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Liquid Pipeline Safety: Identifying High Consequence Areas

September 17, 2019 / Dr. Sheila McGinty / Tulsa, OK



VIRGINIA SOUTHSIDE II CONSTRUCTION
Transco Pipeline, Southern Virginia



KENSINGTON GAS PROCESSING PLANT
Columbiana County, Ohio



SUMAS COMPRESSOR STATION
Northwest Pipeline, Washington

Safety

Our Mission

- > **Operate safely** *in everything we do, every day.*
- > **Execute** *on our commitments exceptionally well.*
- > **Collaborate** *to rapidly deliver our best solutions.*
- > **Grow** *our business, our people, and our industry.*
- > **Improve** *our operations and business performance continuously.*



Pipeline Hazardous Material Safety Administration (PHMSA)

- > In the United States, “more than 2.6 million miles of pipelines safely deliver trillions of cubic feet of natural gas and hundreds of billions of ton/miles of liquid petroleum products each year.”
- > “Pipeline systems are the safest means to move [natural gas and liquid petroleum products].”
- > One modest pipeline equals:
 - “... about 750 tanker trucks loading up and moving every two minutes, 24 hours a day, seven days a week ...”
 - 225 railroad tank cars carrying 28,000 gallons per tank.

<https://www.phmsa.dot.gov/faqs/general-pipeline-faqs>

High Consequence Areas (HCA)

> Populated areas

- High population
- Other population

> Unusually sensitive areas

- Drinking water sources
- Environmentally sensitive areas

> Commercially navigable waterways

> Operator defined high consequence areas



HCA – High & Other Population Areas

NPMS – US Census Bureau

- > ***High Population Areas: “... TIGER Urbanized Areas containing 50,000 or more people with a population density of at least 1,000 people per square mile ...”***
- > ***Other Populated Areas are Census Designated Places (CDP) or incorporated areas that lie outside Urbanized areas.***

49 CFR 195.2

- > ***“Rural area means outside the limits of any incorporated or unincorporated city, town, village, or any other designated residential or commercial area such as a subdivision, a business or shopping center, or community development.”***



HCA – High & Other Population Areas



HCA – Unusually Sensitive Areas

49 CFR 195.2

“... a drinking water or ecological source area that is unusually sensitive to environmental damage from a hazardous liquid pipeline release ...”



HCA – Commercially Navigable Waterway

49 CFR 195.1(a)(2)

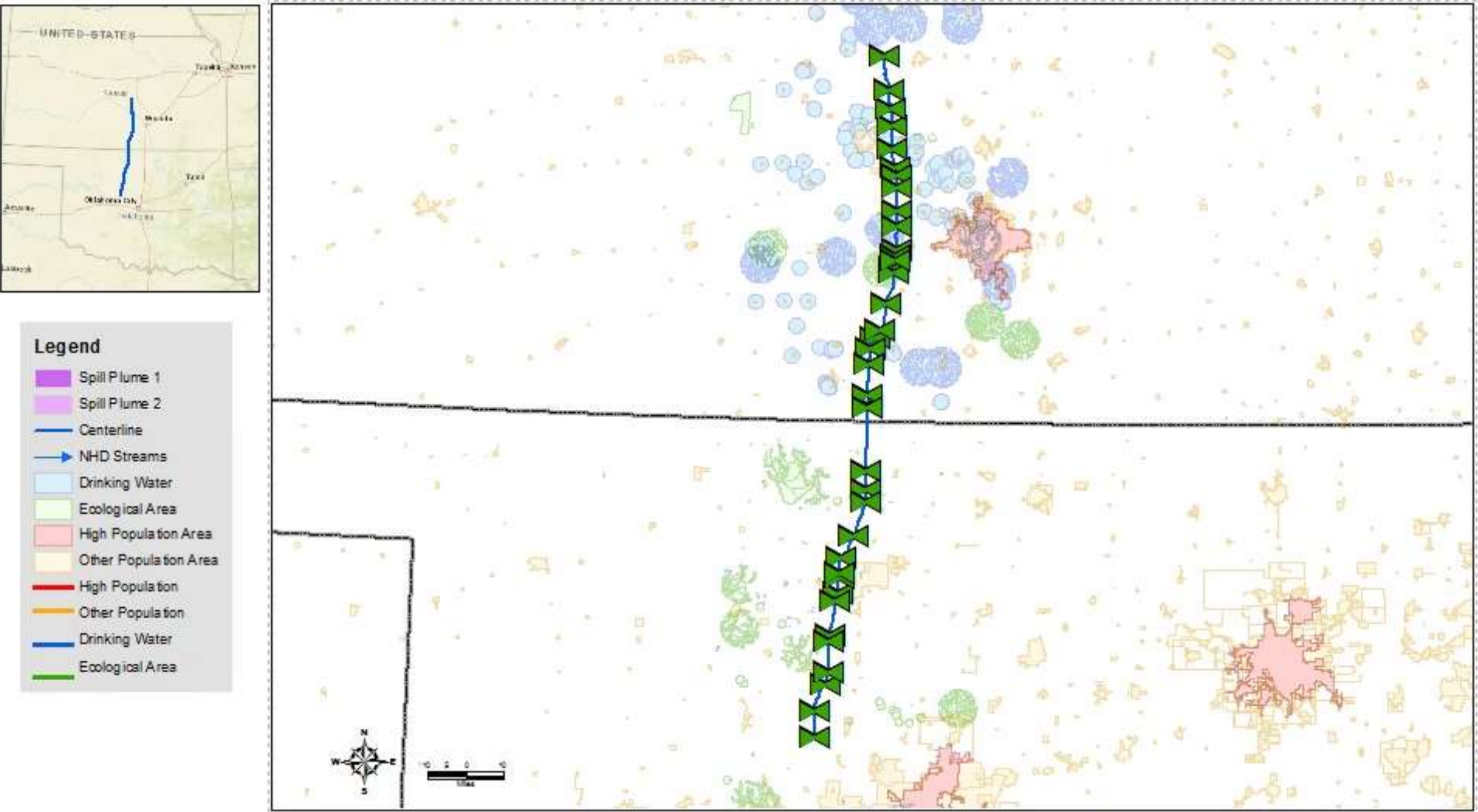
“Any pipeline segment that crosses a waterway currently used for commercial navigation;”



