

Remediation and GIS:

Data, Standards, and Site Examples

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MPCA Air, Water, and Waste Conference
February 28, 2008

Topic Outline

- ▶ Spatial data collection criteria for Remediation programs
 - Standards
 - Understanding coordinate systems
 - Data collection processes
- ▶ GIS data at MPCA
- ▶ GIS applications at MPCA
- ▶ GIS in action at cleanup sites
 - Petroleum Remediation Program (PRP)
 - Voluntary Investigation and Cleanup (VIC) Program
 - Closed Landfill Program



Spatial Data Collection

Data Standards



Data Standards

MPCA Remediation programs require consultants and Responsible/Voluntary Parties to report:

- ▶ Site Location: A point that represents the location of the entire site or facility
 - Approximate center of the parcel or site
 - Entrance to the main site building
 - Main gate or entrance to the site

- ▶ Site Features: Points that represent soil borings, monitoring wells, test pits, tank basins, etc.

Example Site Locations



Example Feature Locations



Data Standards & Guidance

▶ Data Standards on [MPCA Web Site](#)

- Petroleum Remediation Program (PRP)
 - ▶ Guidance Document 1-03a [Spatial Data Reporting Form](#)
- Closed Landfill Program (CLP)
 - ▶ Detailed geodatabase and symbology specifications (not yet published on MPCA web site)
- Superfund & Emergency Response Section (includes VIC)
 - ▶ [Data submittal workbook](#)

▶ Submittal options

- Preferred: E-mail reporting form to site Hydro or Project Manager
- Print and 'snail-mail' reporting form



Site Location Requirements

- ▶ Minimum data fields required for **Site Location**
 - MPCA Program
 - MPCA Site ID (Program ID)
 - Site Name
 - Point description
 - A geographic coordinate (x,y)
 - ▶ Latitude & Longitude or
 - ▶ Universal Transverse Mercator (UTM) Zone 15N Extended (**required** by CLP)
 - Collection method
 - Collection date
 - Organization name
 - Organization type



Site Feature Location Requirements

- ▶ Additional data required for **Site Feature** (well or boring, etc.) location
 - Feature Type
 - Feature Name
 - Ground elevation (z) in feet
 - Unique well number (CWI)
 - Top of screen elevation in feet
 - Bottom of screen elevation in feet
- ▶ Petroleum Remediation and Closed Landfill Programs require slight variations on these data fields (see specific guidance)



Locational Data Forms

► Example Locational Data Entry Form

Superfund and Emergency Response Section - Spatial Data Reporting Spreadsheet

January 2008 Version (see end of Dictionary sheet for description of updates)

For complete instruction refer to the *Guidance for the Collection and Reporting of Spatial Data* available at:

<http://www.pca.state.mn.us/programs/spatialdata.html> or refer to the *Dictionary worksheet* in this workbook for assistance on data entry.

Has a site location point (coordinate) been submitted for this site?

If no, provide a site location point in Part 2. If yes, complete Parts 1 and 3.

PART 1 PROGRAM INFORMATION

1 Remediation Program	2 MPCA Program ID Number	3 Site Name	4 Site Location Point Description	5 Longitude or Easting (X)	6 Latitude or Northing (Y)
VIC	VP1234	Test Site 1	Center of Site	-93.123456	45.123456

PART 2 SITE LOCATION DATA (Fields 4-10)

PART 3 SITE FEATURE LOCATION DATA

11 Station Type <i>Select From List</i>	12 Station Name	13 Longitude or Easting (X)	14 Latitude or Northing (Y)	15 Collection Method	16 Collection Date (mm/dd/yyyy)
Well	MW-12	-93.123498	45.123498	GPS - Survey Quality	02/21/2008
Test Pit Sample	S-123	-93.123444	45.123444	GPS -Receiver	02/20/2008
Surface Water Sample	SW-125	-93.129999	45.129999	GPS -Receiver	02/20/2008



Petroleum Remediation Reporting Form

► Example PRP
Location Reporting
Form



Petroleum Remediation Program

Minnesota Pollution Control Agency

http://www.pca.state.mn.us/programs/lust_p.html

Spatial Data Reporting Form

Guidance Document 1-03a

(For complete instructions, see Guidance Document 1-03.)

Part 1. Background

Has a site location data point been submitted for this site (circle/highlight)? YES or NO
If yes, you do not need to complete Part 2 of this form but should complete Part 3 if there are additional site features to report. This form can be submitted electronically if desired (e.g., as an e-mail attachment to the project manager).

MPCA Site ID: LEAK00016293

Site Name: Former BJM Computer Site

Data Collection Date: 10/24/2007

Name of Person Who Collected Data:

Organization Name:

Organization Type: Consultant

Part 2. Site Location (use one of the three spatial data reporting formats provided)

Point Description: Former UST Basin

Collection Method: On-Line Map Interpolation

Datum (circle/highlight): NAD83

1) Longitude (dd mm ss.ss):

Latitude (dd mm ss.ss):

2) Longitude (dd.dddddd):

Latitude (dd.dddddd):

3) UTM - X (Easting): 369544.59

UTM - Y (Northing): 4871118.61

UTM Zone: 15

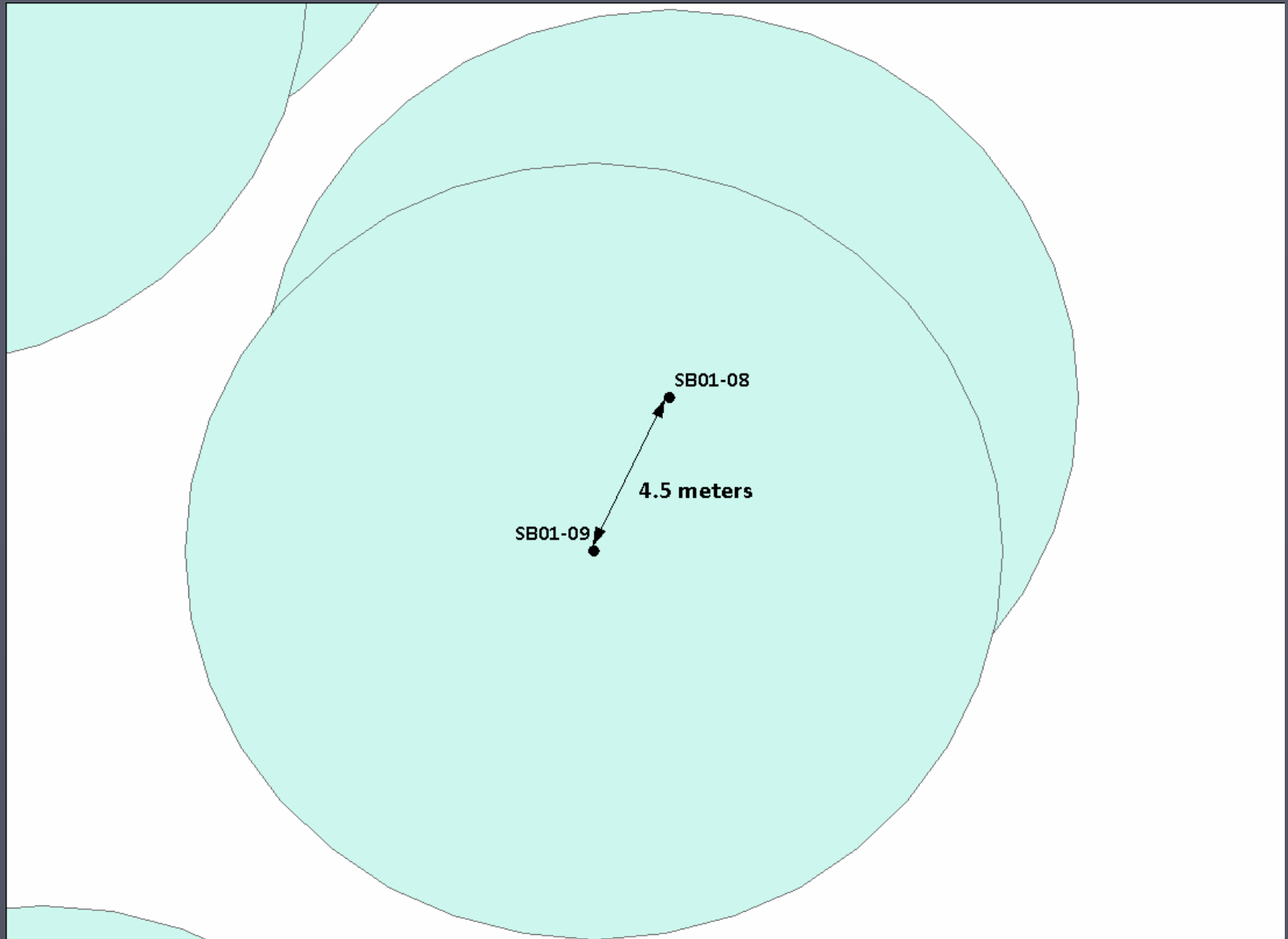
Location Accuracy

► Horizontal Accuracy:

- A measure of how close a geographic coordinate is to the true location of the object on the ground.
- For all programs but Closed Landfill, horizontal accuracy must be within **10 meters**



Horizontal Accuracy



Spatial Data Collection

Understanding Coordinate Systems



Understanding Coordinate Systems

- ▶ Two common coordinate systems are used by MPCA programs
 - Latitude/Longitude, also known as a *geographic* coordinate system
 - ‘Universal Transverse Mercator (UTM)’ refers to a *projected* coordinate system



