

## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 1, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel on from August 31, 2017 through September 1, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for carbon monoxide (CO) and volatile organic compounds (VOCs) using RAE Systems MultiRAE Plus instruments. Additionally, levels of particulate matter (PM<sub>2.5</sub>) potentially related to fire smoke were assessed using TSI SidePak AM510 and Dusttrak aerosol monitors. **Table 1** summarizes the data for all real-time air monitoring readings recorded in Crosby, TX from 12:57 August 31, 2017 through 06:00 on September 1, 2017. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Real-time Handheld Air Monitoring Readings  
12:57 August 31, 2017 – 06:00 September 1, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
Benzene	UltraRAE	23	0	< 1.0 ppm
CO	MultiRAE Plus	16	0	< 1.0 ppm
Cumene	Gastec Tube 122L	6	0	< 50 ppm
LEL	MultiRAE Plus	6	0	< 1.0 %
VOCs	MultiRAE Plus	139	0	< 0.1 ppm
PM <sub>2.5</sub>	AM510	110	110	0.023 – 0.074 mg/m <sup>3</sup>
	Dusttrak	25	25	0.023 – 0.049 mg/m <sup>3</sup>

\*If detections were not observed, the instrument detection limit is listed in this column.



### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH® deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican™) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C. Analytical Air Sampling Results** will be reported upon receipt from the laboratory.



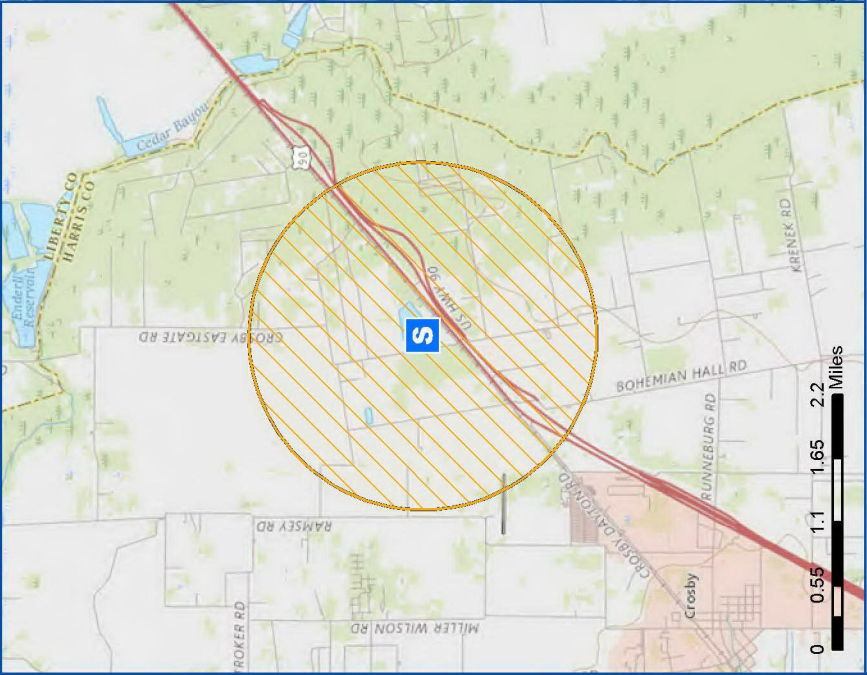
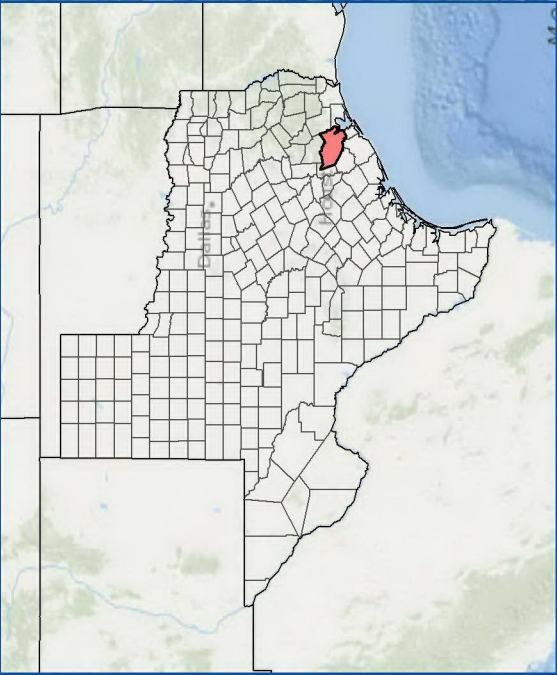
# Attachment A

## Site Location Map





# CTEH Harvey Response Site Location

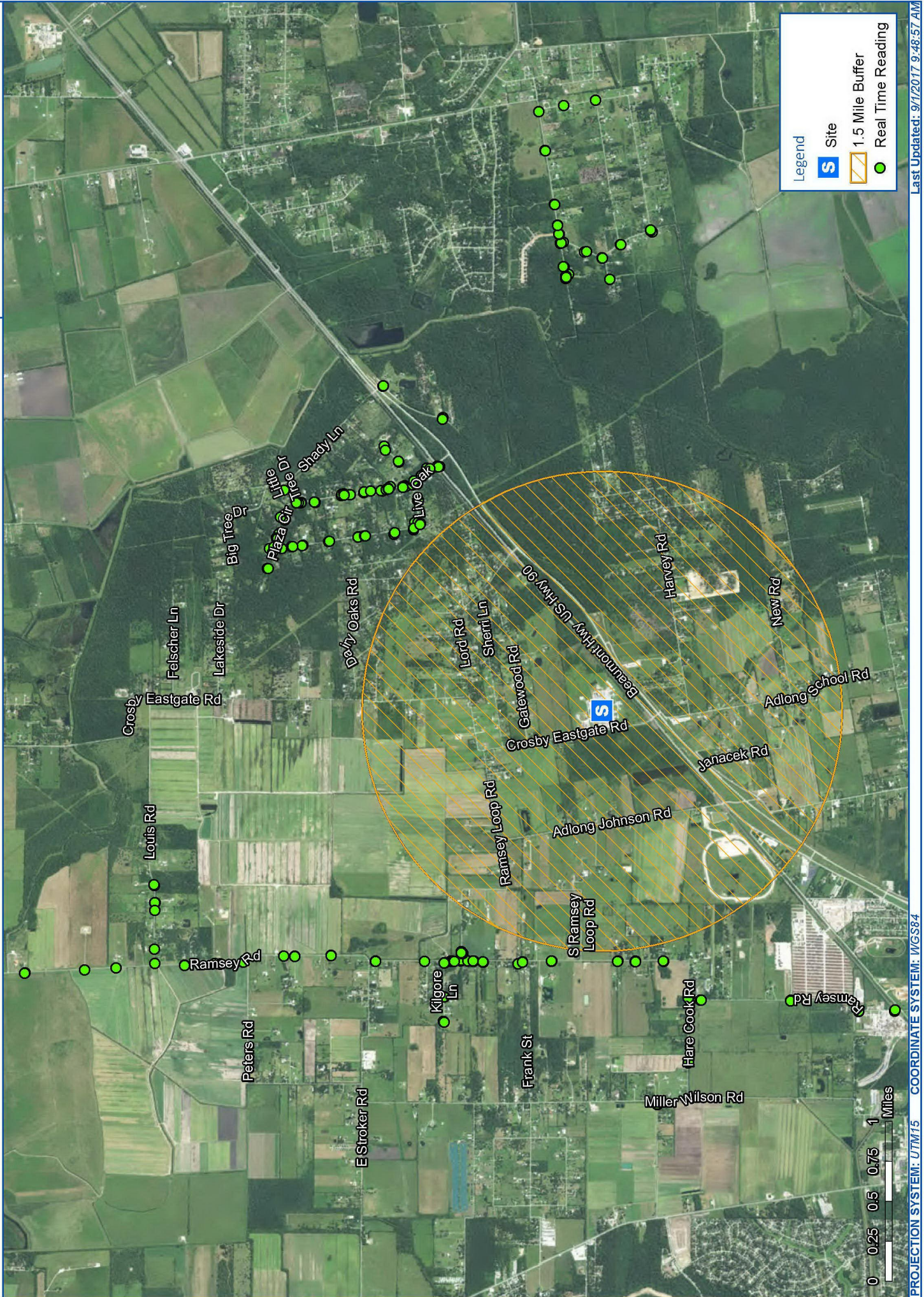


**Legend**

- Site
- 1.5 Mile Buffer

# **Attachment B**

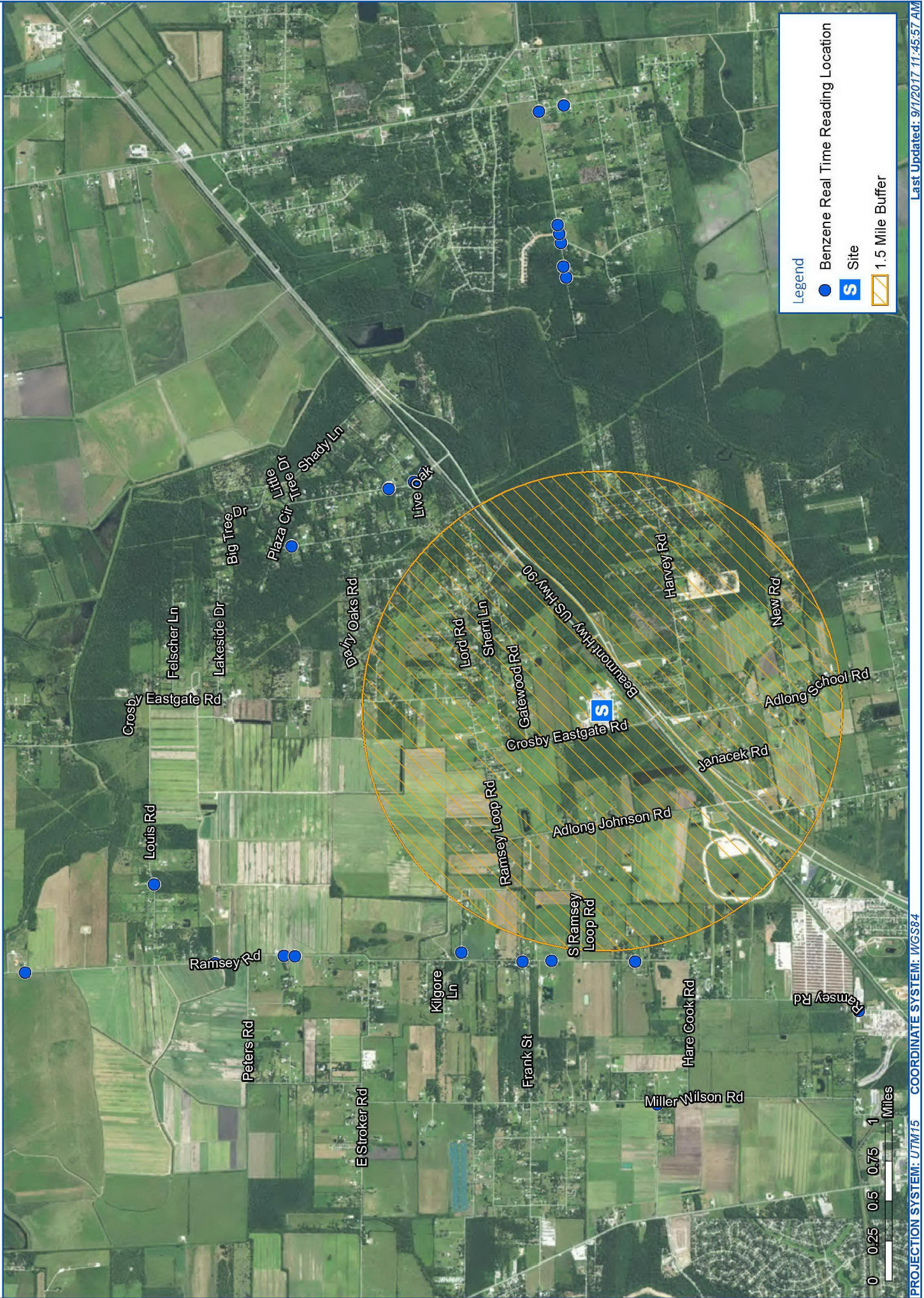
## **Handheld Real-time Air Monitoring Locations**



**Legend**

- Site
- 1.5 Mile Buffer
- Real Time Reading

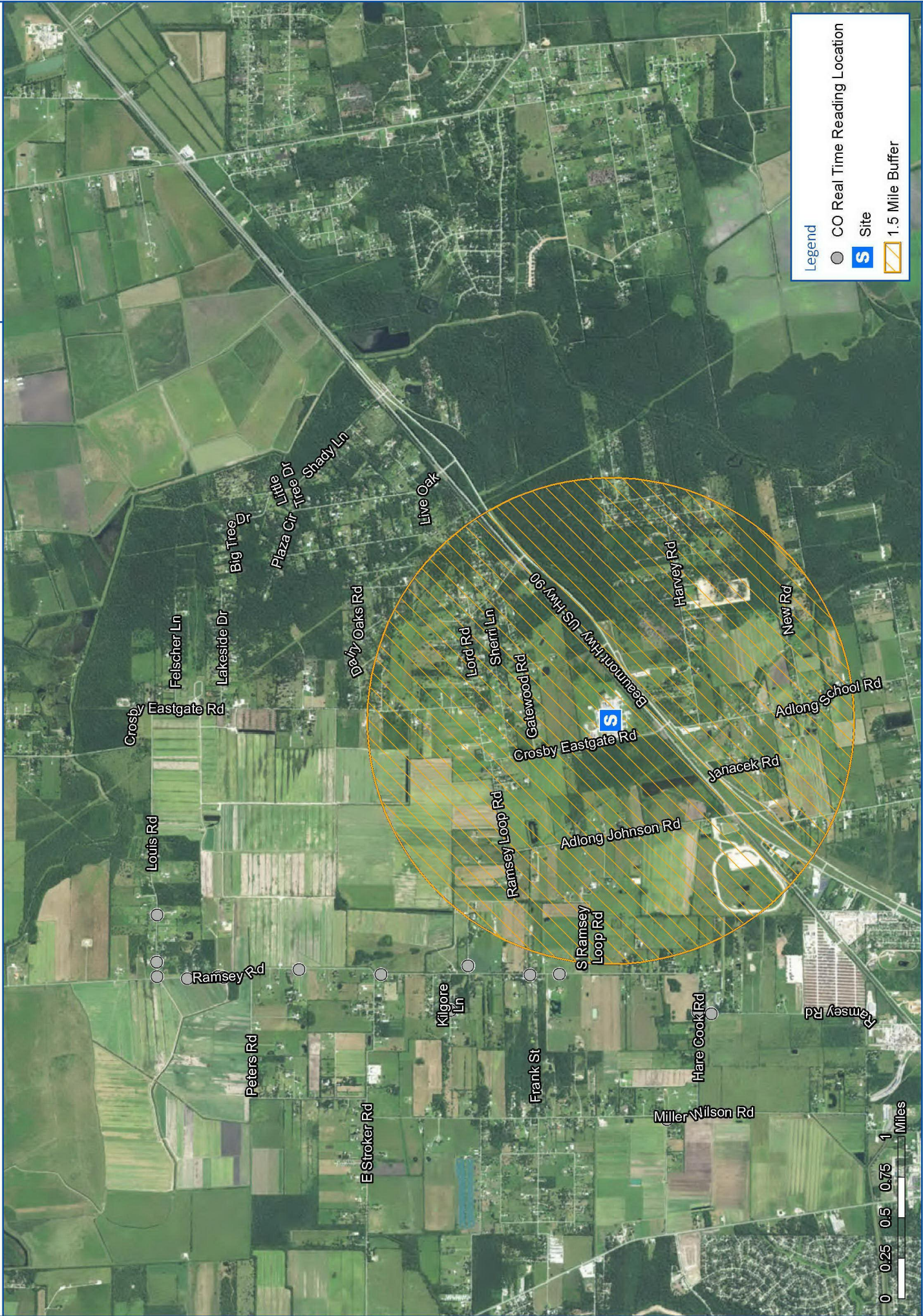




**Legend**

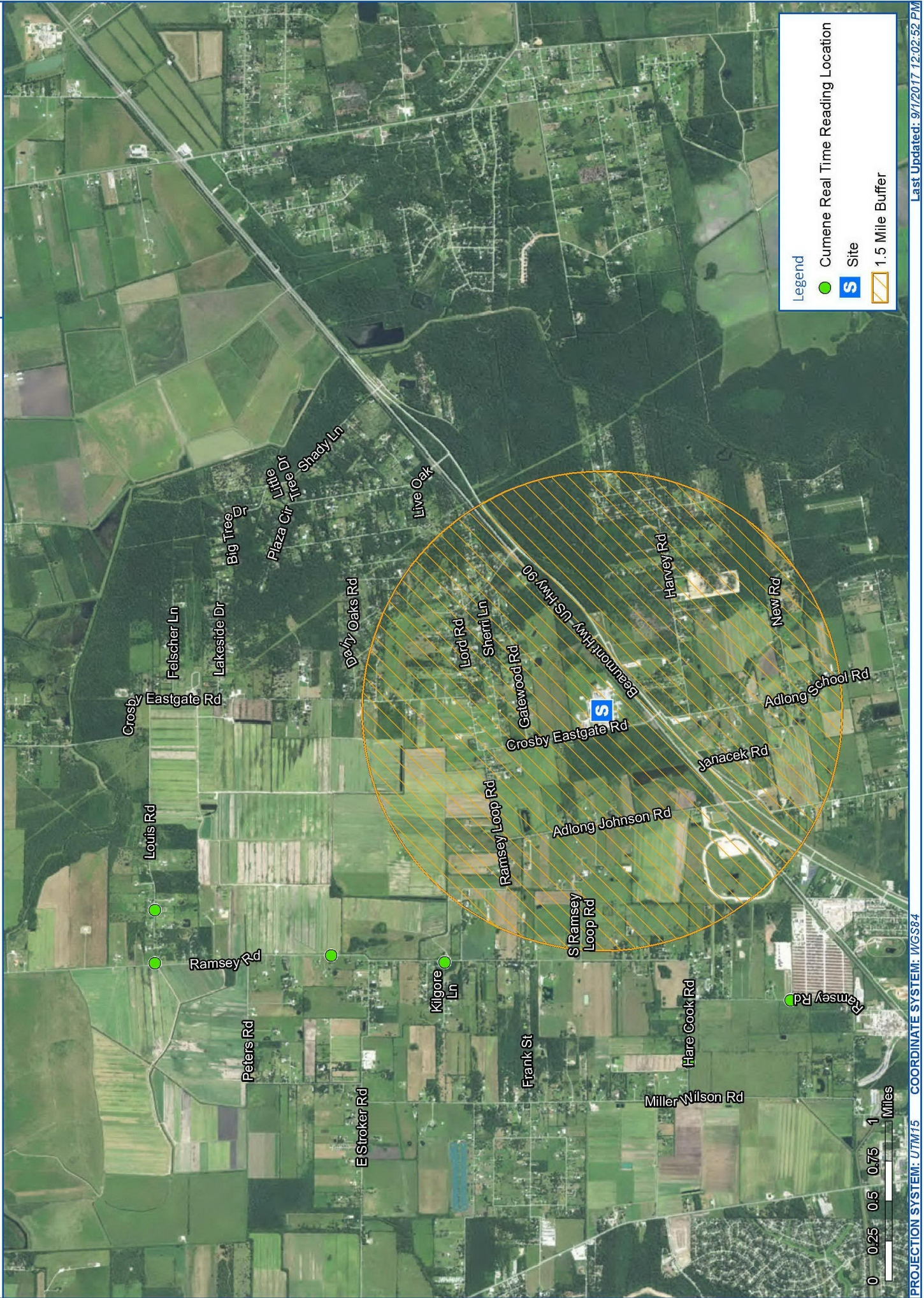
- Benzene Real Time Reading Location
- S Site
- 1.5 Mile Buffer





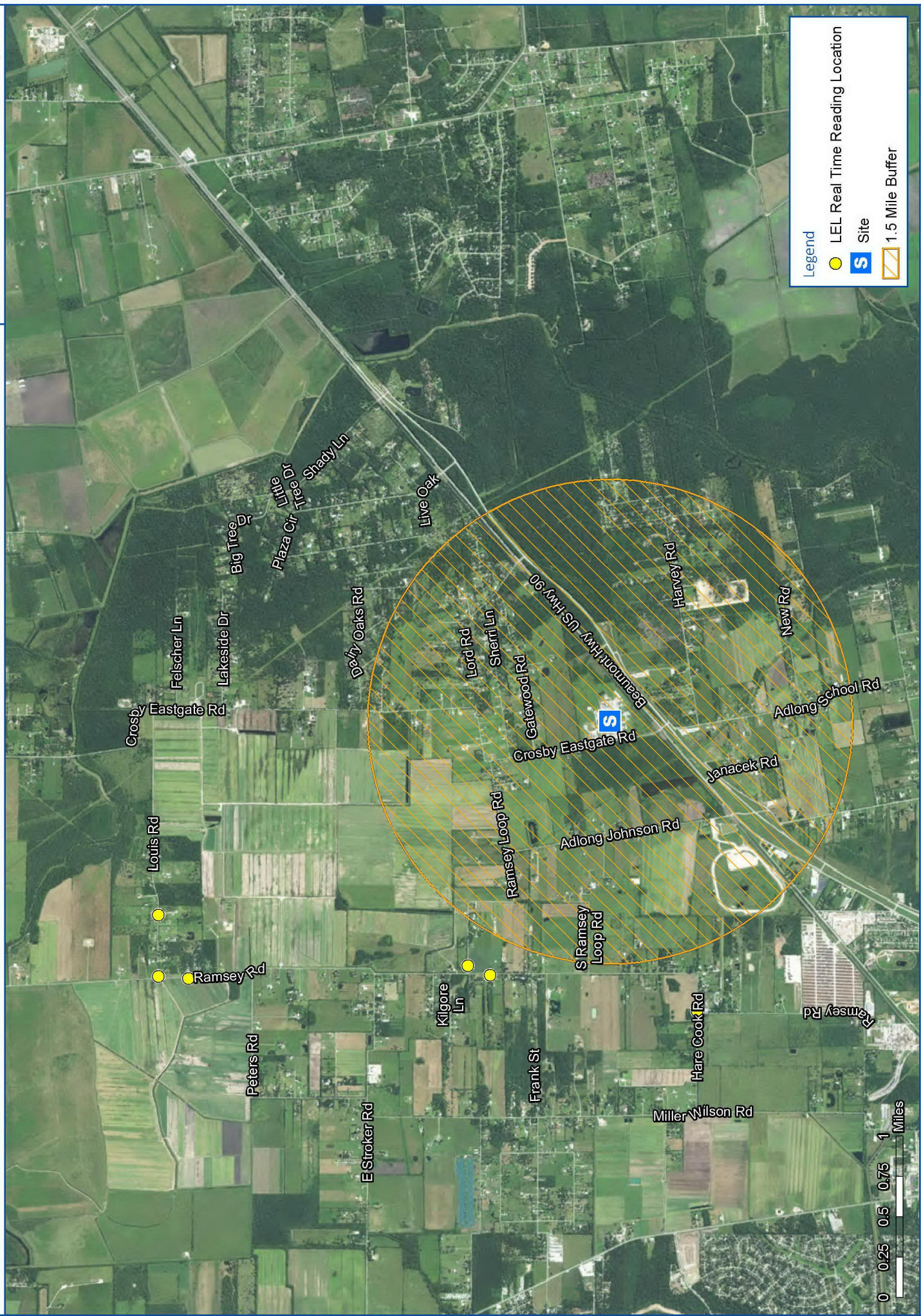
**Legend**

- CO Real Time Reading Location
- S Site
- ▨ 1.5 Mile Buffer



**Legend**

- Cumene Real Time Reading Location
- Site
- 1.5 Mile Buffer

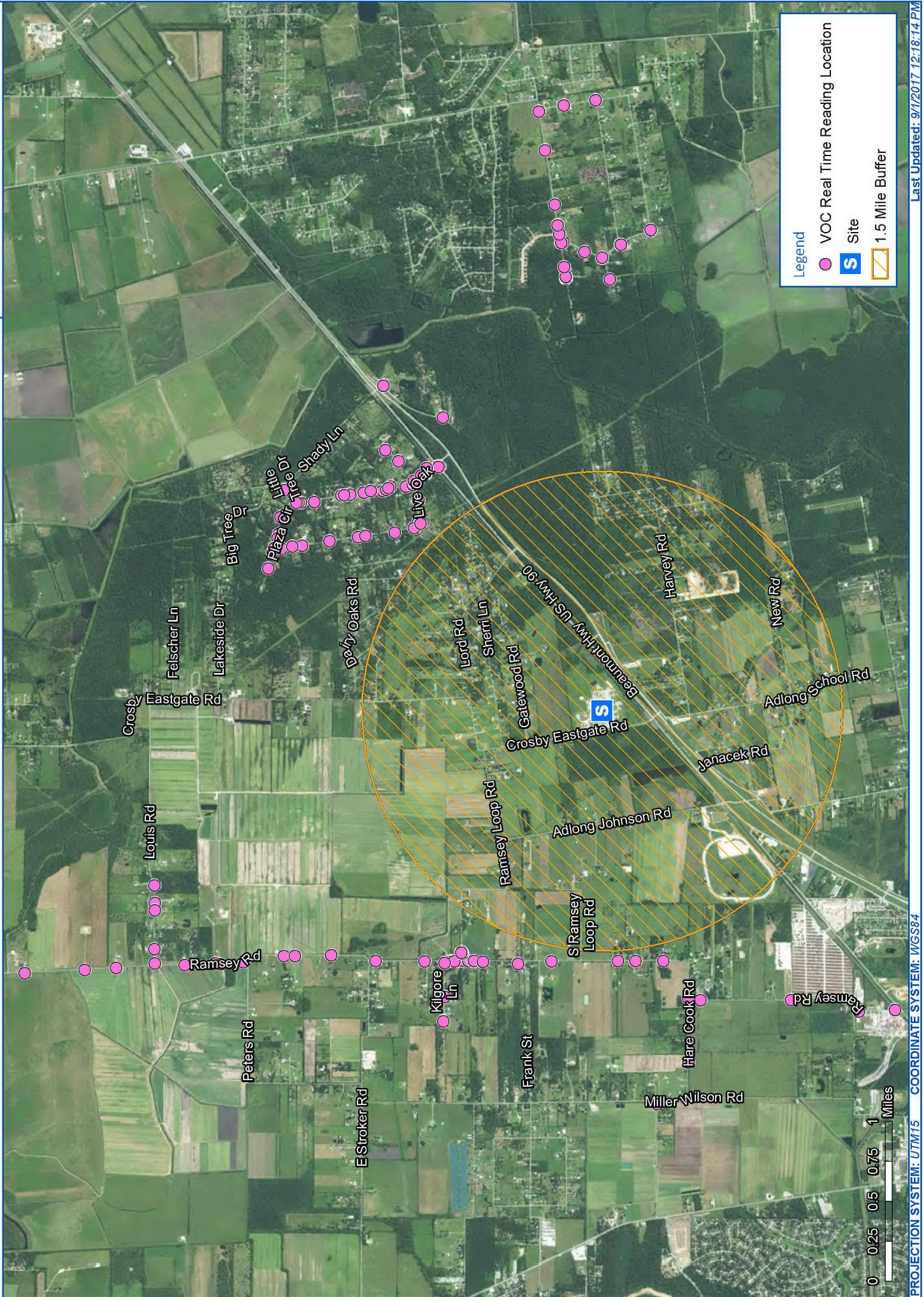


**Legend**

- LEL Real Time Reading Location
- S Site
- 1.5 Mile Buffer





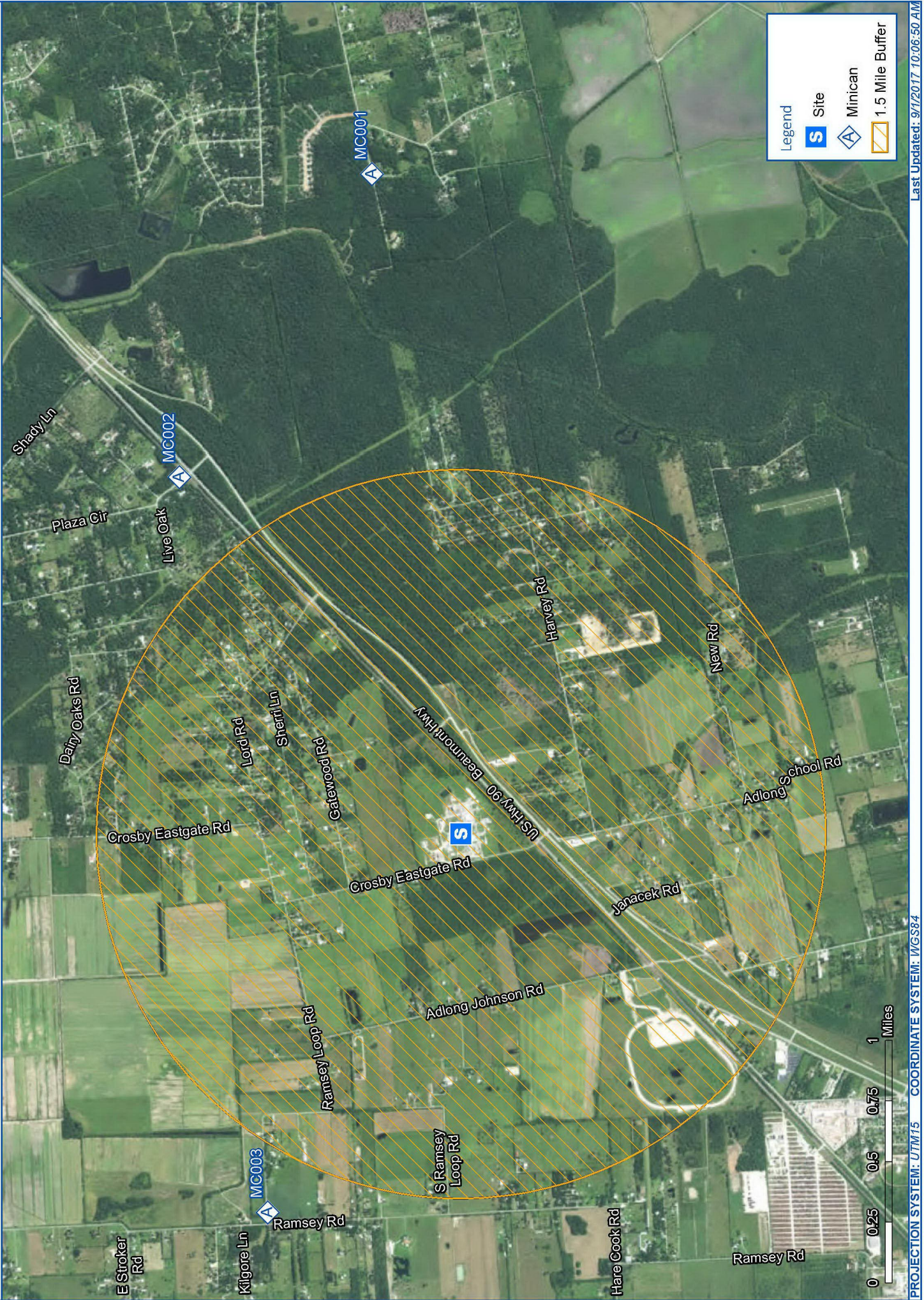


**Legend**

- VOC Real Time Reading Location
- Site
- 1.5 Mile Buffer

# Attachment C

## Map of Analytical Air Sampling Locations



**Legend**

- Site
- Minican
- 1.5 Mile Buffer



# Attachment D

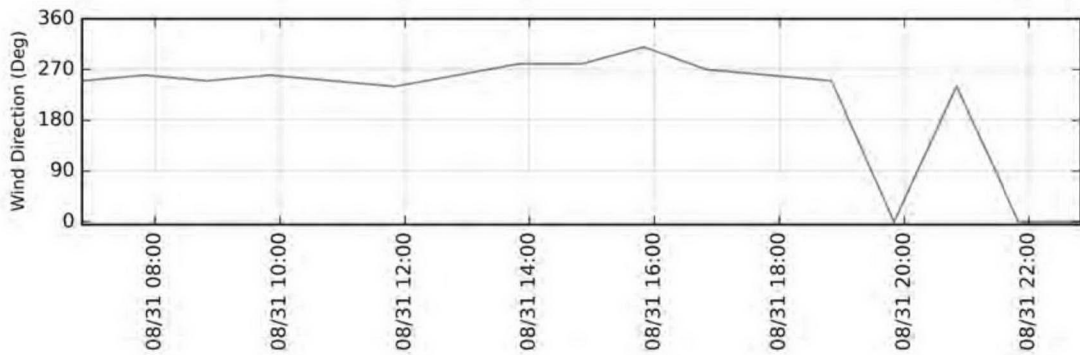
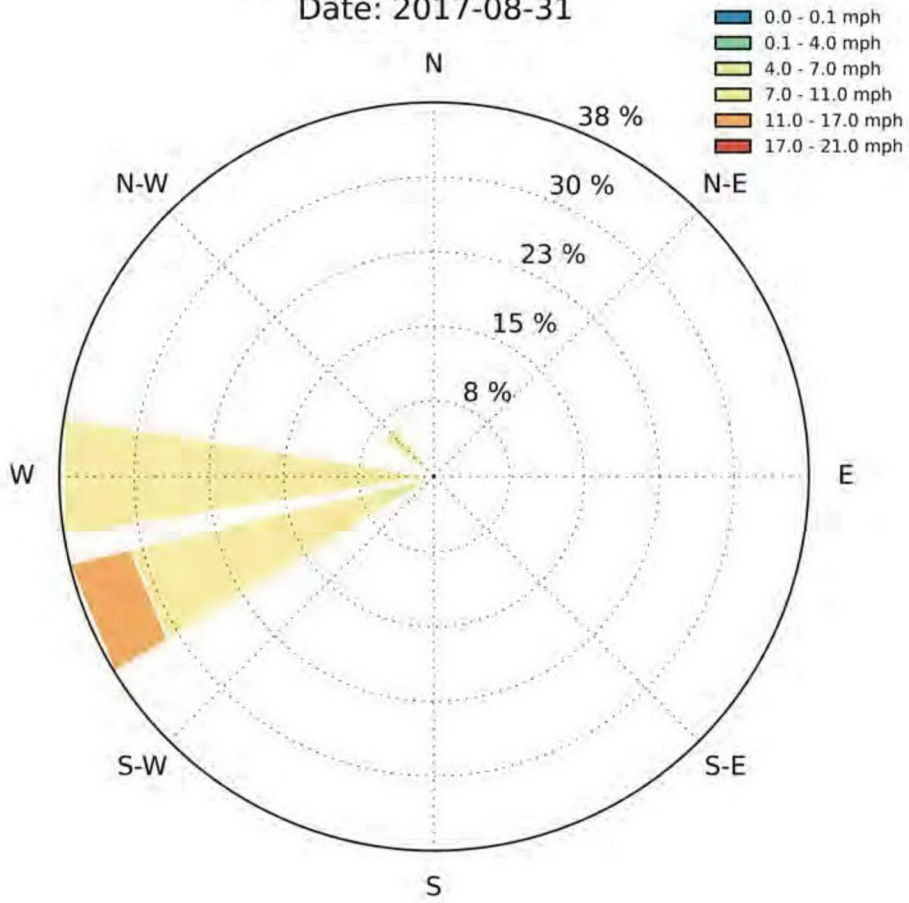
## KHPY Windrose

(Highland Park Airport - 12.5 miles SSE of Site)





Weather Station: KHPY  
Date: 2017-08-31



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 2, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 1, 2017 to 06:00 on September 2, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for benzene, cumene, atmosphere flammability (lower explosive limit - LEL), and volatile organic compounds (VOCs) using RAE Systems and Gastec instruments. Additionally, combustion byproducts potentially associated with fire smoke, such as particulate matter (PM<sub>2.5</sub>), nitrogen dioxide (NO<sub>2</sub>) and sulfur dioxide (SO<sub>2</sub>) were assessed. **Table 1** summarizes the data for all real-time air monitoring readings recorded in Crosby, TX from 06:00 on September 1, 2017 through 06:00 on September 2, 2017. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Real-time Handheld Air Monitoring Readings  
06:00 September 1, 2017 – 06:00 September 2, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
Benzene	UltraRAE	31	0	< 0.025 ppm
	Gastec Tube 121L	7	0	< 0.05 ppm
CO	MultiRAE Plus	40	0	< 1.0 ppm
Cumene	Gastec Tube 122L	2	0	< 50 ppm
LEL	MultiRAE Plus	2	0	< 1.0 %
NO <sub>2</sub>	MultiRAE Plus	14	0	< 0.1 ppm
	Gastec Tube 9L	1	0	< 0.1 ppm
PM <sub>2.5</sub>	AM510	170	170	0.013 - 0.065 mg/m <sup>3</sup>
	Dusttrak	68	68	0.012 - 0.112 mg/m <sup>3</sup>
SO <sub>2</sub>	MultiRAE Plus	54	0	< 0.1 ppm
VOCs	MultiRAE Plus	229	0	< 0.1 ppm

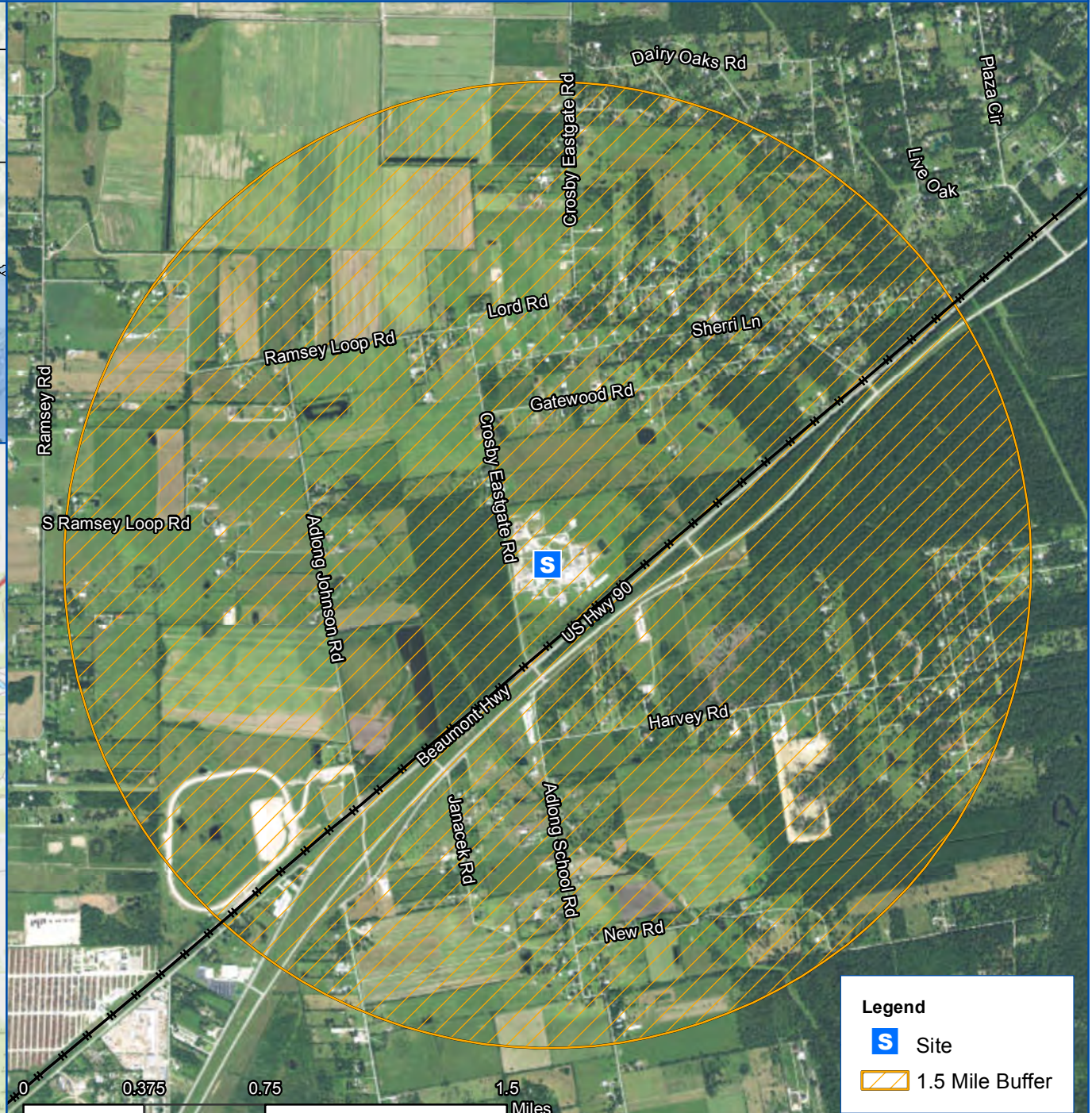
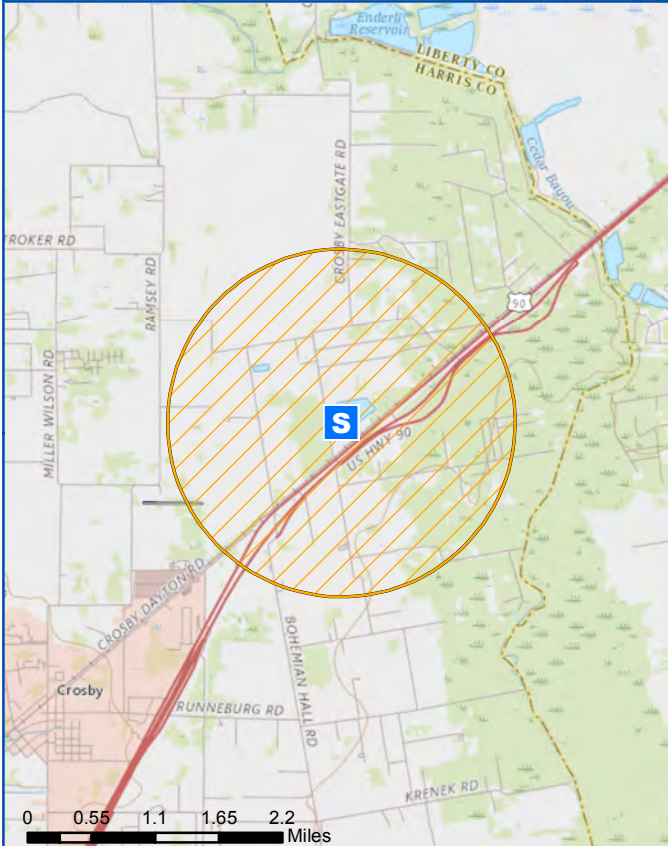
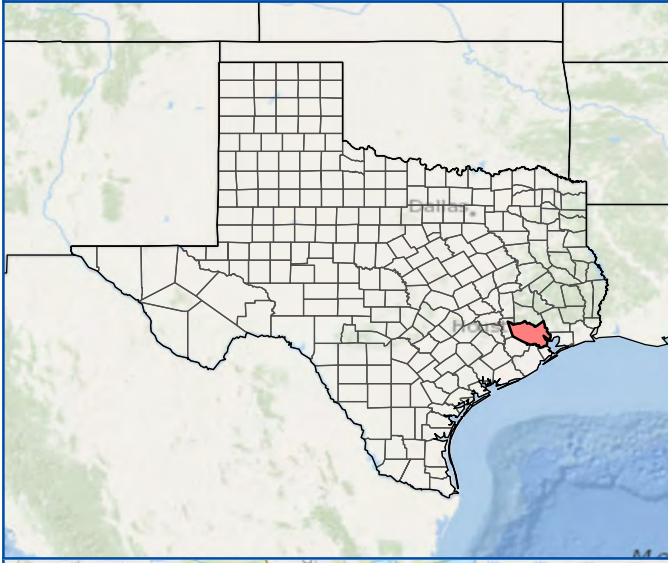
\*If detections were not observed, the instrument detection limit is listed in this column.

### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH® deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican™) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.

