Best Practices, Tools and Techniques utilised in Geospatial-Utility Projects

by Navayuga

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Vice President, GIS Business Solutions

Feb 6, 2014

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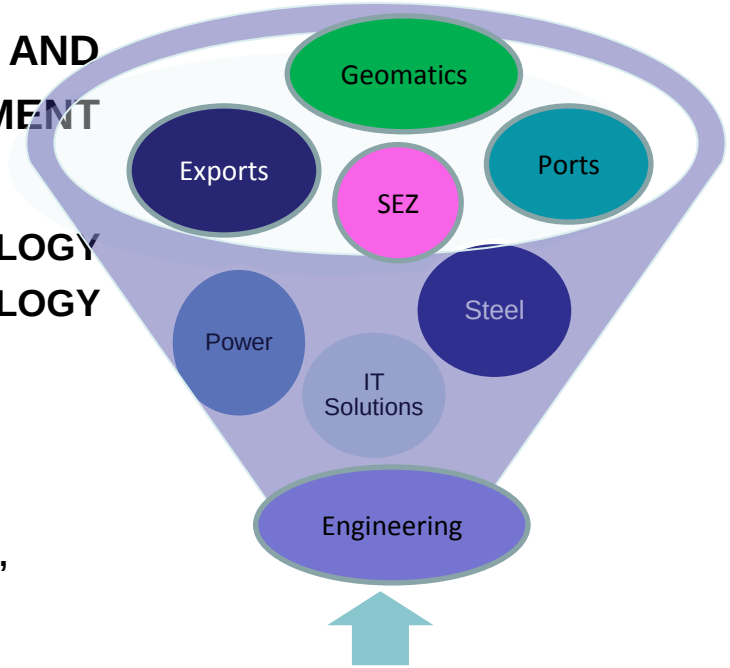
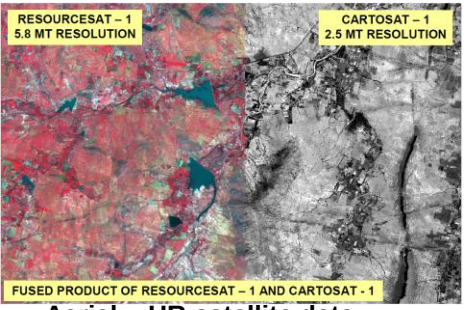
NAVAYUGA - LEADING ENGINEERING ENTERPRISE

- **NAVAYUGA - A 30+ YEARS ENGINEERING AND TECHNOLOGY COMPANY COMMITTED TO DEVELOPMENT PROJECTS**
- **NAVAYUGA IS A GLOBAL ENGINEERING AND TECHNOLOGY ENTERPRISE IN INDIA - ENGINEERING AND TECHNOLOGY SOLUTIONS IS OUR BUSINESS**
  - **5000+ CRORES REVENUES.**
  - **CURRENTLY EXECUTING ORDERS WORTH RS 50,000+ CRORE**
  - **OVER 10,000 EMPLOYEES WORLDWIDE**
  - **DIVERSIFIED CONGLOMERATE - CIVIL AND MARINE ENGINEERING, PORTS & FACILITIES HANDLED MAJOR PROJECTS IN SURVEYING, MAPPING AND 3D GIS**
  - **USE OF IT, SURVEYING, MAPPING AND GIS FOR SEVERAL YEARS AS PART OF ENGINEERING ENTERPRISE**
  - **NAVAYUGA IS A MAJOR PLAYER WITH MANY INTERNATIONAL AND NATIONAL LEVEL IT/ GIS PROJECTS**



NAVAYUGA : EXPERT ON IT AND GEOMATIC SOLUTIONS AND TECHNOLOGY INTEGRATON

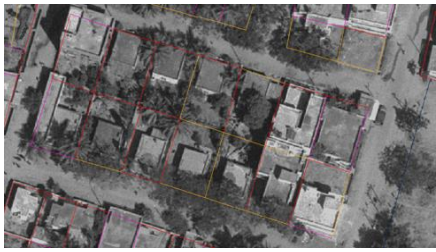


Aerial – HR satellite data
(Visible / IR, Thermal bands)

GPS / Total station

GPR Surveys

Ground Laser Scanner

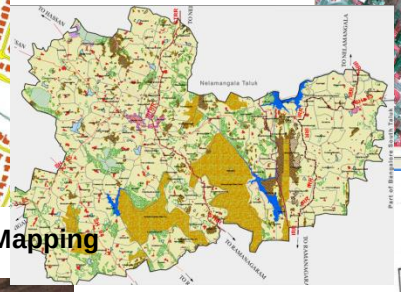


Cadastral / Parcel Mapping

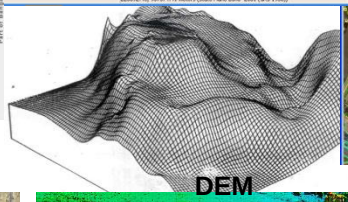
Field data collection

Image Processing & Thematic Mapping

Data Inventory
Scanning / migration



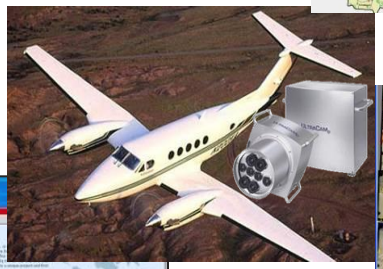
GIS Mapping



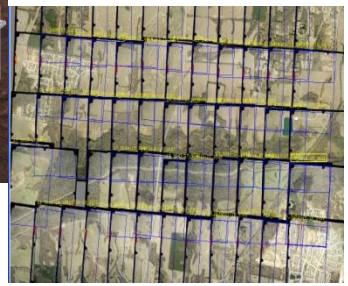
Ortho mosaic

DEM
(Photogrammetry / Lidar)

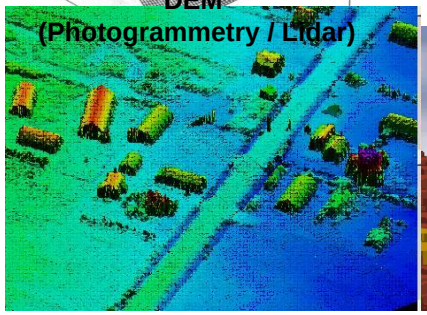
Capacity building & Facility Mgmt

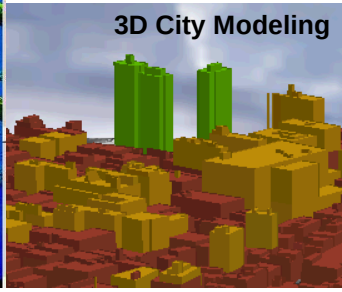


Aerial Survey



Triangulation





3D City Modeling

Enterprise GIS Database & Application Dev

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MAJOR UTILITY PROJECTS OF NAVAYUGA

- FEWA – Federal Electricity and Water Authority
  - Survey, Mapping and GIS database development of complete Electrical and Water network and its Asset
- Delhi SDI – 30 Depts including water, Gas, Sewer, Power, Telephone utilities
- RAPDRP – 3 states in India
  - TamilNadu,
  - Uttarakhand and
  - Puducherry states of India
- Al Ain Electricity Distribution System
- Publi Authority of Electricity & Water, Oman
  - Survey, Mapping and GIS application database development of complete Electrical and Water network and its Asset
- Ministry of Electricity and Water, Kuwait
- Abudhabi Municipality, RAK Municipality, Ajman Municipality
- Krishnapatnam port – Survey and Mapping
- Reliance Telecom – As built survey and mapping in GIS

