Health Consultation

Thatcher Chemical Site

DeLand, Volusia County, Florida

EPA Facility ID: FLR000173195

September 10, 2015

Prepared by:
Florida Department of Health
Division of Disease Control and Health Protection
Under Cooperative Agreement with
U. S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Acronyms and Abbreviations

AI	Avian Influenza
ATSDR	Agency for Toxic Substance and Disease Registry
Bechtol	Bechtol Environmental Testing
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
EPA	Environmental Protection Agency
SCTL	Soil Cleanup Target Level
SMCL	Secondary Maximum Contaminant Level
WNV	West Nile Virus

Foreword

The Florida Department of Health (FDOH) evaluates the public health risk of potential hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This is a state-certified report. FDOH prepared this report following the same procedures as ATSDR-approved reports. This health consultation evaluates health risks associated with soil and groundwater from the Thatcher Chemical site. The FDOH evaluates site-related public health issues through the following processes:

Evaluating exposure: FDOH scientists review available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how human exposures might occur. The Florida Department of Environmental Protection (FDEP) provided the data for this assessment.

Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, FDOH scientists next determine whether that exposure could be harmful to human health. We focus on potential health effects for the community as a whole. We base our conclusions and recommendations on current scientific information.

Developing recommendations: FDOH lists its conclusions regarding any potential health threat posed by groundwater and soil. FDOH then offers recommendations for reducing or eliminating human exposure. The role of the FDOH in dealing with hazardous waste sites is primarily advisory. Our public health assessments will typically recommend actions for other agencies including the FDEP. If a health threat is actual or imminent, FDOH will issue a public health advisory warning people of the danger and will work with the regulatory agencies to resolve the problem.

Soliciting community input: The evaluation process is interactive. FDOH starts by soliciting and evaluating information from various government agencies, individuals, or organizations responsible for cleaning up the site, and those living in communities near the site. We share any conclusions about the site with the groups and organizations providing the information, and we ask for feedback from the public.

If you have questions or comments about this report, please write to us at

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Summary

INTRODUCTION	At the Thatcher Chemical site, the Florida Department of Health's top priority is to ensure nearby residents have the best information to safeguard their health. The Thatcher Chemical site is at 245 Hazen Road, DeLand, Florida. On January 23, 2011, a spill of 8,000 gallons of ferrous (iron) sulfate polluted groundwater and soil. A caller reported buried ferric (iron) and aluminum sulfate waste on the site. Thatcher Chemical removed these wastes in December 2013.
CONCLUSION #1	If property owners southwest of Thatcher Chemical install wells and drink the groundwater, then the known levels of iron, sulfate, and pH levels are not expected to harm health or cause aesthetic problems.
BASIS FOR DECISION #1	Groundwater flows from northeast to southwest near this site. A large wooded commercial property with a cell phone tower is currently southwest of the site. In June 2013, groundwater monitoring well tests on this cell phone tower property right-of-way met Secondary Maximum Contaminant Levels (SMCLs) for iron, sulfate, and pH. SMCLs address chemicals that cause taste, odor, or color problems in drinking water and are lower than health-based concentrations.
CONCLUSION #2	On-site workers or nearby residents are not at risk from exposure to recently measured levels of chemicals in soil.
BASIS FOR DECISION #2	Testing of the surface soil in the storm water pond shortly after the 2011 spill did not find chemicals above their residential Soil Cleanup Target Levels (SCTLs). Trespassers or workers are unlikely to have had contact with ferric and aluminum sulfate wastes buried on the site.
CONCLUSION #3	The levels of iron and sulfate measured in 2014 in off-site private drinking water wells met SMCL standards. Therefore, these

	chemicals are not expected to harm health or cause aesthetic problems with taste, odor, and color.
BASIS FOR DECISION #3	Some monitoring wells on the site exceeded SMCLs shortly after the spill. Iron and sulfate levels have come down in subsequent on- and off-site tests. FDOH in Volusia County tested three wells south and southwest of the site and one background well in November 2014. All met the SMCL guidelines for iron and sulfate.
LIMITATIONS OF FINDINGS	All risk assessments, to varying degrees, require the use of assumptions, judgments, and incomplete data. These contribute to the uncertainty of the final risk estimates. Some more important sources of uncertainty in this assessment are environmental sampling and analysis, exposure parameter estimates, use of limited data, and present toxicological knowledge. We may overestimate or underestimate risk because of these uncertainties. This assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the Thatcher Chemical site.
FOR MORE INFORMATION	If you have concerns about your health or the health of your children, you should contact your health care provider. You may also call the FDOH toll-free at 877-798-2772 or Connie Garrett at 850-245-4444 × 2316 and ask for information about the Thatcher Chemical site.

Background and Statement of Issues

The purpose of this health consultation is to assess the public health threat from chemicals in soil and groundwater at the Thatcher Chemical site. The Florida Department of Health (FDOH) initiated this assessment. Thatcher Chemical is at 245 Hazen Road in DeLand, Volusia County, Florida, 32720-3967 (Figures 1 and 2).

Health scientists look at what chemicals are present and in what amounts. They compare those amounts to national guidelines. These guidelines are set below known or suspected levels associated with health effects. FDOH uses guidelines developed to protect children. If chemicals are not present at levels high enough to harm children, they would not likely harm adults.

This assessment considers health concerns of nearby residents and explores possible associations with site-related contaminants. It requires the use of assumptions, judgments, and incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in this assessment err on the side of protecting public health and may overestimate the risk.

We found no verified incidents in which people who live near the site had exposures to contaminants.

Thatcher Chemical from Hazen Road (retention pond in foreground) October 2013, source Google Earth.