Understanding Coordinate Systems

- ▶ Both coordinate systems are expressed as x, y, z
 - X represents the **horizontal** coordinate on a 2-dimensional grid
 - Y represents the **vertical** coordinate on a 2-dimensional grid
 - Z represents the third dimension – elevation, depth, altitude
 - ▶ Often required for site features (wells) or in site surveys (CLP)

Even though we often use lat/long and x, y interchangeably when talking about coordinates; the **X value is NOT latitude, it is longitude**



Latitude and Longitude

- ▶ A network of horizontal and vertical lines called a Graticular network
- ▶ Expressed as degrees of angle measured from center of Earth to a point on the Earth's surface
- ▶ -180 degrees to 180 degrees Longitude
- ▶ -90 degrees to 90 degrees Latitude

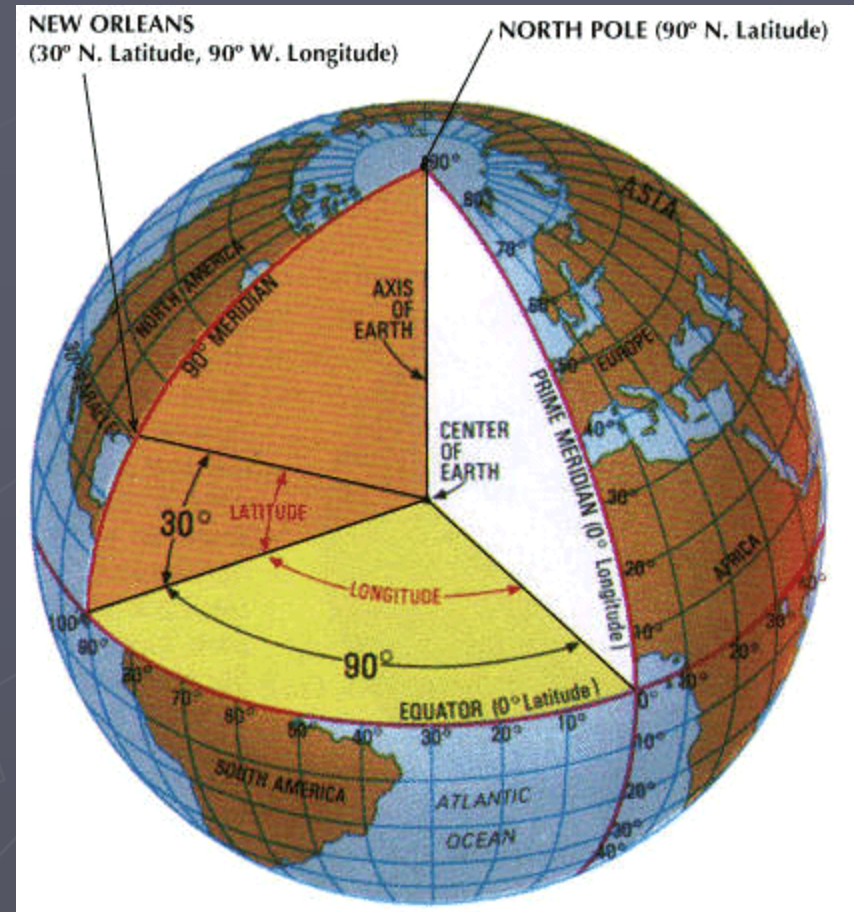
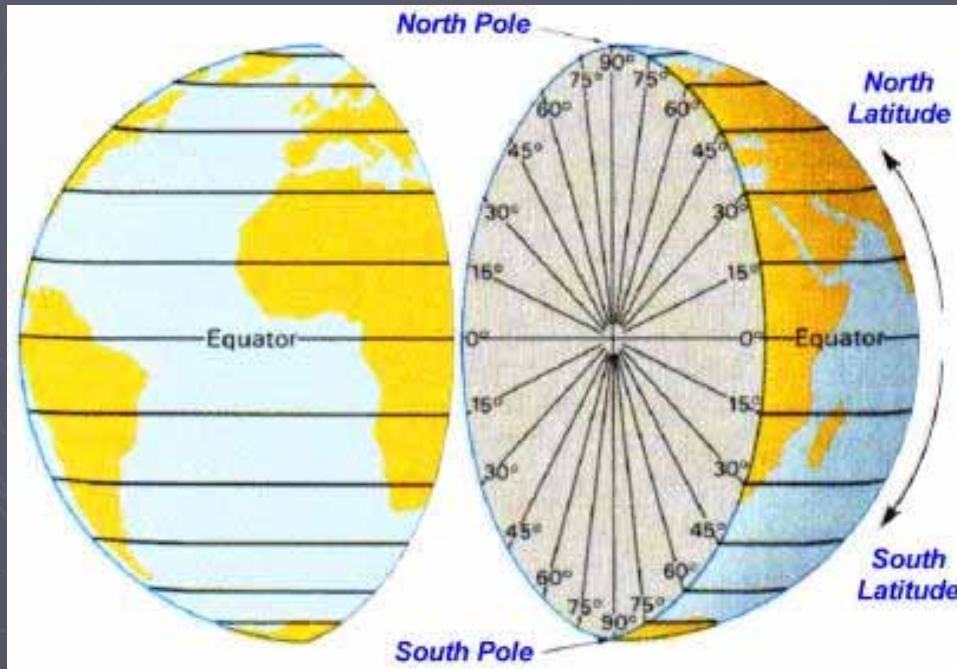


Image: "longitude: place location usage." Online Map/Still. Encyclopædia Britannica Online. 27 Feb. 2008 <<http://www.britannica.com/ebc/art-54586>>.

Latitude



- ▶ Defines the Y coordinate
- ▶ East-west orientation
- ▶ Commonly referred to as Parallels
- ▶ Equator divides earth into northern and southern hemispheres and is 0 degrees

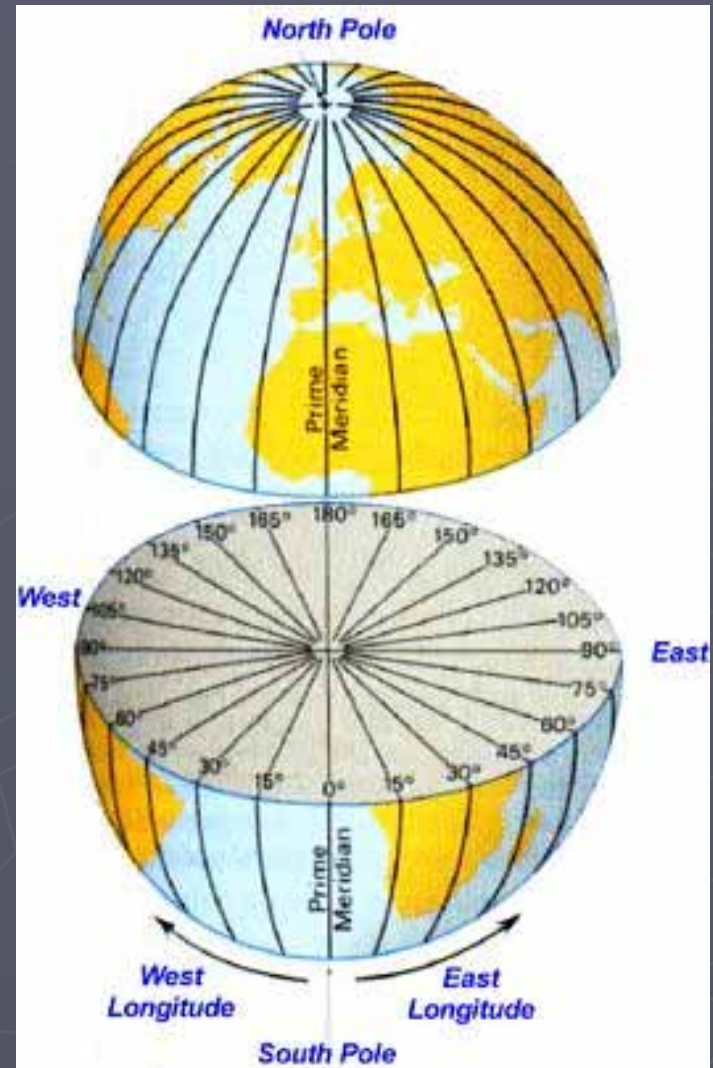
Image: UNESCO - http://gea.zvne.fer.hr/module/module_b/module_b3.html



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Longitude

- ▶ Defines the X Coordinate
- ▶ North-south orientation
- ▶ Commonly referred to as Meridians
- ▶ Prime Meridian divides earth into eastern and western hemispheres and is 0 degrees



Writing Geographic Coordinates

- ▶ Degrees Minutes Seconds (DMS)
 - $DDD^{\circ} MM' SS.ssss''$
 - Default in most GPS receivers
- ▶ Decimal Degrees (DD)
 - $DDD.ddd^{\circ}$
 - Minimum of 3 decimal places required
- ▶ Degrees Decimal Minutes (DDM)
 - $DDD^{\circ} MM.mmm'$
 - Be careful of this one!