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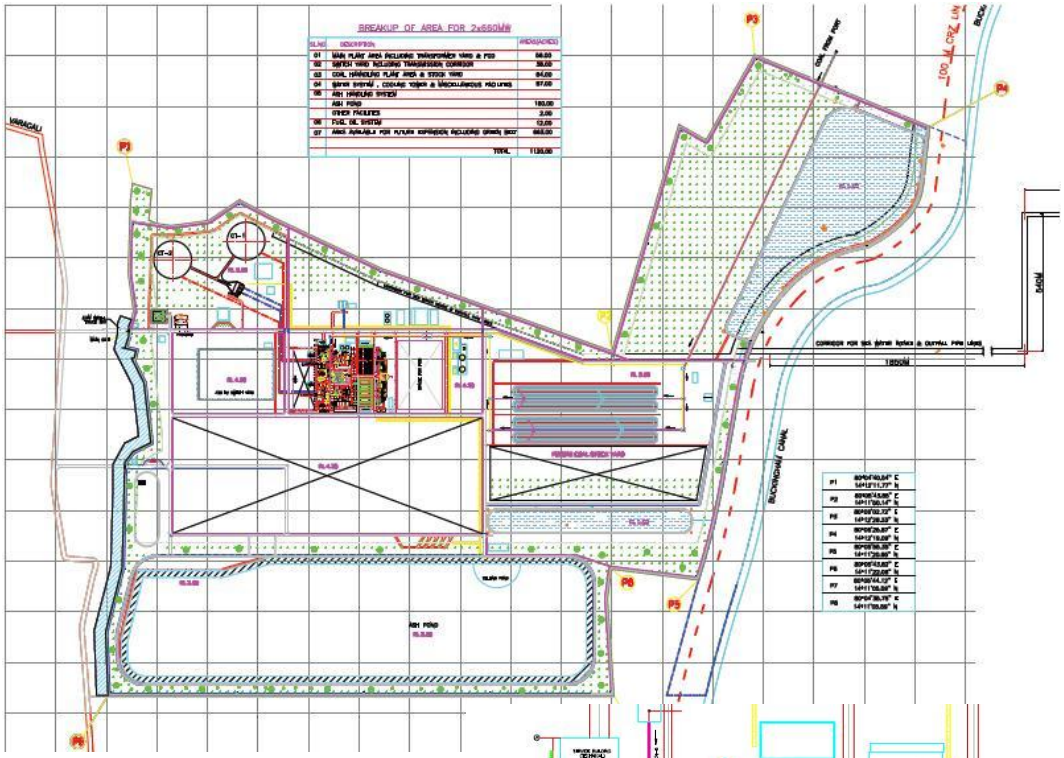
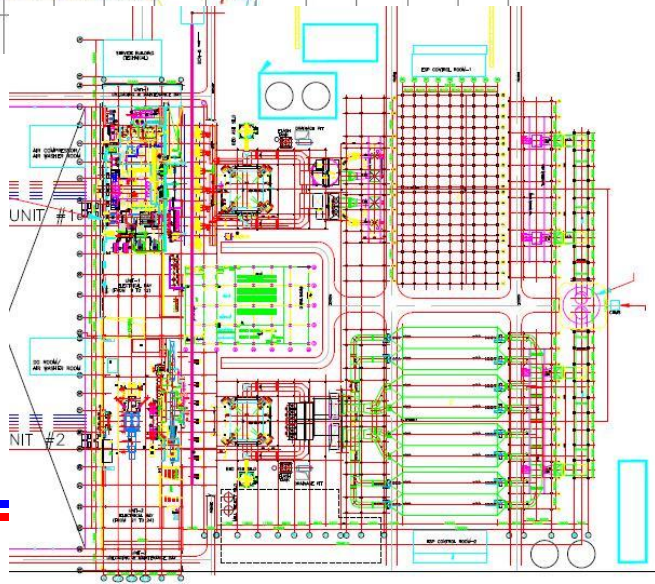
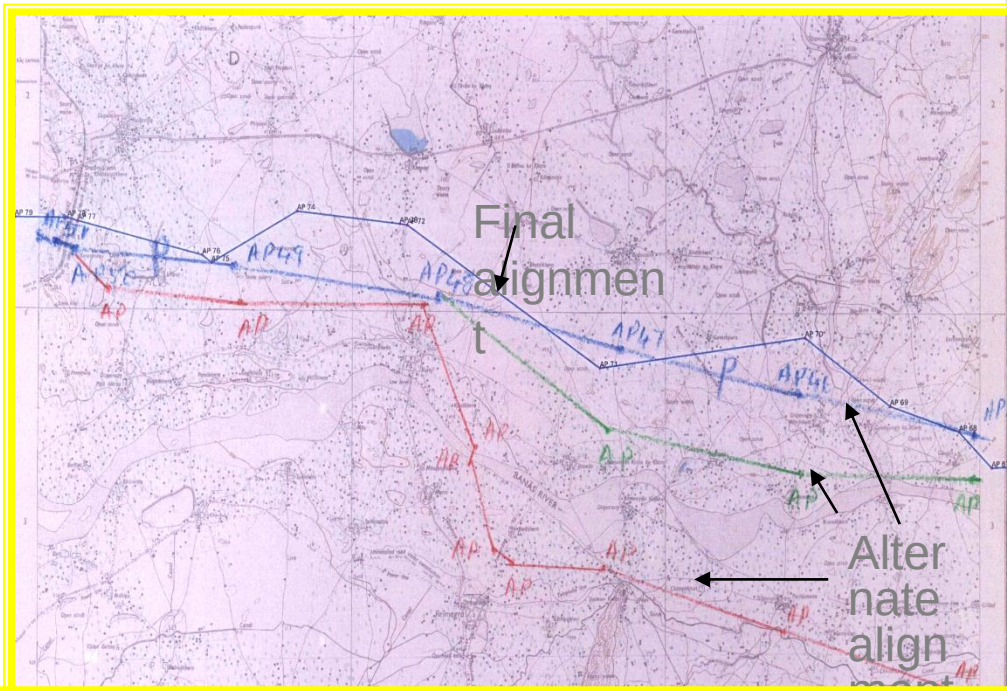
Port and Powerplant – detailed survey

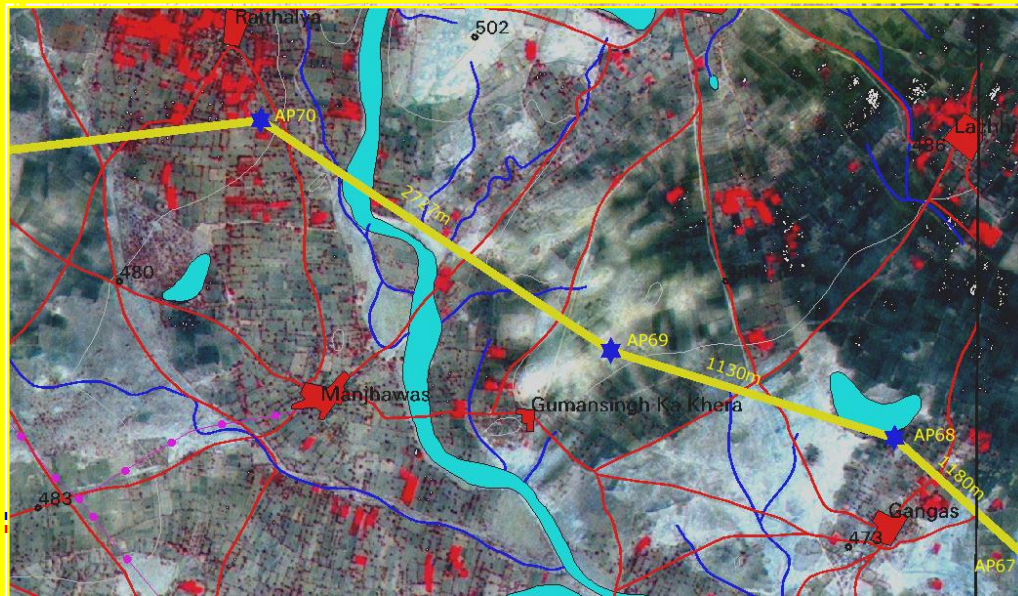




POWERLINE ALIGNMENT SURVEYS

- Reconnaissance survey of the existing Transmission Line using GPS, SOI topo sheets and Satellite imagery
- Delineate new transmission-line using the defined parameters and on-site judgment
- Final field survey using Total Station and DGPS for positional accuracy
- Outputs as maps at various scales of (1:250,000,1:50,000 & 1:25000)





GPS and Total Station

- Dual Frequency GPS for Base Control points
  - Accuracy of less than 5 cm
  - Average of 1 point per 2 km
  - DGPS data processing for manhole / Surface feature identification
- Total Station survey points on urban / Tree covered areas
- GPS Guided Direct Mapping
  - On the mobile mapper units
  - Marking on maps / satellite image prints