Site Description

The 37-acre Thatcher Chemical site is at 245 Hazen Road in DeLand, Volusia County, Florida, 32720-3967 (Figure 1). A railroad track borders the site on the south, Hazen Road and a 30+-acre cell-phone tower property borders the site on the west, a utilities

corridor and Mallory Square subdivision border the site on the north, and an undeveloped portion of the Mallory Square subdivision borders the site on the east (Figure 2). Mallory Square residents north of the site (the nearest residential area) receive municipal water. Older residential areas north, west, and south of the site get their water from private wells.

The main Thatcher Chemical building is on the western half of the property, surrounded by paved parking. The north and west site perimeters and the eastern half of the site are wooded. A railway spur separates the Thatcher Chemical property from the Davies Trucking Property to the south.

Site History

Thatcher Chemical is a subsidiary of the Thatcher Company of Salt Lake City, Utah. The owner built the DeLand plant in 2007; it makes chemicals for the food and water treatment industries.

In January 2011, 8,000 gallons of acidic water (pH 1.8 to 2.2) with 3,000 pounds of dissolved ferrous (iron) sulfate discharged from Thatcher Chemical. A pump failure in the mixing tank allowed the liquid to overflow and the secondary containment system failed because of an open valve. The liquid flowed out of the building into a retention pond on the southwest corner of the site [Bechtol 2011, 2013]. Groundwater testing carried out at the direction of the Florida Department of Environmental Protection (FDEP) shows that the measured levels of iron, pH and sulfate have fallen below their Secondary Maximum Contaminant Levels (SMCLs) since the spill.

At the direction of FDEP, the company's consultants investigated the effects of this discharge. During this investigation, FDEP received an anonymous complaint of waste chemicals buried in the woods behind the plant in 2010 and 2011. In December 2013, the company's consultant excavated and disposed of 800,000 pounds of wastes and soil from seven pits (Figure 3) from the woods behind the plant [Bechtol 2013].

Demographics

FDOH examines demographic and land use data to identify sensitive populations, such as young children, the elderly, and women of childbearing age. Demographics also provide details on population mobility and residential history in a particular area. Approximately 3,400 people live within one mile of the site. Eighty-four percent (84%) are white, 7% are Black, 2% are Asian, and 4% are other. Hispanics are 12% of the total and do not reflect race. Twenty-two percent (22%) are less than 18 years old [EPA 2014].

Land Use

Land bordering the south, west, and southwest of the Thatcher Chemical site is commercial and industrial. Land north and southeast of the site is residential. Land east of the site is an undeveloped part of the Mallory Square subdivision.

Community Health Concerns

In March 2014, FDEP issued Thatcher Company proposed fines of $230,000 for improperly disposing of chemical waste products at this and their other Florida site in Palmetto. News of this fine generated health complaints from nearby residents [WFTV 2014]. One person expressed concerns about asthma, cancer, and any kind of illness. Nearby residents also complained that "toxic matter released in the air was causing things to rust, and that numbers of dead birds are found regularly around the plant" [Beacon 2013].

Discussion

Environmental Data

In February 2011, consultants for Thatcher Chemical collected 20 soil samples at four storm water retention pond locations; four of the 20 samples were surface soil samples (Figures 2 and 4). They analyzed the samples for iron, sulfate and pH. The highest iron concentration (32,500 milligrams/kilogram or mg/kg) was below the FDEP Soil Target Cleanup levels (SCTLs) of 53,000 mg/kg (Table 1) [Water Shed 2011]. There are no ATSDR comparison values, EPA reference doses, or FDEP SCTLs for sulfate or pH in soil.

In October 2011, January 2013, and June 2013, consultants installed and tested nine groundwater monitoring wells, about 30 feet deep [Bechtol 2011, 2013]. While an October 19, 2011 MW-1 test showed iron and sulfate concentrations above their SMCLs, testing in June 2013 showed only three monitoring wells had levels that exceeded their SMCLs for pH and sulfate (Figure 4) [Bechtol 2011, 2013]. We compared the later test results to the 2011 test results. These comparisons show iron above its SMCL moved 50 feet from its source in the retention pond, while sulfate and pH above their SMCLs moved southwest of the property, 30 feet and 100 feet, respectively.

In April 2014, FDOH in Volusia County collected a groundwater sample from a background private well, north of the site. In November 2014, they collected samples from three private drinking water wells in the direction of groundwater flow, southwest of the site (Figure 5). The nearest well was about one-quarter mile to the southwest. The FDEP laboratory analyzed the samples for nitrates, iron, vanadium, aluminum, and sulfate. None of the analytes exceeded primary or secondary drinking water standards (Volusia County unpublished data 2014).

Pathway Analyses

Chemical contamination in the environment can only harm someone's health if he or she contacts those contaminants. If there is no exposure, there can be no associated harm to

health. If exposure does occur, how much of the contaminants someone contacts (concentration), how often the contaminants are contacted (frequency), for how long they are contacted (duration), and the danger of the contaminant (toxicity) all contribute to the risk of harm.

To assess any contaminant's public health importance, we estimate the frequency with which people could have contact with that contaminant. The method for assessing whether people face a health risk is to determine whether a completed exposure pathway connects them to a contaminant source, and whether exposures to that contaminant source are high enough to be of health concern.

The Exposure Pathway

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at contact with the human body. A completed exposure pathway consists of five elements:

1. Source of contamination, such as a hazardous waste site;
2. An environmental medium such as air, water, or soil that can hold or move the contamination;
3. A point where people come into contact with a contaminated medium, such as water at the tap or soil in the yard;
4. An exposure route, such as ingesting (contaminated soil or water) or breathing (contaminated air); and
5. A population, such as people who live near or work on a contaminated waste site.

Generally, ATSDR and FDOH consider three exposure categories:

- Completed exposure pathways—all five elements of a pathway are present;
- Potential exposure pathways—one or more of the elements might not be present, but information is insufficient to eliminate or exclude the element; and
- Eliminated exposure pathways—at least one element is not present and will not likely be present.

