



The purpose of a Hazardous Commodity Flow Analysis

The purpose of a hazardous commodity flow analysis is to examine chemical transportation via local transportation modes for the purpose of identifying and quantifying hazardous substances moved along a specific transportation route, through a geographical area or past a given point. The result of a hazardous commodity flow analysis is a clearer picture of the potential threat posed by chemical transportation and guidance that will aid in planning, preparedness and response efforts. Such a study should:

- Identify commodities transported through a geographical area
- Identify hazardous commodity routes
- Determine unique transportation containers
- Assess the potential impact of hazardous commodity releases, should they occur, along studied routes

- Provide guidance to emergency responders and managers relative to hazardous commodity transportation emergencies in terms of
 - Preventative measures
 - Preparedness measures
 - Training efforts
 - Specialized equipment needs
- Identify potential chemical “targets of opportunity” that could be readily weaponized and utilized as chemical weapons by terrorists

The intent of the Johnson County Hazardous Commodity Flow Analysis-Pipeline and Rail Transportation

The Johnson County Hazardous Commodity Flow Analysis is an examination of hazardous material transportation through Johnson County via pipeline and rail routes. The specific transportation routes or carriers that have been examined as a part of this study are as follows:

Railroad

Cedar Rapids and Iowa City

Iowa Interstate

Pipeline

Liquid

ONEOK

AMOCO

Enterprise

Kinder Morgan

Magellan

Gas

Mid American

ONEOK

Northern Border

The Significance of Various Transportation Modes



Each mode of transportation utilized for the conveyance of hazardous substances poses a unique challenge to the emergency management and response community. Some of the considerations peculiar to specific transportation modes are as follows:

Railroad: Rail transportation-related releases of hazardous materials are frequently the result of factors such as:

- track deterioration
- broken switches
- broken trackage and separating track joints
- deterioration of track beds
- broken wheels
- vandalism
- equipment failures
- human error and
- other causes.

Where highway transportation travels on routes maintained by the federal and various levels of government, railroad right-of-ways are privately owned and privately maintained. The tremendous cost of maintenance can contribute to accident frequency.

The volume of hazardous materials that could potentially be involved in a release is significant. Boxcars may contain 200,000 pounds of a hazardous substance. Liquid rail tank car capacity ranges from 6,000 to 32,000 gallons and liquefied gas tank car volumes can exceed 40,000 gallons-an amount that can quickly exceed the capabilities and resources of a community. To the positive, the railroads in general have a safety record that reflects diligence and by virtue of the volumes transported in a single container, handling of these commodities kept to a minimum. Handling/transfer operations account for a significant percentage of chemical release causes.

Concerns Related to Homeland Security

The significant volume held in a single container coupled with the sometimes extremely hazardous commodities transported and the difficulties associated with maintaining security in remote areas make rail transportation of hazardous materials a concern for homeland security professionals. A past study conducted by EHS Resource Group revealed the isolation of poisonous gas and inhalation hazard rail cars to remote sidings at the edge of a community. For the greatest portion of the year, the area was somewhat safely removed from dense population concentrations. However, an open air venue within two blocks of the sidings brought nearly 100,000 people daily for ten days of the

summer. The prevailing summer winds, the proximity of the rail cars and the lack of protective sheltering-in-place options for the venue are a significant concern. For homeland security purposes, EHS Resource Group recommends plume modeling be conducted for gaseous hazardous commodities when certain areas of a classification yard are utilized for these commodities on an regular basis. Local community responders and managers should have input on the location of such areas if they are determined to exist.

Rail related chemical emergencies can be difficult and extremely challenging for a myriad of reasons. Emergency responders often are unfamiliar with even the most basic of rail operations and practices, and yet are frequently first on the scene of an emergency. Community responders and managers do not fully understand the jurisdiction of rail personnel and it is common for jurisdictional tensions to impair emergency response. Direct communication in a timely manner with rail personnel is typically non-existent and community contact, familiarity and trust are not as easily forged as with a fixed facility.

This makes efforts to form supportive emergency response relationships and identify resources that can be called upon to assist in these events extremely critical. The resources sufficient to control and contain a release of this magnitude may in fact already exist in a community but must be located and timely access procedures established. Rail carriers may possess their own in-house spill response personnel, but may not have a sufficient number in a single location to mount a response and require hot zone assistance from local emergency responders. They may have an entire OSHA HAZWOPER-

qualified HAZ MAT Technician level team available or have an emergency response contractor on retainer.

There a number of steps that can facilitate an effective emergency response in a timely manner while avoiding the inter-agency minefield, these include:

- Establishing clear and concise notification procedures and insist rail personnel keep them current
- Clarify jurisdiction on railroad property
- Clarify emergency response roles, expectations and capabilities
- Anticipate a lengthy response with a relatively greater potential for public impacts
- Plan for lengthy responder rehabilitation operations
- Develop plans for a unified command approach to these incidents and practice it with exercises that will tax this arrangement to ensure they are realistic and fully functional
- Due to the remote location of most trackage, access for emergency responders and the availability of sufficient water supplies necessary for fire fighting operations would prove a significant obstacle to successful emergency management.
- Emergency response agencies should be familiar with the proper methods to halt rail traffic. They should be able to conduct safe emergency operations on railroad property and be familiar with braking cars, signaling methods utilized by the railroads to prohibit all traffic on a

given track and the need to post rail traffic observers during operations. Emergency responders should also be aware when trackage is utilized by more than one railroad so that complete notification can be made.

- The purchase of a Midland kit for use by the Iowa City Fire Department Hazardous Materials Team serving the area to handle releases from liquefied gas tank cars containing such commodities as anhydrous ammonia and propane
- Identification of population centers, vulnerable populations, high value property, sensitive environmental locations and critical systems and the steps necessary to insure protection
- Familiarity with the techniques to control car movement ranging from methods for contacting yardmasters and setting breaks to visually indicating closed lines
- Members of the Iowa City Fire Department Hazardous Materials Team should attend the Association of American Railroads Transportation Test Center in Pueblo, Colorado in increasing numbers to become comfortable with rail operations and rail car release management
- Points of access for rail yards should be identified as well as locations for meeting railroad personnel during emergency operations
- Water shuttle operations for remote rail fire fighting should be preplanned
- The estimated time of arrival for railroad resources necessary to contain or control product or move rail cars should be determined

- HAZWOPER training levels of private industry emergency responders should be clearly understood by public emergency responders ultimately responsible for incident management
- Remote sites where leaking or damaged hazardous cargoes may be relocated away from sensitive exposures until managed or repaired should be identified
- The equipment and facilities necessary for handling intermodal containers should be identified and 24 hour contacts established
- Specialized equipment that may help local emergency responders manage rail incidents should be obtained and distributed. Items such as wheel chocks, flares and other signaling devices should be included in emergency equipment inventories.

Pipeline

Pipeline accidents have the potential to release the greatest volume of hazardous substances of any of the modes extant in Johnson County. By design, large volume pipelines conveying hazardous substances are located in remote areas where they are least likely to experience disruptions and impact population centers should an accident occur. The great distance between valves and pumping stations along pipelines however, make the release of potentially tens of thousands of gallons or huge volumes of gases a

likelihood should a pipeline breach occur. Emergency responders should anticipate playing a role in the containment of a large liquid volume or responding to a substantial airborne release of gas that may migrate toward and impact people, property, the environment or critical systems. An awareness of pipeline locations and the commodities they carry should be encouraged among Johnson County emergency responders, and emergency notification procedures for pipeline operators clearly communicated. Timely notification of pipeline accidents is a key to minimizing the product lost and potential impact. The emergency response capabilities of pipeline operators should be determined in order to identify sources of assistance, equipment and the materiel they may be able to supply. Any community awareness efforts to familiarize construction workers, utility contractors and farmers with pipeline locations may help prevent pipeline accidents. By far, the greatest volume of hazardous material conveyed via pipeline transportation in Johnson County is natural gas.

Pipeline information for the study was supplied by the United States Department of Transportation Pipeline and Hazardous Materials Safety Administration's National Pipeline Mapping System. This mapping system identifies pipeline routes, operator and in general terms, the commodity transported. The routes are provided in the following section, along with operator and commodity information. Vulnerable zones (identified as one-half mile in the 2008 DOT Emergency Response Guidebook) for natural gas and LP pipeline releases and approximately .2 miles for flammable liquid fuels follow the pipeline data. Because of the tremendous volume of hazardous substances conveyed via pipeline, and the likelihood that product would continue to leak from a damaged pipeline

for some time (owing to the distance between control valves) following discovery, pipeline accidents have the potential for releasing the largest volumes of hazardous substances of any transportation mode studied.

The unique nature of pipeline transportation requires pre-emergency planning and preparation for successful management. In light of the tremendous volume of hazardous substances conveyed through Johnson County via pipeline, the following recommendations are made:

- emergency responders should be made aware of the location of the various pipelines in Johnson County and the commodities they transport
- the emergency response capabilities and response time of pipeline operators should be ascertained and noted in emergency response plans
- an estimate of the volume of product that will continue to be released following notification of pipeline operators should be obtained for emergency planning purposes
- access points for pipeline routes should be identified
- water shuttle operations capable of transporting fire fighting water to remote locations should be planned
- the necessary equipment and materiel for containing large volumes of released liquid should be located and 24 hour contacts established
- emergency notification procedures for pipeline operators should be established and estimated time of arrival on scene for private responders determined

- vulnerable exposures such as population centers, sensitive environmental areas, critical systems and high value property in close proximity to pipelines should be identified and plans made to insure protection in the event of a release



Transportation Data-Rail

Cedar Rapids and Iowa City

(CRANDIC) and Iowa

Interstate Railroad

shipments

When the commodity

transported is a gas or liquid,

the volume transported is

fairly easy to quantify since the tank cars used to convey these substances have a range of capacities and an average capacity-which was used to calculate vulnerable zones.

Commodities in the solid state or shipped in intermodal containers are nearly impossible to quantify since shipment size and weight are not available, the percentage of hazardous ingredients in formulations is unknown and due to the number of mixed loads where the hazardous commodity may constitute only a portion of the total car volume. With the exception of explosive solids, risk assessment typically focuses on the liquid and gas volumes since hazardous substances in these states are the likeliest to migrate and impact surrounding areas.

Since precise volume data is not supplied by the railroad, an exact annual quantification is not possible. However, vulnerable zone calculation is, and those calculations are included in the following pages, along with the number of carloads of various hazardous commodities as reported by the Iowa Interstate and Cedar Rapids and Iowa City railroads.

Transportation Vulnerable Zones

Utilizing CAMEO/ALOHA/MARPLOT software developed by the National Oceanic and Atmospheric Administration, vulnerable zones along rail transportation routes were identified. CAMEO stands for "computer-aided management of emergency operations". It is chemical emergency management software that includes a chemical release plume modeling (ALOHA) and mapping (MARPLOT) function. The United States Census Bureau's Landview maps utilized with MARPLOT include rail routes. The CAMEO program allows site, meteorological and chemical specific information to be entered into the screening and scenario portions of the software where vulnerable zones surrounding a point of chemical release or a route can be identified on census map segments. This function is an extremely useful planning and emergency response tool, giving a community an approximate idea of the geographical area potentially impacted as a result of a chemical release. In order to arrive at a vulnerable zone, some assumptions must be made regarding the type of release and meteorological conditions. The federal Environmental Protection Agency (EPA) has developed worst case scenario recommendations for this planning process. EPA's recommendations for credible worst case assumptions include a total release of the contents of the largest single or manifolded container within a ten-minute time period into a totally stable (class F) atmosphere. This tends to result in unlikely vulnerable zones of such massive proportions, that emergency planners have a difficult time identifying where to begin the planning process. It is possible with CAMEO to adjust worst case assumptions to reflect more likely or more typical conditions. The assumptions made upon which vulnerable zones are based were modified to reflect more likely atmospheric conditions. In lieu of assuming a stable

atmosphere, an average Iowa wind speed of twelve miles per hour and a stability class of C were utilized and it was assumed a release occurred in an urban area. Other EPA credible worst case assumptions, specifically the total release time period were retained and utilized in the formula. A vulnerable zone is identified for planning purposes as an area where it may be anticipated that airborne concentrations of a released hazardous substance may reach one-tenth of the concentration considered to be immediately dangerous to life and health (IDLH). An IDLH atmosphere is one that will kill or incapacitate within a 30-minute period of time. It is recommended by EPA that the actual IDLH not be utilized for planning purposes, as it does not accurately reflect the actual time of exposure for individuals who may be in the area of a release. Following are vulnerable zones and scenario assumptions for each of the studied routes in Johnson County.

For vulnerable zones along pipeline routes, information regarding the physical state and commodity transferred was obtained from the USDOT's Pipeline and Hazardous Materials Safety Administration's National Pipeline Mapping System. Vulnerable zones were developed using the recommended isolation distance recommended by the 2008 USDOT Emergency Response Guidebook.

Vulnerable zones for a worst-case ammonia release from a pressurized rail tank car are included for both railroad routes. Both Iowa Interstate Railroad and CRANDIC report they transport the commodity. A pressurized rail car carrying ammonia would contain

approximately 33,800 gallons ($\times 6 = 169,338$ pounds) and would result in a 1.7 mile vulnerable zone.

Factoring Month of the Year into Release Planning

During winter months incoming solar radiation lessens. This usually allows an airborne release of a hazardous material to remain "intact" and concentrated over a greater distance. Incoming radiation strikes the earth's surface during warmer months, warming it and creating thermal updrafts that tend to carry gases, vapors and dusts upward and out of the "breathing zone". Additionally, as these currents of air lift, fresh air moves in at ground level and this has a mixing and diluting effect on harmful concentrations.

Ammonia, a normally buoyant gas (approximately $\frac{1}{2}$ the weight of air) tends to rise in warmer ambient temperatures, but will move along the ground as a "heavy" gas during colder months.

When assessing the public threat an airborne hazardous materials release poses, time of year factors into public exposure potential as well as public protection decisions. A release occurring during winter months is more likely to persist for a greater amount of time in the environment. This increases the potential for public contact with the material while still at harmful concentrations however, the public is more likely to be protected in an enclosure of some sort, possibly even one that has been weatherized against the colder temperatures. Open-air venues that afford no protection against exposure are less likely to be utilized during winter months and homes, businesses and institutions less likely to have open windows and doors.

In assessing the potential harm resulting from an airborne release, the likely worst-case scenario would be a heavy or cold gas release during winter months in a stable

atmosphere near open venues. In this scenario, the released material would remain intact and concentrated for the maximum distance impacting people with no shelter.

To further enhance emergency preparedness

The vulnerable zone distances identified in this study can be combined with the Des Moines windrose to determine which direction an airborne release is most likely to travel during the various seasons. It is further helpful during this effort to identify plume movement into areas likely to contain open-air venues (i.e. sports stadiums, state or county fairs, pedestrian malls, etc.) where inadequate sheltering structures exist for public protection. An area in the path of an airborne release containing a large open-air venue likely to be occupied during winter months would represent, in the opinion of EHS Resource Group, the greatest possible potential. The stability of the atmosphere, ambient temperature and open venue could combine to pose a serious public threat.

Definitions

Combustible liquid: liquids, which have a flash point greater than 141 degrees Fahrenheit and below 200 degrees Fahrenheit. United States' regulations permit a flammable liquid flashing between 100 degrees Fahrenheit and 140 degrees Fahrenheit. Kerosene and diesel fuel are two of the most common examples of combustible liquids.

Corrosive: any liquid or solid that causes destruction of human skin tissue or a liquid that has a severe corrosion rate on steel or aluminum

Cryogenic liquid: a refrigerated liquefied gas that has a boiling point colder than -130 degrees Fahrenheit at atmospheric pressure. Liquefied oxygen, helium, argon and nitrogen are some of the most common cryogenic liquids transported.

Flammable liquid: a liquid that has a flash point of 141 degrees Fahrenheit or lower. Solvents, gasoline and alcohol are common flammable liquids.

Flash point: the lowest temperature at which a liquid or solid gives off vapor in such a concentration that, when the vapor combines with air near the surface of the liquid or solid, a flammable mixture is formed, capable of being ignited with an ignition source.

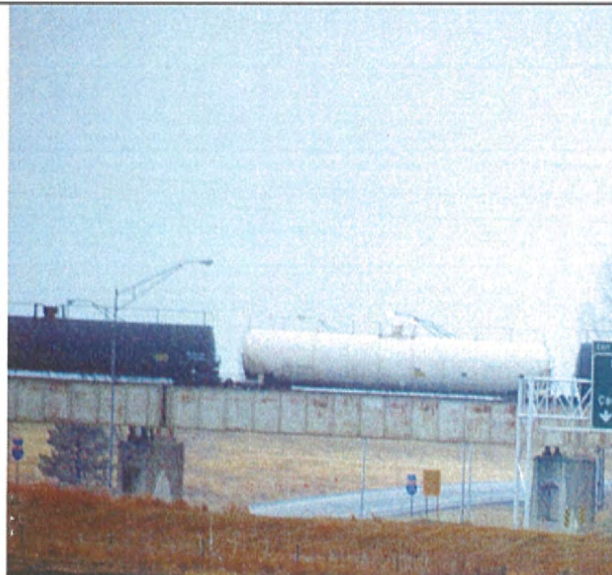
Intermodal container: a commonly used shipping container of various dimensions and suitable for conveying goods by water, rail or highway.