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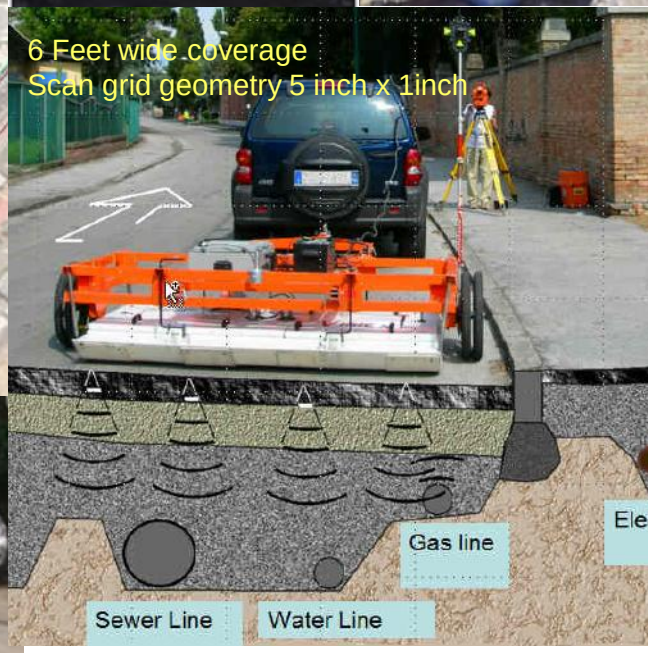
GPR SURVEYS: UNDERGROUND ASSET MAPING



- PROFILING RADAR FOR ASSET MAPPING BELOW GROUND
- DETECTS METAL, CERAMIC MATERIALS ETC
- LINKED TO GPS FOR PRECISE LOCATION
- TRANSFORMED OVER ROADMAP TO MAKE A ASSET GIS

Multichannel cart radar system-Terravision

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UTILITY SURVEY

Collection and Analysis of Existing Utility Maps, Associate Data, and Local Area Knowledge

↓

Survey Planning -Base Line Survey Map Preparation

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Segmentation of Roads

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Preliminary Survey to fine tune the equipment settings – UtilityScan and Terravision

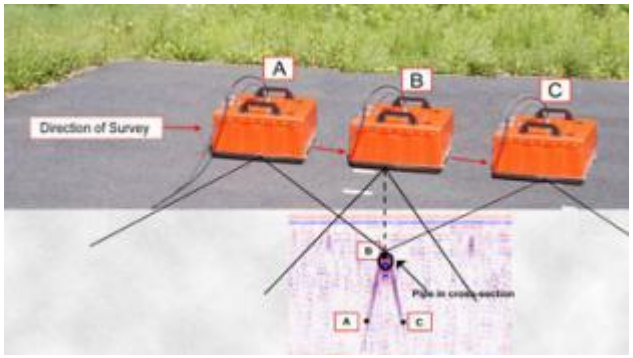
↓

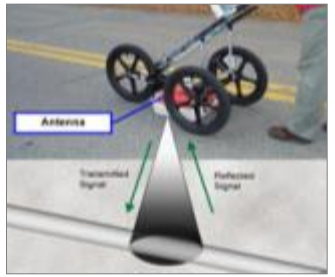
Utility Survey

↓

Under Ground Survey

Over Ground Survey





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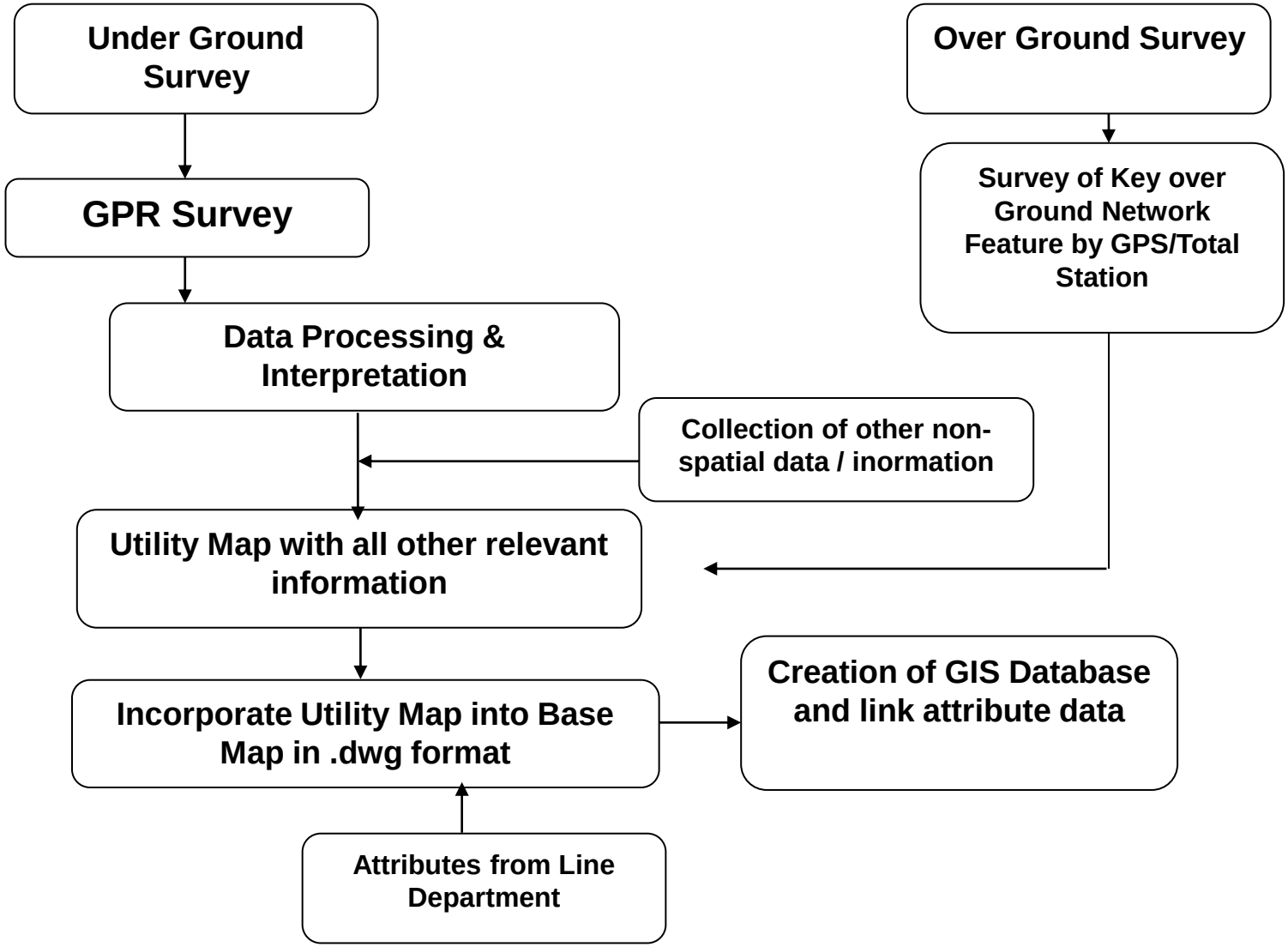
UTILITY SURVEY