Exposure pathways evaluate specific ways in which people were, are, or might be exposed to environmental contamination in the past, present, and future.

Completed exposure pathways

FDOH did not identify any completed exposure pathways.

Potential exposure pathways

FDOH evaluated future potential use of potable water from wells that people might install in the direction of groundwater flow from the site (Table 3). A 2011 spill of ferrous sulfate with a low pH (acidic water) from Thatcher Chemical is the source of contamination. Groundwater beneath the retention pond and southwest of this pond is the

environmental medium. Water from private wells in future residences and businesses are potential points of exposure. Drinking (ingestion) is a potential route of exposure. New private well users are the potentially exposed population.

Eliminated exposure pathways

In December 2013, Thatcher's consultant removed buried wastes and tested the sides and bottoms of the pits to verify the removal was complete [Bechtol 2013]. Surface soil testing in the retention pond did not find iron above its residential SCTL [Water Shed 2011]. Therefore, there are no exposure pathways for workers or trespassers (Table 3).

Public Health Implications

This assessment requires the use of assumptions and judgments, and relies on incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in the assessment of the site's impact on public health err on the side of protecting public health and may overestimate the risk (Appendix E).

FDOH provides site-specific public health recommendations based on toxicological literature, levels of environmental contaminants, evaluation of potential exposure pathways, duration of exposure, and characteristics of the exposed population. Whether a person will be harmed depends on the type/amount of contaminant, how they are exposed, how long they are exposed, how much contaminant is absorbed, genetics, and individual lifestyles.

Identifying Parameters of Concern

ATSDR has not set health-based comparison values nor has EPA set primary drinking water standard maximum contaminant levels (MCLs) for iron, sulfate, or pH. Instead, FDOH compared levels found in the groundwater at Thatcher Chemical with EPA guidelines for odor, taste, or color, known as Secondary Maximum Contaminant Levels (SMCLs). EPA does not enforce SMCLs; instead, they are guidelines to assist public water systems in managing their drinking water. If these contaminants are present in drinking water at levels above these standards, the contaminants may cause the water to appear cloudy or colored, or to taste or smell bad. This may cause a great number of people to stop using water from their public water system even though the water is safe to drink [EPA 2013].

Comparing the highest measured concentrations in groundwater to EPA SMCLs, FDOH selected iron, sulfate, and pH as parameters of concern.

Iron, pH, and sulfate affect the taste of water. Iron causes water to have a rusty color, sediment, a metallic taste, and it leaves a reddish or orange staining on household fixtures. Low pH causes a bitter metallic taste and corrosion. Sulfate gives water a salty taste and can cause diarrhea.

Iron

Iron is a naturally occurring metal. It is not usually hazardous to health, but is considered a secondary or aesthetic contaminant. Essential for good health, iron helps transport oxygen in the blood. Most tap water in the United States supplies approximately 5 percent of the dietary requirement for iron [IDPH 2010].

Iron is mainly present in water in two forms: either the soluble ferrous iron or the insoluble ferric iron. Water containing ferrous iron is clear and colorless because the iron is completely dissolved. When exposed to air in the pressure tank or atmosphere, water with 300 µg/L iron (the SMCL level) will turn water a reddish-brown color and a reddish brown substance begins to form. This sediment is the oxidized or ferric form of iron (rust) that will not dissolve in water [IDPH 2010].

At concentrations above 1,000 ug/L, iron gives water a noticeable taste. Long-term ingestion of water with more than 10,000 ug/L may increase iron levels in the body (hemosiderosis) leading to abnormal glucose metabolism and heart disease. It is unlikely however, that anyone would drink water with 10,000 ug/L iron due to its strong taste [Freeman 1987] and FDEP requires corrective action when iron is above 4,200 ug/L.

In October 2011, the concentration of iron (21,800 ug/L) in the groundwater under the Thatcher Chemical retention pond was 72 times higher than the SMCL (300 ug/L). By June 2013, however, the highest levels of iron (135 ug/L) in the monitoring wells on and off the site were below the SMCL.

pH

The pH level of water reflects how acidic it is. In modern chemistry pH stands for "the decimal logarithm of" the amount of hydrogen found in a substance (in this case, water). pH is measured on a scale that runs from 0 to 14. Seven is neutral, meaning there is a balance between acidity and alkalinity. A measurement below 7 means acid is present and a measurement above 7 is basic (or alkaline) [Wellcare® 2007].

The EPA recommends that public water systems maintain pH levels of between 6.5 and 8.5, which also serves as a good guide for individual well owners. The groundwater associated with the Thatcher spill had a low pH. Water with a low pH can be acidic, naturally soft and corrosive. Acidic water can leach metals from pipes and fixtures, such as copper, lead and zinc. It can also damage metal pipes and cause aesthetic problems, such as a metallic or sour taste, laundry staining or blue-green stains in sinks and drains. Water with a low pH may contain metals in addition to the before-mentioned copper, lead and zinc [Wellcare® 2007].

Ingestion of water with a broad range of pH values is not a direct human health threat. Low pH, however, increases the solubility of metals. High pH decreases the efficacy of chlorine disinfection and increases the formation of trihalomethanes [Freeman 1987].

In June 2012, the lowest pH in groundwater under Thatcher (3.76) was outside of the SMCL range (6.5 to 8.5). By June 2013, however, the lowest pH in the groundwater (6.01) was only slightly outside the SMCL range.

Sulfate

Sulfate is a chemical made of sulfur and oxygen. Sulfur odor is produced when a non-harmful sulfur-reducing bacteria digests a small amount of the sulfate mineral. The sulfate mineral is commonly found in well water but when found in concentrations greater than 500 mg/L (twice the SMCL); it can cause a bitter taste and a laxative effect (diarrhea), which in some individuals can lead to health problems including dehydration [Wellcare® 2007].