# **Attachment A**

## **Site Location Map**

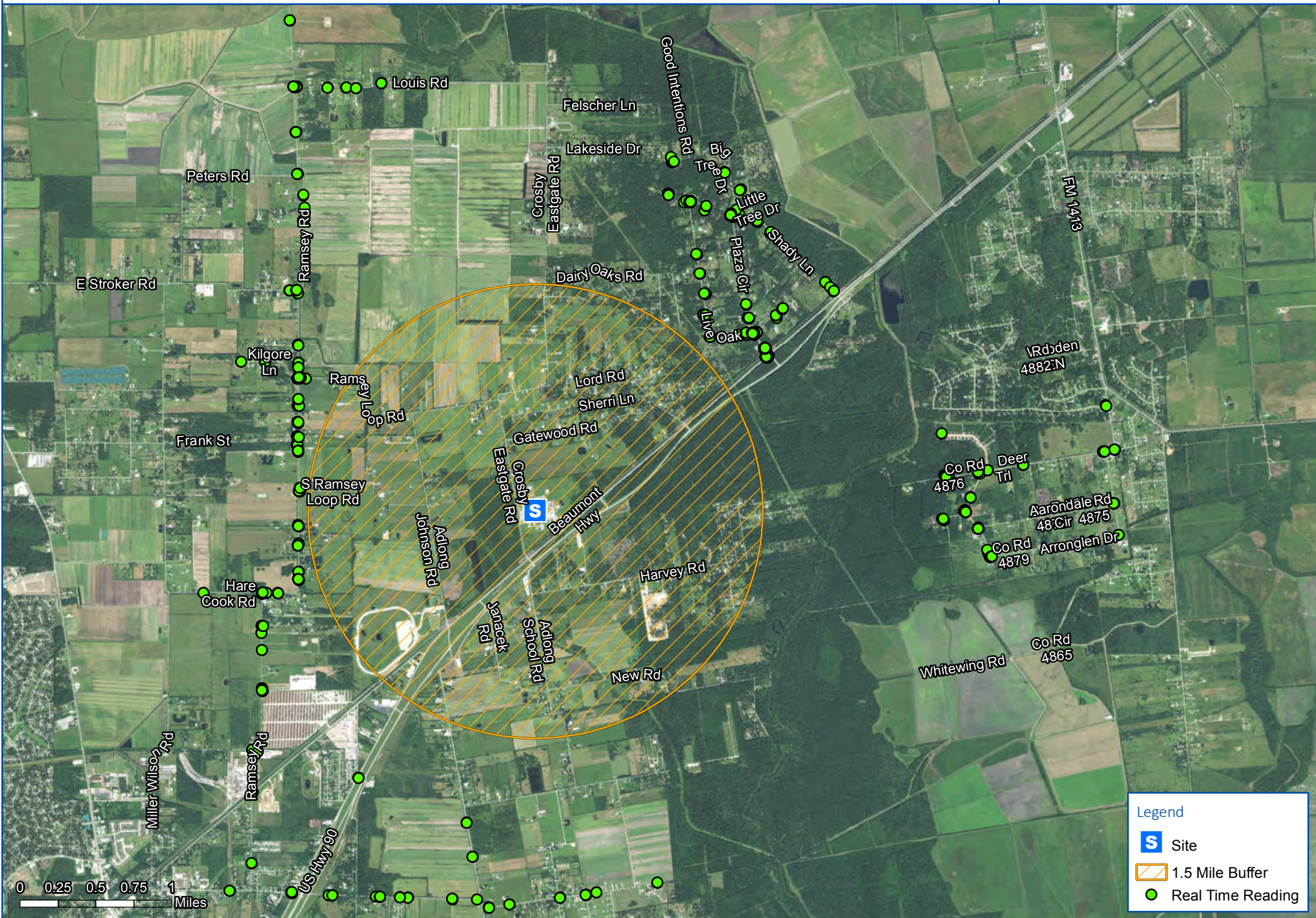


**Legend**

- Site
- 1.5 Mile Buffer

# **Attachment B**

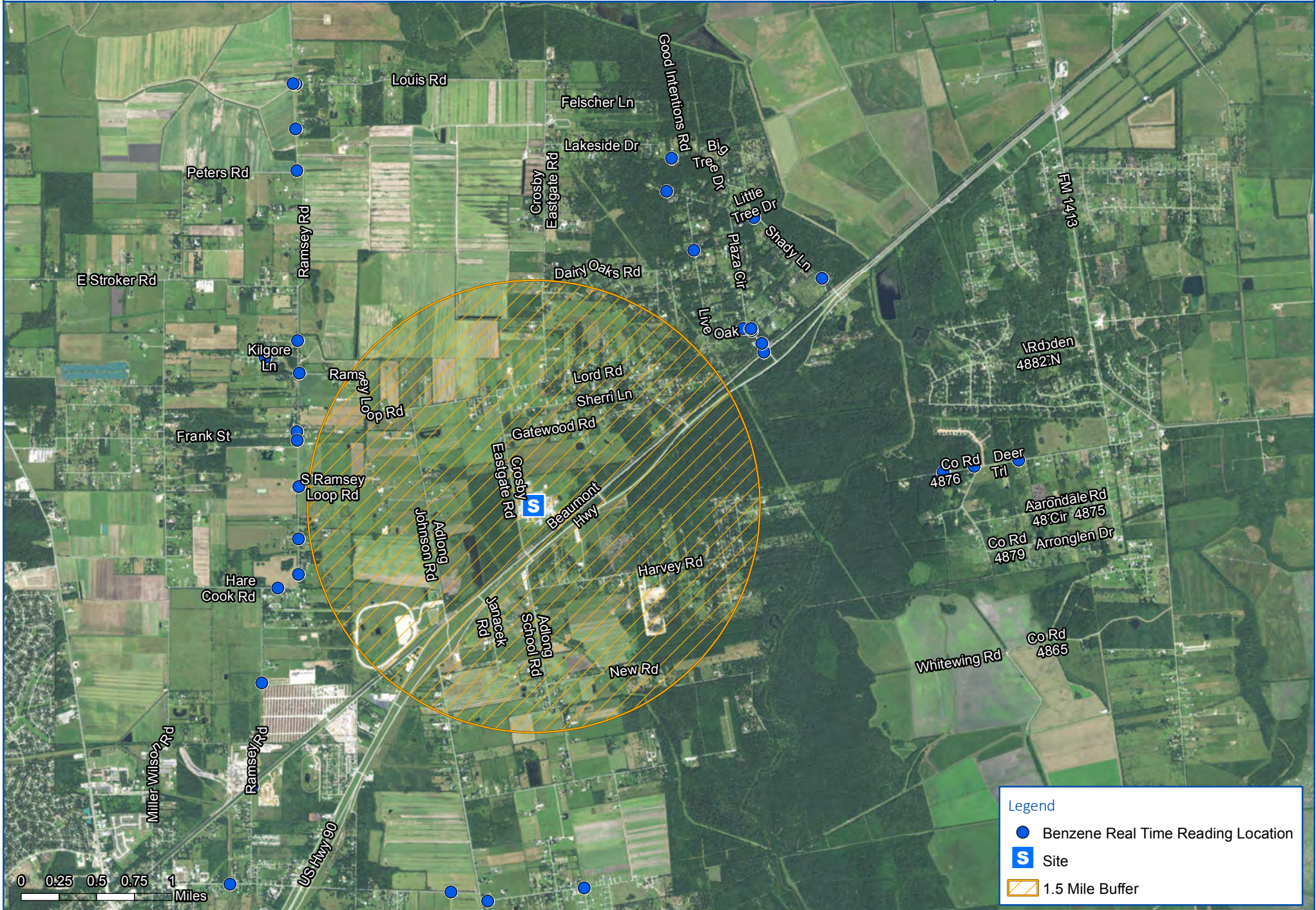
## **Handheld Real-time Air Monitoring Locations**



Legend

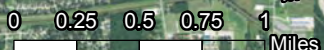
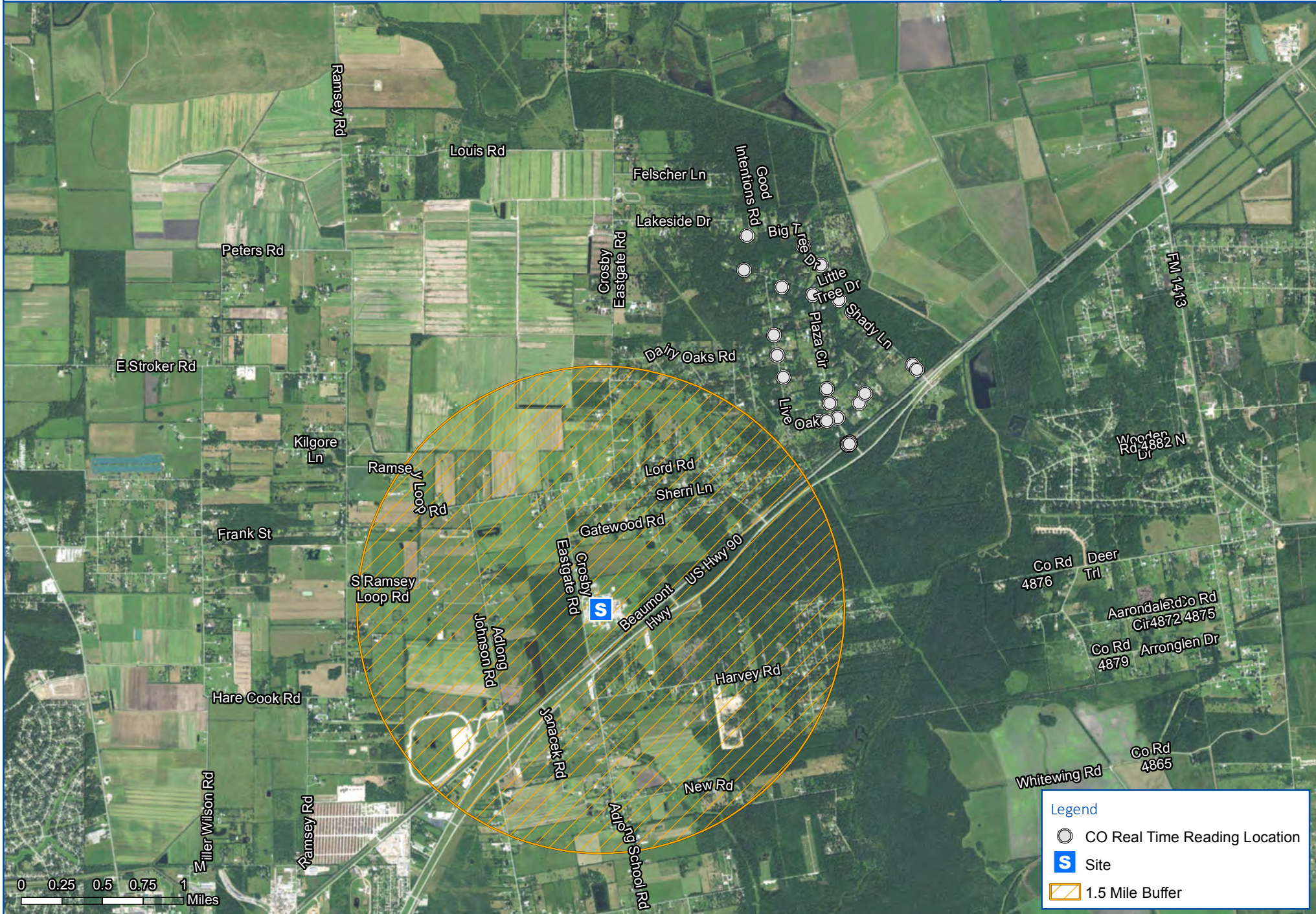
- S Site
- 1.5 Mile Buffer
- Real Time Reading





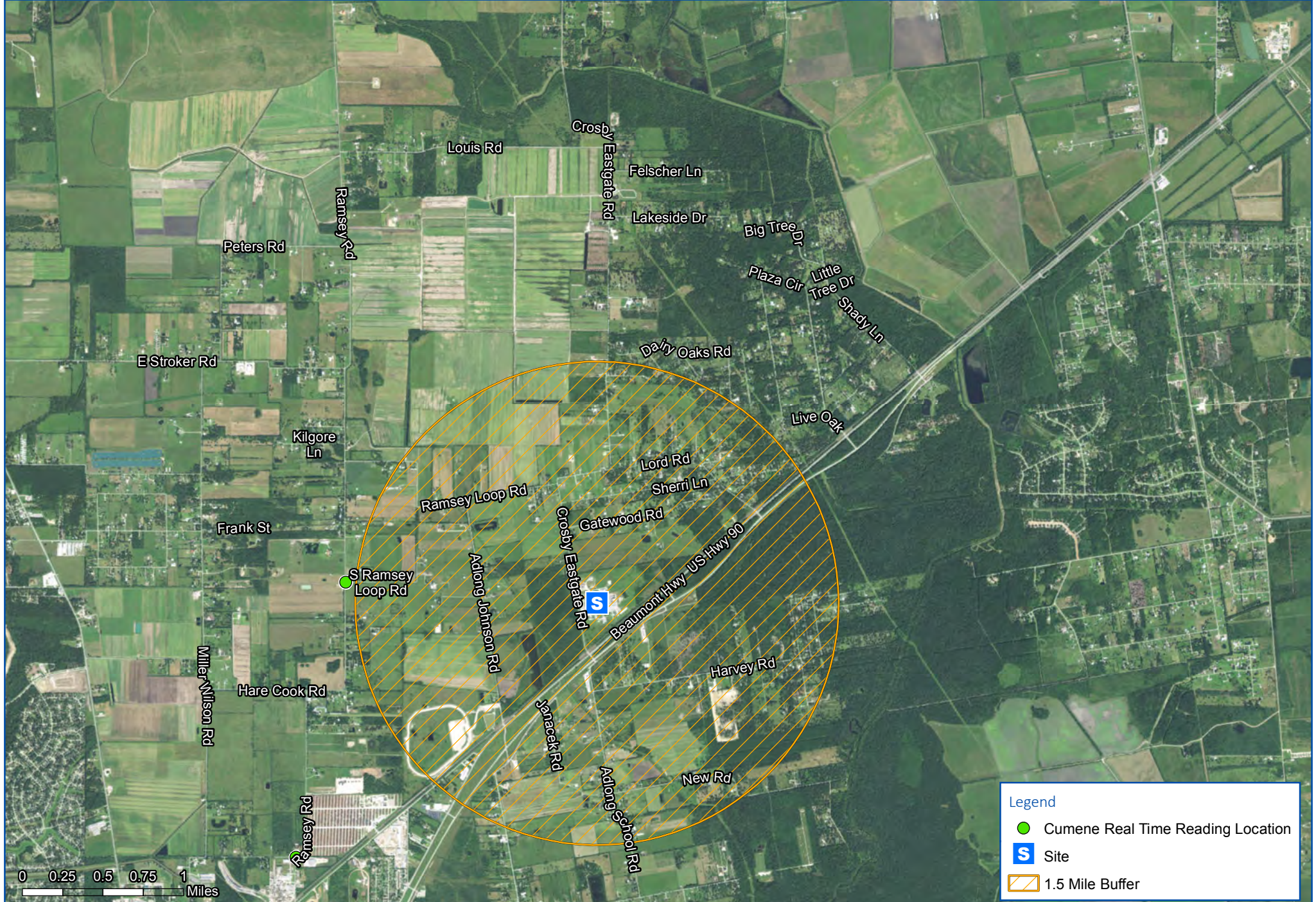
**Legend**

- Benzene Real Time Reading Location
- S Site
- 1.5 Mile Buffer



**Legend**

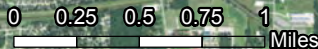
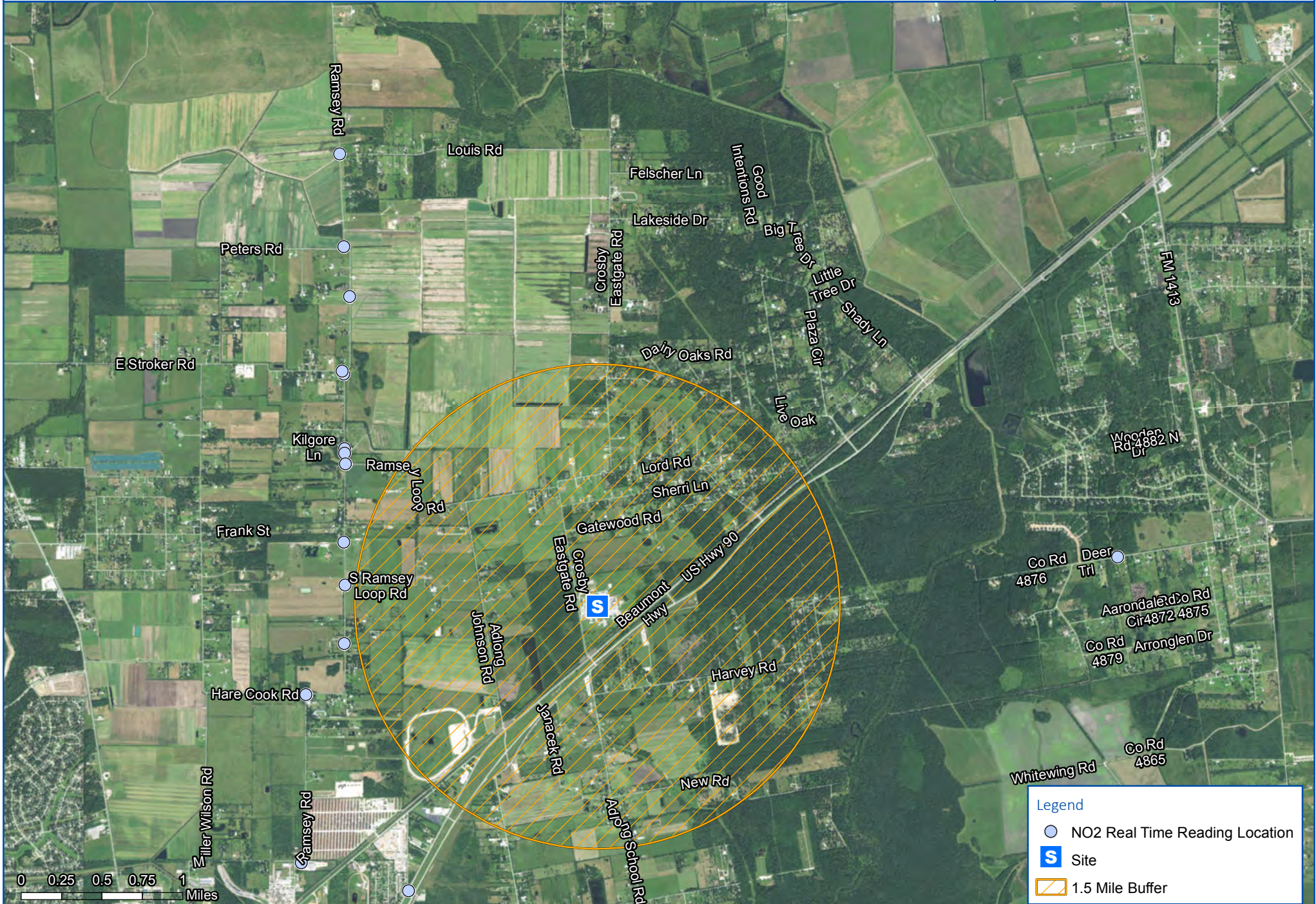
- CO Real Time Reading Location
- S Site
- ▨ 1.5 Mile Buffer






**Legend**

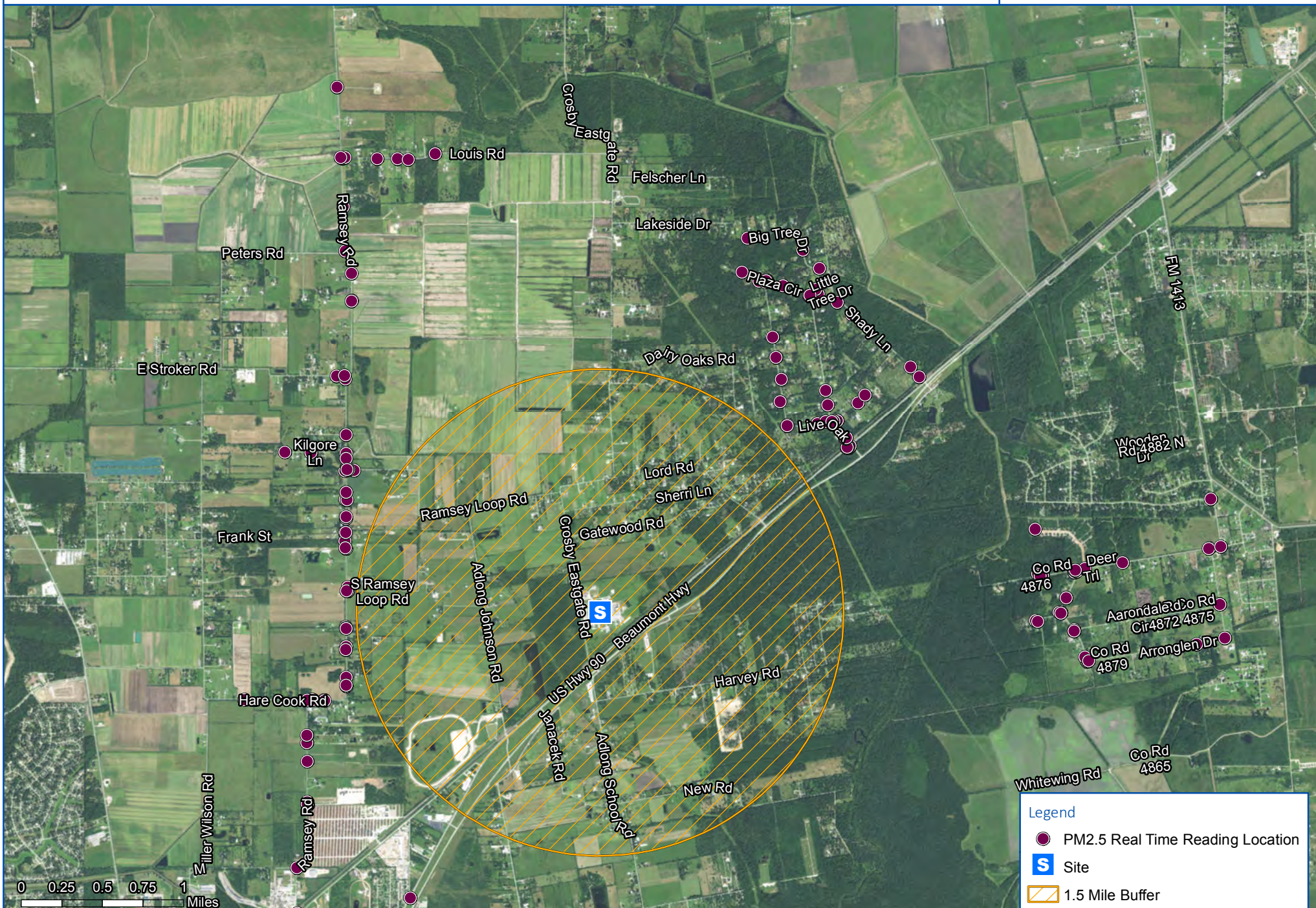
- Cumene Real Time Reading Location
- Site
- 1.5 Mile Buffer





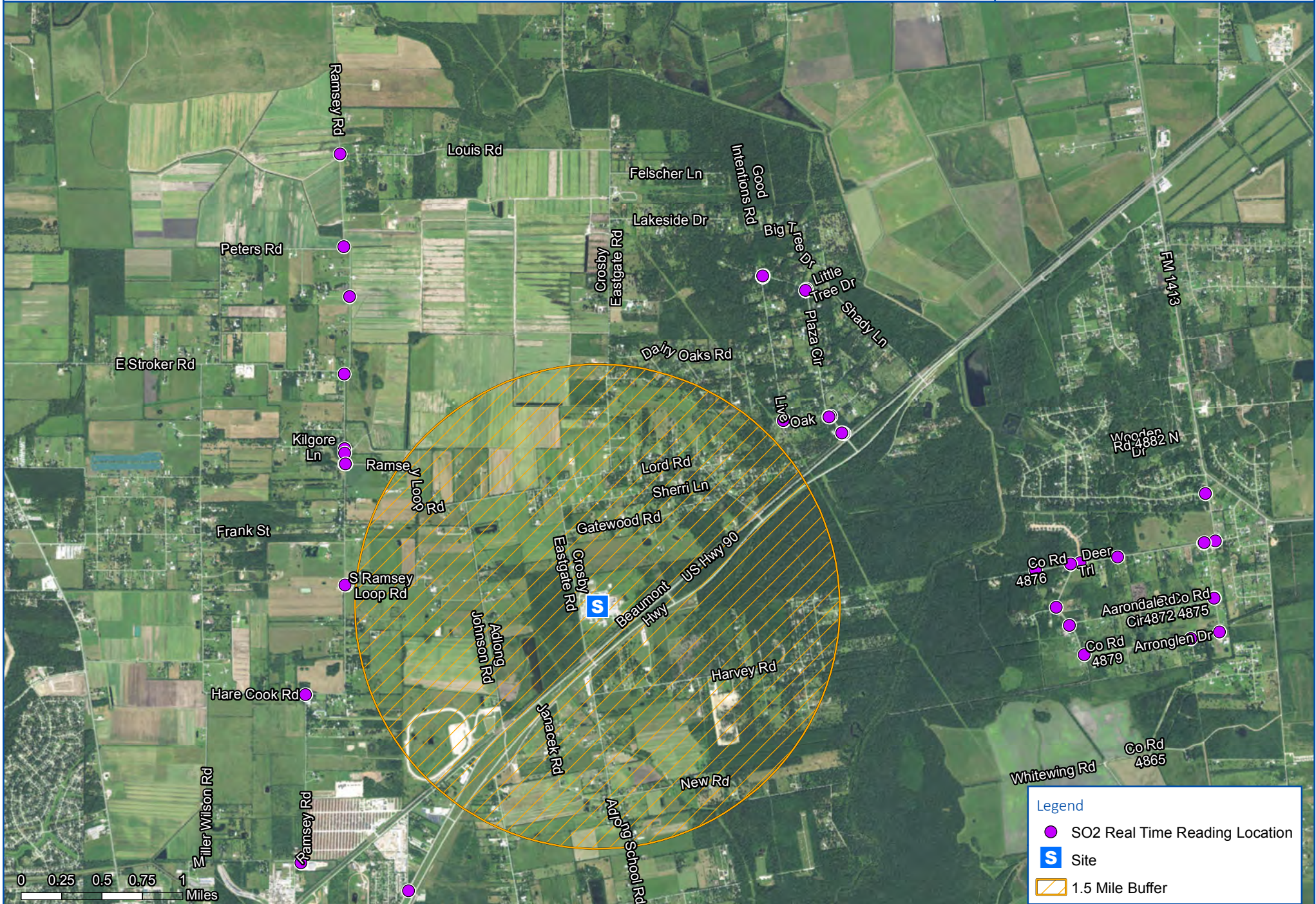
**Legend**

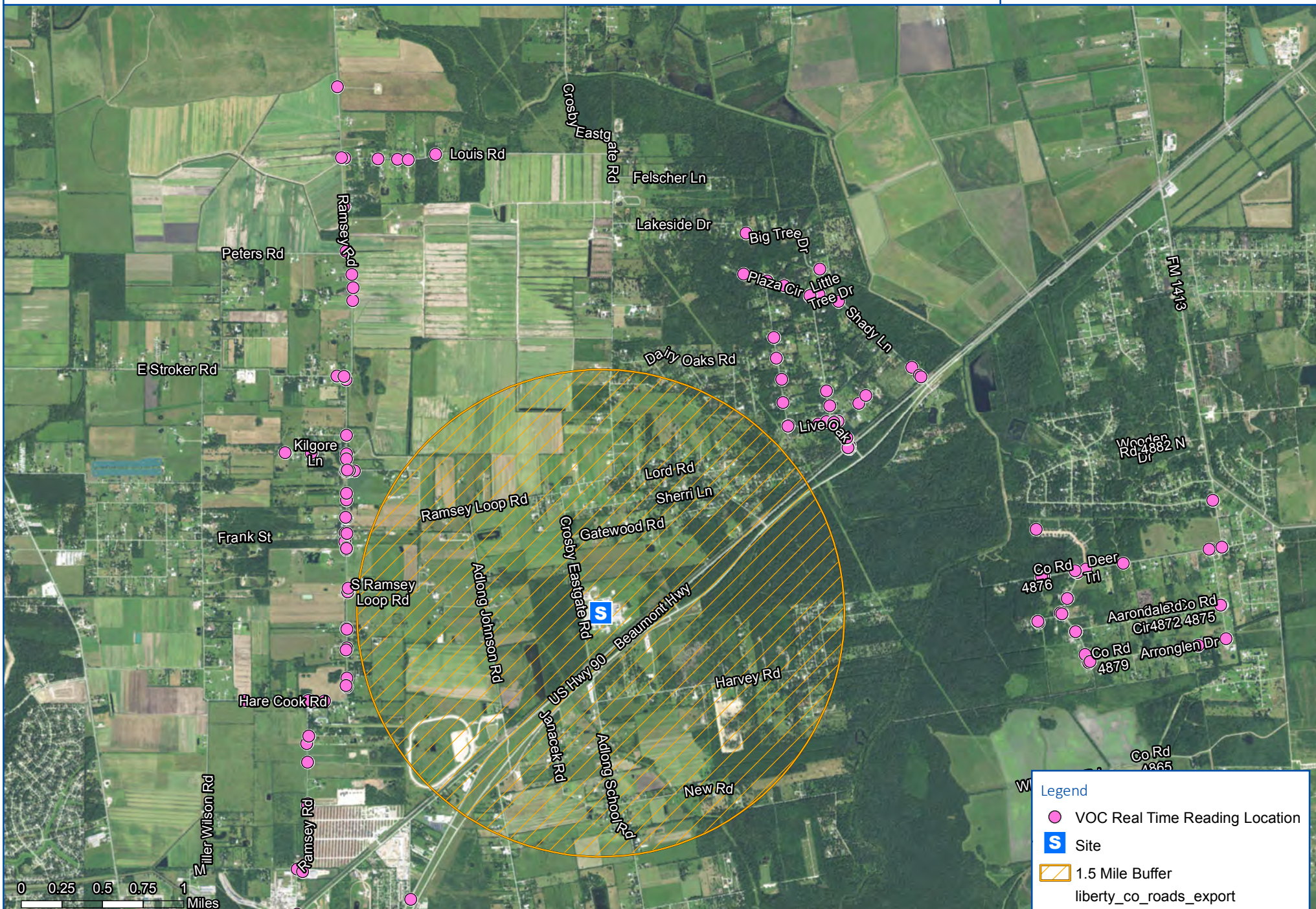
-  NO2 Real Time Reading Location
-  Site
-  1.5 Mile Buffer



**Legend**

- PM2.5 Real Time Reading Location
- Site
- 1.5 Mile Buffer





**Legend**

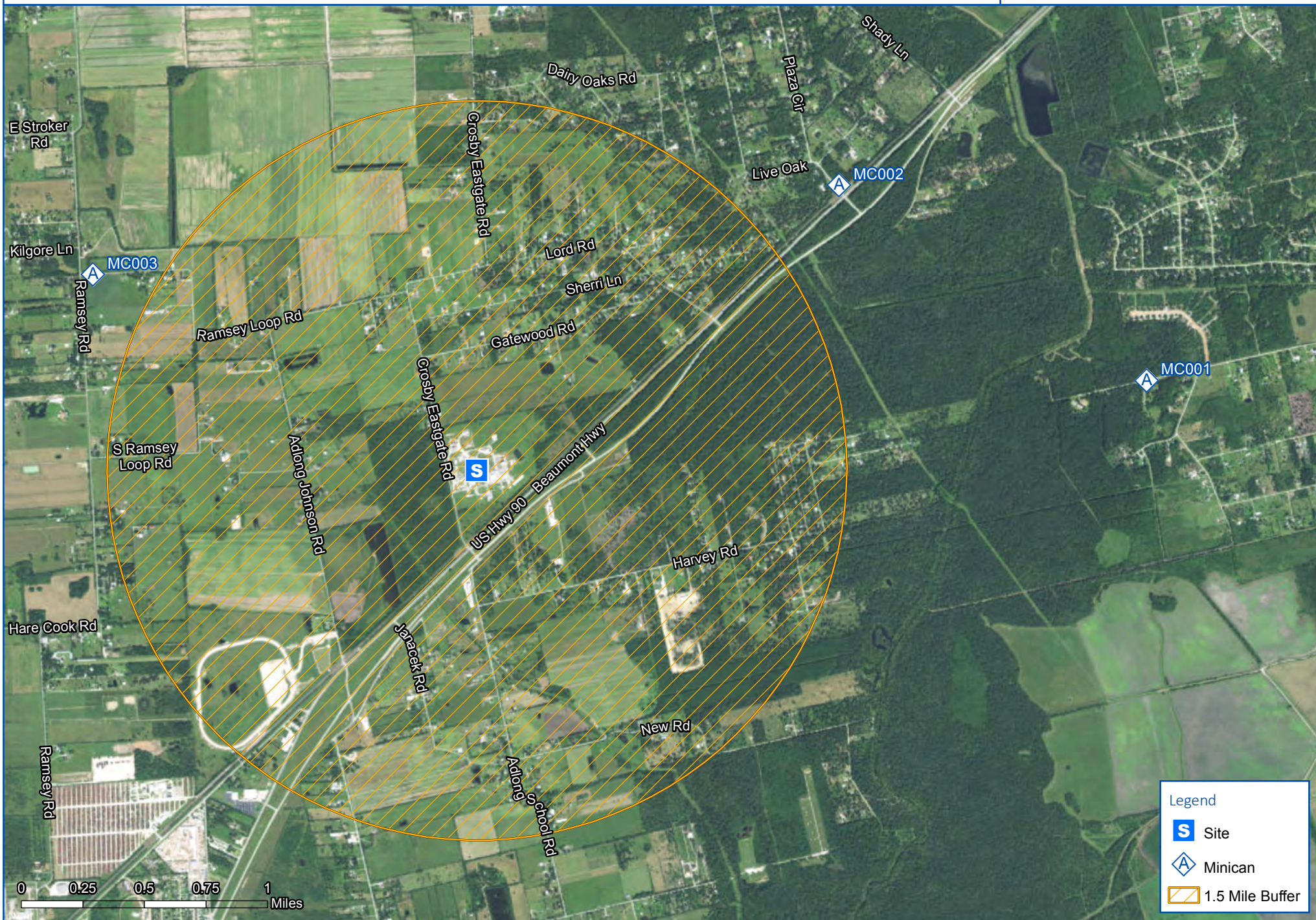
- VOC Real Time Reading Location
- Site
- 1.5 Mile Buffer

liberty\_co\_roads\_export



# Attachment C

## Map of Analytical Air Sampling Locations



Legend

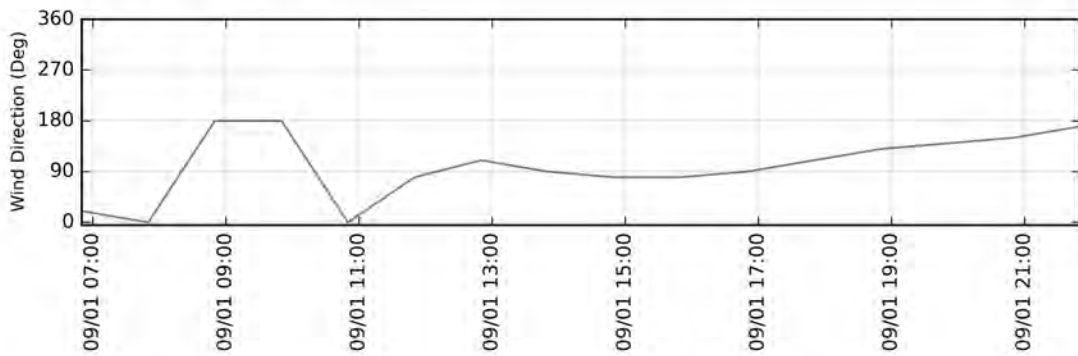
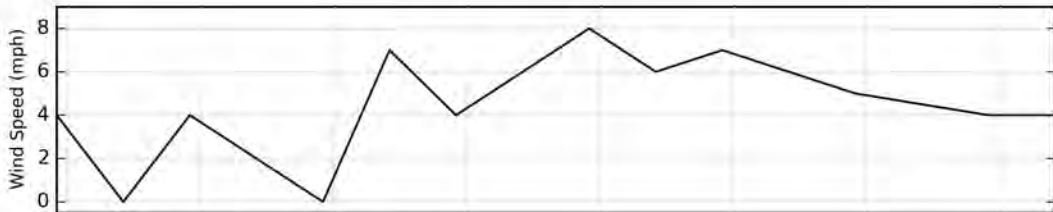
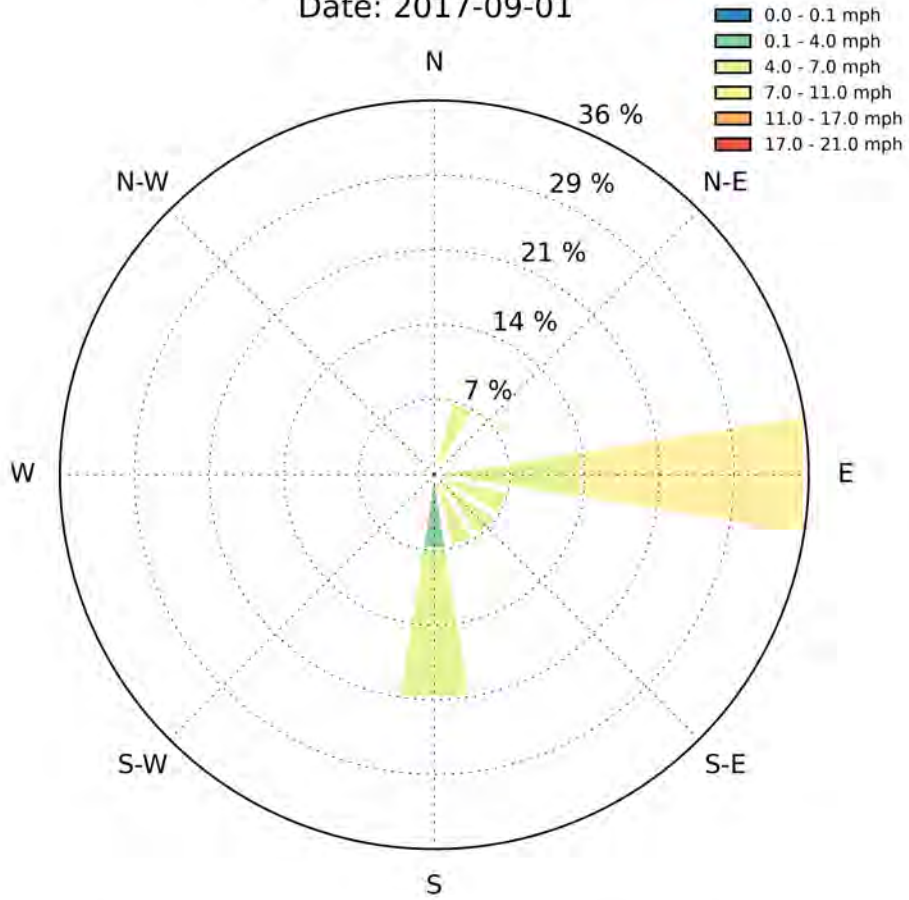
- S Site
- A Minican
- 1.5 Mile Buffer

# **Attachment D**

## **KHPY Windrose**

**(Highland Park Airport - 12.5 miles SSE of Site)**

Weather Station: KHPY  
Date: 2017-09-01



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 3, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 2, 2017 to 06:00 on September 3, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for benzene, cumene, and volatile organic compounds (VOCs) using RAE Systems and Gastec instruments. Additionally, combustion byproducts potentially associated with fire smoke, such as particulate matter (PM<sub>2.5</sub>), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>) were assessed. **Table 1** summarizes the data for all real-time air monitoring readings recorded in Crosby, TX from 06:00 on September 2, 2017 through 06:00 on September 3, 2017. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Real-time Handheld Air Monitoring Readings  
06:00 September 2, 2017 – 06:00 September 3, 2017**

<b>Analyte</b>	<b>Instrument</b>	<b>Number of Readings</b>	<b>Number of Detections</b>	<b>Range of Detections*</b>
Benzene	UltraRAE	47	0	< 0.025 ppm
Cumene	Gastec Tube 122L	2	0	< 2.0 ppm
NO <sub>2</sub>	MultiRAE Plus	68	0	< 0.1 ppm
PM <sub>2.5</sub>	AM510	142	142	0.022 - 0.13 mg/m <sup>3</sup>
	Dusttrak	58	58	0.017 - 0.12 mg/m <sup>3</sup>
SO <sub>2</sub>	MultiRAE Plus	81	0	< 0.1 ppm
VOCs	MultiRAE Plus	211	5	0.6 - 1.4 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

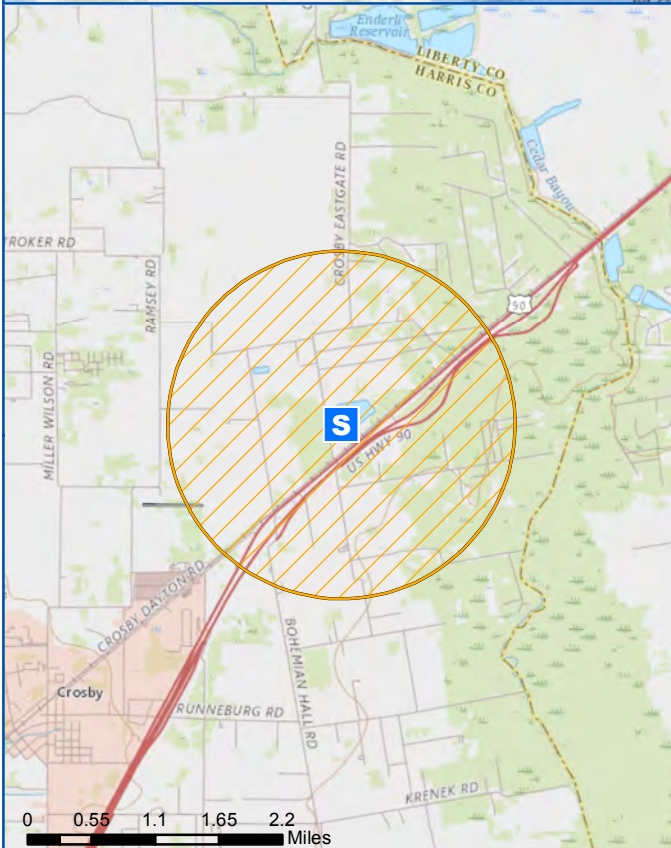
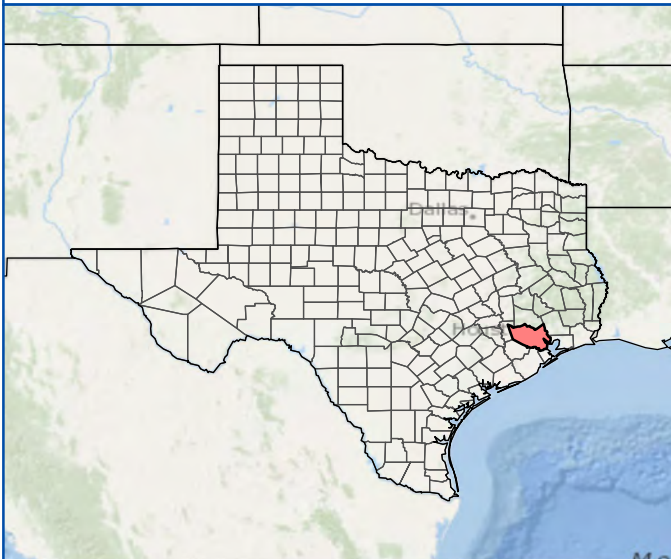
### **3.0 Analytical Air Sampling**

To supplement real-time air monitoring, CTEH® deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican™) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.