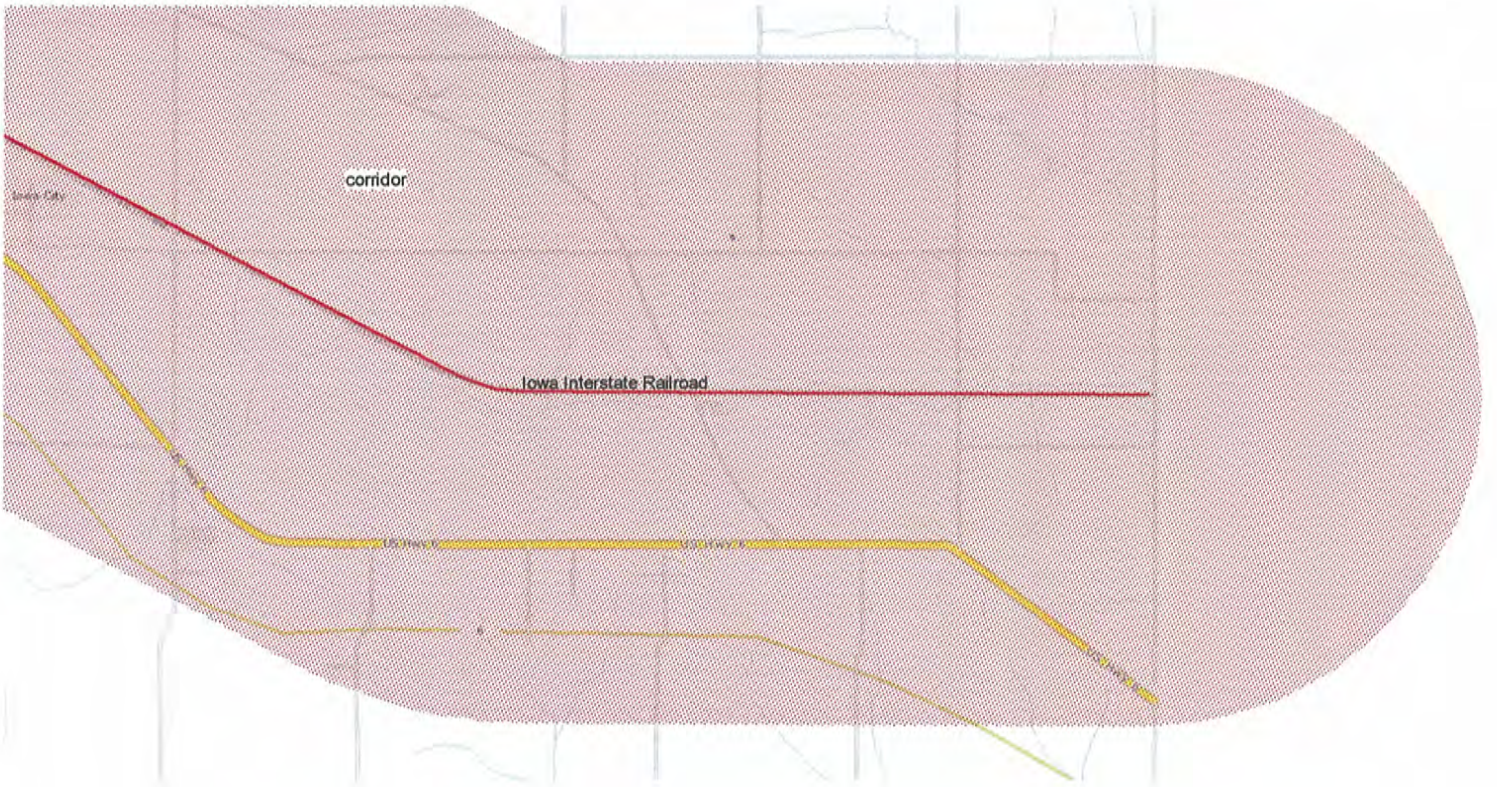
Oxidizer: a chemical which supplies its own oxygen or oxidizing agent and which helps other combustible materials burn more readily and potentially violently. Ammonia nitrate is a common oxidizer, as is oxygen in gaseous and liquefied form.

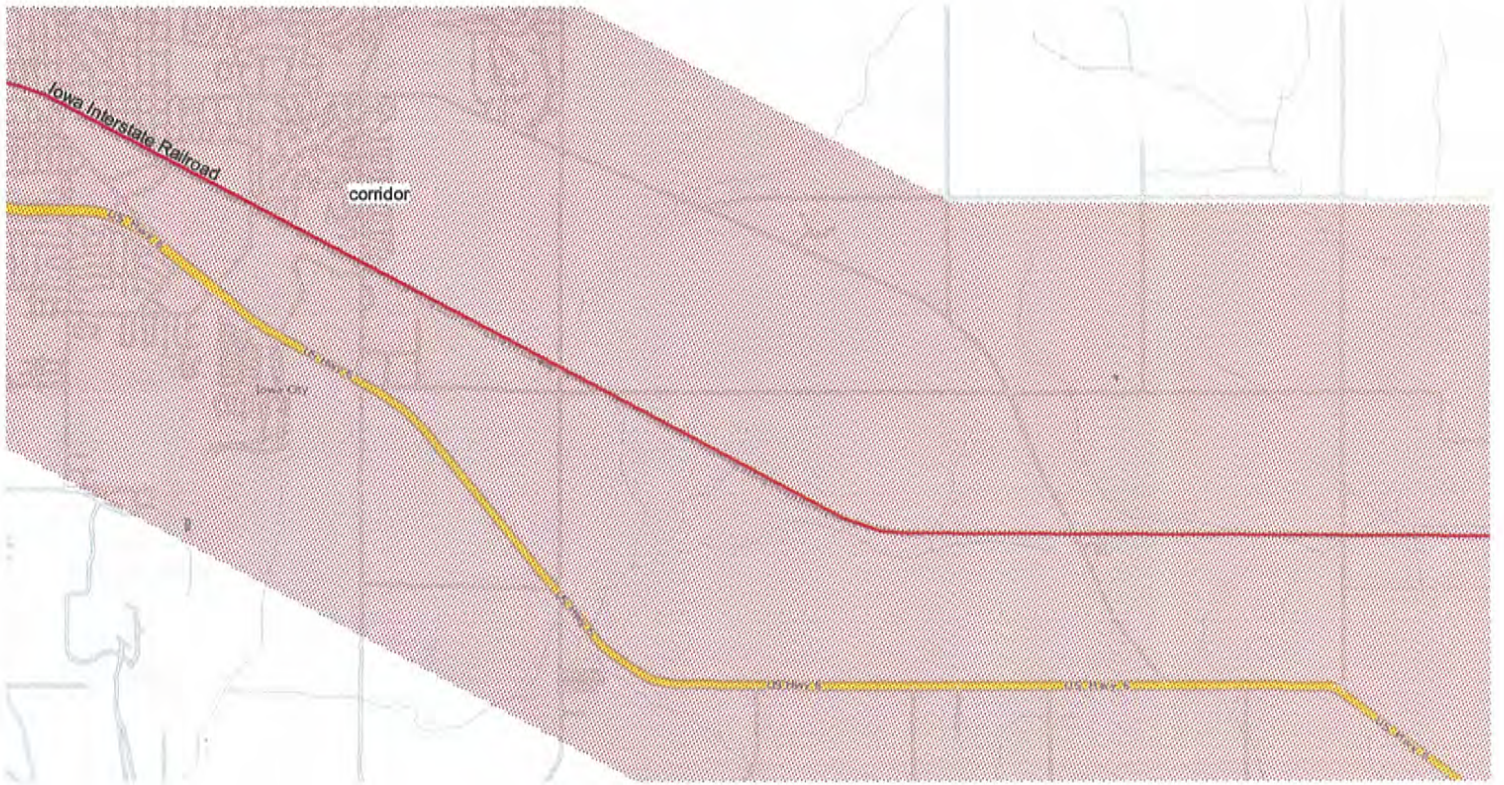
Radioactivity: the property of some substances to emit invisible and potentially harmful radiation.

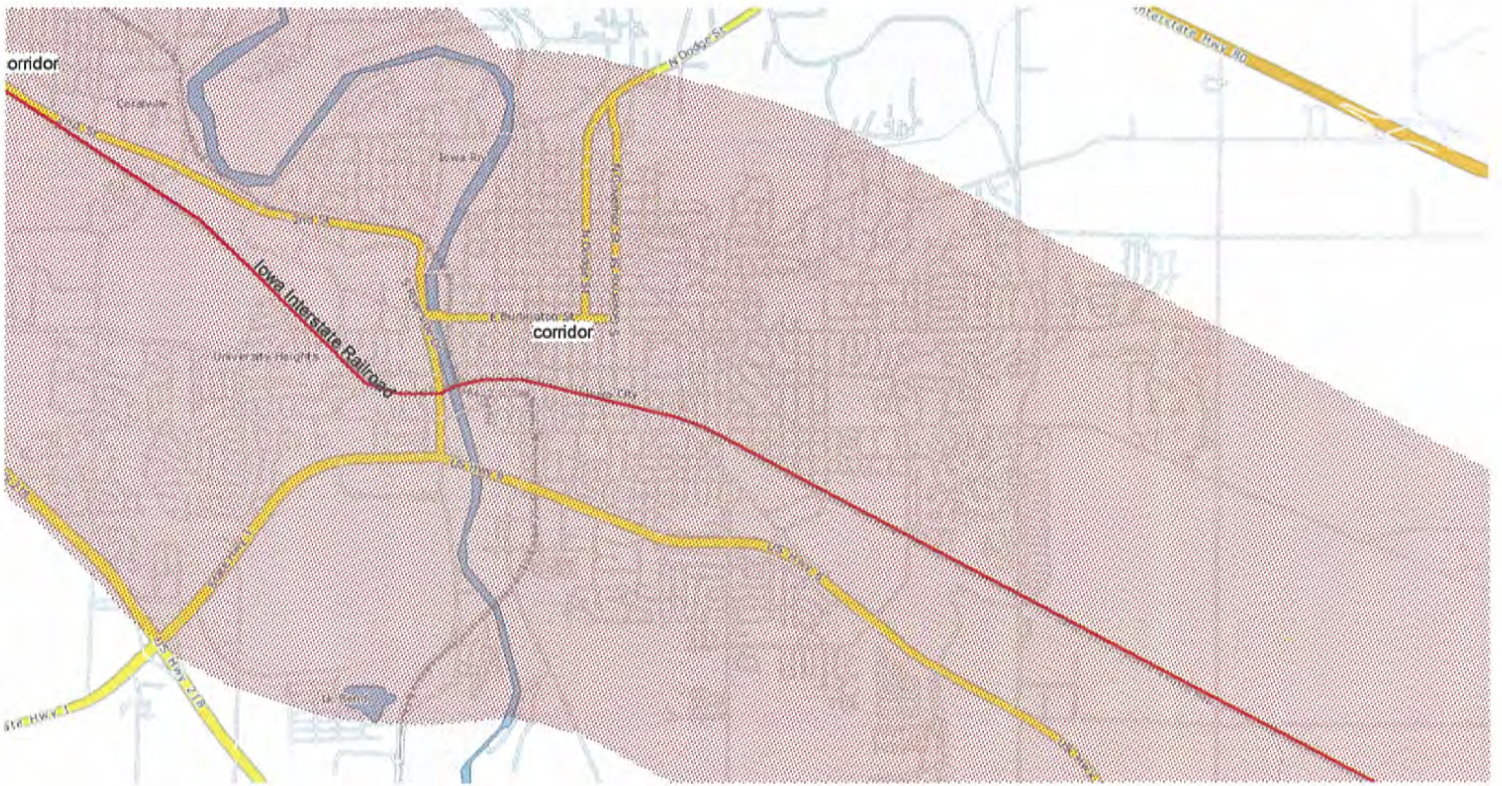
Vulnerable Zones-Railroad

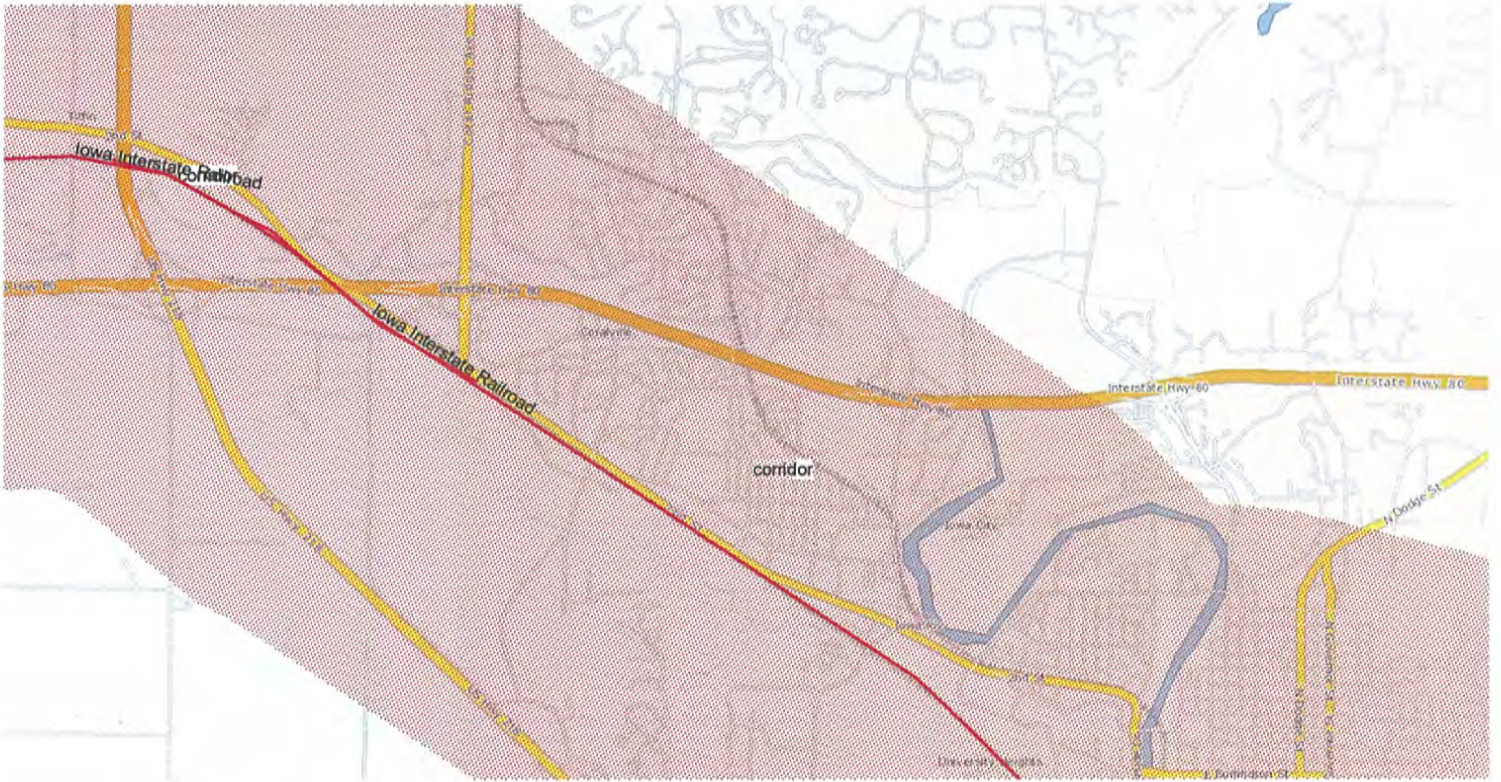
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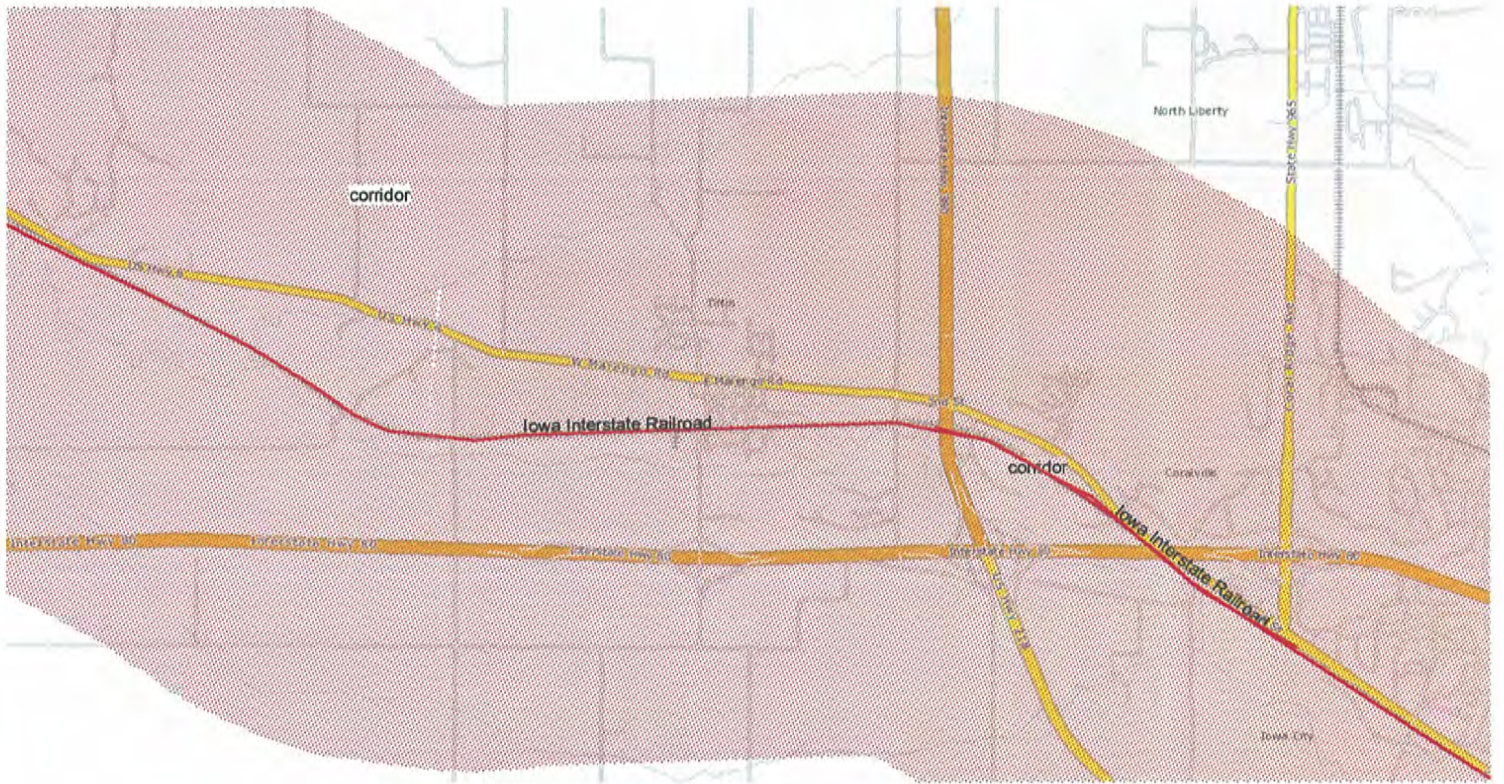