HCA – Operator Defined



HCA in GIS



Valve Locations

49 CFR 195.258 & 195.260

- > Accessible but protected
- > On each side of pump station
- > At locations that will minimize damage or pollution
- > On each side of a water crossing more than 100 feet across
- > On each side of a drinking water reservoir



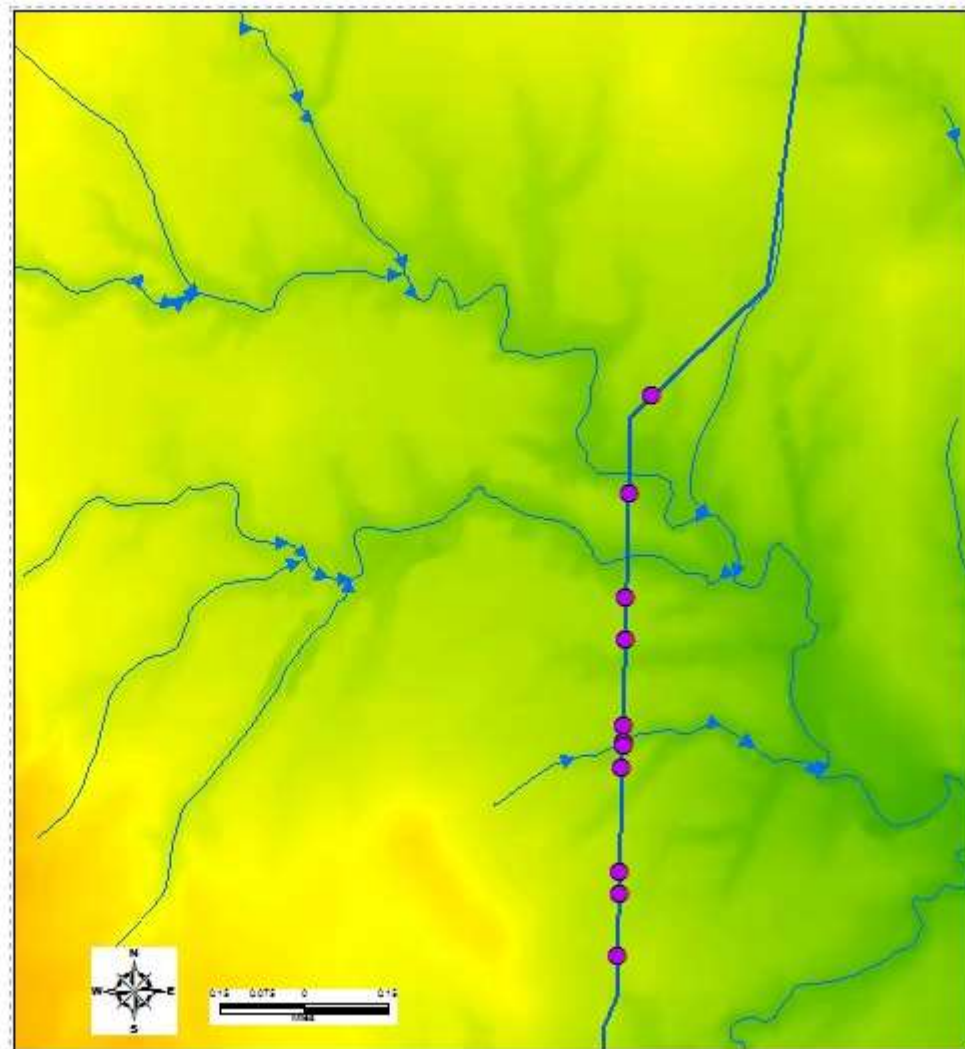
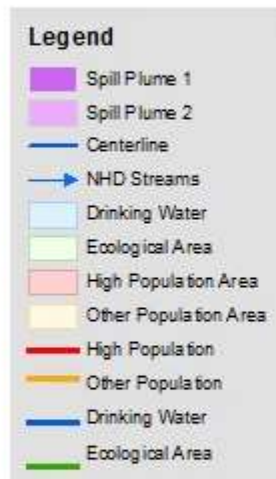
Spill Modeling

