NFSS RAB MEETING

Niagara Falls Storage Site Geophysical Survey Results

Science Applications International Corporation

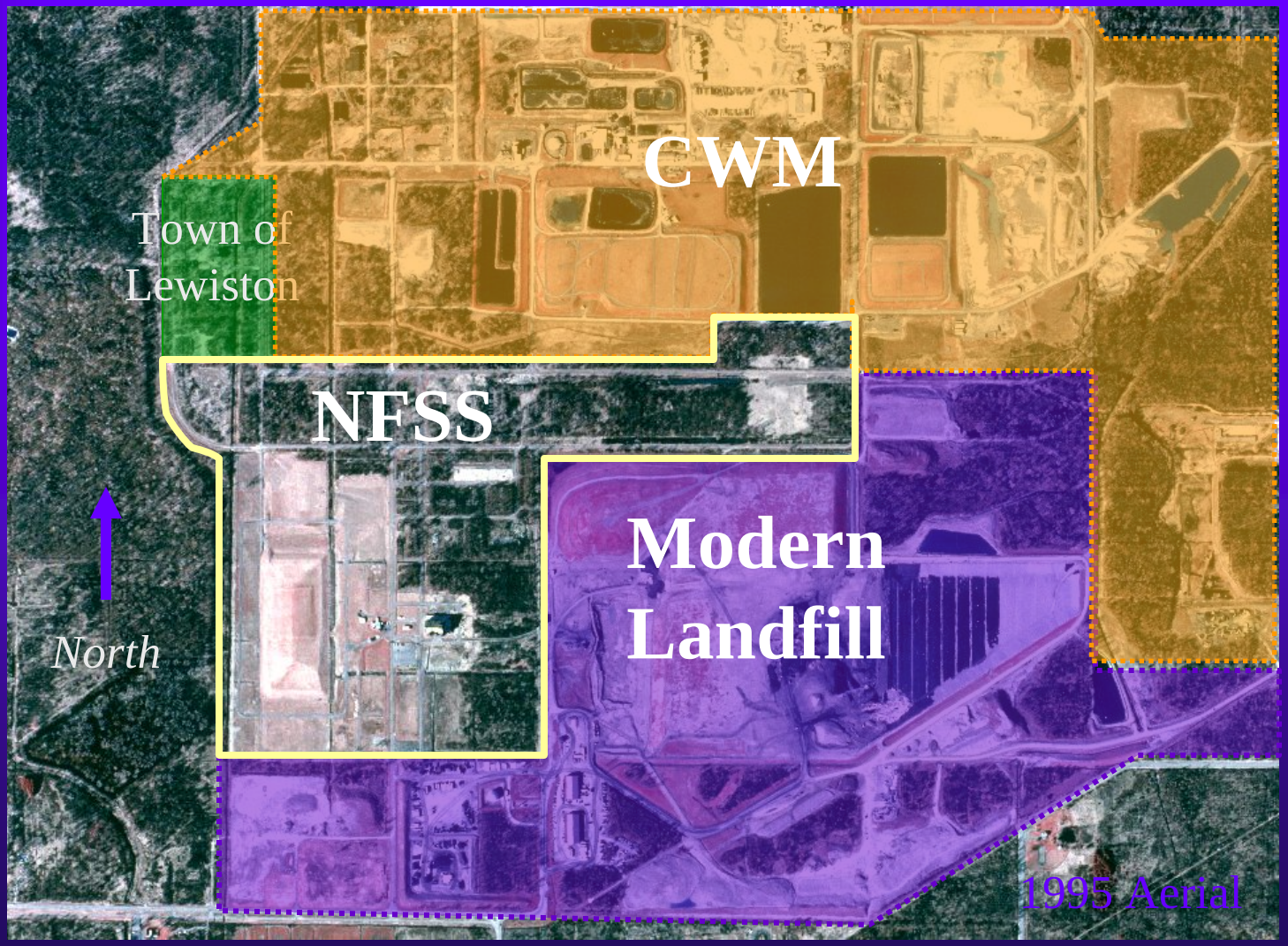
Center of Geophysical Excellence – Harrisburg, Pennsylvania

www.quality-geophysics.com

200-1e

NFSS_08.10_0069_a

Niagara Falls Storage Site
Lewiston, NY



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Niagara Falls Storage Site
Lewiston, NY

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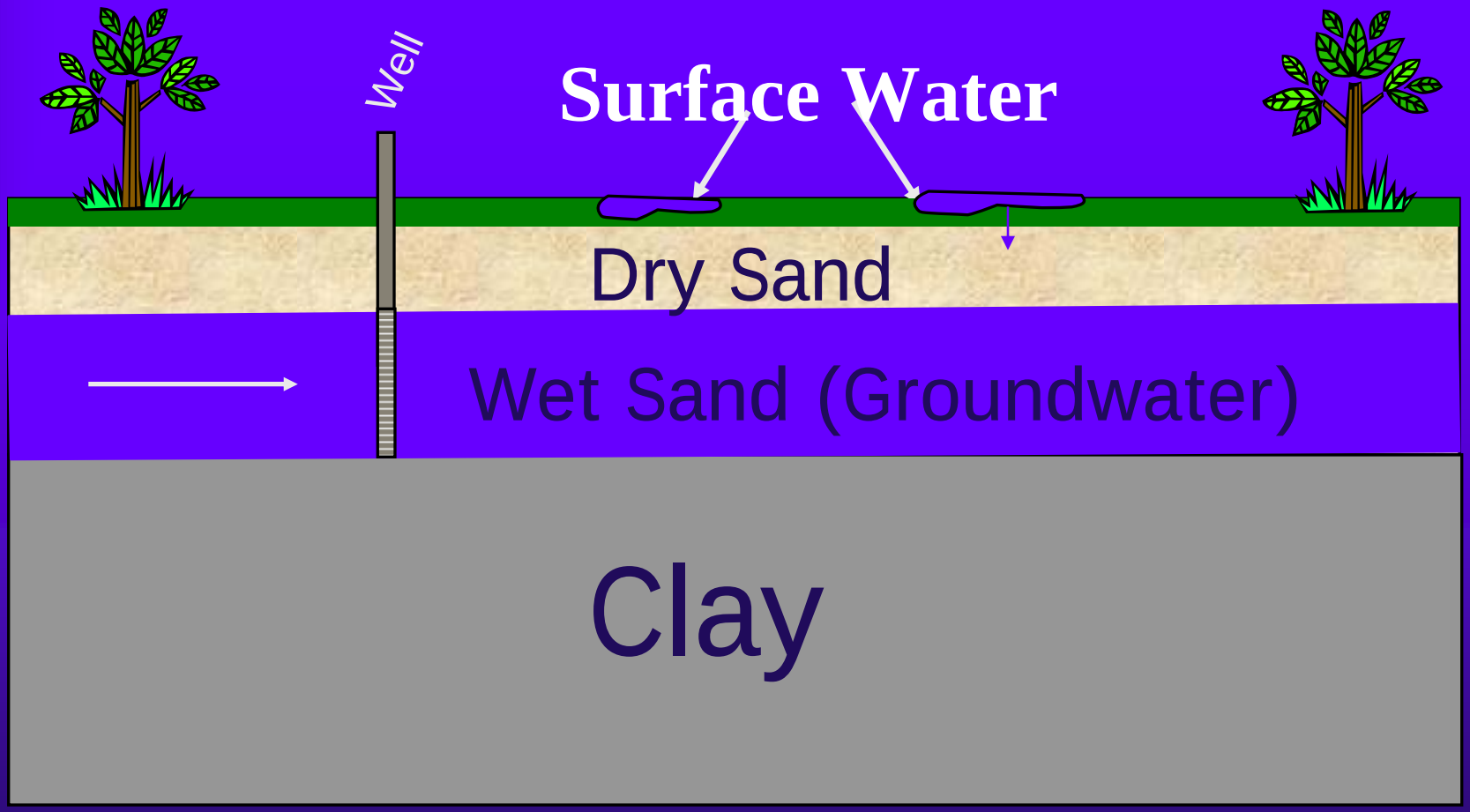
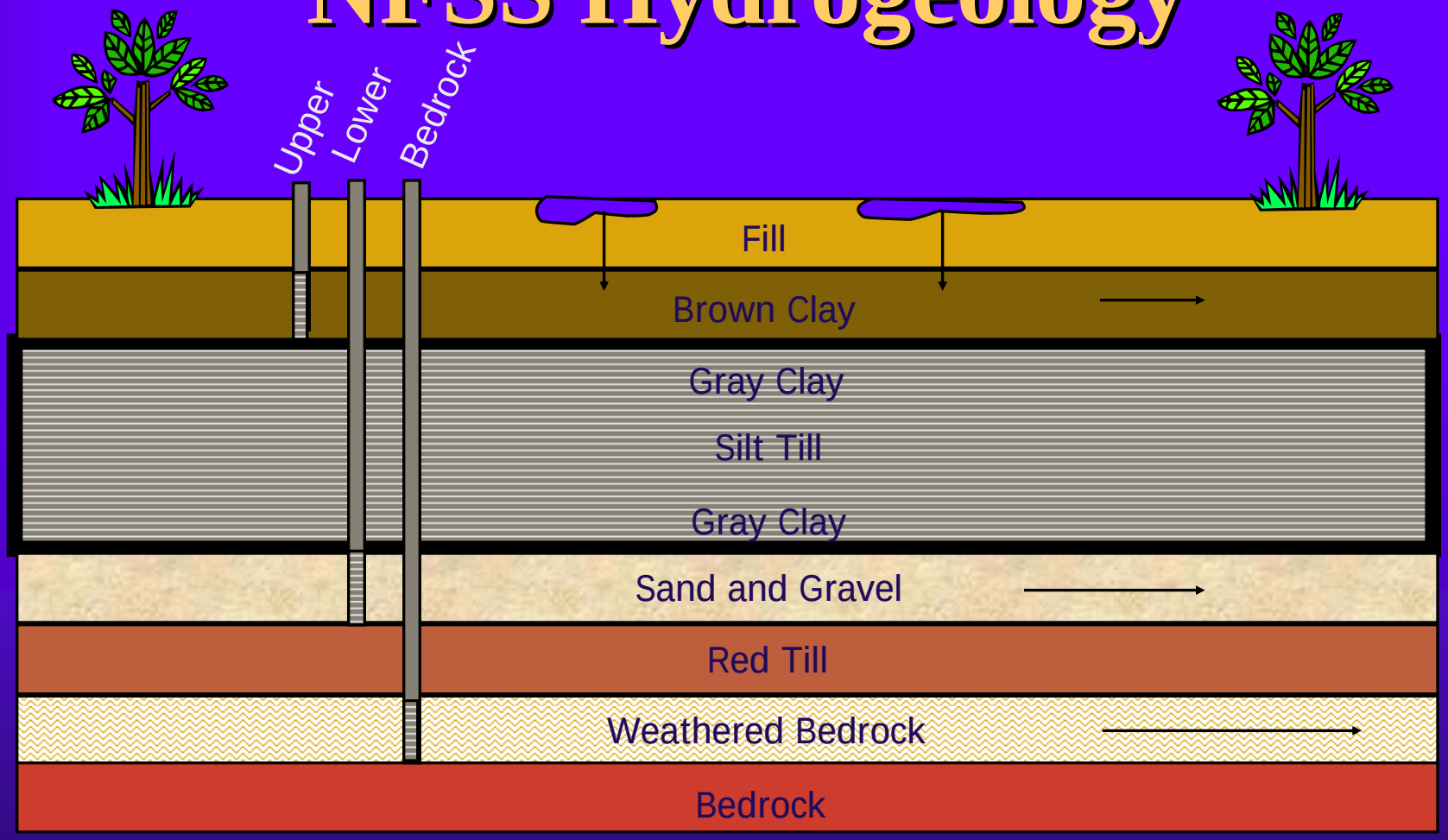
General Hydrogeology