In October 2011, the highest sulfate concentration in groundwater under the Thatcher Chemical site (909,000 ug/L) was 3.6 times higher than the SMCL (250,000 ug/L). By June 2013, however, the highest sulfate concentration (205,000) was less than the SMCL.

Mixtures

FDOH did not address mixtures in this health consultation. Iron, sulfate and pH do not have apparent toxicity at low levels of exposure and ATSDR authors do not consider them in ATSDR's interaction profiles.

Child Health Considerations

In communities faced with air, water, soil, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults might be for certain kinds of exposure to hazardous substances. Children play outdoors and sometime engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults are; this means they breathe dust, soil, and vapors closer to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body system of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health.

In general, premature babies and newborns with immature/developing organs are more vulnerable to toxic substances than are healthy adults. In addition, if the metabolic products are more toxic than the parent compound, children and adolescents (with higher metabolic rates) are more vulnerable than healthy adults are [ATSDR 2005].

If children or older adults drink water with elevated levels of sulfate, they could be more susceptible to dehydration than adults and older adolescents due to sulfate's laxative effects [EPA 2012]. Although Thatcher's consultant did not take confirmation samples

once tests showed levels below SMCLs, no private wells are in the impacted area now or in the past. Additionally, it appears significant attenuation of sulfate, iron, and pH levels has occurred in soil and groundwater.

Community Health Concerns Evaluation

1. Neighbors of the plant complained to reporters that "toxic matter released in the air was causing things to rust, and that numbers of dead birds are found regularly around the plant."

> There are no air monitoring data at this site for FDOH to evaluate the health risk from air pollution.
>
> Mosquito-borne diseases identified in Florida in the last few years have proved deadly, especially to large birds like crows. The Florida Fish and Wildlife Conservation Commission (FWC) is working with the FDOH on a wild bird mortality database: http://legacy.myfwc.com/bird/default.asp. FWC initiated this project to support surveillance for bird die-offs and aids in monitoring for Avian Influenza (AI) and West Nile Virus (WNV). The Centers for Disease Control and Prevention (CDC) has additional information concerning WNV. Please see this web page for links and information concerning Avian Influenza.
>
> FWC and FDOH are also interested in monitoring bird electrocutions from power lines and poles so that they can contact local utilities to repair faulty facilities.

2. One resident expressed concern about asthma, cancer, and any kind of illness.

> Studies have not related iron and sulfate exposures to asthma or cancer. Iron helps transport oxygen in the blood and is essential for good health. However, sulfate concentrations greater than 500 mg/L (twice the SMCL); can cause a bitter taste and a laxative effect (diarrhea), which in some individuals can lead to health problems including dehydration [IDPH 2010, Wellcare® 2007].

Conclusions

1. If property owners southwest of Thatcher Chemical were to install wells and drink the groundwater, then the measured levels of iron, sulfate, and pH are not expected to harm health or cause aesthetic problems. Groundwater flows from the site to the southwest. A large wooded commercial property with a cell phone tower is the property closest to the site to the southwest. In June 2013, groundwater monitoring well tests on the property

right-of-way found iron, sulfate, and pH acceptable for drinking and below levels causing taste, odor, or color problems.

2. On-site workers or nearby residents are not at risk from exposure to recently measured levels of chemicals in soil. Testing of the surface soil in the storm water pond shortly after the 2011 spill did not find chemicals above their residential SCTLs. Trespassers or workers are unlikely to have had contact with ferric and aluminum sulfate wastes buried on the site that were removed.

3. The levels of iron and sulfate measured in 2014 in off-site private drinking water wells met SMCL standards. Therefore, these chemicals are not expected to harm health or cause aesthetic problems with taste, odor, and color. Some monitoring wells on the site exceeded SMCLs shortly after the spill. Iron and sulfate levels have come down in subsequent on- and off-site tests. In 2014, FDOH in Volusia County tested three wells south and southwest of the site and one background well. All met the SMCL guidelines for iron and sulfate.

Public Health Action Plan

Actions Undertaken

In April and November 2014, the FDOH in Volusia County tested nearby private drinking water wells, following a request from FDEP, but did not find any contamination related to the Thatcher Chemical site.

Actions Underway

The FDOH informed nearby residents of our findings about the Thatcher Chemical site and solicited public comment on a draft report. FDOH received no comments or health concerns to address in this final version.

Actions Planned

FDOH will consider review of new data when requested.

Report Preparation

The FDOH prepared this Health Consultation for the Thatcher Chemical site with funding from FDOH's cooperative agreement with ATSDR, U.S. Department of Health and Human Services. *The findings and conclusions are those of the author(s) and do not necessarily represent the views of the Agency for Toxic Substances and Disease Registry or the U.S. Department of Health and Human Services. This document has not been revised or edited to conform to agency standards.* While ATSDR did not review and clear this document, FDOH prepared it in accordance with the approved agency methods, policies, and procedures existing at the time of its publication and FDOH completed the editorial review.

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Appendices

Tables and Figures

Table 1. Thatcher Chemical Surface Soil Parameters of Concern

Parameter	Concentration Range	Screening Guideline*	Source of Screening Guideline	# Above Screening Guideline/Total #
Iron	7,100–32,500 (mg/kg)	53,000 (mg/kg)	FDEP residential STCL	0/4
Sulfate	129–2,880 (mg/kg)	none	none	-
pH	3.1–7.8 (standard units)	none	none	-

SCTL –FDEP's Soil Target Cleanup Levels for residential land use
mg/kg = milligrams per kilogram
* We use screening guidelines to select chemicals for further scrutiny, not to the judge the risk of illness.
Source of data: [Water Shed 2011]

Table 2. Parameters of Concern in Thatcher Chemical Monitoring Wells (about 30 feet deep)