USGS Digital Elevation Model

- > 1/3 arc-second
- > Highest resolution seamless dataset
- > Ground spacing is ~ 10 meters north/south; variable east/west

USGS National Hydrography Dataset

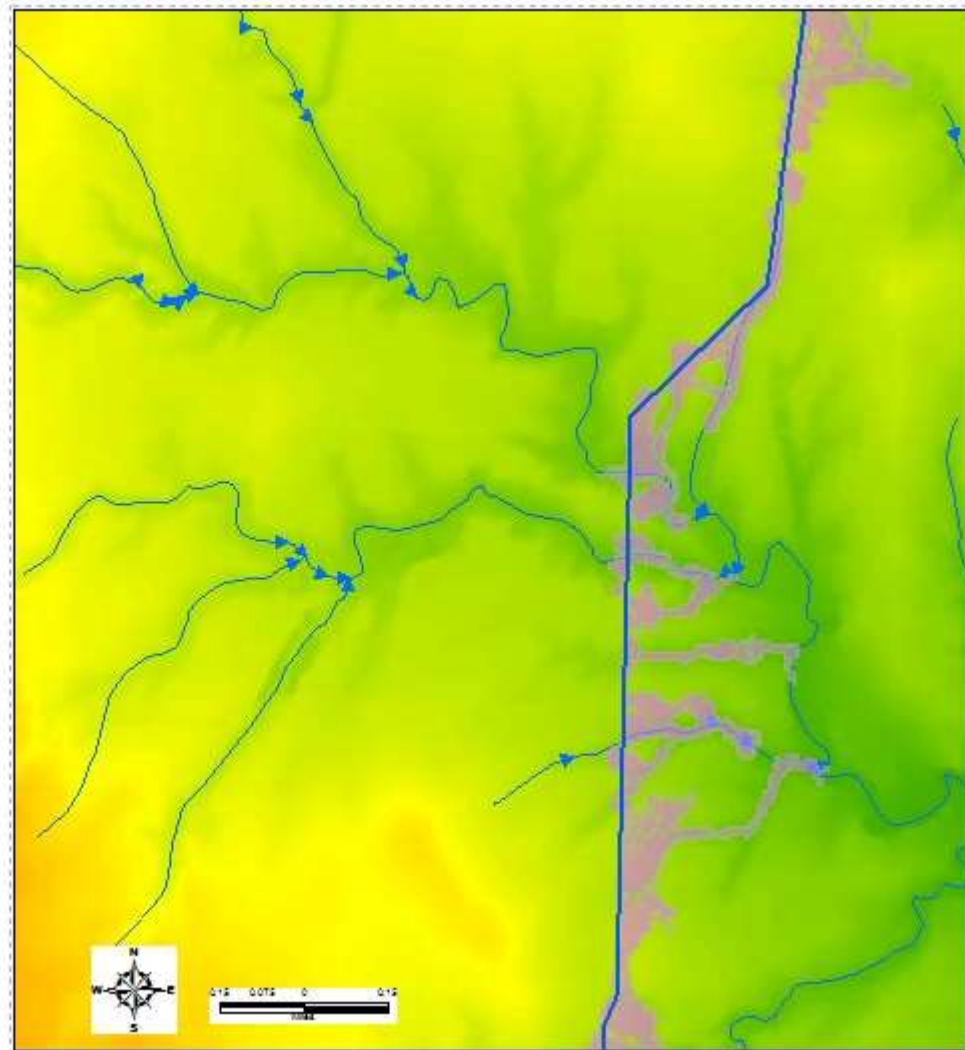
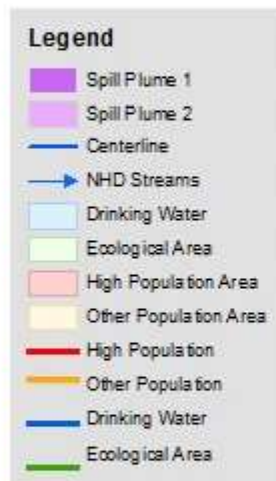
- > Usually 1:24,000 or 1:12,000 scale
- > Includes networked features and flow directions