# **Attachment A**

## **Site Location Map**



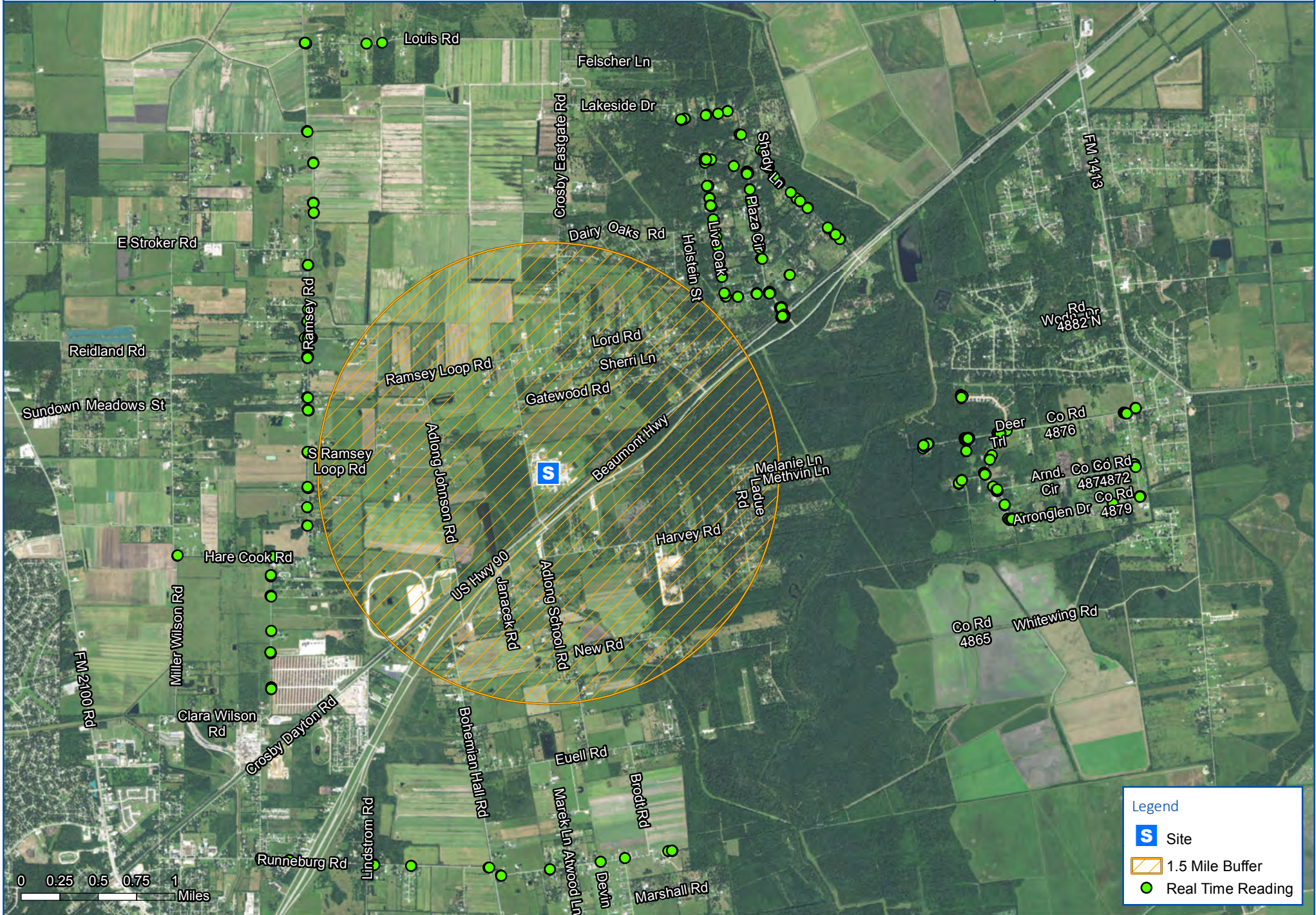


**Legend**

- Site
- 1.5 Mile Buffer

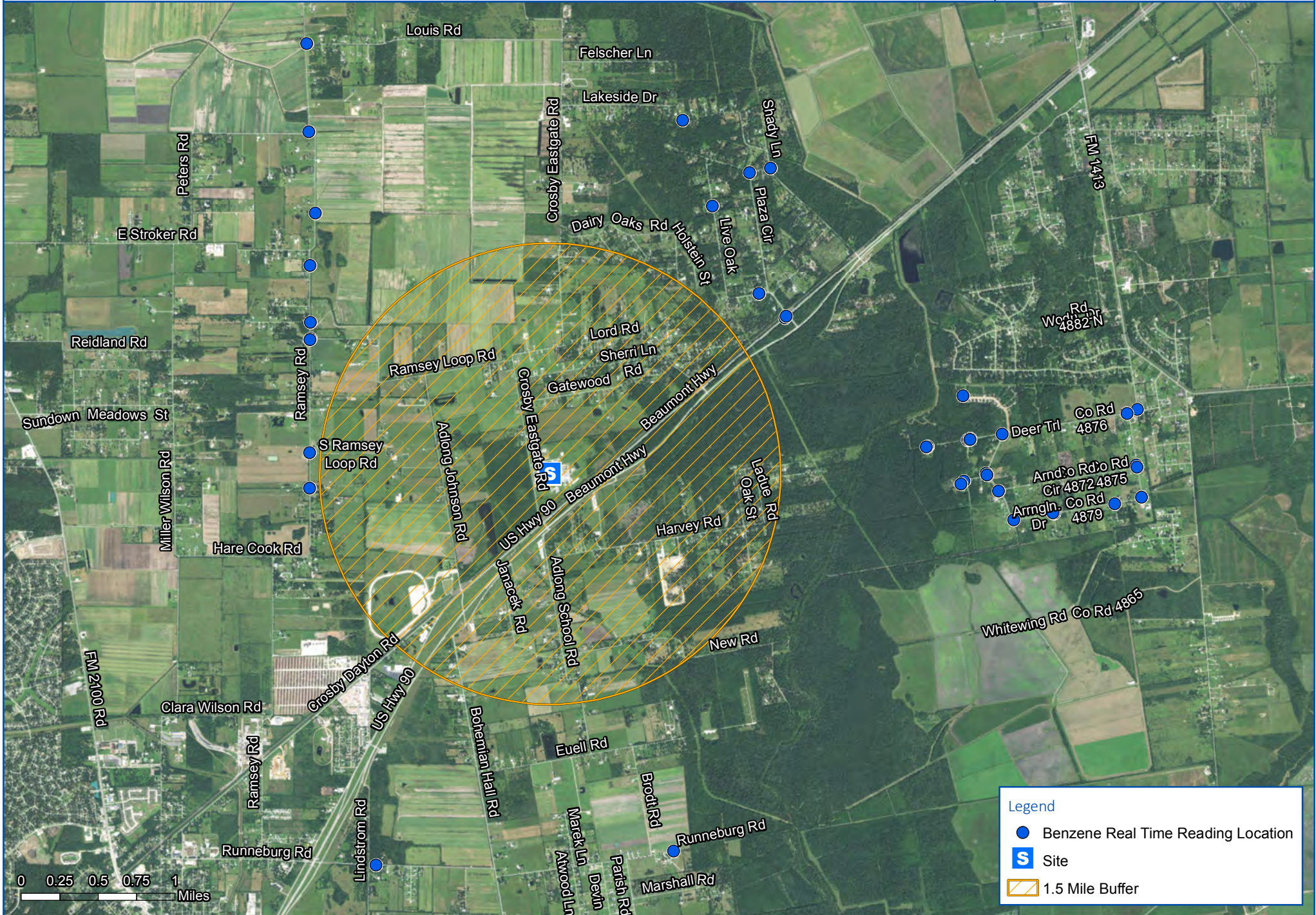
# **Attachment B**

## **Handheld Real-time Air Monitoring Locations**



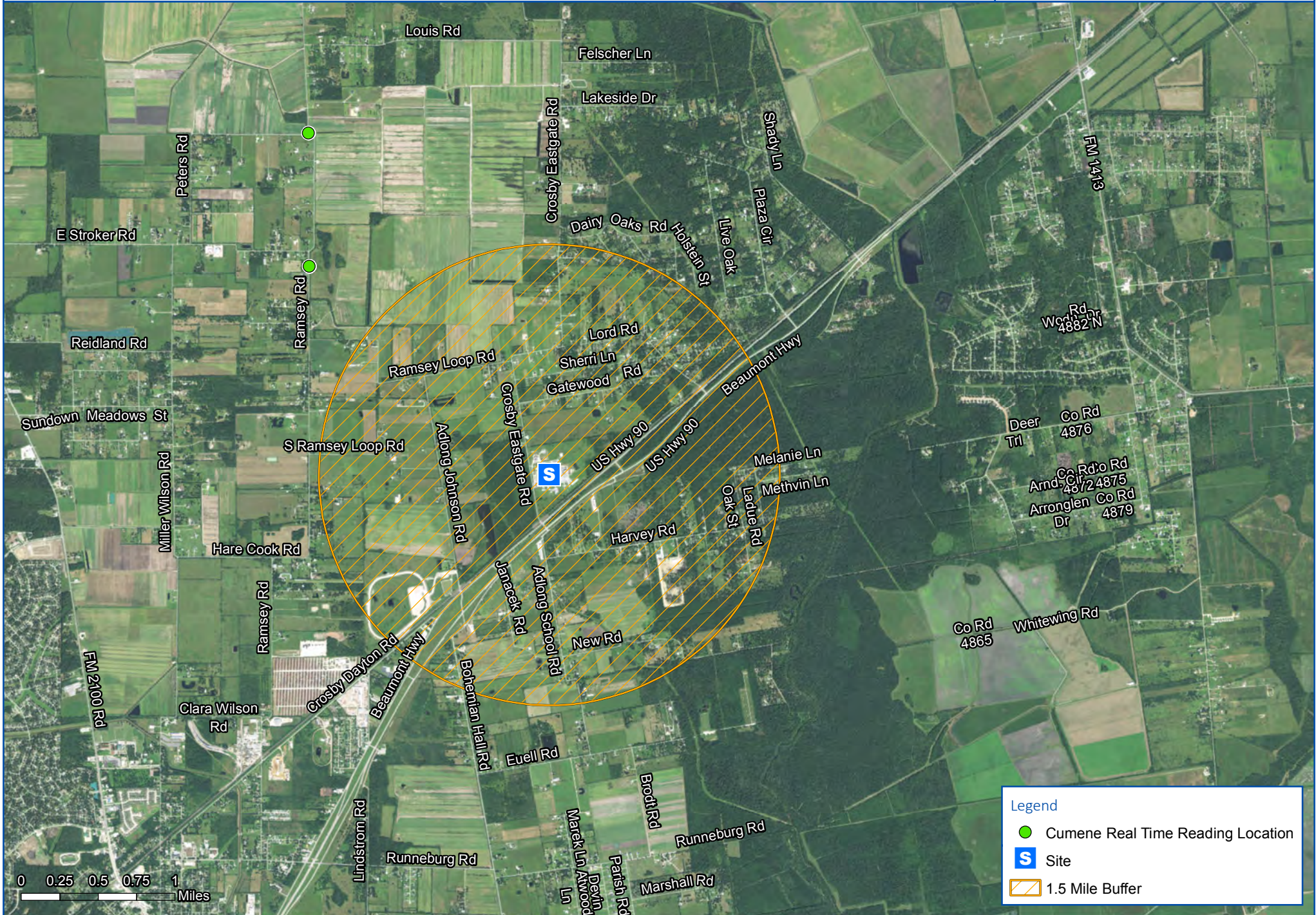
Legend

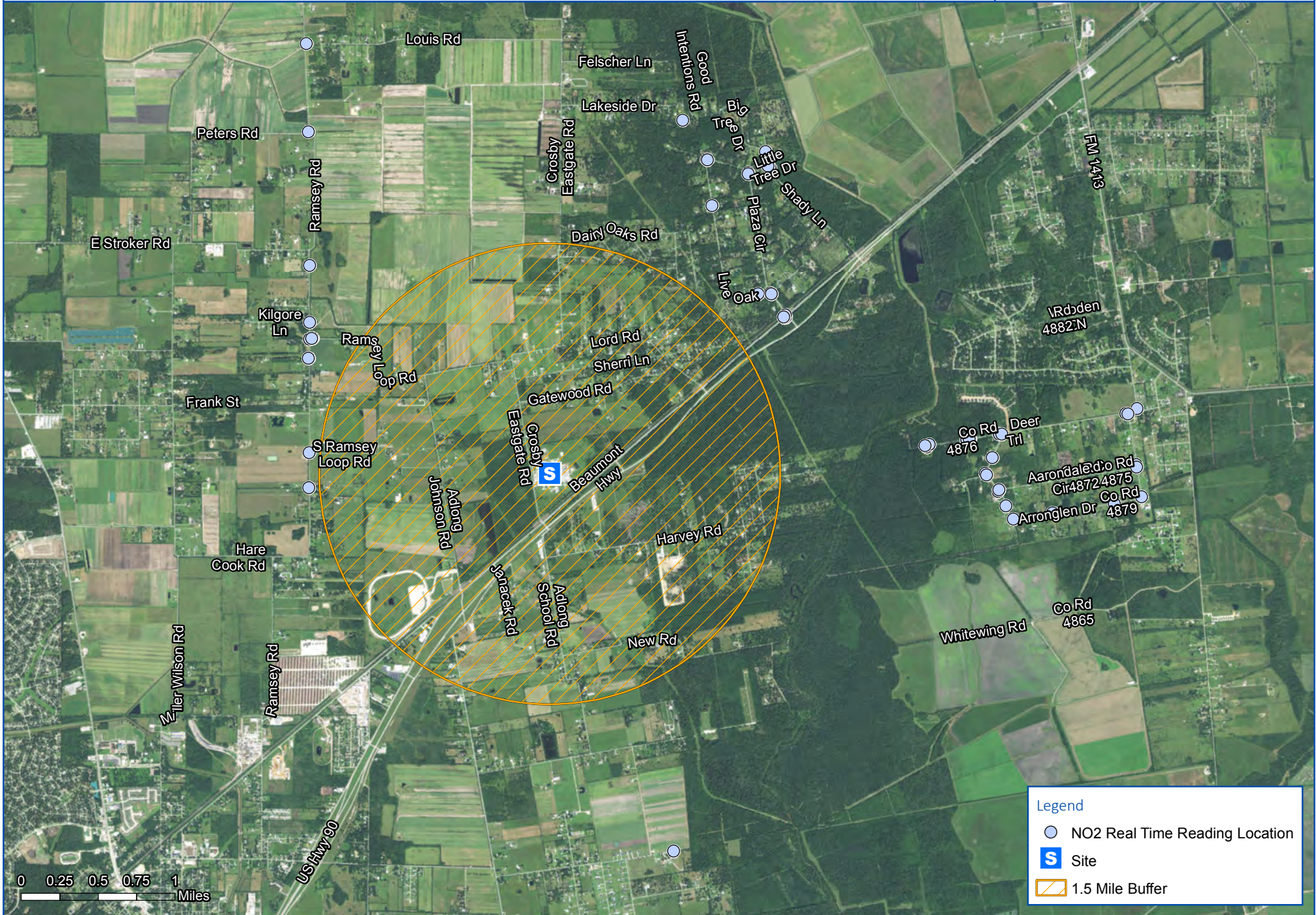
- Site
- 1.5 Mile Buffer
- Real Time Reading






**Legend**

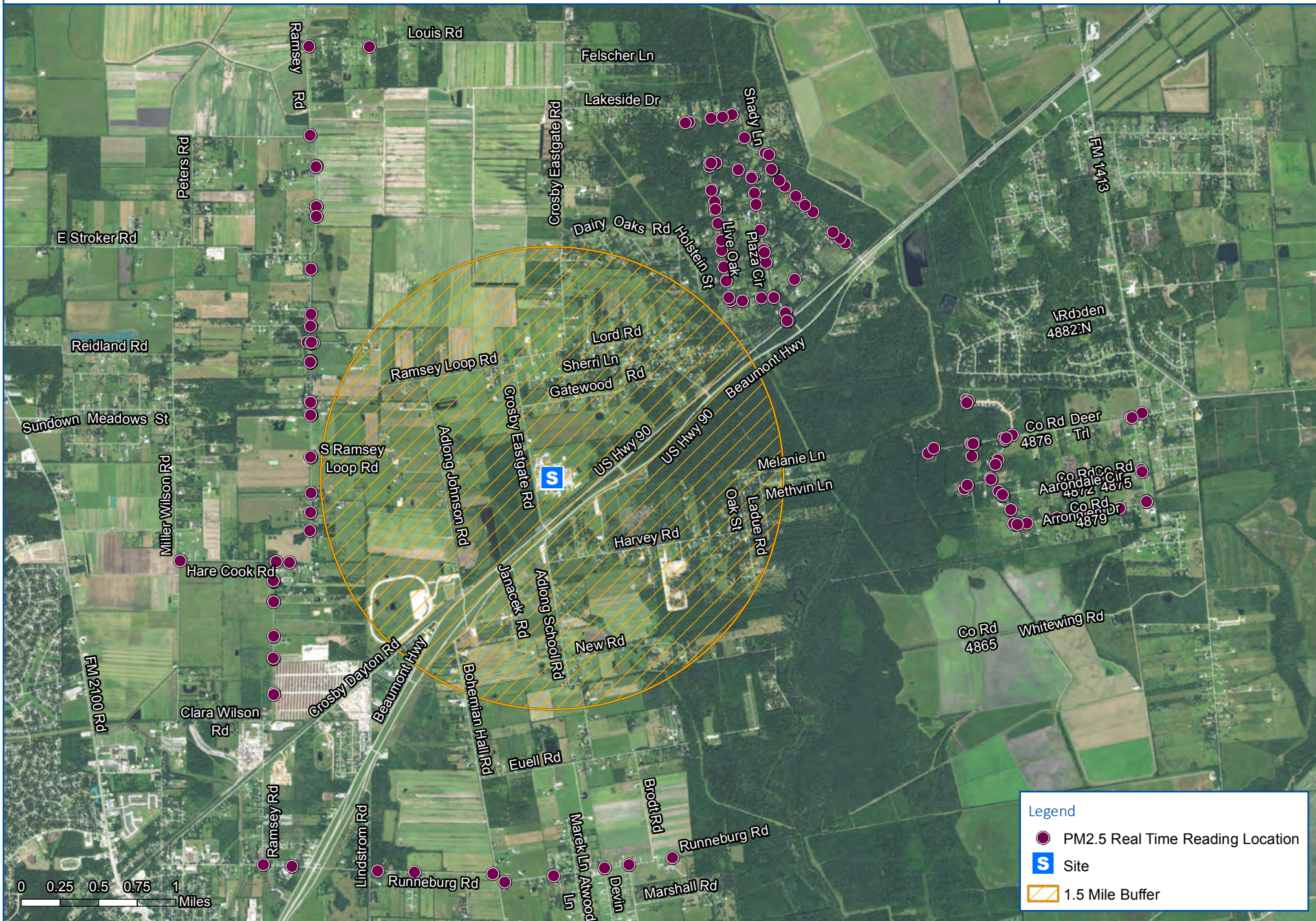
- Benzene Real Time Reading Location
- S Site
- 1.5 Mile Buffer








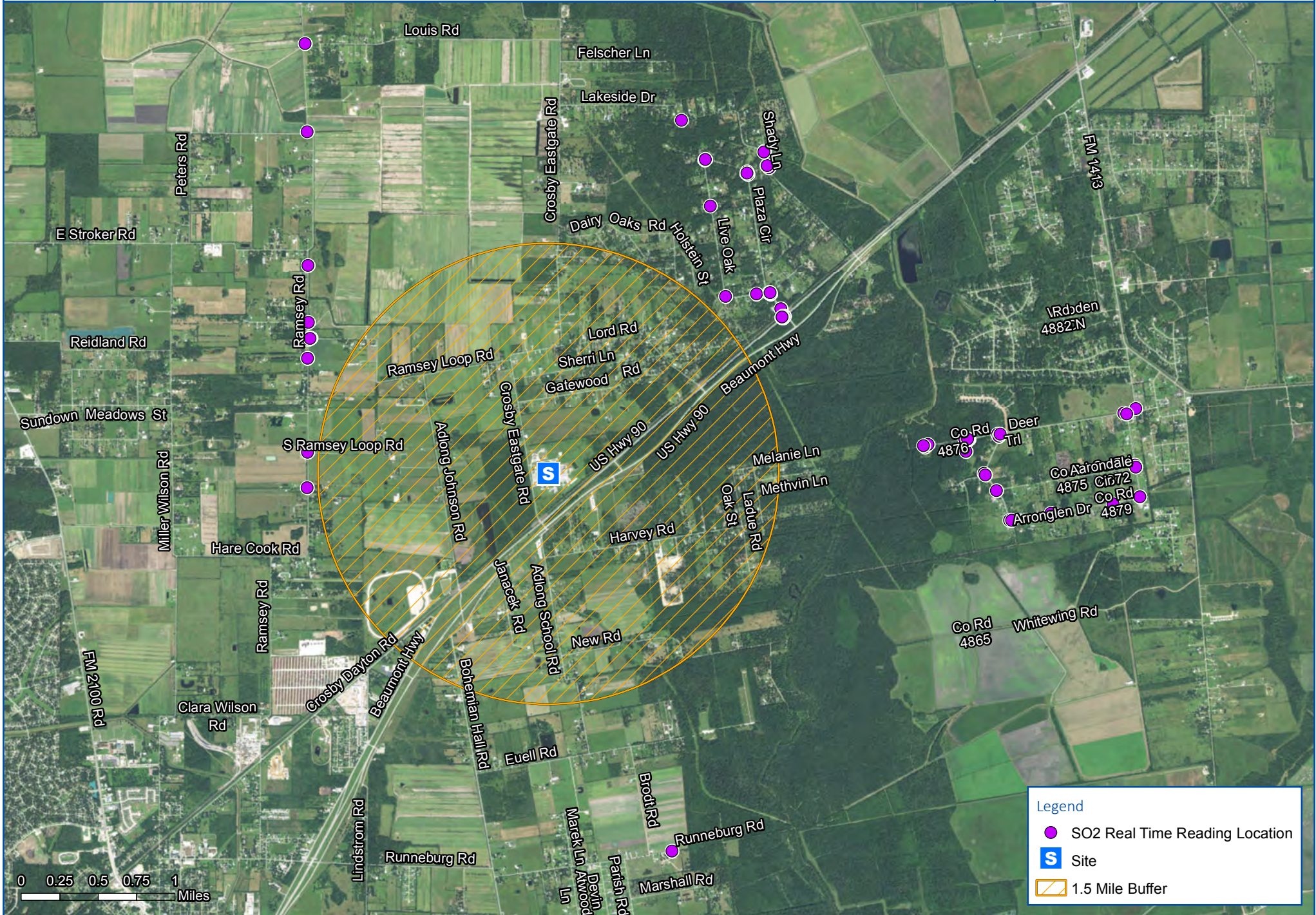
**Legend**

-  NO2 Real Time Reading Location
-  Site
-  1.5 Mile Buffer

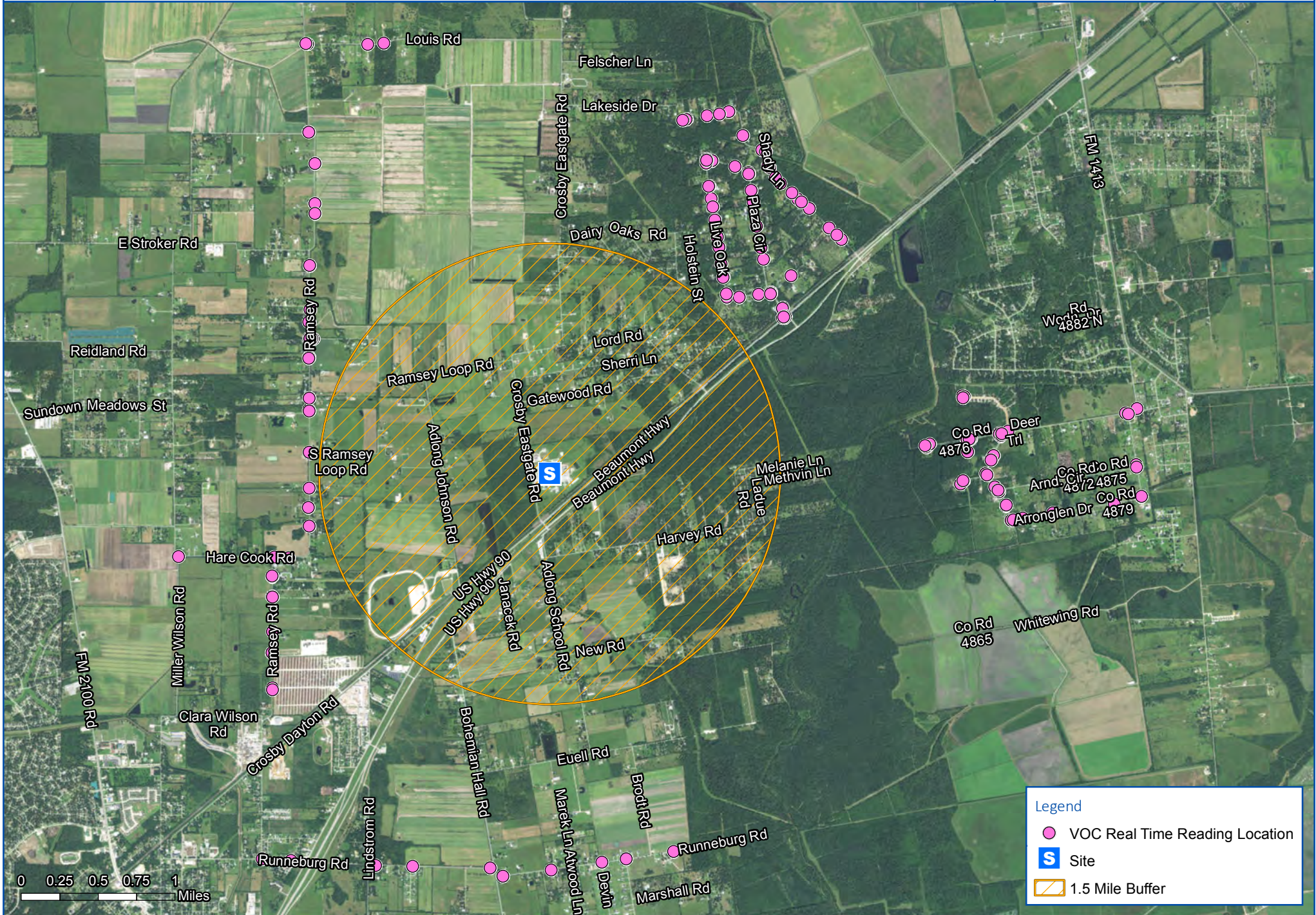


**Legend**

-  PM2.5 Real Time Reading Location
-  Site
-  1.5 Mile Buffer

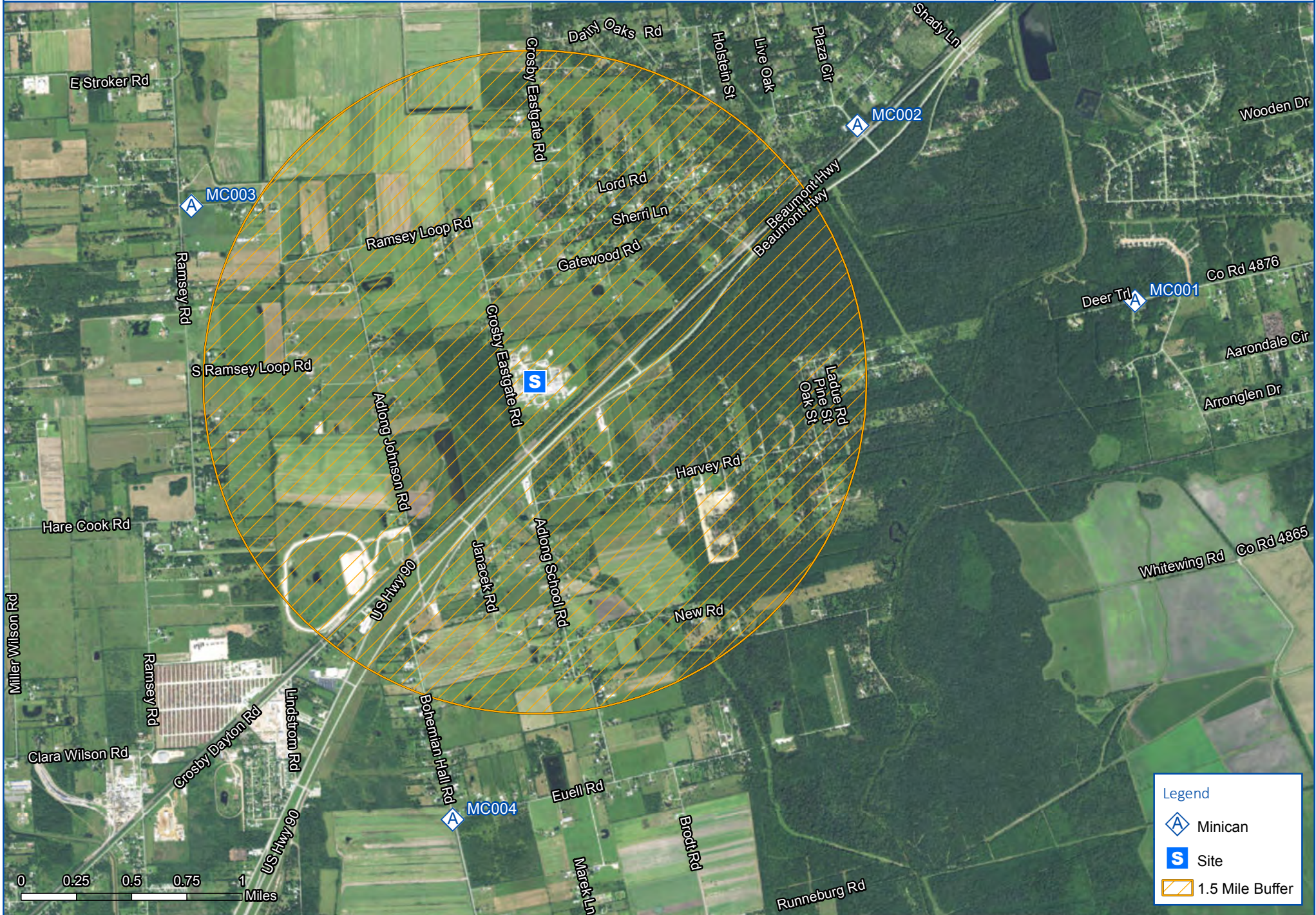






# Attachment C

## Map of Analytical Air Sampling Locations



Legend

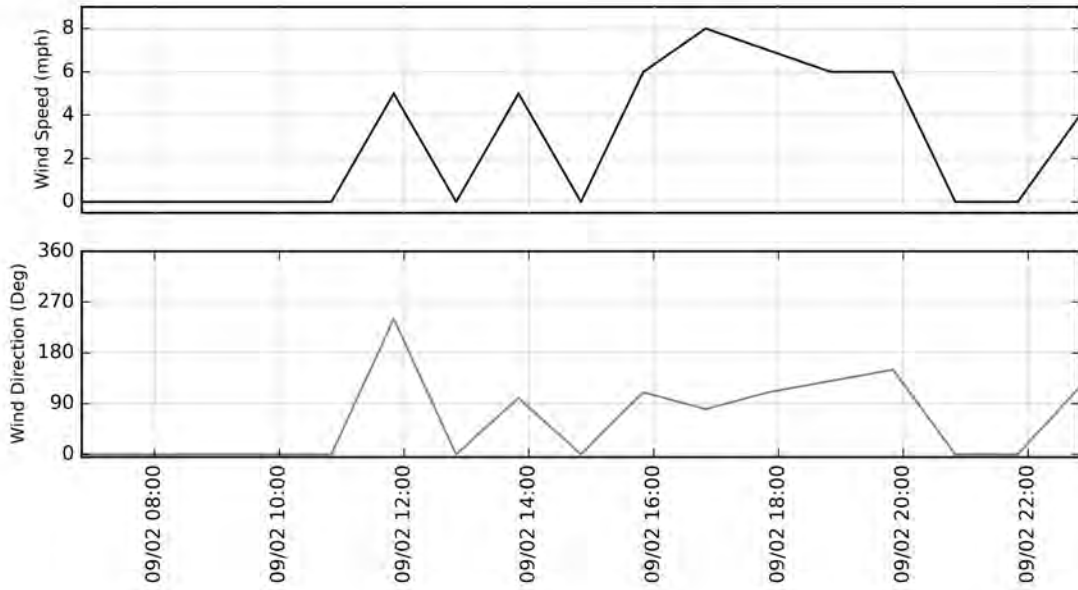
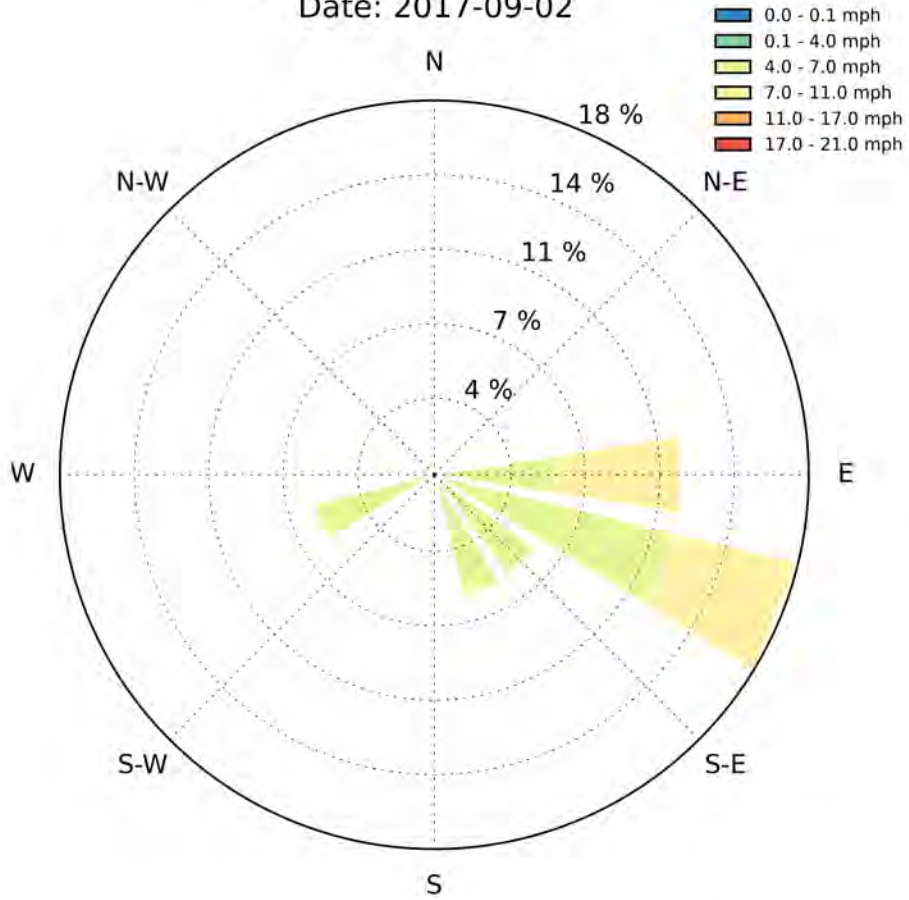
- Minican
- Site
- 1.5 Mile Buffer

# **Attachment D**

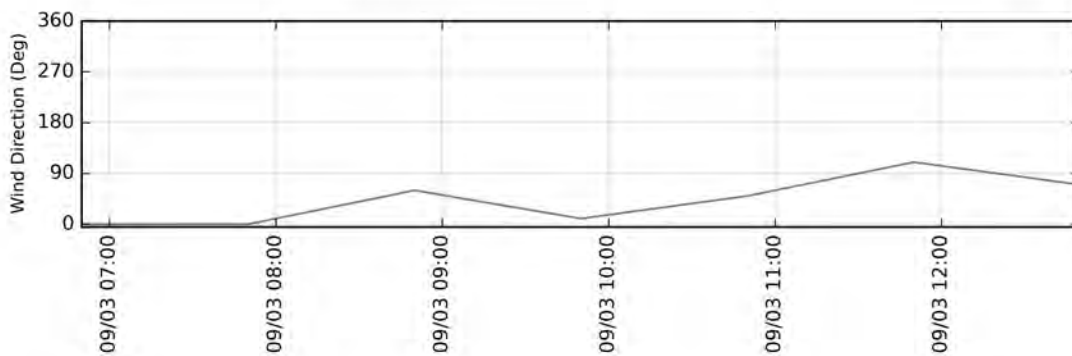
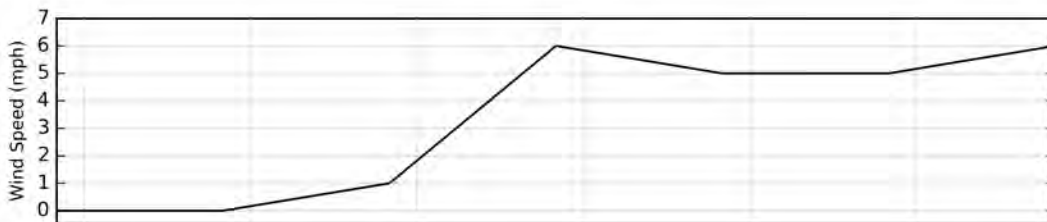
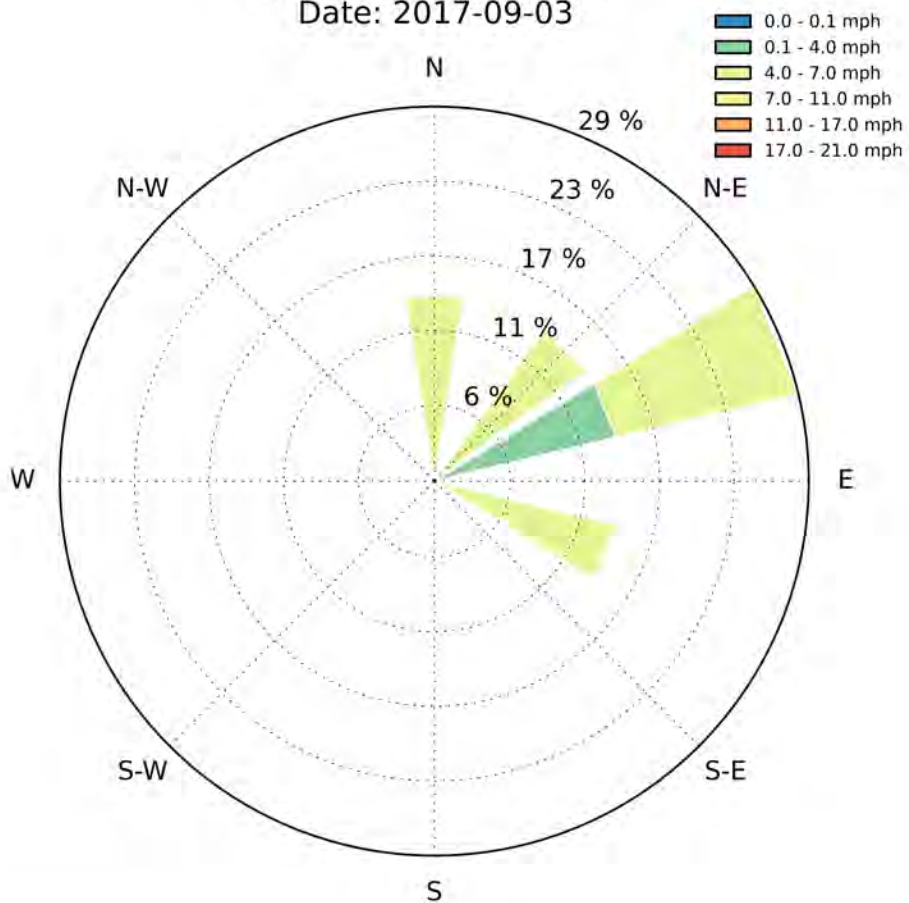
## **KHPY Windrose**

**(Highland Park Airport - 12.5 miles SSE of Site)**

Weather Station: KHPY  
Date: 2017-09-02



Weather Station: KHPY  
Date: 2017-09-03



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 4, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 3, 2017 to 06:00 on September 4, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for benzene and volatile organic compounds (VOCs) using RAE Systems UltraRAE and MultiRAE instruments. Additionally, combustion byproducts potentially associated with fire smoke, such as particulate matter (PM<sub>2.5</sub>), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>) were assessed using Gastec Tubes, DustTraks, and AM510s. **Table 1** summarizes the data for all real-time air monitoring readings recorded in Crosby, TX from 06:00 on September 3, 2017 through 06:00 on September 4, 2017. Maps of real-time air monitoring locations are provided as **Attachment B**.



