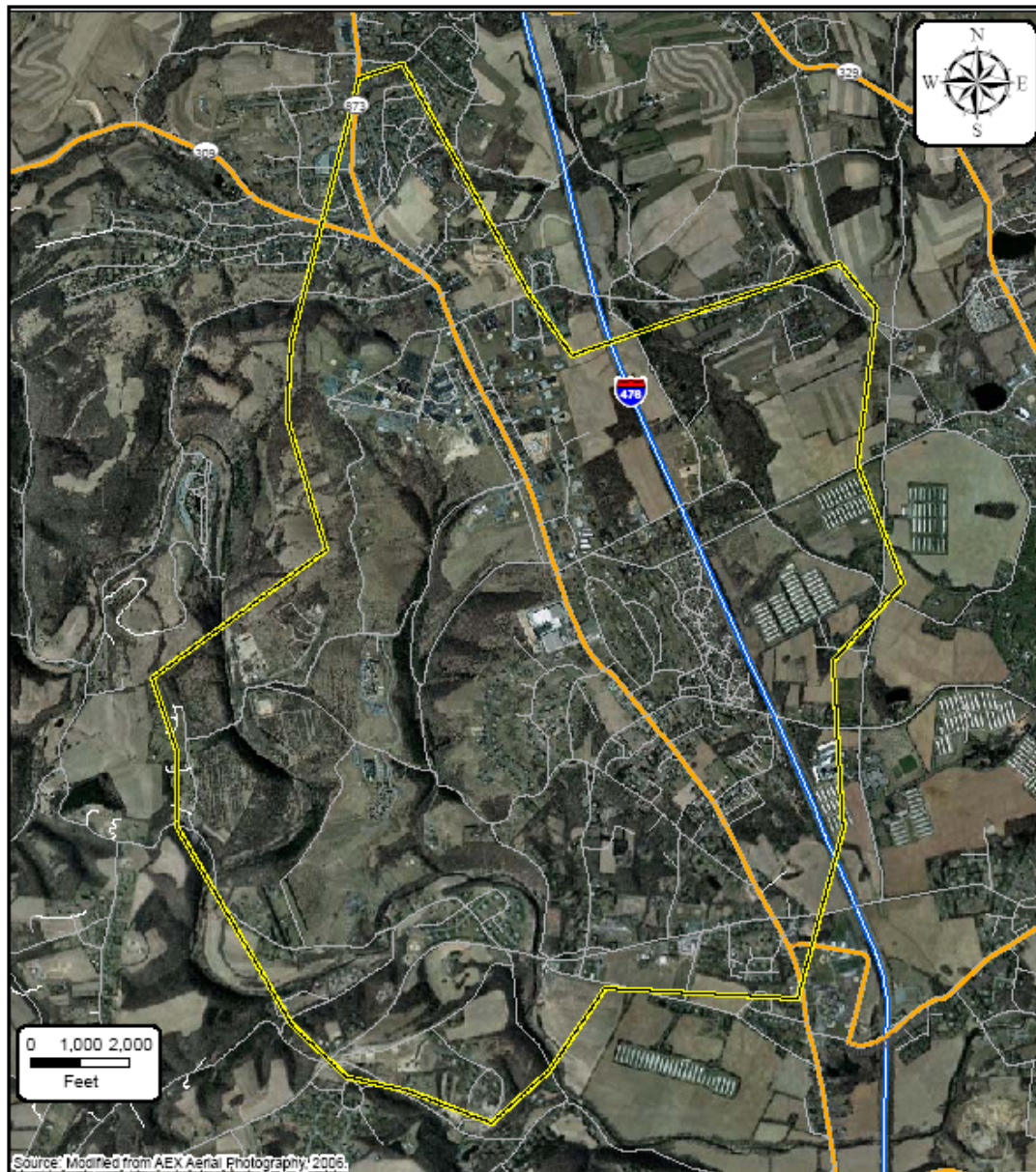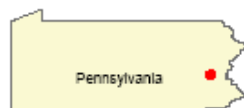# Random Soil Study Presentation

Soil Study Purpose:

To determine if the historical application of lead-arsenate pesticide in former orchard areas has resulted in elevated levels of arsenic and lead in soil that may potentially threaten human health and/or the environment.