Spill Modeling

Plume size is determined by the amount of fluid in the pipeline based on:

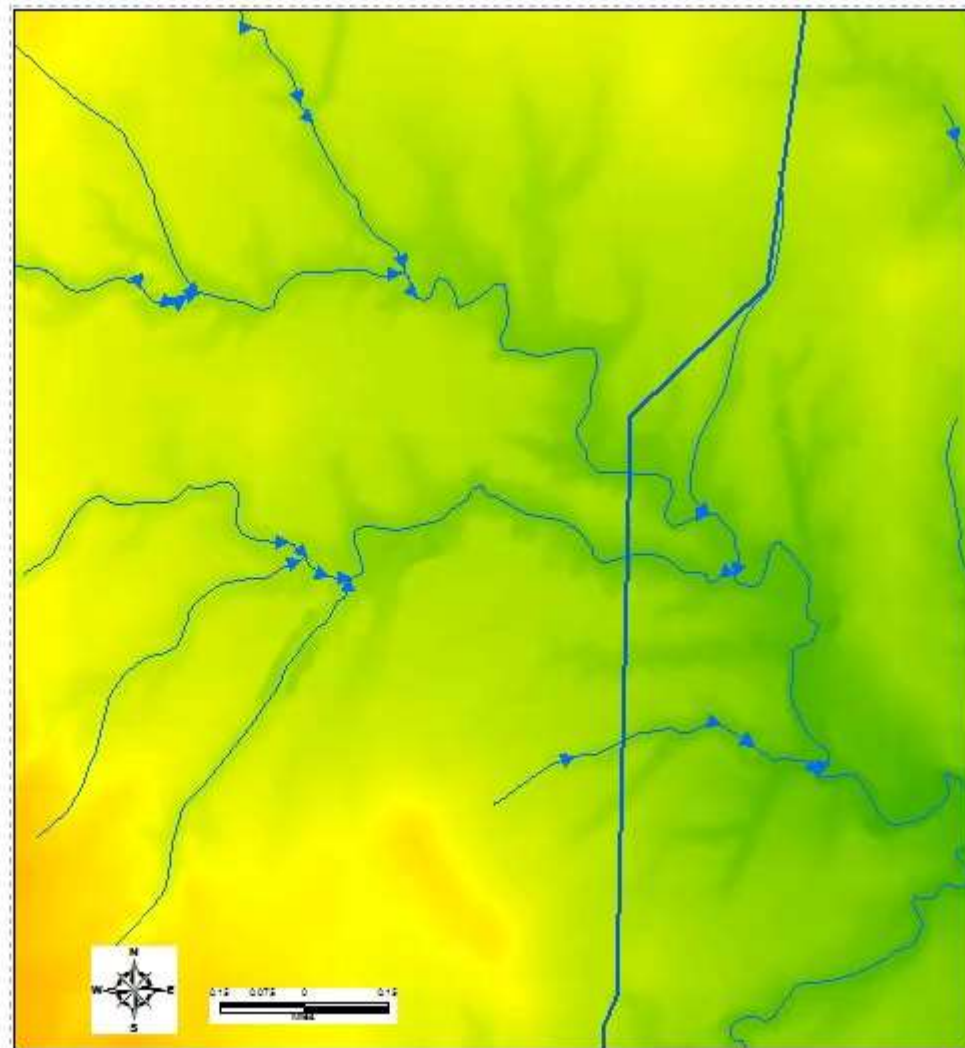
- > Pipe diameter
- > Pipe length
- > Flow rate (barrels per hour)
- > Valve locations
- > Valve response and shutoff times