**Table 1 Real-time Handheld Air Monitoring Readings  
06:00 September 3, 2017 – 06:00 September 4, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
Benzene	UltraRAE	27	0	< 0.025 ppm
CO	MultiRAE Plus	71	0	< 1.0 ppm
NO <sub>2</sub>	Gastec Tube 9L	3	0	< 0.1 ppm
	MultiRAE Plus	5	0	< 0.1 ppm
PM <sub>2.5</sub>	AM510	142	142	0.020 - 0.213 mg/m <sup>3</sup>
	Dusttrak	66	66	0.023 - 0.051 mg/m <sup>3</sup>
SO <sub>2</sub>	MultiRAE Plus	65	0	< 0.1 ppm
VOCs	MultiRAE Plus	215	0	< 0.1 ppm

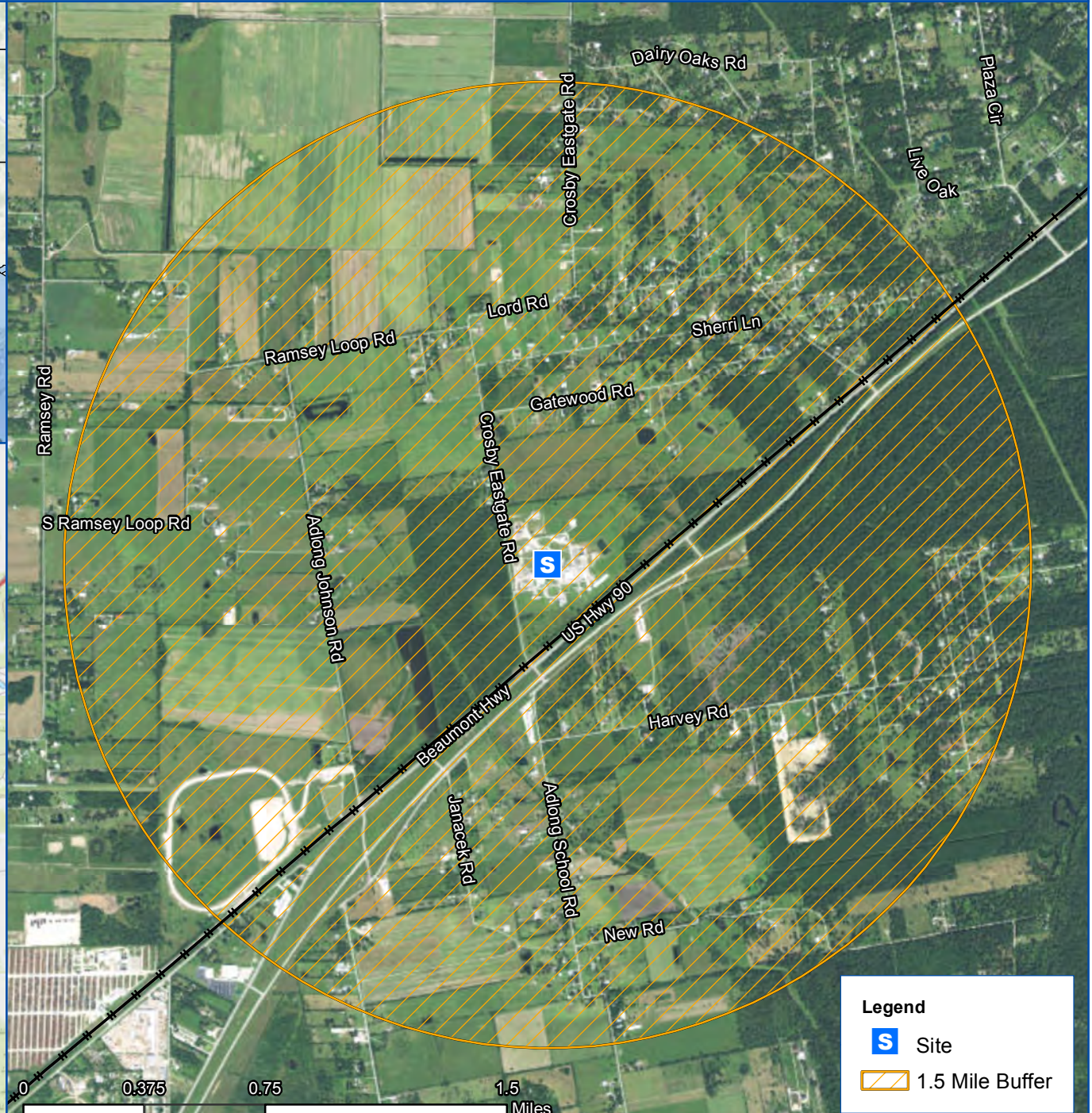
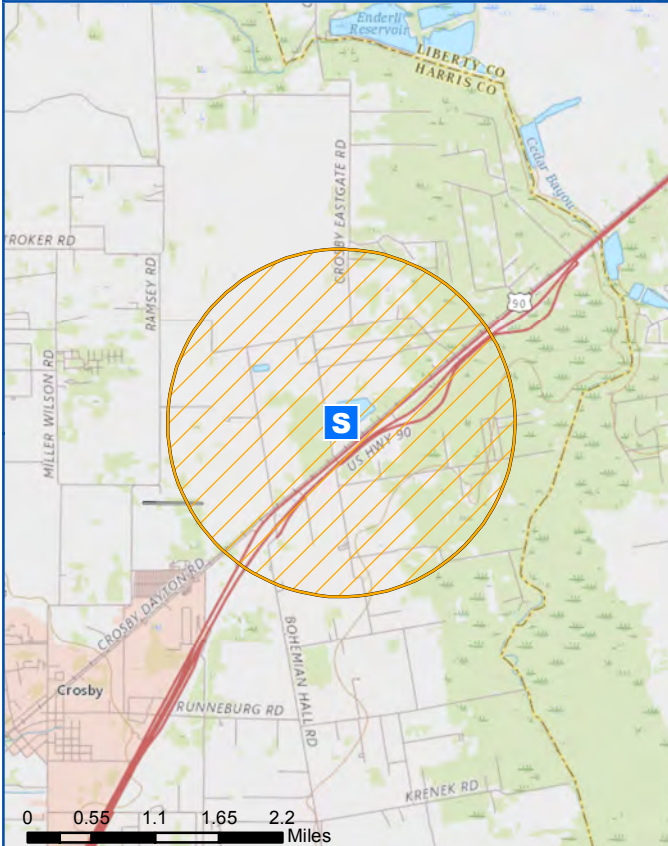
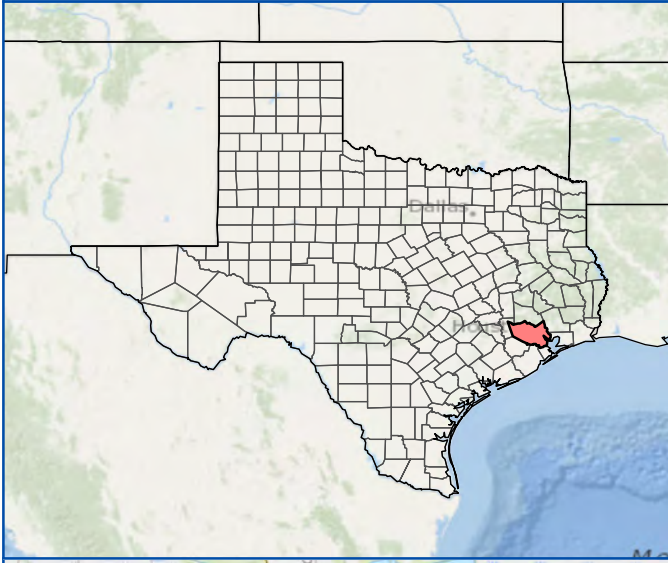
\*If detections were not observed, the instrument detection limit is listed in this column.

### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH<sup>®</sup> deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican<sup>™</sup>) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.

# **Attachment A**

## **Site Location Map**

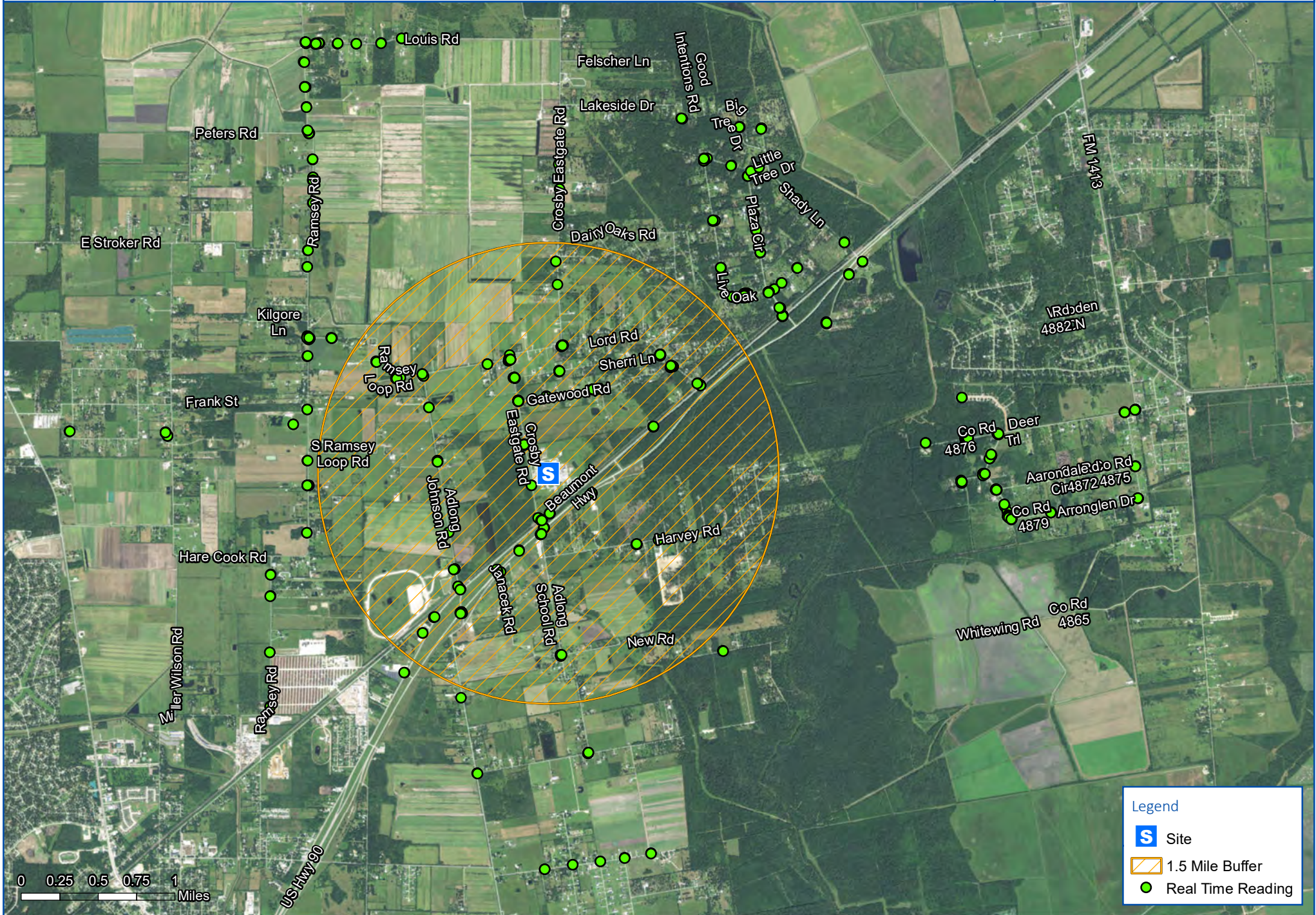


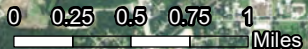
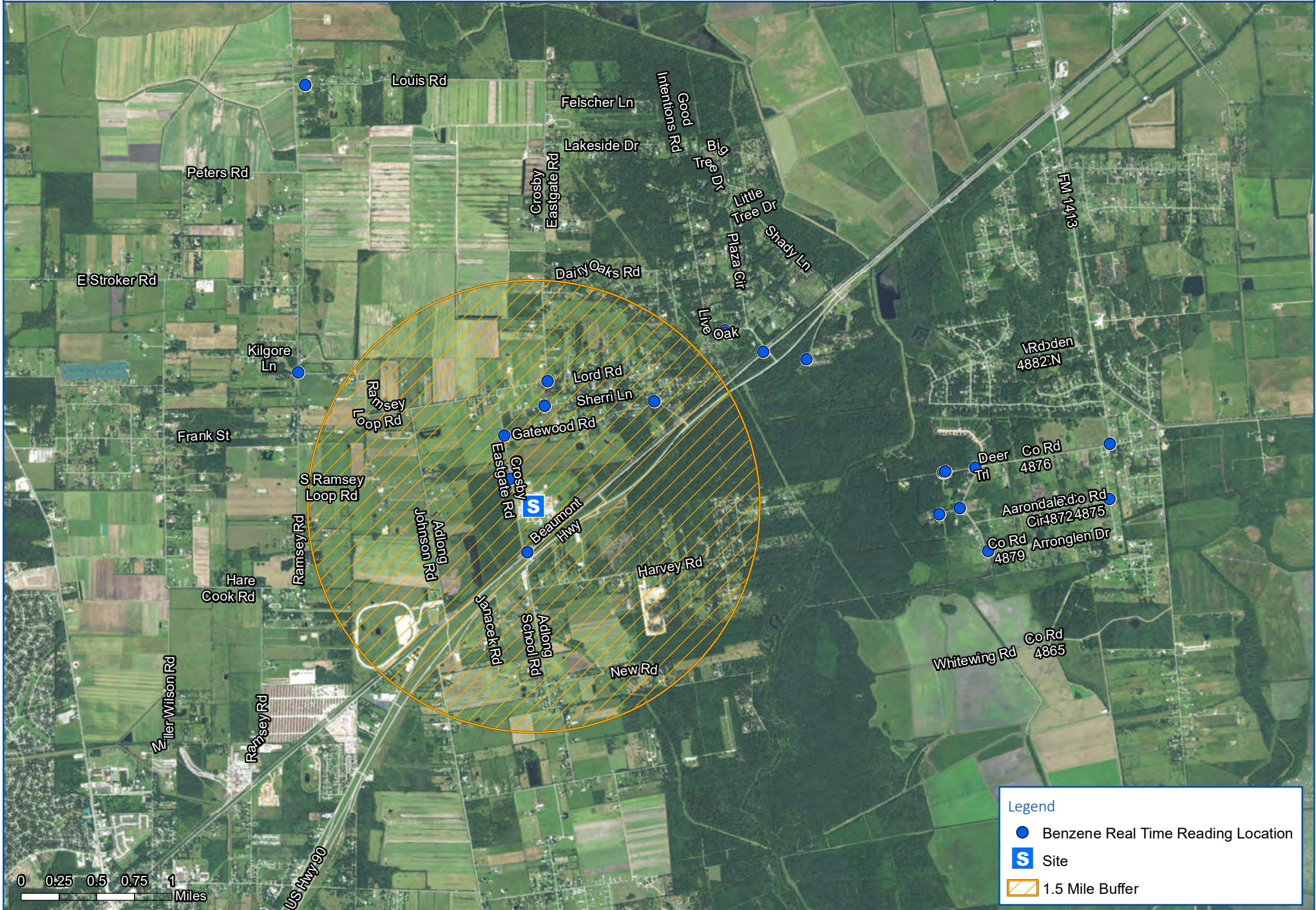
**Legend**

- S Site
- 1.5 Mile Buffer

# **Attachment B**

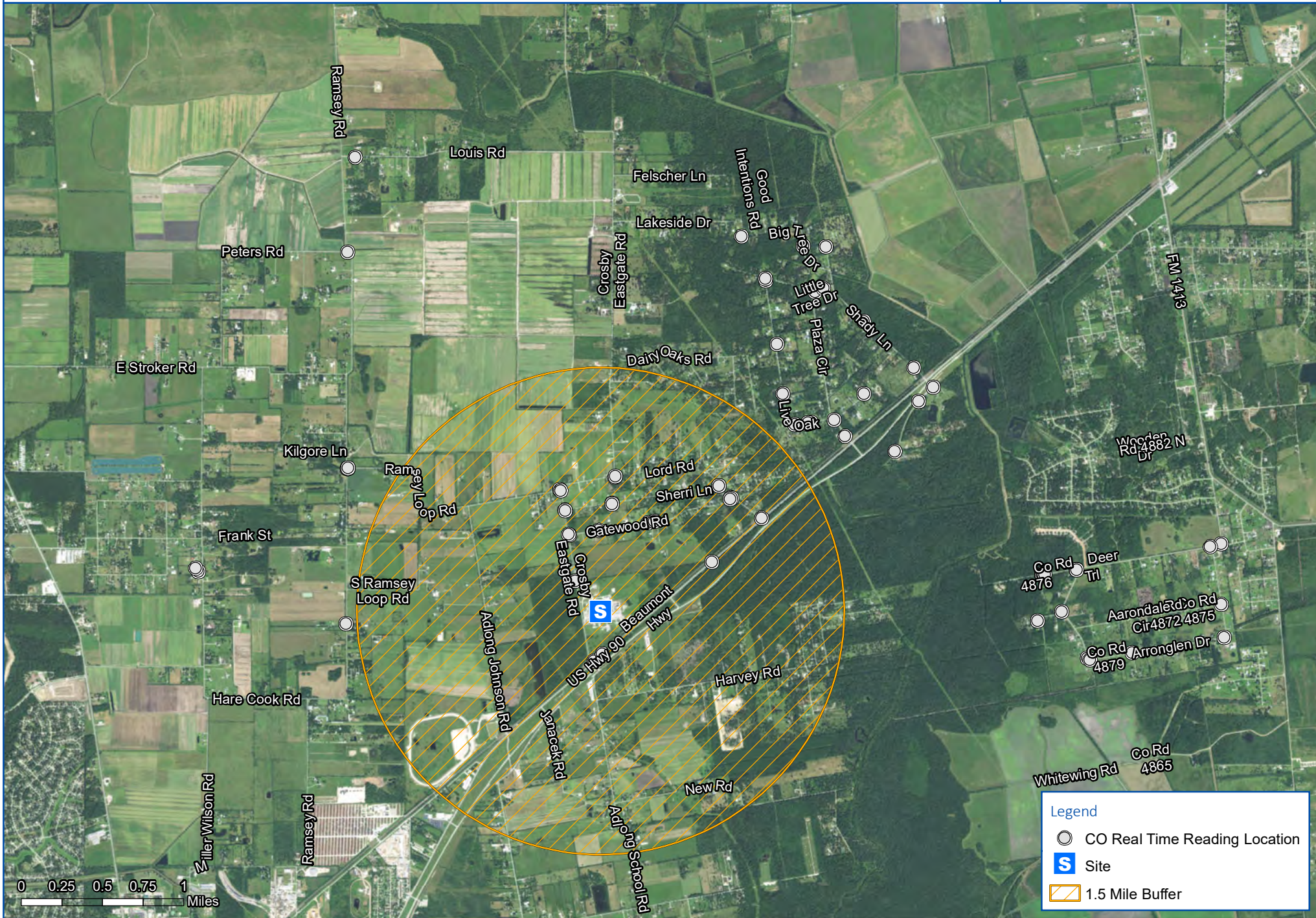
## **Handheld Real-time Air Monitoring Locations**

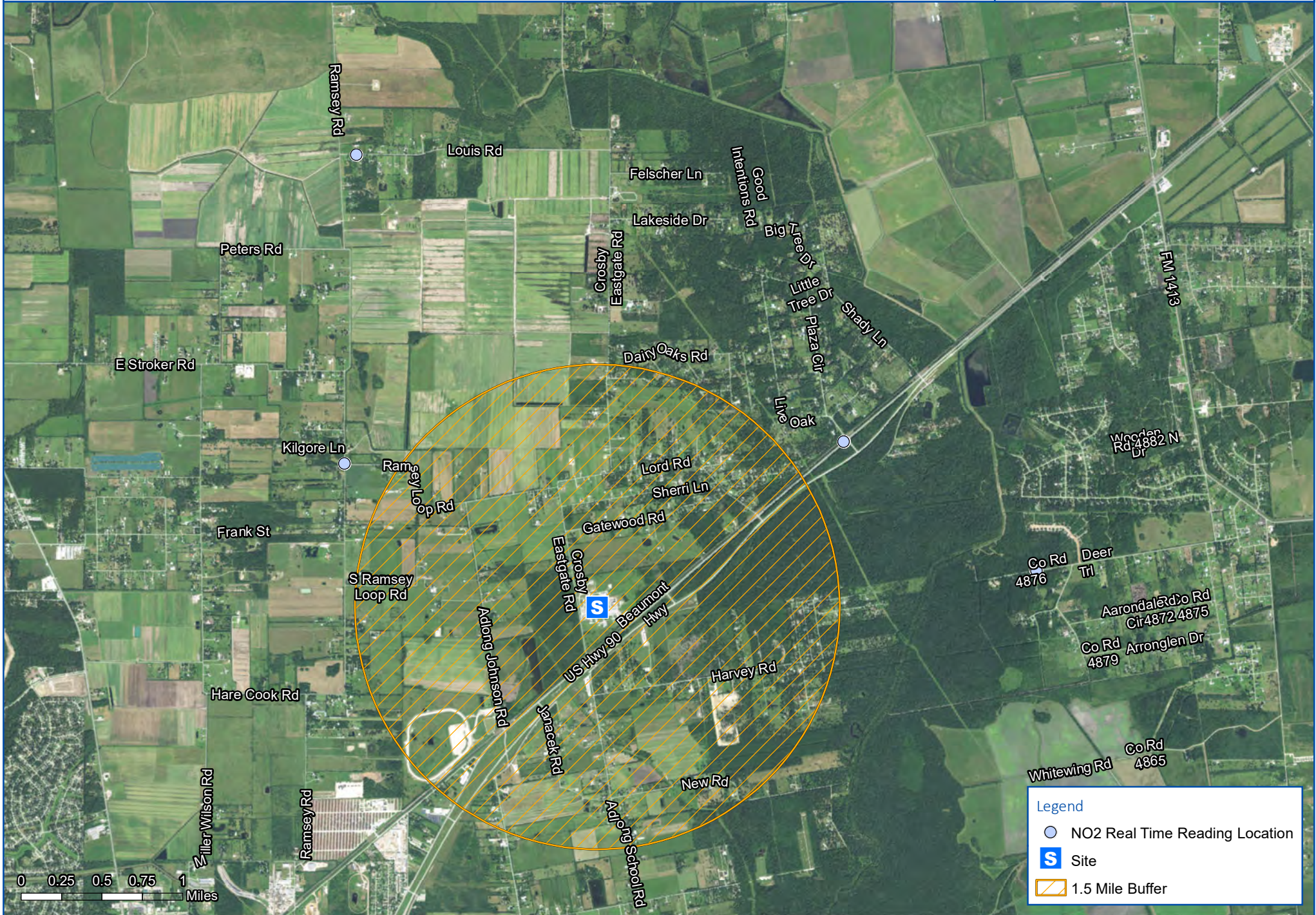




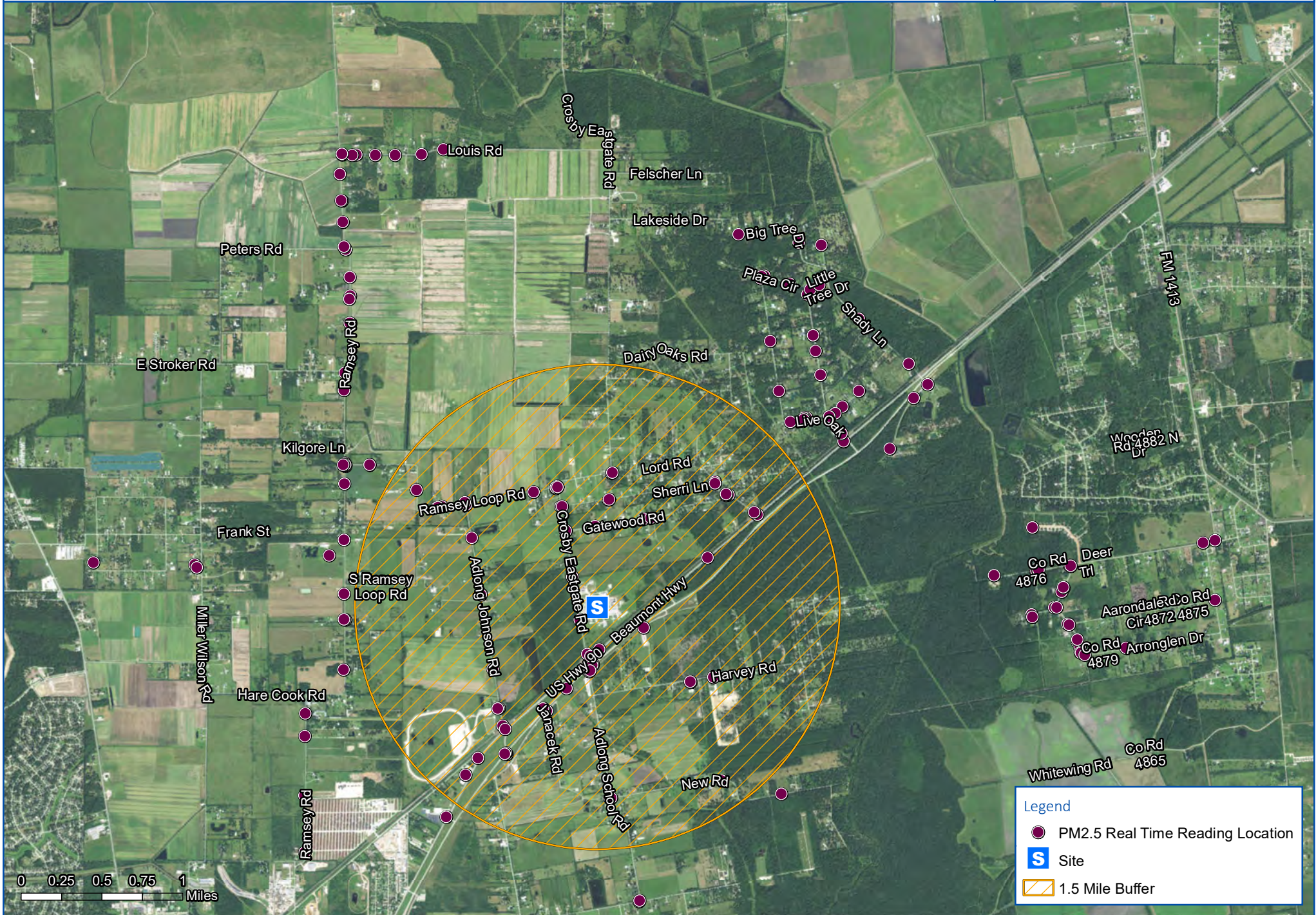
**Legend**

- Benzene Real Time Reading Location
- S Site
- 1.5 Mile Buffer



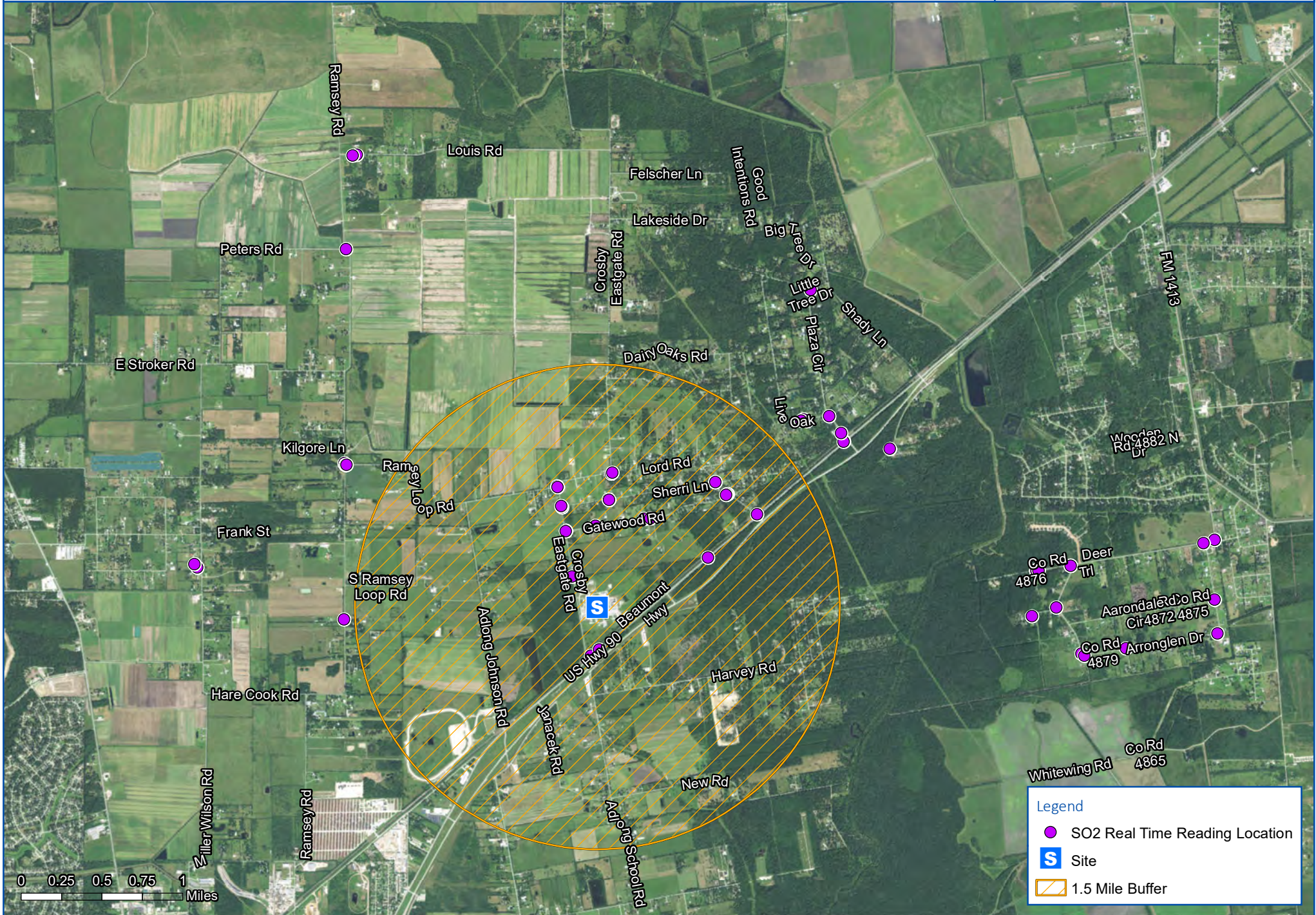






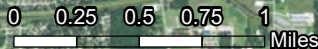
**Legend**

- PM2.5 Real Time Reading Location
- S Site
- 1.5 Mile Buffer



**Legend**

- SO2 Real Time Reading Location
- S Site
- 1.5 Mile Buffer





# Attachment C

## Map of Analytical Air Sampling Locations

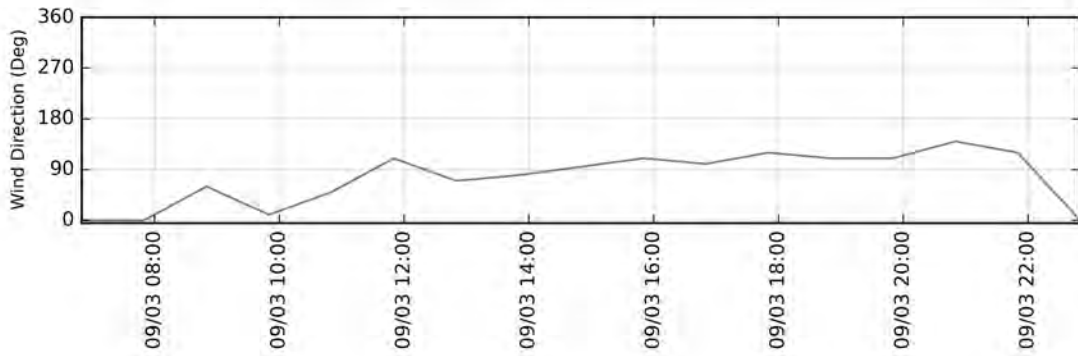
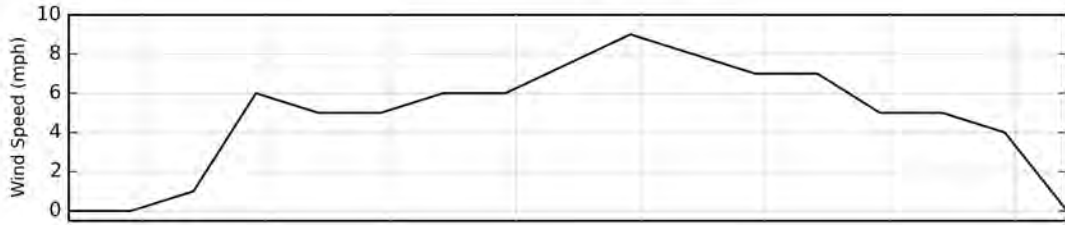
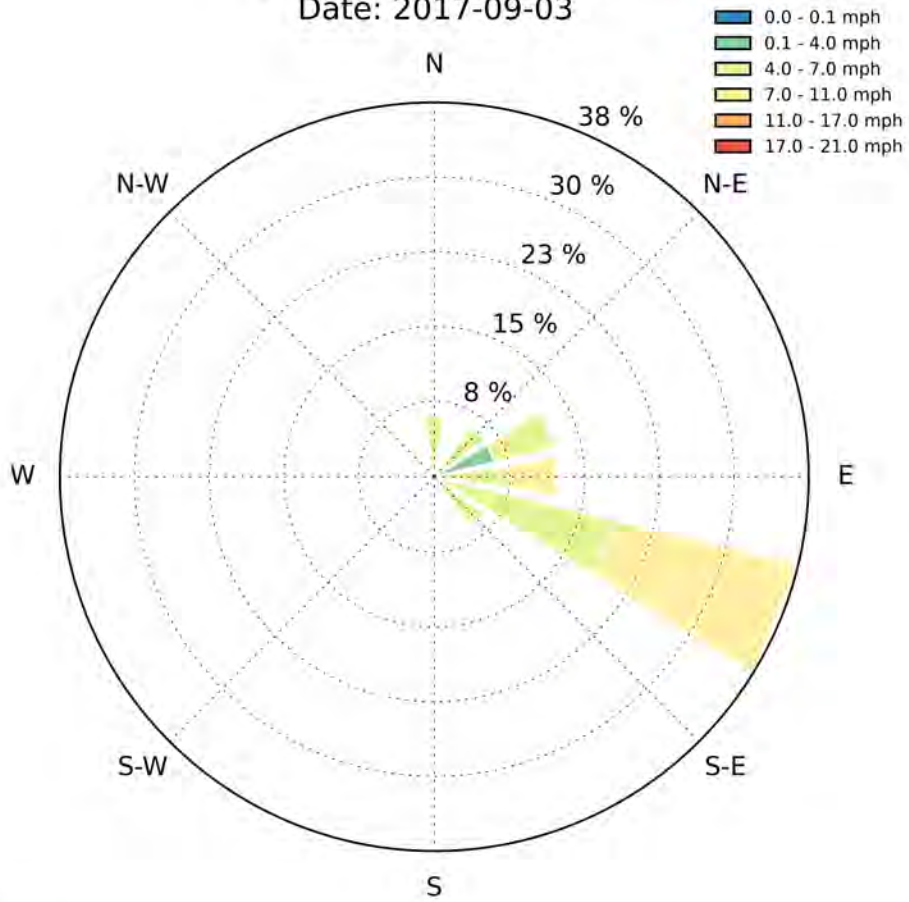


# **Attachment D**

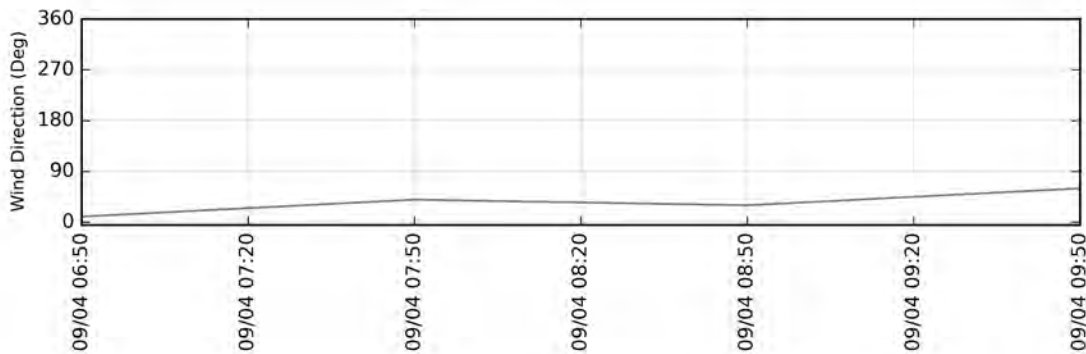
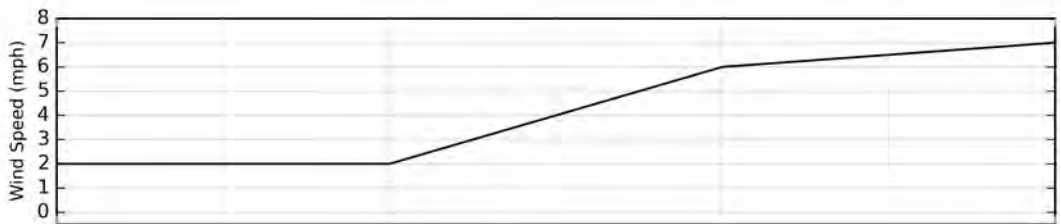
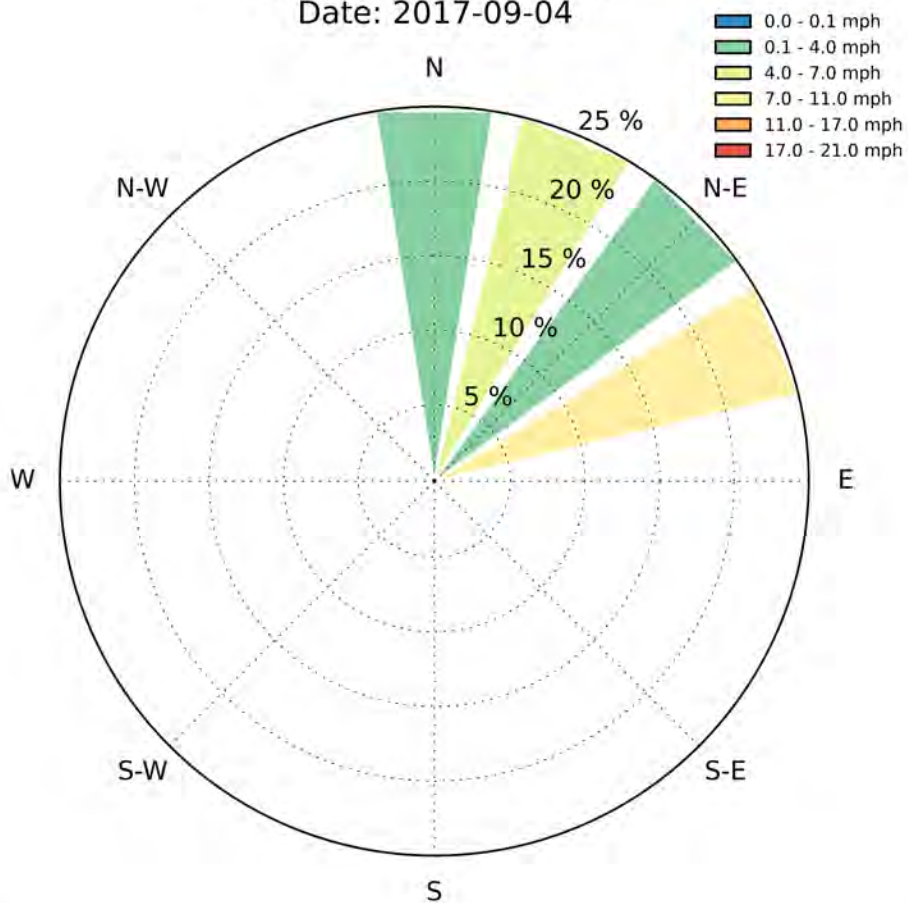
## **KHPY Windrose**

**(Highland Park Airport - 12.5 miles SSE of Site)**

Weather Station: KHPY  
Date: 2017-09-03



Weather Station: KHPY  
Date: 2017-09-04





## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 5, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 3, 2017 to 06:00 on September 4, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for benzene, carbon monoxide, oxygen (O<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), and volatile organic compounds (VOCs) using RAE Systems UltraRAE and MultiRAE instruments. Additionally, particulate matter (PM<sub>2.5</sub>) was assessed using DustTraks, and AM510s. **Table 1** summarizes the data for all real-time air monitoring readings recorded in the Crosby, TX Community from 06:00 on September 3, 2017 through 06:00 on September 4, 2017 and **Table 2** summarizes the Worker Activity real-time air monitoring readings from within the site boundary for the same period. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Community Real-time Handheld Air Monitoring Readings  
06:00 September 4, 2017 – 06:00 September 5, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
Benzene	UltraRAE	1	0	< 0.025 ppm
CO	MultiRAE	5	0	< 1.0 ppm
PM <sub>2.5</sub>	AM510	151	151	0.012 - 0.408 mg/m <sup>3</sup>
	Dusttrak	26	26	0.023 - 0.047 mg/m <sup>3</sup>
SO <sub>2</sub>	MultiRAE	7	0	< 0.1 ppm
VOCs	MultiRAE	173	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

**Table 2 Worker Activity Real-time Handheld Air Monitoring Readings  
06:00 September 4, 2017 – 06:00 September 5, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
O <sub>2</sub>	MultiRAE	1	1	20.9 %
VOCs	MultiRAE	13	4	0.7 - 2.4 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH® deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican™) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.