If so,

Identify properties in target areas that need further assessment.

Former Mohr Orchard
North Whitehall Township, Pennsylvania

Figure 2
Aerial Photograph

Approximate Site Location = □

Legend

□ Site Boundary

Pennsylvania

0   1,000 2,000
Feet

Source: Modified from AEX Aerial Photography, 2006.

TDD No. 0210200807025
EPA Contract No. EP-S3-05-02

Map created on July 25, 2008
by A. Dye, Tetra Tech EMI

TETRA TECH

- Soil Study was limited to property located on former orchards that are
  - residential use
  - public use.
- Area was divided into 200'x 200' grids.
- Process generated 1465 grids
  - In most cases multiple properties fell within a grid

Mohr Orchard
North Whitehall Township, Pennsylvania

Figure 4
Sampling Grid Map

Approximate Site Location = ▯

Legend
▢ 200' x 200' Sampling Grid
▢ Site Boundary

Pennsylvania

TDD No. 0210200807025
EPA Contract No. EP-S3-05-02

Map created on July 25, 2008
by A. Dye, Tetra Tech EMI

TETRA TECH

0   0.25   0.5
Miles
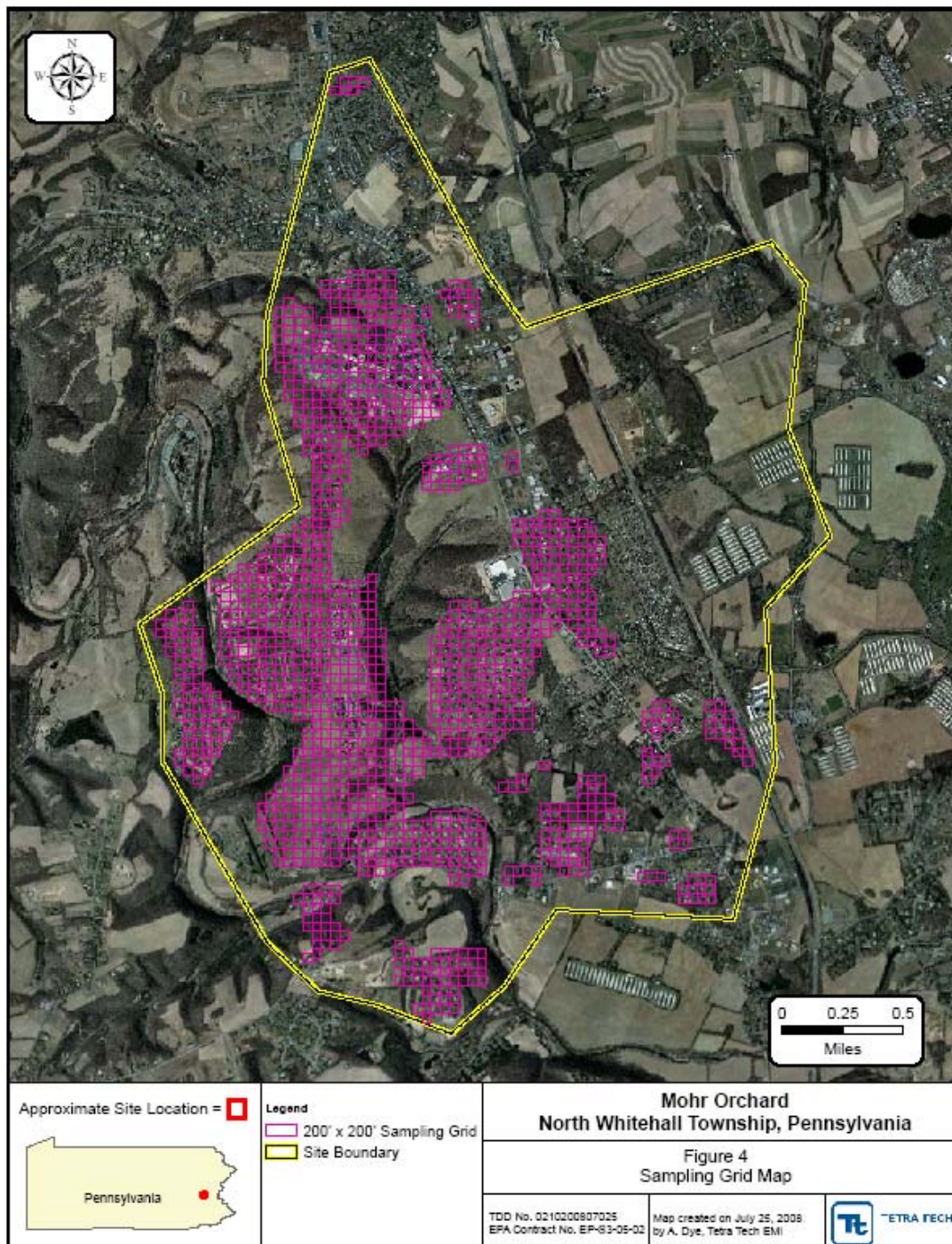
Adaptive Cluster Sampling Strategy Utilized