Writing Geographic Coordinates

MSP Airport is at:

Degrees Minutes Seconds

44° 52' 56.856 Latitude, -93° 12' 33.339" Longitude

Decimal Degrees

44.882° Latitude, -93.209° Longitude

Degrees Decimal Minutes

44° 52.948' Latitude, -93° 12.556' Longitude



Universal Transverse Mercator (UTM)

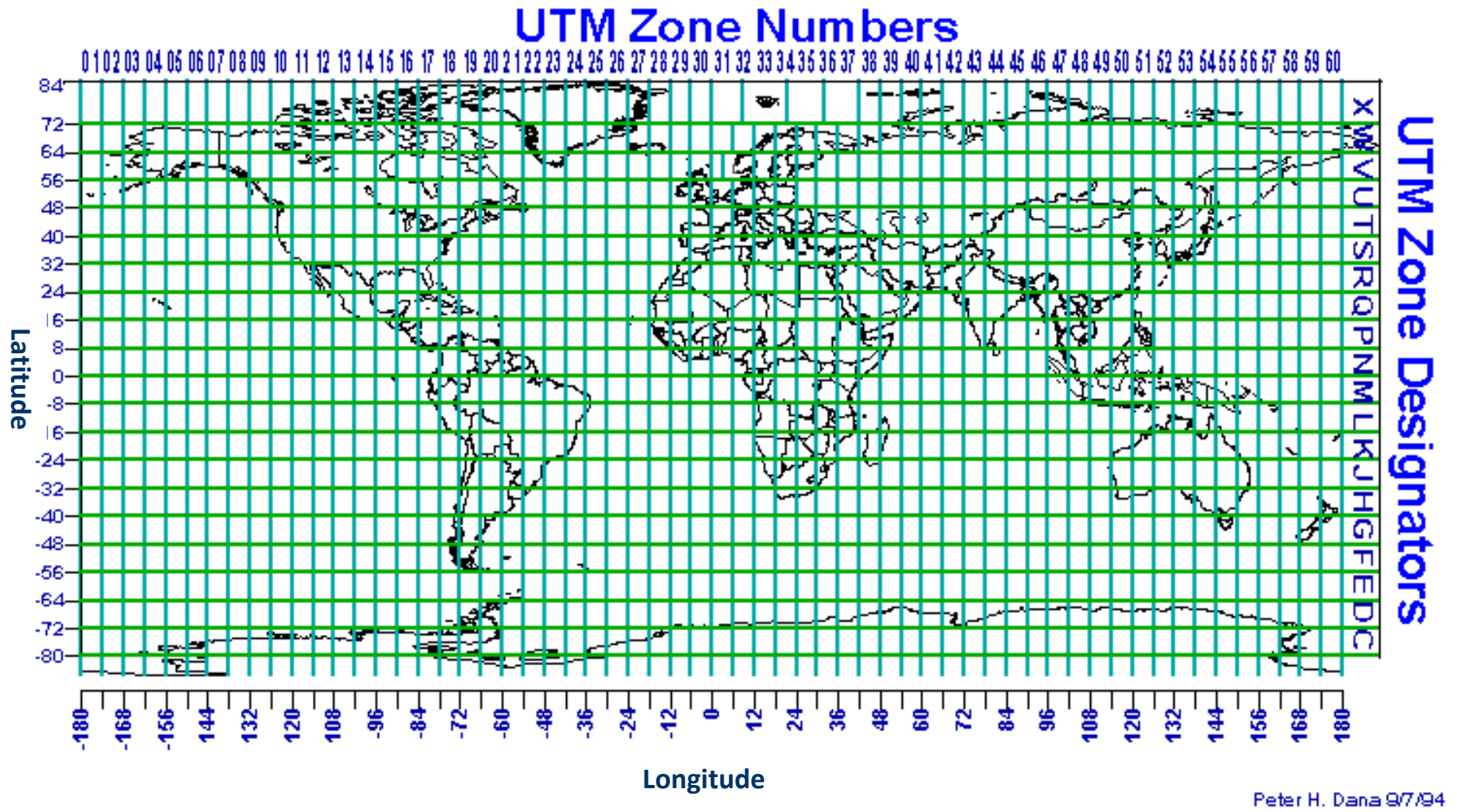


Image: Peter H. Dana, The Geographer's Craft Project, Department of Geography, The University of Colorado at Boulder

UTM in Minnesota

- ▶ Most of Minnesota is in Zone 15T
- ▶ Far western MN is in Zone 14T
- ▶ Northeastern MN is in Zone 16T
- ▶ MPCA requires use of Zone 15T Extended

UTM Zones in Continental U.S.

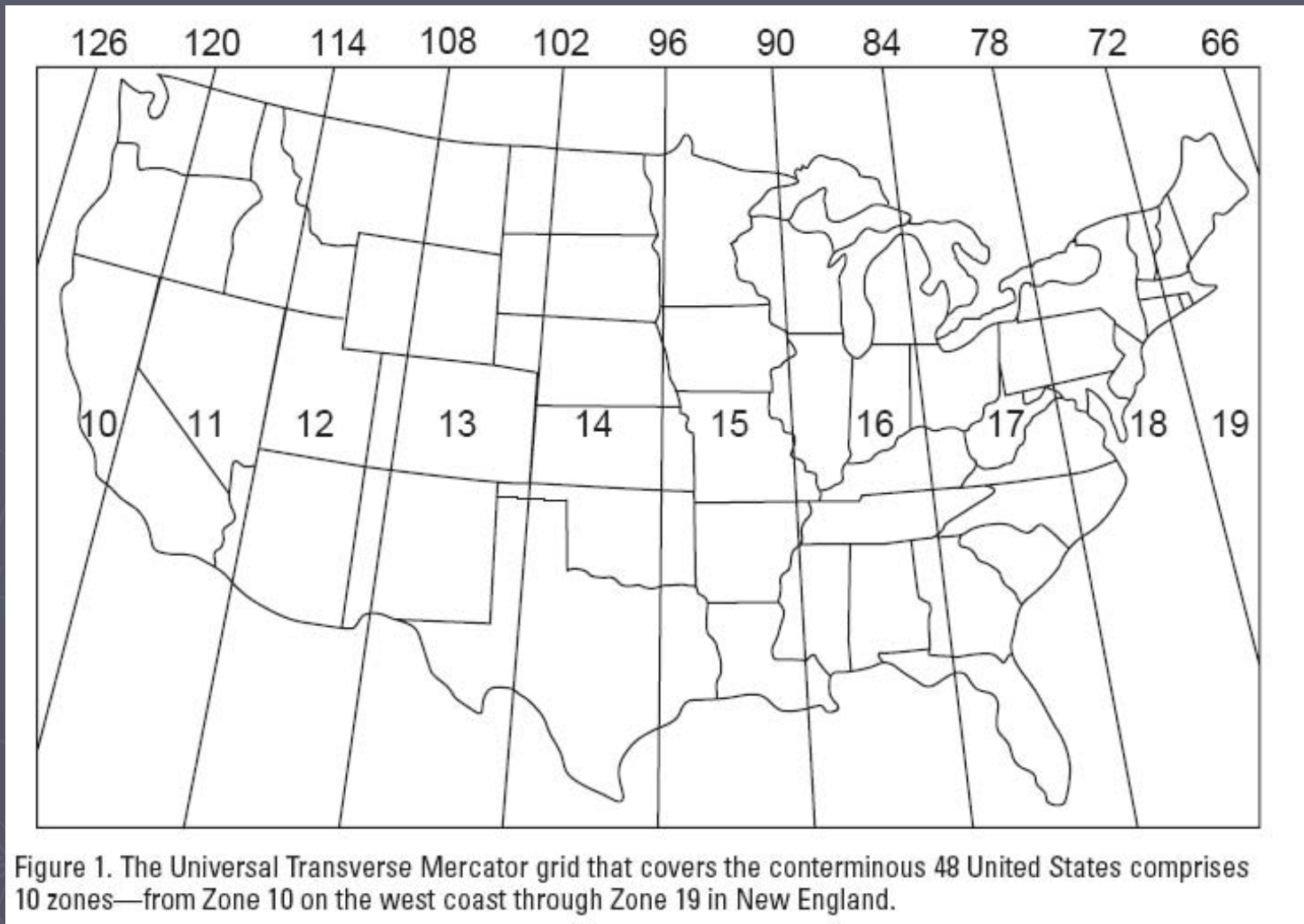


Figure 1. The Universal Transverse Mercator grid that covers the conterminous 48 United States comprises 10 zones—from Zone 10 on the west coast through Zone 19 in New England.

Image courtesy of the U.S. Geological Survey:
http://en.wikipedia.org/wiki/Universal_Transverse_Mercator_coordinate_system



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UTM – Pros and Cons

▶ UTM – Pros

- Area, distance, and shape are minimally distorted
- More accurate at state level than at national level

▶ UTM – Cons

- Not designed to be used across more than a few zones
- Error and distortion increase if used across multiple zones
- Numbers aren't as 'meaningful' as Lat/Long