# Attachment A

## Site Location Map

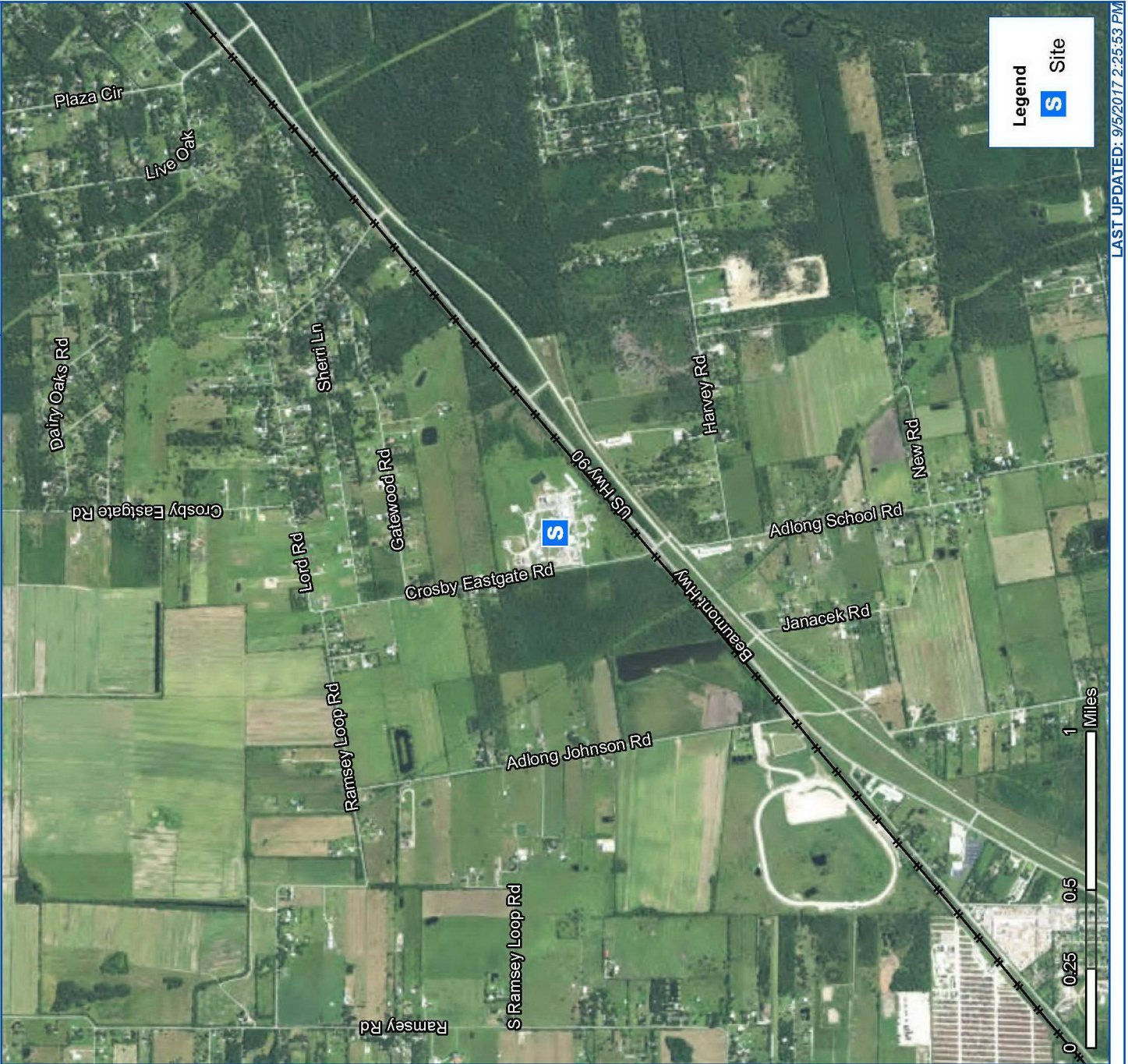
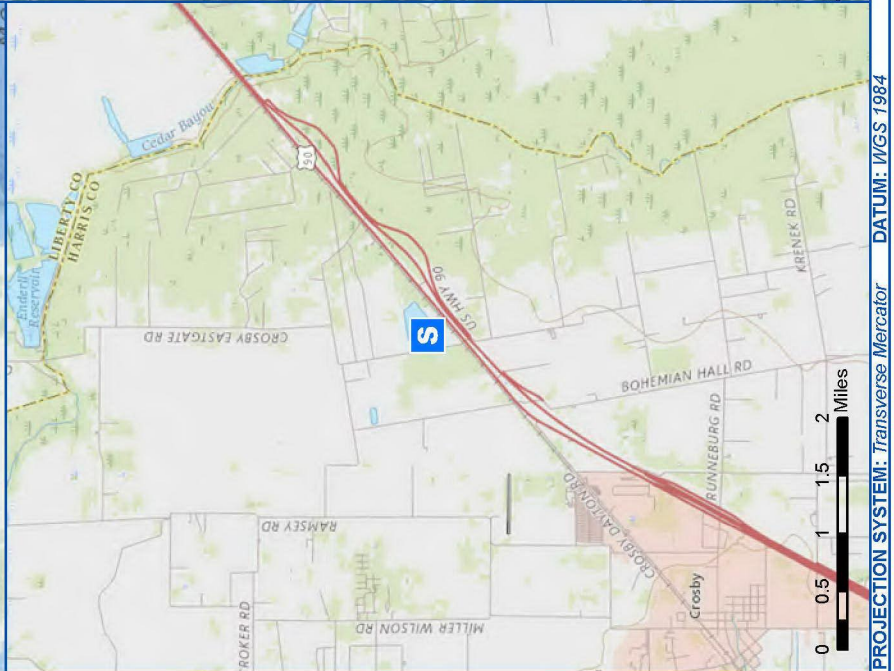


Project: 109458  
Client: Arkema  
City: Crosby, TX  
County: Harris



# Harvey Response

Site Location



Legend  
**S** Site



PROJECTION SYSTEM: Transverse Mercator DATUM: WGS 1984

LAST UPDATED: 9/5/2017 2:25:53 PM

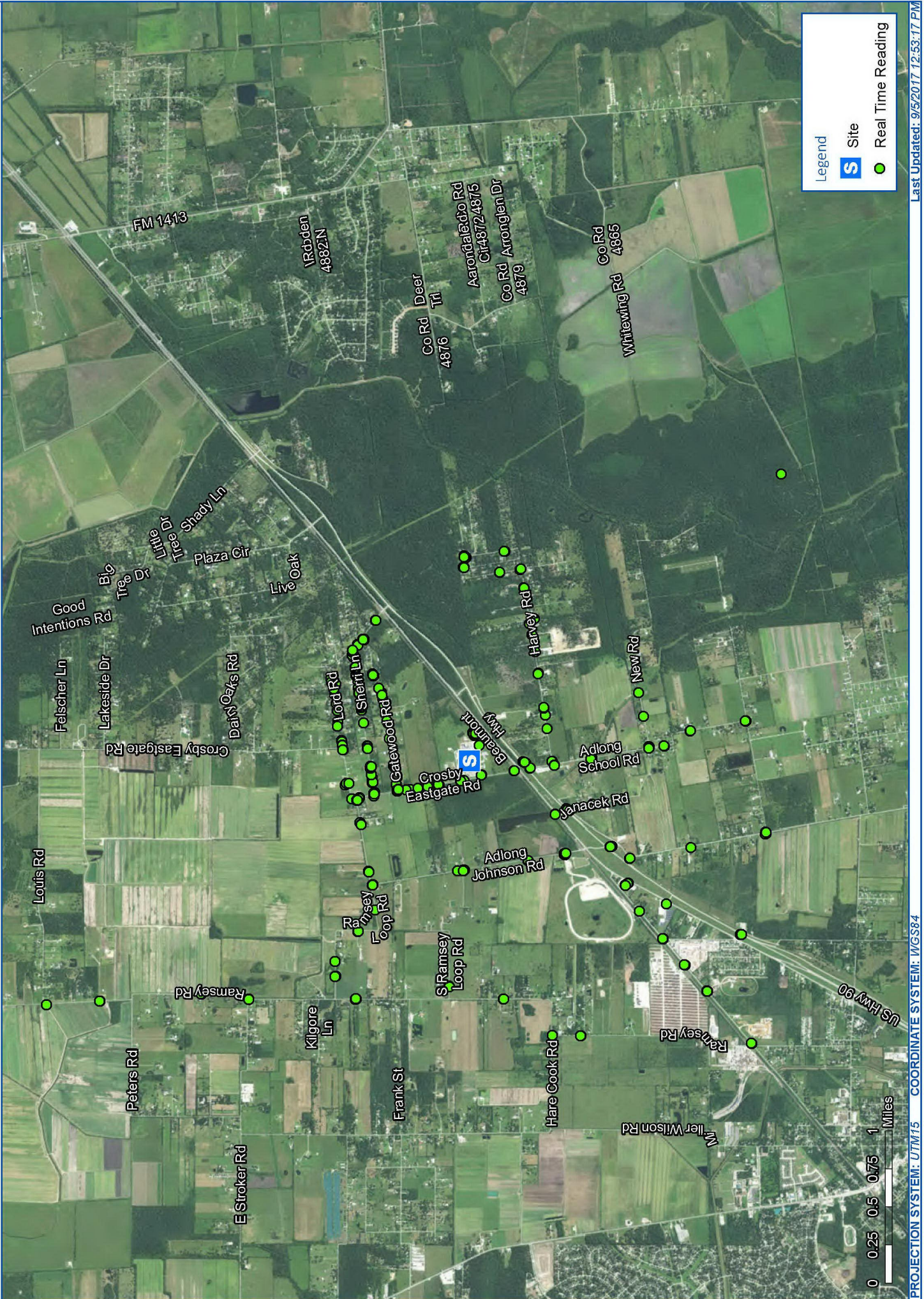
# **Attachment B**

## **Handheld Real-time Air Monitoring Locations**



# Hand-held Real-time Reading Locations

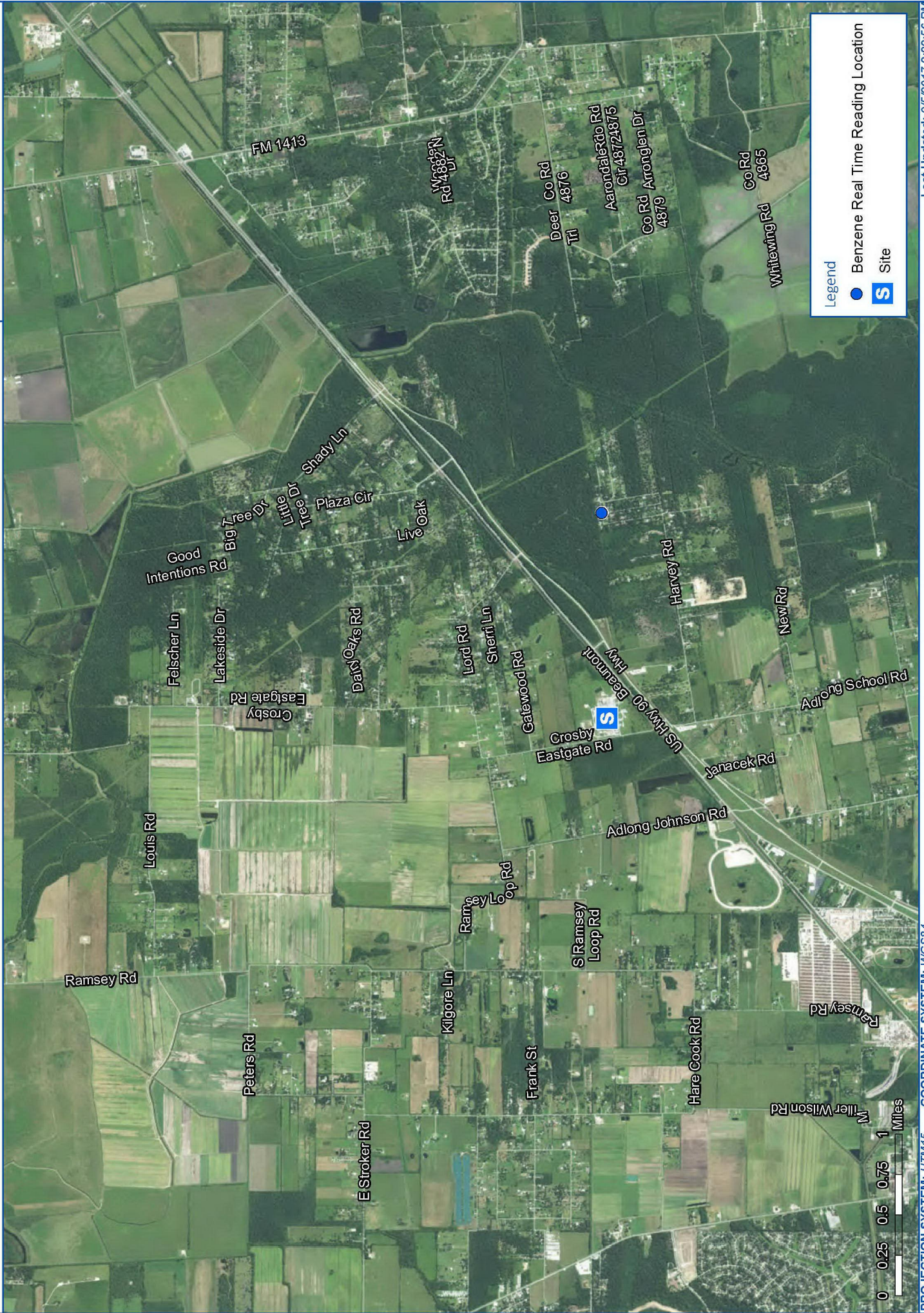
Harvey Response - 06:00 September 4, 2017 to 06:00 September 5, 2017



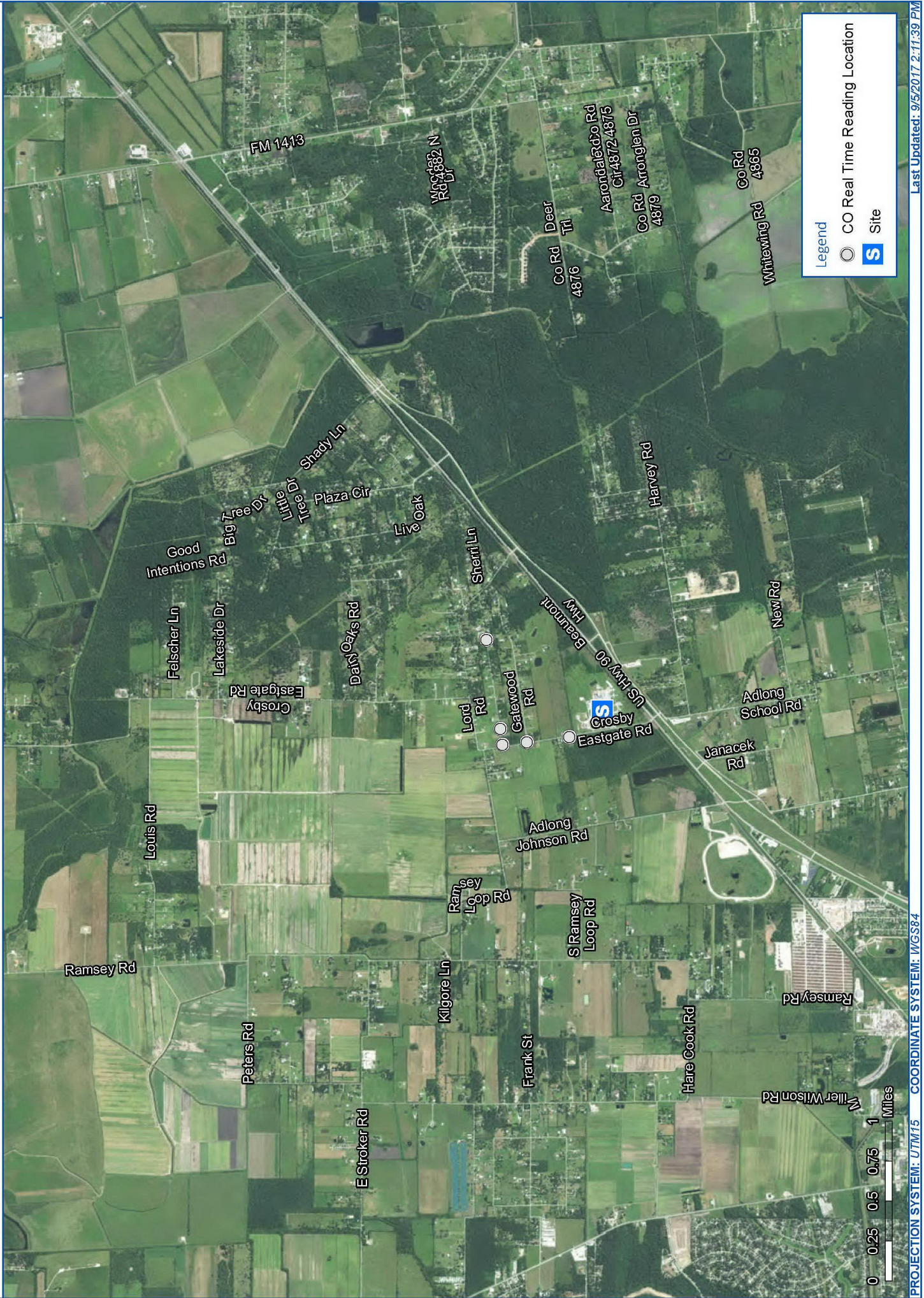
Legend

- Site
- Real Time Reading

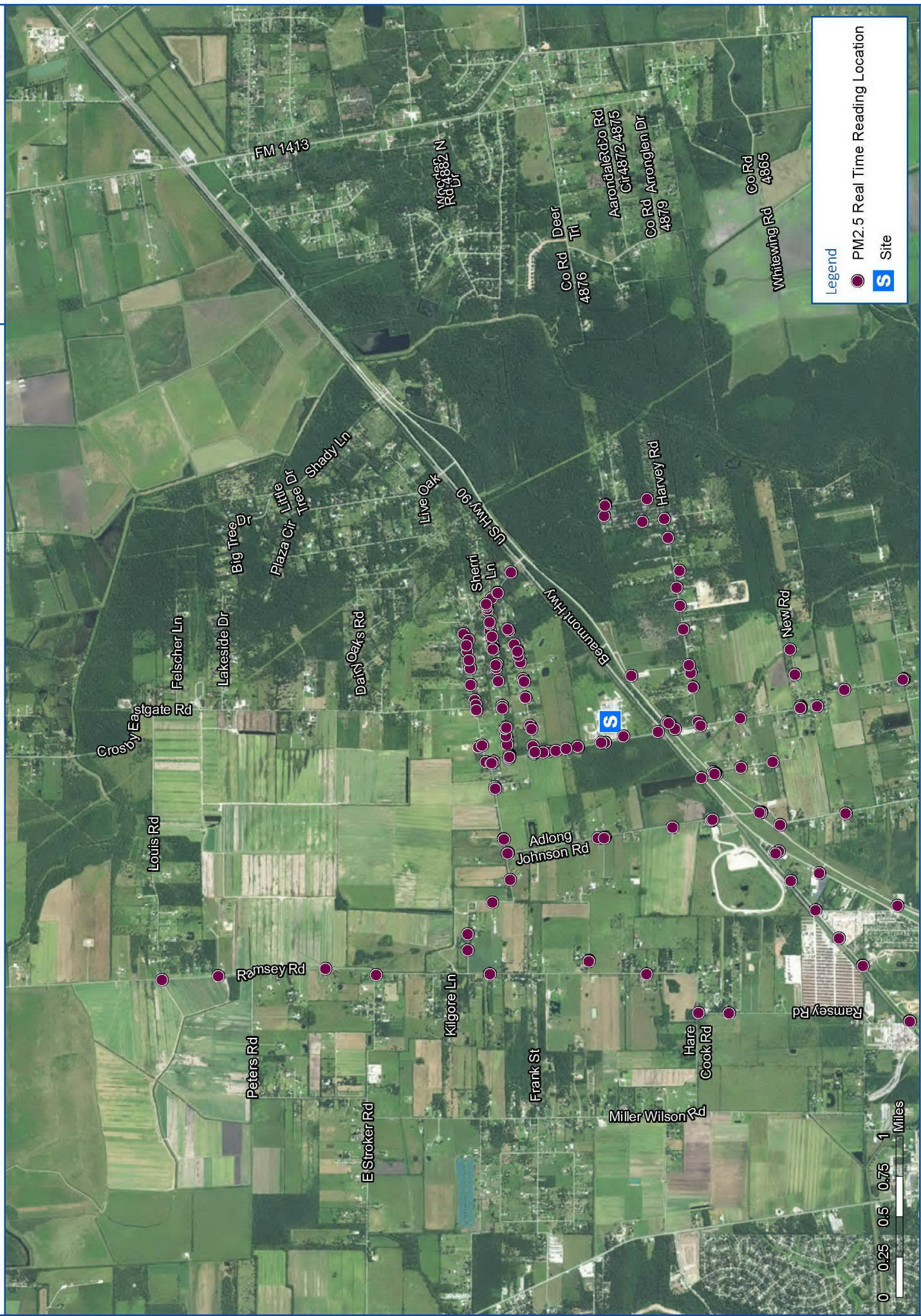








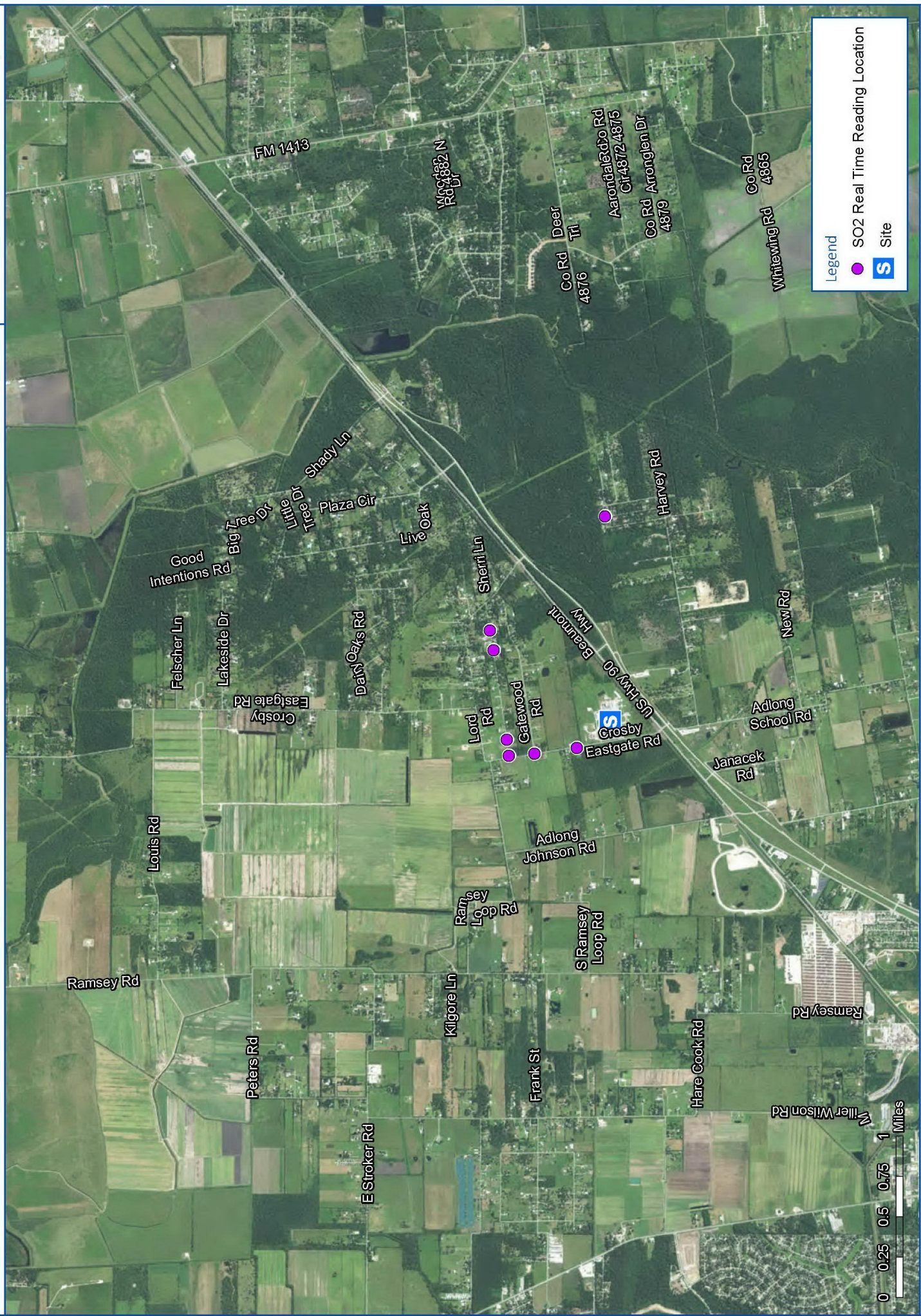




**Legend**

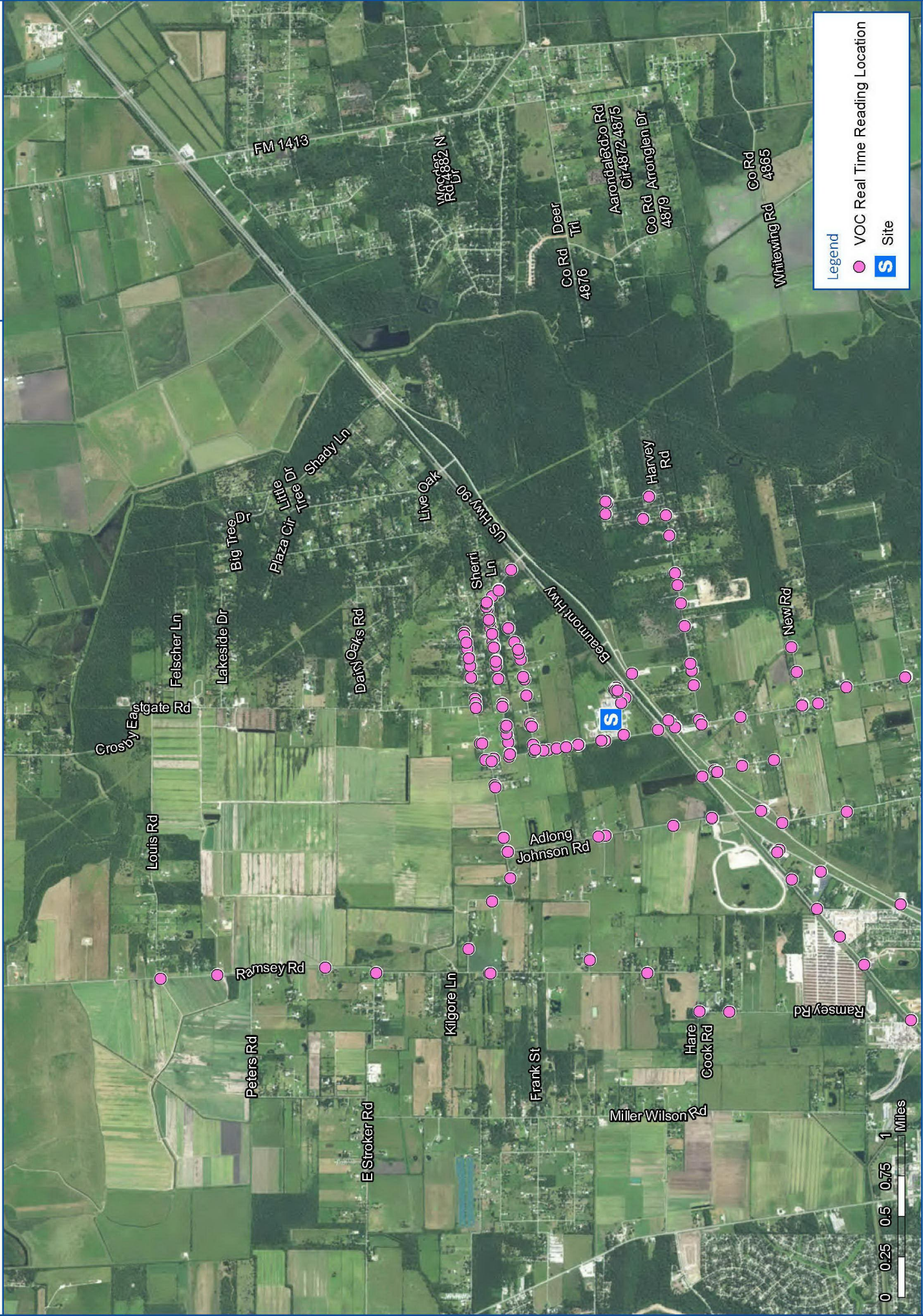
- PM2.5 Real Time Reading Location
- Site





Legend

- SO2 Real Time Reading Location
- Site



**Legend**

- VOC Real Time Reading Location
- Site

# Attachment C

## Map of Analytical Air Sampling Locations



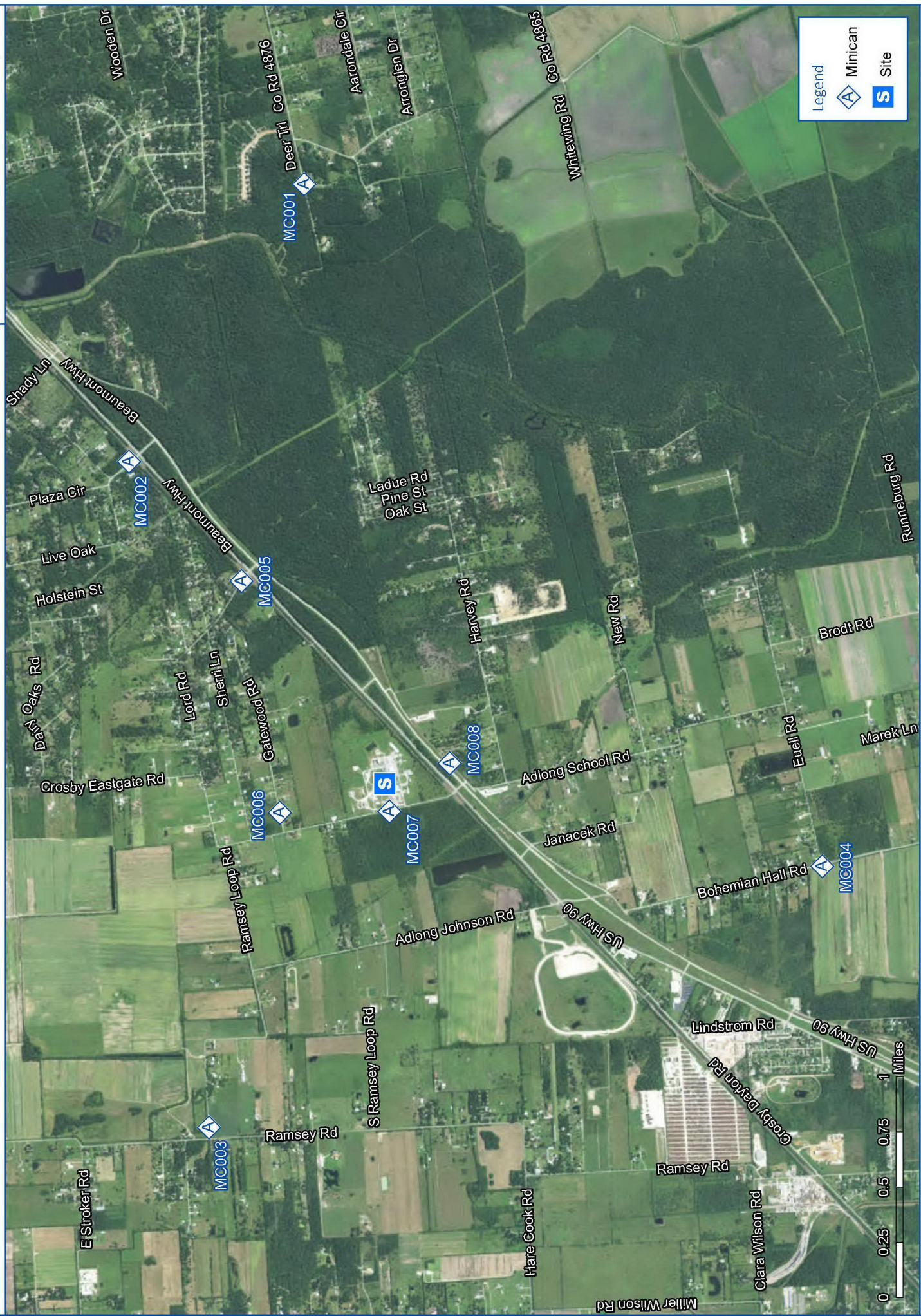


# Analytical Air Monitoring Station Locations as of September 5, 2017

Harvey Response



Project: 109458  
Client: Arkema  
City: Crosby, TX  
County: Harris



PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84 Last Updated: 9/5/2017 8:49:04 PM

# **Attachment D**

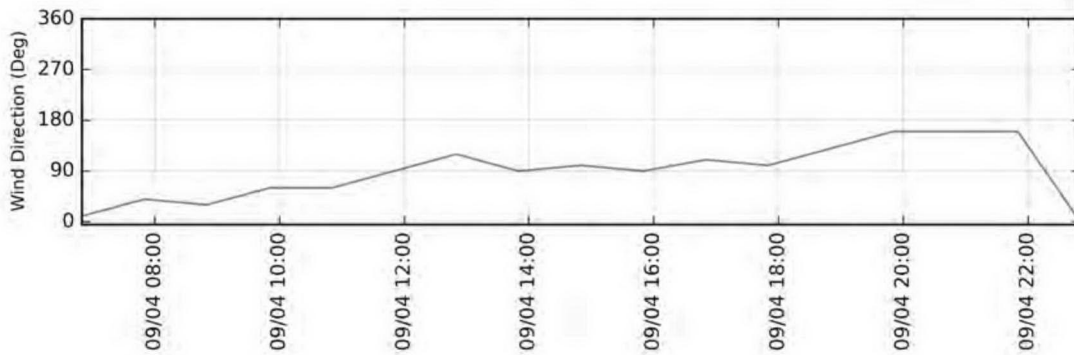
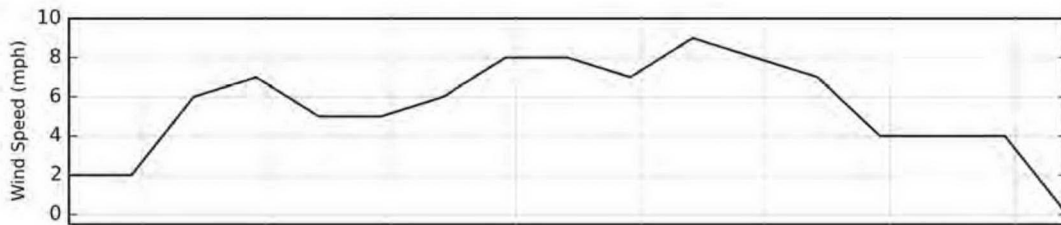
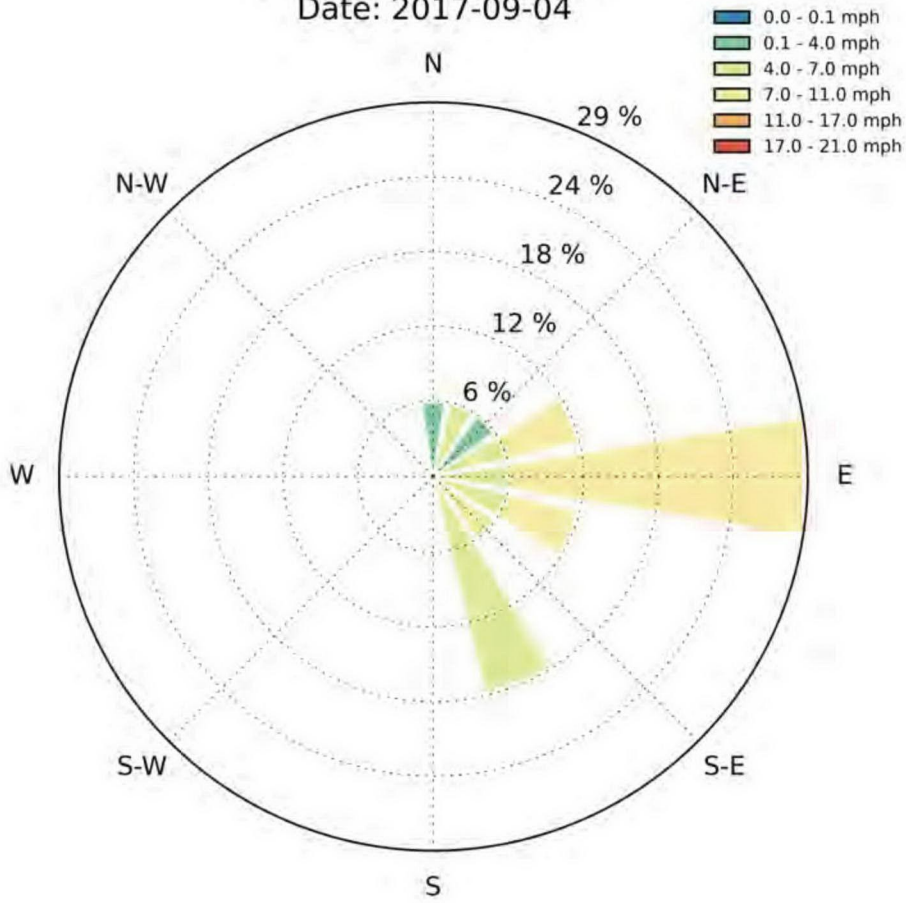
## **KHPY Windrose**

**(Highland Park Airport - 12.5 miles SSE of Site)**

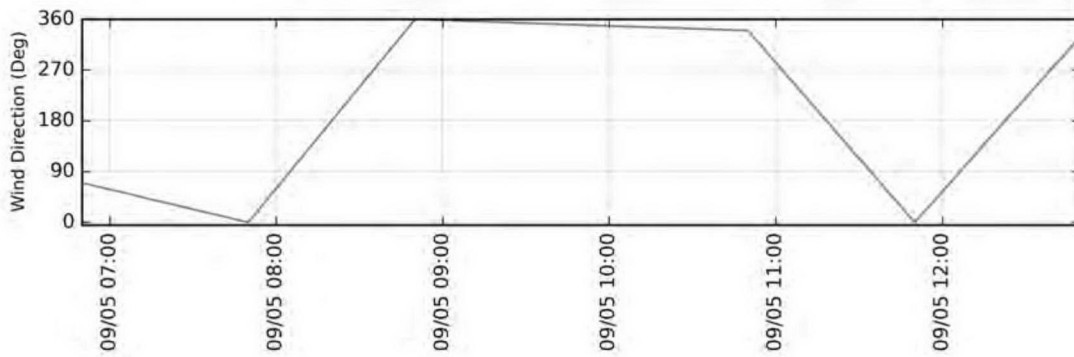
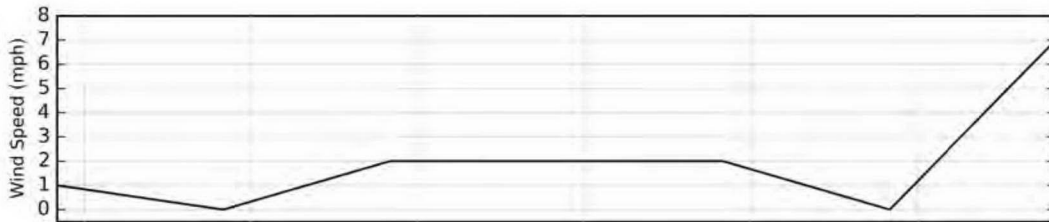
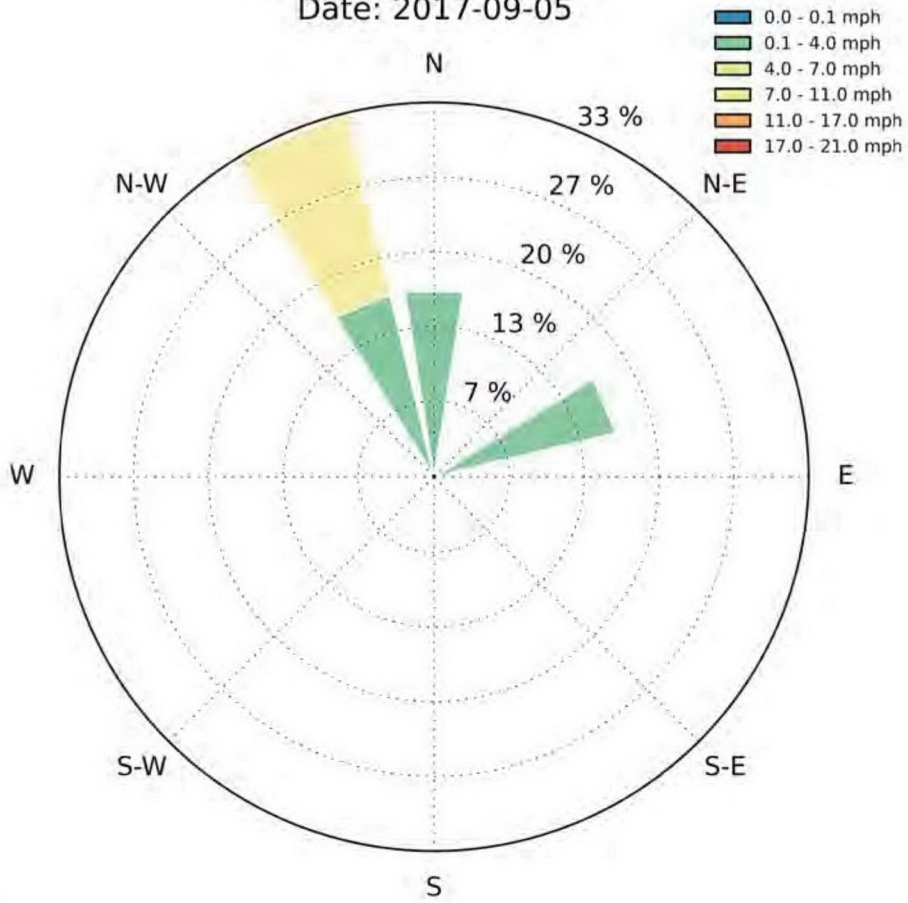




Weather Station: KHPY  
Date: 2017-09-04



Weather Station: KHPY  
Date: 2017-09-05



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 6, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 5, 2017 to 06:00 on September 6, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for carbon monoxide (CO), lower explosive limit (LEL), oxygen (O<sub>2</sub>), and volatile organic compounds (VOCs) using RAE Systems UltraRAE and MultiRAE instruments. Additionally, particulate matter (PM<sub>2.5</sub>) was assessed using DustTraks, and AM510s. **Table 1** summarizes the data for all real-time air monitoring readings recorded in the Crosby, TX Community from 06:00 on September 5, 2017 through 06:00 on September 6, 2017 and **Table 2** summarizes the Worker Activity real-time air monitoring readings from within the site boundary for the same period. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Community Real-time Handheld Air Monitoring Readings  
06:00 September 5, 2017 – 06:00 September 6, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
CO	MultiRAE	2	0	< 1.0 ppm
PM <sub>2.5</sub>	AM510	85	85	0.010 - 0.280 mg/m <sup>3</sup>
VOCs	MultiRAE	84	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

**Table 2 Worker Activity Real-time Handheld Air Monitoring Readings  
06:00 September 5, 2017 – 06:00 September 6, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
LEL	MultiRAE	4	0	< 1.0 %
O <sub>2</sub>	MultiRAE	1	1	20.9 - 21.2 %
VOCs	MultiRAE	77	4	0.4 - 0.9 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH® deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican™) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.



