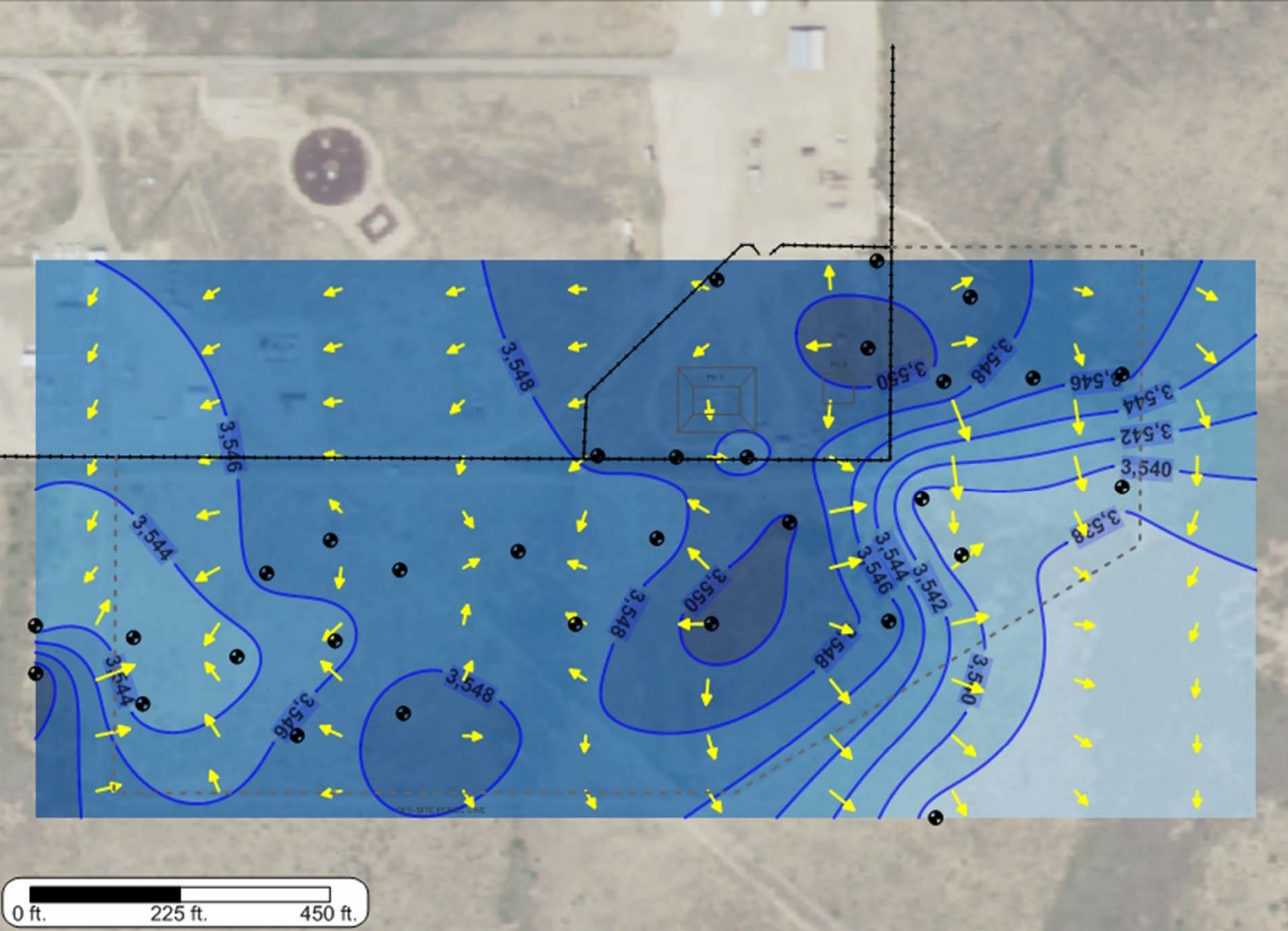
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GWE

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Groundwater Elevation Jan-2009

Elevation (ft.)

3,550
3,548
3,546
3,544
3,542
3,540
3,538
3,536
3,534
3,532
3,530

0 ft.   225 ft.   450 ft.