Involves:

1) choosing an initial # of random samples,

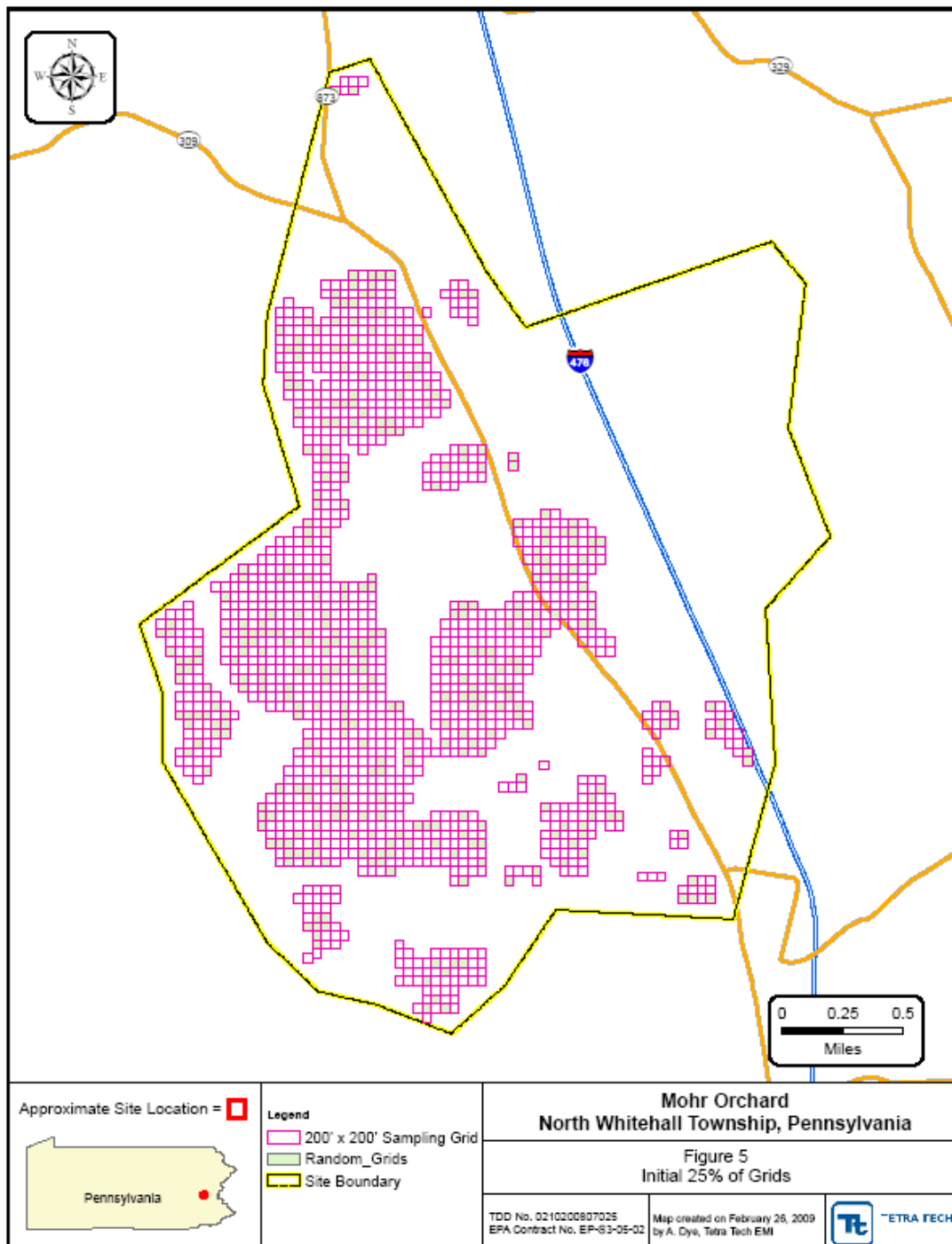2) following a rule for choosing additional adjacent samples.