# Attachment A

## Site Location Map

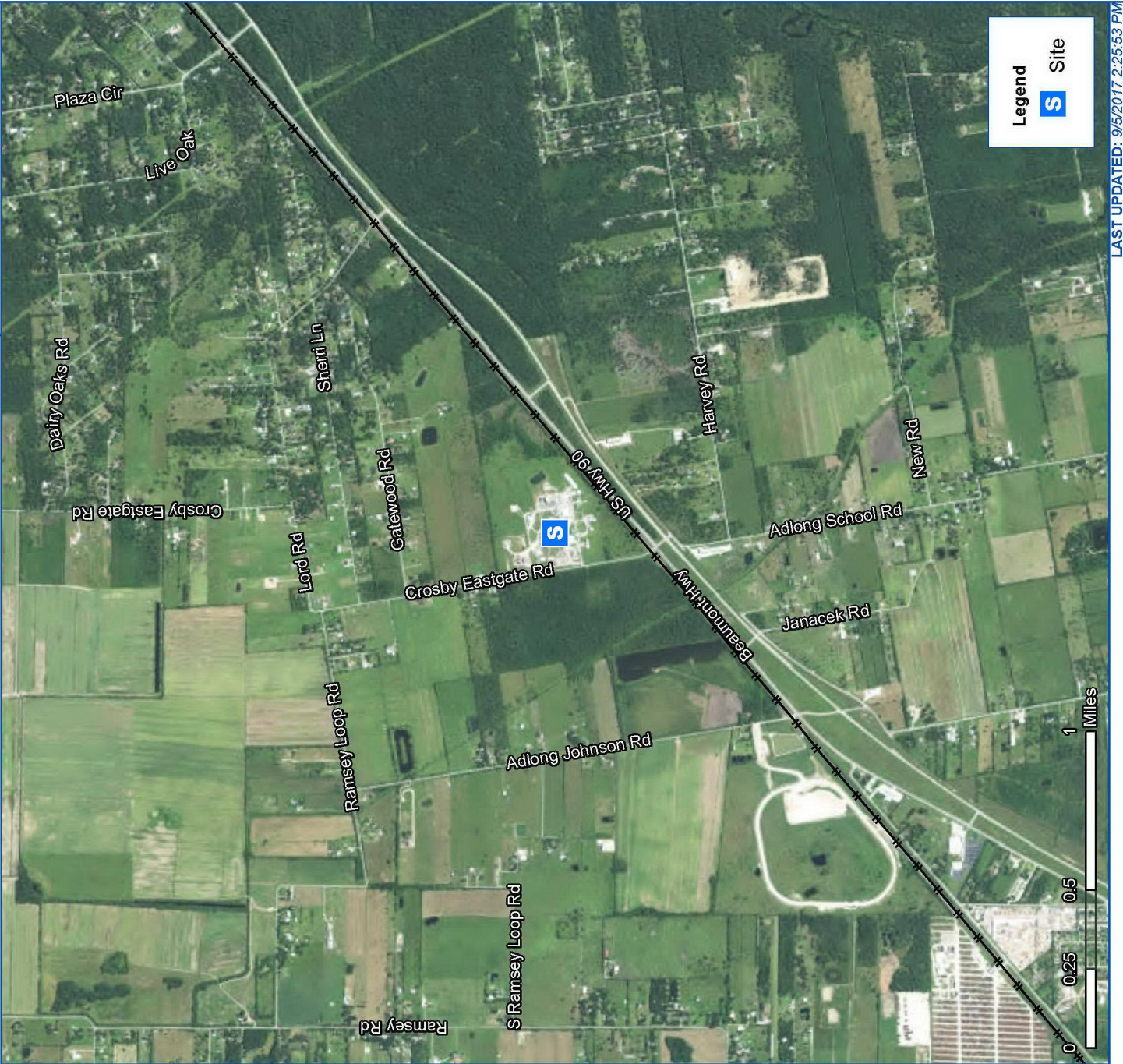
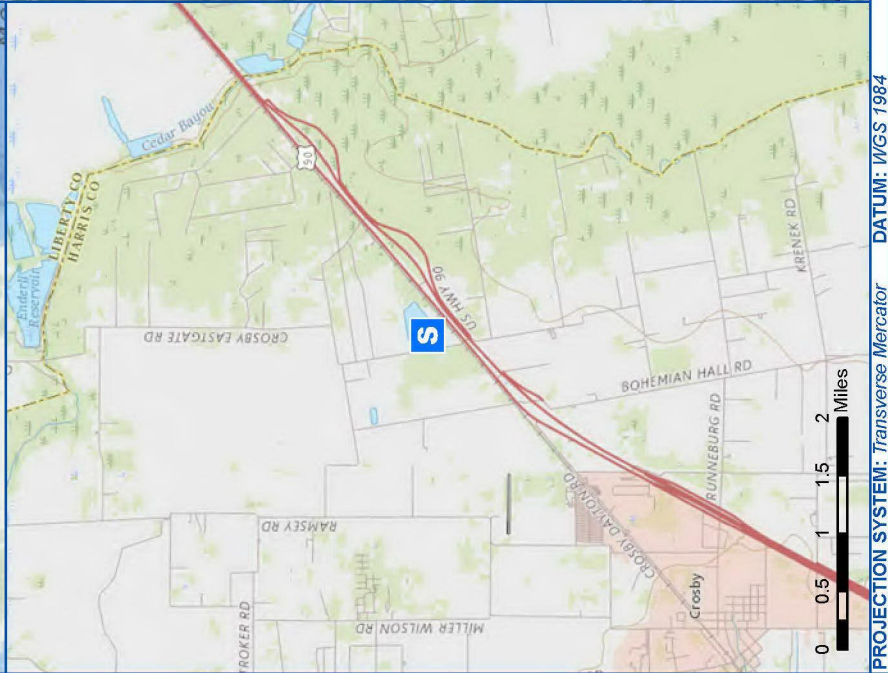


Project: 109458  
Client: Arkema  
City: Crosby, TX  
County: Harris



# Harvey Response

Site Location



Legend

**S** Site



PROJECTION SYSTEM: Transverse Mercator DATUM: WGS 1984

LAST UPDATED: 9/5/2017 2:25:53 PM

# **Attachment B**

## **Handheld Real-time Air Monitoring Locations**

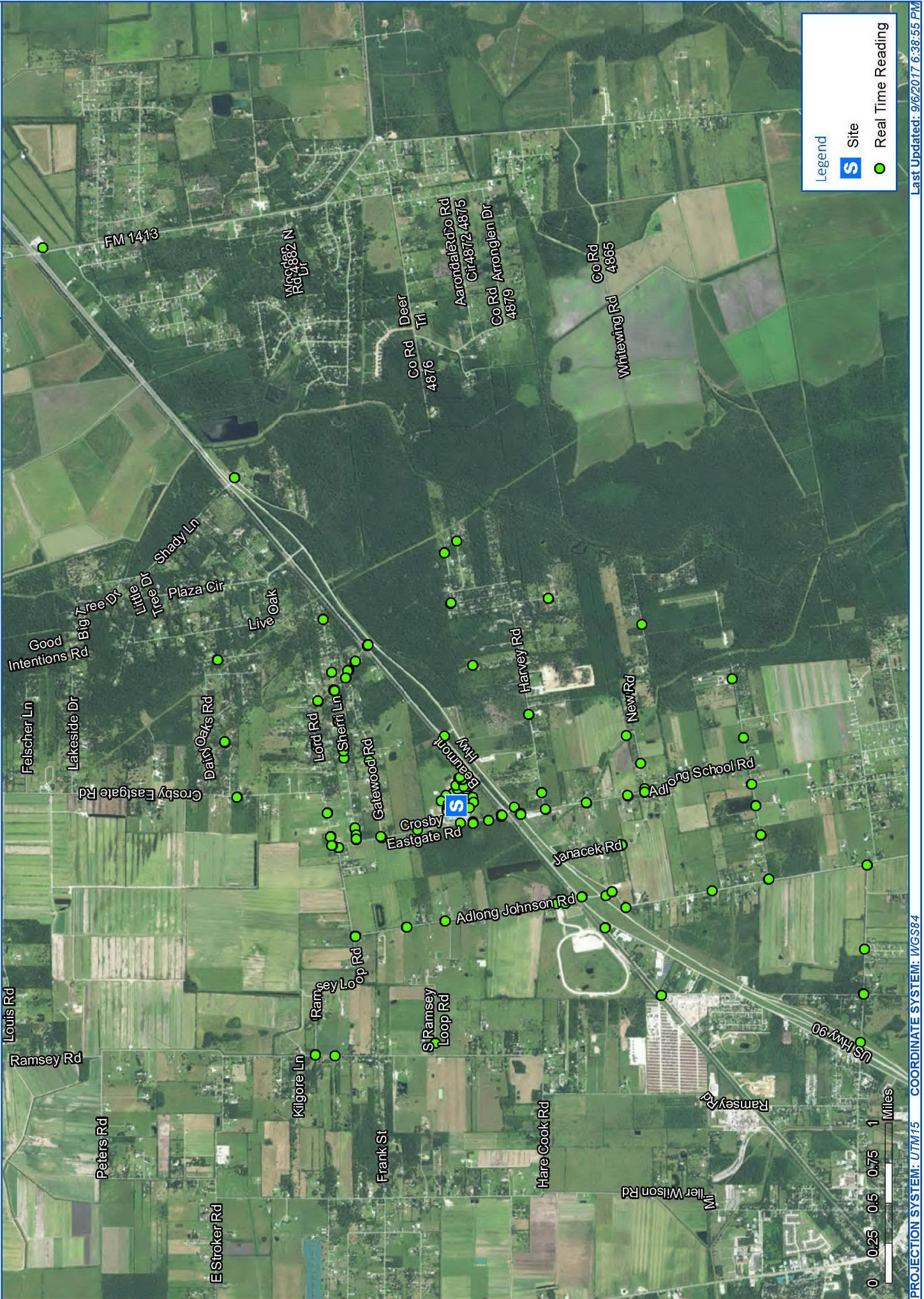






# Hand-held Real-time Reading Locations

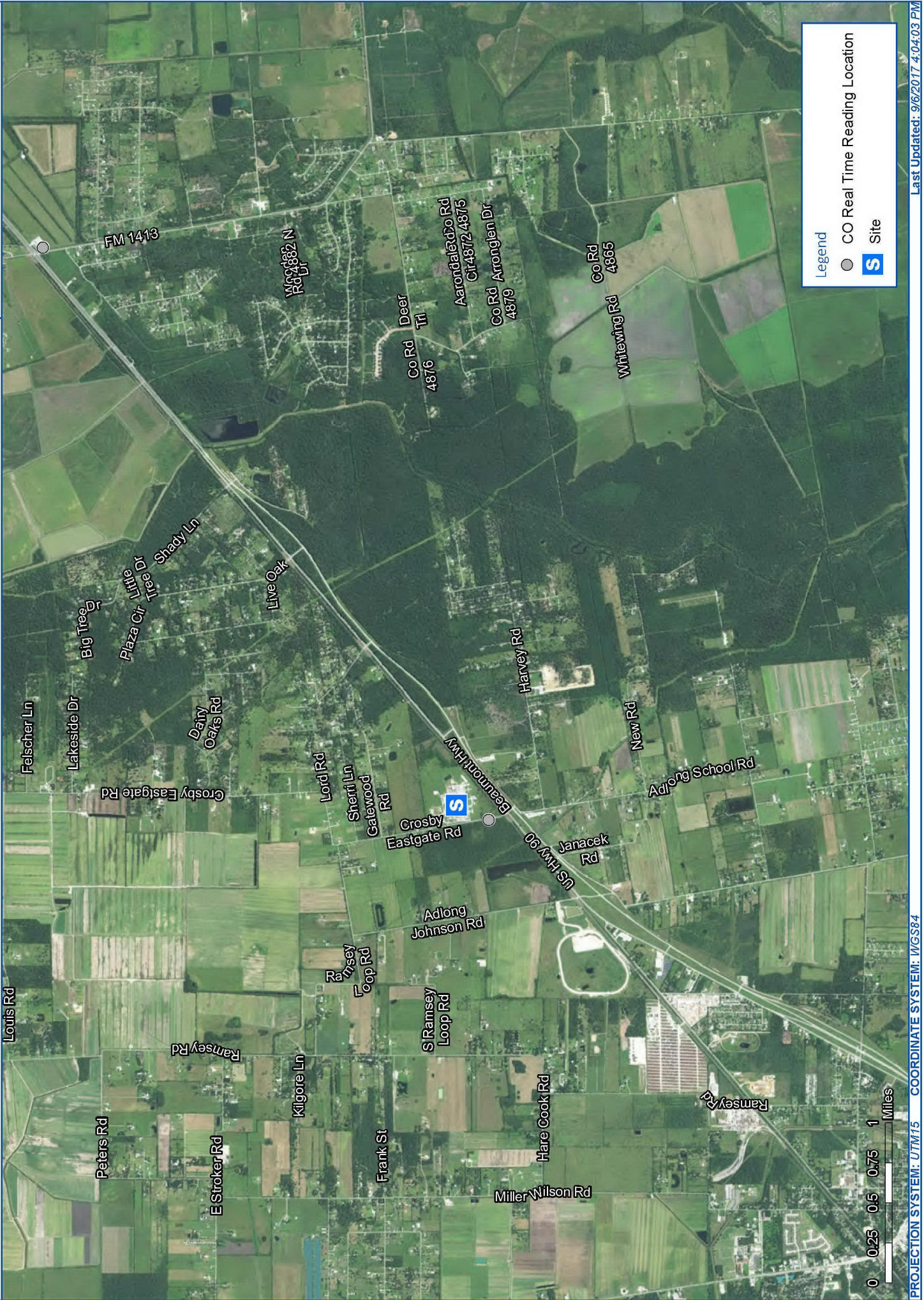
Harvey Response - 06:00 September 5, 2017 to 06:00 September 6, 2017



Legend

- Site
- Real Time Reading





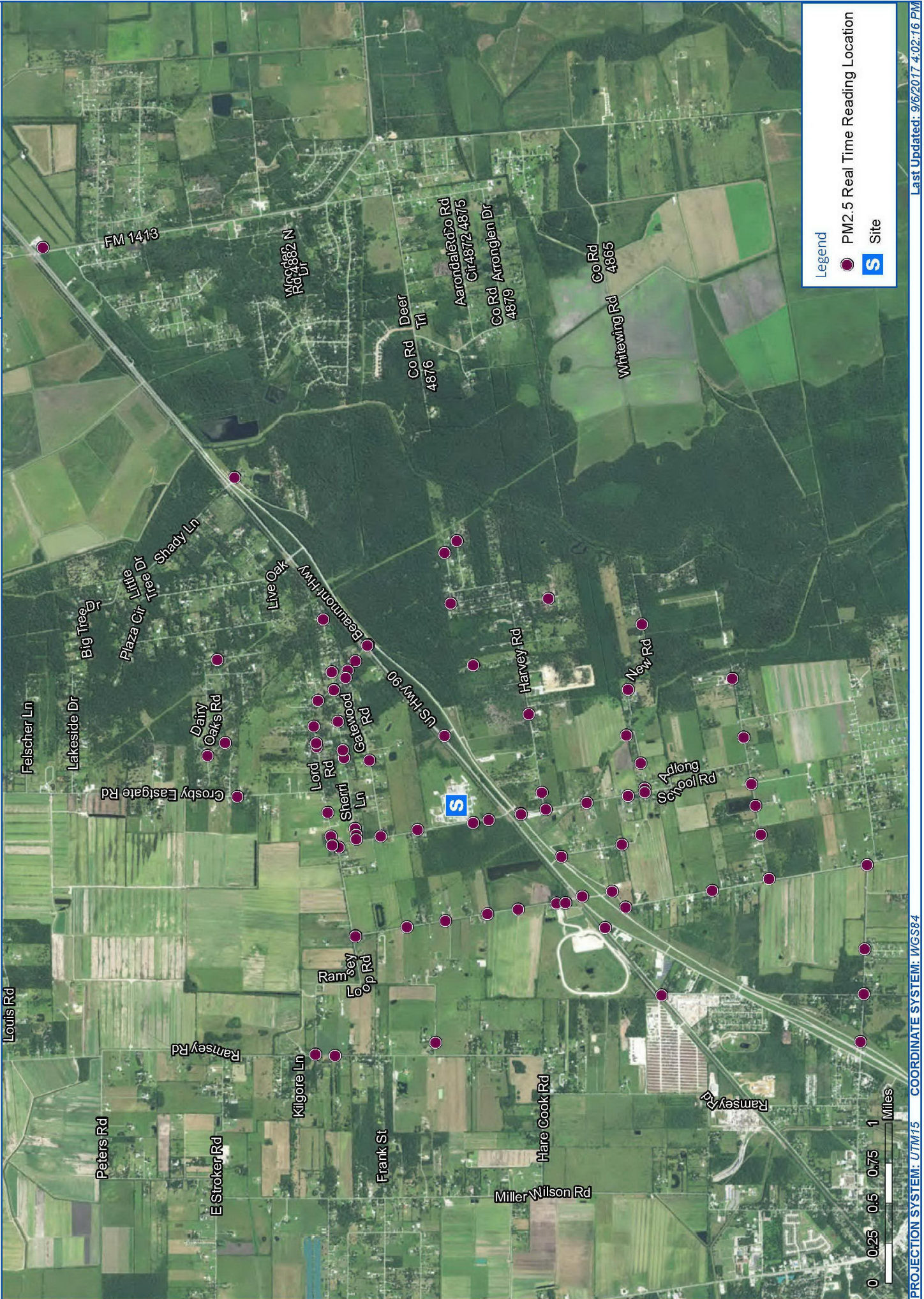
Legend

- CO Real Time Reading Location
- S Site

# Community PM2.5 Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 5, 2017 to 06:00 September 6, 2017

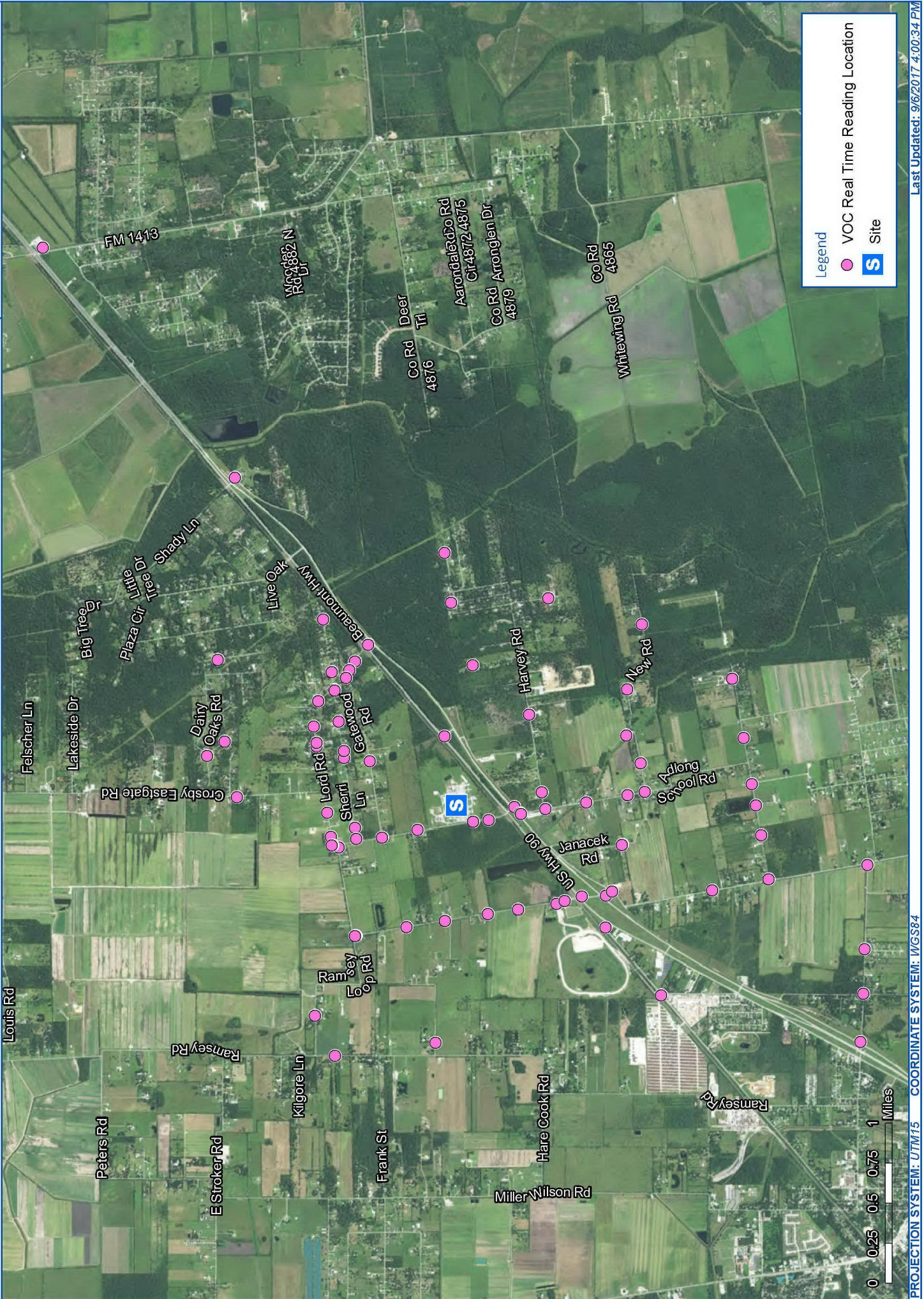
Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



# Community VOC Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 5, 2017 to 06:00 September 6, 2017

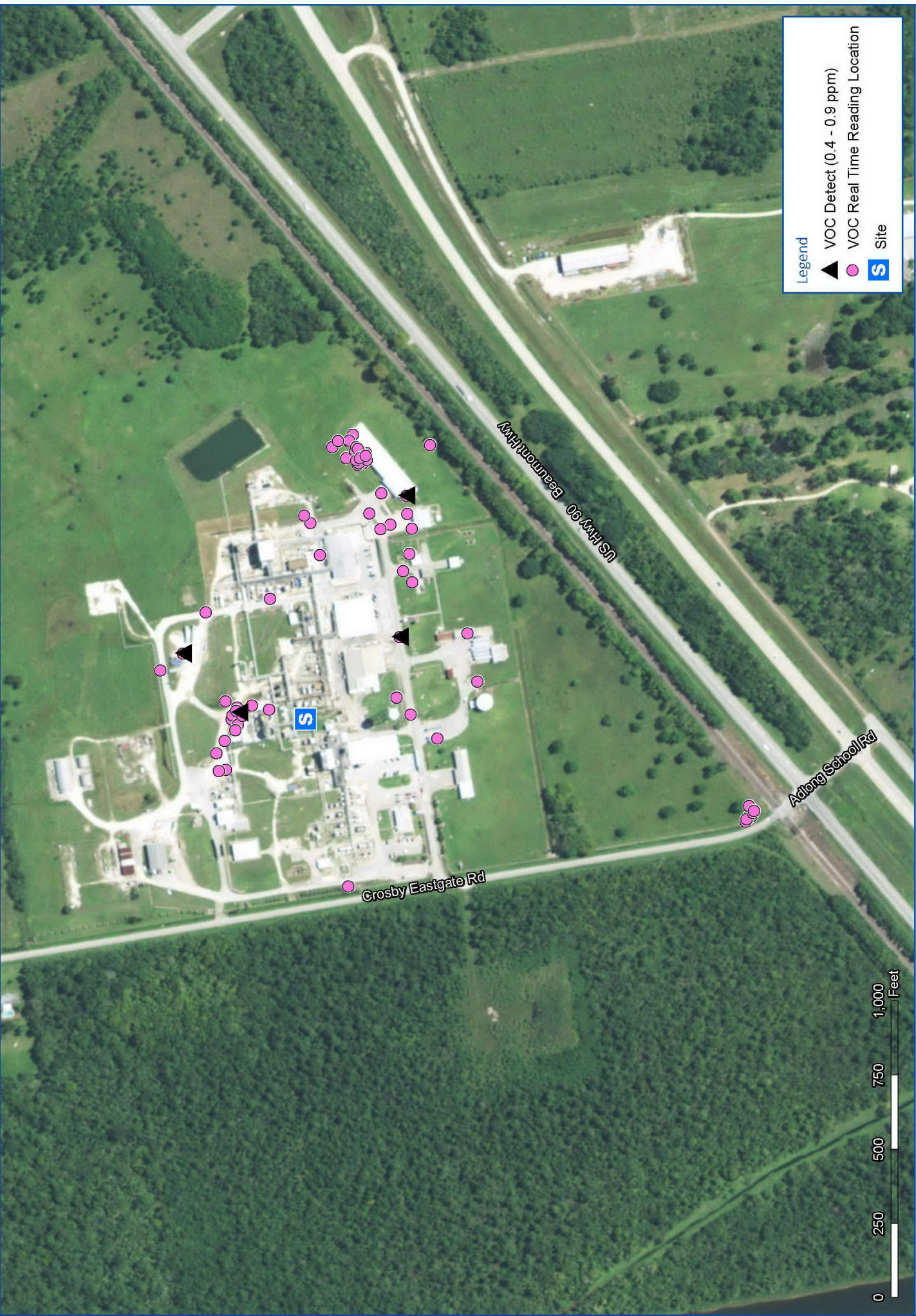
Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris





# VOC Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 5, 2017 to 06:00 September 6, 2017





# LEL Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 5, 2017 to 06:00 September 6, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- LEL Real Time Reading Locations
- S Site

PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84 Last Updated: 9/6/2017 1:39:01 PM



# Oxygen Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 5, 2017 to 06:00 September 6, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- O2 Real Time Reading Location
- S Site

PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84

Last Updated: 9/6/2017 1:40:33 PM

# Attachment C

## Map of Analytical Air Sampling Locations



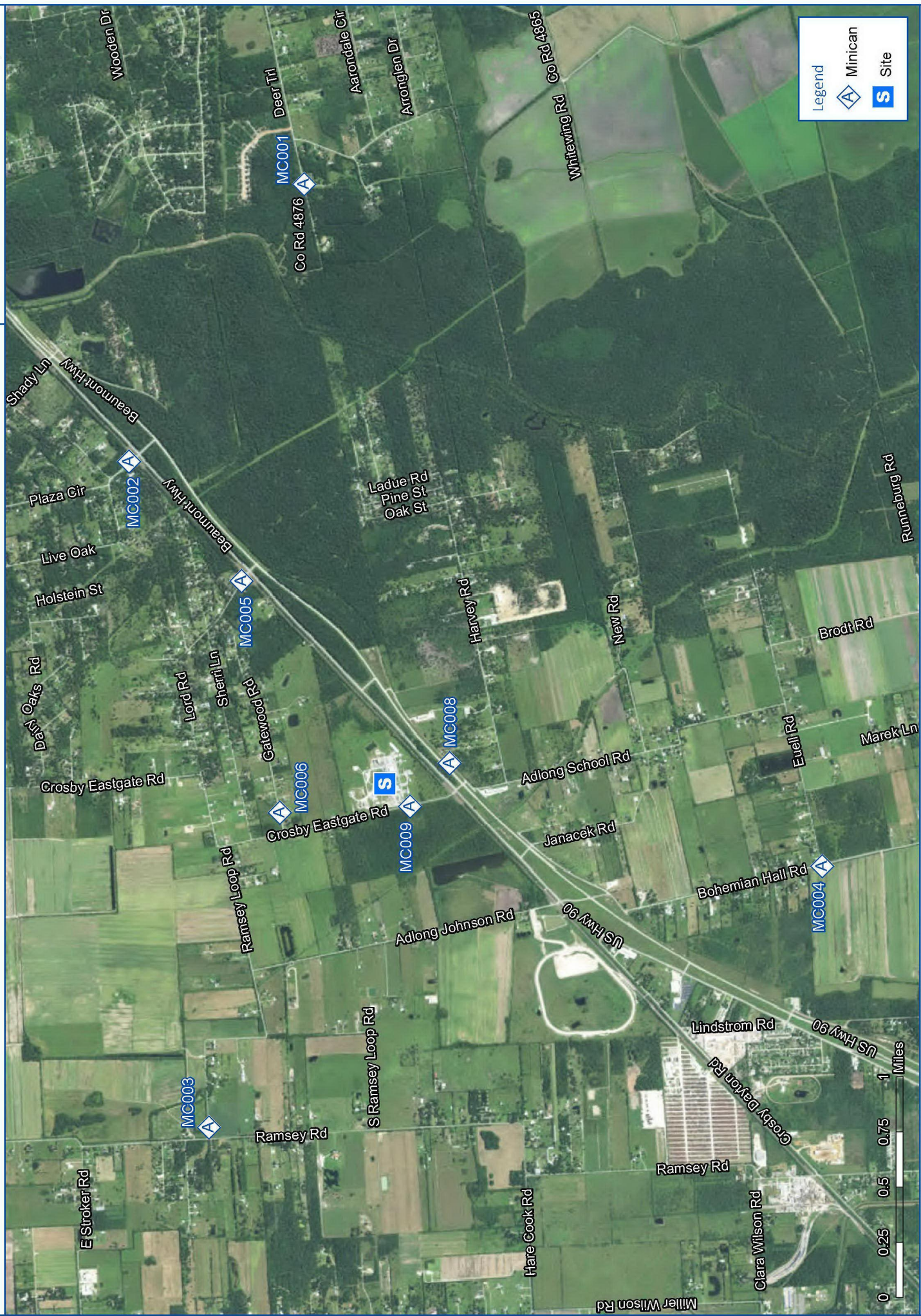


# Analytical Air Monitoring Station Locations as of September 6, 2017

Harvey Response



Project: 109458  
Client: Arkema  
City: Crosby, TX  
County: Harris



PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84 Last Updated: 9/6/2017 11:23:36 PM

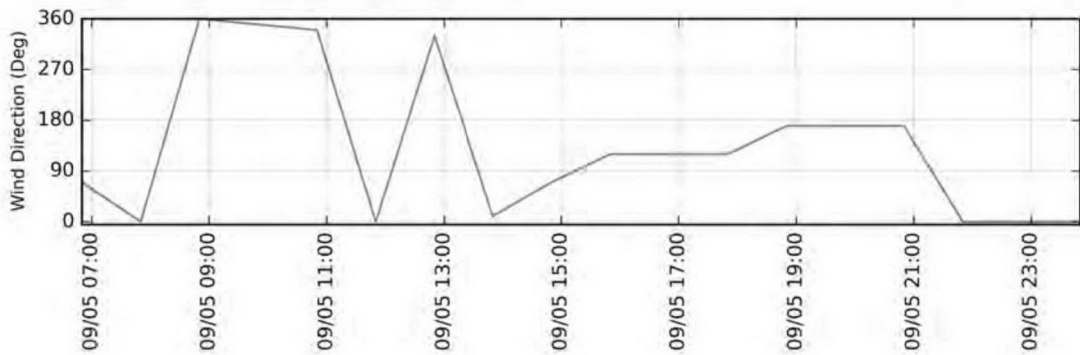
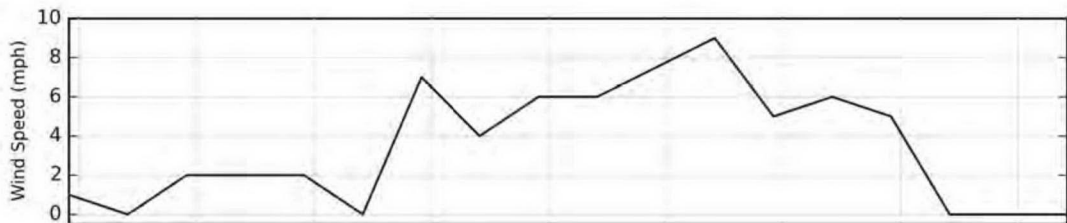
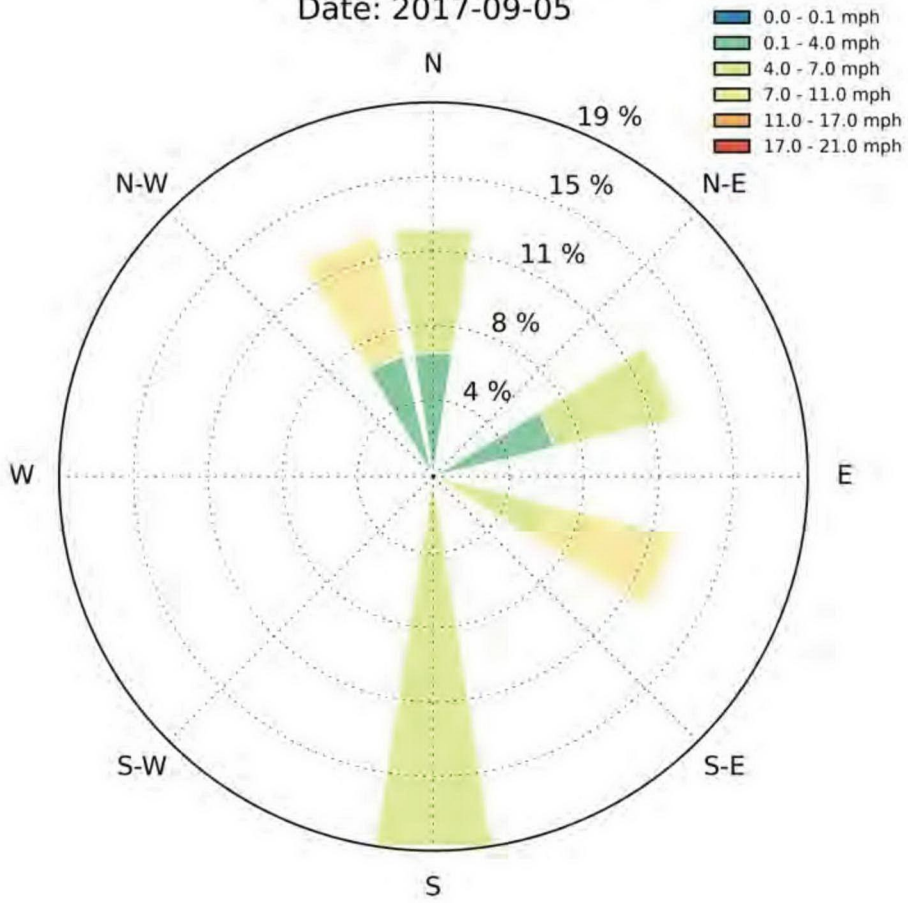
# Attachment D

## KHPY Windrose

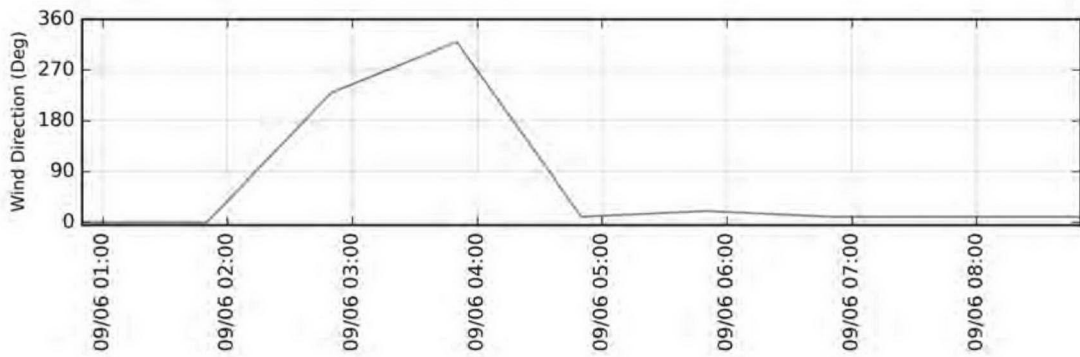
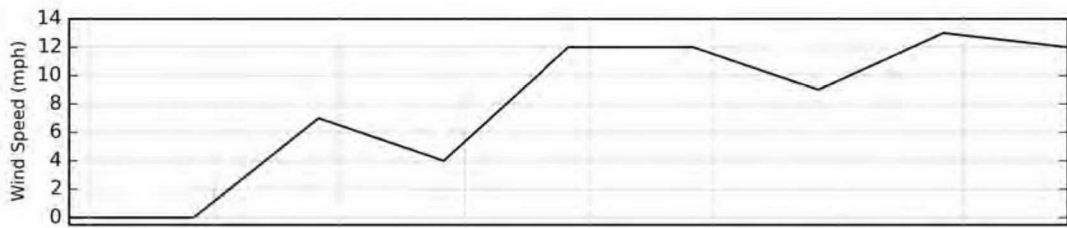
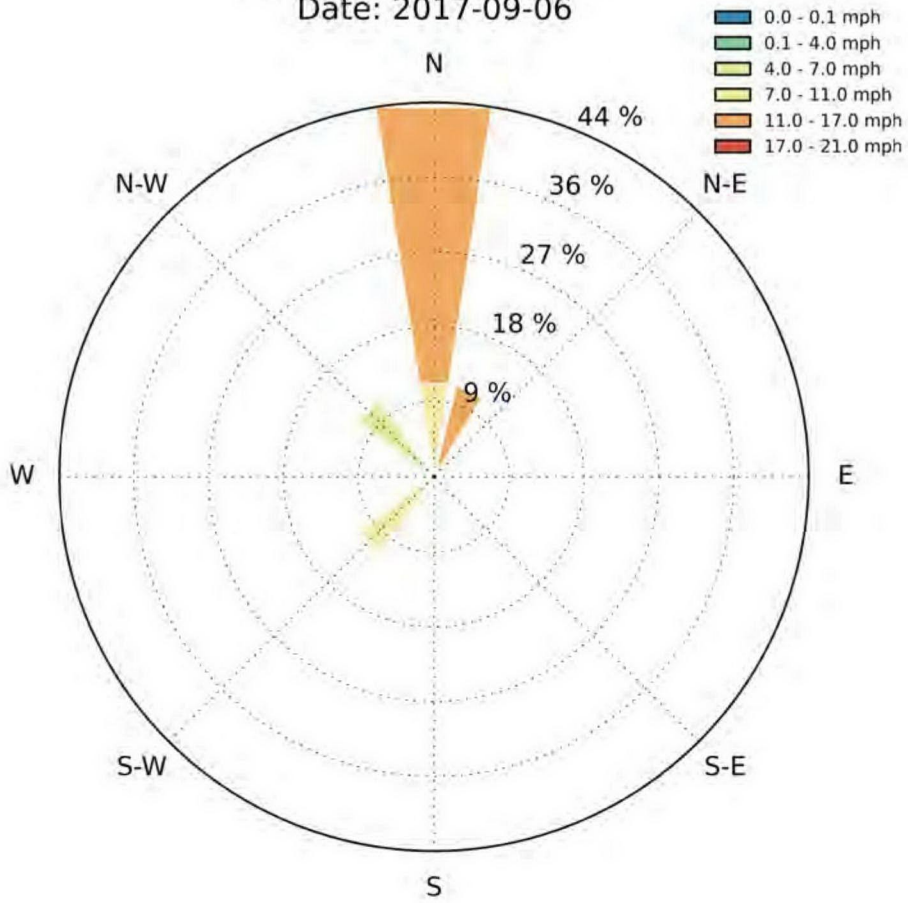
(Highland Park Airport - 12.5 miles SSE of Site)



Weather Station: KHPY  
Date: 2017-09-05



Weather Station: KHPY  
Date: 2017-09-06



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 7, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 6, 2017 to 06:00 on September 7, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for oxygen (O<sub>2</sub>) and volatile organic compounds (VOCs) using RAE Systems MultiRAE instruments. Additionally, particulate matter (PM<sub>2.5</sub>) was assessed using TSI SidePak AM510s. **Table 1** summarizes the data for all real-time air monitoring readings recorded in the Crosby, TX Community from 06:00 on September 6, 2017 through 06:00 on September 7, 2017 and Table 2 summarizes the Worker Activity real-time air monitoring readings from within the site boundary for the same period. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Community Real-time Handheld Air Monitoring Readings  
06:00 September 6, 2017 – 06:00 September 7, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
PM <sub>2.5</sub>	AM510	85	85	0.012 - 0.320 mg/m <sup>3</sup>
VOCs	MultiRAE	86	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

**Table 2 Worker Activity Real-time Handheld Air Monitoring Readings  
06:00 September 6, 2017 – 06:00 September 7, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
O <sub>2</sub>	MultiRAE	13	13	20.9 %
VOCs	MultiRAE	51	2	0.4 - 3.3 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH® deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican™) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.



# Attachment A

## Site Location Map

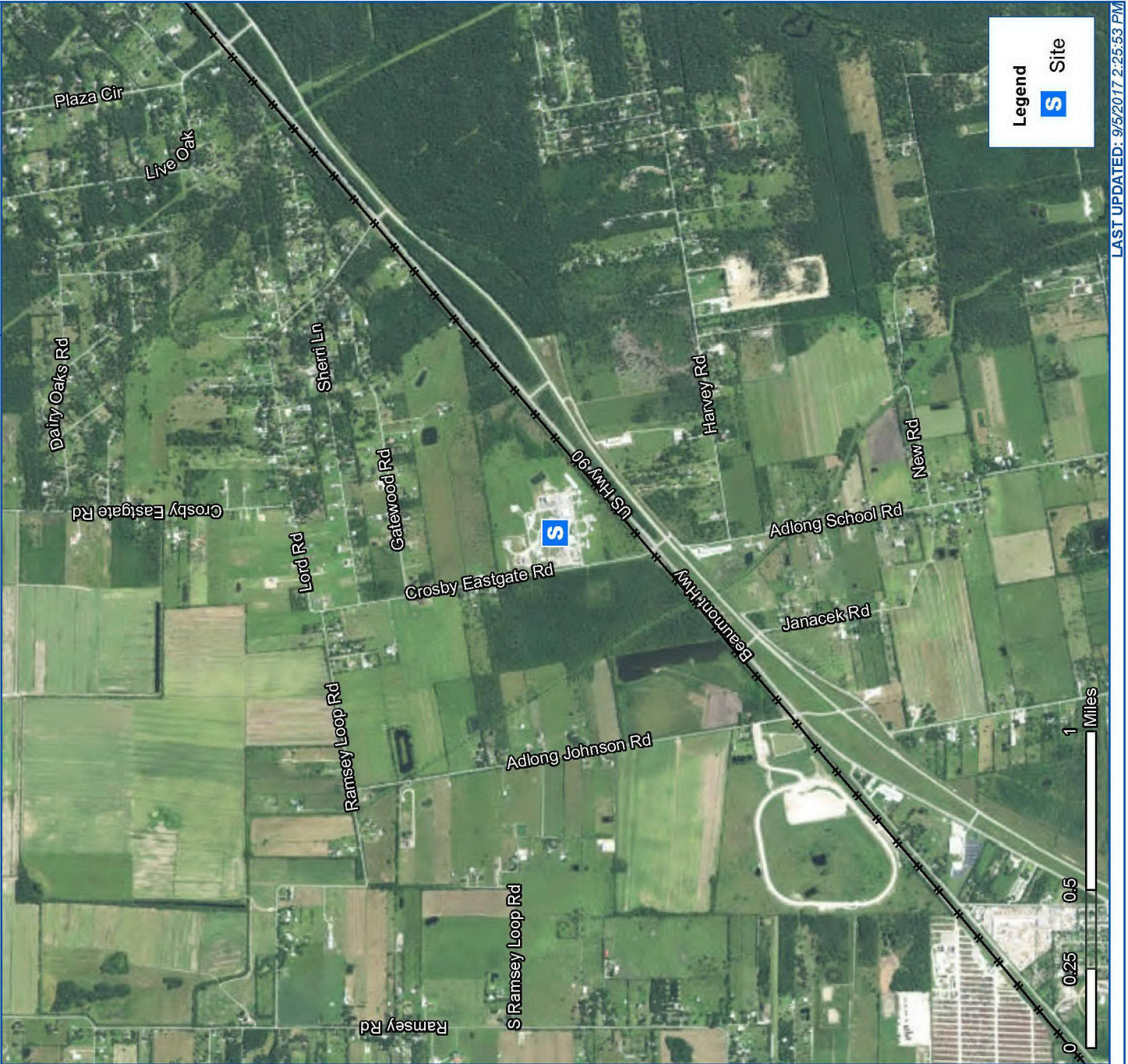
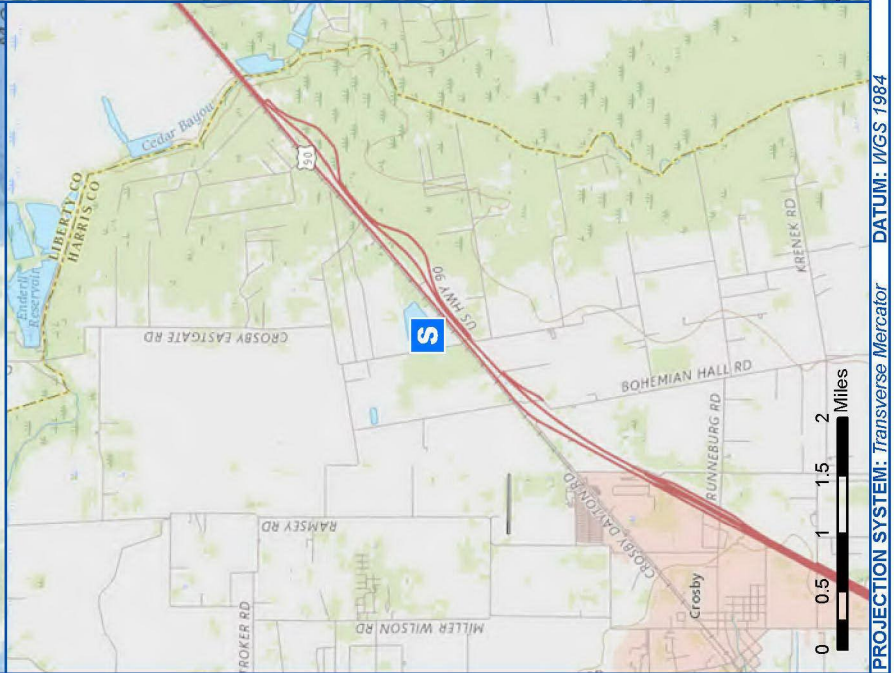






# Harvey Response

Site Location



Legend

**S** Site



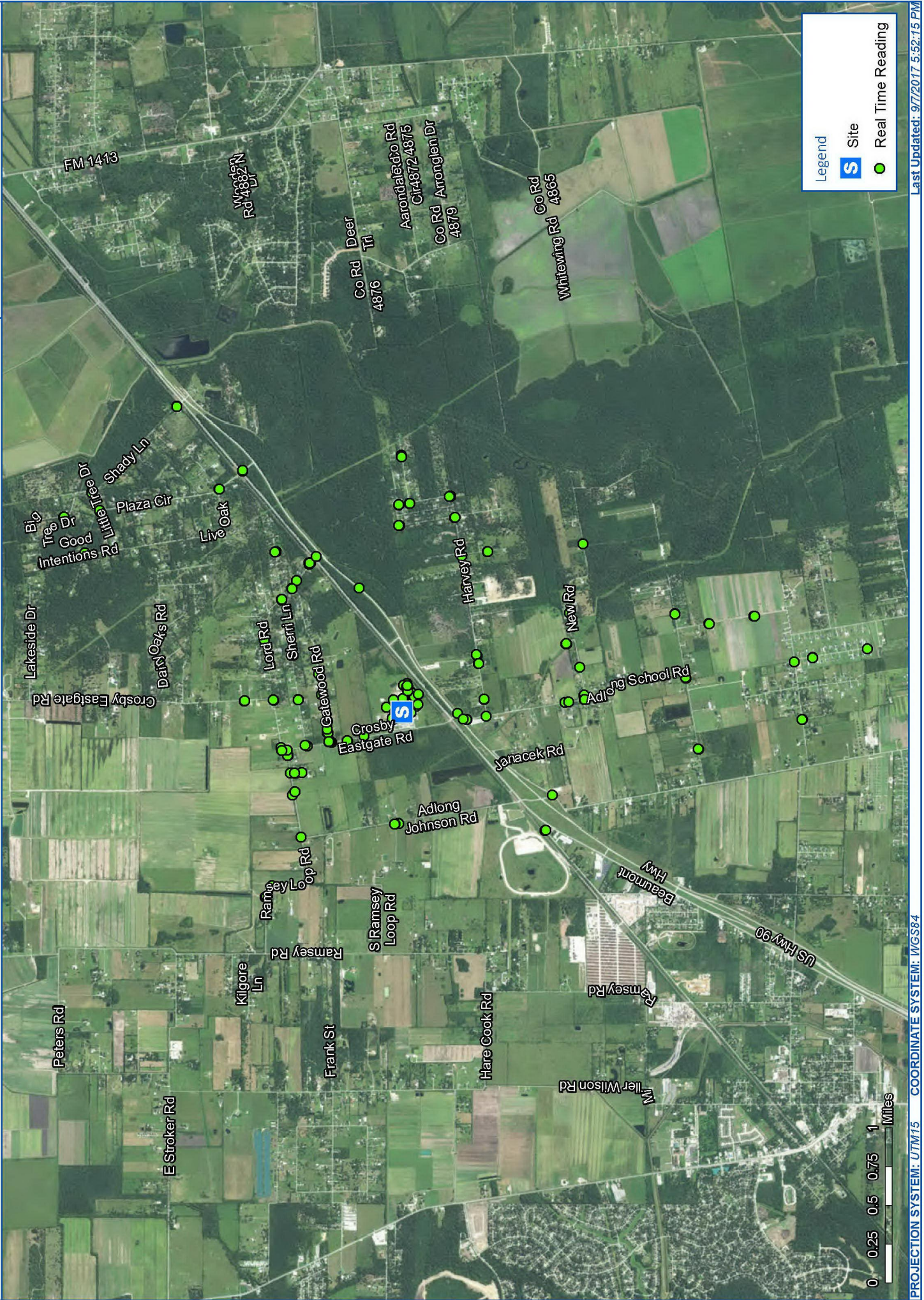
# **Attachment B**

## **Handheld Real-time Air Monitoring Locations**



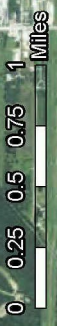
# Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 6, 2017 to 06:00 September 7, 2017