LEGEND

MW-4M   Monitoring Well

MW-4M   Hanging Well

Extraction Well

Groundwater Elevation Contour
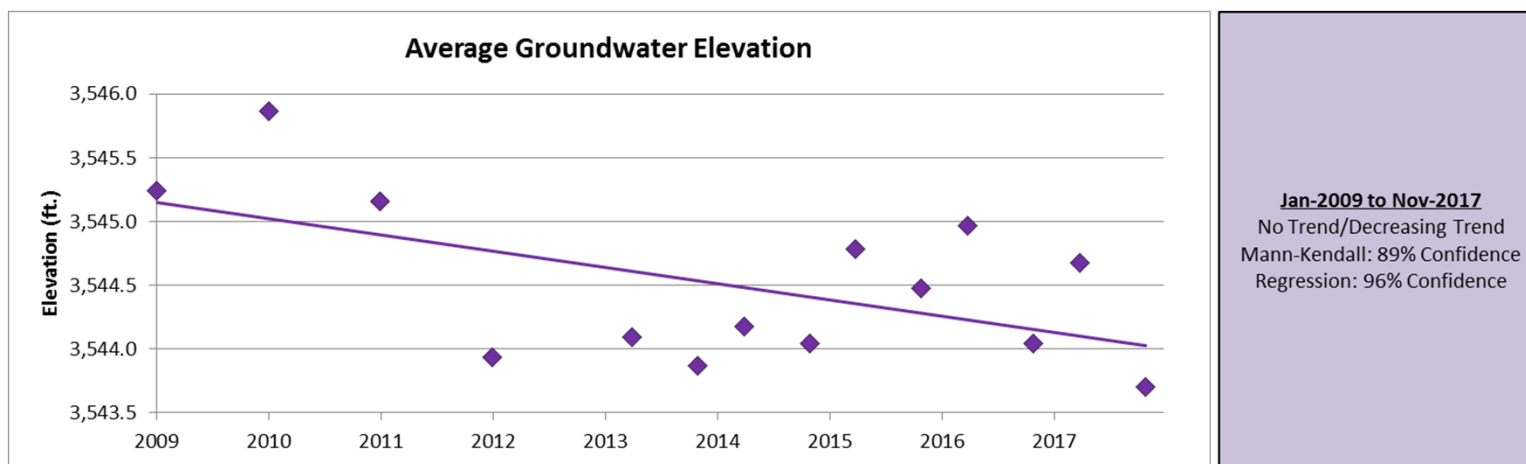
Groundwater Flow Direction

Plume Characteristics

Average Groundwater Elevation: **3,545 ft.**

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Average Groundwater Elevation

Jan-2009 to Nov-2017
No Trend/Decreasing Trend
Mann-Kendall: 89% Confidence
Regression: 96% Confidence

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Groundwater Elevation
Jan-2009

Potentiometric Surface
Variance (ft.)