NFSS Hydrogeology



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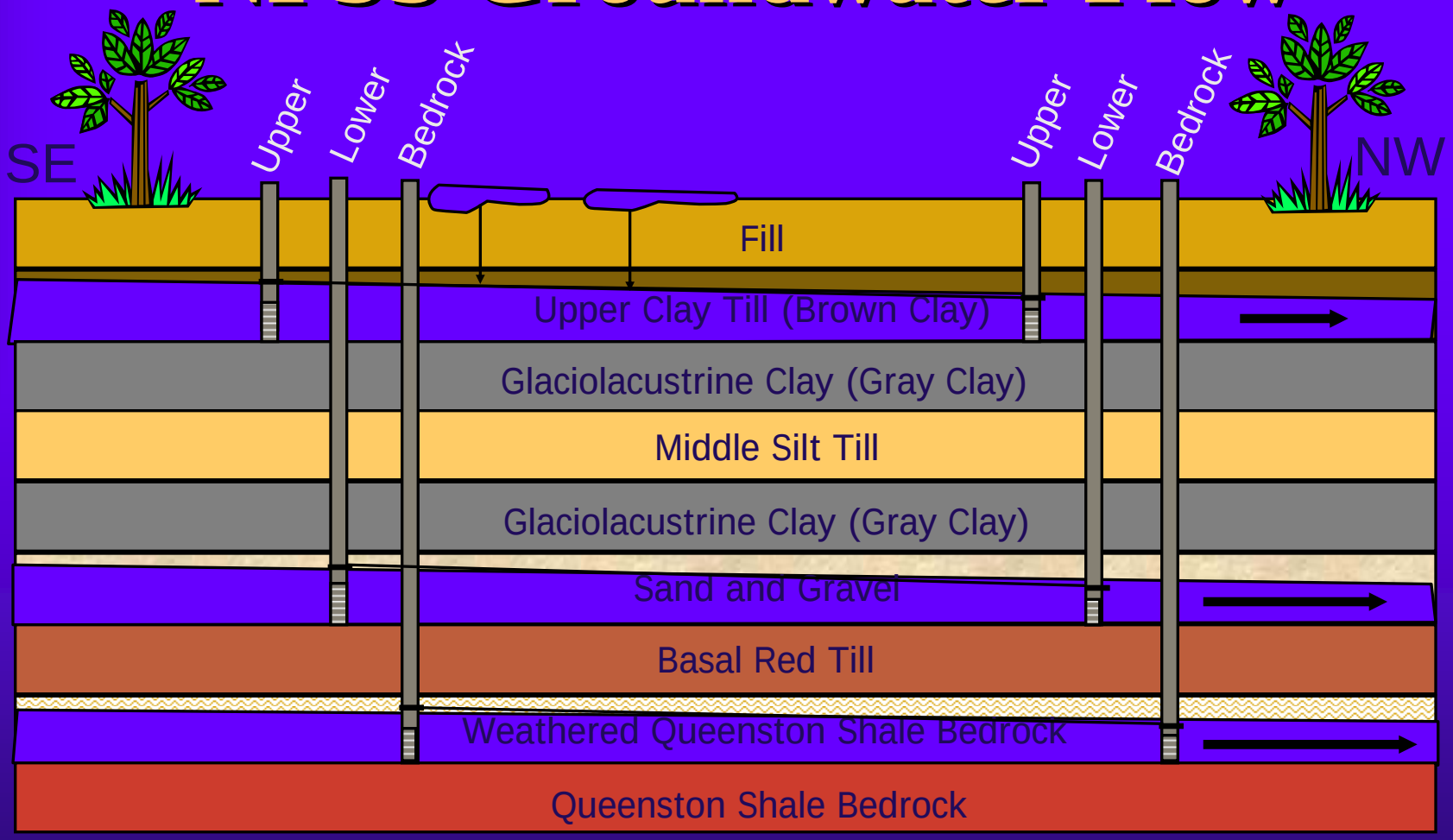
NFSS Groundwater Flow



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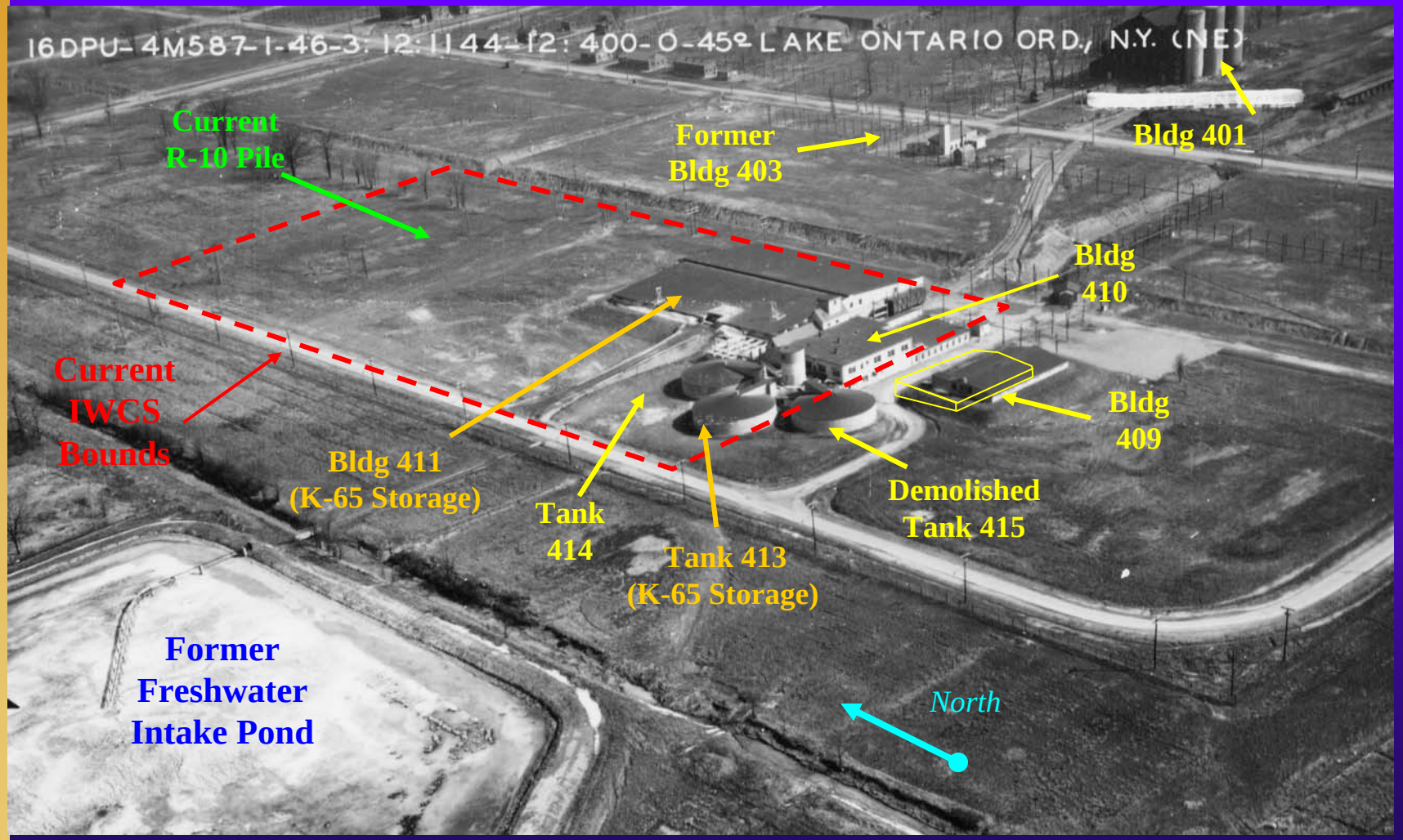
Former IWCS Area