UTM Zone 15T Extended

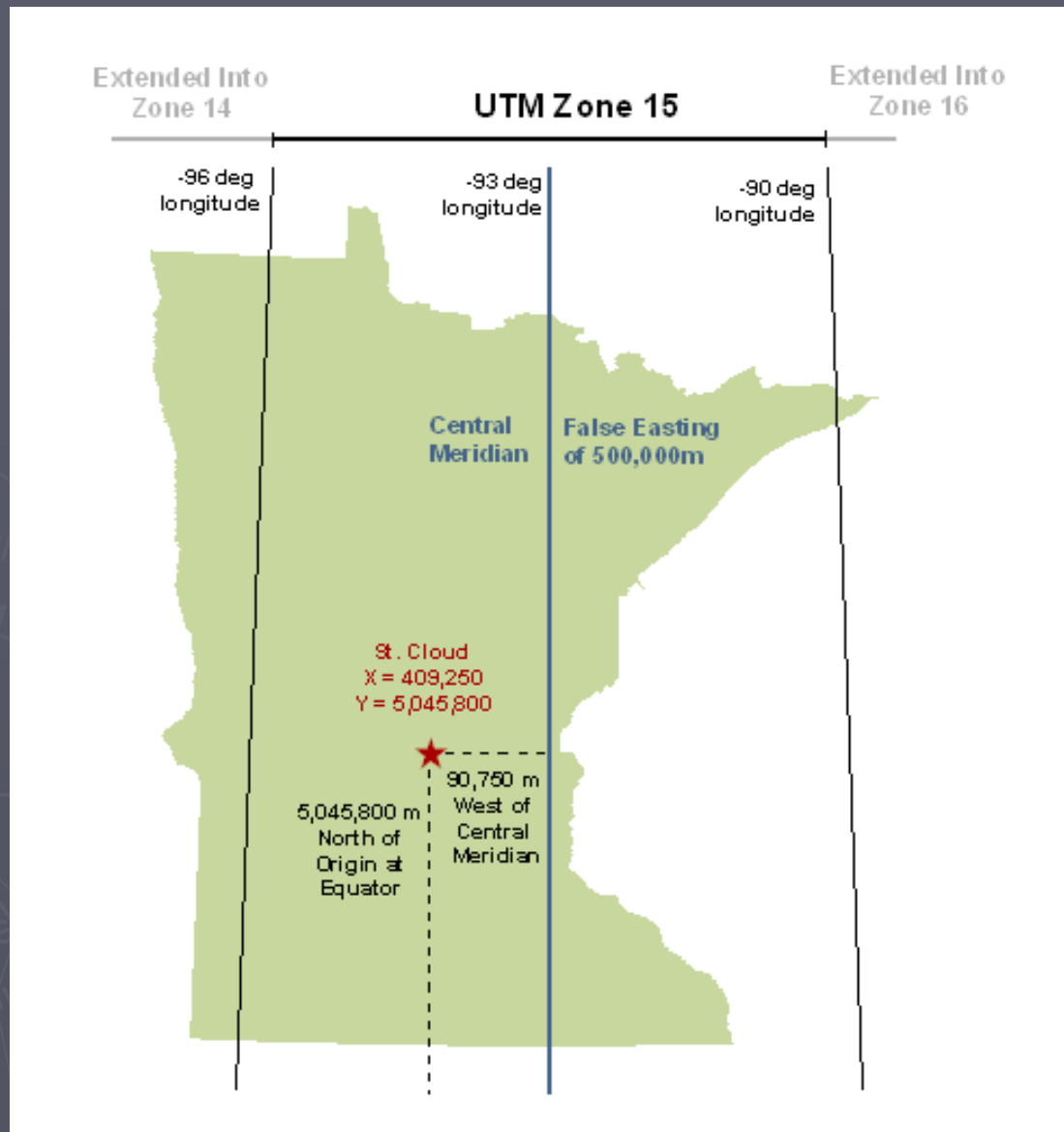


Image courtesy of
David Fawcett,
Minnesota Pollution
Control Agency

Spatial Data Collection

Data Collection Processes

Data Collection Processes

▶ GPS

- 'Recreational' Receivers (Magellan, Garmin)
 - ▶ 10-30 meter accuracy
 - ▶ Accuracy ↑ if more satellites are 'acquired' by the receiver
 - ▶ Many receivers give you an estimate of accuracy on-screen
- Survey-quality Receivers (Trimble, Leica)
 - ▶ Sub-meter to 3-meter accuracy

▶ Internet-based maps

- [What's In My Neighborhood](#)
- [Google Earth](#)

▶ Your own desktop GIS

▶ Free GIS

- Free [ArcGIS Explorer](#) GIS software
- Free [aerial photography](#) from [Land Management Information Center](#)
- Free [aerial photography](#) from [MN DNR](#)



GIS Data and Applications at MPCA

GIS Data at MPCA

- ▶ Downloadable at MPCA's web site
 - 'What's In My Neighborhood' Site Locations
 - Petroleum Remediation Program Site Locations
 - Ground water monitoring stations – limited station availability at this time, is improving
 - Surface water monitoring stations
 - Surface water assessments
 - ▶ 305(b) lakes and streams (Assessed waters)
 - ▶ 303(d) lakes and streams (Impaired waters)
 - St. Louis River Area of Concern sediment database (see Section IV database download)



GIS Data from other State Departments

- ▶ DNR [Data Deli](#)
- ▶ Land Management Information Center [Geographic Data Clearinghouse](#)
- ▶ Both organization host free, statewide aerial photography

Remediation-focused GIS Apps at MPCA

- ▶ MPCA has created a number of web-enabled GIS applications for customers/stakeholders and the general public
- ▶ Two Remediation-specific applications are:
 - [What's In My Neighborhood?](#)
 - Petroleum Remediation [Wellhead Protection](#) Tool

Other GIS Applications at MPCA

- ▶ Web-based GIS applications for other environmental/program areas:
 - Environmental Data Access (EDA) System
 - ▶ Ground Water
 - ▶ Surface Water
 - Station Viewer
 - Assessment Viewer
 - ▶ Air
 - Point Source
 - Ambient
 - Special and Impaired Waters Search



GIS at Cleanup Sites



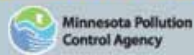
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GIS at Cleanup Sites

- ▶ MPCA technical staff increasingly rely on GIS to help make decisions at cleanup sites
- ▶ Remediation programs will be slowly going paperless, so requests for electronic data submittal will increase
- ▶ High-quality locational data is important for both Sites and Site Features
 - Reporting to EPA/Legislature
 - Informing General Public
 - Phase I Investigations
 - Phase II Investigations



PRP Wellhead Protection Tool



PETROLEUM REMEDIATION PROGRAM

Wellhead Protection Areas, Drinking Water Supply Management Areas and Source Water

Map Tools

- Zoom In
- Zoom Out
- Pan Map
- ID PRP
- ID Wells
- ID WHPA
- ID DWSMA
- ID SWA
- Vuln On/Off
- Color Photo
- B/W Photo
- Quad On/Off
- Draw Radius
- Measure
- Overview
- Reset Map
- Back
- New Search
- Clear
- Print
- Help
- Exit



Create Radius

Click once on the map to create a radius.

Enter a distance: Mile(s)

Update Distance

Enter any distance up to 3. Please note that requests for distances greater than 1 mile may take longer to process.

POP-UP blockers must be turned OFF for this tool to function properly.

Legend

- Address Location
- Radius Center
- Private Wells
- Petroleum Remediation Program
- Wellhead Protection Area
- Drinking Water Supply Management Area
- Source Water Assessment Area
- Moderate Vulnerability
- High Vulnerability

To view more information, click on a name above.

Quick Zoom County: Go City: Go

[Questions/Comments](#)

PRP Leak Site Search (beta)



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[Home](#) | [Site Index](#) | [Glossary](#) | [What's New](#) | [Ask MPCA](#) | [Visitor Center](#)

Search

- [Air](#)
- [Water](#)
- [Cleanup](#)
- [Waste](#)
- [Pollution Prevention](#)
- [Rules/Regulations](#)
- [Permits](#)
- [News/Notices](#)
- [Training](#)
- [Publications](#)
- [Hot Topics](#)
- [Programs](#)
- [Sustainability](#)
- [Education](#)
- [Assistance](#)
- [About MPCA](#)

[MPCA Home](#) > Storage Tank Site Search



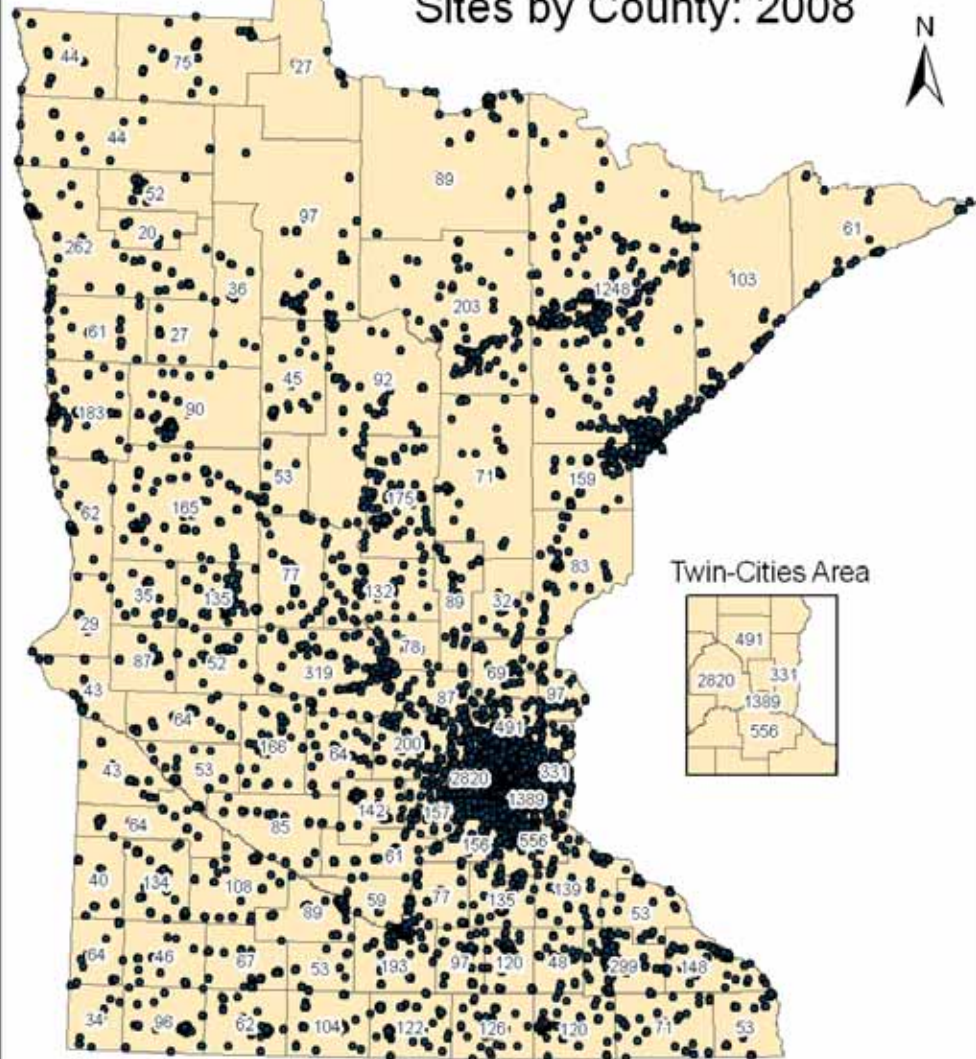
Leak Address	Former Total Station
Leak ID Number	4554
Site Name	6830 Brooklyn Blvd
City Name	Brooklyn Center
Station Type	55429
County	Hennepin
Release Discovered	07-31-1991
Release Report	07-31-1991
Conditional Closure Date	
Complete Site Closure Date	
Contaminated Soils Remaining	Y
Offsite Contamination	Y
Product Released	Gasoline, Type Unknown
Project Manager:	Miller, Amy