10
8
6
4
2
1

0

-1
-2
-4
-6
-8
-10

0 ft.   225 ft.   450 ft.
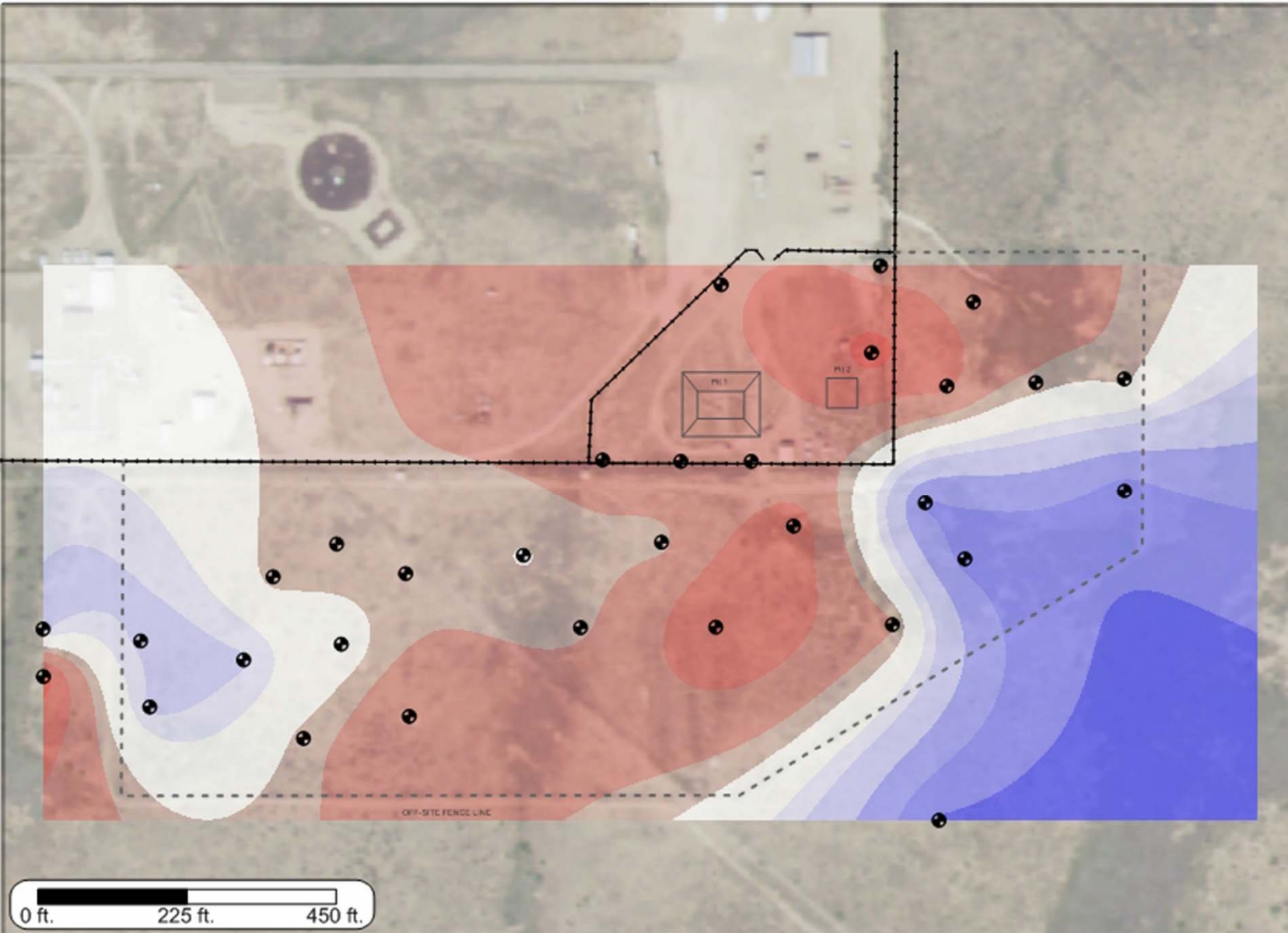
LEGEND

MW-4M Monitoring Well

MW-4M Hanging Well

Extraction Well

Plume Characteristics

Average Groundwater Elevation: **3,545 ft.**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.
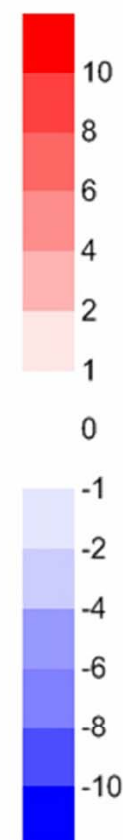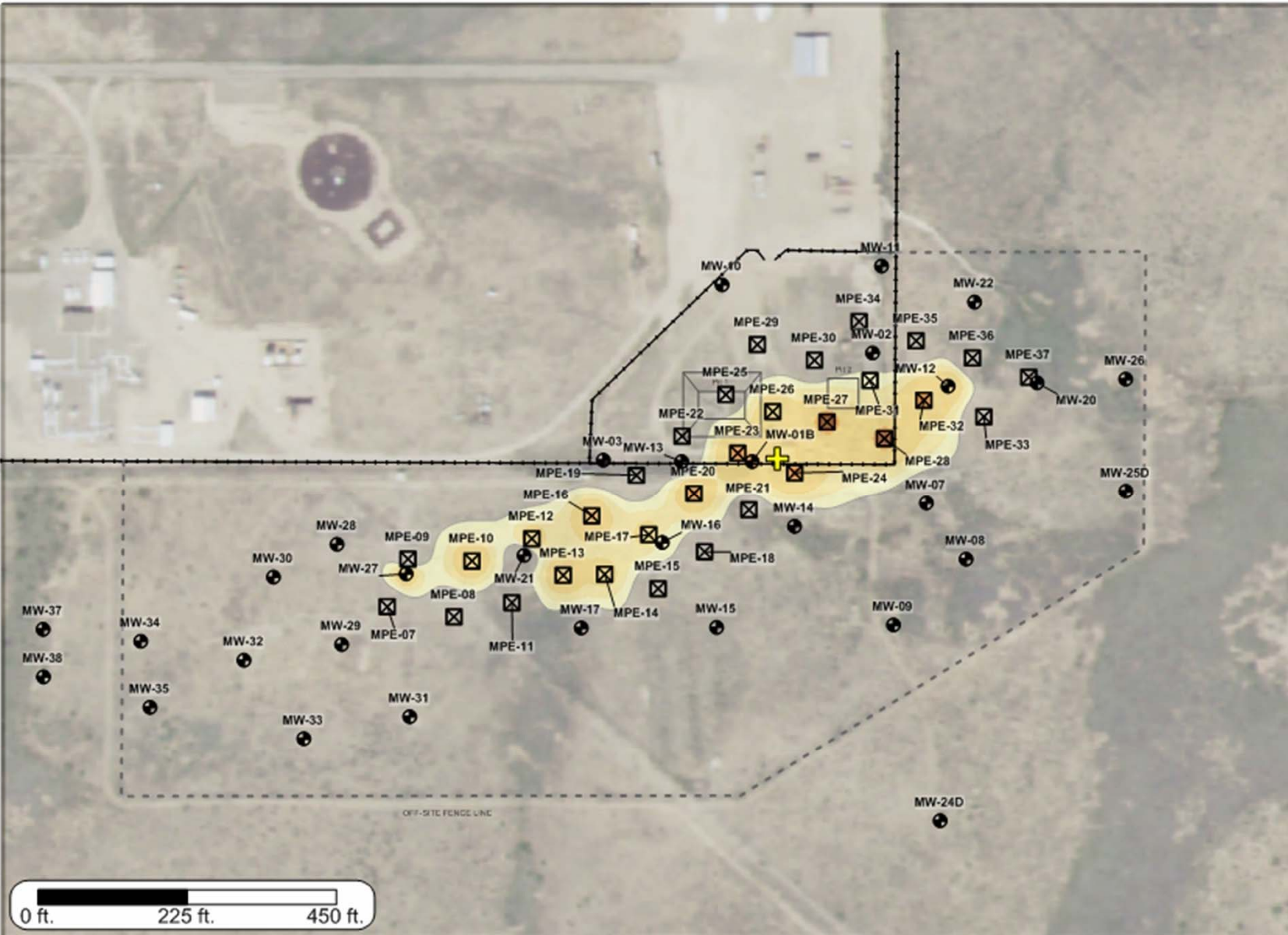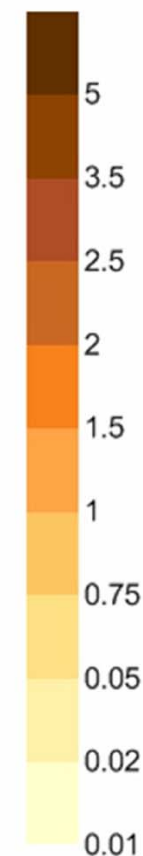
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Thickness (ft.)