Parameter of Concern	Date Sampled	Concentration Range (µg/L)	Screening Guidelines * (µg/L)	Source of Screening Guideline	# Above Screening Guideline/ Total #
Iron	10/19/11	21,800	300	EPA/FDEP SMCL	1/1
	6/20/12	210–2,090	300	EPA/FDEP SMCL	1/4
	1/17/13	194–1,250	300	EPA/FDEP SMCL	1/2
	6/10/13	75.3–135	300	EPA/FDEP SMCL	0/2
Sulfate	10/19/11	909,000	250,000	EPA/FDEP SMCL	1/1
	6/20/12	42,000–306,000	250,000	EPA/FDEP SMCL	3/4
	1/17/13	30,000–419,000	250,000	EPA/FDEP SMCL	3/9
	6/10/13	128,000–205,000	250,000	EPA/FDEP SMCL	0/4
pH	10/19/11	NA	6.5–8.5**	EPA/FDEP SMCL	–
	6/20/12	3.76–4.24 **	6.5–8.5**	EPA/FDEP SMCL	4/4
	1/17/13	4.82–6.71 **	6.5–8.5**	EPA/FDEP SMCL	8/9
	6/10/13	6.01–6.36 **	6.5–8.5**	EPA/FDEP SMCL	2/2

µg/L = micrograms per liter
***** We use screening guidelines to select chemicals for further scrutiny, not to the judge the risk of illness.
** Standard units
SMCL = Secondary Maximum Concentration Level.
NA = Not Analyzed.
Sources of data: [Bechtol 2011, 2013]

Table 3. Parameters of Concern in Private Well Samples near Thatcher Chemical

Well Number	Iron	Units	SMCL*	Sulfate	Units	SMCL*
AA08335 (background)	240	µg/L	300 µg/L	16	mg/L	250 mg/L
AA08330	290	µg/L	300 µg/L	37	mg/L	250 mg/L
AA08329	30 U	µg/L	300 µg/L	33	mg/L	250 mg/L
AA08328	30 U	µg/L	300 µg/L	31	mg/L	250 mg/L

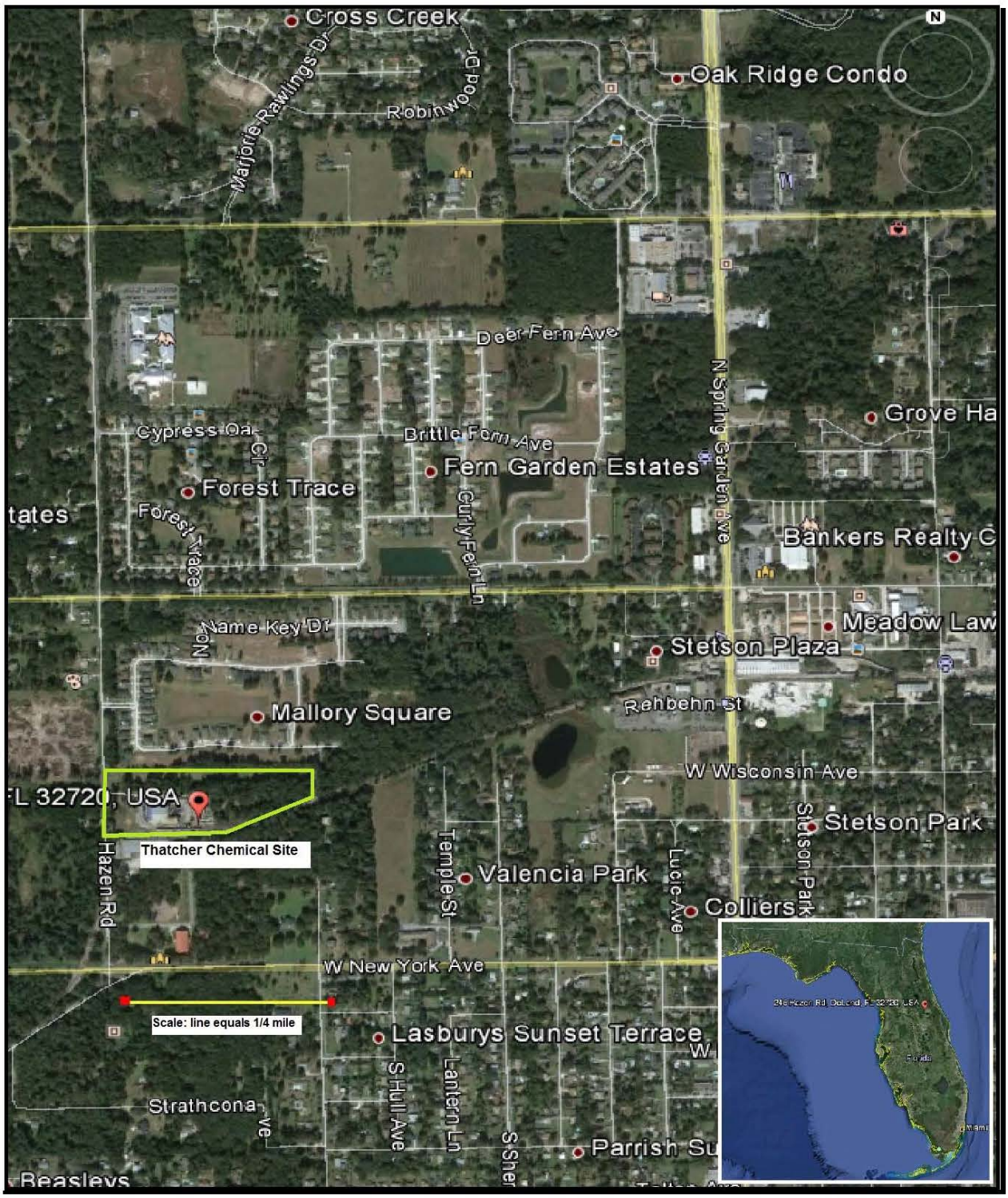
µg/L = micrograms per liter
mg/L = milligrams per liter
U = below detection limits. The value is the detection limit.
* We use screening guidelines to select chemicals for further scrutiny, not to the judge the risk of illness.
** Standard units
SMCL = Secondary Maximum Concentration Level.
Source of data: [FDEP 2014] Laboratory Test results