Ground Water

[Cleanup Actions](#) | [Site Contacts](#) | [Treatments](#) | [Reporting](#) | [Field Work](#) | [Release Detail](#) | [Remarks](#)

Drinking Water Contamination	N
Free Product Observed	Y
Free Product Thickness	0.50
Groundwater Contamination	Y
Cleanup Goal (X HRL)	100.00

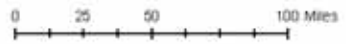
Amount of Closed Leak Sites by County: 2008



Twin-Cities Area

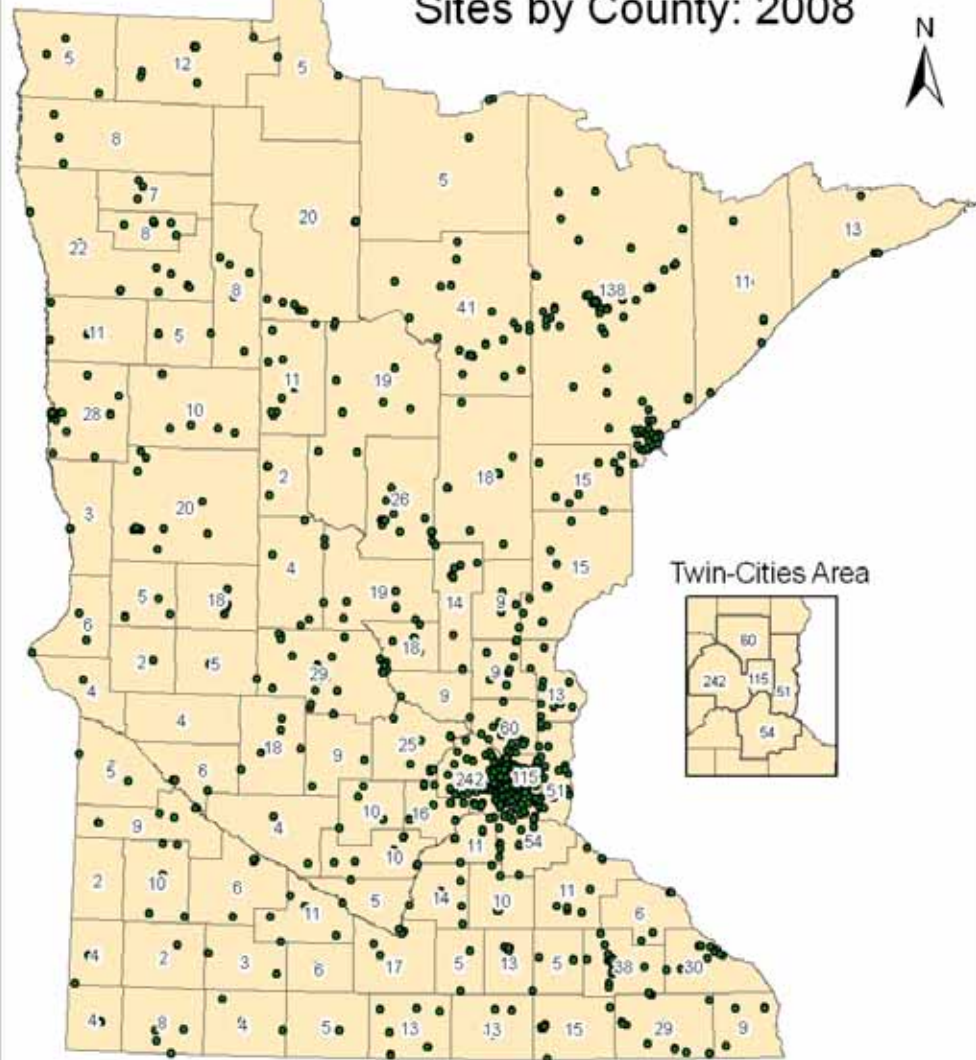


Data taken from the Minnesota Pollution Control Agency, February 2008



- Leak Sites
- Counties

Amount of Open Leak Sites by County: 2008



Data taken from the Minnesota Pollution Control Agency, February 2008

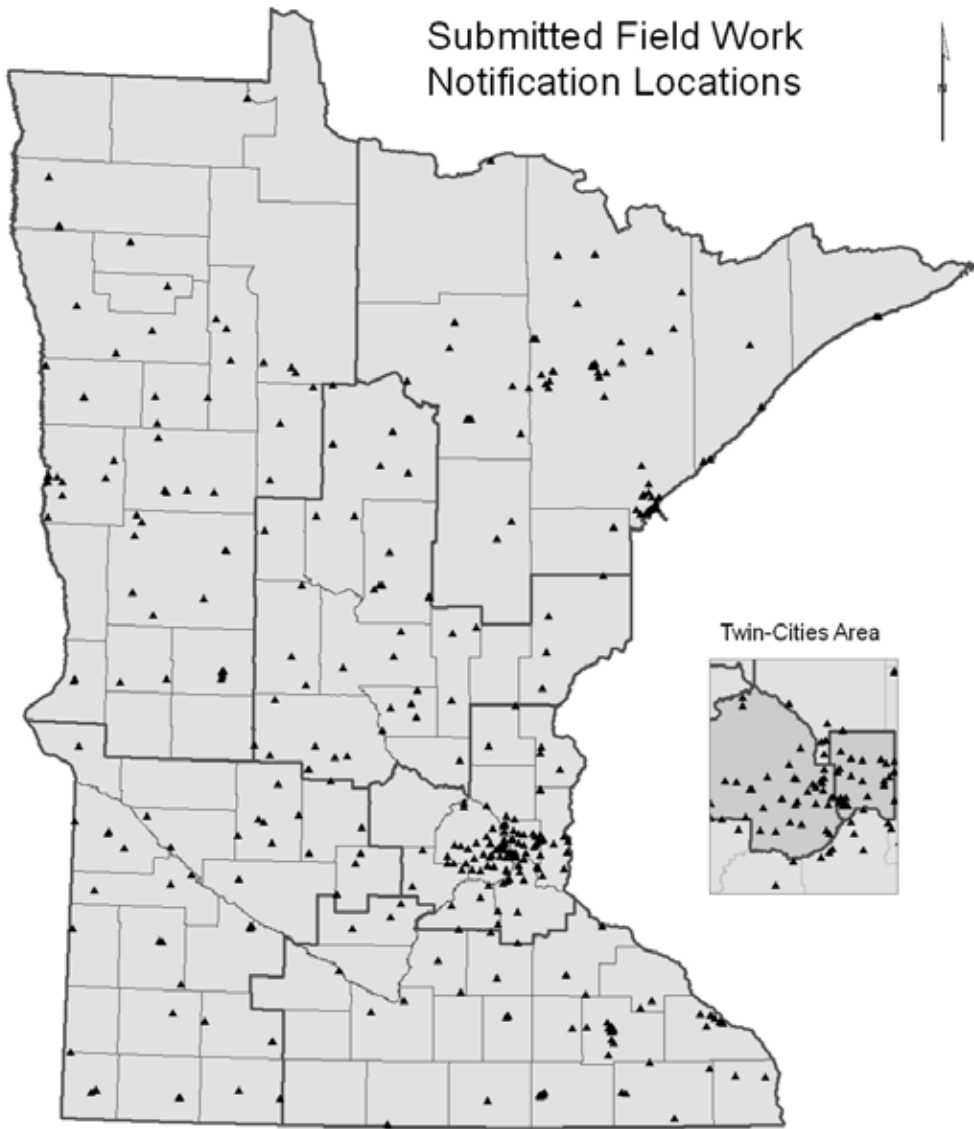
0 25 50 100 Miles

- Leak Sites
- Counties

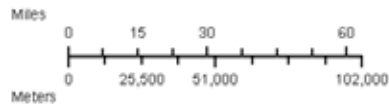
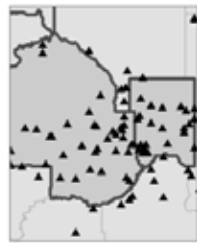


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Submitted Field Work Notification Locations