Randomly Selected Grids

	x				x		
			x			x	
x		x					
				x			x
		x				x	
				x			x
	x		x				
x					x		

Adaptive Cluster Sampling – Tier 1 and Tier 2

	x				x No Access		
		o	x			x	
x	o	**X**	o				
		o		x		o	x
		x			o	**X**	o
				x No Access		o	x
	x		x				
x				x			

- 25% of the grids were randomly selected for sampling using a computer program.

- The grid composite sample consisted of 10 randomly selected points.

- Sampling of grids limited by access

Mohr Orchard
North Whitehall Township, Pennsylvania

Figure 5
Initial 25% of Grids

Approximate Site Location = ▢

Pennsylvania

Legend
▢ 200' x 200' Sampling Grid
▢ Random_Grids
▢ Site Boundary

0   0.25   0.5
Miles

TDD No. 0210200807025
EPA Contract No. EP-S3-05-02

Map created on February 26, 2009
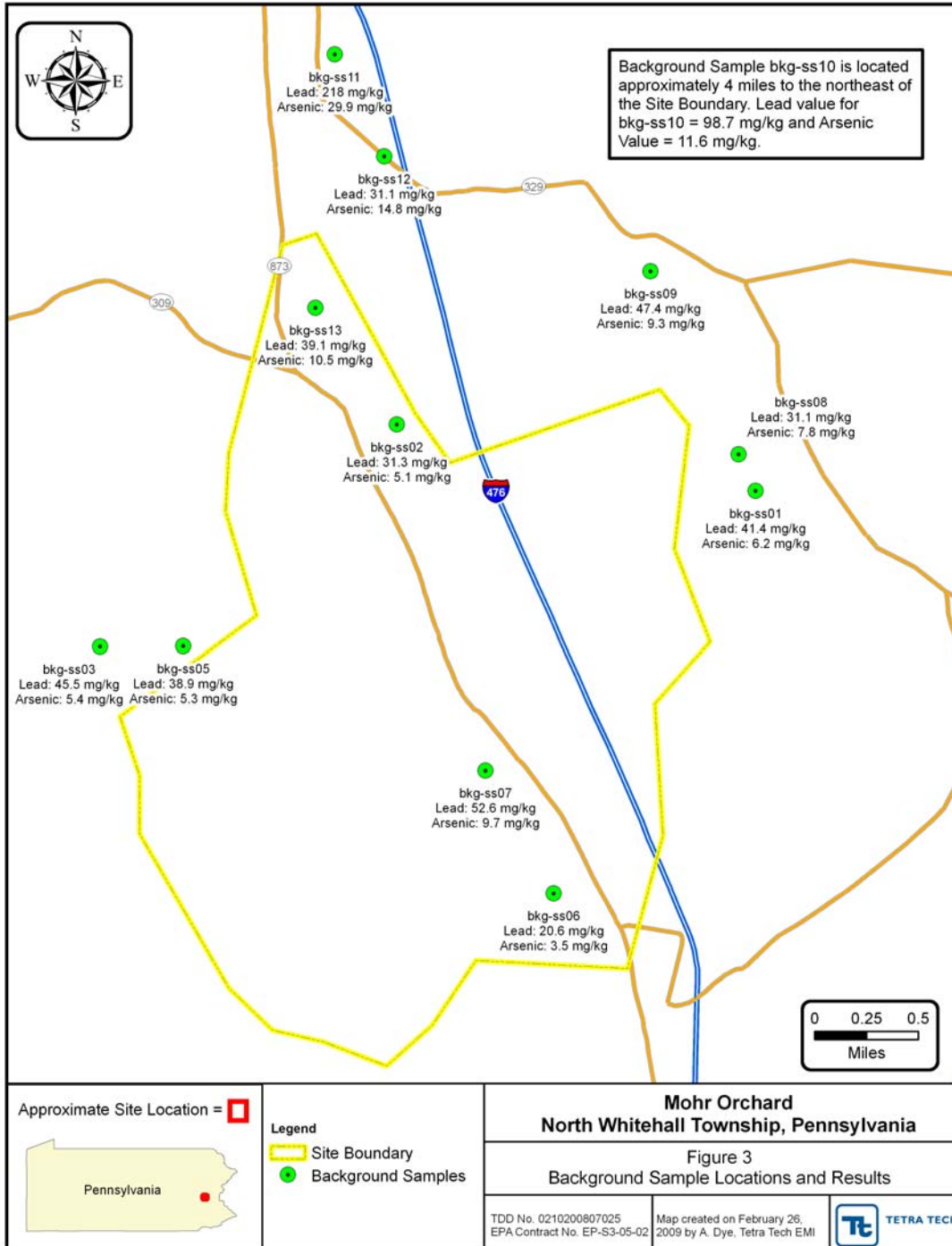by A. Dye, Tetra Tech EMI

TETRA TECH

- Tier 1 are initial grids actually sampled.

- Tier II and III selected based on Rule.
  - If arsenic concentration in select sample exceeded the 40 ppm screening value, a composite sample was collected from adjacent grids, N, E, S and W.

- 327 grids sampled (August – Dec. 08).

    Tier 1 - 254 grids

    Tier 2 - 66 grids

    Tier 3 - 7 grid

- 246 grids- Public use
- 81 grids – Residential use

- 12 Background soil samples to offsite lab

Mohr Orchard
North Whitehall Township, Pennsylvania

Figure 6
Tier I, II, & III Sample Grids

Legend
- Tier I Sample Grid
- Tier II Sample Grid
- Tier III Sample Grid
- 200' x 200' Sampling Grid
- Site Boundary