1944 Oblique



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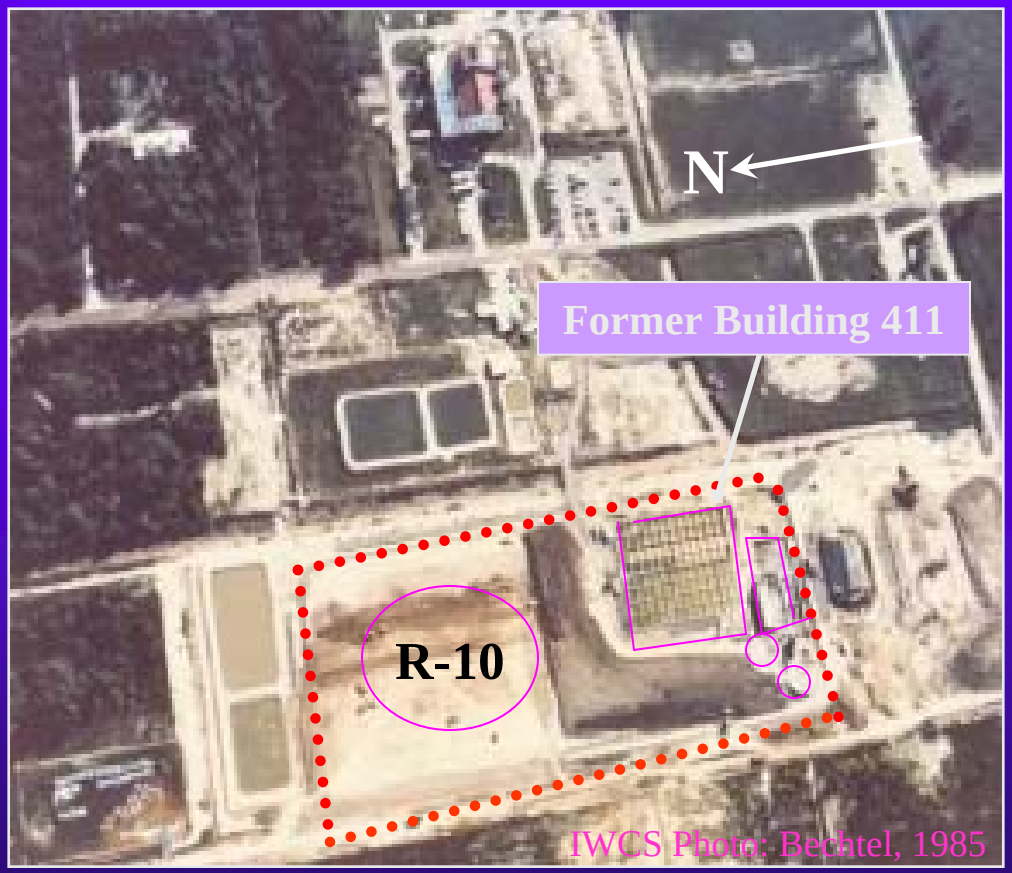
DQOs for NFSS IWCS

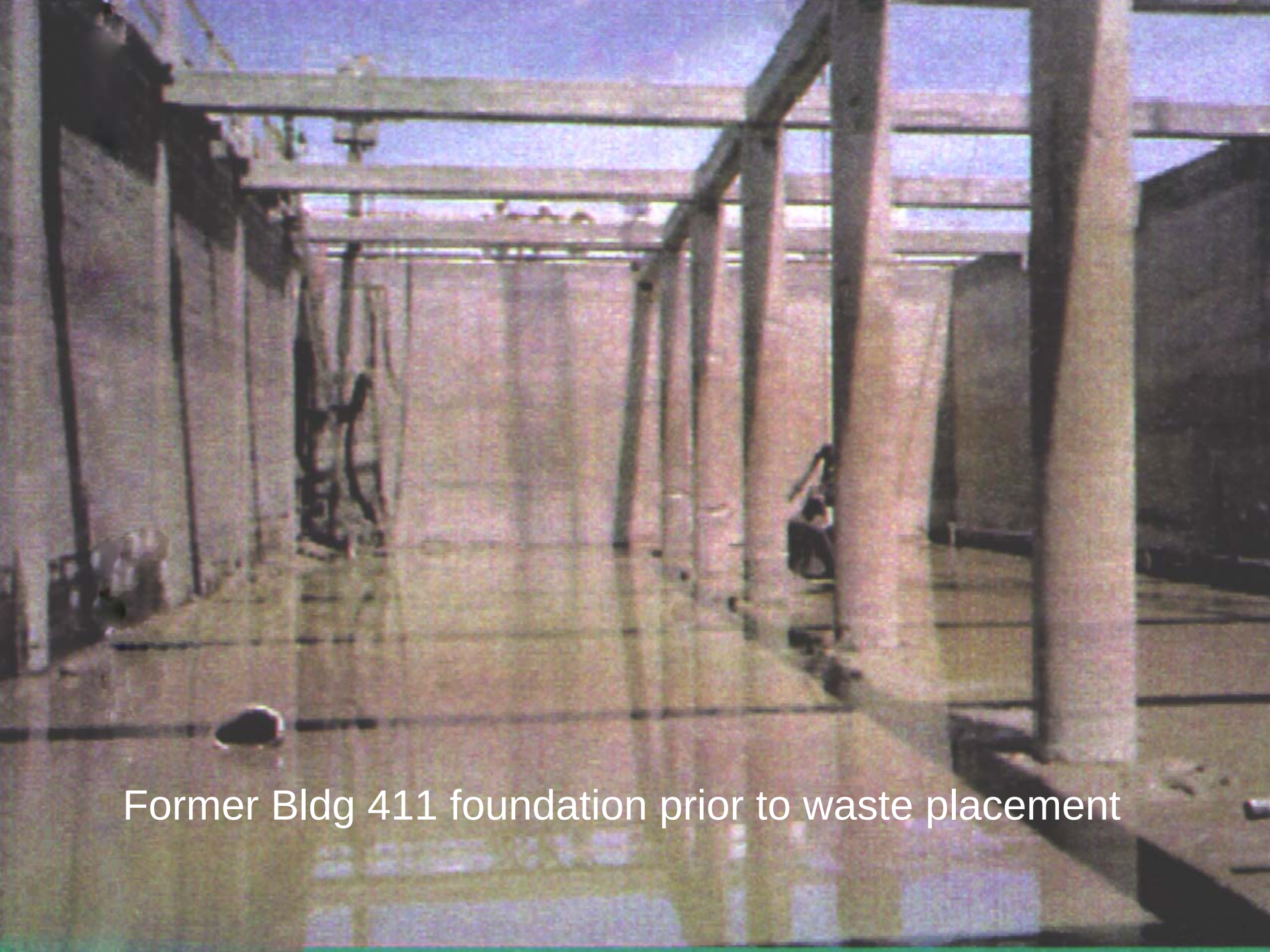


Current Radioactive Landfill Boundary

Radioactive Storage

Assess the Integrity of the IWCS

- Investigate Nonintrusively
- Delineate Landfill Contents
- Locate Potential Contaminant Plumes
- Examine Clay Cutoff Wall
- Identify Fractures/Faults/ Seismic Pressure Points
- Identify Areas of Increased Water Saturation