Spill Modeling

Plume size is determined by the amount of fluid in the pipeline based on:

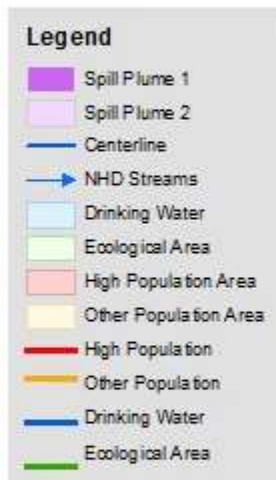
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Spill Modeling

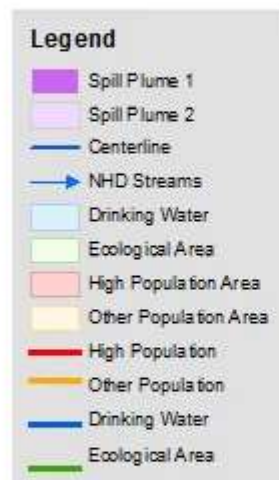
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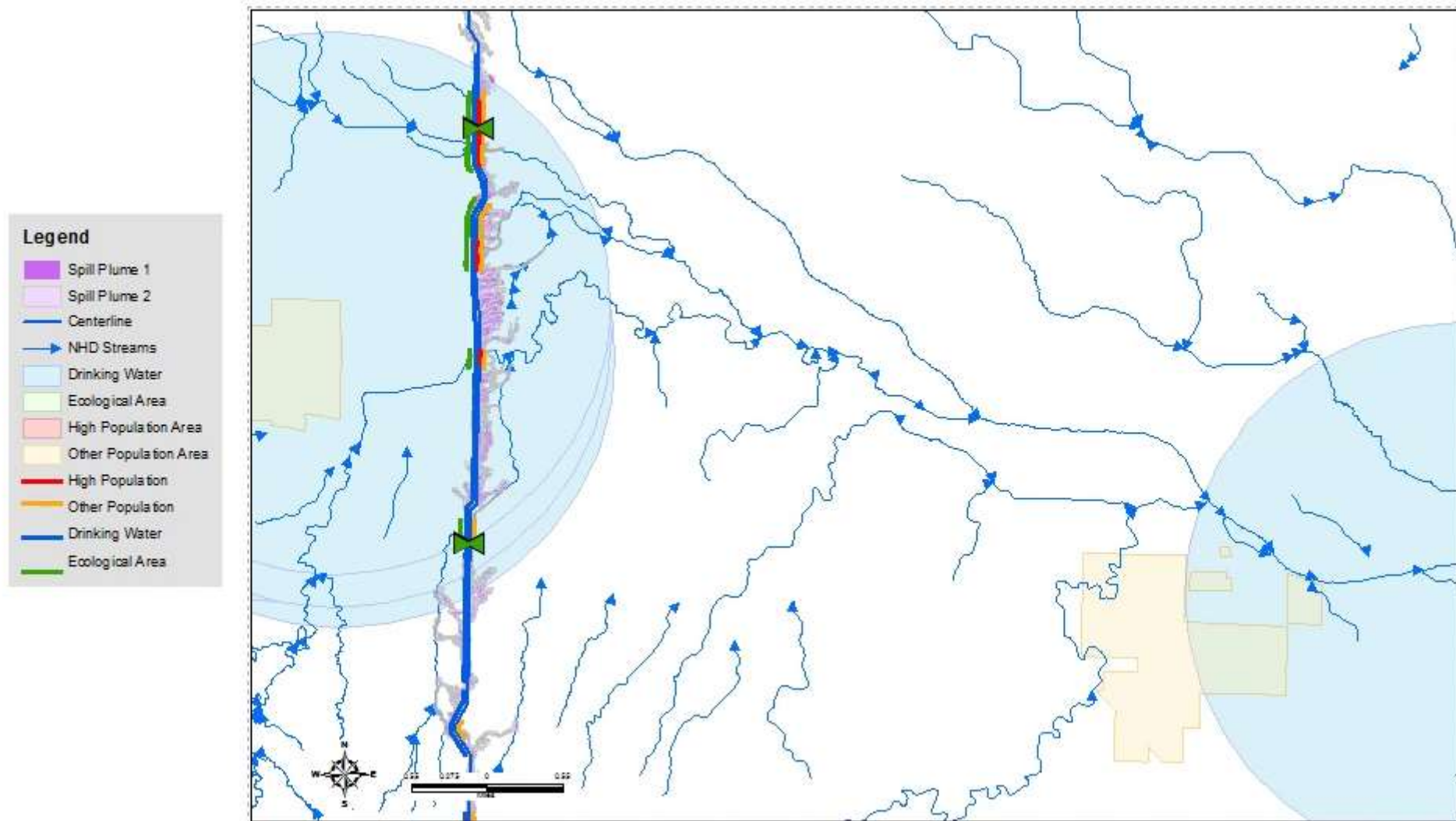