Approximate Site Location =

Pennsylvania

TDD No. 0210200807025
EPA Contract No. EP-S3-05-02

Map created on February 26, 2009
by A. Dye, Tetra Tech EMI

TETRA TECH
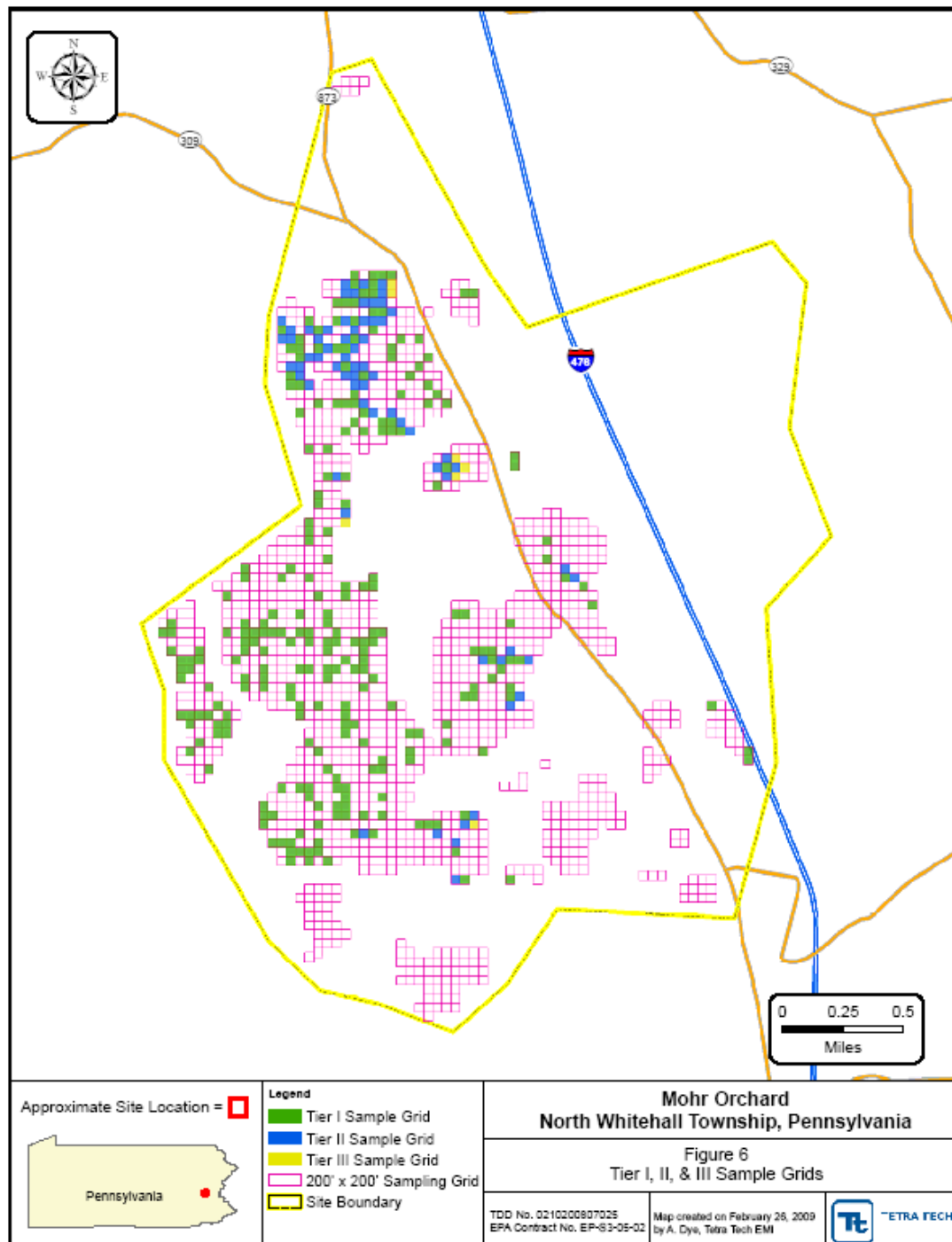
- 400 Samples analyzed in an onsite lab using X-Ray Fluorescence Technology.

- 36 samples were analyzed at an offsite laboratory. Lab results confirmed onsite lab XRF results.

- Background Soil results
  - Samples were collected within or near site area at locations that were not former orchard
  - Samples analyzed in offsite lab
    - Arsenic ranged from 3.5 ppm to 29.9 ppm
      - Average of 9.9 ppm
    - Lead ranged from 20.6 ppm to 218 ppm
      - Average of 58 ppm