Former Bldg 411 foundation prior to waste placement

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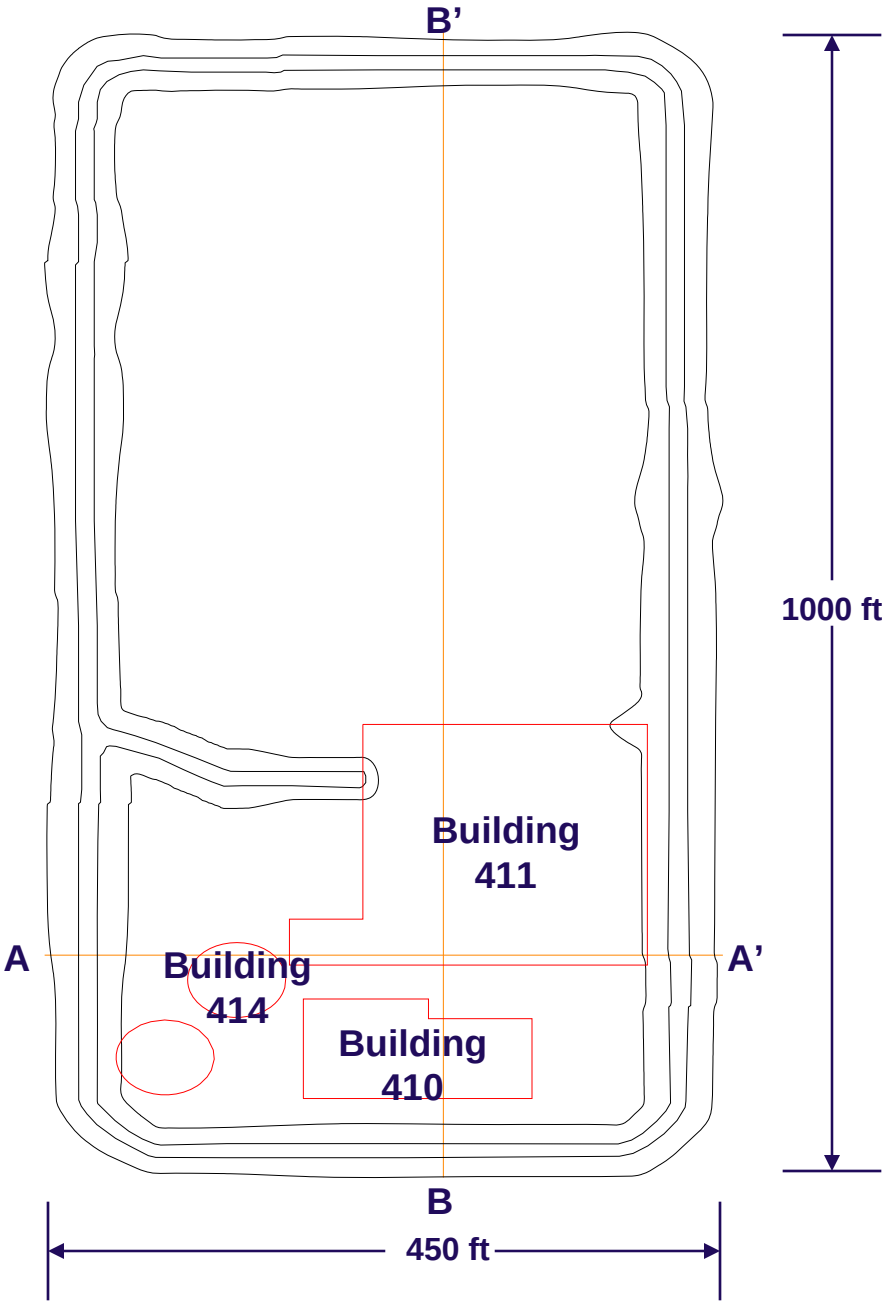
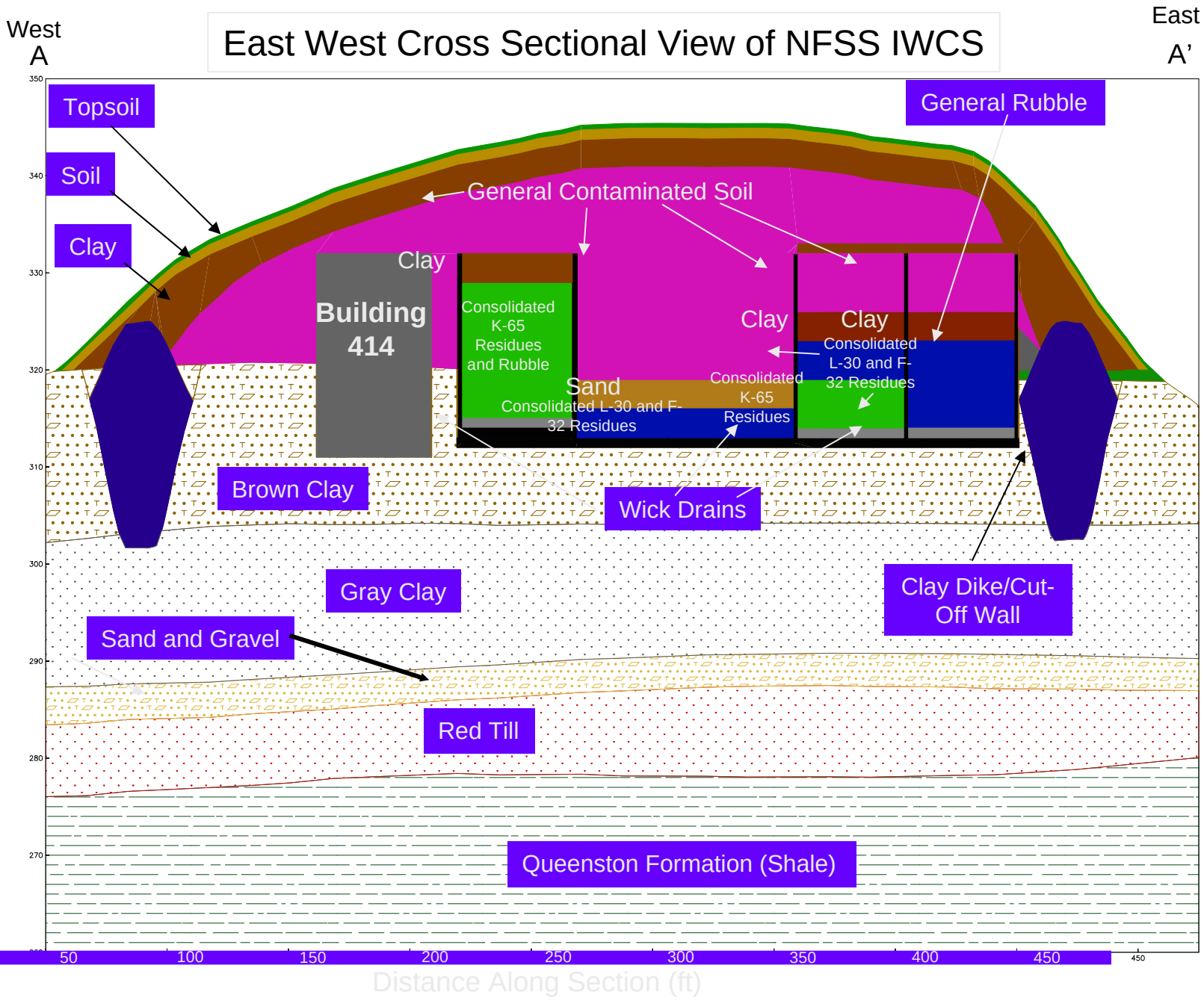
Plan View of NFSS IWCS Cross Section Locations



East West Cross Sectional View of NFSS IWCS



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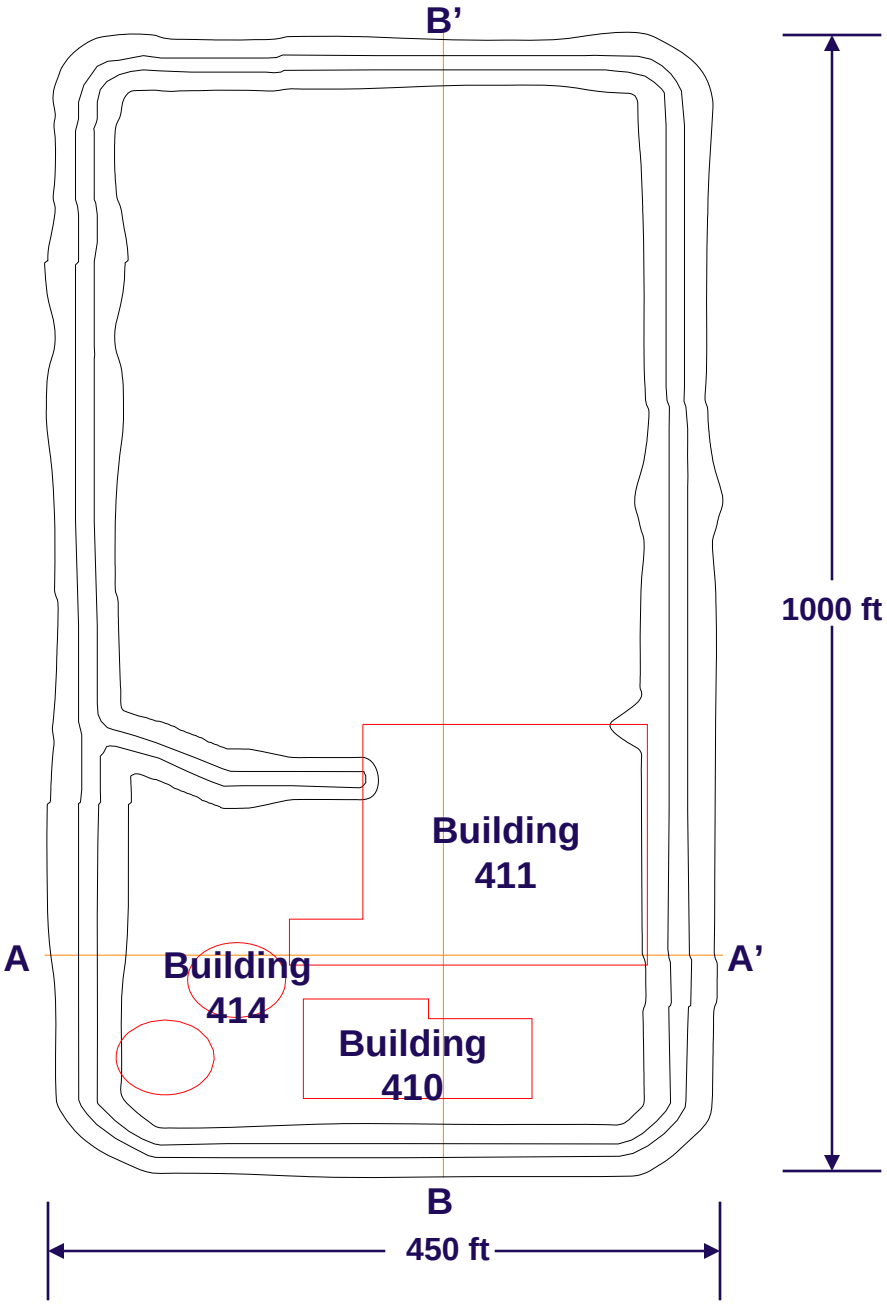
Plan View of NFSS IWCS Cross Section Locations



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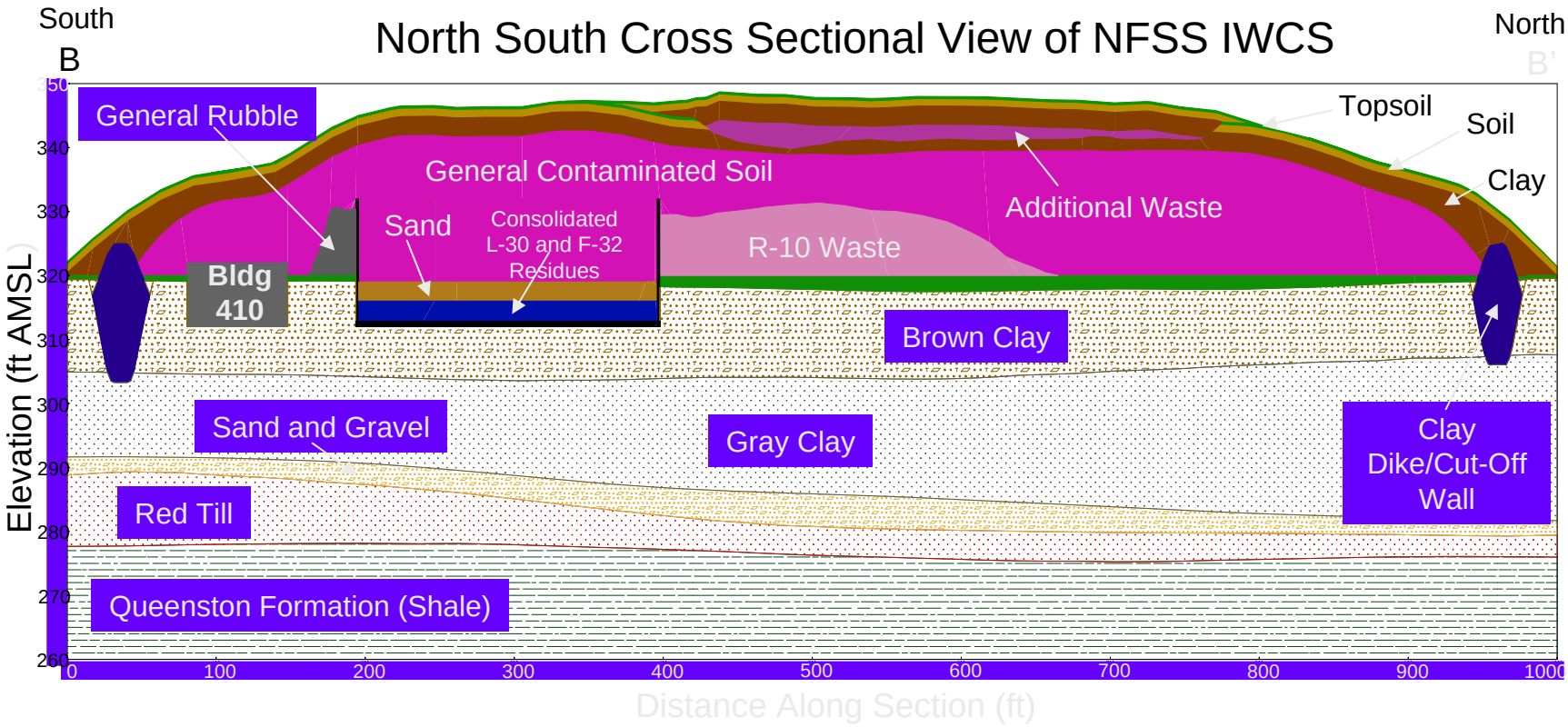
North South Cross Sectional View of NFSS IWCS



Why Use Geophysics at NFSS?