Potentially Impacted HCAs

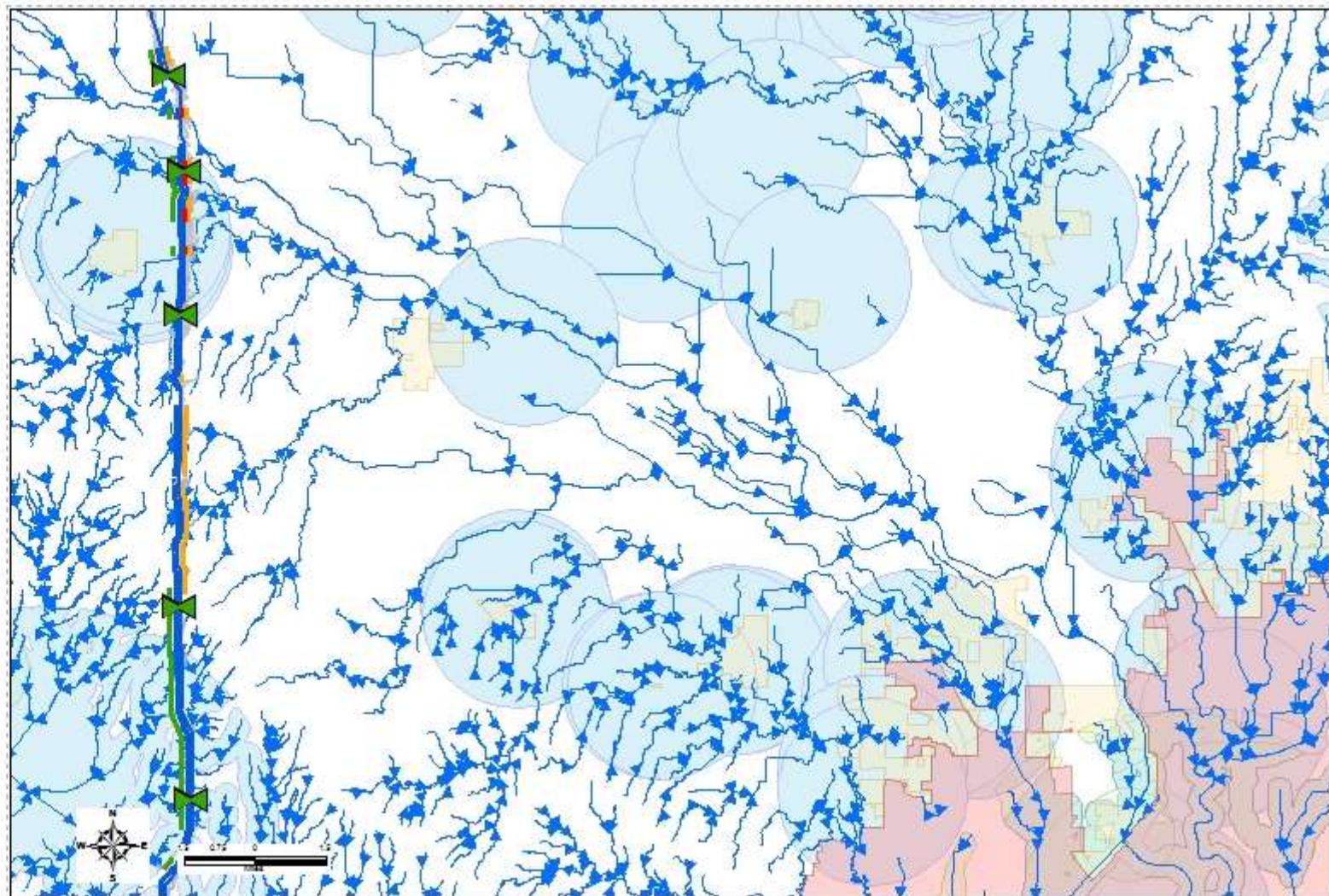
- > **Could directly affect a drinking water source**
- > **Could indirectly affect**
 - High Population
 - Other Population
 - Drinking water
 - Ecological