Twin-Cities Area



- ▲ Sites with Notifications
- ▭ Counties
- ▭ PCA Regions

MPCA: February 2008

VIC – Twin Cities Ford Plant

Legend

★ Ford Plant Site Location

Ford Feature Locations 1

Station Type

● Boring

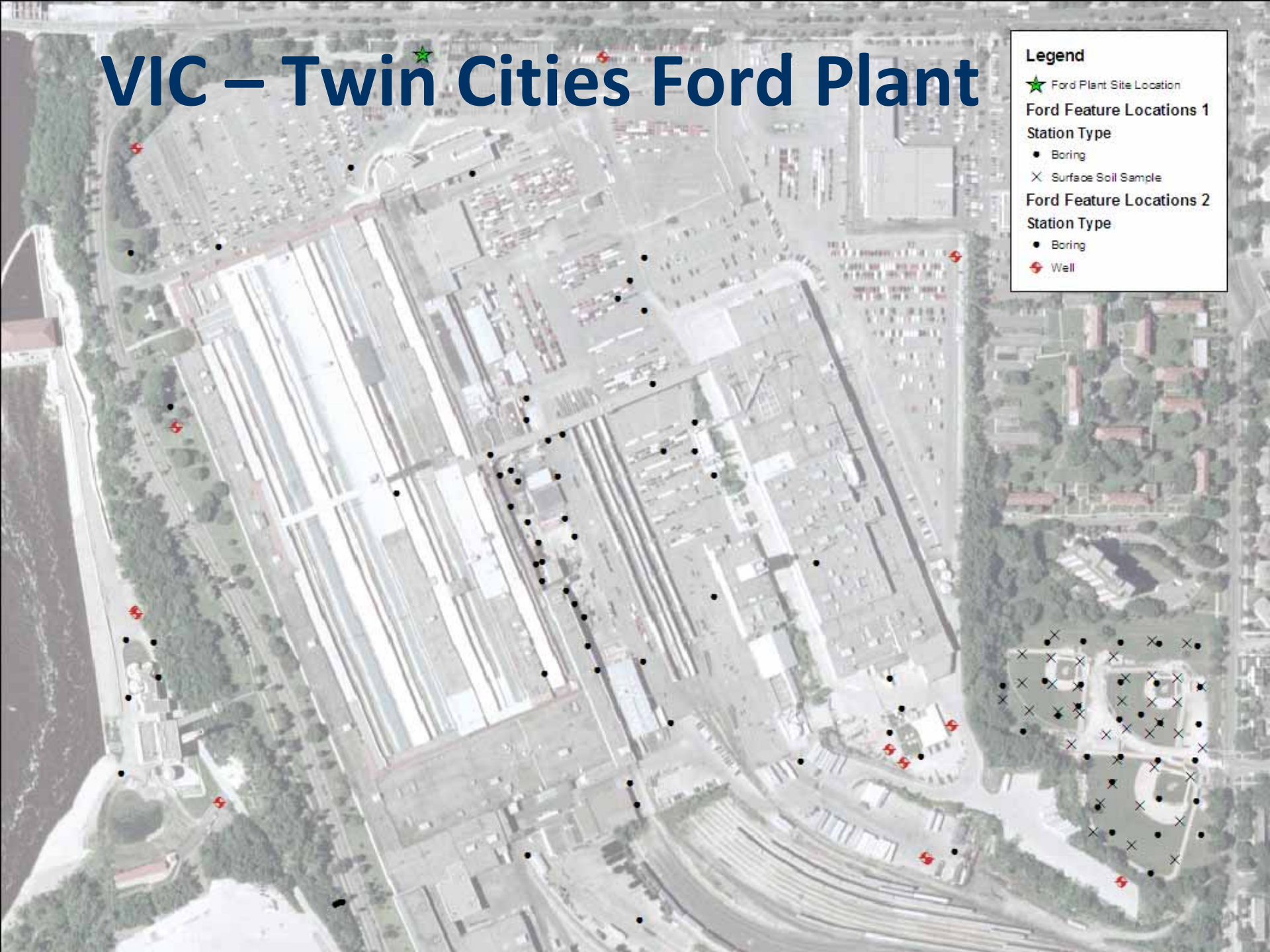
× Surface Soil Sample

Ford Feature Locations 2

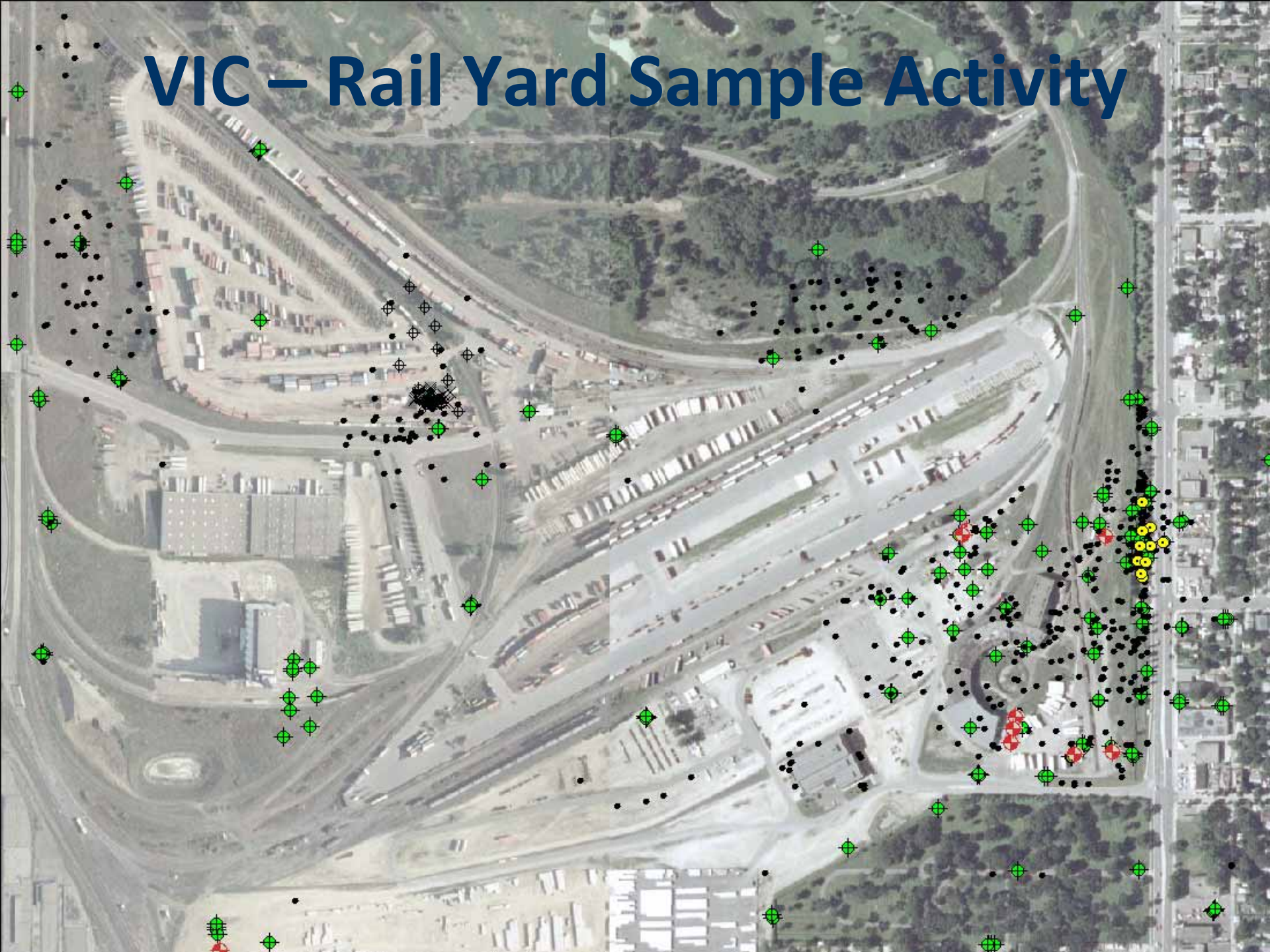
Station Type

● Boring

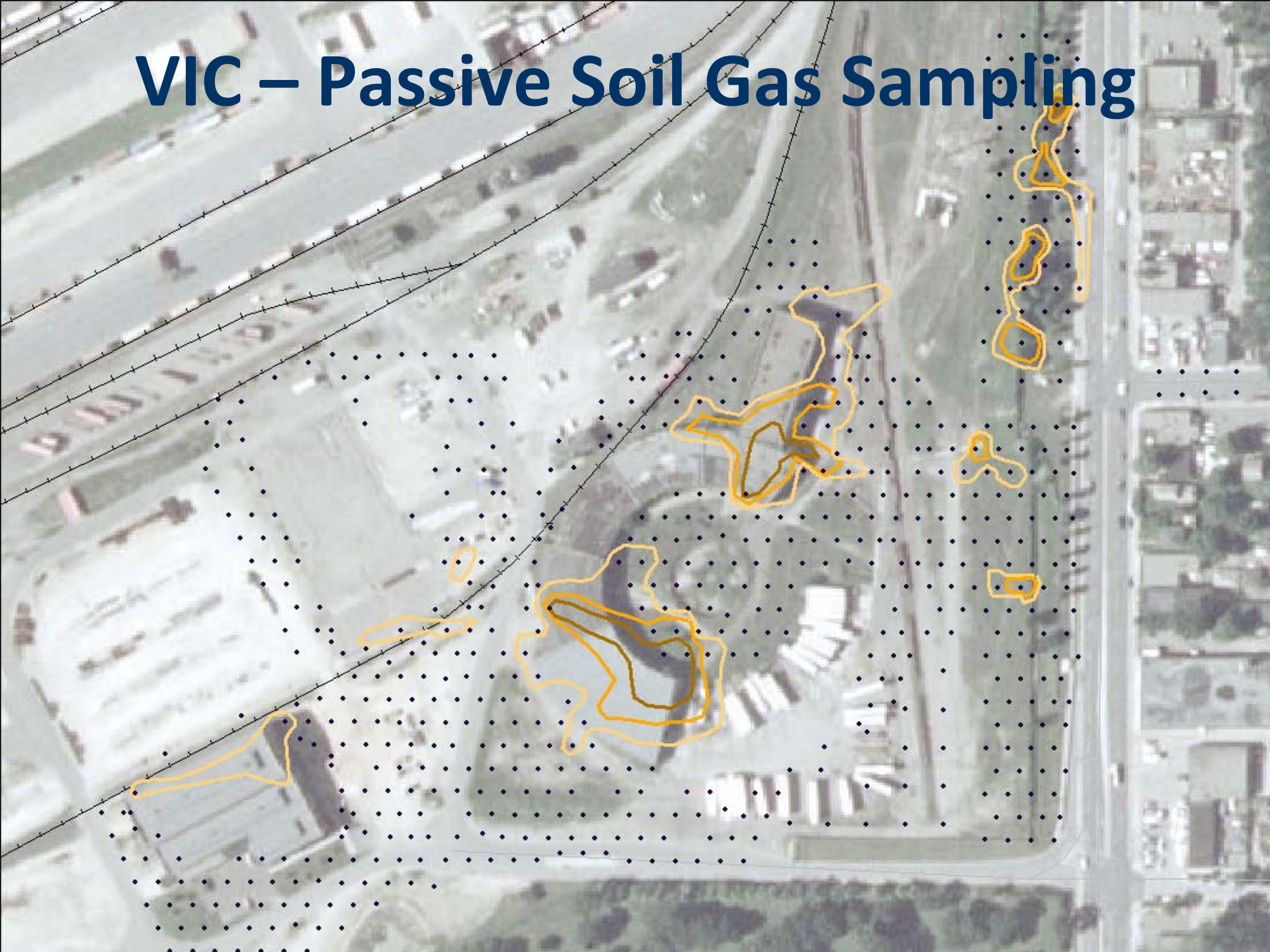
⬮ Well



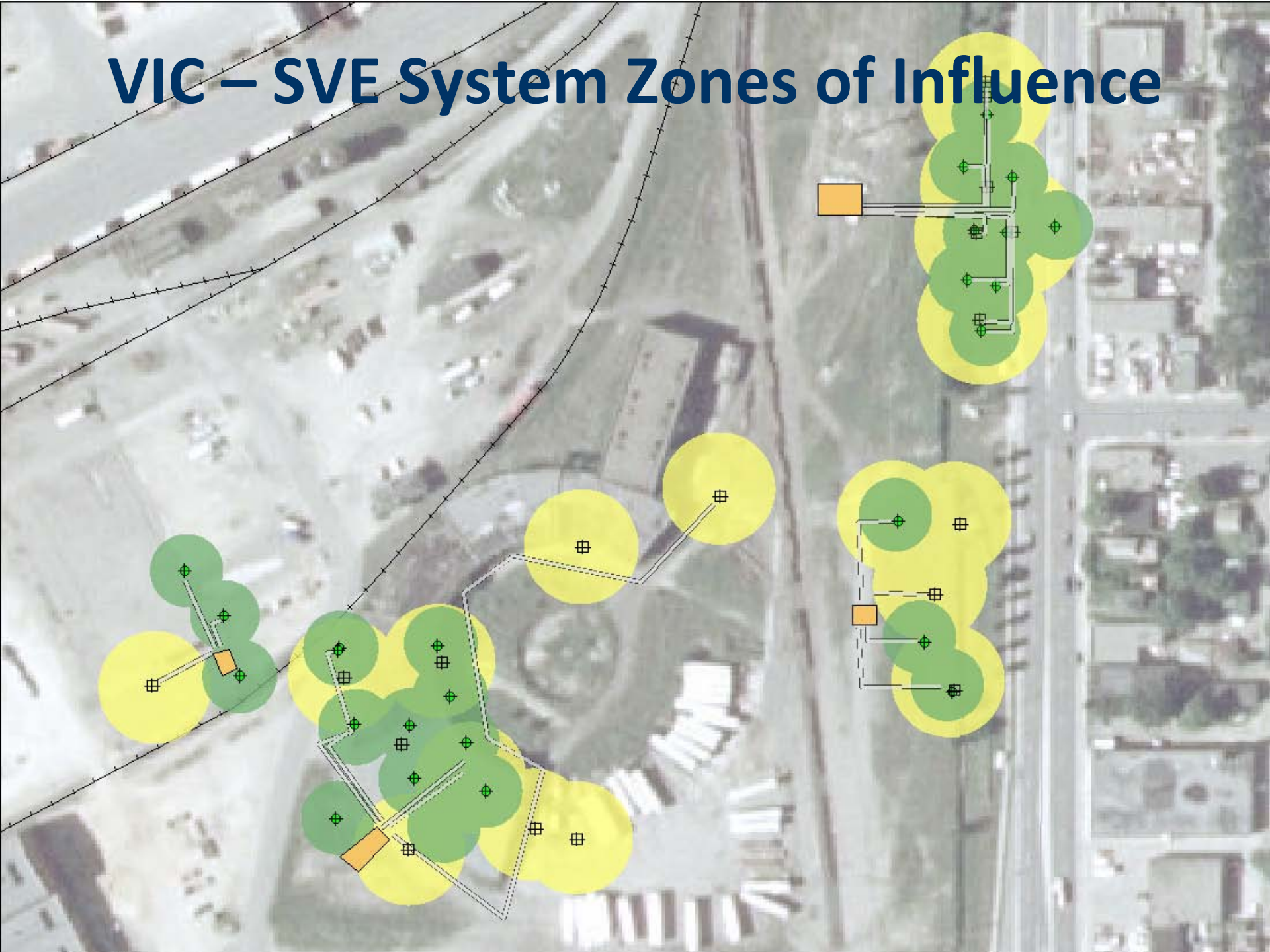
VIC – Rail Yard Sample Activity



VIC – Passive Soil Gas Sampling



VIC – SVE System Zones of Influence



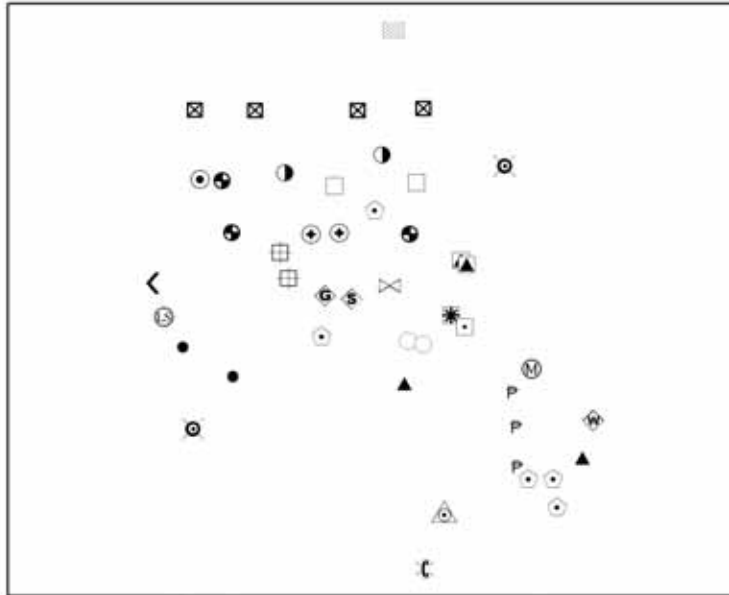
Closed Landfill Program

- ▶ Previously only received CAD files from consultants working at landfills
- ▶ Created rigorous survey standards for all landfill features