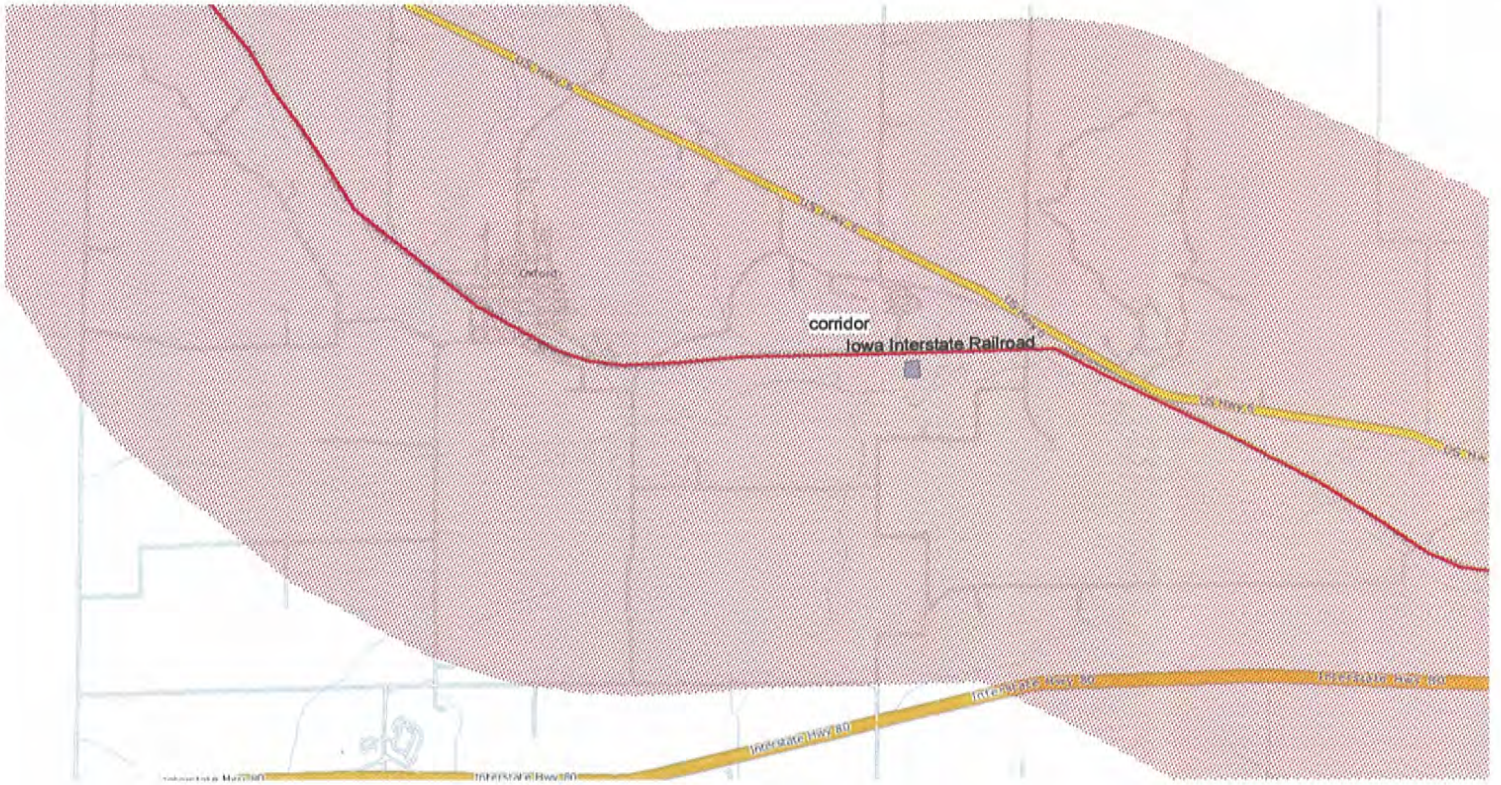


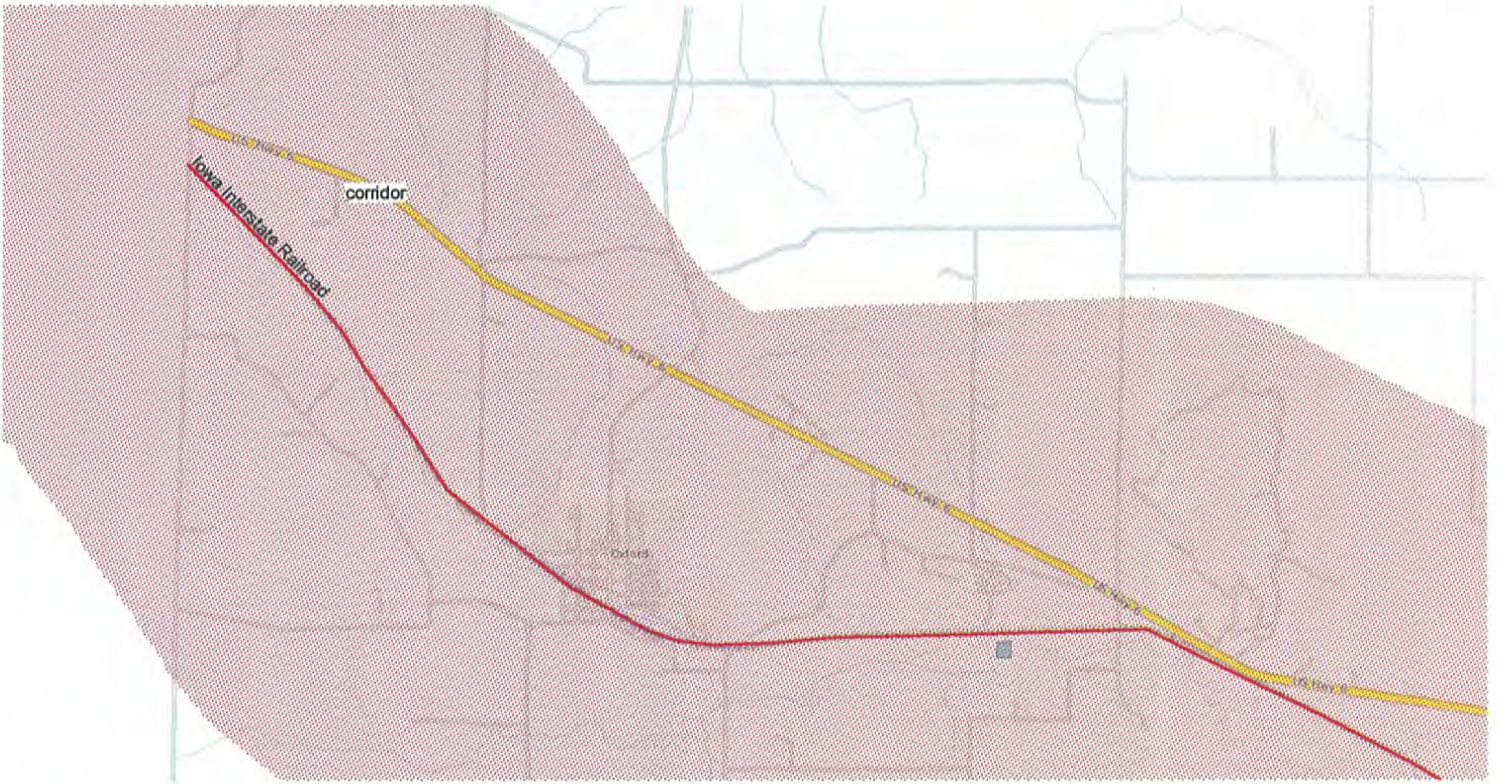






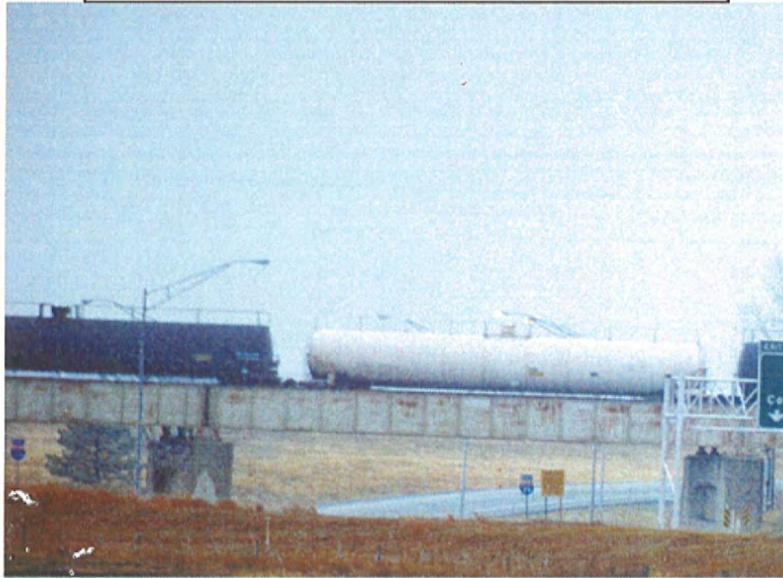






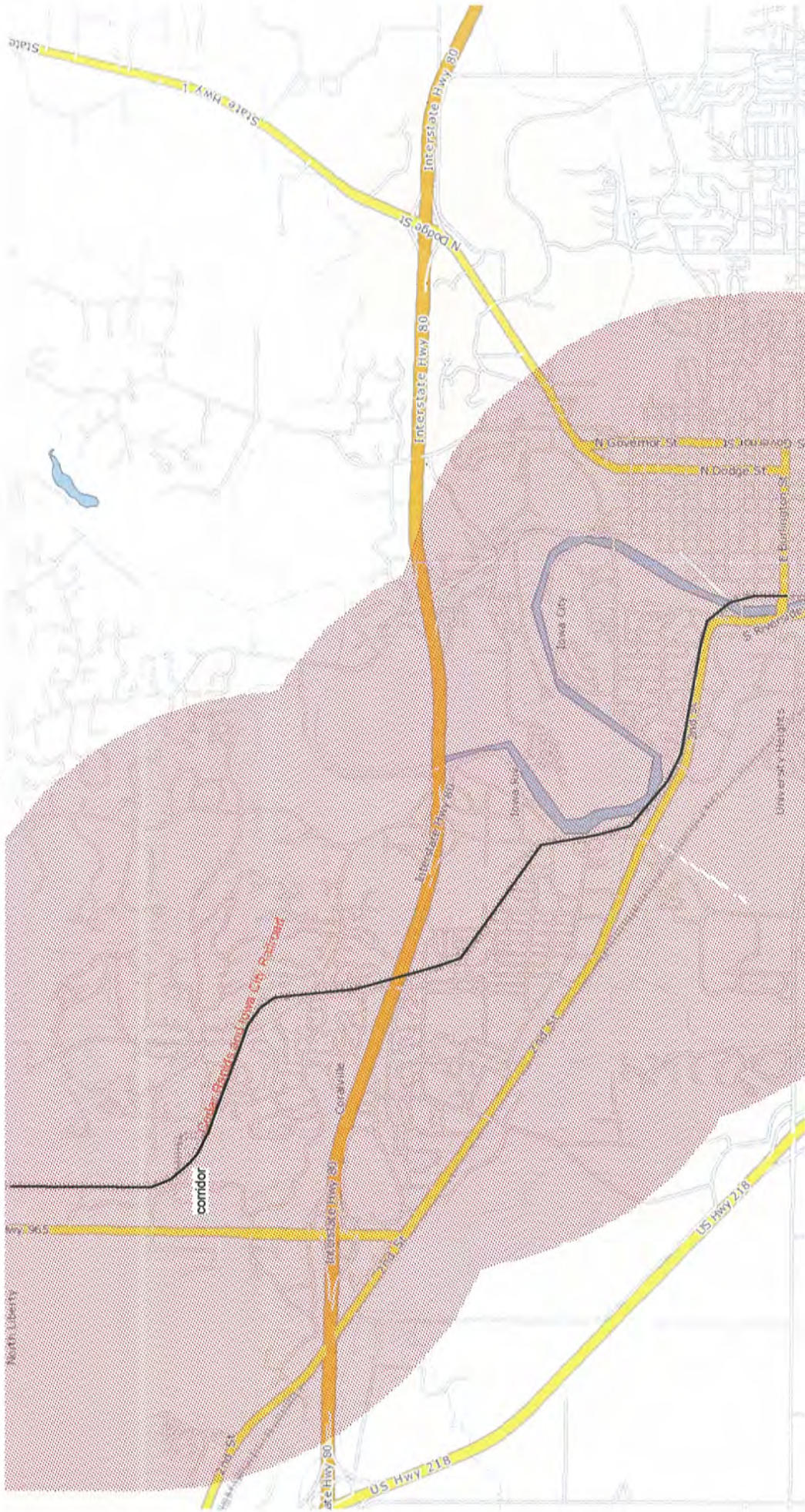
Vulnerable Zones-Railroad

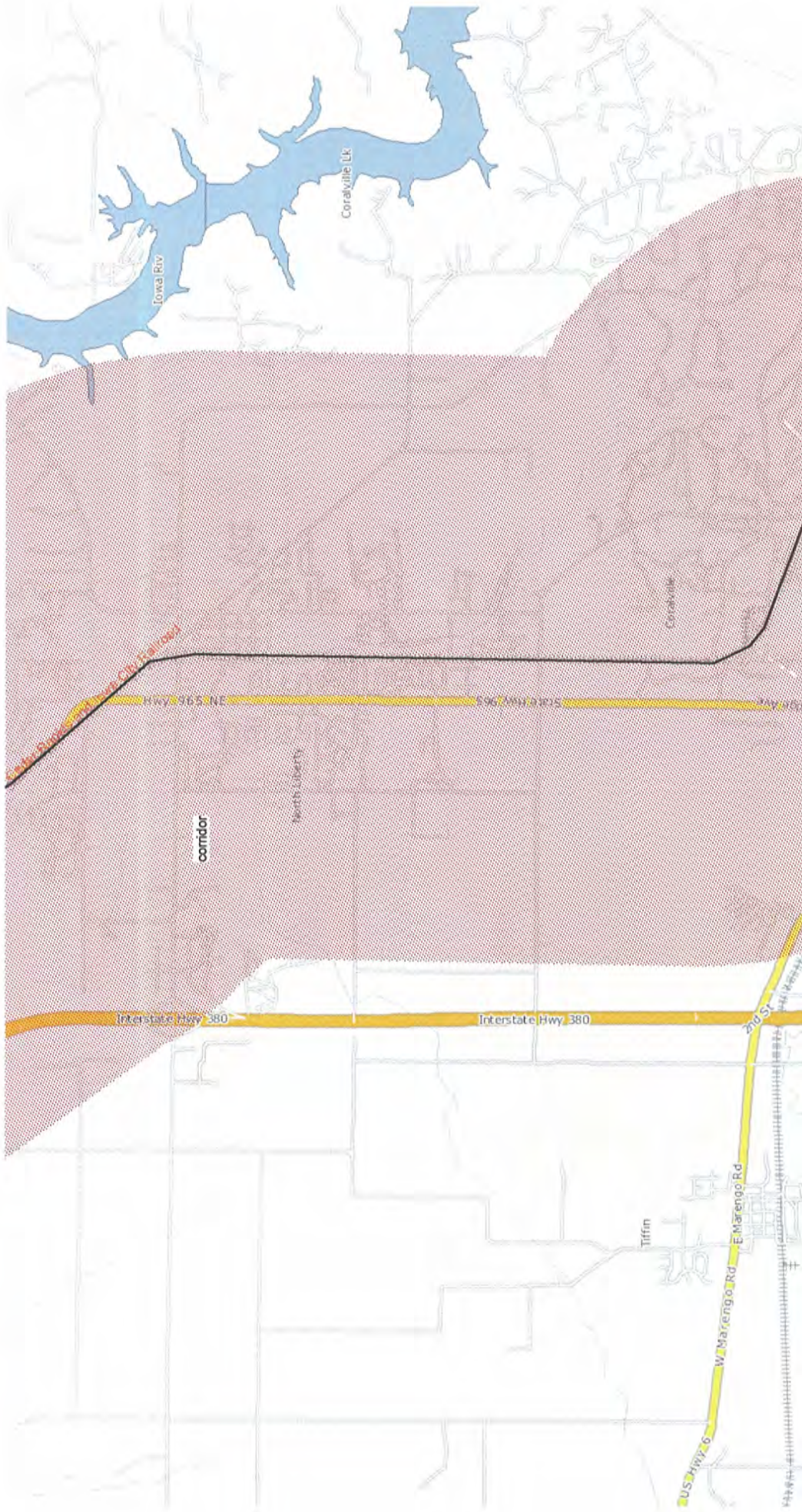
Cedar Rapids and Iowa City





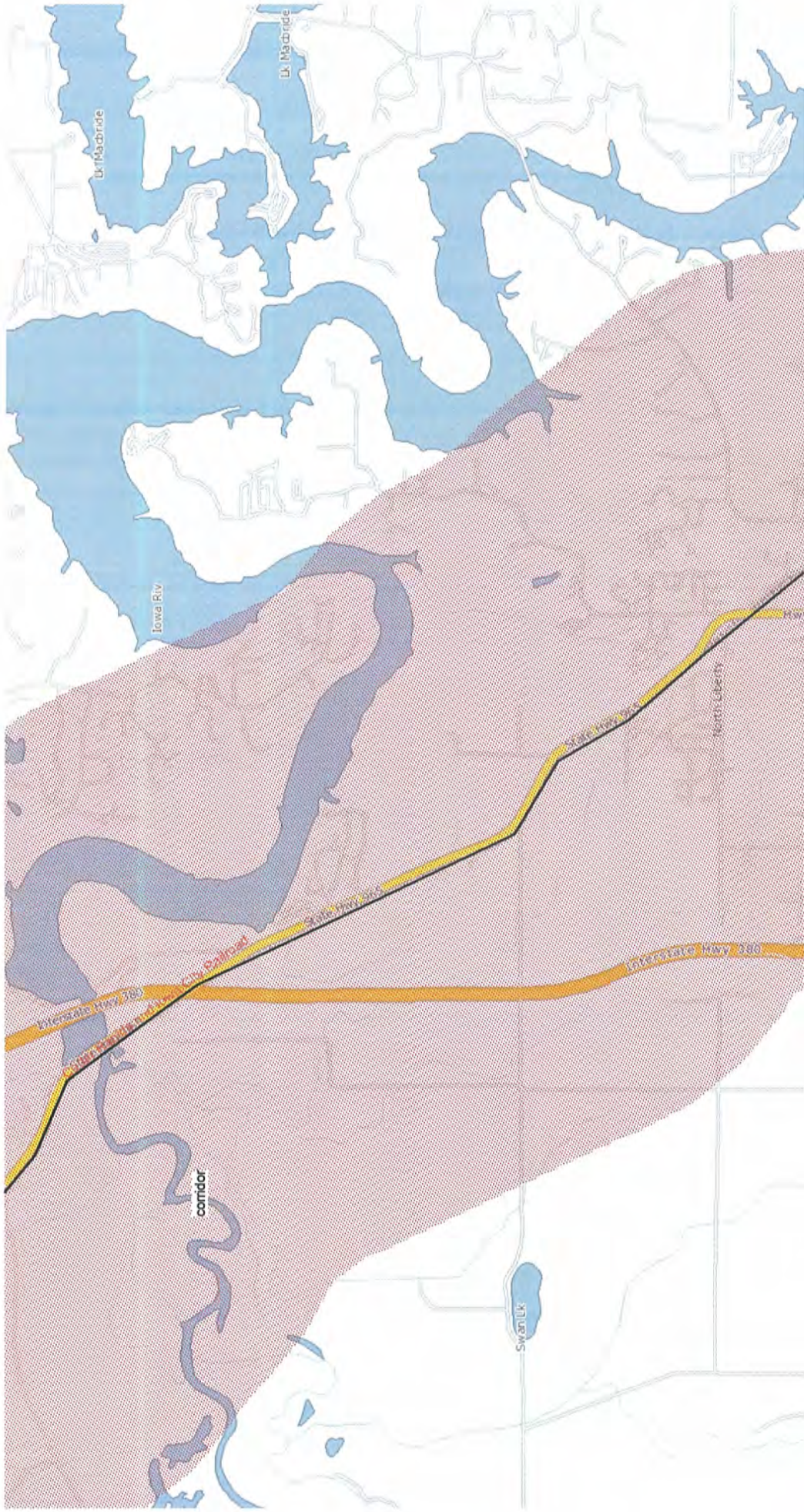