- Nonintrusive
- Cost-Effective
- Efficient
- Dense Data Coverage
- Increased Spatial Resolution
- Comprehensive

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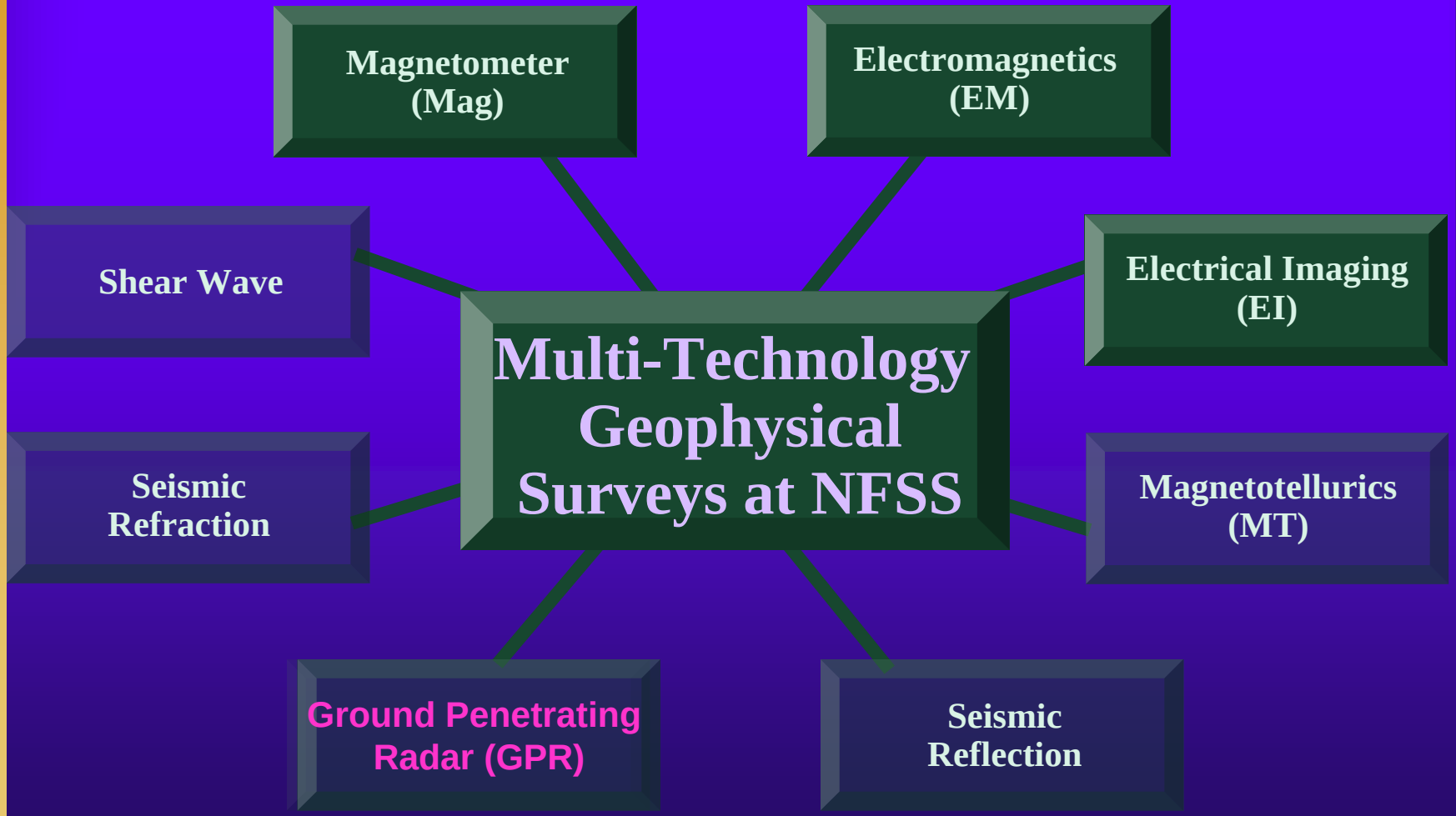
Geophysical Applications



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Electromagnetics (EM-31)

EM-31 with Data Logger and GPS

Conductivity

- Water Saturation
- Voids/Sinkholes
- Metallic Signature
- Changes in Soil Properties
- Contaminant Plumes

Magnetic Susceptibility

- Metallic Signature

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EM Results of the NFSS IWCS

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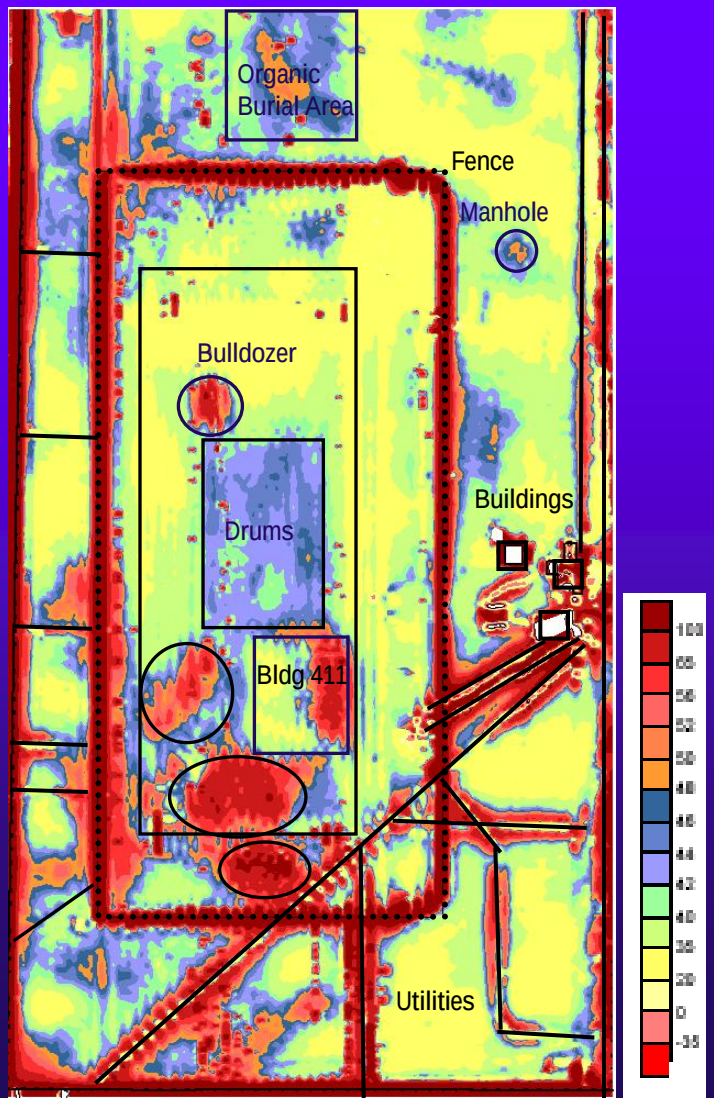
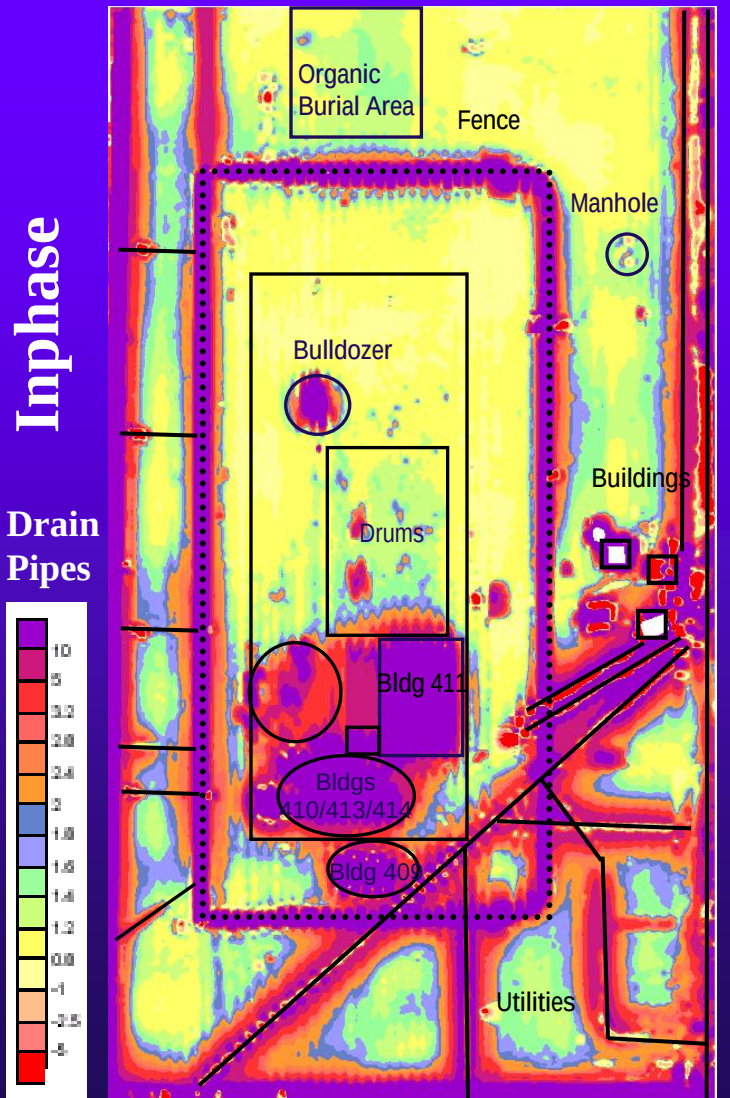
Conductivity (mM/m)