- ▶ Geodatabase template includes comprehensive standards for attribute tables, naming scheme, projections, etc.



CLP – Point Symbology Standards

Point Symbology

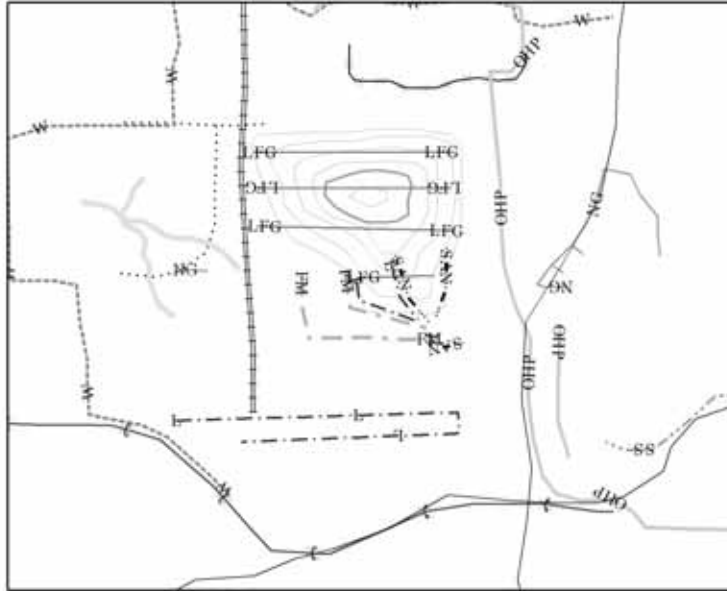


- | | | | |
|--|-------------------------|--|---------------------------|
| | Cleanout | | Invert |
| | Condensate Sample Point | | Leachate Sample Point |
| | Fence Gate | | Lift Station |
| | Flared End Section | | Manhole |
| | Gas Engine | | Monitoring Well |
| | Gas Extraction Well | | Power Pole |
| | Gas Flare | | Private GW Supply |
| | Gas Passive Vent | | Public GW Supply |
| | Gas Probe | | Survey Marker (x, y) |
| | Geoprobe - Gas | | Survey Monument (x, y, z) |
| | Geoprobe - Soil | | SW Test Station |
| | Geoprobe - Water | | Telephone Terminal Box |
| | GW Pumpout Well | | Valve |