5
3.5
2.5
2
1.5
1
0.75
0.05
0.02
0.01

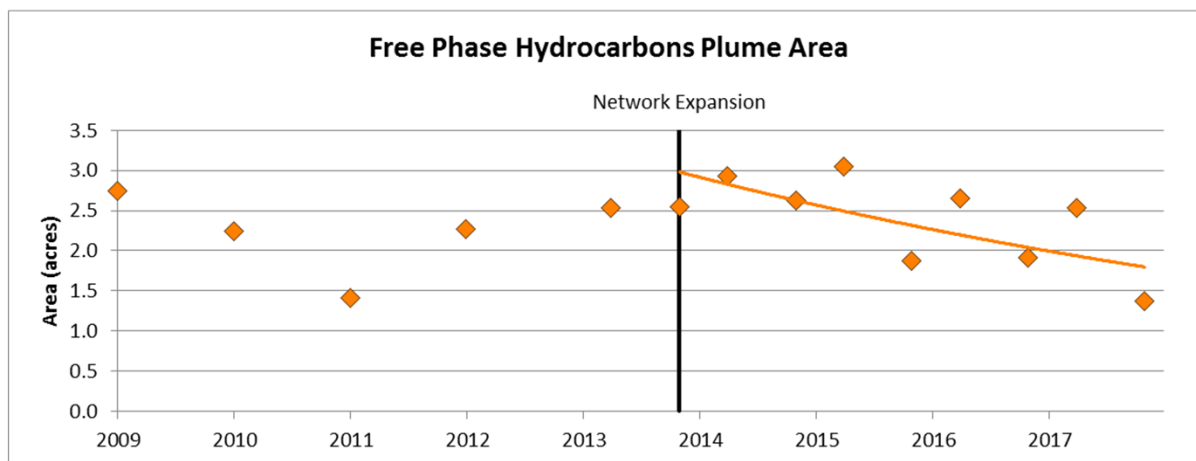**LEGEND**

MW-4M Monitoring Well

Extraction Well

Hanging Well

112 Thickness (ft.)

NS (146) Well Not Sampled (Assigned Value Shown)

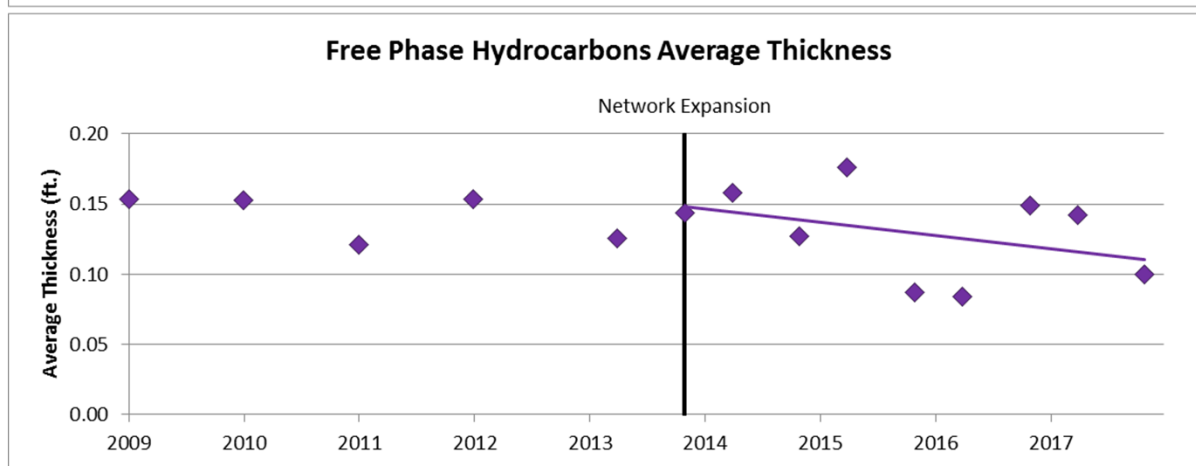Plume Center of Mass

0 ft.   225 ft.   450 ft.