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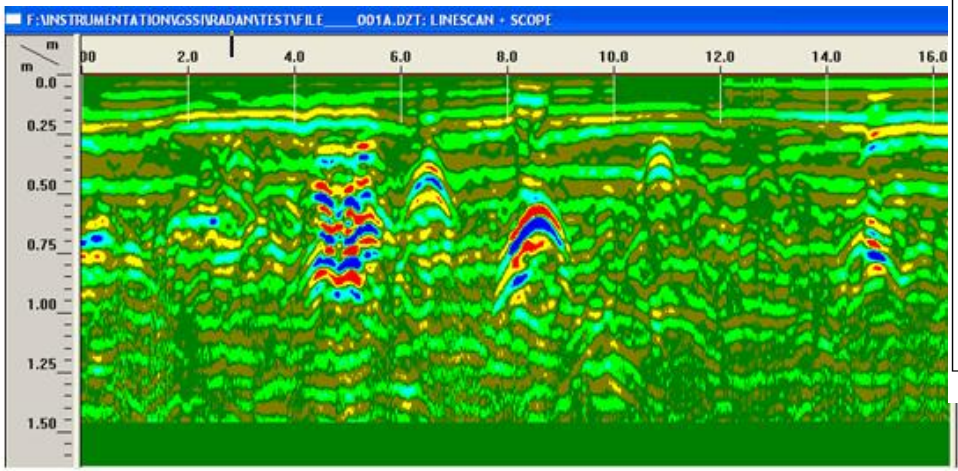
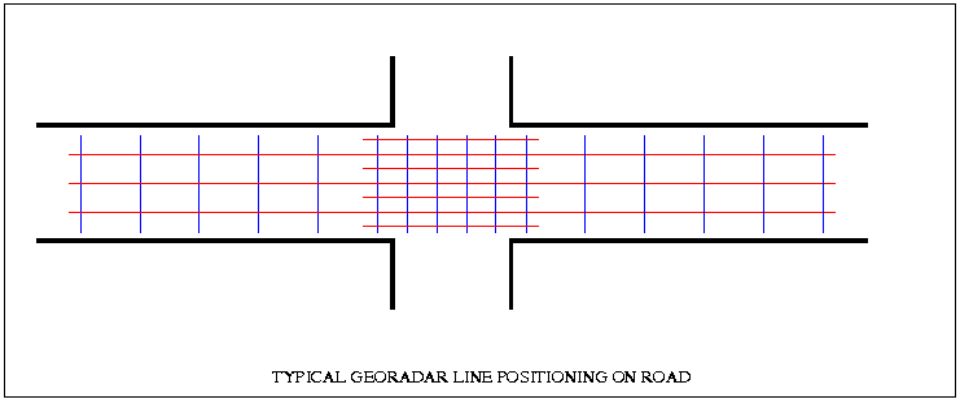
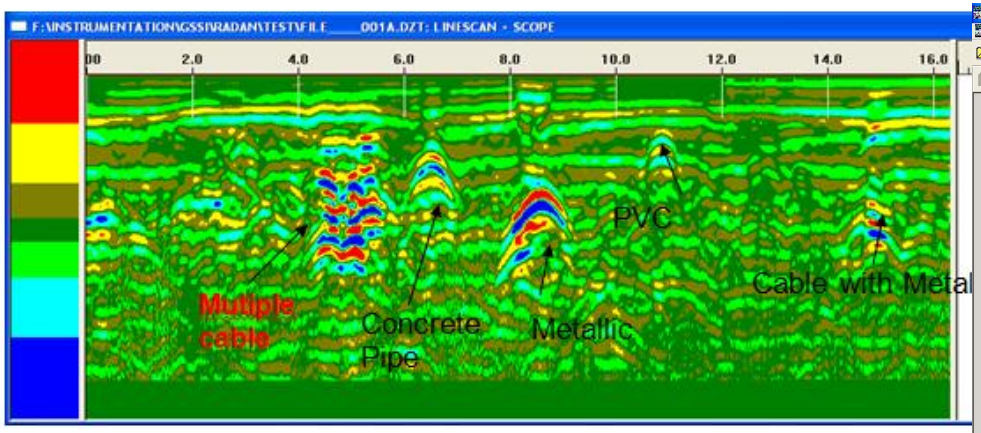
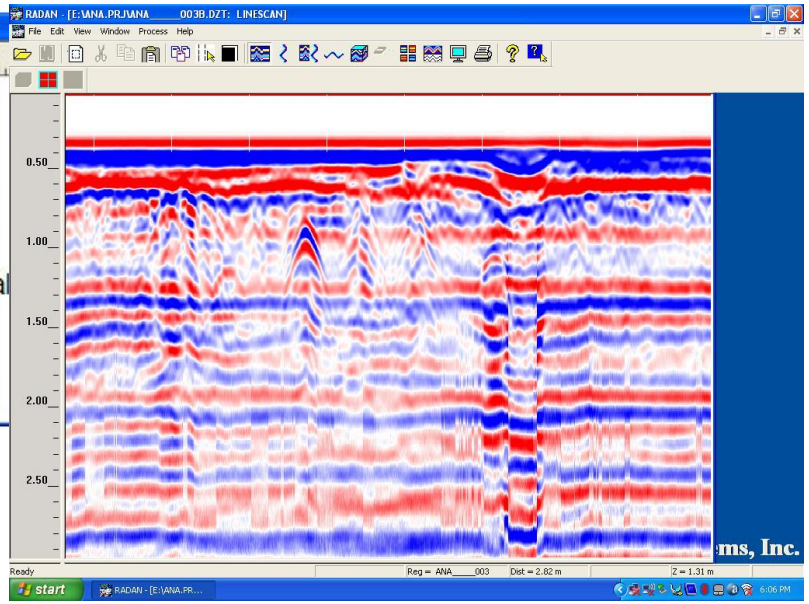
GPR Data





TYPICAL GEORADAR LINE POSITIONING ON ROAD





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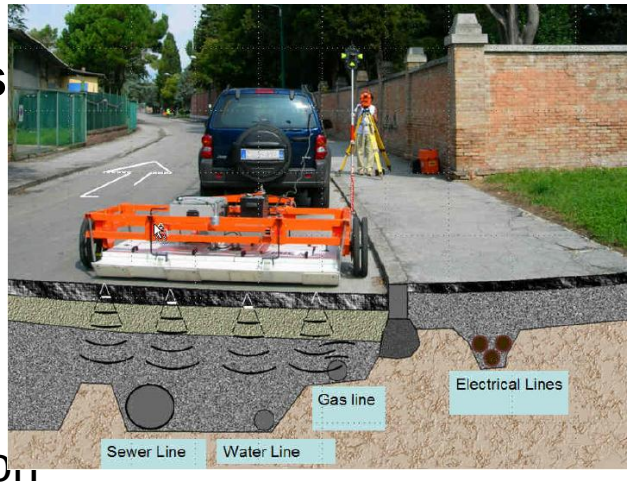
UNDERGROUND UTILITY DETECTION : Equipment and software

- **Utility Scan – SIR** system for real time 2D profiles,
  - Utility Scan-400 MHz for Shallow Penetration-Highest Resolution (0 – 4 m)
  - Utility Scan-270 MHz for Deeper Penetration-High Resolution (0 – 6 m)
    - ideally suited for detection and mapping of utility pipes.
    - can locate buried utilities, drums and underground storage tank.
    - identify depth and location of objects of all metallic and non-metallic pipes.
- **Terravision** system for 3D survey.
  - Records 3D data from 14 hardware channels simultaneously at 400 MHz in 6 feet wide survey swath for automatic pipe recognition.
- Pipe Locators with signal **generators** and **clamps**
  - DXL, MXL from Stanlay
  - RD 7000 from Sigma, 3M 2250
- GPR Data Processing Software
  - identification and data enhancement - Rdx pro
  - Radan will be used for scans collected by Terravision
  - CAD / GIS Software for Data management and attribute attachment