Magnetic Susceptibility (ppt)



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Magnetometer

Magnetic Gradiometer with GPS and Data Logger

- Ferrous Metallic Signature

Magnetometer Results of IWCS

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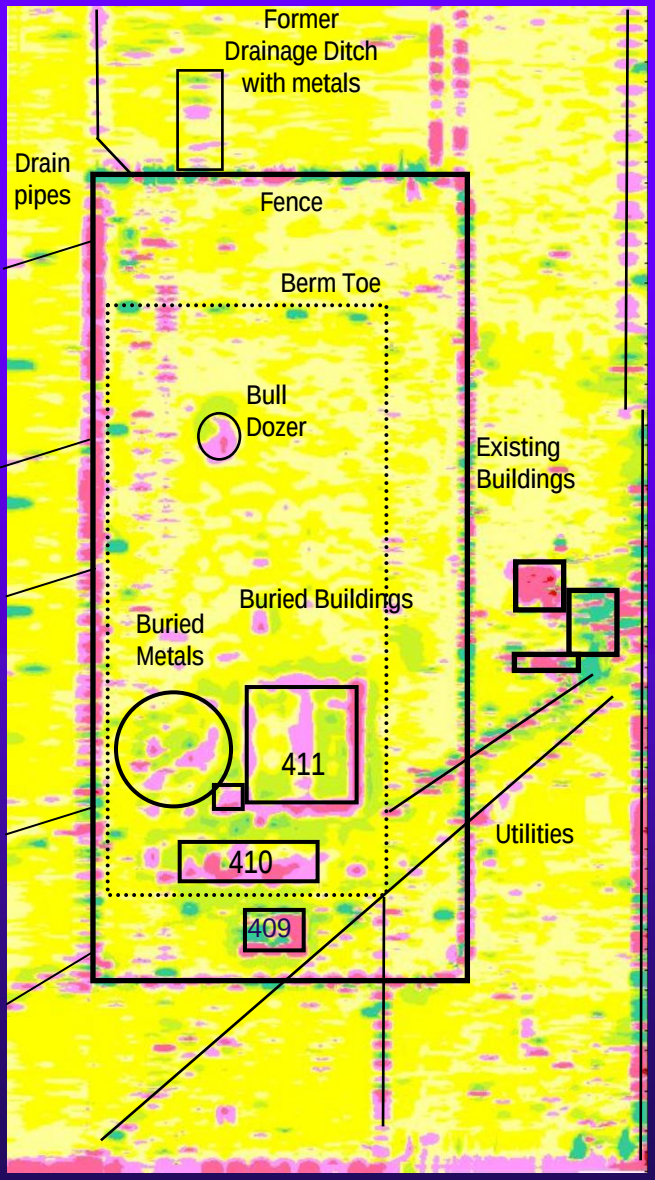

Magnetic Gradient (nT/m)

Electrical Imaging (EI)

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Electrical Imaging Setup

Measures Electrical Resistivity

- Water Saturation
- Voids/Sinkholes
- Fractures
- Stratigraphy
- Soil/Bedrock Interface
- Contaminant Plumes
- Metallic Signature

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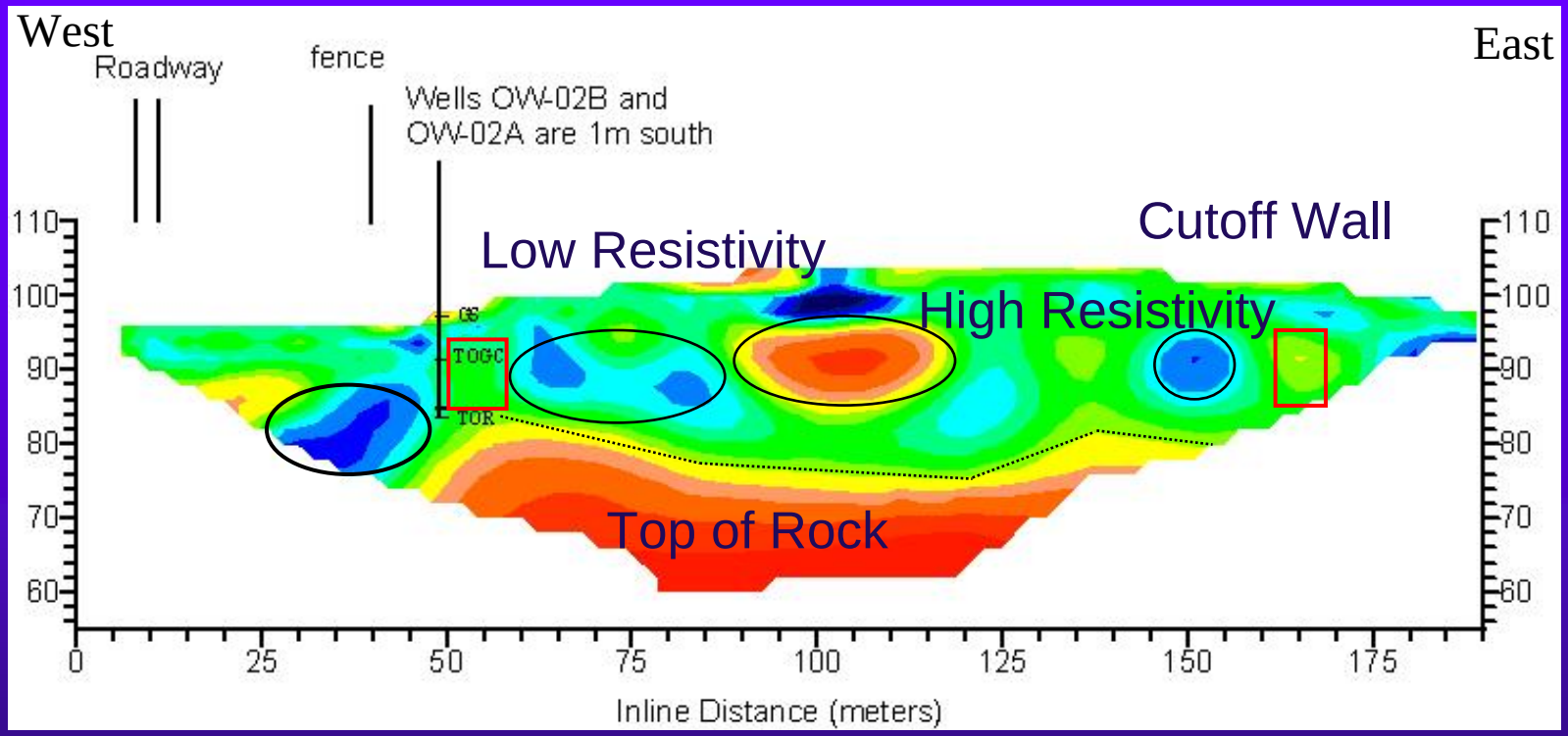
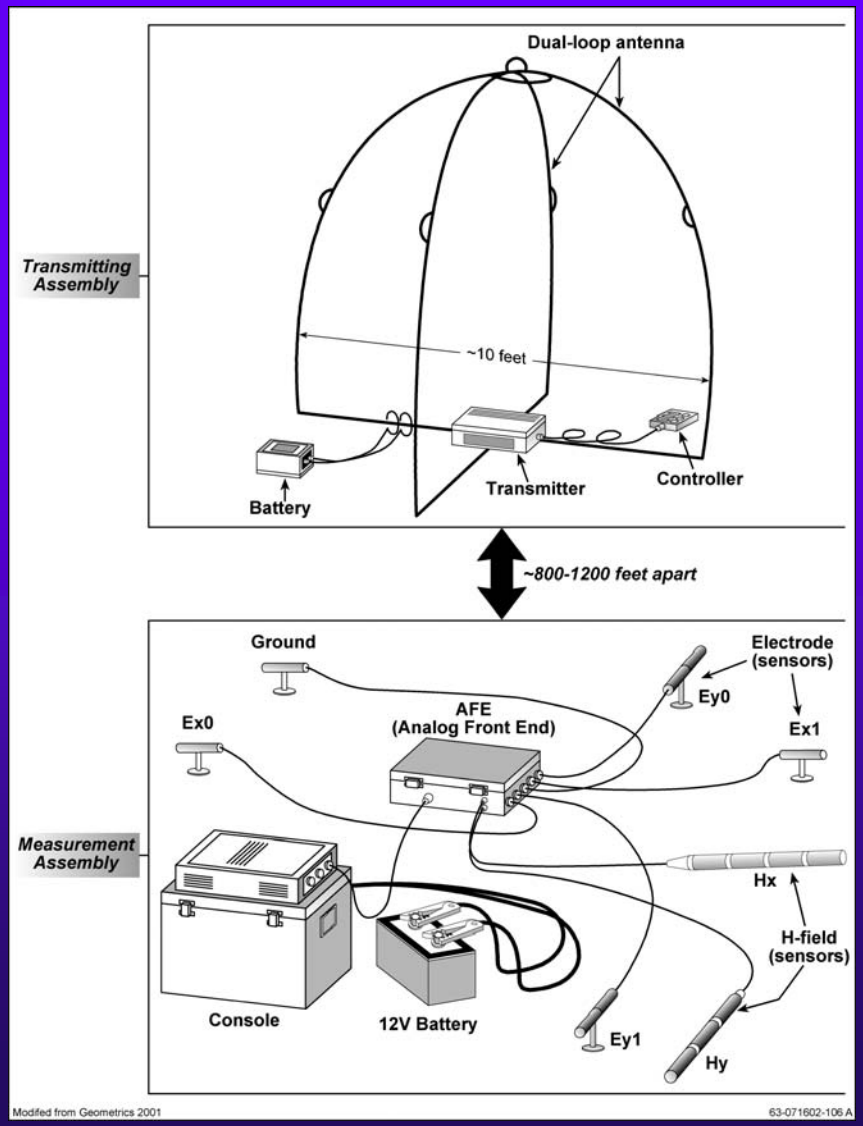
Electrical Imaging Results IWCS