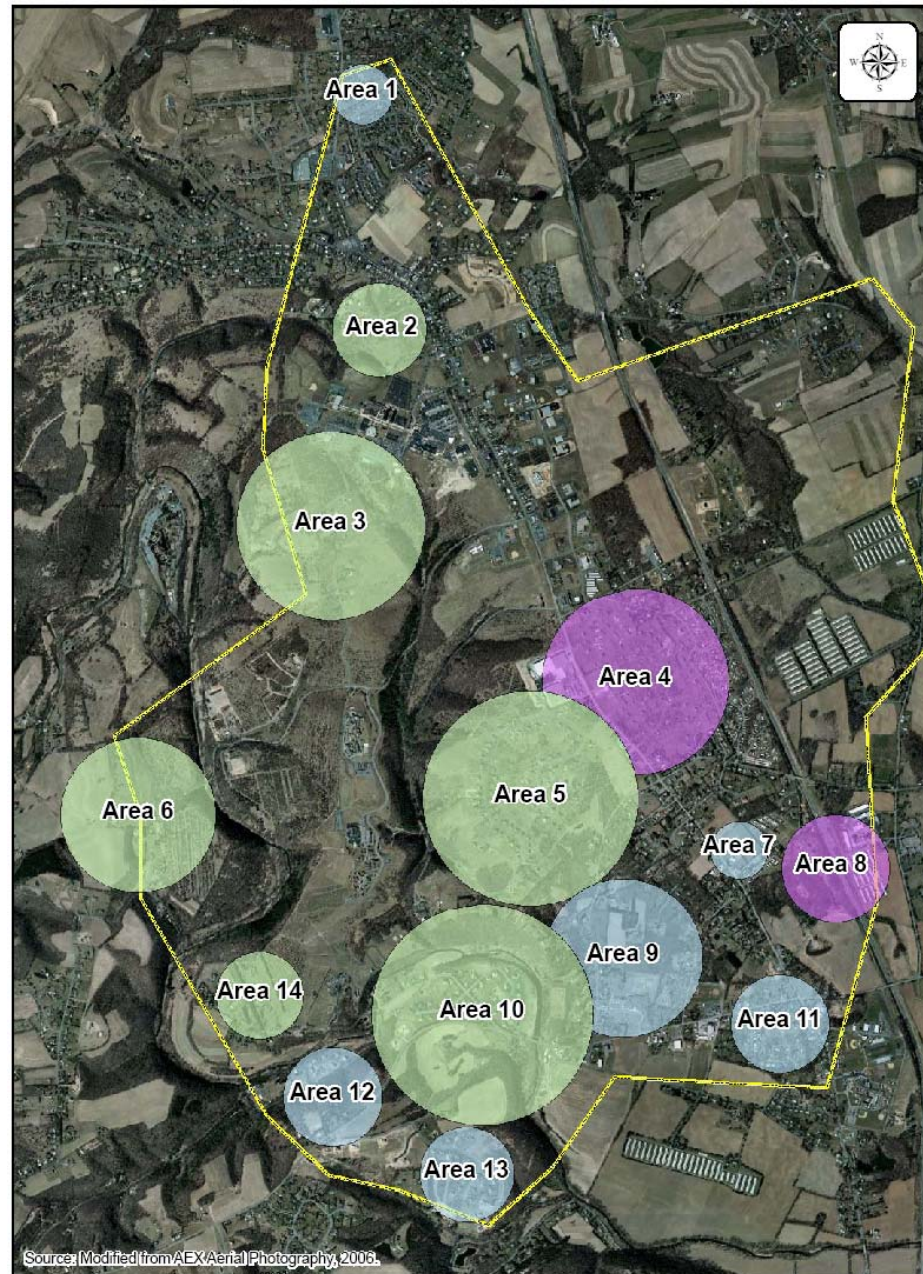Background Sample bkg-ss10 is located approximately 4 miles to the northeast of the Site Boundary. Lead value for bkg-ss10 = 98.7 mg/kg and Arsenic Value = 11.6 mg/kg.