Table 4. *Human Exposure Pathways at the Thatcher Chemical Site*

Potential Pathway Name	Potential Exposure Pathway Elements					Time
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population	
Future private well use	Liquid ferrous sulfate spill at Thatcher Chemical	Groundwater	Future taps and spigots southwest of Thatcher Chemical	Ingestion (drinking)	Potential new users of groundwater southwest of the site	Future

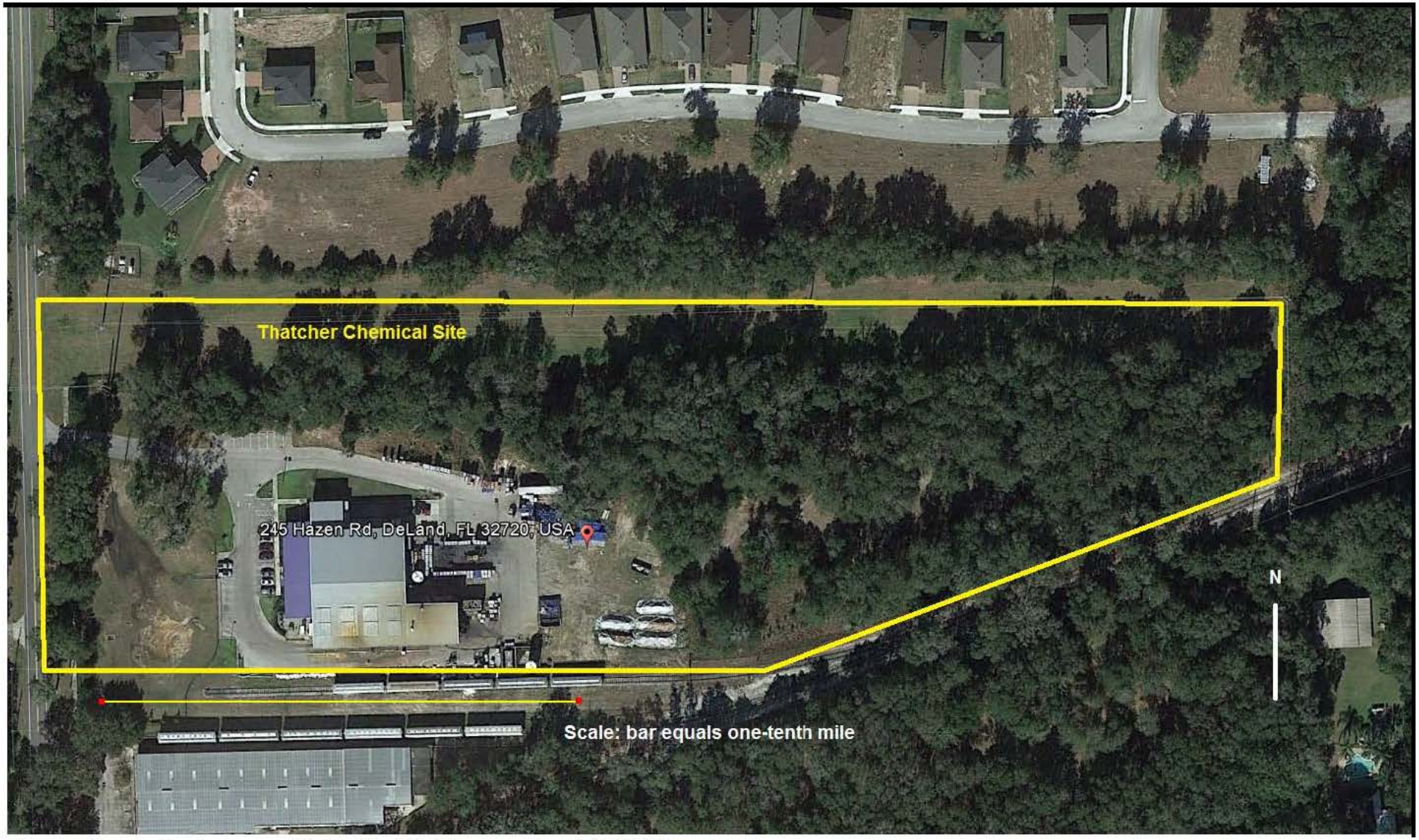
Eliminated Pathway Name	Eliminated Exposure Pathway Elements					Time
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population	
Waste buried on the site	Buried ferric and aluminum sulfate waste from Thatcher Chemical	Buried wastes	On-site	Incidental ingestion	None	Past