Legend

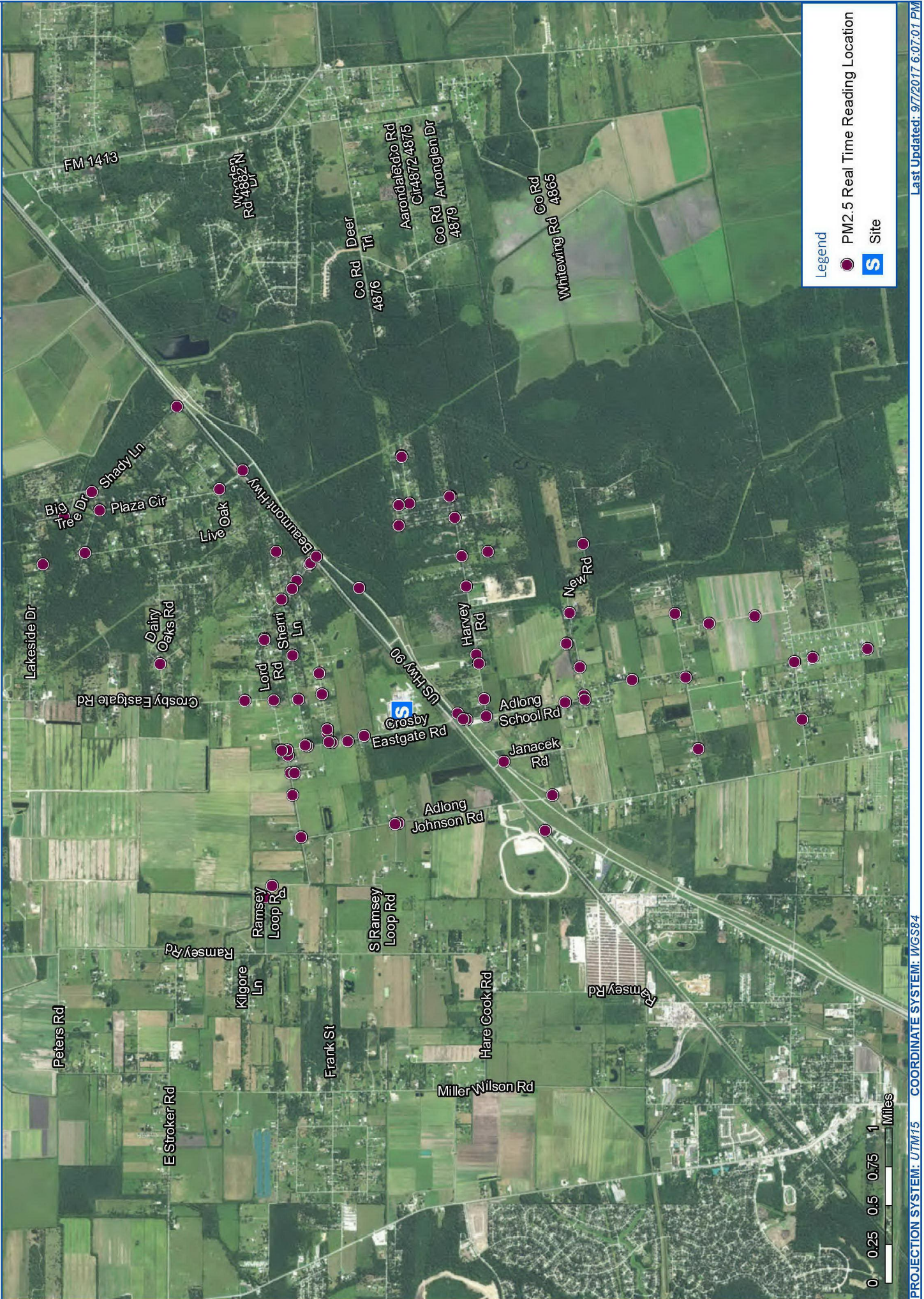
- Site
- Real Time Reading





# Community PM2.5 Hand-held Real-time Reading Locations

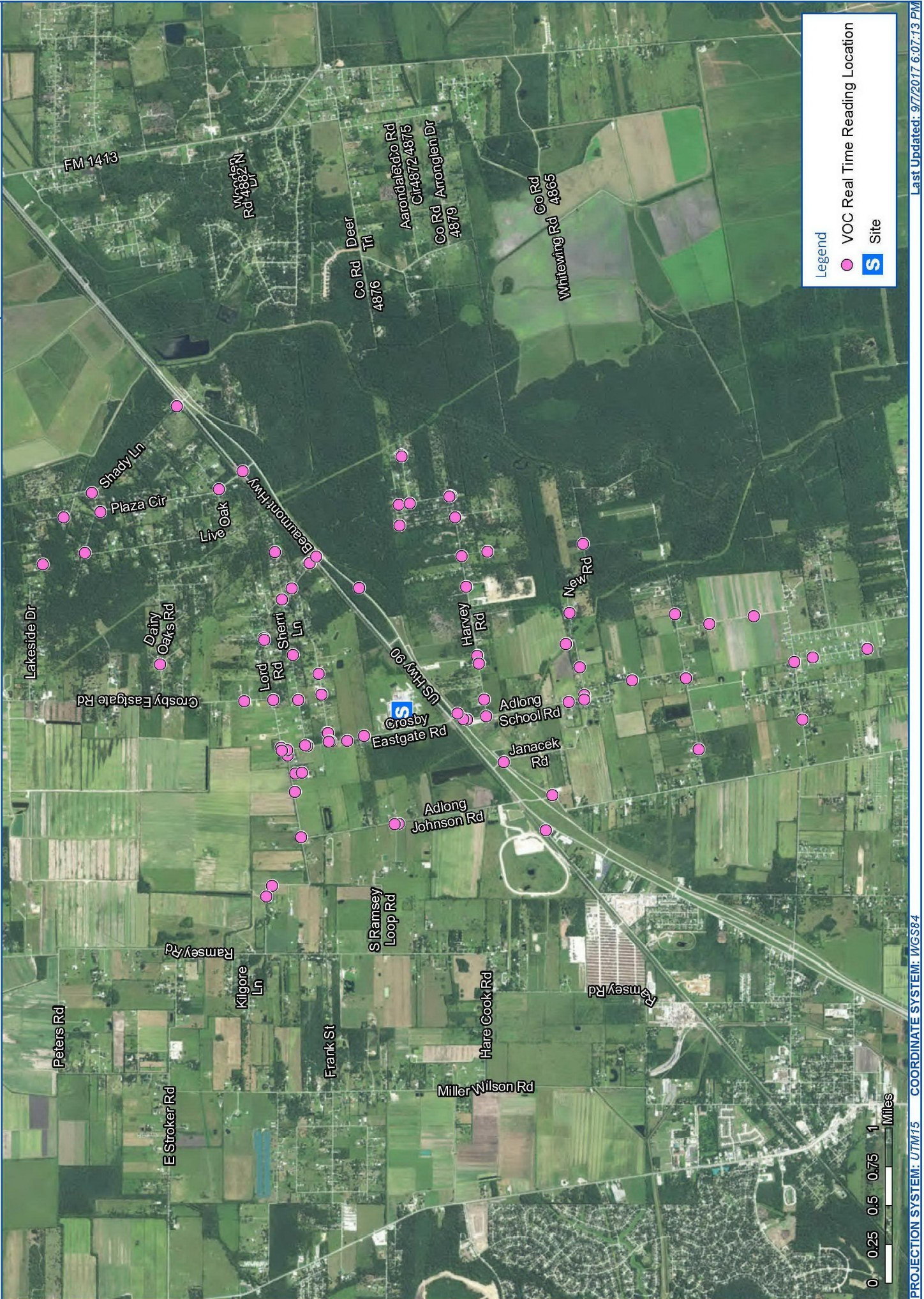
Harvey Response - 06:00 September 6, 2017 to 06:00 September 7, 2017





# Community VOC Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 6, 2017 to 06:00 September 7, 2017





# Oxygen Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 6, 2017 to 06:00 September 7, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- O2 Real Time Reading Location
- S Site



# VOC Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 6, 2017 to 06:00 September 7, 2017



# Attachment C

## Map of Analytical Air Sampling Locations

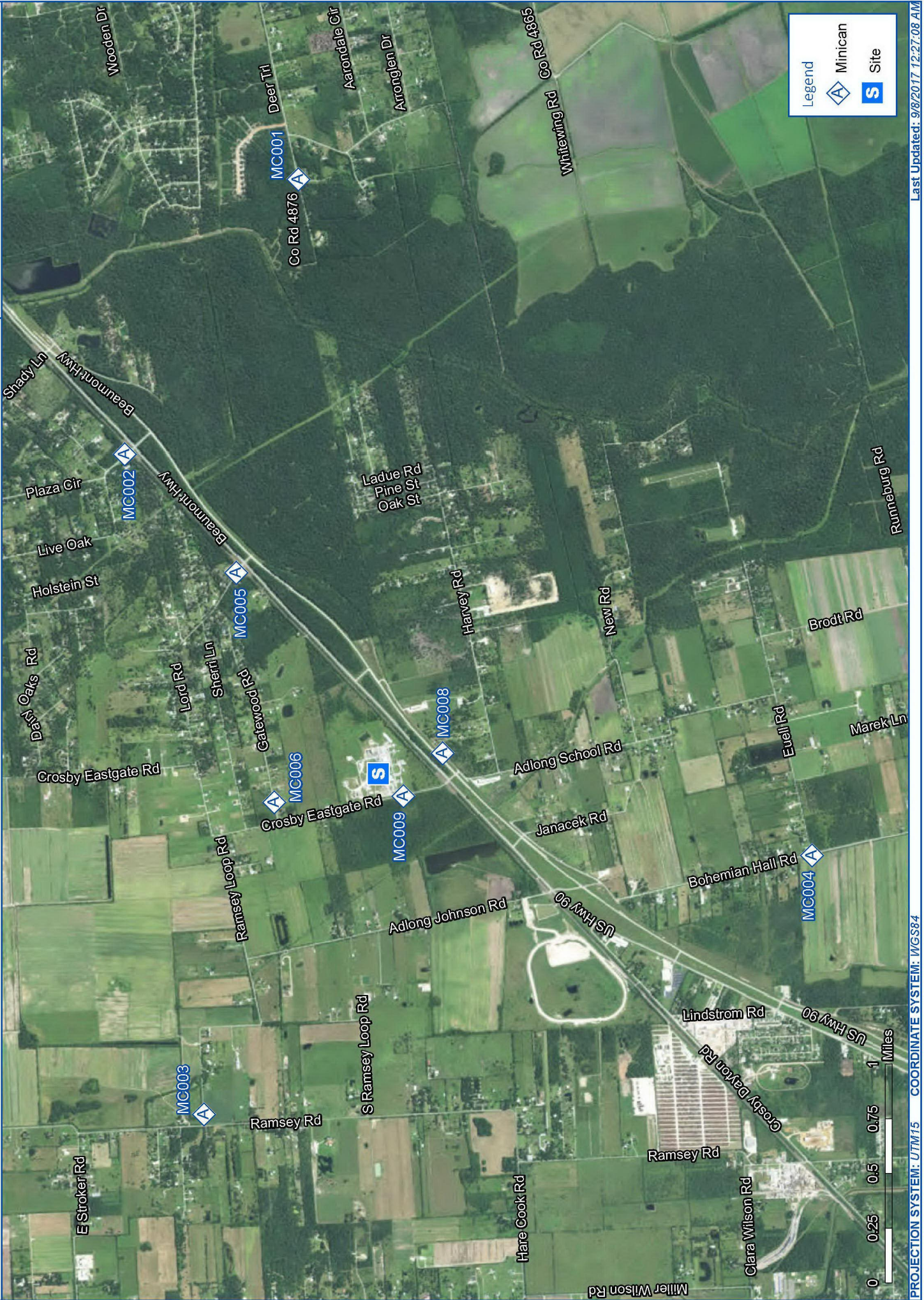






# Analytical Air Monitoring Station Locations as of September 7, 2017

Harvey Response



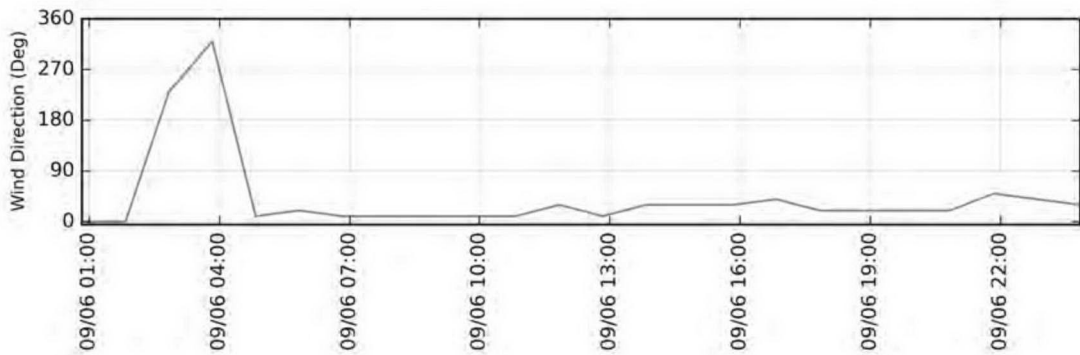
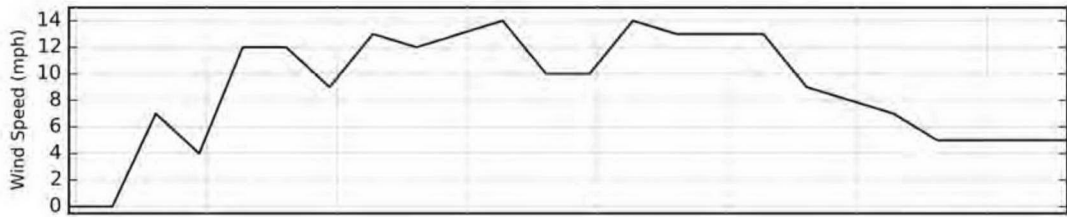
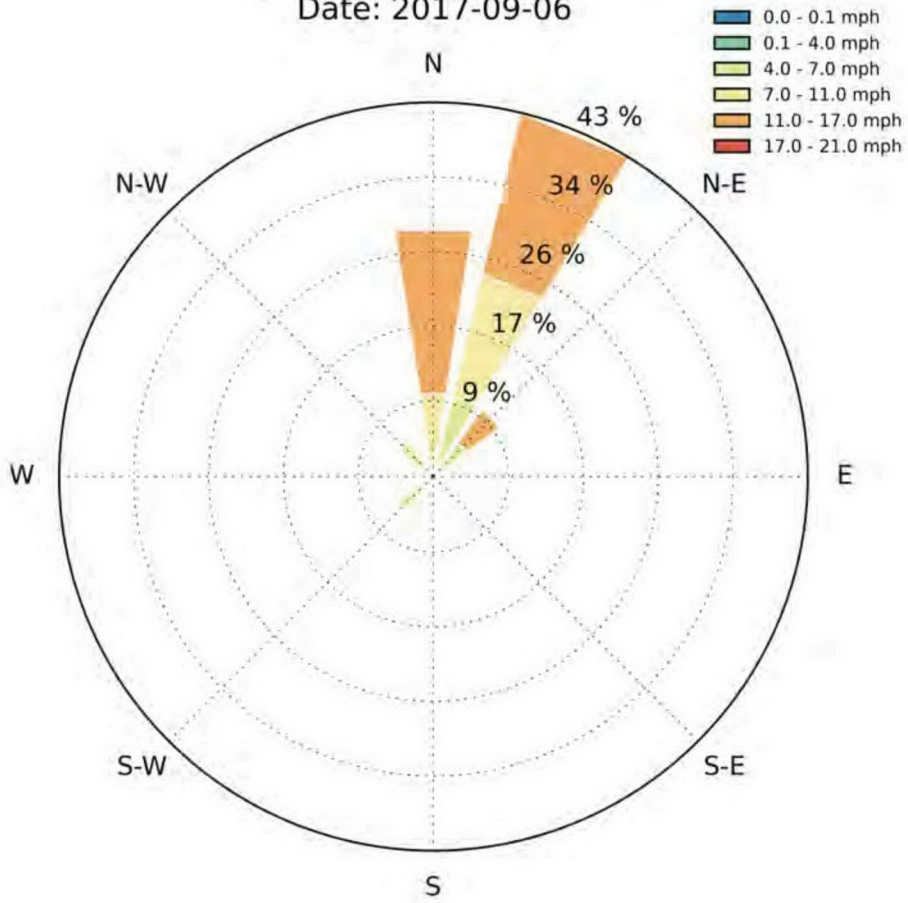
# Attachment D

## KHPY Windrose

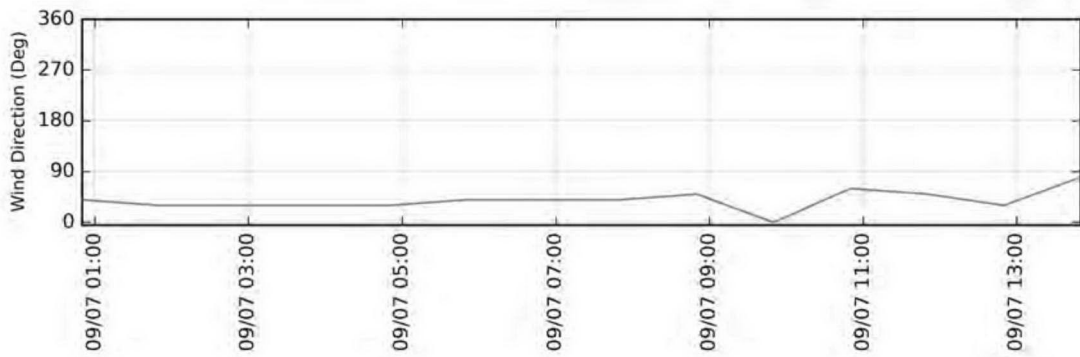
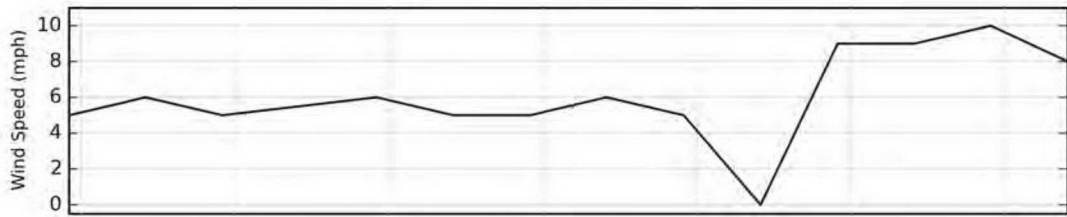
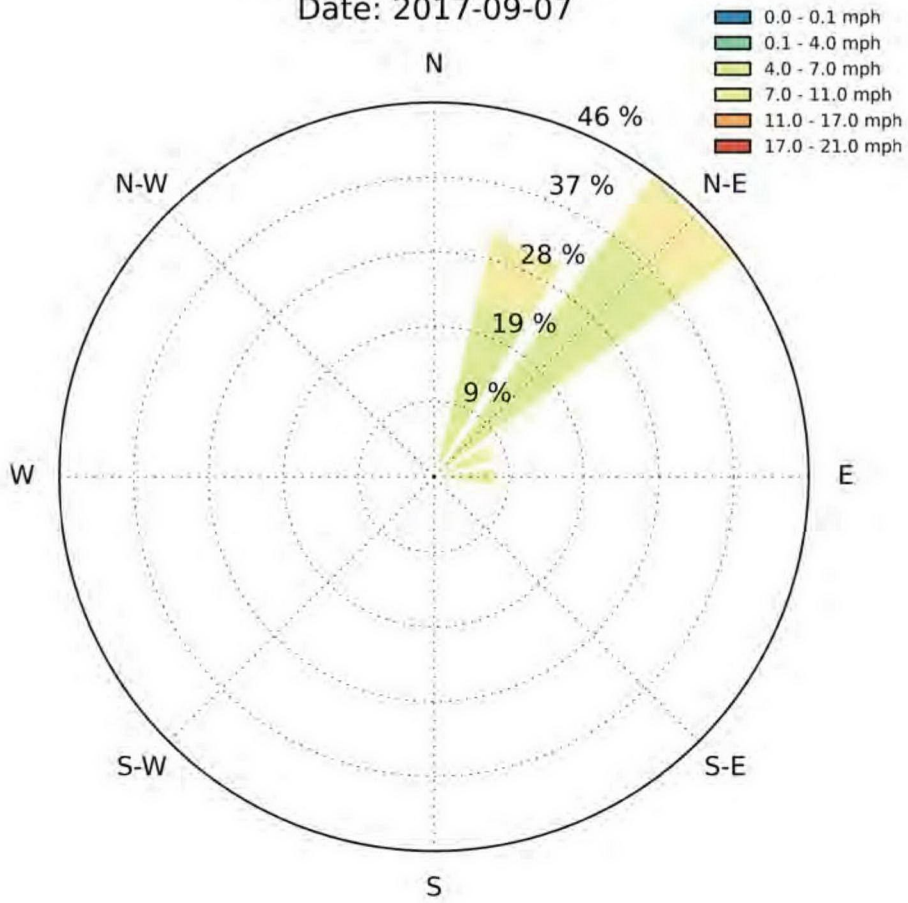
(Highland Park Airport - 12.5 miles SSE of Site)



Weather Station: KHPY  
Date: 2017-09-06



Weather Station: KHPY  
Date: 2017-09-07



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 8, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 7, 2017 to 06:00 on September 8, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for oxygen (O<sub>2</sub>) and volatile organic compounds (VOCs) using RAE Systems MultiRAE instruments. Additionally, particulate matter (PM<sub>2.5</sub>) was assessed using TSI SidePak AM510s. **Table 1** summarizes the data for all real-time air monitoring readings recorded in the Crosby, TX Community from 06:00 on September 7, 2017 through 06:00 on September 8, 2017 and Table 2 summarizes the Worker Activity real-time air monitoring readings from within the site boundary for the same period. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Community Real-time Handheld Air Monitoring Readings  
06:00 September 7, 2017 – 06:00 September 8, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
PM <sub>2.5</sub>	AM510	112	112	0.012 - 0.320 mg/m <sup>3</sup>
VOCs	MultiRAE	112	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

**Table 2 Worker Activity Real-time Handheld Air Monitoring Readings  
06:00 September 7, 2017 – 06:00 September 8, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
LEL	MultiRAE	2	0	< 1.0 %
O <sub>2</sub>	MultiRAE	1	1	20.9 %
VOCs	MultiRAE	6	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

### 3.0 Analytical Air Sampling

To supplement real-time air monitoring, CTEH<sup>®</sup> deployed areas along the perimeter of the evacuated area within the community. Evacuated canister (Minican<sup>™</sup>) samplers were regulated to collect air evenly over a 24-hr period. Analytical air samples will be submitted to SGS Galson Laboratories, an AIHA-accredited laboratory, for analysis using EPA Method TO-15. A map highlighting the analytical air sampling locations is provided as **Attachment C**. Analytical Air Sampling Results will be reported upon receipt from the laboratory.



# Attachment A

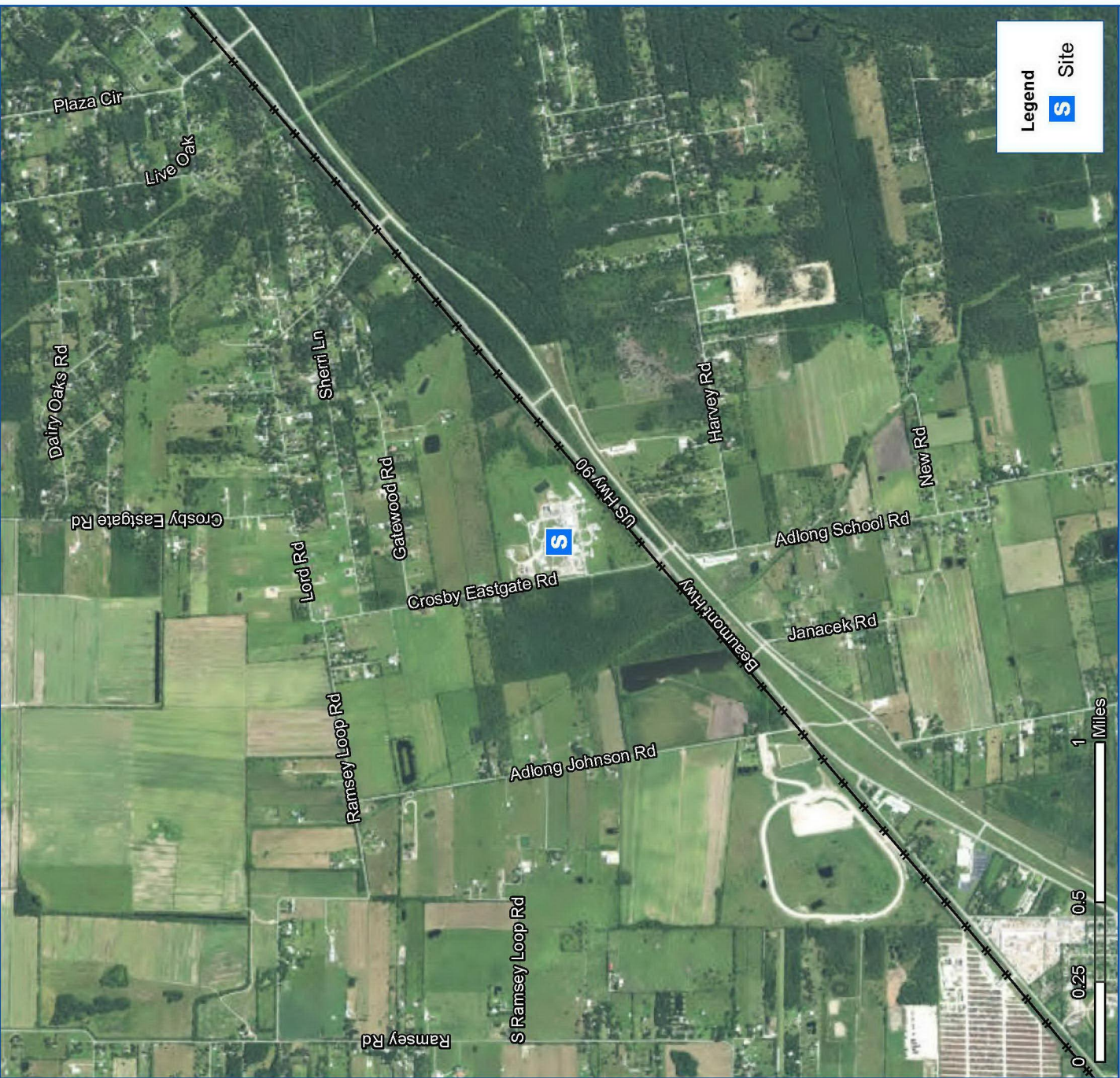
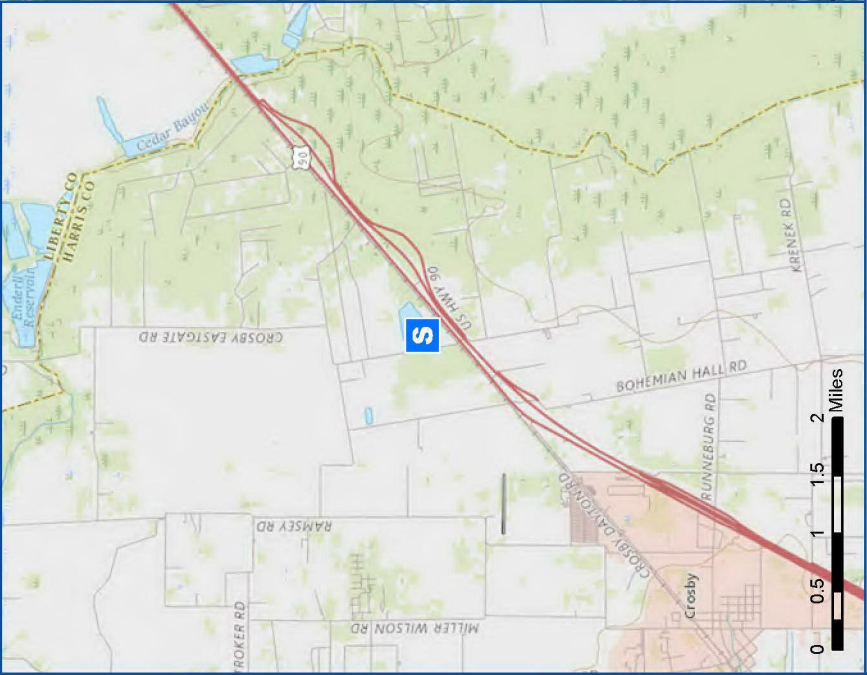
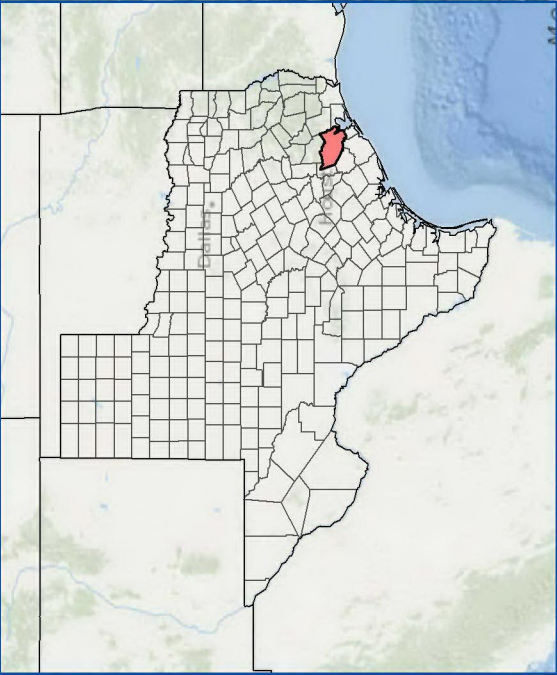
## Site Location Map







# CTEH Harvey Response Site Location



Legend  
**S** Site



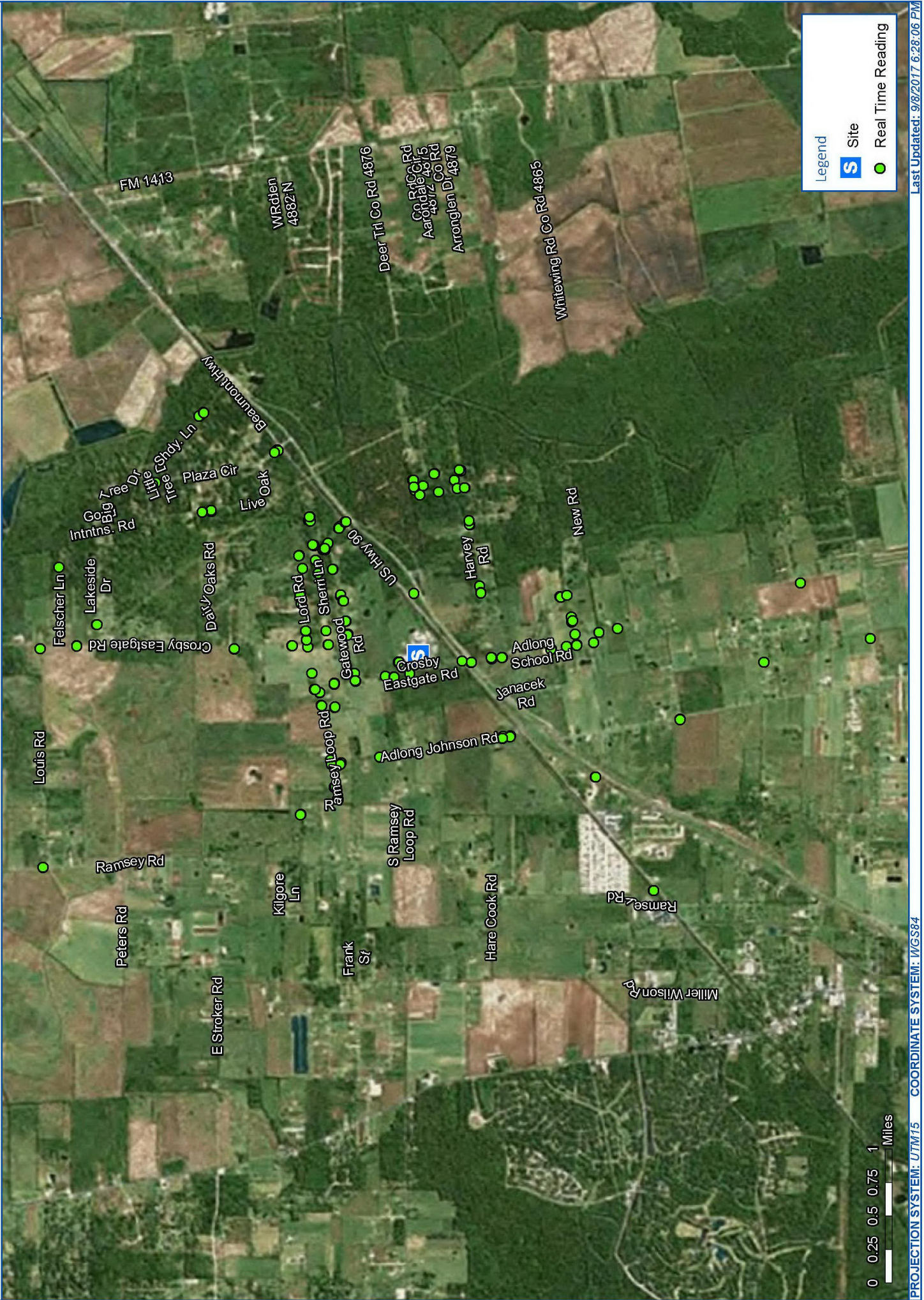
# **Attachment B**

## **Handheld Real-time Air Monitoring Locations**



# Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 7, 2017 to 06:00 September 8, 2017



Legend

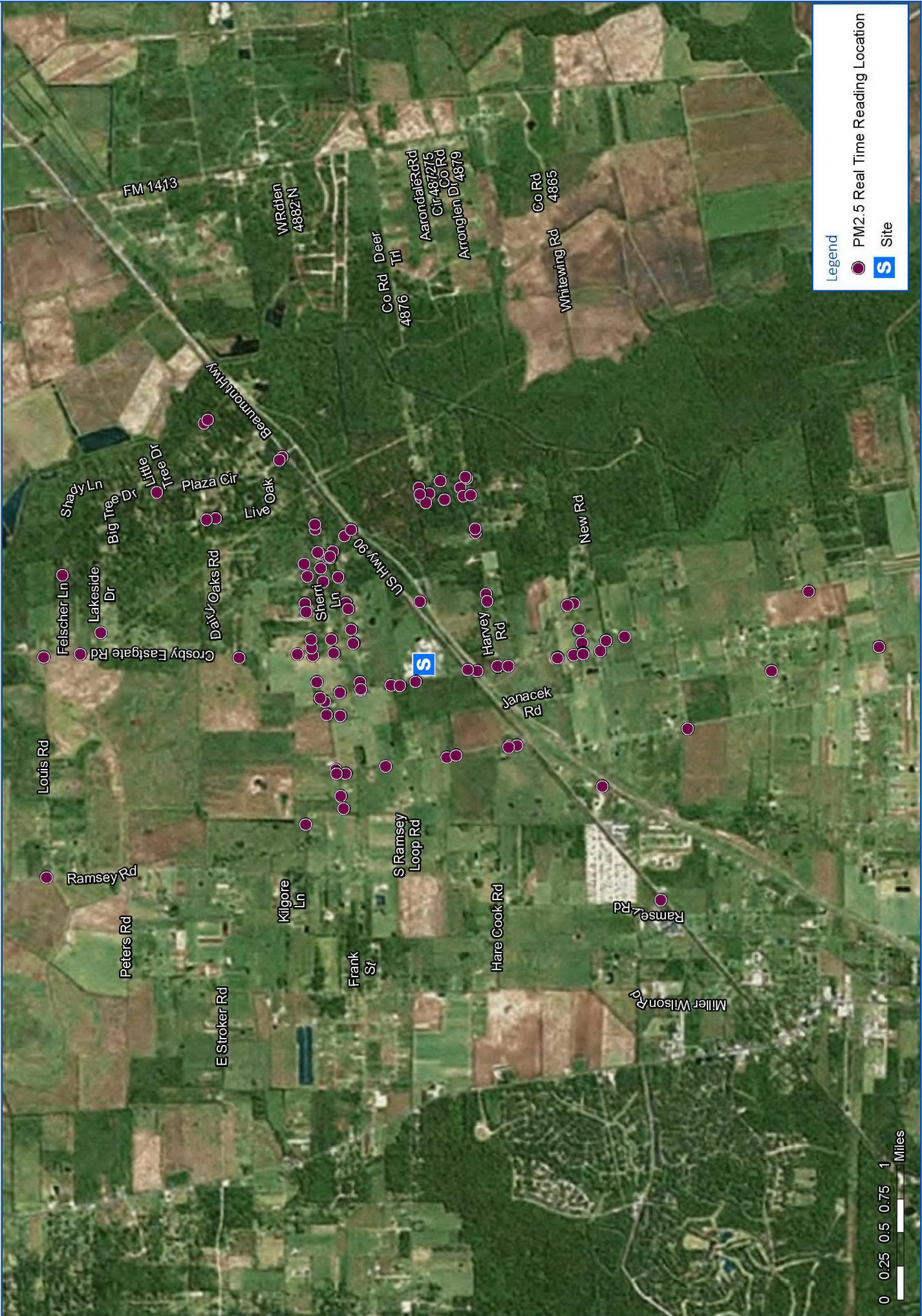
- Site
- Real Time Reading





# Community PM2.5 Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 7, 2017 to 06:00 September 8, 2017



Legend

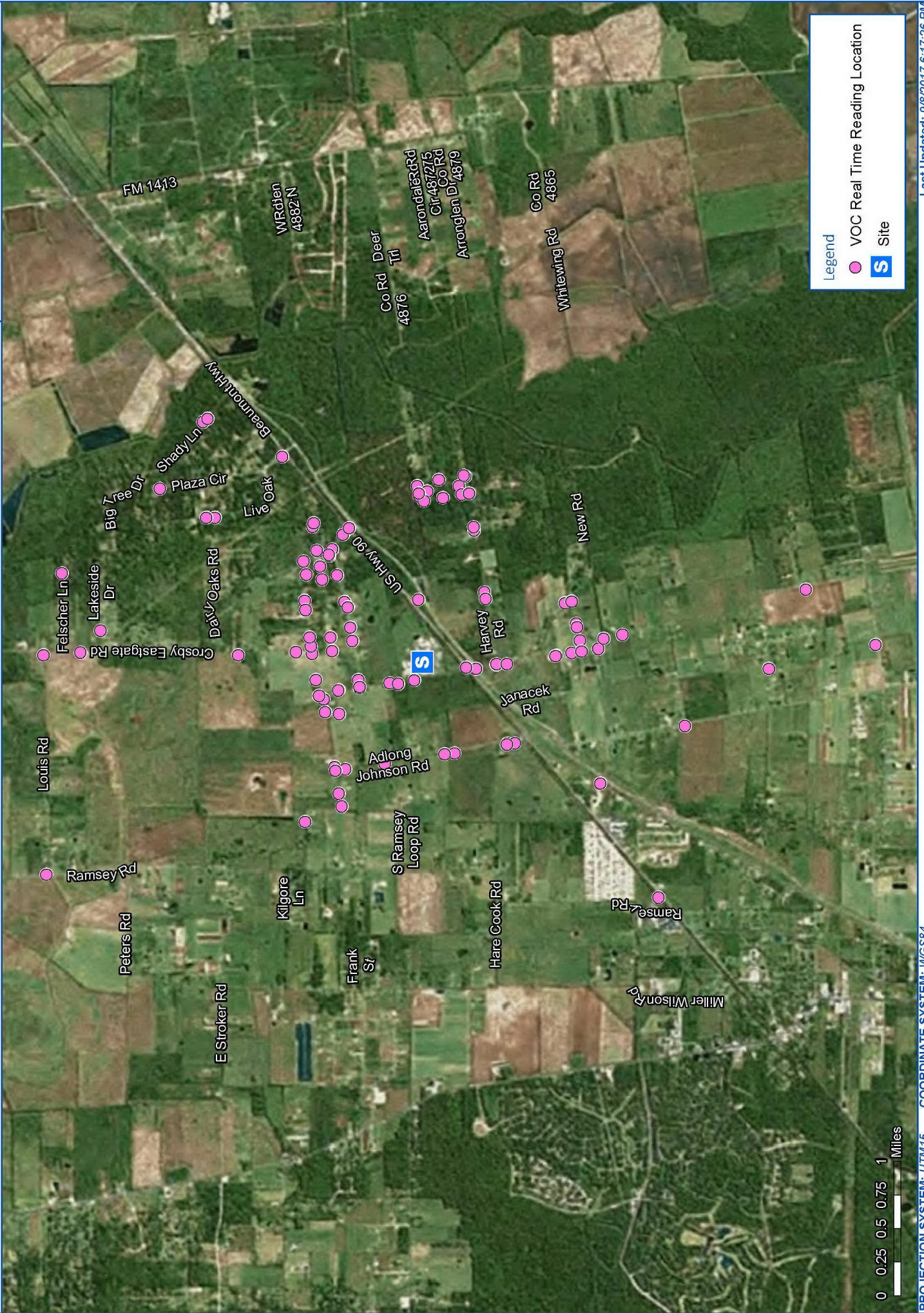
- PM2.5 Real Time Reading Location
- S Site





# Community VOC Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 7, 2017 to 06:00 September 8, 2017



Legend  
● VOC Real Time Reading Location  
■ Site



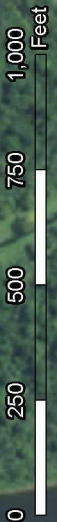


# LEL Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 7, 2017 to 06:00 September 8, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- LEL Real Time Reading Locations
- S Site



# Oxygen Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 7, 2017 to 06:00 September 8, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- O2 Real Time Reading Location
- S Site

PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84 Last Updated: 9/8/2017 10:02:45 AM



# VOC Hand-held Real-time Reading Locations - Worker Activity

Harvey Response - 06:00 September 7, 2017 to 06:00 September 8, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- VOC Real Time Reading Location
- Site



PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84 Last Updated: 9/8/2017 11:17:12 AM



# Attachment C

## Map of Analytical Air Sampling Locations

# Attachment D

## K6R3 Weather

(Cleveland Municipal Airport - 27.3 miles North of Site)



# Cleveland, TX

Cleveland

© 3:40 PM CDT on September 08, 2017 (GMT -0500)

Forecast **History** Calendar Rain / Snow Health

## Weather History for K6R3 - September, 2017

From:

September 7 2017

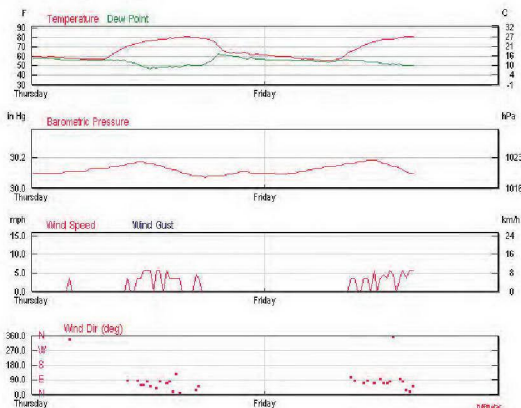
To:

September 8 2017

Get History

	Max	Avg	Min	Sum
<b>Temperature</b>				
Max Temperature	81 °F	81 °F	81 °F	
Mean Temperature	69 °F	68 °F	68 °F	
Min Temperature	57 °F	56 °F	56 °F	
<b>Degree Days</b>				
Heating Degree Days (base 65)	0	0	0	0
Cooling Degree Days (base 65)	4	4	4	8
Growing Degree Days (base 50)	19	18	18	37
<b>Dew Point</b>				
Dew Point	63 °F	56 °F	48 °F	
<b>Precipitation</b>				
Precipitation	0.00 in	0.00 in	0.00 in	0.00 in
Snowdepth	-	-	-	-
<b>Wind</b>				
Wind	6 mph	1 mph	0 mph	
Gust Wind	-	-	-	
<b>Sea Level Pressure</b>				
Sea Level Pressure	30.18 in	30.12 in	30.07 in	

## Custom Weather History Graph



## Weather History & Observations

2017	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high		
7	81	69	57	63	56	48	96	70	32	30.17	30.11	30.07	10	10	7	6	1	-	0.00	
8	81	68	56	58	55	51	96	72	34	30.18	30.13	30.09	10	9	7	6	1	-	0.00	



## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 9, 2017

Project #109489 Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On August 31, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) was contacted by Arkema Inc. (Arkema) to initiate air monitoring and sampling around the community areas outside of the evacuation zone perimeter. Air monitoring in support of Worker Activity was conducted within the perimeter of the facility during facility stabilization operations. This submittal summarizes the results of real-time air monitoring conducted by CTEH® personnel from 06:00 on September 8, 2017 to 06:00 on September 9, 2017. A map of the site location is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for oxygen (O<sub>2</sub>) and volatile organic compounds (VOCs) using RAE Systems MultiRAE instruments. Additionally, particulate matter (PM<sub>2.5</sub>) was assessed using TSI SidePak AM510s. **Table 1** summarizes the data for all real-time air monitoring readings recorded in the Crosby, TX Community from 06:00 on September 8, 2017 through 06:00 on September 9, 2017 and **Table 2** summarizes the Worker Activity real-time air monitoring readings from within the site boundary for the same period. Maps of real-time air monitoring locations are provided as **Attachment B**.