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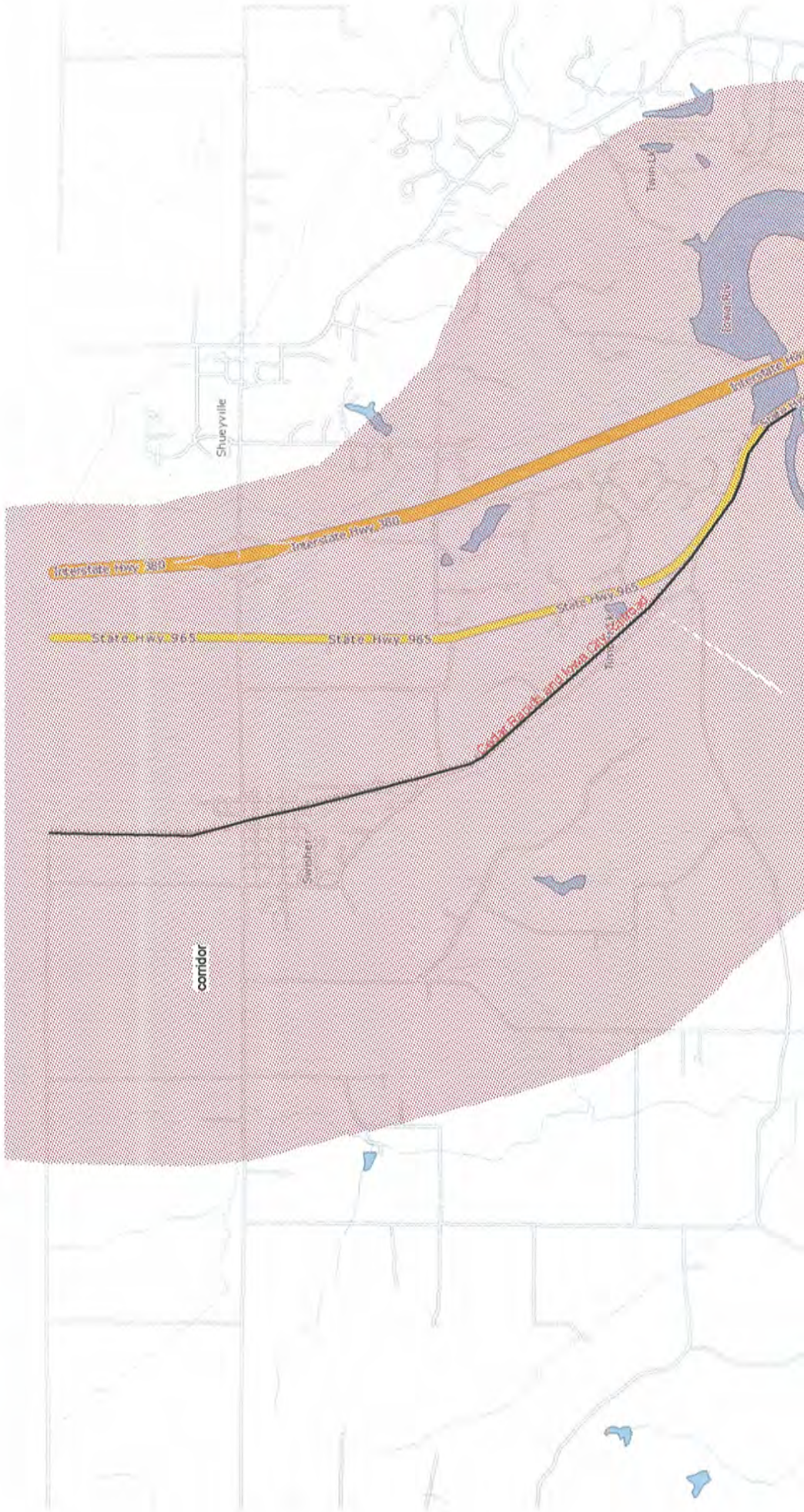


MARPLOT



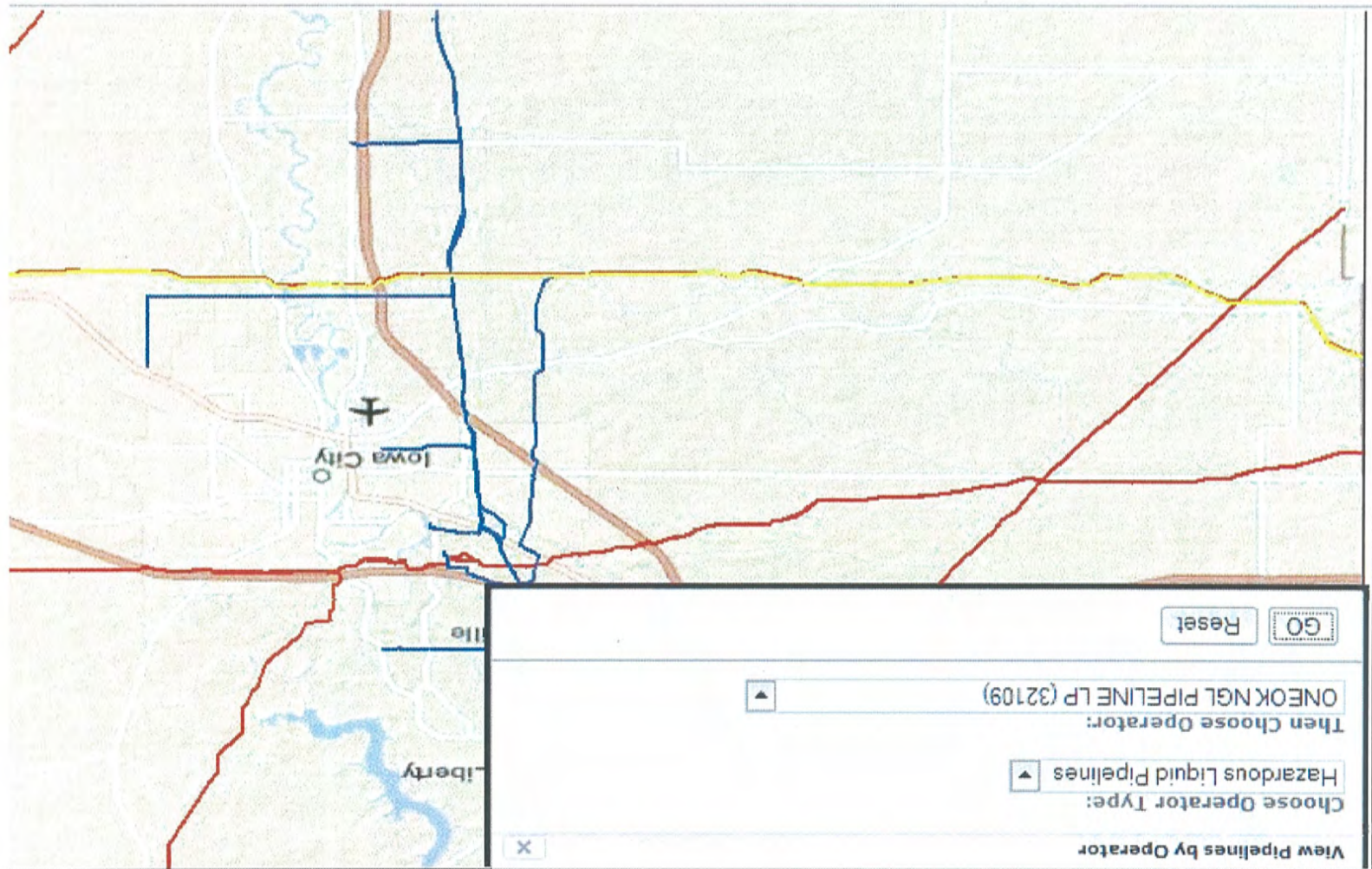


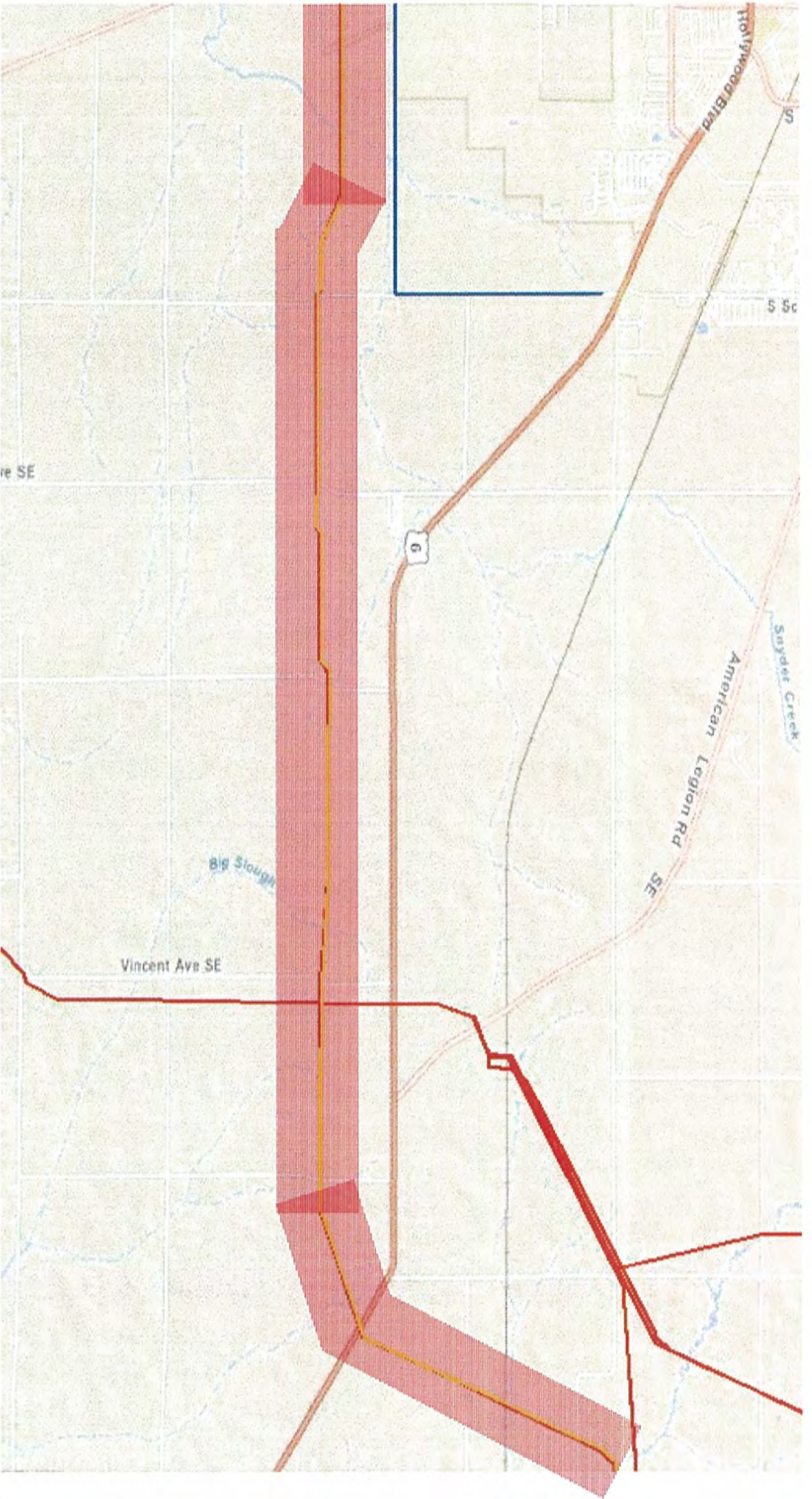
MARPLOT





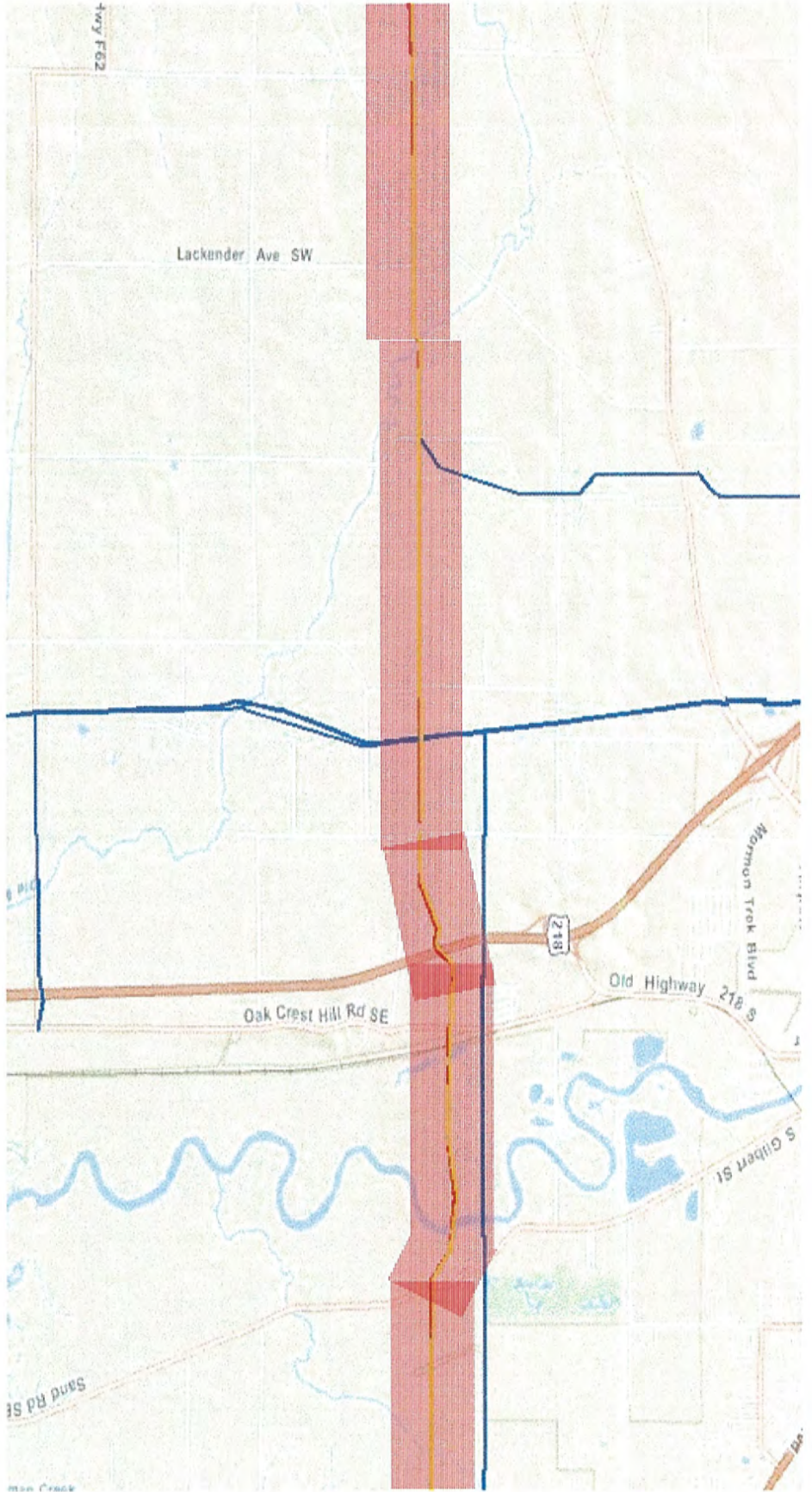
Vulnerable Zones-Liquid Pipeline
ONEOK





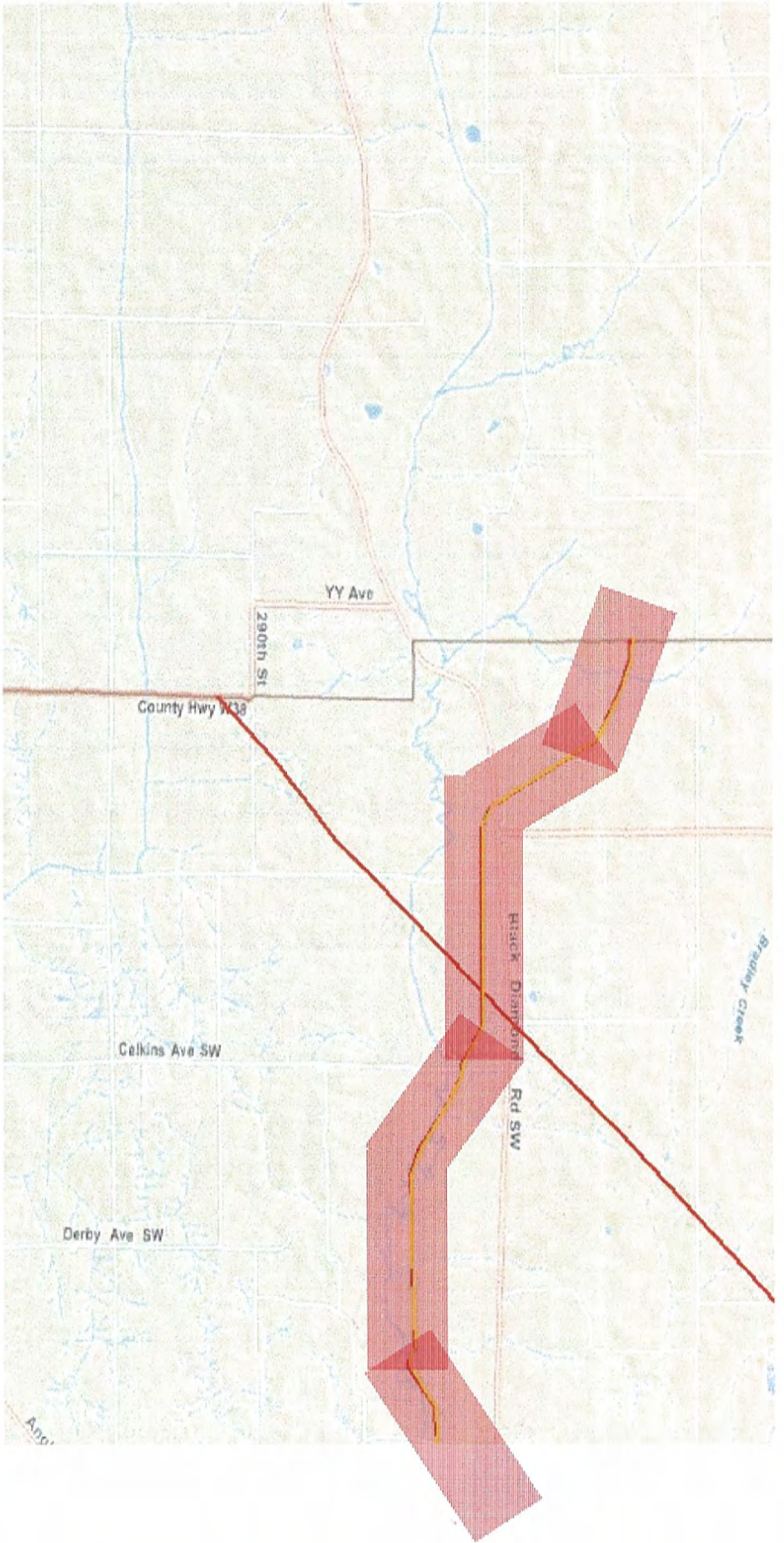
ONEOK LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