Figure 1. Location of the Thatcher Chemical Site in Volusia County



Source: Google Earth, accessed May 30, 2014, imagery date 1/15/2014

Figure 2. Thatcher Chemical 2014 Aerial Photograph



Source: Google Earth, accessed May 30, 2014, imagery date 1/15/2014

Figure 3. Locations of Buried Wastes Removed in December 2013

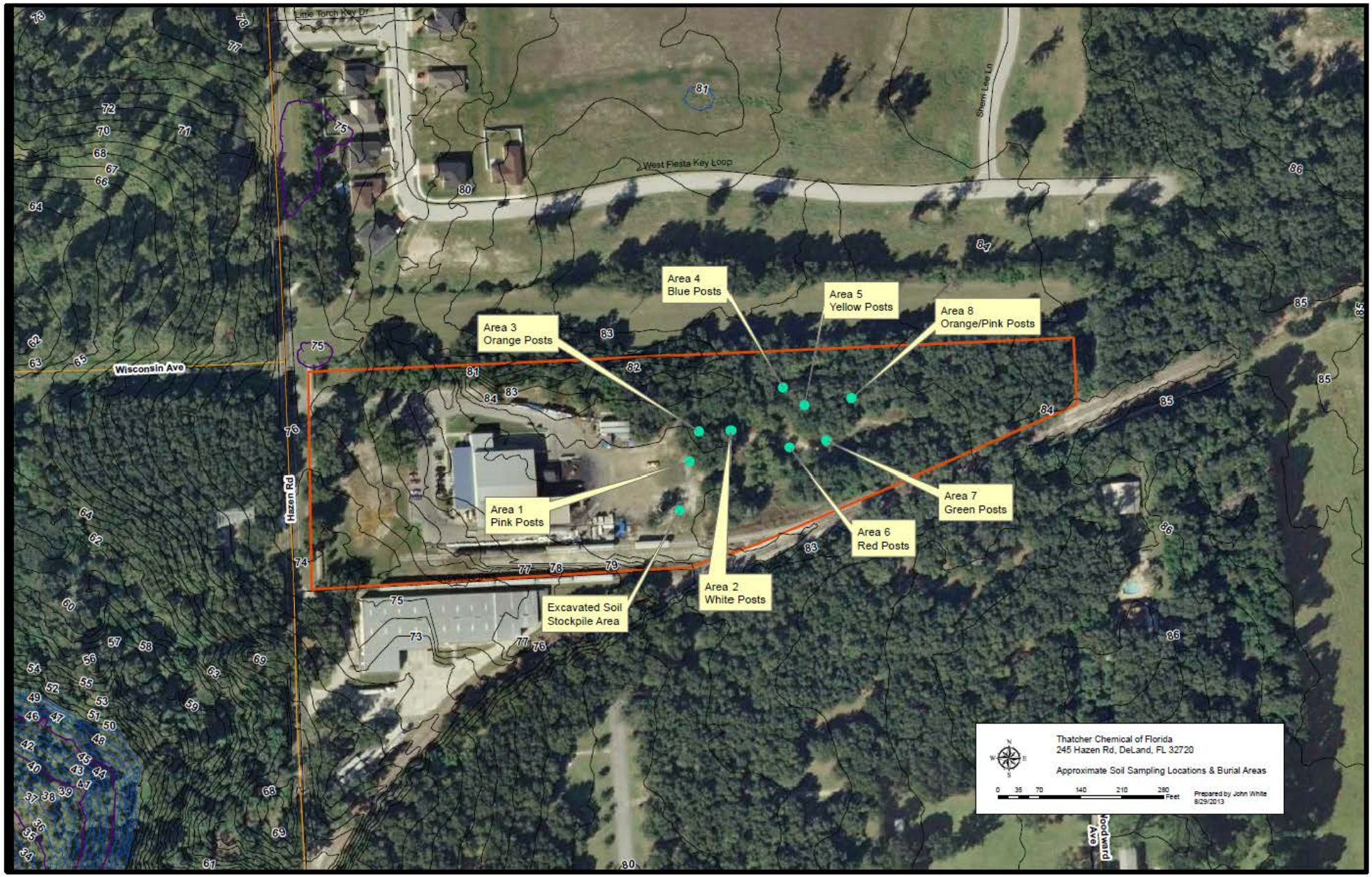


Figure 4. Thatcher Chemical Groundwater pH and Sulfate Values, 6/10/13 [Bechtol 2013].