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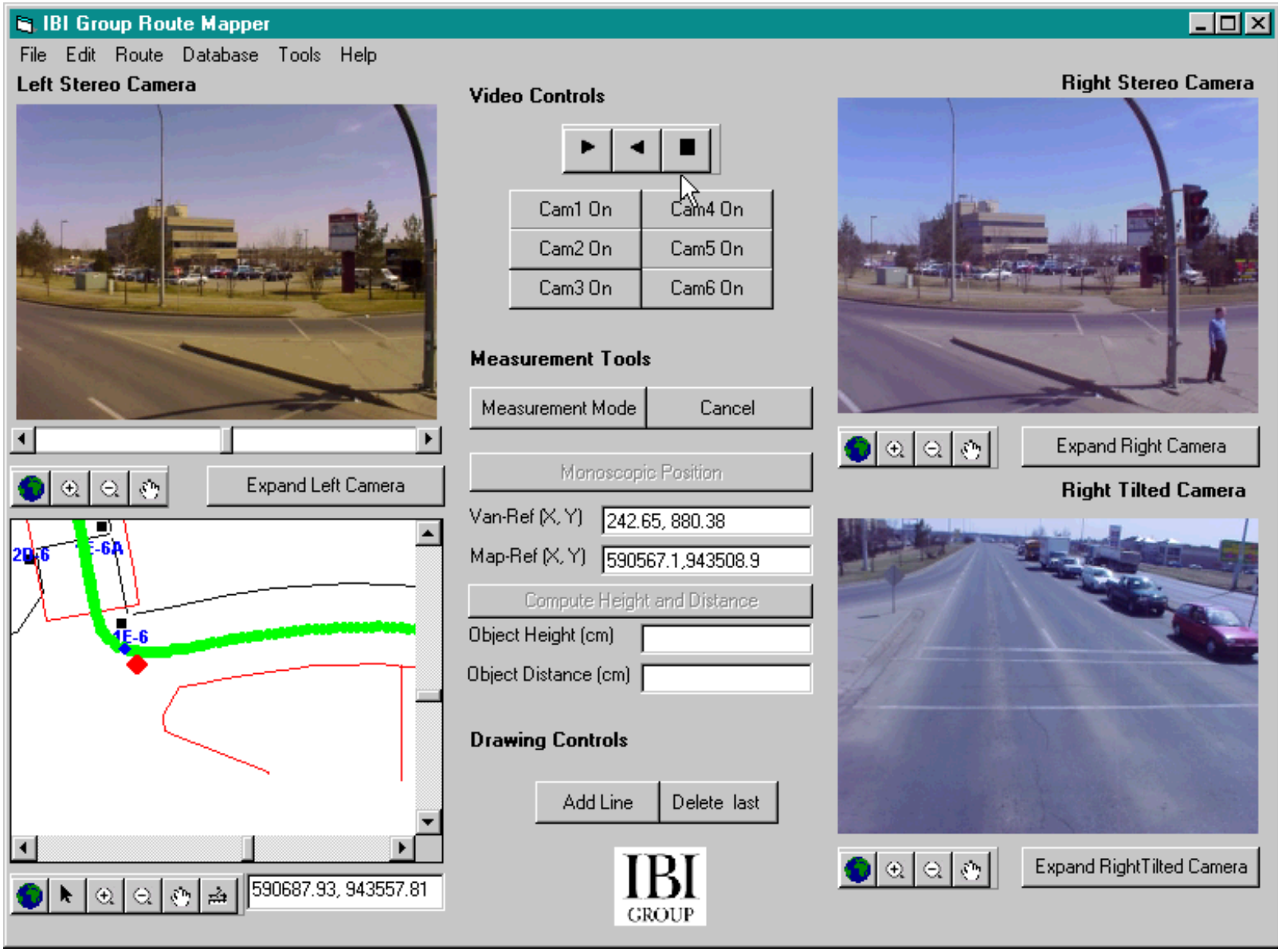
MOBILE DATA ACQUISITION: SURFACE UTILITY MAPPING



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MOBILE DATA COLLECTION for RAPDRP

- Good for Surface data extraction, verification and planning, landmark collection
- Guaranteed Accuracy of location and pole info
- Difficult for attribute data updation of wires which was needed

DATA COLLECTION

Paper Based

- Easy for data collection
- Low capital investment
- May lead to confusion due to hand writing
  - Avoided as much as possible by form design
- Lot of validation process to be built
- Highly Scalable
- Easy to train for large scale implementation

PDA / Direct Digital

- Dependencies
  - Battery backup
- Direct validation
- Takes time during survey
- Security of the instruments on large scale implementation
- Accuracy is more
- Scalability is difficult

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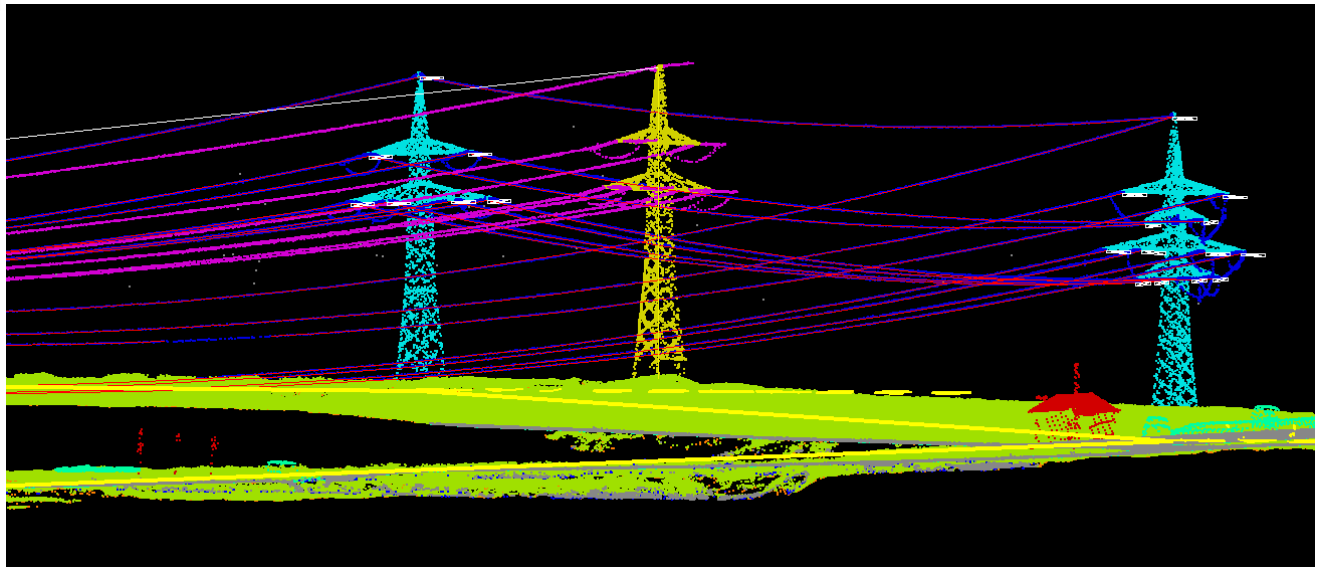
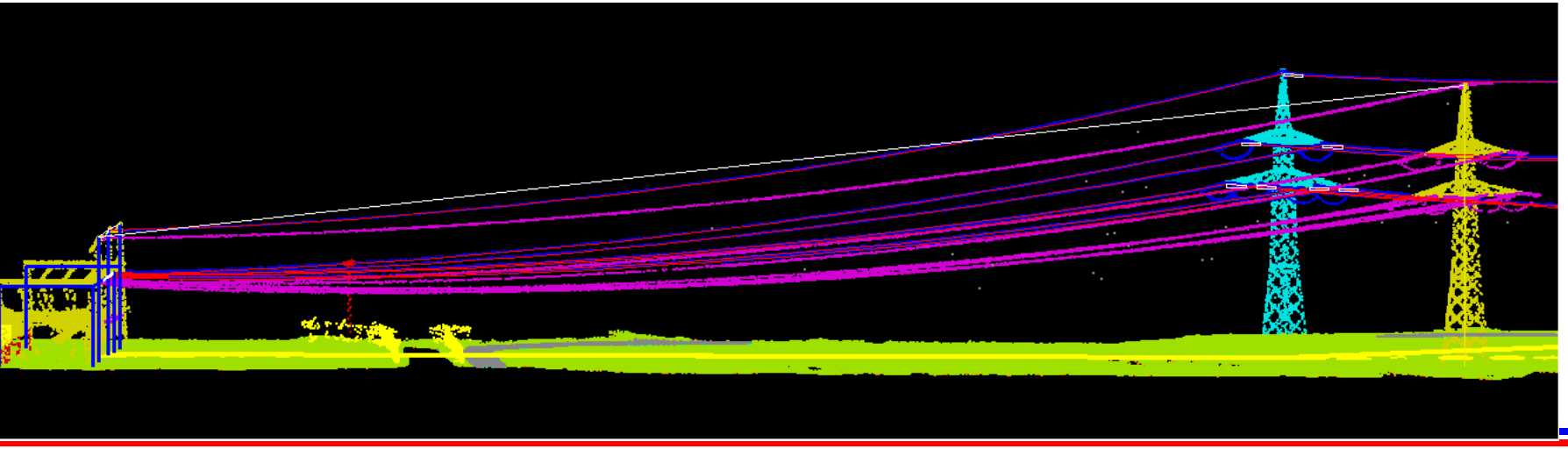
Airborne LIDAR: Acquisition and Processing



- Lidar Surveys
- DEM / DTM
- Transmission network mapping
- Orthoimagery
- Vector Map for PLS CADD integration