ONEOK LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

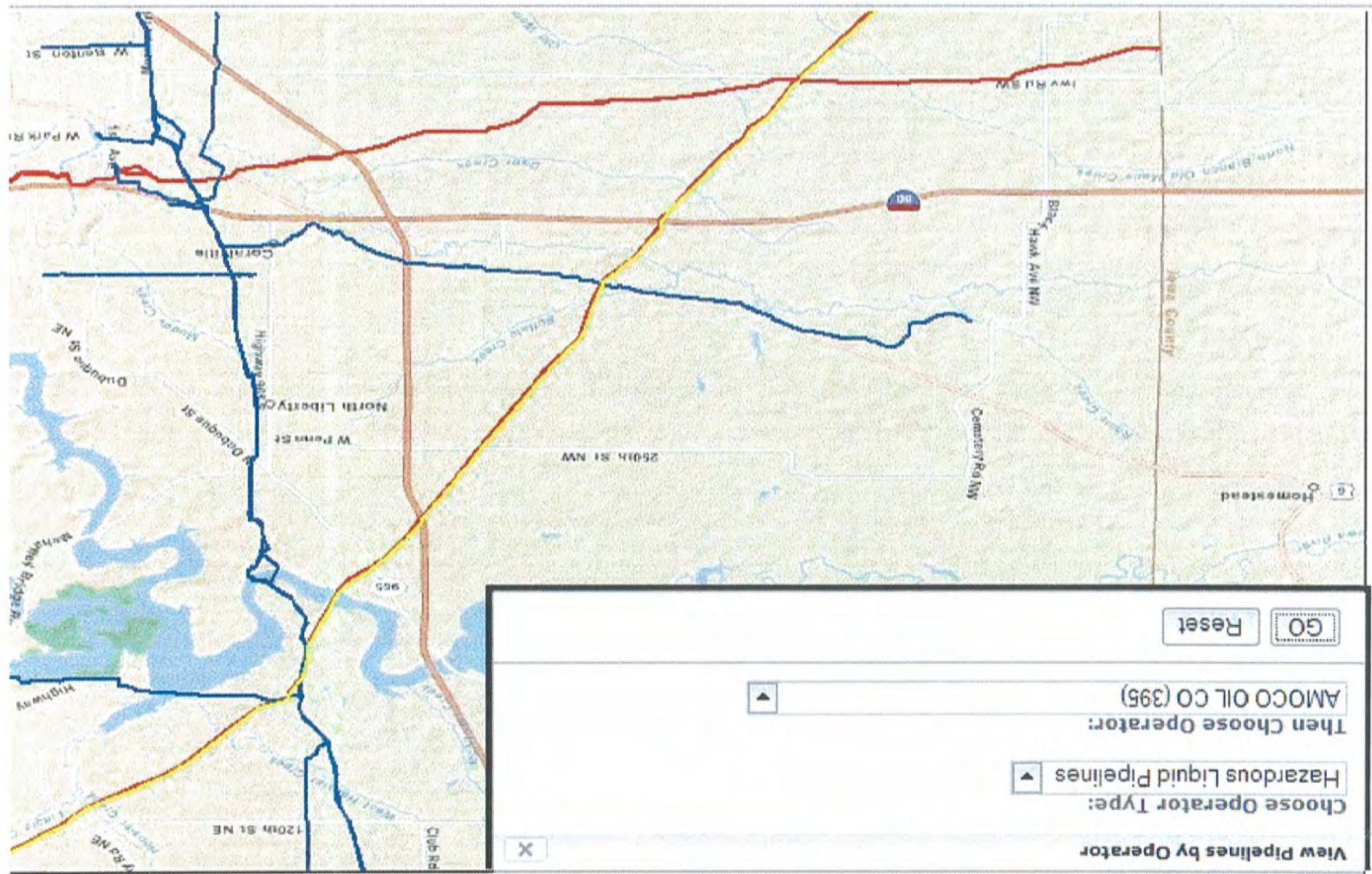


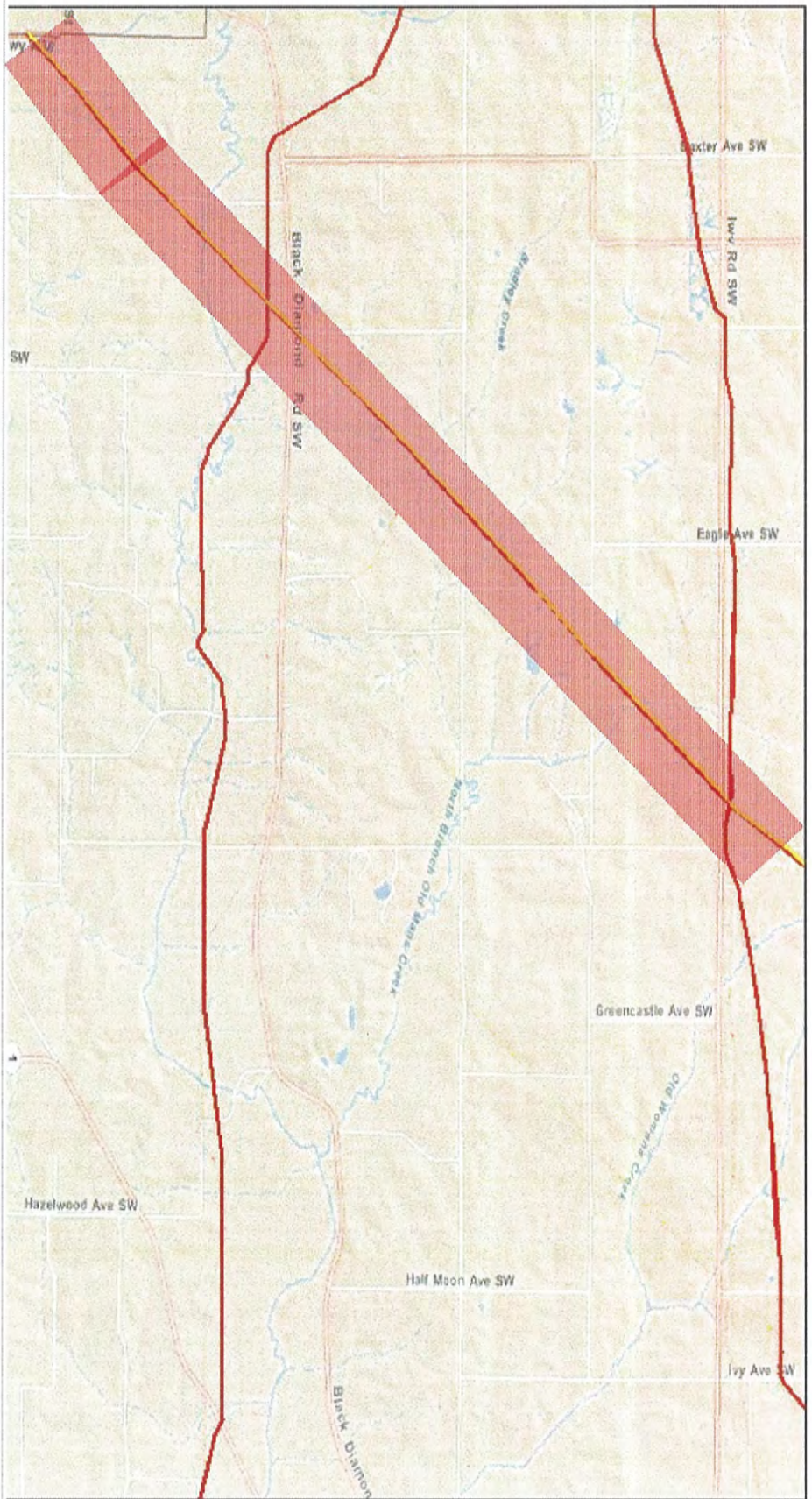
ONEOK LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



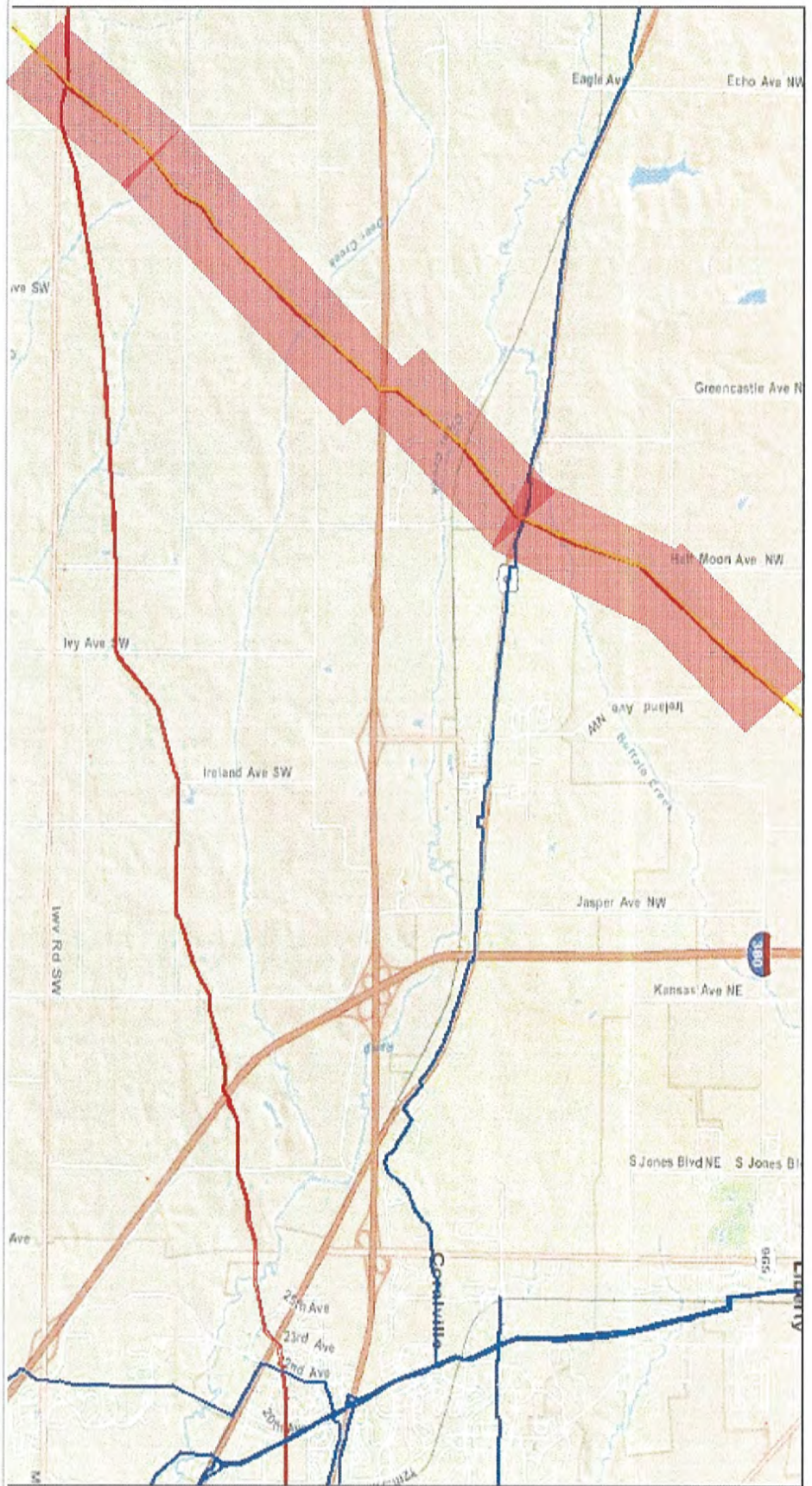
Vulnerable Zones-Liquid Pipeline
AMOCO





AMOCO LIQUID

Vulnerable zone based on ERG2009 recommended 1000' isolation distance



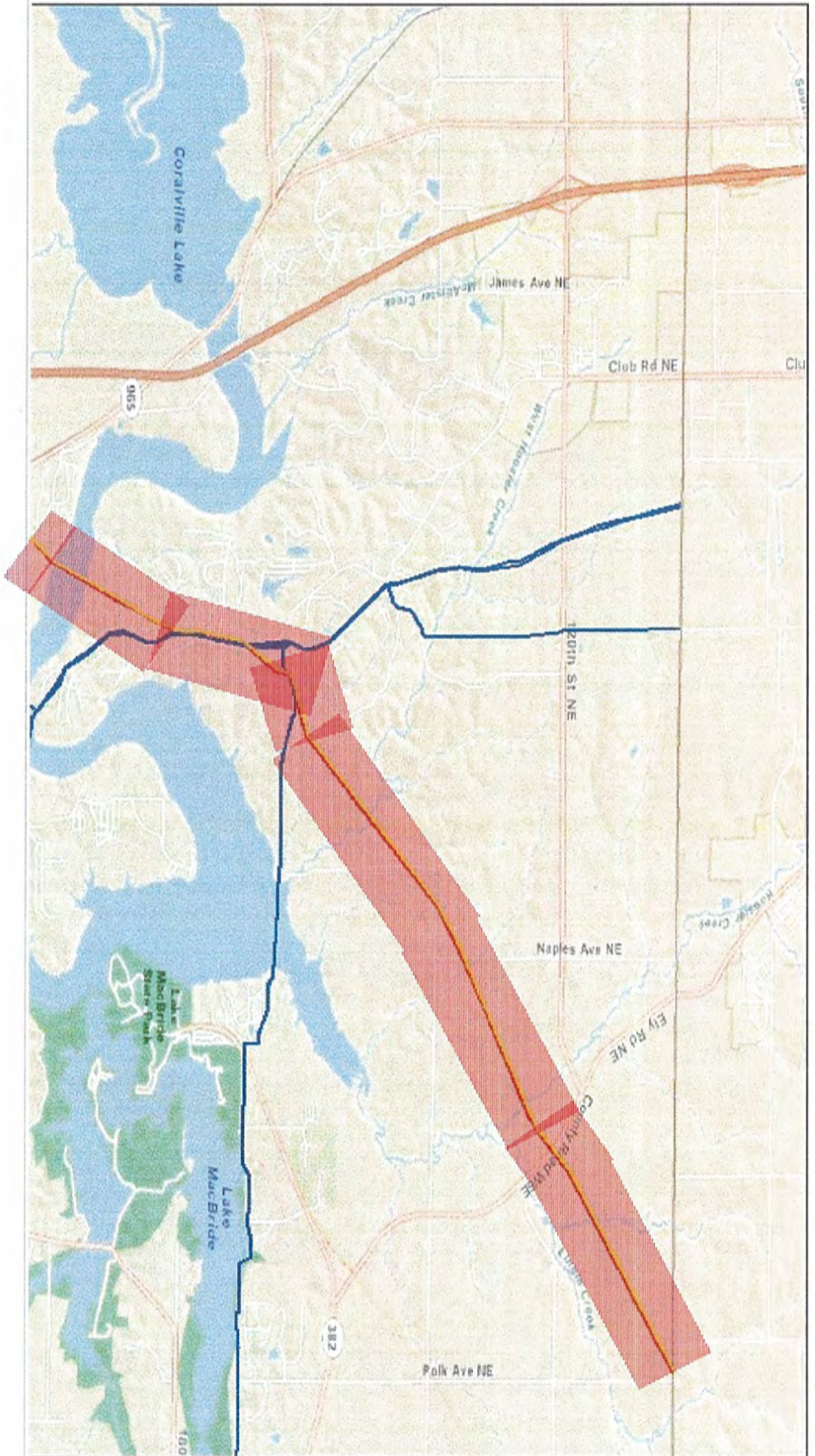
AMOCO LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