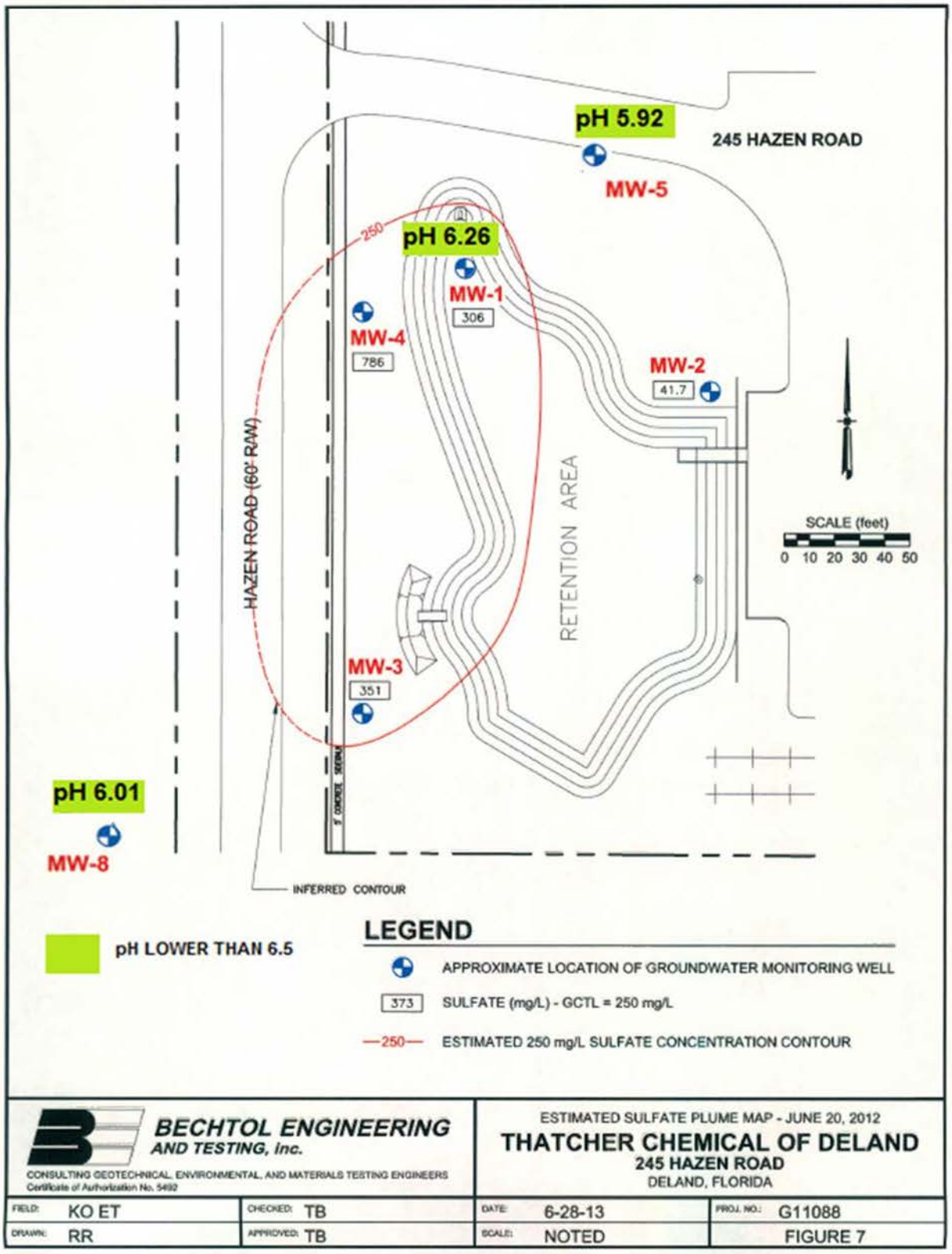
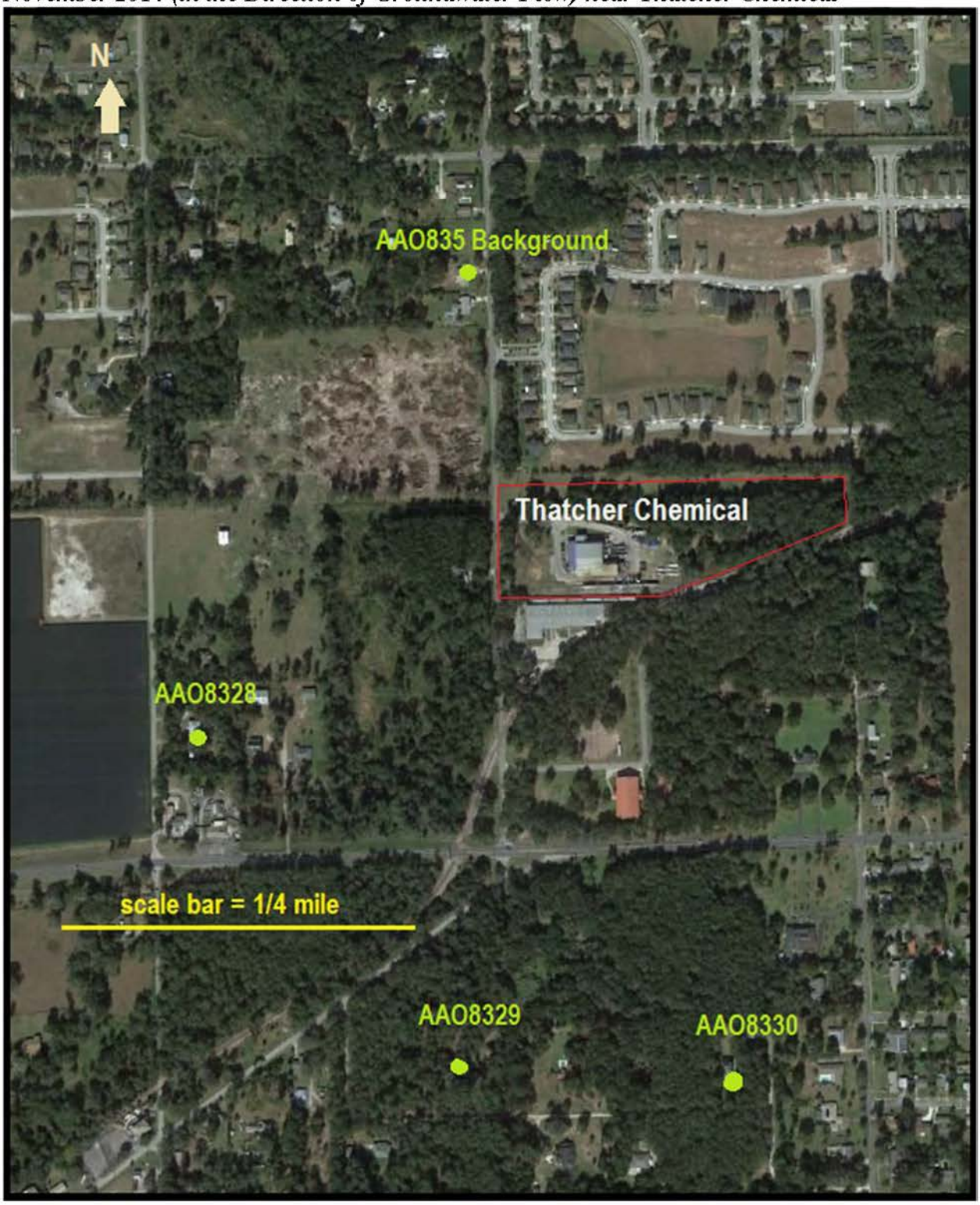


Figure 5. Locations of Private Potable Wells Sampled in April 2014 (Background) and November 2014 (in the Direction of Groundwater Flow) near Thatcher Chemical



Google Earth. Imagery date 1/15/2014

Glossary

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Completed exposure pathway [see **exposure pathway**].

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA
United States Environmental Protection Agency.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching), and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with **surface water**].

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Ingestion
The act of swallowing something through eating, drinking, or putting soiled objects like toys in their mouths. A hazardous substance can enter the body this way [see **route of exposure**].

mg/kg
Milligram per kilogram.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action
A list of steps to protect public health.

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Toxicology
The study of the harmful effects of substances on humans or animals.