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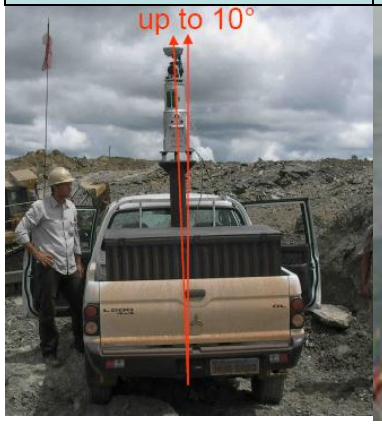
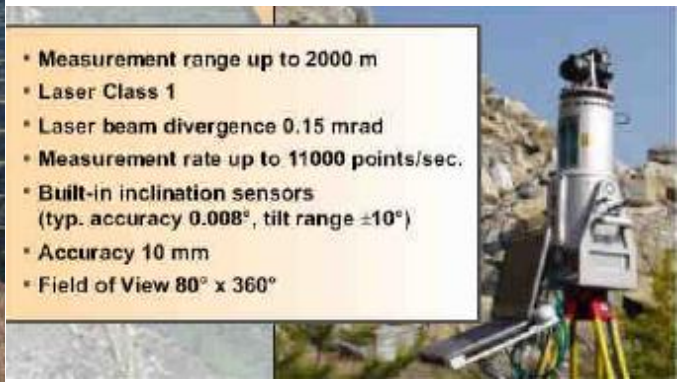
Terrestrial Laser Scanning

- Surveying, 3D Models for Breakline Detection and Bench Monitoring
- Monitoring of rockfaces and slopes
- Detection of rock- and slope-movements
- Open Pit Mining Monitoring
- Volume Calculation,
- Blast-planning and -supervision

Mobile	Fixed - Temp	Fixed - Permanent



- Panorama Image
- Textured 3D Model
- Detail of 3D Model
- 3D-Model with truecolor
- 3D-Model showing vegetation
- 3D-Model colored by height
- Contour lines



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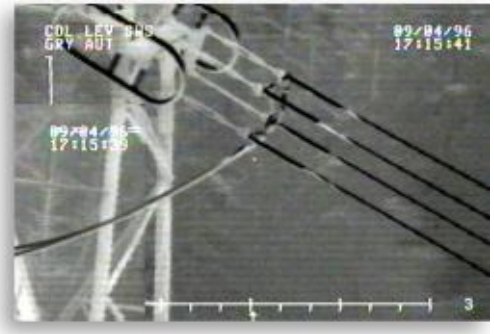
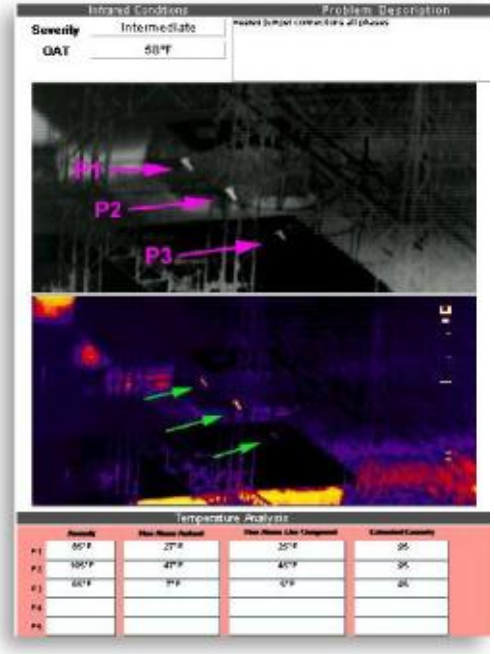
Power line surveys for inspection





- Corrdior Mapping
- LIDAR and Imagery acquisition
- Monitoring of power lines
- Infra red inspection for full evaluation of all detected thermal anomalies
- Asset inspection service
  - Damaged, burned or rotting structures
  - Broken or damaged cross arms and braces
  - Missing aerial markers and FAA warnings
  - Broken or missing guy wires and anchors
  - Broken or damaged insulators Missing structure numbers, or incorrectly numbered structures
  - Determine minimum ROW widths
  - Locate ROW restrictions / encroachments
  - Locate ROW access features, including bridges and gates
  - Erosion near structures

Source: GeoDigital

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RAPDRP : Components and Process Flow

Main Activities	Sub Activities			
1 Base Mapping	Satellite Data Procurement	GPS Control Point Planning	Base Station Establishment	GPS Control Survey
	GPS Data Processing	Geo referencing	Digitisation of base map	
2 Existing Data usage	Collection of existing data	Review and Planning	Georeference with base map	Digitisation as per design
3 Asset Mapping	Collection of SLD and dept data	Marking of DT & RFP Location	Area Demarcation	AM– attribute collection
	AM – Survey of position - DGPS	AM – Data entry and Linking	Creation of Network data	Lin king and Validation
4 Consumer Indexing	Collection of Consumer data	Survey of HT & LTCT consumers	Survey of Street Light meters	Survey of landmarks
	LT Consumer Data Collection	CI - Data Entry and Linking	Lin king and Validation	
5 GIS Data base Generation	QA / QC of Asset data	QA / QC of Consumer data	QA / QC of Base map database	Integrated Geodatabase
6 GIS based Network Analysis - Application	Database & High Level Design	Functional Design	Development and Integration	Testing and Deployment

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RAPDRP – Our Implementation Process

- Use of Geodetic GPS receivers
- Use of Google Data in the initial days
  - Establishment of transformation matrices
- Boundary study
- Clear spatial indexing of the project area
- Paper based data collection process along with GPS data
  - Flexibility in increasing more manpower
  - GPS only for location identification
  - Tools for generation of electrical network
  - Use of open source tool
  - Central Data Validation
  - Colour coding & Unique numbering during the field surveys
  - Predefined building ID's for ground survey. Quick to link attributes and check for anomalies
- OH and UG based Data collection procedure / forms
- Process of achieving 100% consumer and mapping them to identification
- Duplicate clearance and resolution of mixed numbering scheme

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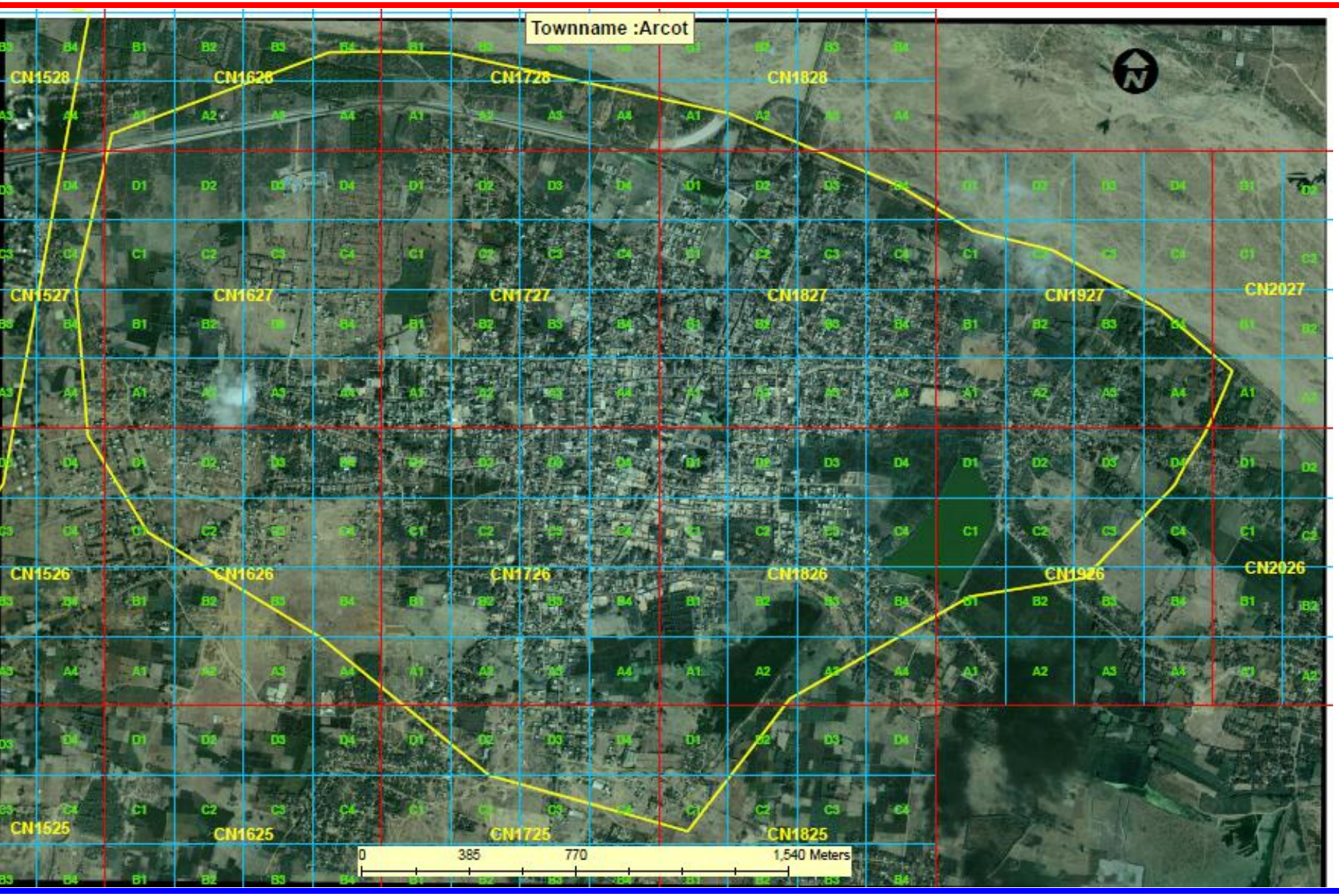
Gridlayout – Sample