Potentially Impacted HCAs



Potentially Impacted HCAs



Adjusting Valve Locations

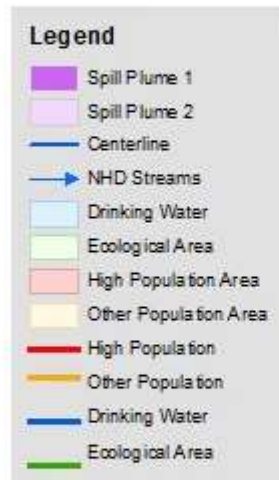
- > Streams
- > HCAs
- > Topography

49 CFR 195.258 & 195.260

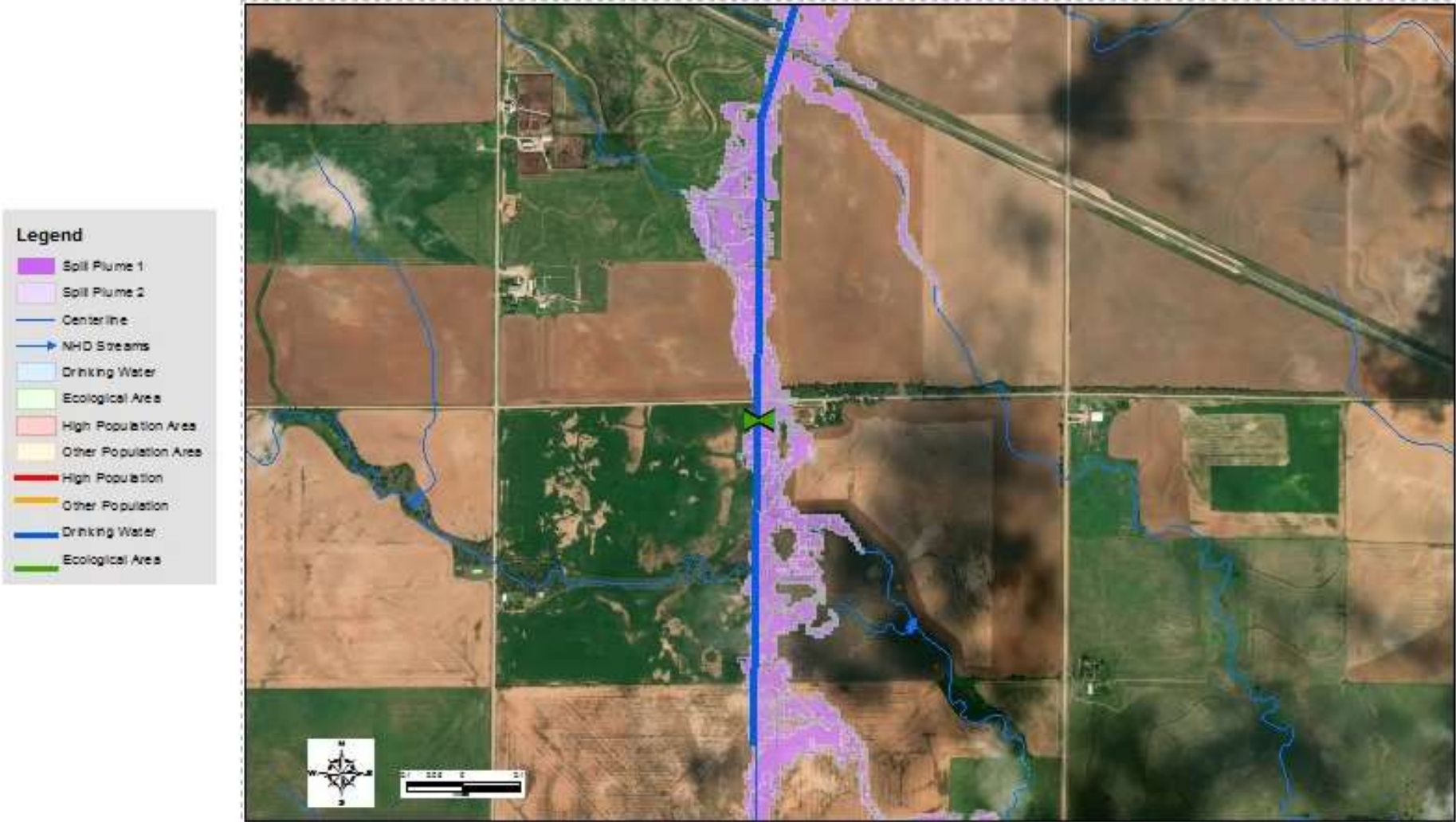
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Second Spill Model