Apparent Resistivity (ohm-meter)



Magnetotelluric (MT)



- Measures <u>DEEP</u> electrical properties of the bedrock

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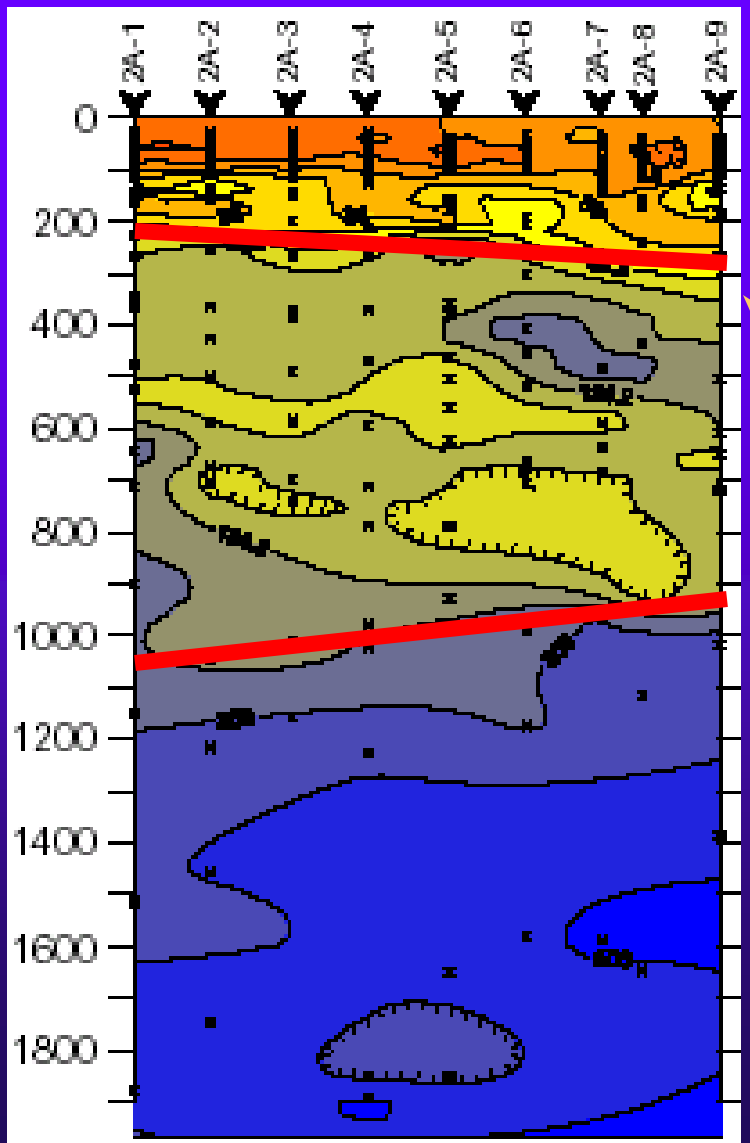
Magnetotelluric Results IWCS



- Seismic Pressure Points
- Geologic Discontinuities
- Deep Faults/Fractures

Top of Queenston Bedrock

Precambrian Basement

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Seismic Reflection

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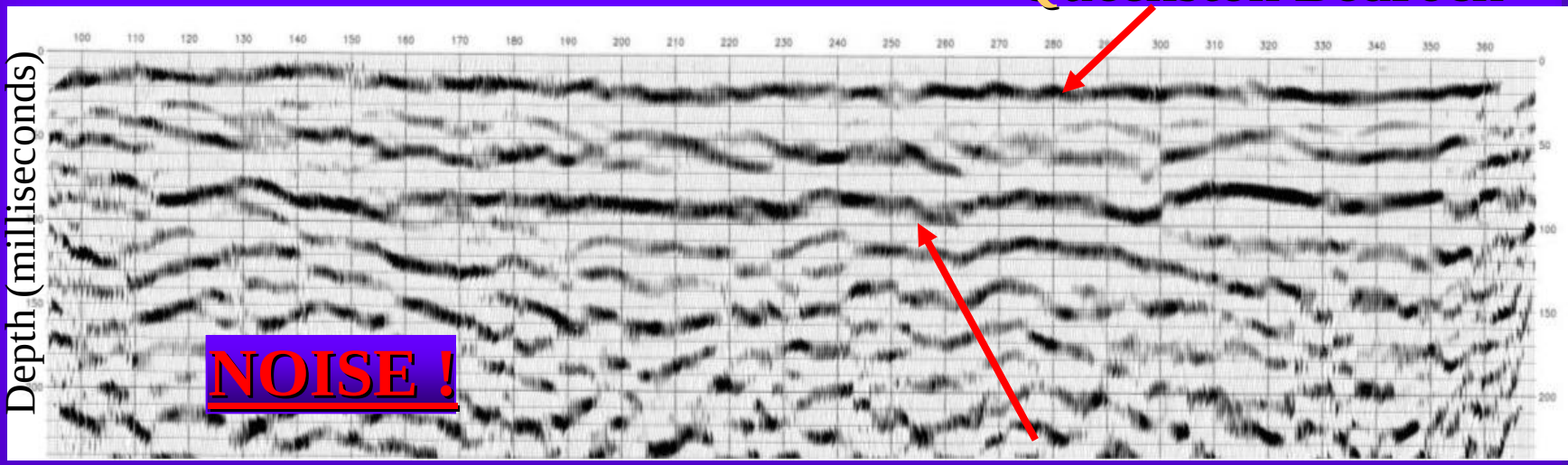
- Measure <u>DEEP</u> bedrock features

Elastic Wave Generator and Geophone String

Seismograph

Seismic Reflection Results IWCS



- Seismic Pressure Points
- Geologic Discontinuities
- Deep Faults/Fractures

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Seismic Reflection and MT Conclusions

- Soil/Bedrock Interface Identified
- Geologic Discontinuities Identified
- No Deep Faults/Fractures Identified
- No Seismic Pressure Points Identified

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IWCS-SPECIFIC CONCERNS- Voids or Caverns

- Key Technologies EM and EI:
  - Voids have an infinitely high resistivity.
  - Voids have “0” conductivity (EM).
- No “Extreme” values were measured.
- Conclusion: No Voids or Caverns.

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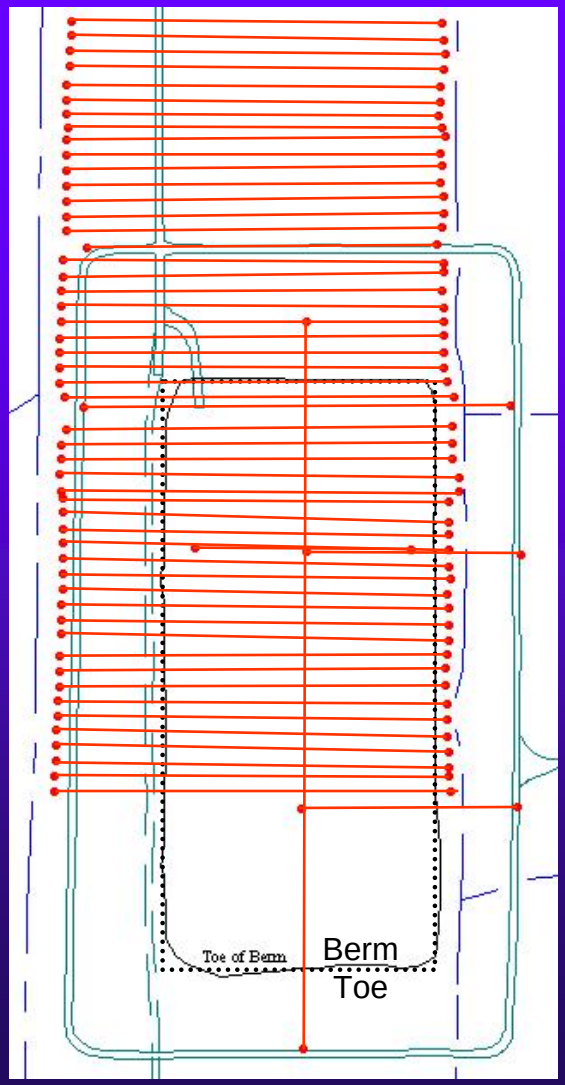
IWCS-SPECIFIC CONCERNS- Cutoff Wall Assessment



- Key Technology EI
  - Traverses every 10 meters
  - Generally north of the buried building area

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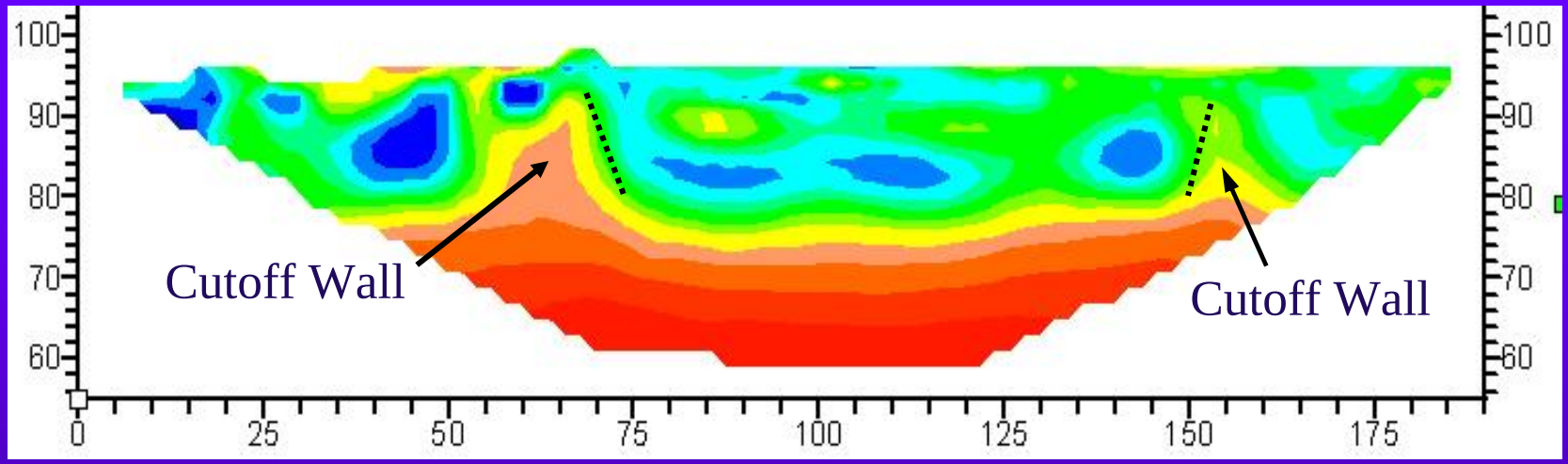
IWCS-SPECIFIC CONCERNS- Cutoff Wall Assessment