AMOCO LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



AMOCO LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

Vulnerable Zones-Liquid Pipeline

Enterprise



View Pipelines by Operator



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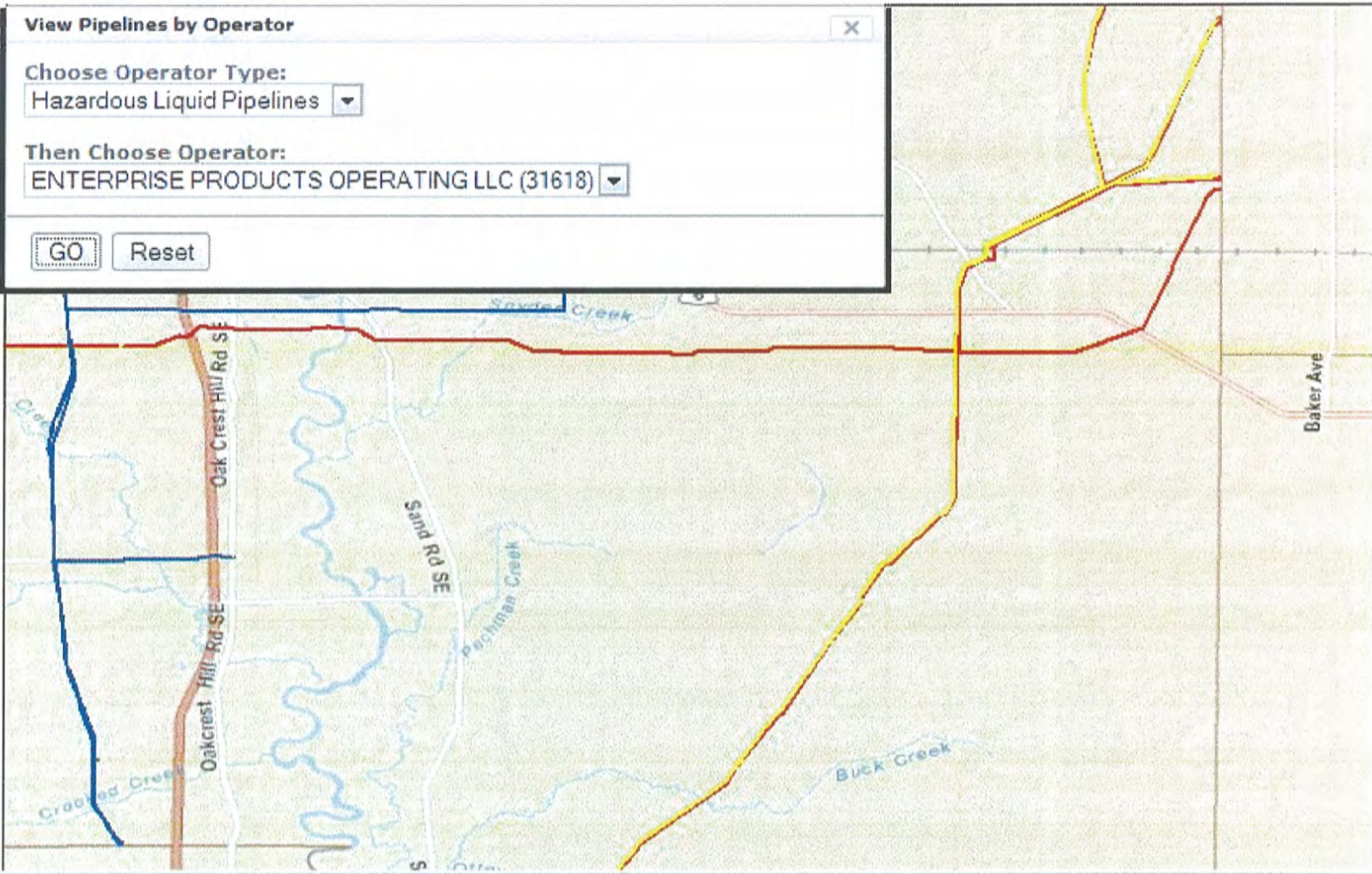
Hazardous Liquid Pipelines

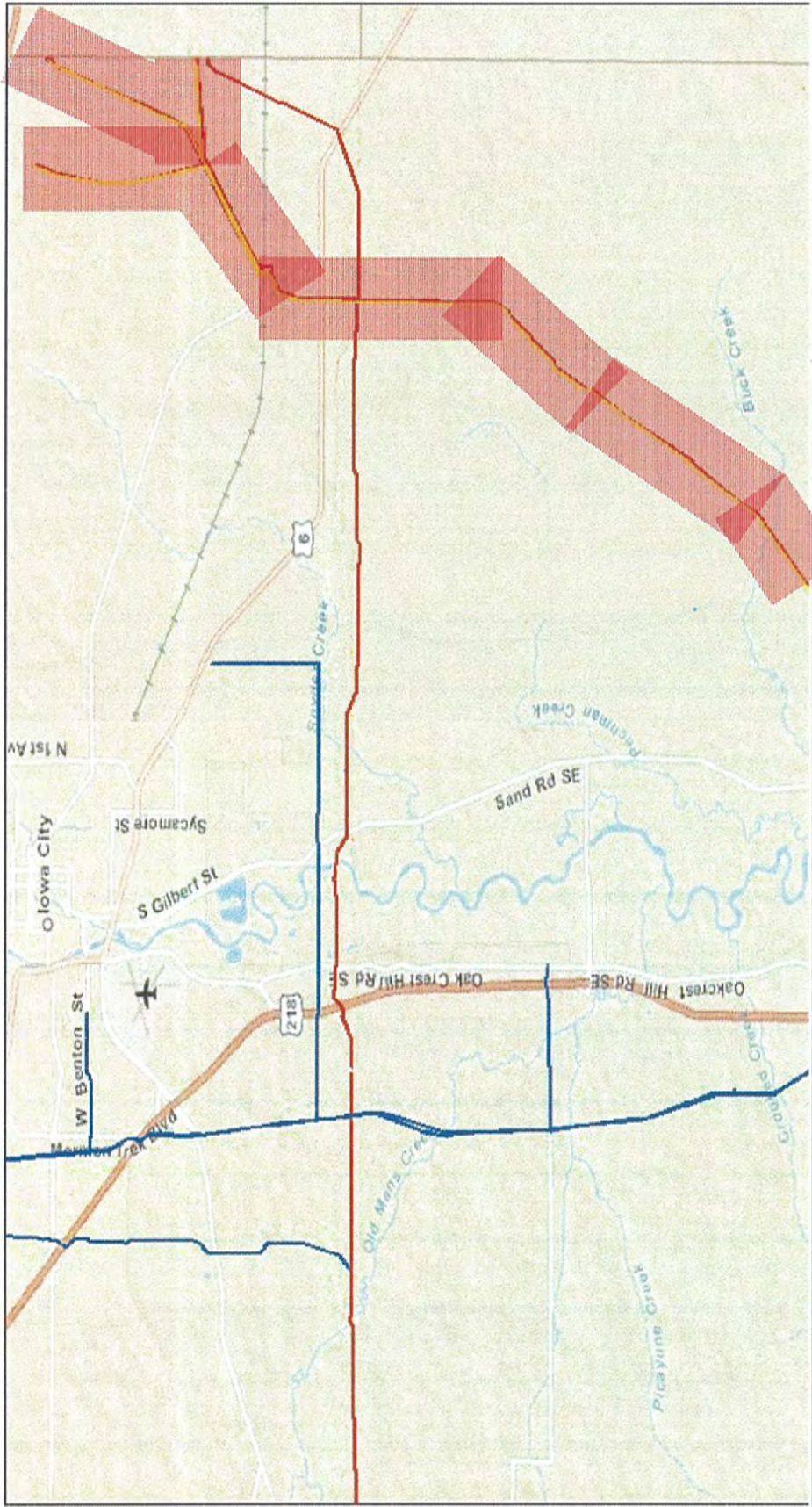
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ENTERPRISE PRODUCTS OPERATING LLC (31618)

GO

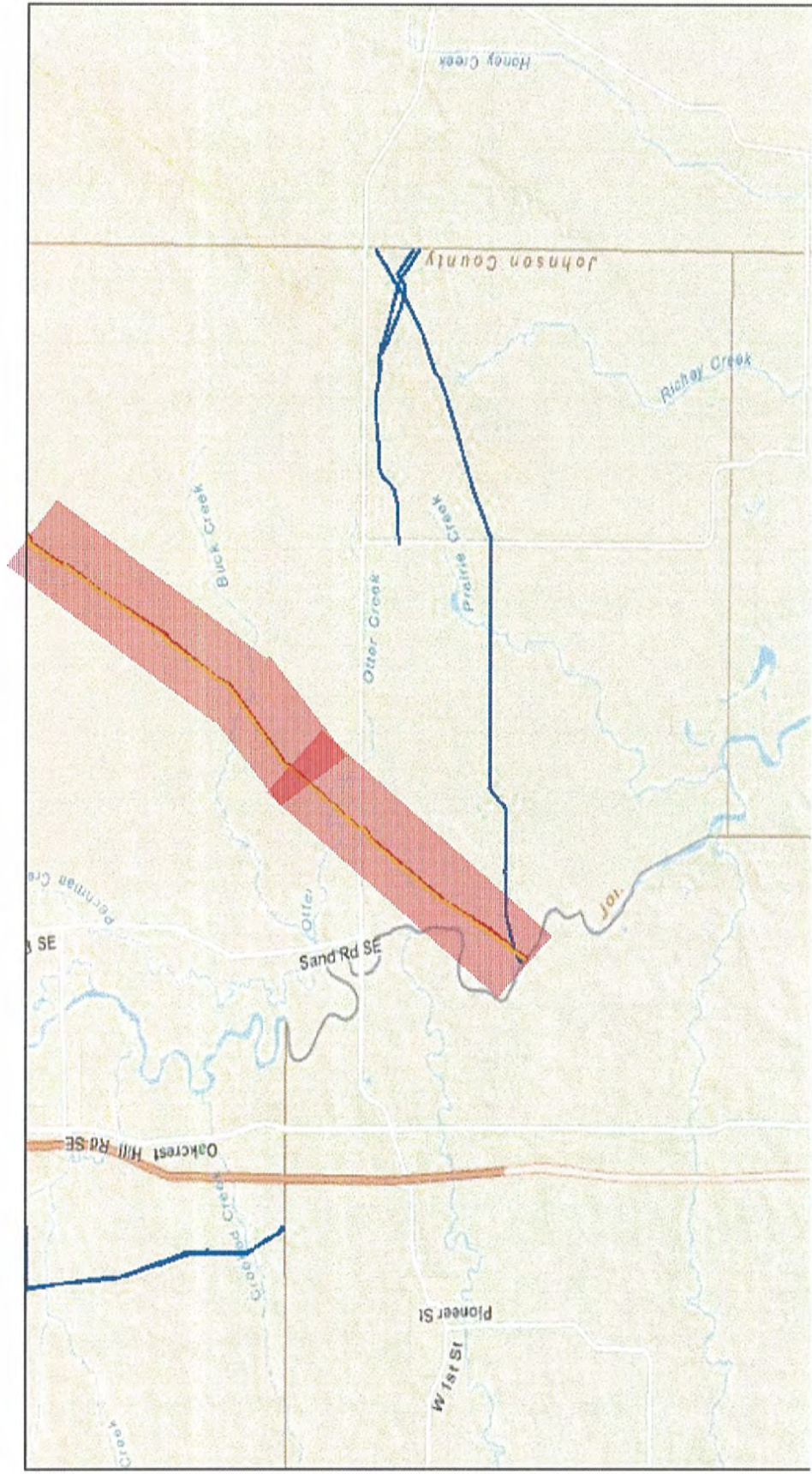
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ENTERPRISE LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



ENTERPRISE LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

Vulnerable Zones-Liquid Pipeline

Kinder Morgan



View Pipelines by Operator

X

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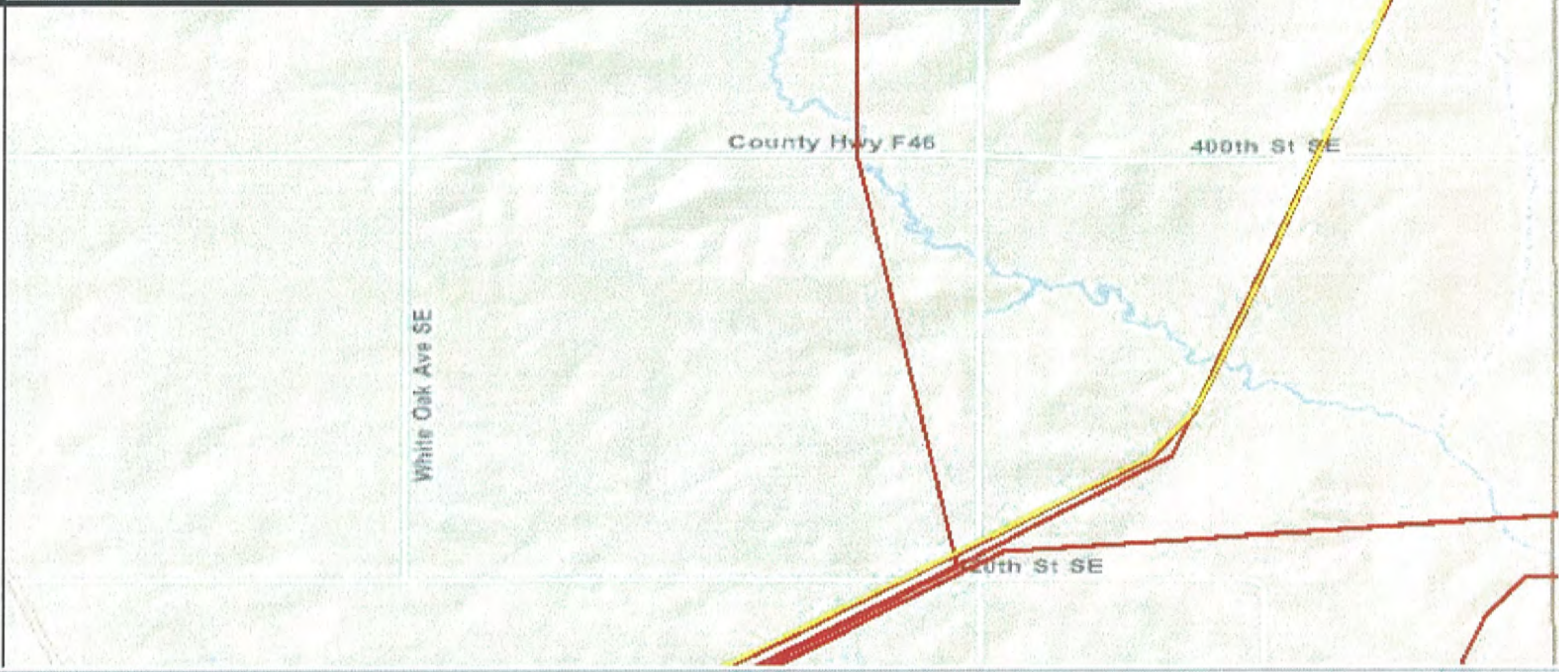
Hazardous Liquid Pipelines

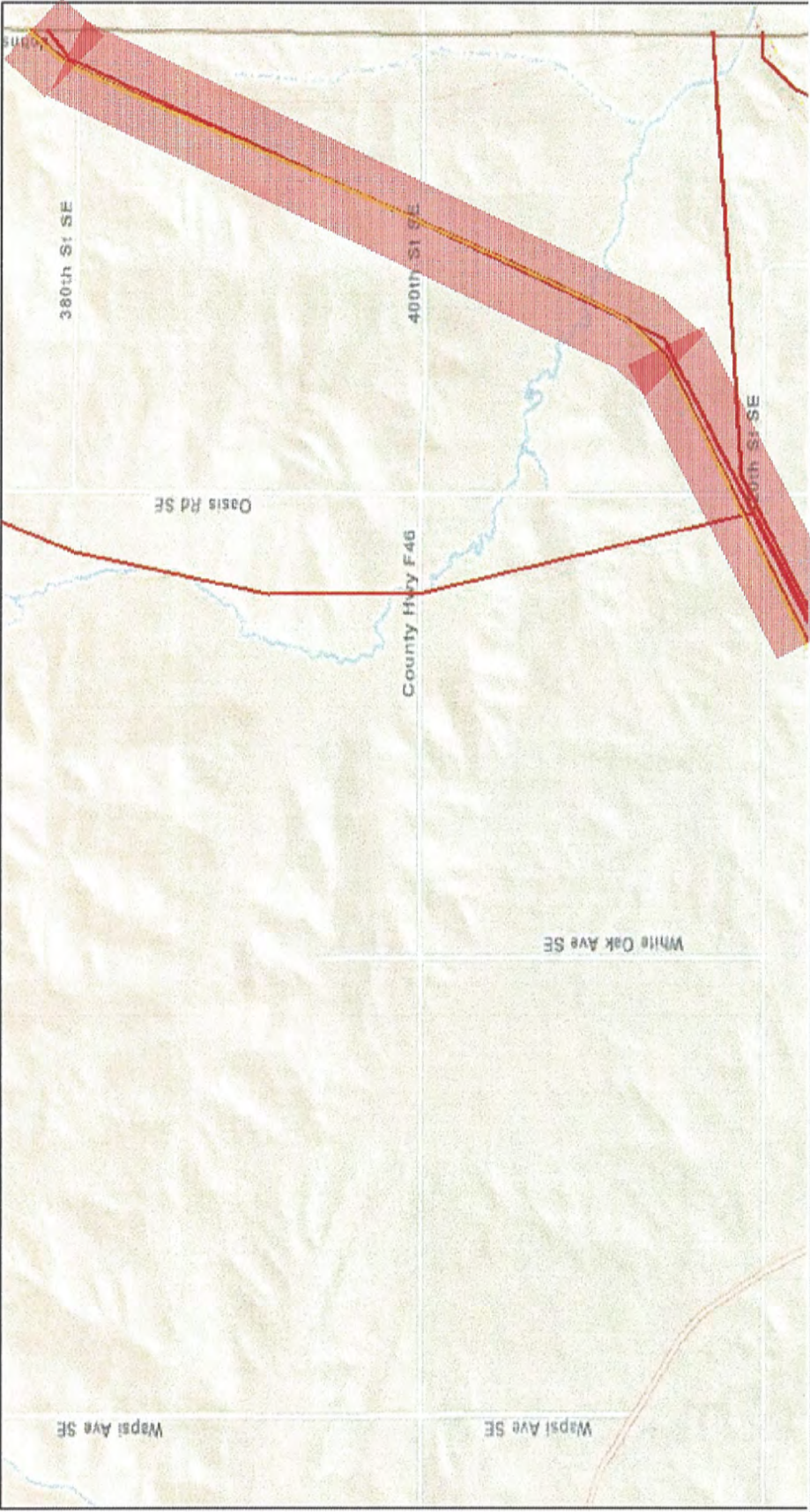
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KINDER MORGAN COCHIN LLC (32258)