**Table 1 Community Real-time Handheld Air Monitoring Readings**

06:00 September 8, 2017 – 06:00 September 9, 2017				
Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
PM <sub>2.5</sub>	AM510	8	8	0.020 - 0.027 mg/m <sup>3</sup>
VOCs	MultiRAE	8	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.



**Table 2 Worker Activity Real-time Handheld Air Monitoring Readings  
06:00 September 8, 2017 – 06:00 September 9, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
LEL	MultiRAE	1	0	< 1.0 %
O <sub>2</sub>	MultiRAE	13	13	20.9 %
VOCs	MultiRAE	30	5	0.7 – 1.0 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

# Attachment A

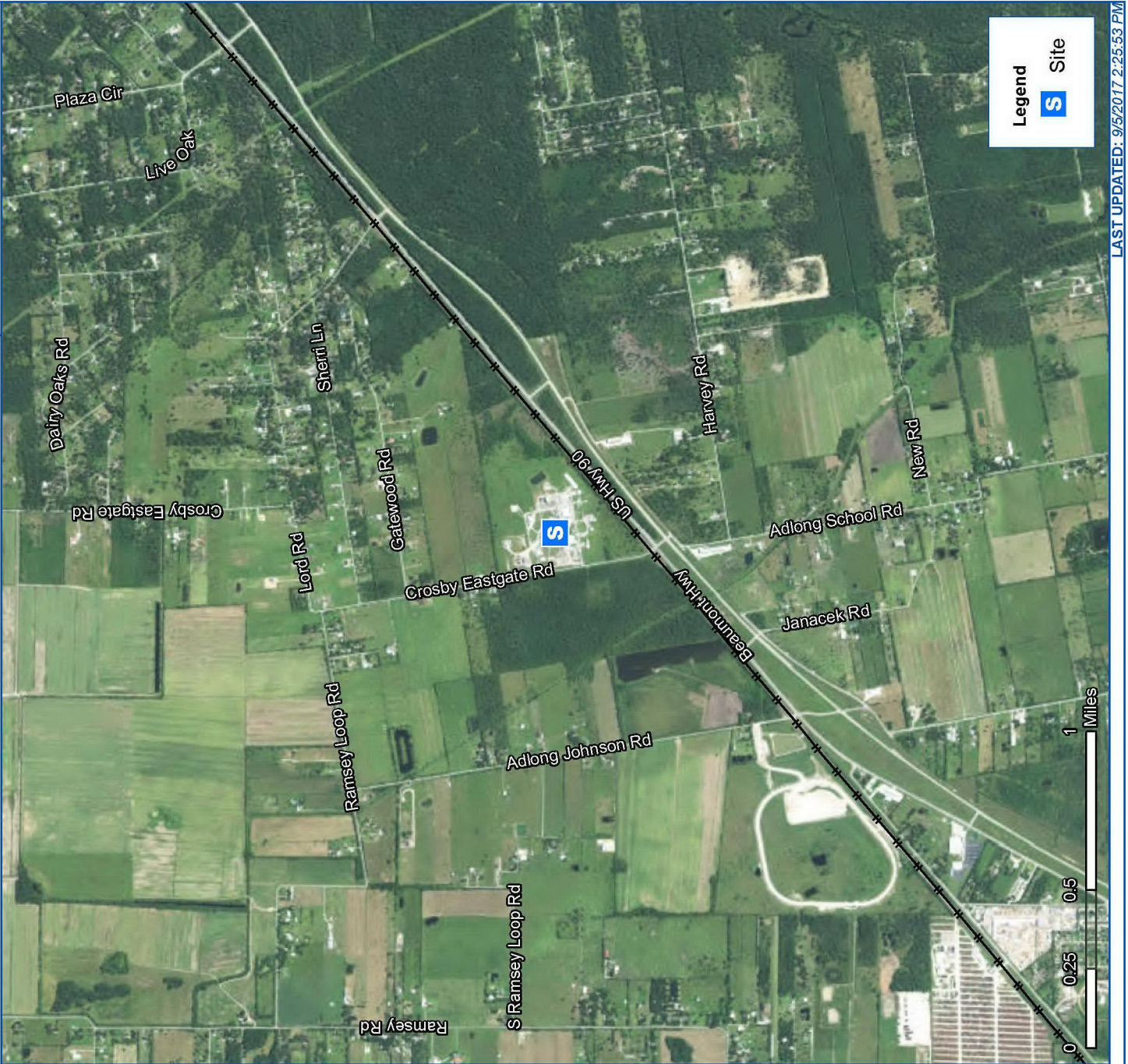
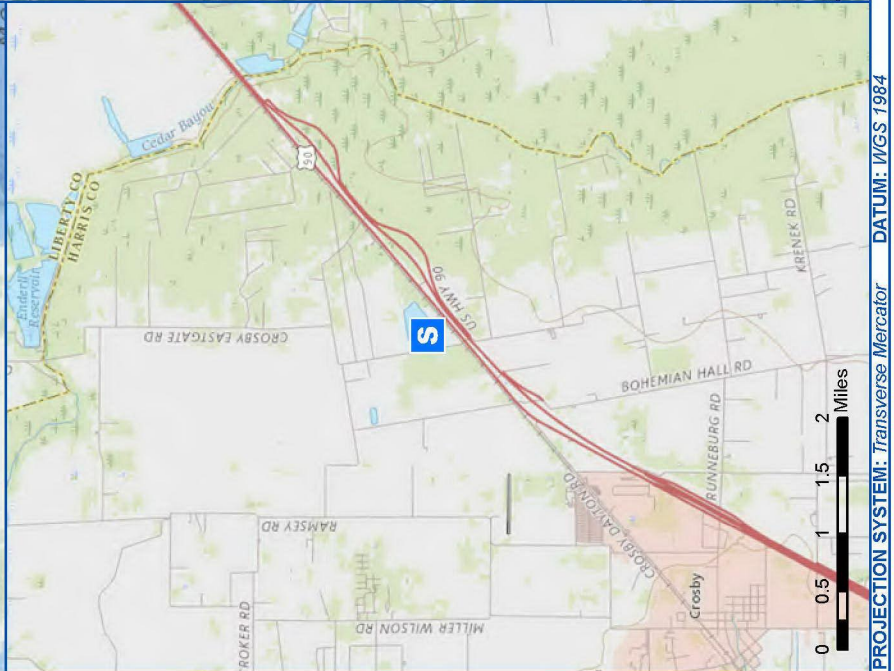
## Site Location Map





# Harvey Response

Site Location



Legend  
**S** Site





# **Attachment B**

## **Handheld Real-time Air Monitoring Locations**

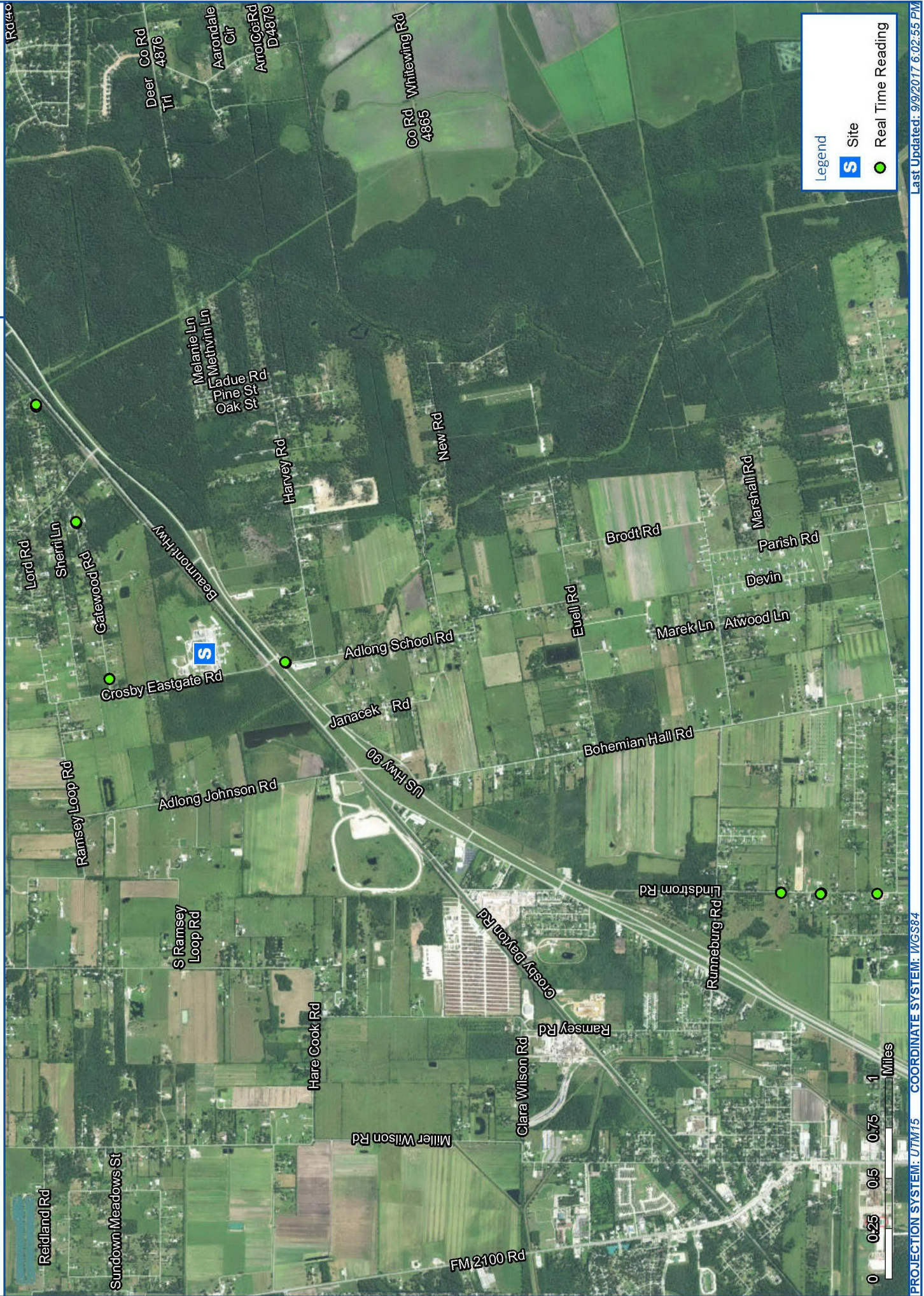


# Community Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 8, 2017 to 06:00 September 9, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



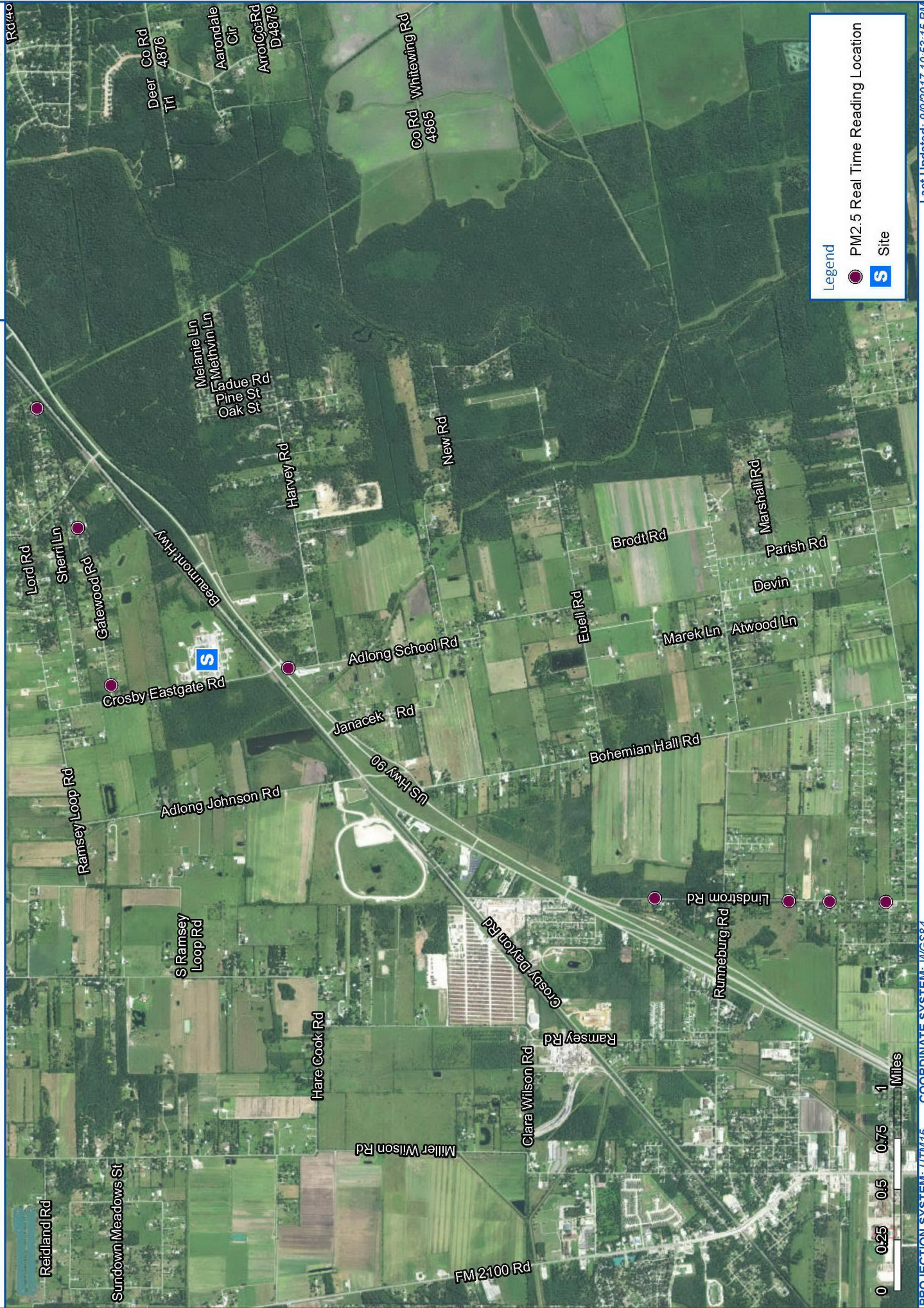
Legend

- S Site
- Real Time Reading



# Community PM2.5 Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 8, 2017 to 06:00 September 9, 2017



**Legend**

- PM2.5 Real Time Reading Location
- Site



PROJECTION SYSTEM: UTM15 COORDINATE SYSTEM: WGS84

Last Updated: 9/9/2017 10:53:15 PM

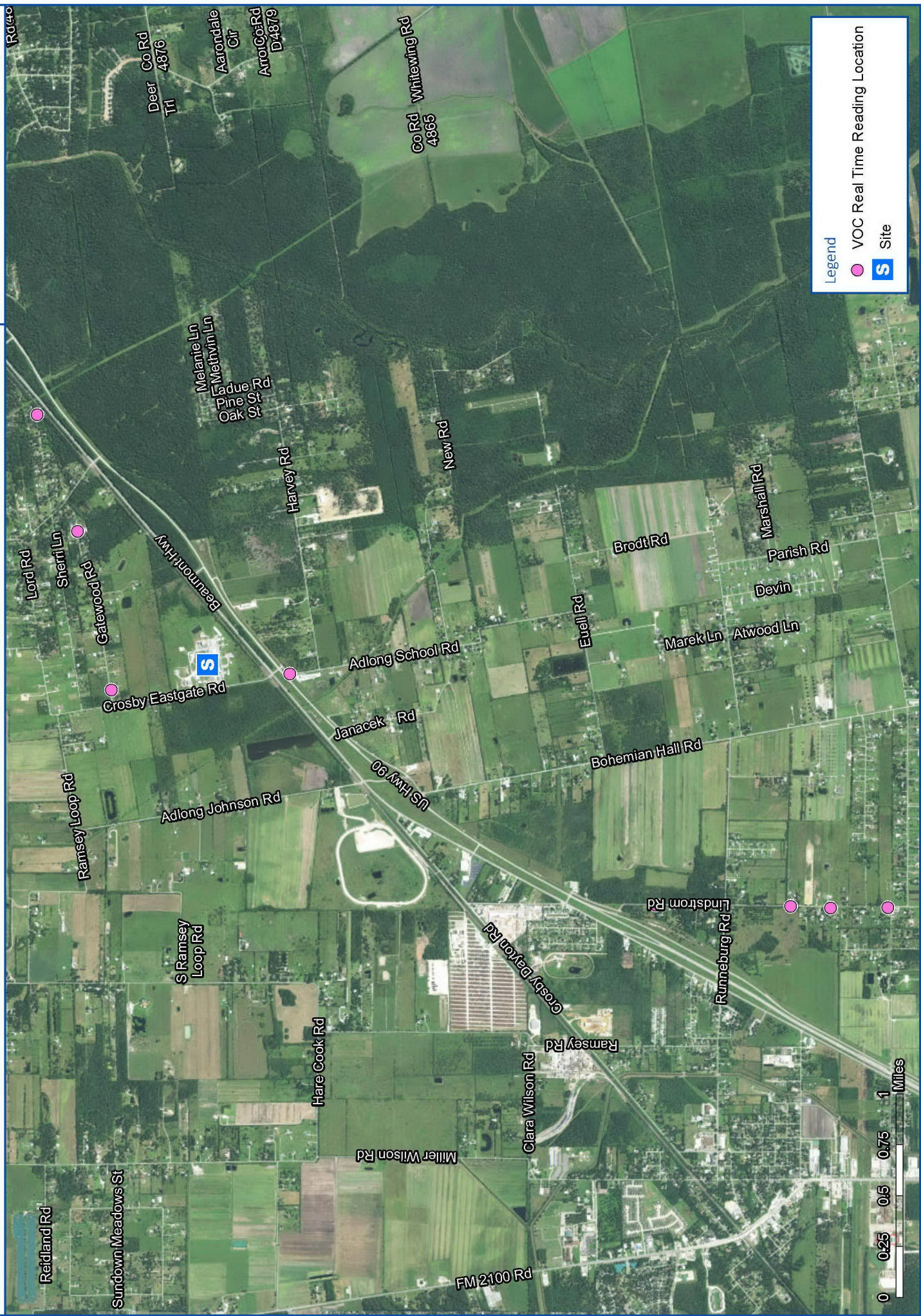


# Community VOCs Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 8, 2017 to 06:00 September 9, 2017



Project: 109489  
Client: Arkema  
City: Crosby, TX  
County: Harris



Legend

- VOC Real Time Reading Location
- Site





# Worker Activity Hand-held Real-time Reading Locations

Harvey Response - 06:00 September 8, 2017 to 06:00 September 9, 2017





Legend

- LEL Real Time Reading Location
- S Site



Legend

- O2 Real Time Reading Location
- Site



Legend

- VOC Real Time Reading Location
- Site



# **Attachment C**

## **KHPY Weather**

**(Cleveland Municipal Airport – 12.5 miles North of Site)**

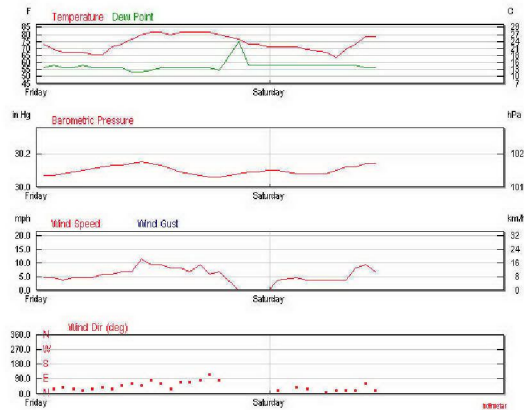
Weather History for KEFD - September, 2017

From: September 9 2017 To: September 9 2017

[Get History](#)

	Max	Avg	Min	Sum
<b>Temperature</b>				
Max Temperature	82 °F	80 °F	78 °F	
Mean Temperature	74 °F	71 °F	68 °F	
Min Temperature	66 °F	65 °F	64 °F	
<b>Degree Days</b>				
Heating Degree Days (base 65)	0	0	0	0
Cooling Degree Days (base 65)	9	6	4	13
Growing Degree Days (base 50)	24	21	18	42
<b>Dew Point</b>				
Dew Point	75 °F	58 °F	54 °F	
<b>Precipitation</b>				
Precipitation	0.00 in	0.00 in	0.00 in	0.00 in
Snowdepth	-	-	-	-
<b>Wind</b>				
Wind	12 mph	4 mph	0 mph	
Gust Wind	-	-	-	
<b>Sea Level Pressure</b>				
Sea Level Pressure	30.15 in	30.10 in	30.06 in	

Custom Weather History Graph



Weather History & Observations

2017	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
Sep	82	74	66	75	58	54	94	56	39	30.15	30.10	30.06	10	10	10	12	5	-	0.00	
8	82	74	66	75	58	54	94	56	39	30.15	30.10	30.06	10	10	10	12	5	-	0.00	
9	78	68	64	59	59	57	83	66	47	30.14	30.10	30.08	10	10	10	9	4	-	0.00	





# Arkema Organic Peroxide Facility Air Monitoring

Crosby, TX

## Air Sampling and Analysis Plan

Version 1.3

Prepared On Behalf Of:

Arkema

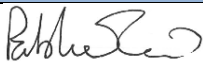
Prepared By:

Center for Toxicology and Environmental Health, L.L.C.

5120 Northshore Drive


North Little Rock, AR 72118

9/8/2017

Version 1.2			
	Name/Organization	Signature	Date Signed
Prepared by:	Pablo Sanchez Soria, Ph.D. – Project Technical Director		9/8/17
Reviewed by:	Jamie Beck – Project Manager		
Reviewed by:			
Approved by:			
Approved by:			
Approved by:			
Approved by:			

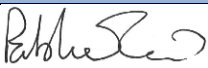
**Change from version 1.0 to 1.1**

*Added SO<sub>2</sub> and NO<sub>2</sub> as target analytes. Corrected measuring range on MultiRAE Plus instruments.*

	Name/Organization	Signature	Date Signed
Prepared by:	Pablo Sanchez Soria		9/1/2017
Review by:			
Approved by:			
Approved by:			
Approved by			
Approved by			

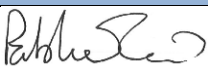
**Change from version 1.1 to 1.2**

*Air Monitoring Plans for Worker Area and Site Characterization added*

	Name/Organization	Signature	Date Signed
Prepared by:	Pablo Sanchez Soria		9/5/2017
Review by:	Jamie Beck		
Approved by:			
Approved by:			
Approved by			

**Change from version 1.2 to 1.3**

*Added carbon monoxide as a target analyte for Work Area Monitoring due to the heavy presence of generators throughout the facility*

	Name/Organization	Signature	Date Signed
Prepared by:	Pablo Sanchez Soria		9/8/2017
Review by:	Jamie Beck		
Approved by:			
Approved by:			

**Air Monitoring and Sampling Strategy**

CTEH® is focusing on the chemicals chosen below because they are among the most important and readily monitored hazards of this response. The possible hazards of this response vary by the source and type of the chemical as well as with the environmental conditions associated with the release. Monitoring and sampling for some chemicals or indicators of the presence of this response may be conducted less frequently or even discontinued as product-specific information becomes available or as initial monitoring and sampling results indicate that these chemicals and indicators do not pose a health concern.

The strategy is to utilize three broadly defined monitoring plans: **1) Worker Monitoring 2) Site Characterization and 3) Community Monitoring.** Workers may be designated as the individuals actively or sporadically involved in remediation and/or normal work activities within a Work Area generally with established site control zones (exclusion zone, contaminant reduction zone, support zone) where remediation activities are taking place. Site Characterization may involve a variety of different monitoring tasks intended to provide information that may help to delineate the nature and extent of the release (e.g. worst case determination, container head space, etc.) rather than monitoring for potential breathing zone exposures. Community Monitoring may take place in those residential and commercial locations surrounding the incident site, not necessarily currently occupied by members of the community.

Free-roaming handheld real-time air monitoring may be conducted in a variety of areas based on levels of activity, proximity to the release, and site conditions.

Discrete air samples may be collected in all monitoring areas and sent to an off-site laboratory for chemical analysis. These analytical air sampling techniques may be used to provide air quality data beyond the scope of real-time instruments. When necessary, discrete air samples may be collected on individual workers (personal sampling) to provide exposure data over the course of a work shift for more direct comparison to occupational exposure values.

**CTEH Site-Specific Action Levels**

**CTEH® site-specific action levels may be employed in all air monitoring plans to provide information for corrective action to limit potential exposures. These values do not replace occupational or community exposure standards or guidelines, but are intended to represent a concentration limit that triggers a course of action to better address worker and public safety. Action level exceedances will be communicated to Site Management and the CTEH Project Technical Director by the CTEH Project Manager (PM). Work practice may be assessed and then altered if necessary. Site-Specific Action Levels are not utilized for Site Assessment monitoring.**

**Plan 1: Worker Monitoring**
**Objective: Report air levels before they reach those requiring respiratory protection**

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	30 ppm sustained for 5 min.	Assess for the presence of benzene/toluene/hexane, Report reading to Site Management	To avoid over exposure to benzene/toluene/hexane	MultiRAE AreaRAE	0.1 ppm	MultiRAE and AreaRAE Range: 0-5,000 ppm	NA
Benzene	2.5 ppm sustained for 5 min.	Sample as requested. Exit Area or don air purifying respirator; Report reading to Site Management or IC	ACGIH STEL Action level	UltraRAE	0.05 ppm	Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
				MR Pro Sensor	0.1 ppm	Range: 0 – 100 ppm	NA
				Gastec tube #4LL	0.1 ppm	Range: 0.25 – 120 ppm Volume: Variable	Var.
Oxygen	<19.5%	Egress site or don supplied air respirator	Oxygen Deficient Atmosphere, as defined by OSHA	MultiRAE	0.1%	Range 0 – 30%	NA
Carbon Dioxide	5000 ppm sustained for 5 min	Egress site or don supplied air respirator	ACGIH TLV TWA	MultiRAE Sensor	100 ppm	Range 0 – 50,000 ppm	NA
LEL	10%	Egress site and report reading to site management	Industry Standard	MultiRAE, AreaRAE	1%	Range 0 – 100%	NA
Sulfur Dioxide	0.25 ppm sustained for 15 min	Sample as requested. Don full-face APR	ACGIH TLV TWA	MultiRAE sensor	0.1 ppm	Range 0 – 20 ppm	NA
Carbon Monoxide	25 ppm sustained for 15 minutes	Egress site and report reading to site management	ACGIH TLV TWA	MultiRAE Sensor	1 ppm	Range: 0 – 500 ppm	NA

**Plan 2: Site Characterization Monitoring**
**Objective: Characterize nature and extent of release (Non-breathing zone, i.e. headspace monitoring; excavation/trench monitoring, etc. As requested)**

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	NA	Report reading to Site Management	NA	MultiRAE, AreaRAE	0.1 ppm	Measuring range: 0 – 5,000	NA
Oxygen	NA	Report reading to Site Management	NA	MultiRAE, AreaRAE	0.1%	Measuring range: 0 – 30%	NA
Carbon Dioxide	NA	Report reading to Site Management	NA	MultiRAE sensor	100 ppm	Measuring range 0 – 50,000 ppm	NA
LEL	NA	Report reading to Site Management	NA	MultiRAE, AreaRAE	1%	Measuring range: 0 – 100%	NA
Sulfur Dioxide	NA	Report reading to Site Management	NA	MultiRAE sensor	0.1 ppm	Measuring range: 0 – 20 ppm	NA

<b>Plan 3: Community Monitoring</b>
-------------------------------------

Objective: Report air levels before they reach those that may be associated with nuisance or health concerns.

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	30 ppm 5 minutes	Assess for the presence of cumene. Report reading to PM	To avoid over exposure to volatile compounds	MultiRAE PID	0.1 ppm	Measuring range: 0 – 2,000 ppm	NA
Particulate Matter (PM <sub>2.5</sub> )	0.138 mg/m <sup>3</sup> sustained for 15 min.	Report reading to project manager	Wildfire Smoke Guidelines for 1 hr avg. upper-bound breakpoint for unhealthy AQI	SidePak AM510	0.001 mg/m <sup>3</sup>	PM2.5 impactor – 50% cut-off at 2.5 microns;	NA
Carbon Monoxide	75 ppm sustained 5 min.	Report reading to PM	PAC-1 value	MR Sensor	1 ppm	MultiRAE - Measuring range: 0 – 100 ppm	NA
Cumene	50 ppm uncorrected (92.6 ppm corrected) sustained 5 min.	Report reading to PM	PAC-1 value	MultiRAE PID	0.1 ppm	Measuring range: 0 – 2,000 ppm	0.54
				Gastec tube #122L	2 ppm	Measuring range: 2 – 100 ppm. 2 strokes** See image attached below	NA
Nitrogen Dioxide	0.5 ppm sustained for 5 minutes	Report reading to PM	AEGL-1 value (8-hr)	Gastec tube #9L	0.1 ppm	Measuring range: 0.5 – 125 ppm	NA

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
				MultiRAE sensor	0.1 ppm	Measuring range: 0 – 20 ppm	NA
Sulfur Dioxide	0.2 ppm sustained	Report reading to PM	AEGL-1 value (8-hr)	MultiRAE sensor	0.1 ppm	Measuring range: 0 – 20 ppm	NA
				Gastec tube #5La	0.1 ppm	Measuring range: 0.5 – 60 ppm	NA
				Gastec tube #5Lb	0.01 ppm	Measuring range: 0.05 – 10 ppm	NA
				Gastec tube #5LC	0.02 ppm	Measuring range: 0.1 – 25 ppm	NA

**Cumene scale on tube 122L:**

Tube 122L can also be used for other substances as below:

Substance	Correction Factor	No. of Pump Strokes	Measuring Range
Xylene	2	1, 2, 4	2 - 200 ppm
<b>(1) Ethyl benzene</b>			
Ethyl benzene			
Tube 122L Reading (n = 2)			
<b>(2) Cumene</b>			
Cumene			
Tube 122L Reading (n = 2)			
<b>(3) Diethyl benzene</b>			
Diethyl benzene			
Tube 122L Reading (n = 4)			

Analytical Methods			
Analyte	Media/Can	Method	Notes
VOCs	Minicans	EPA TO-15 + TICS	





CENTER FOR TOXICOLOGY  
AND ENVIRONMENTAL HEALTH, LLC

Air Sampling and Analysis Plan

Version: 1.3

Effective Date: **09/08/2017**

**General Information on Procedures (Assessment Techniques) Used**

Procedure	Description
Real-Time Hand-held Survey	CTEH staff members may utilize handheld instruments (e.g. MultiRAE, Gastec colorimetric detector tubes, etc.) to measure airborne chemical concentrations.
Analytical sampling	Analytical sampling may be used to validate the hand-held data monitoring data, or to provide data beyond the scope of the real-time instruments. Analytical samples may be collected as whole air samples in evacuated canisters or on specific collection media, and sent to an off-site laboratory for further chemical analysis.

**Quality Assurance/Quality Control Procedures**

Method	Procedure
Real-Time	<ul style="list-style-type: none"> <li>• Real-time instruments may be calibrated in excess of the manufacturer’s recommendations.               <ul style="list-style-type: none"> <li>○ At a minimum whenever indicated by site conditions or instrument readings.</li> </ul> </li> <li>• Co-located sampling for analytical analysis may be conducted, if necessary, to assess accuracy and precision in the field.</li> <li>• Lot numbers and expiration dates may be recorded with use of Gastec colorimetric tubes.</li> </ul>
Analytical	<ul style="list-style-type: none"> <li>• Chain of custody documents may be completed for each sample.</li> <li>• Level IV data validation may be performed on the first sample group analyzed.</li> <li>• Level II data validation may be performed on 20% of all samples.</li> <li>• Level IV data validation may be performed on 10% of all samples.</li> </ul>
Reporting	<ul style="list-style-type: none"> <li>• Daily Data Summaries may be provided for informational purposes using data that have not undergone complete QA/QC.</li> <li>• Comprehensive reports of real-time and/or analytical data may be generated following QA/QC and may be delivered 60 days following receipt of validated results, if applicable.</li> </ul>

**Glossary**

Term	Definition
Sustained	Instrument reading above the action level continuously for the listed time period.
Excursion Limit	Whenever a reading exceeds a ACGIH® TLV reading by 5 times (if the chemical does not have a STEL or Ceiling based action level), exit the area and notify the PM
Breathing zone	The area within an approximate 10-inch radius of an individual’s nose and mouth.
Ambient Air	That portion of the atmosphere (indoor or outdoor) to which workers and the general public have access.

## Arkema Facility - Harvey Response

Crosby, TX

Arkema Inc.

September 4, 2017

Project #109489 Evacuation Zone Data Summary

## 1.0 Introduction

As a result of flooding events related to Hurricane Harvey, the Arkema facility located in Crosby, TX suffered a loss of power and failure on refrigeration of manufacturing process. The loss of temperature control resulted in degradation and heating of organic peroxides, with the potential of creating a fire. As a precautionary measure, local authorities established a 1.5-mile radius evacuation zone around the facility.

On September 3, 2017, the Center for Toxicology and Environmental Health, LLC (CTEH®) initiated air monitoring in the community areas within the evacuation zone to support data needs for the evaluation of evacuation zone adequacy by unified command. This submittal summarizes the results of the real-time air monitoring that was conducted by CTEH® personnel from 21:04 on September 3, 2017 to 05:50 on September 4, 2017. A map of the 193 readings is provided in **Attachment A**.

## 2.0 Real-time Air Monitoring

All real-time air monitoring instrumentation was calibrated per the manufacturer's recommendations prior to air monitoring. Handheld, real-time air monitoring was conducted for benzene, and volatile organic compounds (VOCs) using the RAE Systems MultiRAE and UltraRAE. Additionally, combustion byproducts potentially associated with fire smoke, such as particulate matter (PM<sub>2.5</sub>), and sulfur dioxide (SO<sub>2</sub>), were assessed. **Table 1** summarizes the data for all real-time air monitoring readings recorded within a 1.5-mile radius of the Arkema facility in Crosby, TX from 21:04 on September 3, 2017 to 05:50 on September 4, 2017.

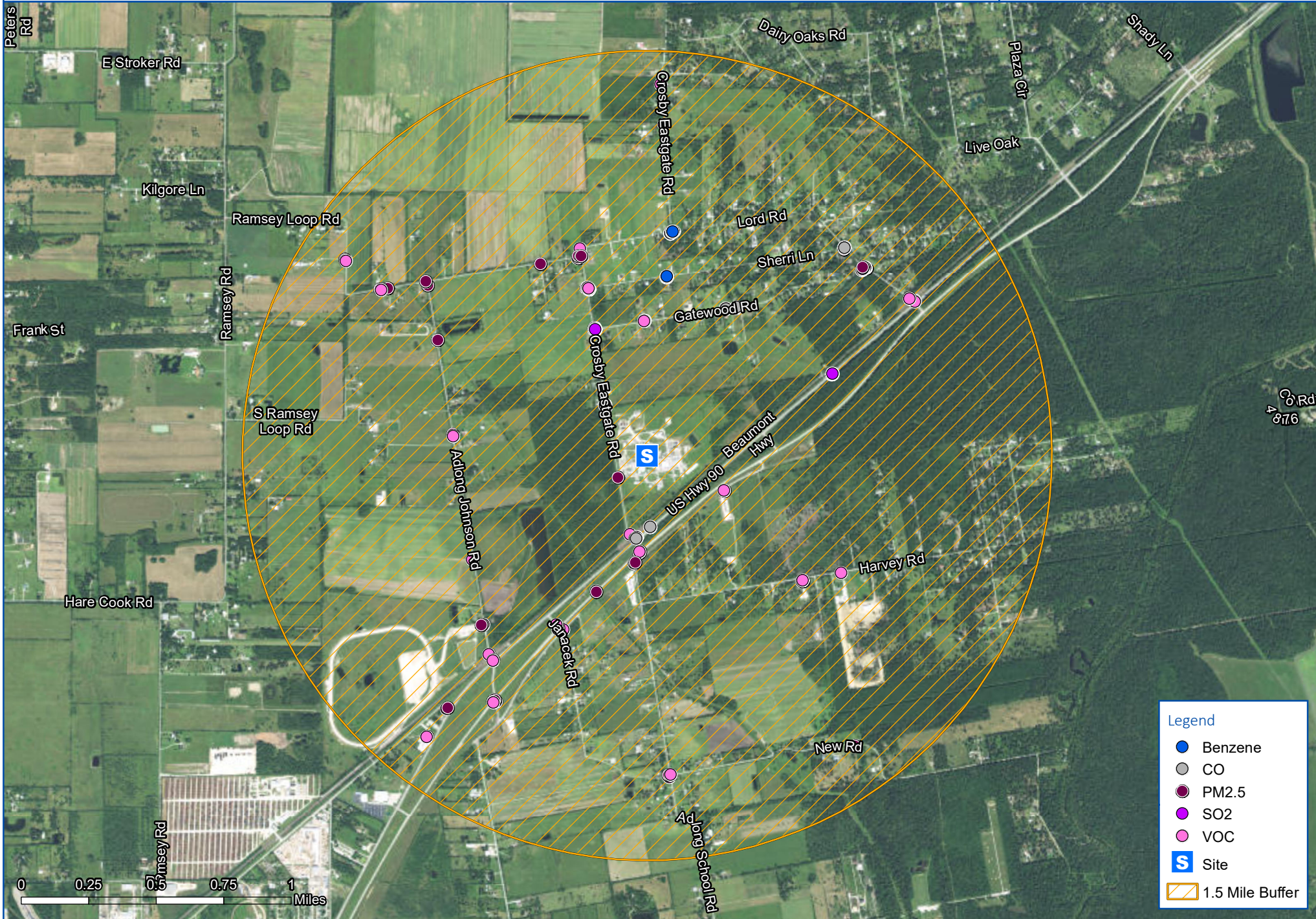
**Table 1 Real-time Handheld Air Monitoring Readings  
21:04 September 3, 2017 – 05:50 September 4, 2017**

Analyte	Instrument	Number of Readings	Number of Detections	Range of Detections*
Benzene	UltraRAE	7	0	< 0.025 ppm
CO	MultiRAE Plus	23	0	< 1.0 ppm
PM <sub>2.5</sub>	AM510	46	46	0.025 - 0.129 mg/m <sup>3</sup>
	Dusttrak	22	22	0.027 - 0.48 mg/m <sup>3</sup>
SO <sub>2</sub>	MultiRAE Plus	23	0	< 0.1 ppm
VOCs	MultiRAE Plus	72	0	< 0.1 ppm

\*If detections were not observed, the instrument detection limit is listed in this column.

# **Attachment A**

## **Handheld Real-time Air Monitoring Locations**



Legend

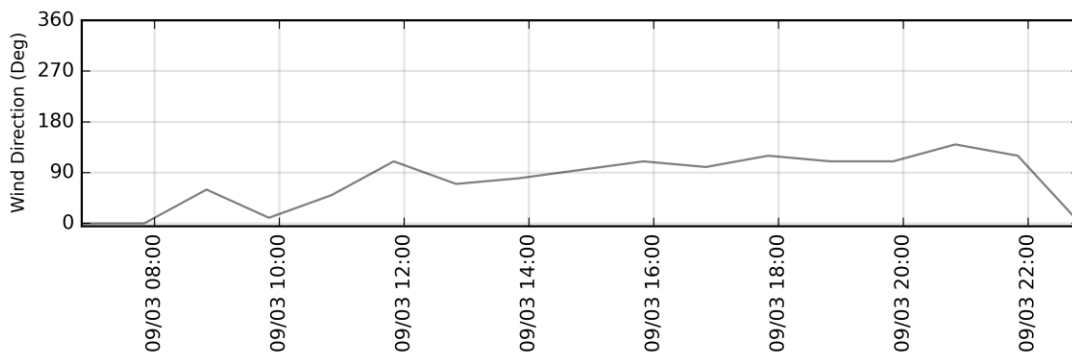
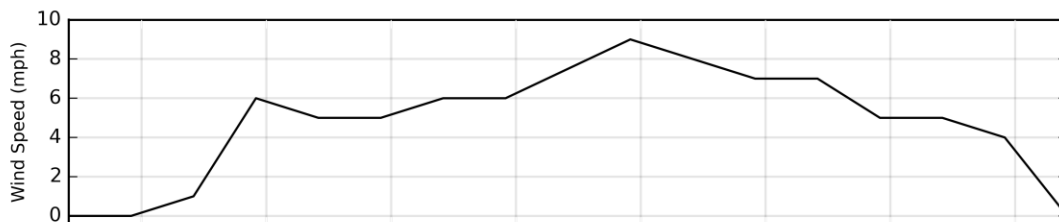
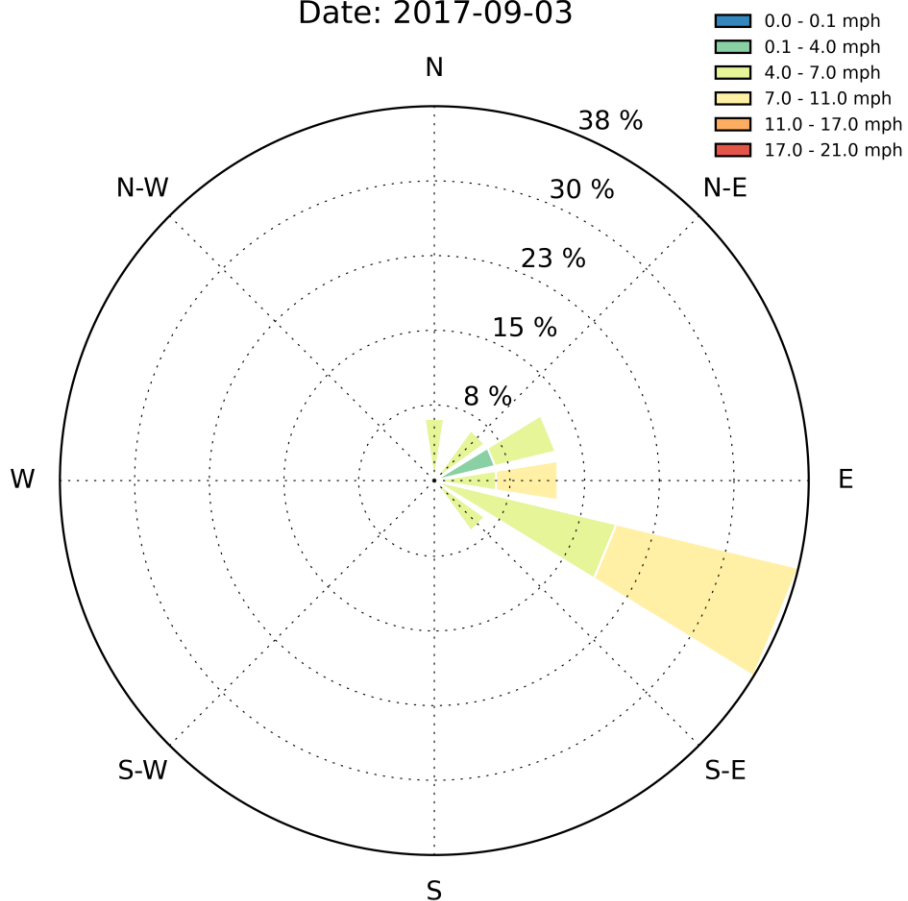
- Benzene
- CO
- PM2.5
- SO2
- VOC
- S** Site
- 1.5 Mile Buffer

# **Attachment B**

## **KHPY Windrose**

**(Highland Park Airport - 12.5 miles SSE of Site)**

Weather Station: KHPY  
Date: 2017-09-03





Weather Station: KHPY  
Date: 2017-09-04