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1 km grid layout on 1 : 5000 scale – optimised for A3 paper

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250 m grid – layout for Asset mapping and consumer indexing

RAPDRP : Our Solution

- ESRI based Solution
- PRDC Mipower based Network Analysis
- Enterprise Service Oriented Architecture
- Data Updation Procedure
  - Complete automation
  - Utility driven approach
- Hardware sizing
  - Load balanced App servers
  - DB servers – 2 nos of IBM P7 6 core processor,
    - 3.72GHz of 416 GB RAM.
- Network Sizing
  - 30 Mbps Network for DC
  - Dedicated 512 kbps network for the section offices
- LowerTime delay / display in webpages
  - Configuration of network parameters and monitoring
  - Database design, dynamic Cache, query / display, Role based data extract and display

- Load flow Analysis
- Fault Analysis
- Contingency Analysis
- Protective Device Co-ordination
- Line Re-Conductoring
- Network Re-Configuration / Express Feeder
- Cost Estimation
- Cost Benefit Analysis

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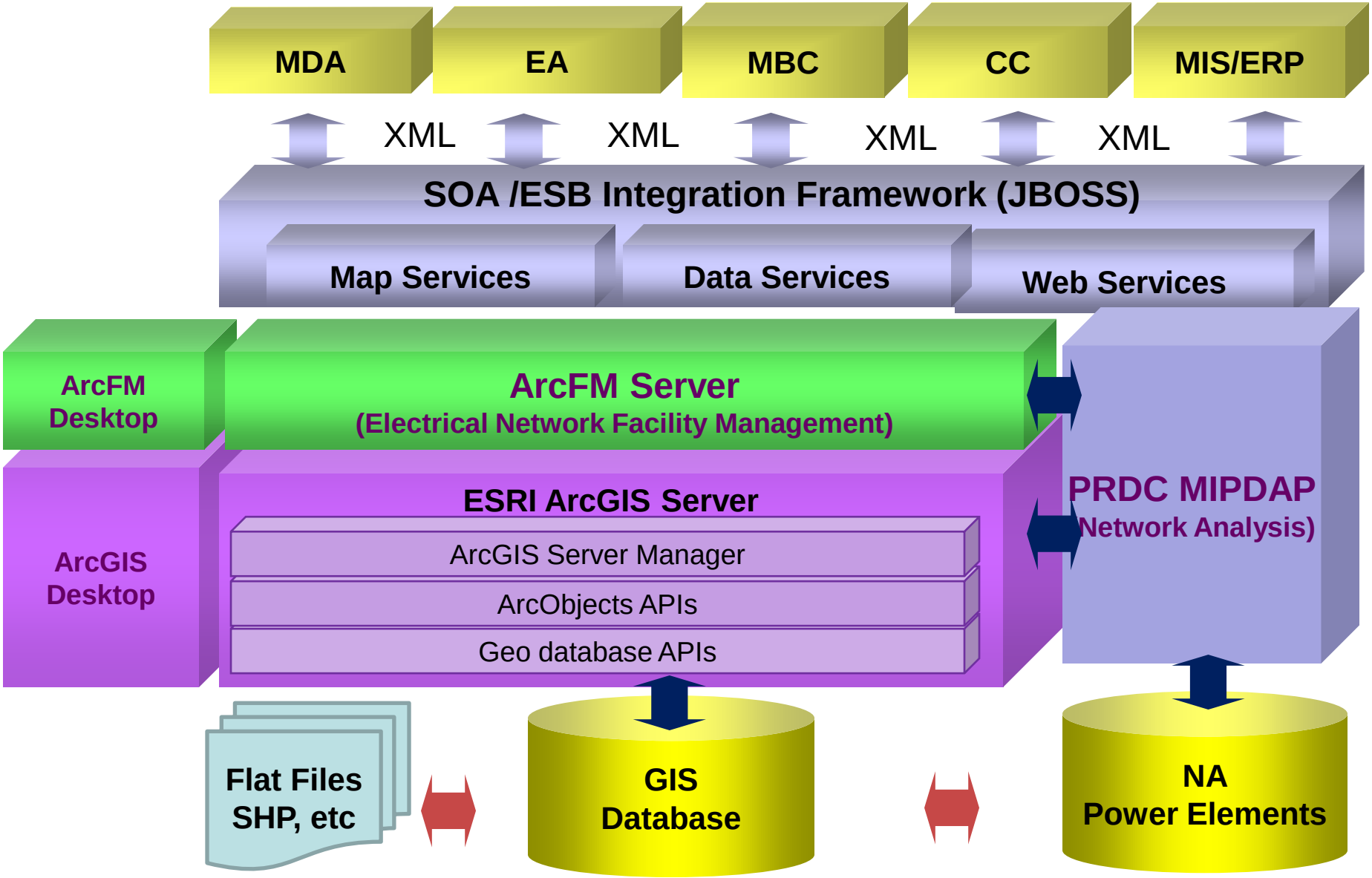
GIS SOLUTION ARCHITECTURE



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Integrated Solutions @ Utility Industry