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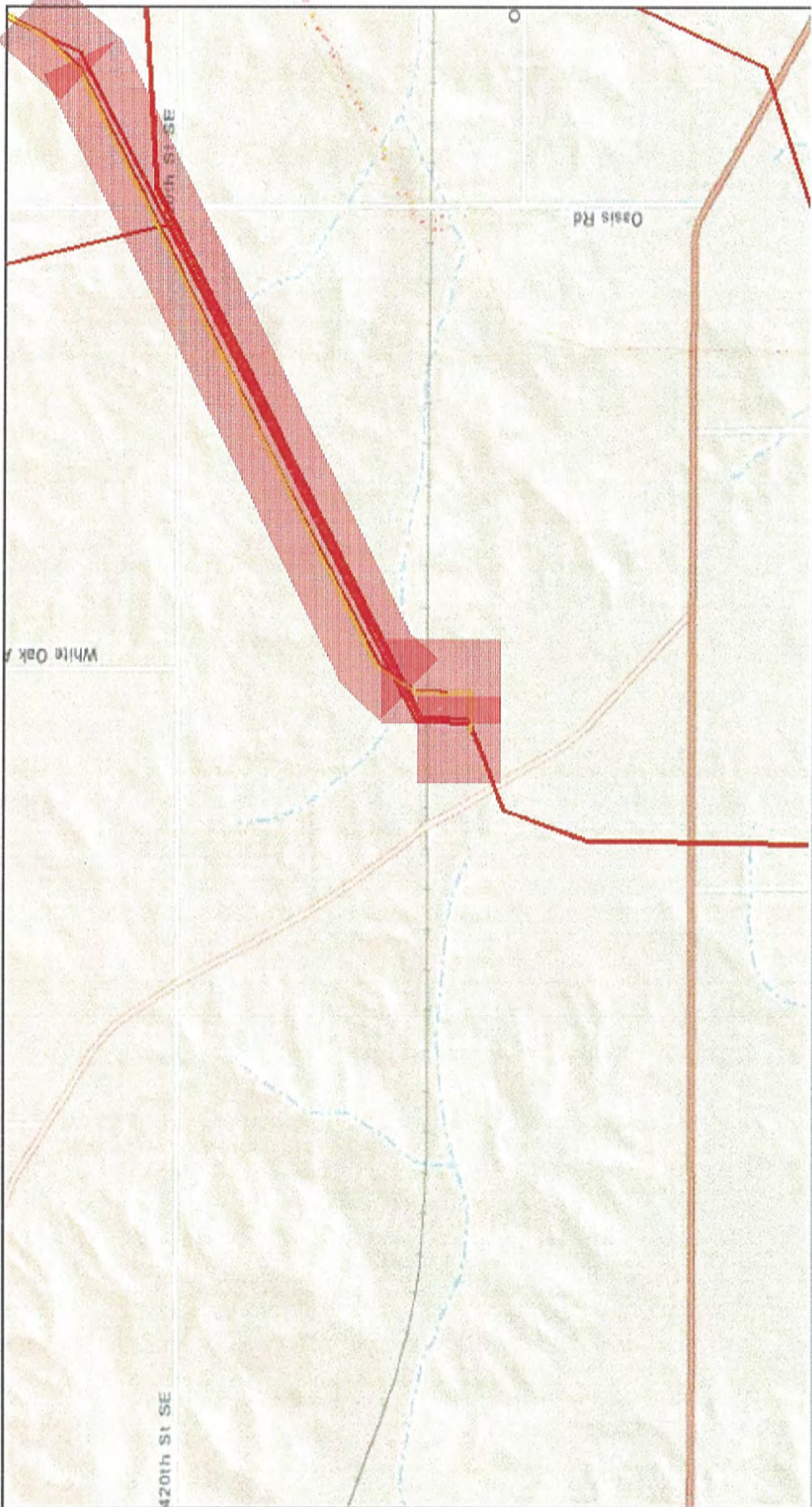
Reset





KINDER MORGAN LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



KINDER MORGAN LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

Vulnerable Zones-Liquid Pipeline

Magellan



View Pipelines by Operator



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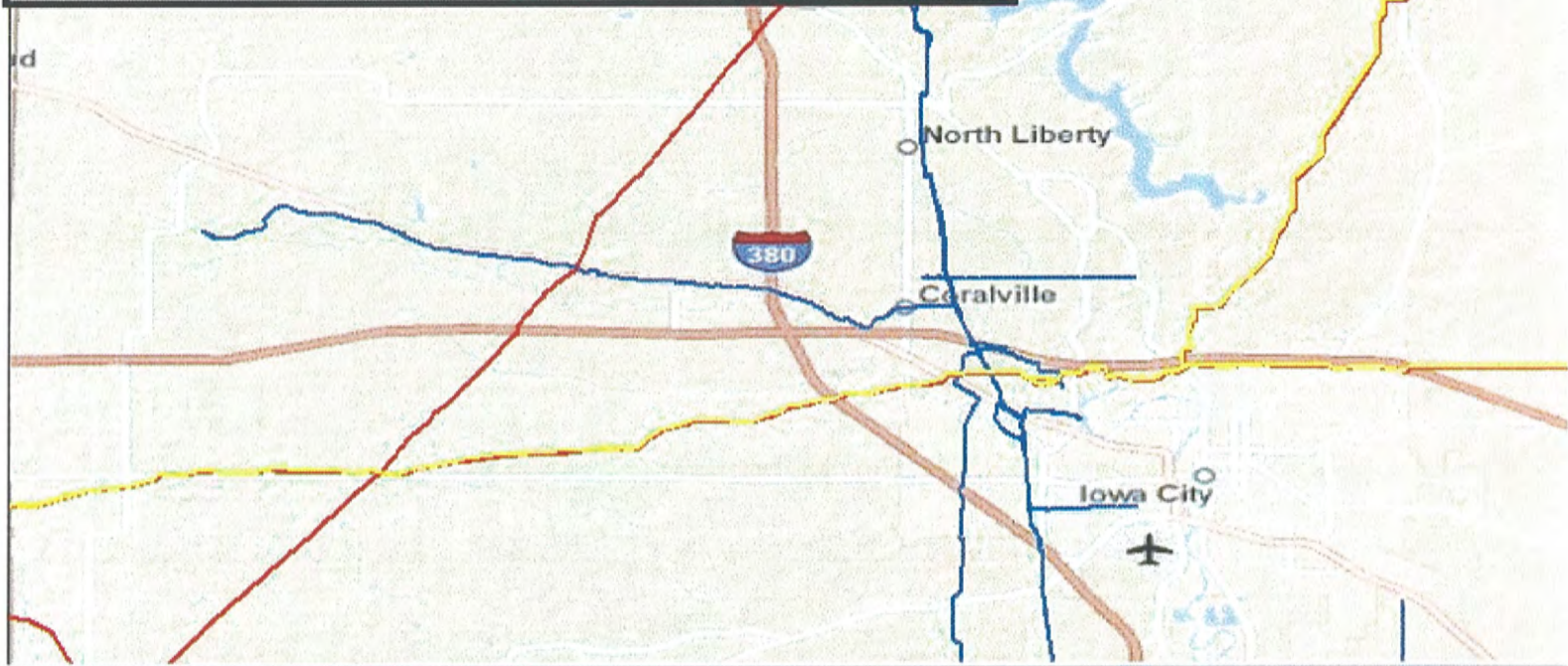
Hazardous Liquid Pipelines

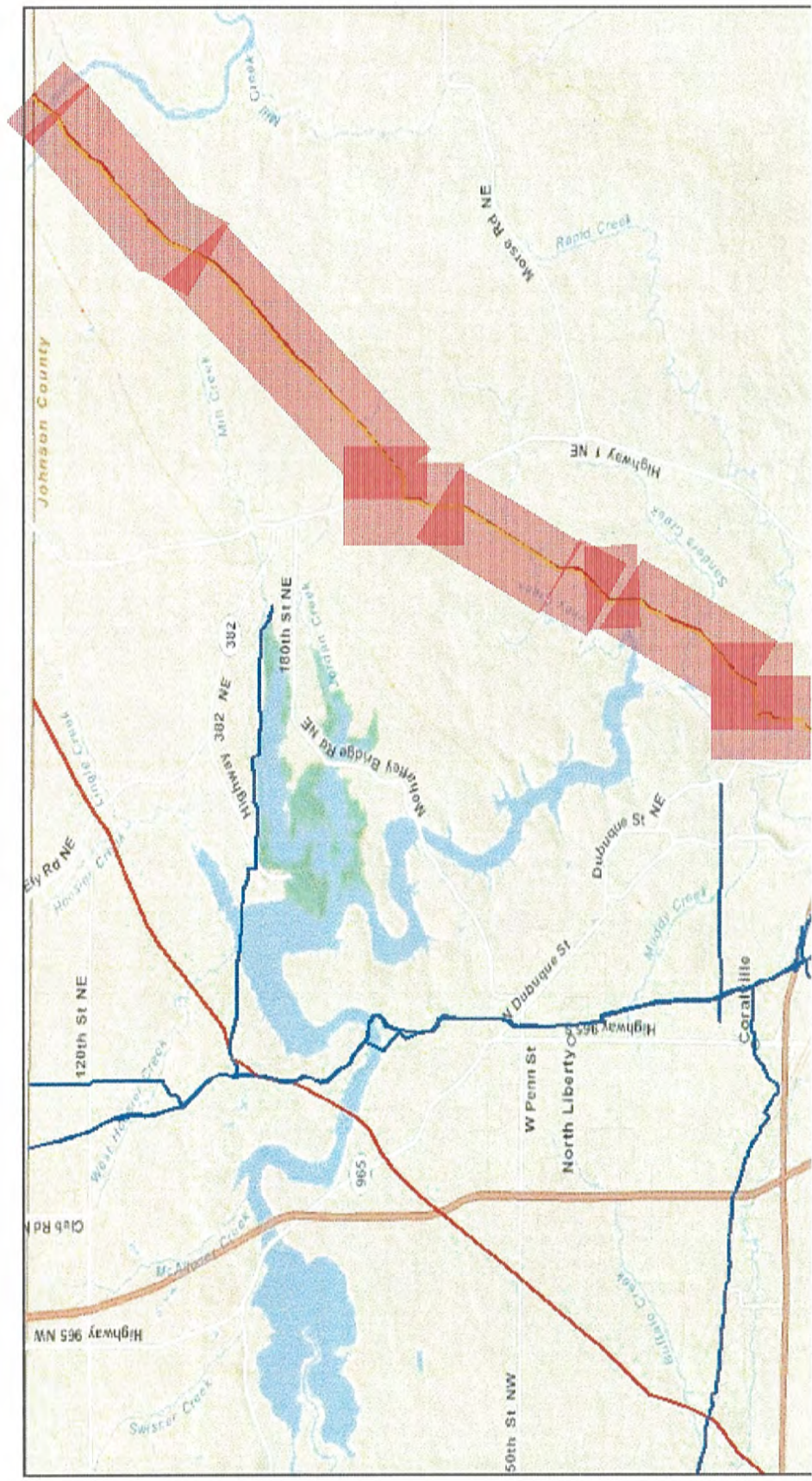
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MAGELLAN PIPELINE COMPANY, LP (22610)

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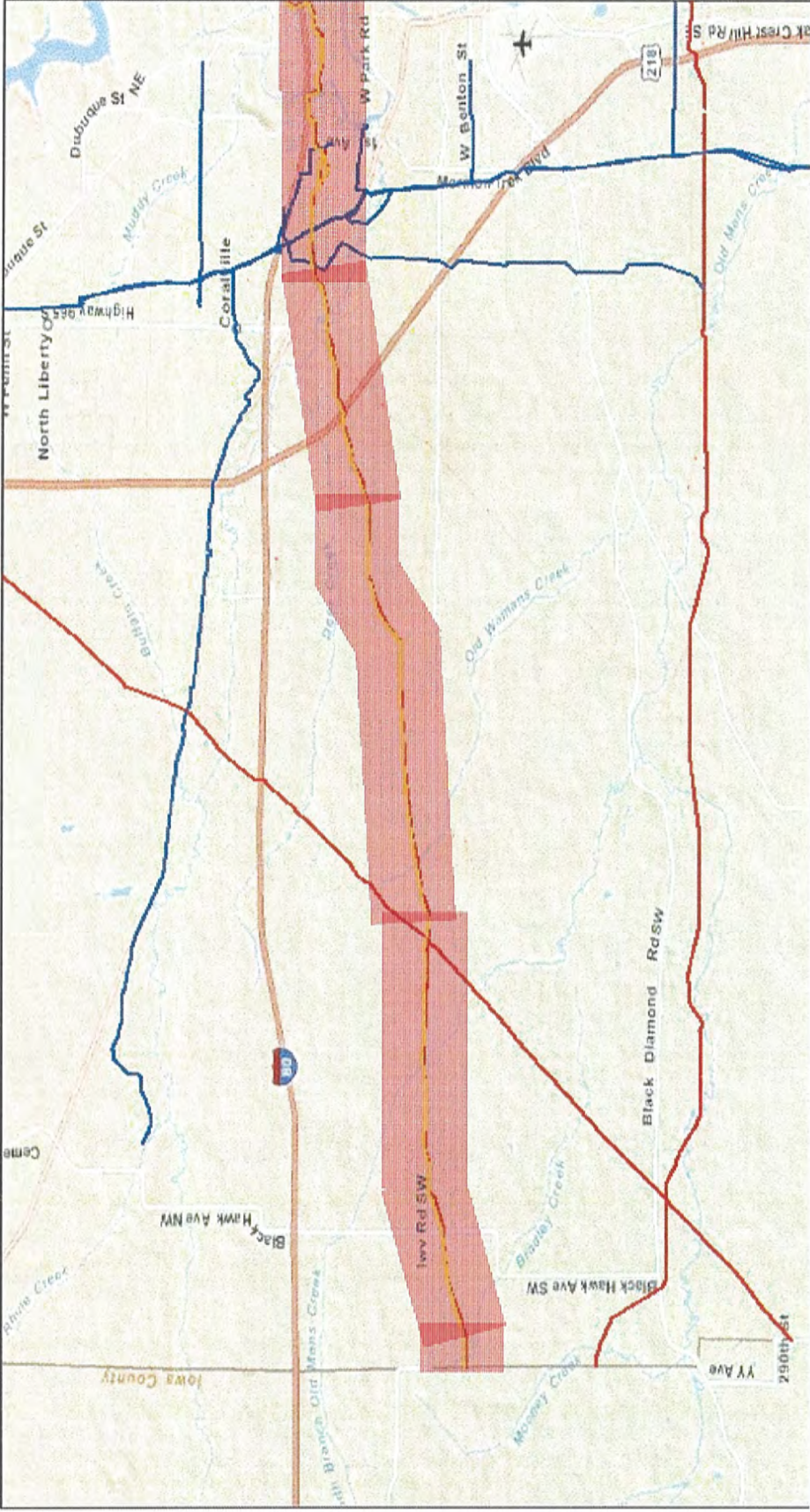
Reset





MAGELLAN LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



MAGELLAN LIQUID

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

Vulnerable Zones-Gas Pipeline

Mid American



View Pipelines by Operator



Choose Operator Type:

Gas Transmission Pipelines

Then Choose Operator:

MIDAMERICAN ENERGY COMPANY (30750)