Plume Characteristics

Plume Area: **2.7 acres**
Plume Average Thickness: **0.15 ft.**

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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Free Phase Hydrocarbons Plume Area

Network Expansion

Nov-2013 to Nov-2017
Decreasing Trend
Mann-Kendall: 91% Confidence
Regression: 95% Confidence

Free Phase Hydrocarbons Average Thickness

Network Expansion

Nov-2013 to Nov-2017
No Trend
Mann-Kendall: 82% Confidence
Regression: 70% Confidence
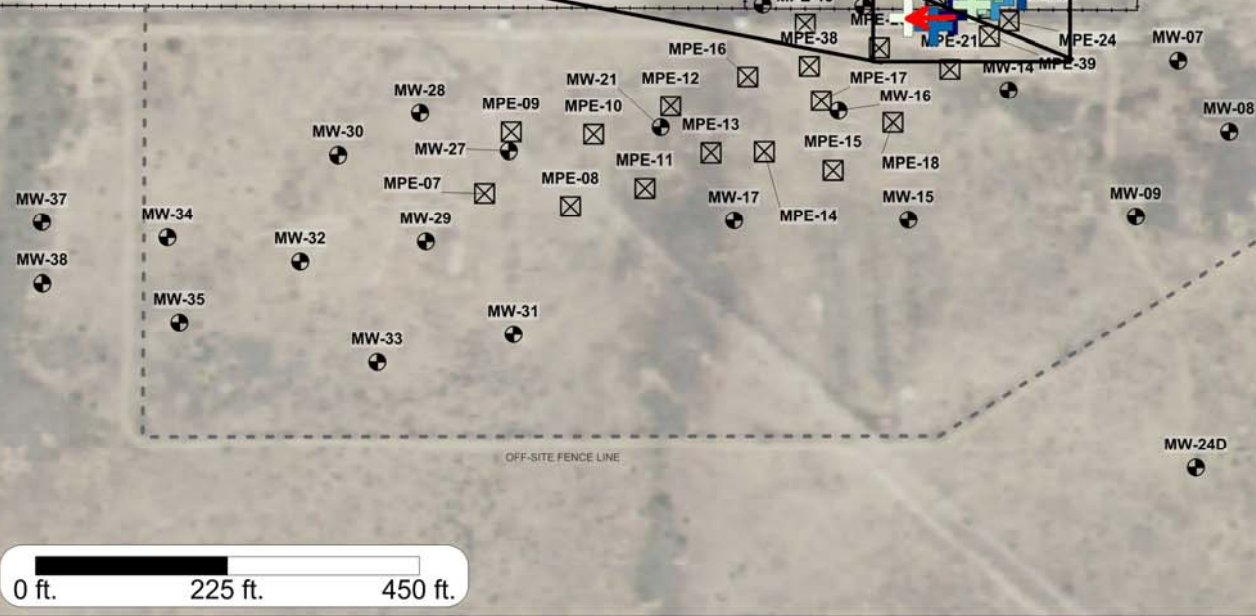
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PSH
Center of Mass

Nov-2015
Nov-2016
Nov-2017
Nov-2014
Nov-2013

MPE-23
MW-01B
MPE-24
MPE-20
MPE-39
MPE-27

0 ft.   75 ft.   150 ft.

MW-10   MW-11   MW-22   MW-41

MPE-34   MW-02 MPE-35
MPE-29   MPE-31   MPE-36   MW-39   MW-40
MPE-30   MPE-37   MW-26   MW-42
MPE-25   MPE-26   MW-12   MPE-41   MW-20
Pit 1   MPE-27
MPE-22   MPE-28   MPE-32
MPE-23   MPE-33
MW-03   MW-13   MW-25D
MPE-19   MPE-21   E-40
MPE-38   MPE-24
MPE-16   MPE-17   MPE-14 MPE-39   MW-07
MW-21 MPE-12   MW-16   MW-08
MW-28   MPE-09   MPE-10   MW-09
MW-30   MPE-13
MW-27   MPE-11   MPE-15
MPE-07   MPE-08   MPE-18
MW-37   MW-34   MW-17   MPE-14   MW-15
MW-29
MW-38   MW-32
MW-35
MW-33   MW-31

OFF-SITE FENCE LINE

MW-24D

0 ft.   225 ft.   450 ft.