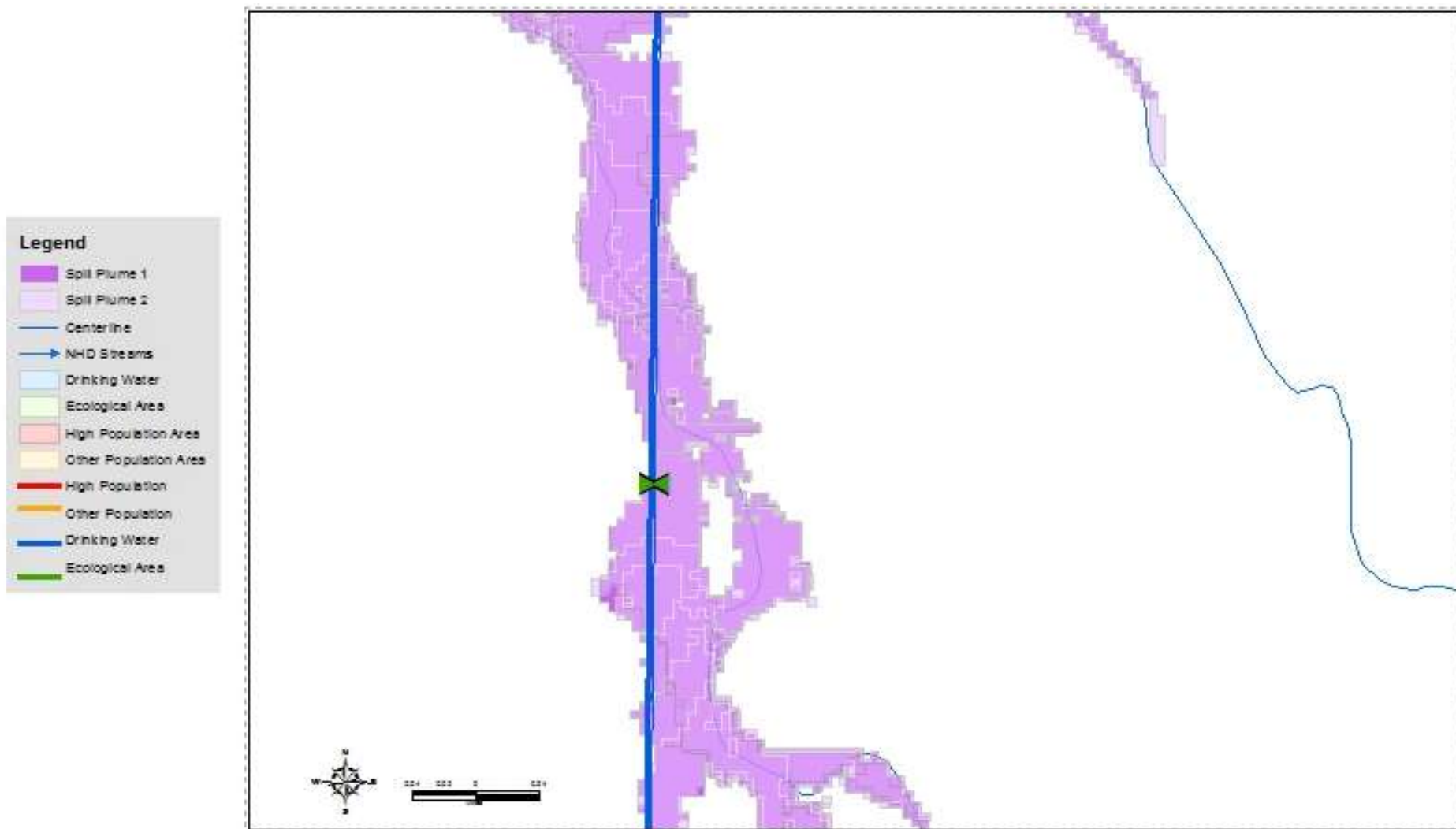
Second Spill Model



Second Spill Model



Second Spill Model



Thank you