- Cutoff wall represented by increased resistivity
- Conclusion: No significant discontinuities (breaches) observed in data; however….
- Variations in resistivities observed
  - attributed to adjacent material (interferences) and
  - variations in composition (clay type/compaction)

IWCS-SPECIFIC CONCERNS- Water Saturation in the WCS

- Key Technology Shear Wave Seismic Refraction
  - Shear waves do not refract at water surface
  - Compressional waves refract at water surface
- Performed Assessment in “Quiet” Area

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Seismic Comparison

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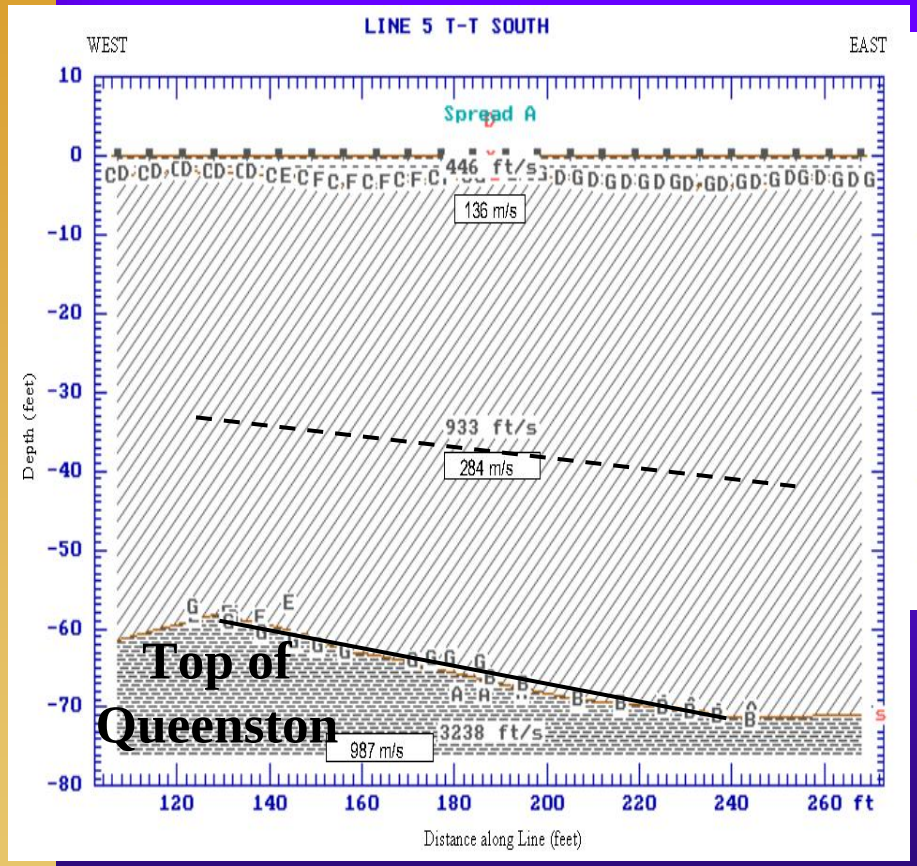
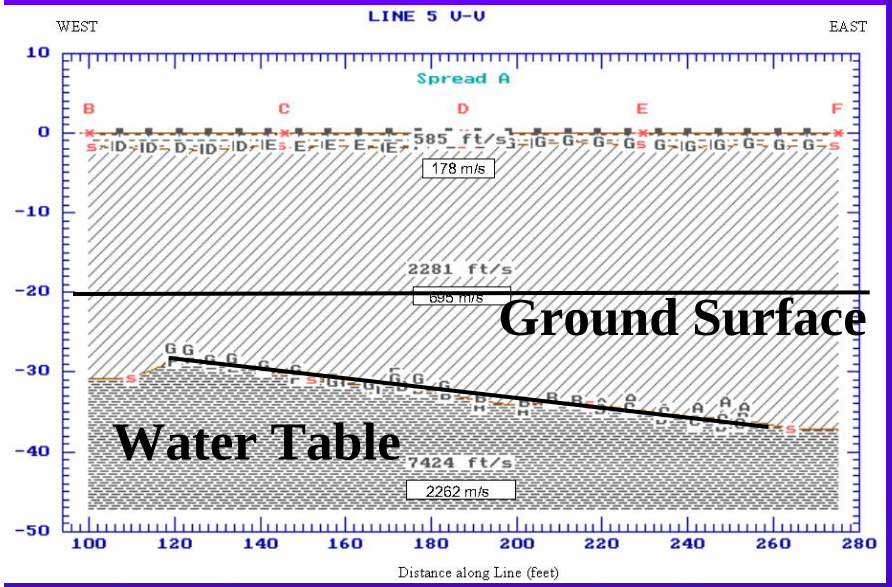
Shear Wave Data



Compressional Wave Data



Water Below Landfill is 3 feet below the foundation of Building 411

Top of Queenston Velocities suggest weathering/fracturing

EM Results of the NFSS IWCS

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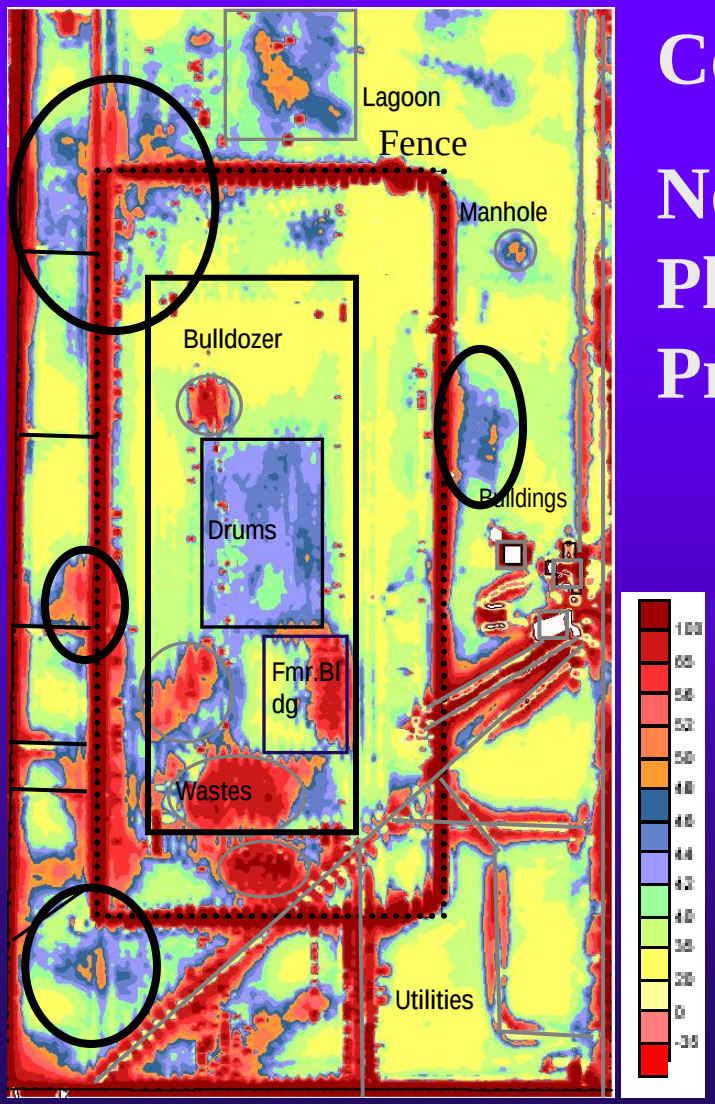
Conductivity (mM/m)

Quadrature Phase



Conclusion:

No Contaminant Plumes Interpreted Present

Geophysical Conclusions

Electromagnetics (EM-31, EM-61) and Magnetometer

- Delineated lateral extent of landfill contents and metallic debris (buildings, bulldozer, etc.)
- Geospatially located Building Foundations within IWCS
- Identified metallic debris in Bays B and C of Building 411
- Identified metallic debris outside building footprints
- Confirmed rebar-reinforced walls and floor in Building 411
- Confirmed lateral extent of 1991 drum addition to IWCS
- Confirmed no voids or areas of increased water saturation within IWCS

Geophysical Conclusions (cont'd)

Electrical Imaging (EI)

- Determined that the clay dike appears competent
- Identified most likely vulnerable areas of surrounding clay dike
- Delineated vertical and lateral extent of landfill contents
- Delineated vertical and lateral extent of metallic debris
- Confirmed no voids or areas of increased saturation within IWCS
- Identified areas of potential increased water saturation outside IWCS
- Delineated heterogeneity in landfill bottom

Magnetotellurics (MT)

- Confirmed no deep faults, fractures, or seismic pressure points near IWCS
- Delineated variations in weathered and un-weathered bedrock elevations

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Geophysical Conclusions (cont'd)

Seismic

- No significant lateral geologic discontinuities
- No faults/fractures/seismic pressure points near IWCS
- Confirmed stagnant water table beneath IWCS (3 feet below Building 411)
- Confirmed no areas of increased saturation within IWCS
- Delineated weathered and un-weathered bedrock topography
- Identified a bedrock "sag" outside IWCS boundaries

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IWCS-Baseline Integrity

- No voids interpreted in data - Implies no significant deterioration of the landfill
- No interpreted contaminant plumes - Still stable and intact
- No “unusual” conditions interpreted - Other than it is a reasonably well organized landfill.

- Conclusion-No immediate, obvious concerns for IWCS integrity.

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Acknowledgments

- R. Hoover
- S. Eichelburger
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