- | | | | |
|--|-------------------------|--|---------------------------|
| | Cleanout | | Invert |
| | Condensate Sample Point | | Leachate Sample Point |
| | Fence Gate | | Lift Station |
| | Flared End Section | | Manhole |
| | Gas Engine | | Monitoring Well |
| | Gas Extraction Well | | Power Pole |
| | Gas Flare | | Private GW Supply |
| | Gas Passive Vent | | Public GW Supply |
| | Gas Probe | | Survey Marker (x, y) |
| | Geoprobe - Gas | | Survey Monument (x, y, z) |
| | Geoprobe - Soil | | SW Test Station |
| | Geoprobe - Water | | Telephone Terminal Box |
| | GW Pumpout Well | | Valve |

CLP – Line Symbology Standards

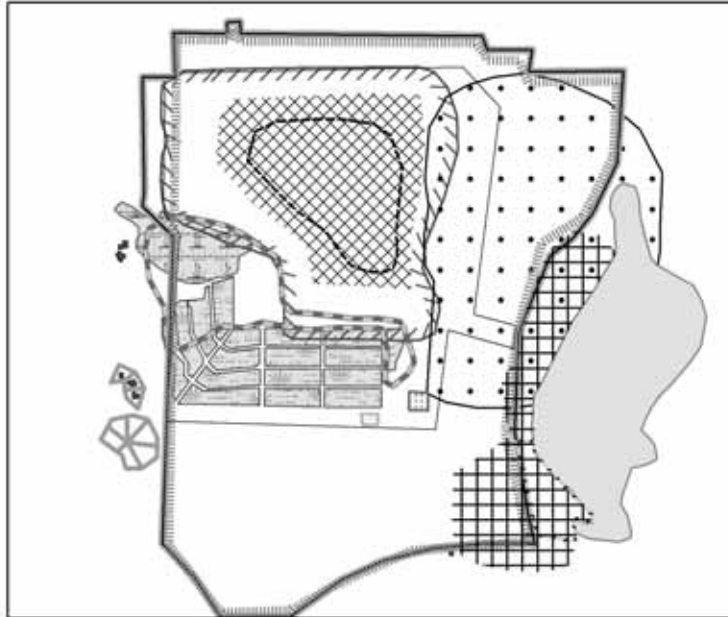
Line Symbology



- | | | | |
|--|---|---|---|
|  Buried Power |  Railroad |  Buried Power |  Railroad |
|  Contour |  Road |  Contour |  Road |
|  Contour Index |  Sanitary Sewer |  Contour Index |  Sanitary Sewer |
|  Fence |  Storm Sewer |  Fence |  Storm Sewer |
|  Force Main |  Stream |  Force Main |  Stream |
|  Gas/Oil Lines |  Telephone Lines |  Gas/Oil Lines |  Telephone Lines |
|  Landfill Gas Lines |  Water Main |  Landfill Gas Lines |  Water Main |
|  Leachate Lines | |  Leachate Lines | |
|  Overhead Power Lines | |  Overhead Power Lines | |

CLP – Polygon Symbology Standards

Polygon Symbology



Approx. Contaminated GW Plume	Leachate Tank	Approx. Contaminated GW Plume	Leachate Tank
BA Boundary	Methane Buffer Area	BA Boundary	Methane Buffer Area
Building	Natural Wetland	Building	Natural Wetland
Condensate Tank	Parcels (non-State Owned)	Condensate Tank	Parcels (non-State Owned)
Constructed Wetland	Parcels (State Bond Dollars Spent)	Constructed Wetland	Parcels (State Bond Dollars Spent)
Edge of Waste	Parcels (State Owned)	Edge of Waste	Parcels (State Owned)
Groundwater Buffer Area	Leased Parcels	Groundwater Buffer Area	Leased Parcels
Infiltration Basin	Qualified Facility	Infiltration Basin	Qualified Facility
Lake	Sedimentation Pond	Lake	Sedimentation Pond

CLP – Mapping Gas Extraction Points

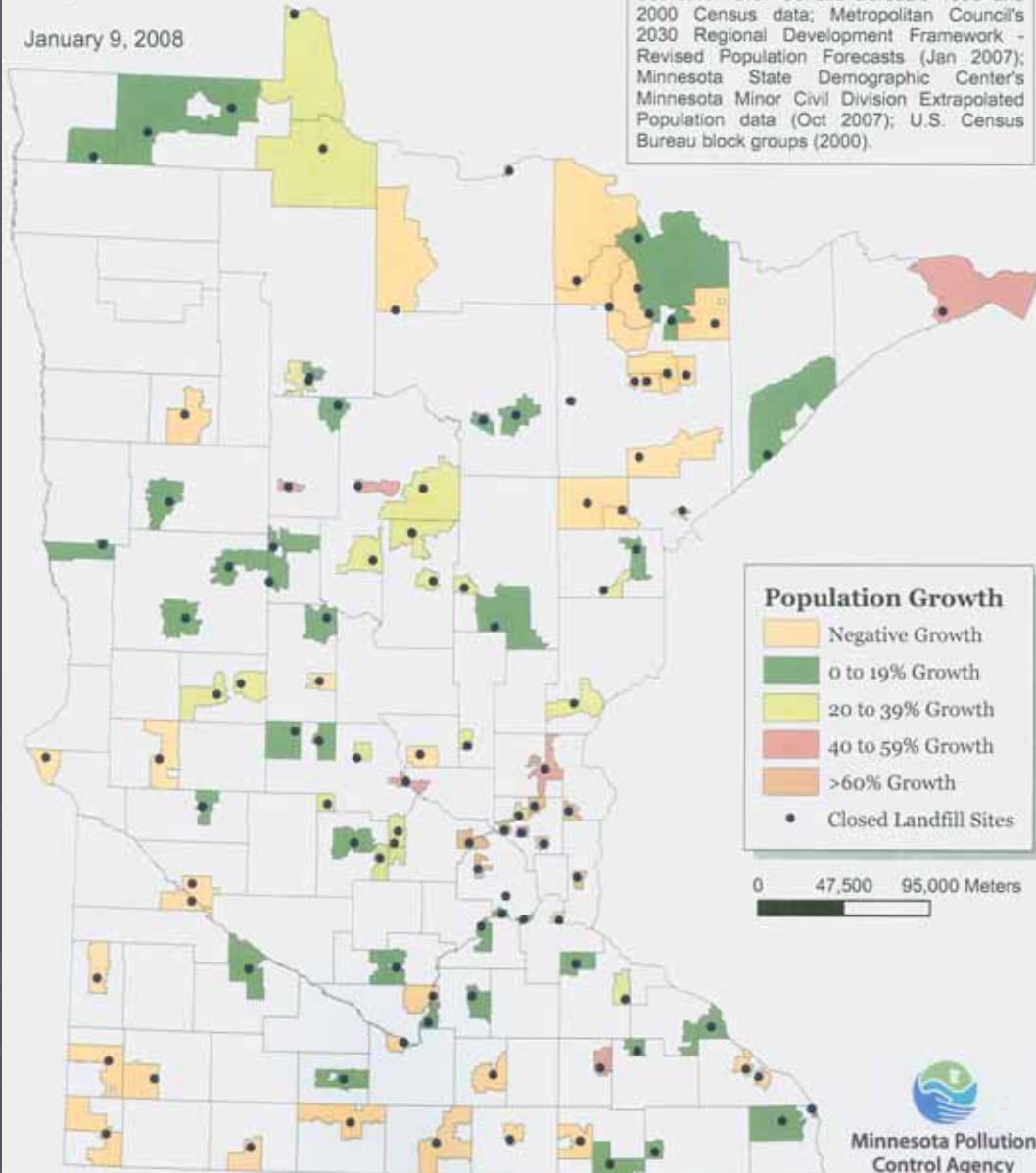


Population Growth Pressures on Closed Landfill Program Sites



January 9, 2008

Sources: U.S. Census Bureau's 1990 and 2000 Census data; Metropolitan Council's 2030 Regional Development Framework - Revised Population Forecasts (Jan 2007); Minnesota State Demographic Center's Minnesota Minor Civil Division Extrapolated Population data (Oct 2007); U.S. Census Bureau block groups (2000).



CLP – Mapping Population Growth Pressures

CLP – Sensitivity Analysis

- ▶ Goal: Score and rank sensitivity at landfills
- ▶ A sensitivity assessment model in ArcGIS' Model Builder is currently under development
- ▶ CLP staff will run model against land use & sensitive features data, which will change over time
 - Impaired waters
 - Trout Streams
 - County Well Index
 - Wellhead Protection Areas
 - National Wetlands Inventory
 - State- or Federally-owned lands



Additional Resources

<http://www.gis.com>

<http://www.geographynetwork.com>

ESRI:

<http://www.esri.com>

http://training.esri.com/acb2000/showdetl.cfm?DID=6&Product_ID=697

http://store.esri.com/esri/showdetl.cfm?SID=2&Product_ID=99&Category_ID=28

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Georeferencing_and_coordinate_systems

United Nations:

<http://gea.zvne.fer.hr/module/index.html>

Colorado University at Boulder

http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj_f.html

http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj_f.html



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Questions?



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