LEGEND
MW-4M   Monitoring Well   N
⊠   Extraction Well
———   Center of Mass Movement
→   Net Movement

Center of Mass Scale

✚✚✚✚✚✚✚✚✚✚
2013 ———————————→ 2017

W   NW
SW
S   0 ft   20 ft   40 ft   60 ft   80 ft   100 ft   120 ft   N
SE   NE
E

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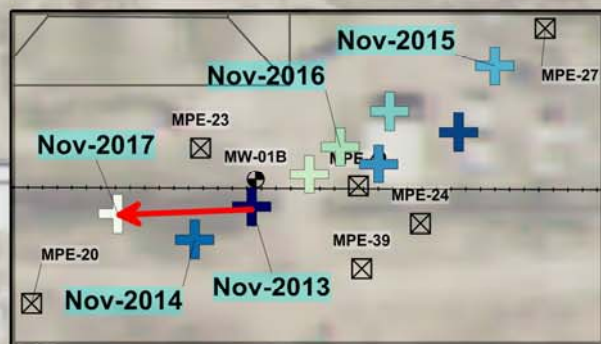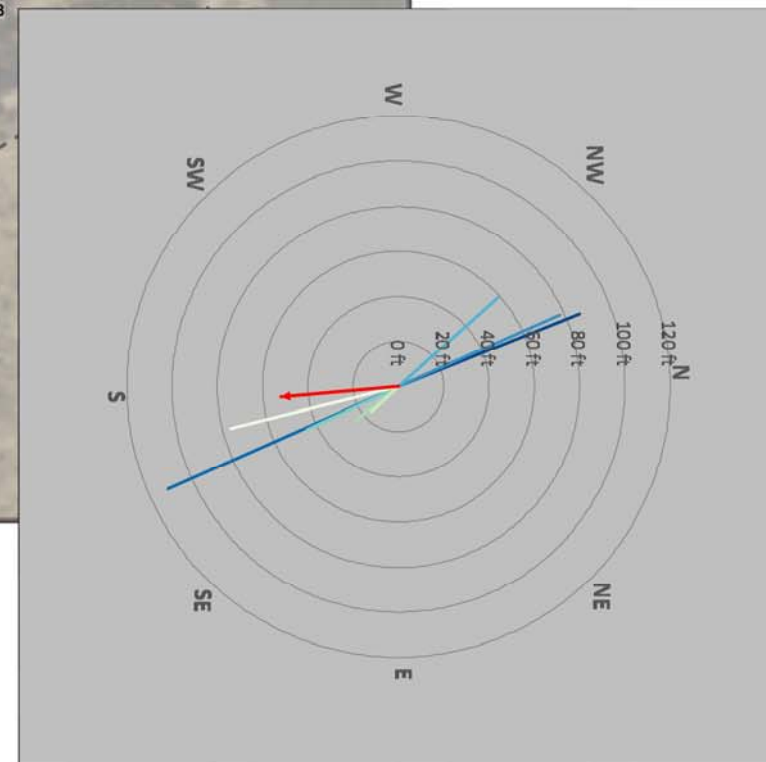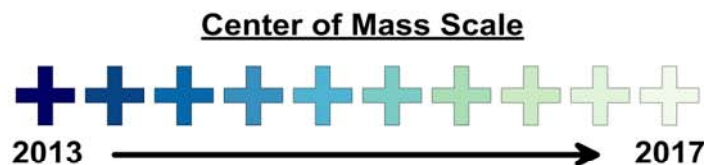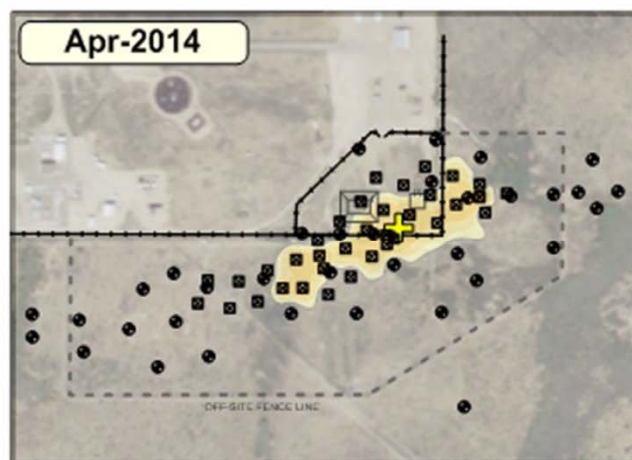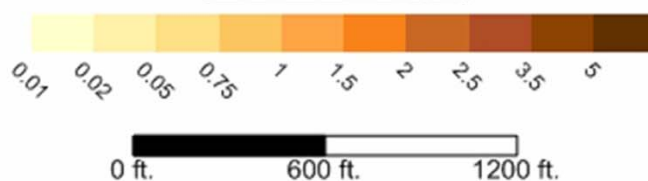
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Nov-2013

Apr-2014

Concentration (µg/L)