GO

Reset

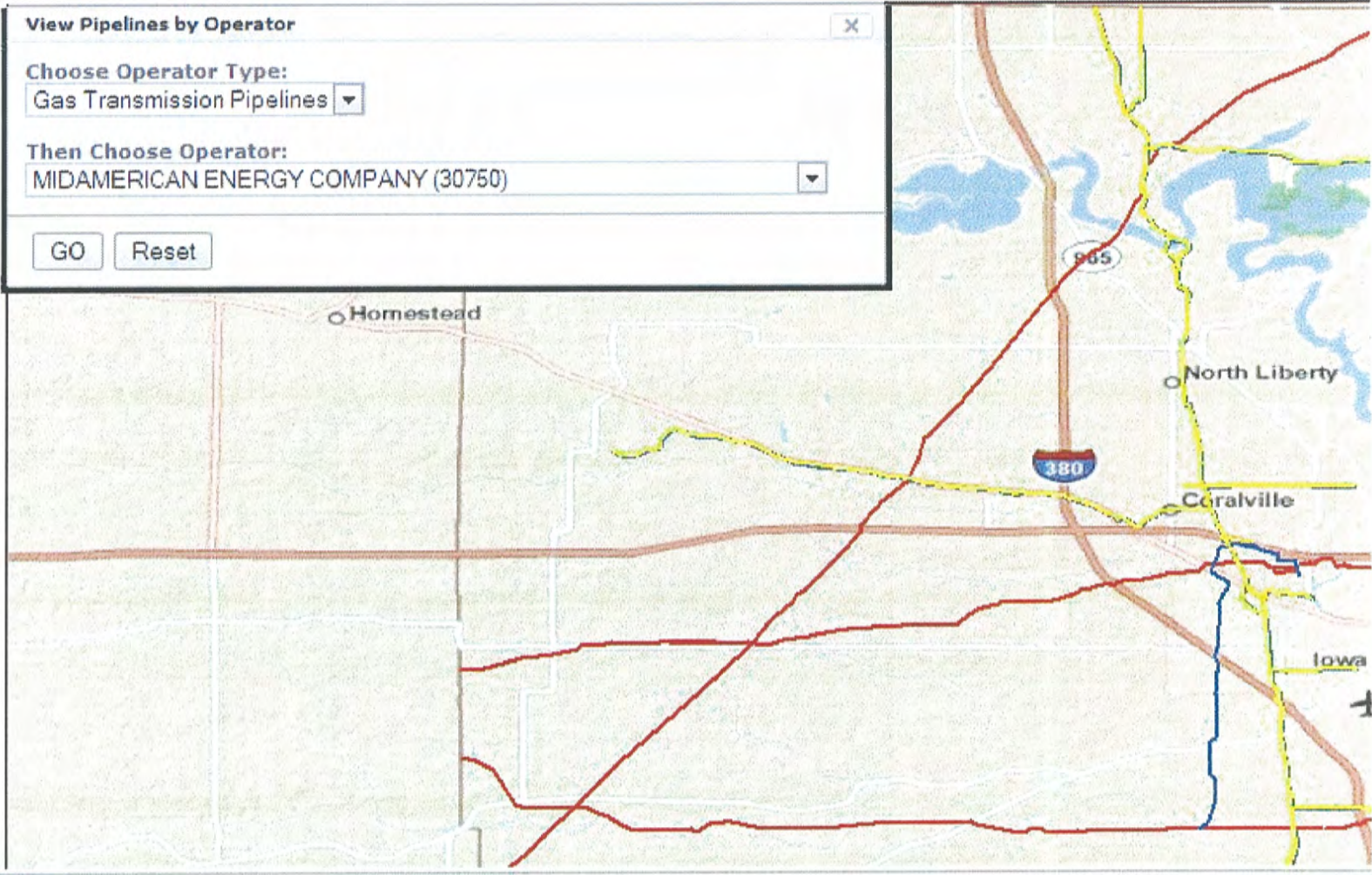
Homestead

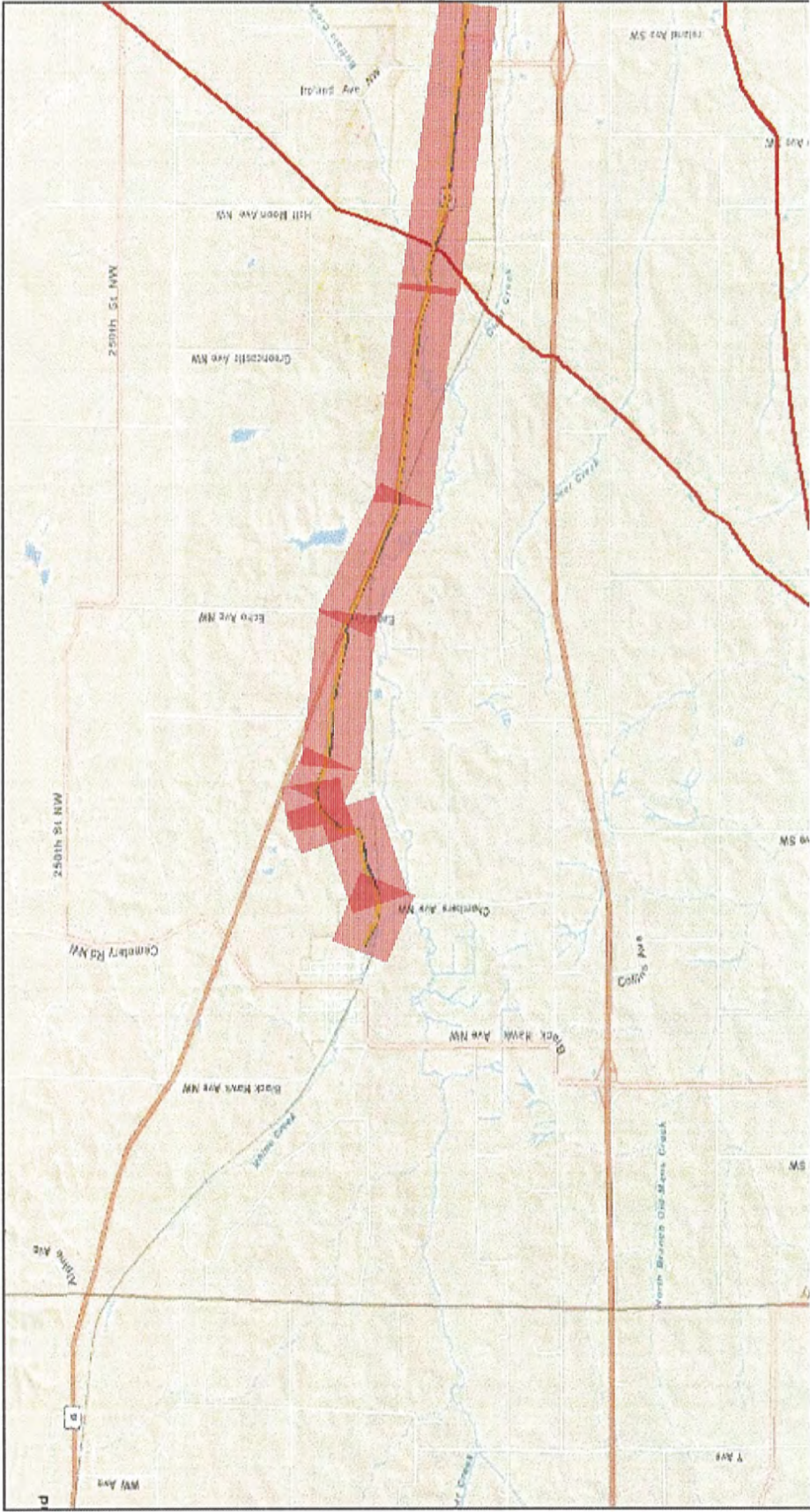
North Liberty

380

Coralville

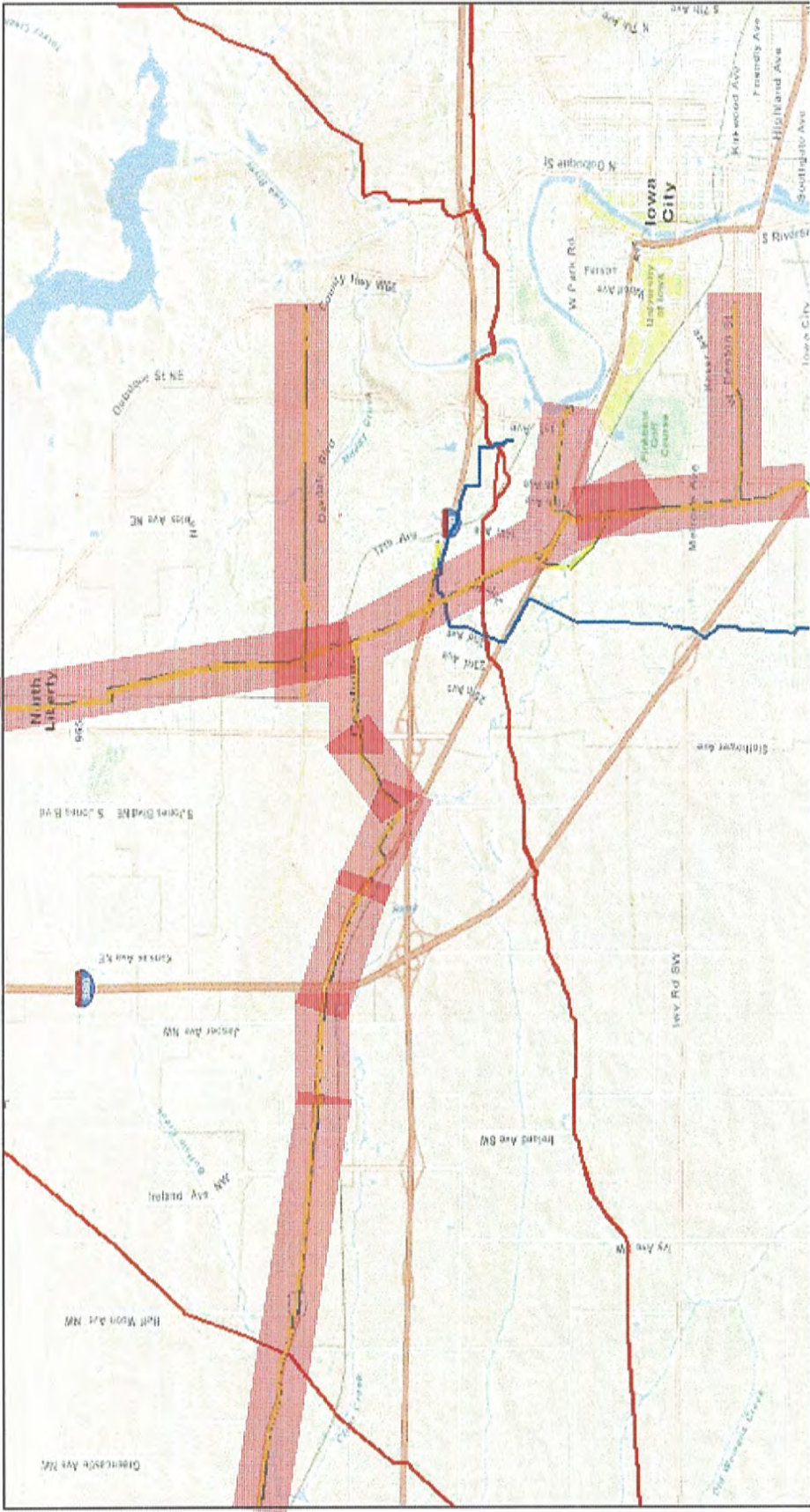
Iowa





MID AMERICAN GAS

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone



MID AMERICAN GAS

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

Vulnerable Zones-Gas Pipeline

ONEOK



View Pipelines by Operator



Choose Operator Type:

Gas Transmission Pipelines

Then Choose Operator:

ONEOK NGL PIPELINE LP (32109)

GO

Reset

Ivy Rd SW

Slothower Ave

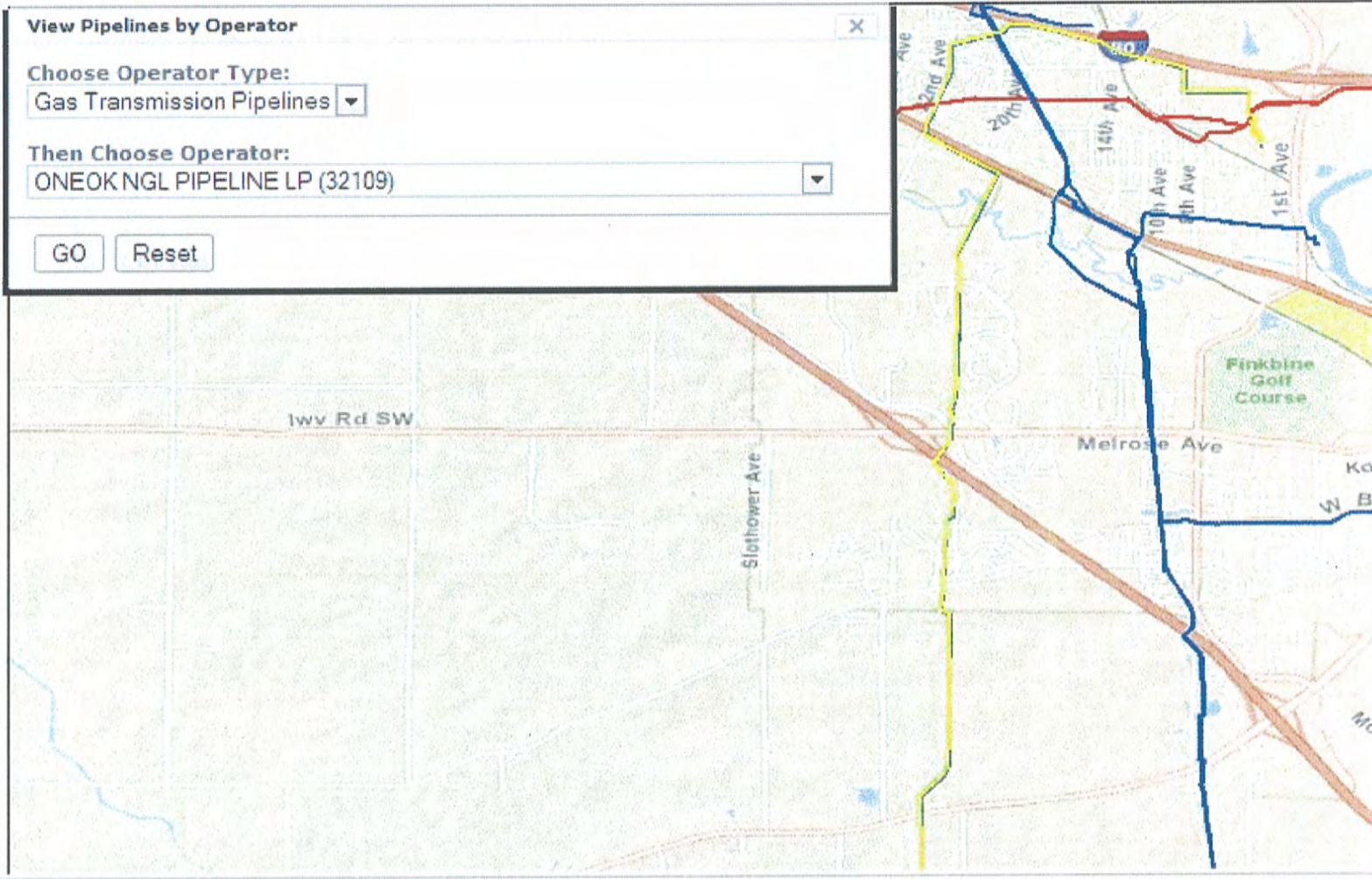
Melrose Ave

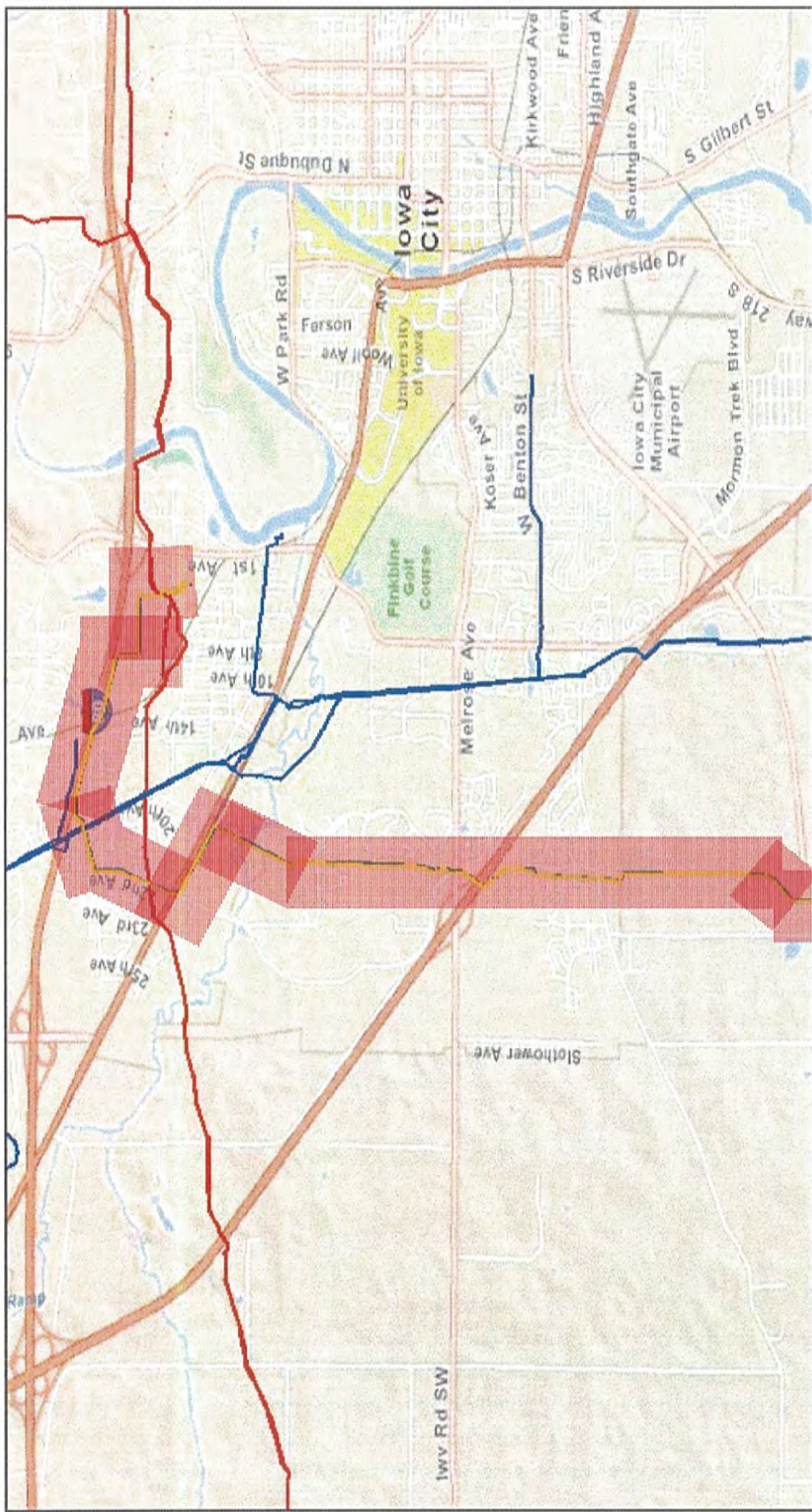
Finkbine Golf Course

Ko

W B

Mo





ONEOK NGL GAS

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone

Vulnerable Zones-Gas Pipeline

Northern Border



View Pipelines by Operator

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Choose Operator Type:

Gas Transmission Pipelines

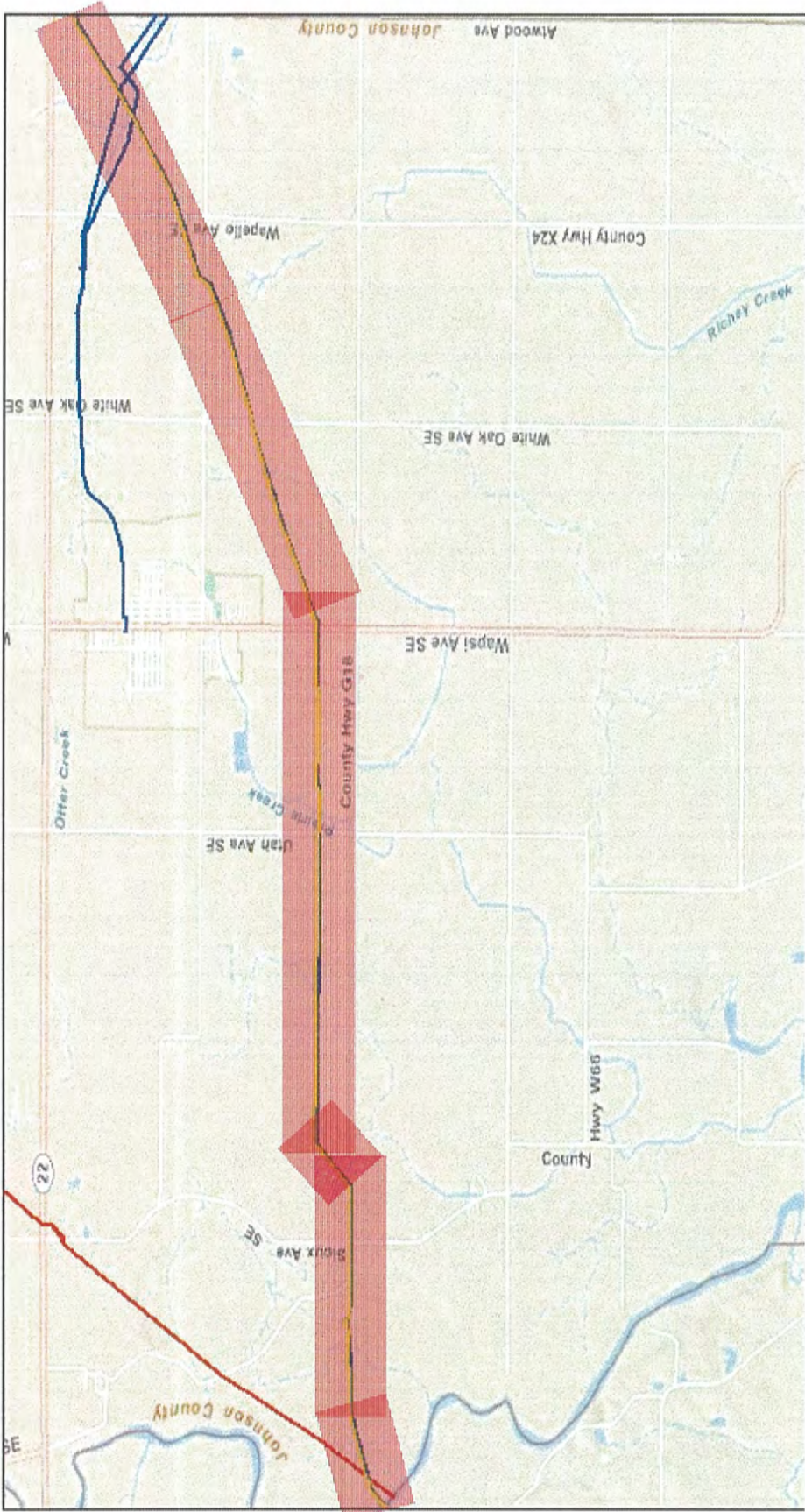
Then Choose Operator:

NORTHERN BORDER PIPELINE COMPANY (13769)

GO

Reset





NORTHERN BORDER GAS

Vulnerable zone base on ERG2009 recommendation of 1000' downwind isolation zone