bkg-ss11
Lead: 218 mg/kg
Arsenic: 29.9 mg/kg

bkg-ss12
Lead: 31.1 mg/kg
Arsenic: 14.8 mg/kg

bkg-ss09
Lead: 47.4 mg/kg
Arsenic: 9.3 mg/kg

bkg-ss13
Lead: 39.1 mg/kg
Arsenic: 10.5 mg/kg

bkg-ss08
Lead: 31.1 mg/kg
Arsenic: 7.8 mg/kg

bkg-ss02
Lead: 31.3 mg/kg
Arsenic: 5.1 mg/kg

bkg-ss01
Lead: 41.4 mg/kg
Arsenic: 6.2 mg/kg

bkg-ss03
Lead: 45.5 mg/kg
Arsenic: 5.4 mg/kg

bkg-ss05
Lead: 38.9 mg/kg
Arsenic: 5.3 mg/kg

bkg-ss07
Lead: 52.6 mg/kg
Arsenic: 9.7 mg/kg

bkg-ss06
Lead: 20.6 mg/kg
Arsenic: 3.5 mg/kg

Miles
0   0.25   0.5

Approximate Site Location = ▢

Pennsylvania

Legend
Site Boundary
Background Samples

Mohr Orchard
North Whitehall Township, Pennsylvania

Figure 3
Background Sample Locations and Results

TDD No. 0210200807025
EPA Contract No. EP-S3-05-02

Map created on February 26, 2009 by A. Dye, Tetra Tech EMI

TETRA TECH

Public Use Area Results

246 Grids sampled

- Arsenic concentration ranged from

    Non-detect to 140.39 ppm

    Average of 50 ppm

- Lead concentration ranged from
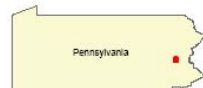
   35.02 ppm to 1950.84 ppm

    Average of 362 ppm

Residential Area Results

81 grids

- Arsenic concentration ranged from

    Non-detect to 148.93 ppm.

    Average of 49 ppm

- Lead concentration ranged from

    39.39 ppm to 1833.36 ppm.

    Average of 308 ppm

Area 1
Area 2
Area 3
Area 4
Area 5
Area 6
Area 7
Area 8
Area 9
Area 10
Area 11
Area 12
Area 13
Area 14

Source: Modified from AEX Aerial Photography, 2006.

Approximate Site Location =			Mohr Orchard North Whitehall Township, Pennsylvania

Limited Access Granted Within Area for Assessment Sampling
Access Not Granted Within Area for Assessment Sampling
No Additional Sampling will be Conducted
Site Boundary

Pennsylvania

Figure 7
Residential Grouping Areas

0   1,000   2,000
Feet

TDD No. 0210200807025
EPA Contract No. EP-S3-05-02

Map created on February 26,
2009 by A. Dye, Tetra Tech EMI

Tt TETRA TECH

RESIDENTIAL SURFACE SOIL SAMPLING SUMMARY

	Number of Grids Sampled	Lead (ppm)			Arsenic (ppm)		
		Maximum	Minimum	Average	Maximum	Minimum	Average
Area 2	8	1,238	74.12	465	138.09	10.2	56
Area 3	10	344.85	156.17	254	73	27.24	50
Area 4	7	174.16	71.4	115	37.77	15.4	26
Area 5	25	814.5	76.54	271	87.99	19.93	48
Area 6	4	1833.36	234.58	851	148.93	36.09	71
Area 8	3	66.36	52.88	61	17.66	10.03	14
Area 10	16	1012.64	39.39	315	120.66	11.38	62
Area 14	3	231.63	182.11	210	45.66	36.22	42

Notes:
ppm = parts per million

- Areas for further assessment:
  - Six Target Areas - 2,3,5,6,10 and 14 (Average Arsenic concentration above 40 ppm)
  - Residential properties with current access agreements that were not sampled in the random study
  - Areas 7, 11, 12, & 13 - Offer sampling to residential property owners in these areas that were eliminated because of access in the random study, who did not receive an access request letter.

- Areas where no sampling is currently being planned:
    - Areas 4 and 8 out due to lower average arsenic concentration
    - Areas 1 and 9 out due to denied access in random study.

Next steps for Spring/Summer 2009

- Develop Biased Sampling Plan.

  Focus on properties currently being used for residential purpose.

- Obtain written access. Needs to be received by April 13, 2009.

- Conduct Residential property sampling.

Future Steps

- Determine the need for immediate action based upon data from bias sampling.

- Develop site-specific action level for arsenic.
  - arsenic bioavailability study

- Determine if action is warranted
  based on long-term arsenic or lead exposure