0.01 0.02 0.05 0.75 1 1.5 2 2.5 3.5 5

0 ft.   600 ft.   1200 ft.
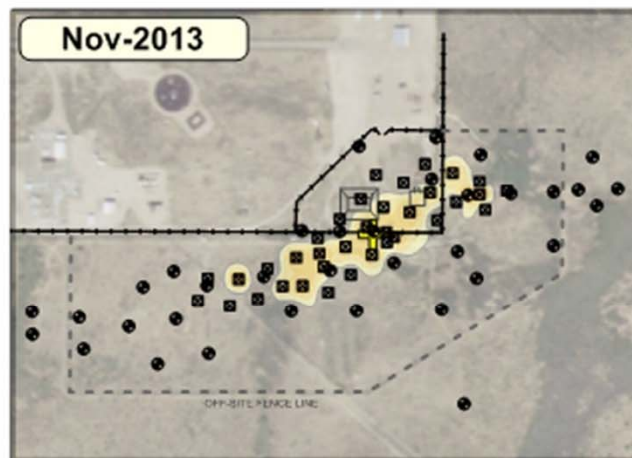
PSH

Plume Differences Nov-2013 vs Apr-2014

0 ft.   275 ft.   550 ft.

Spatial Change Indicator

-1   0   1

LEGEND

MW-4M Monitoring Well

MW-4M Hanging Well

☒ Extraction Well

✚ Plume Center of Mass

― ― ― Nov-2013 Plume Boundary

――― Apr-2014 Plume Boundary

Plume Characteristics

Area: **15% Increase**

Average Thickness: **10% Increase**

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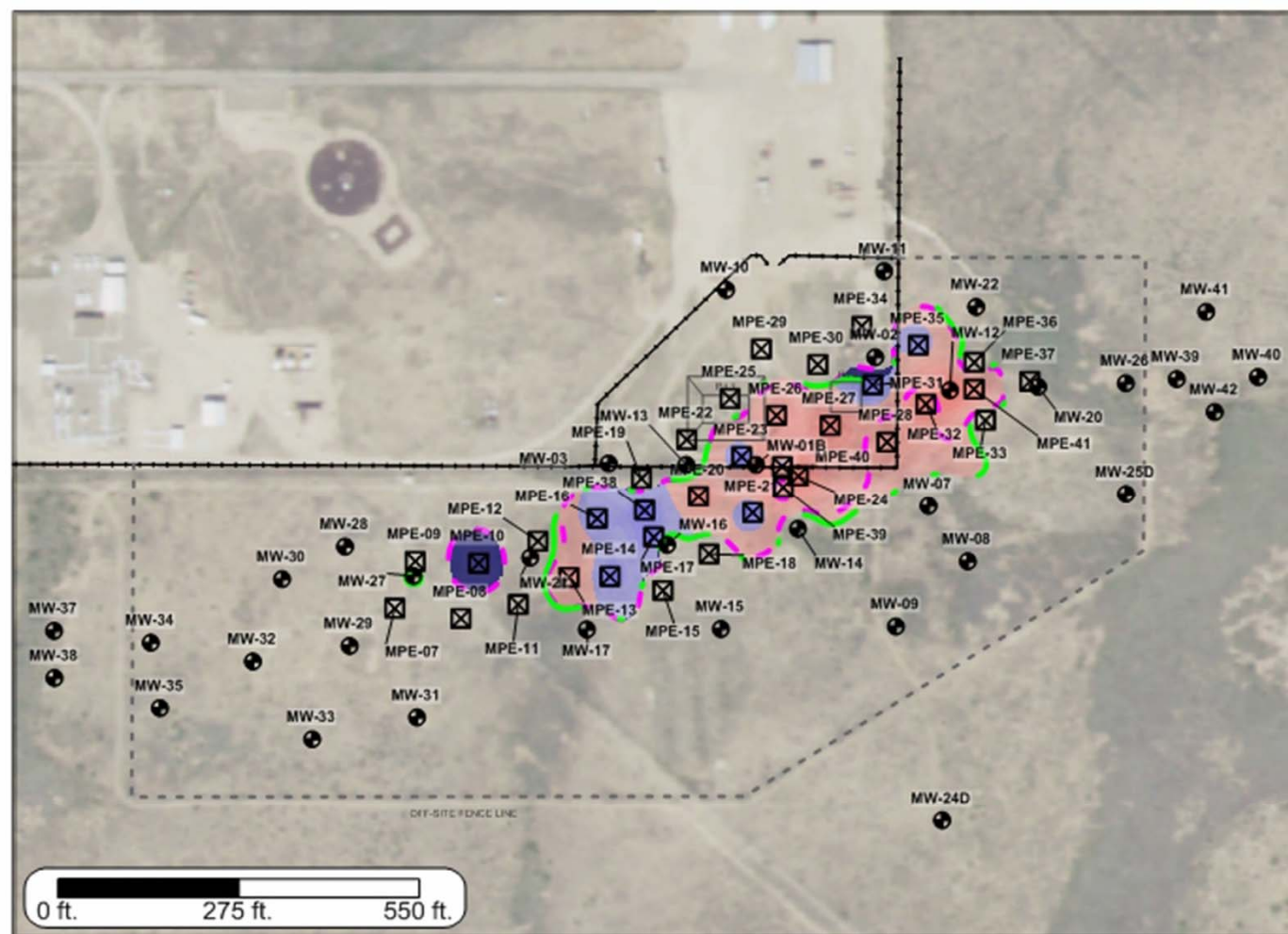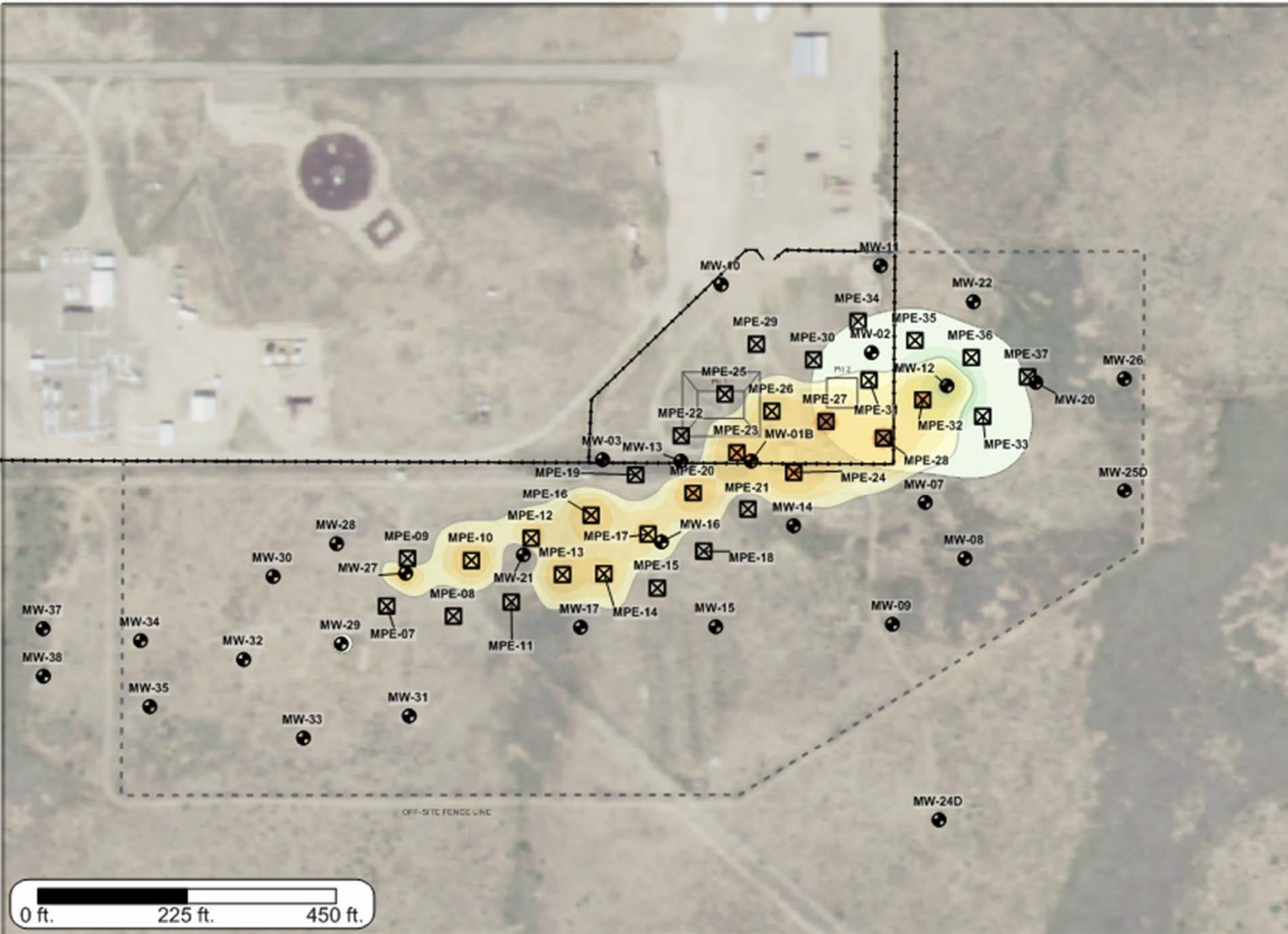© EarthCon 2018

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PSH Jan-2009

Benzene Plume Characteristics

Plume Area: **1.6 acres**
Plume Average Concentration: **52.5 µg/L**
Plume Mass Indicator: **1.3 lbs**

PSH Plume Characteristics

Plume Area: **2.7 acres**
Plume Average Thickness: **0.15 ft.**

LEGEND

MW-4M — Monitoring Well
⊠ — Extraction Well
⬡ — Hanging Well

Thickness (ft.)
5
3.5
2.5
2
1.5
1
0.75
0.05
0.02
0.01

Concentration (µg/L)
1,000
900
800
700
600
500
250
100
50
5

0 ft.   225 ft.   450 ft.

This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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