Deliver

Capture Real World

Electric 10.1 | Comms 10.1 | Water 10.1 | Gas 10.1 | Pipeline 10.1

Accurate – Authoritative – Actionable Information

Process

Data

Desktop | Web | Mobile

Database Server

Store

Sensors

Geospatial Portfolio

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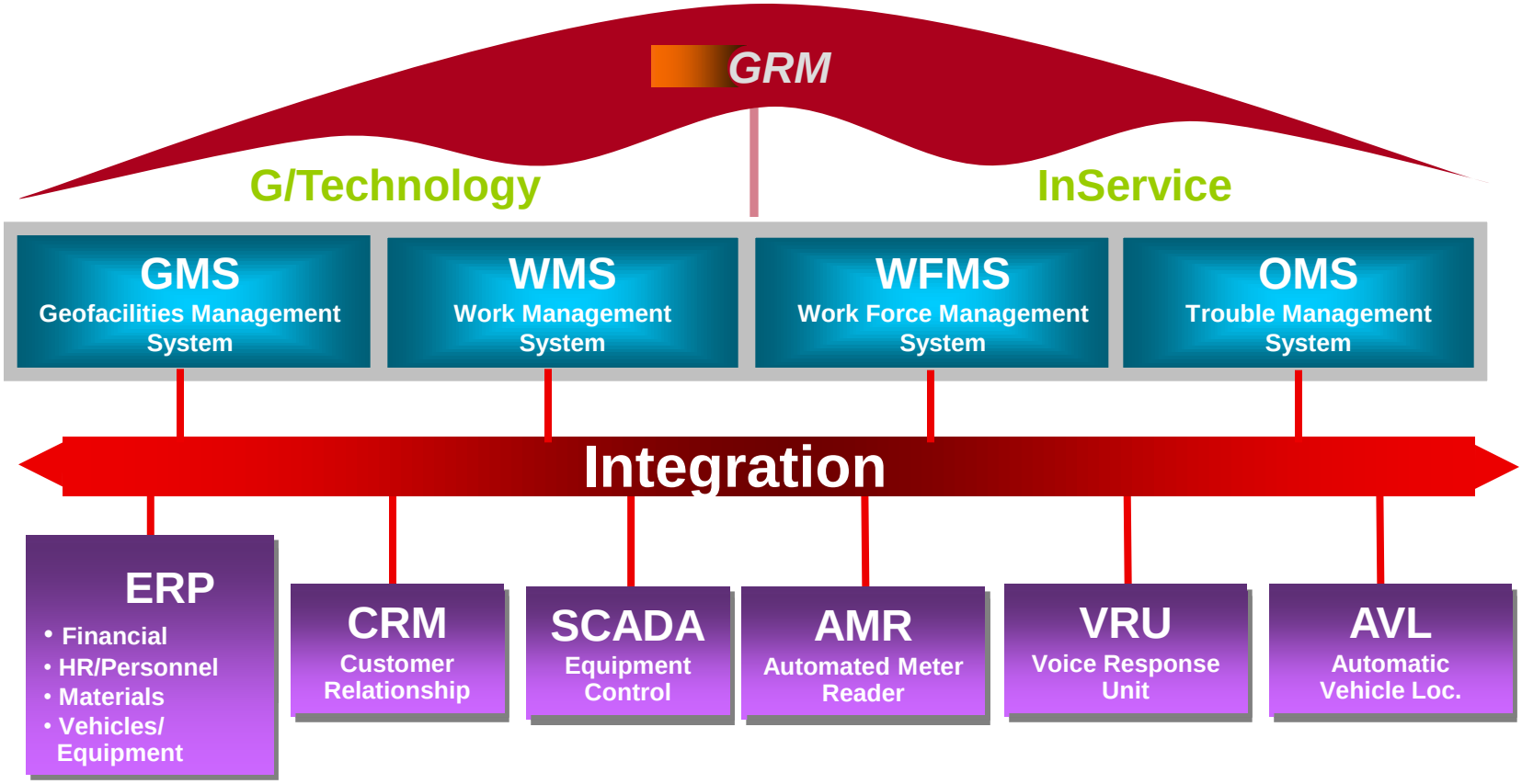
Intergraph @Geospatial Resource Management



Geospatial Resource Management (GRM) provides advanced integrated solutions to increase efficiencies, streamline workflows and lower the costs of network operation and maintenance

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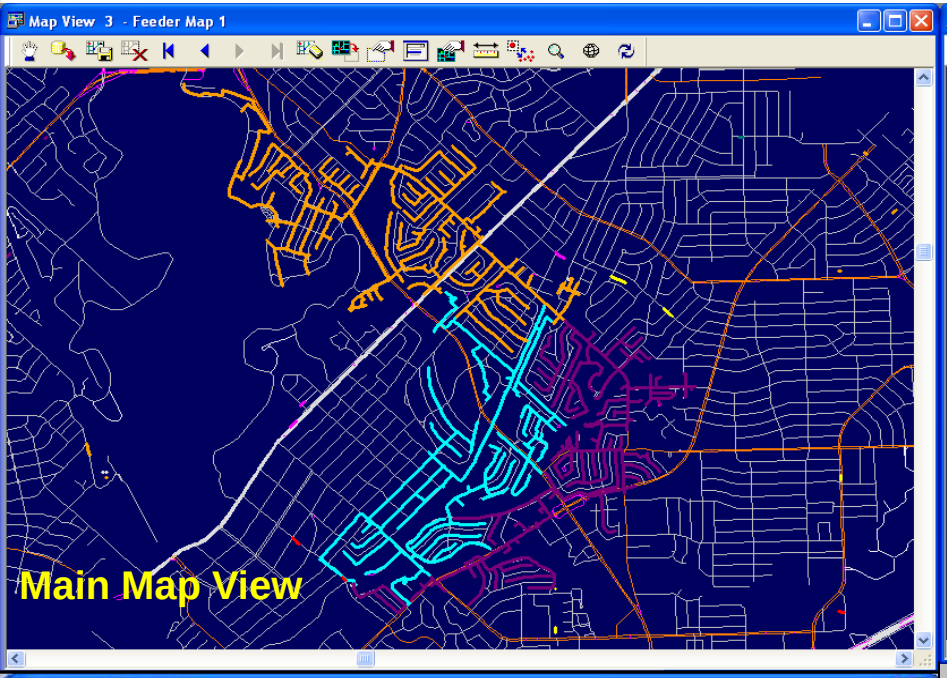
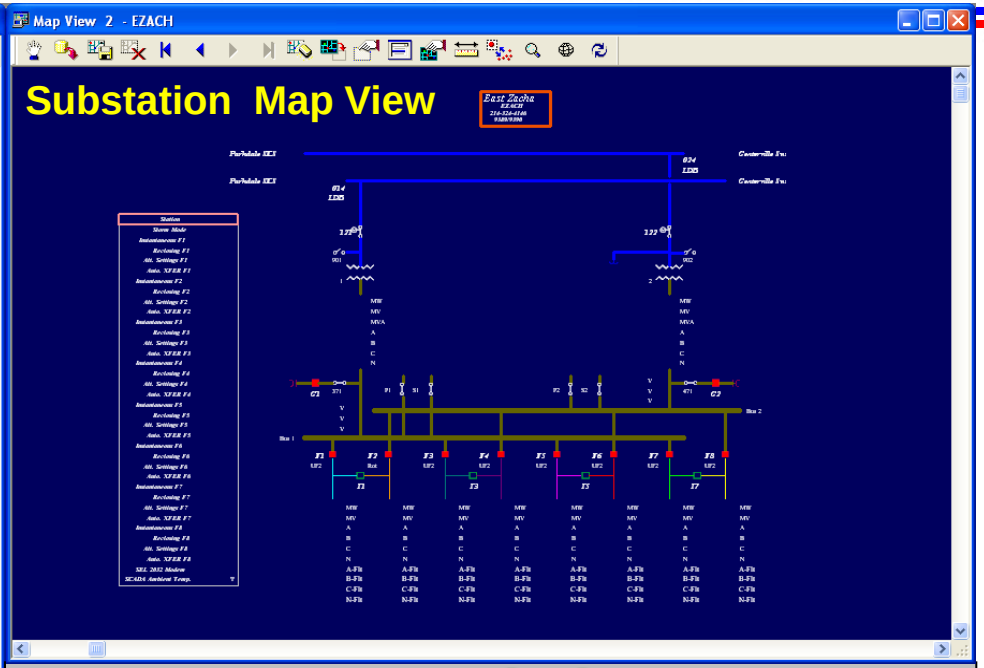
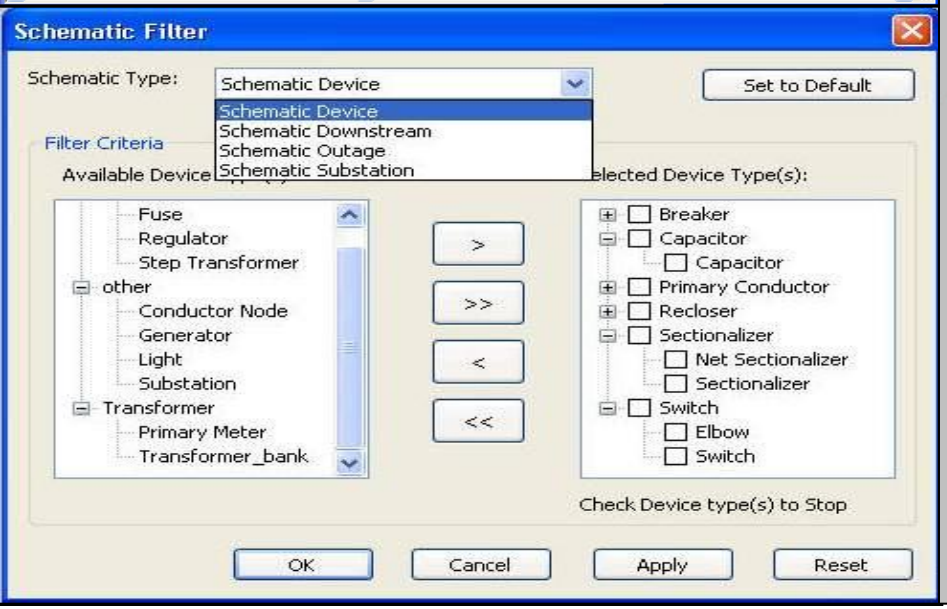
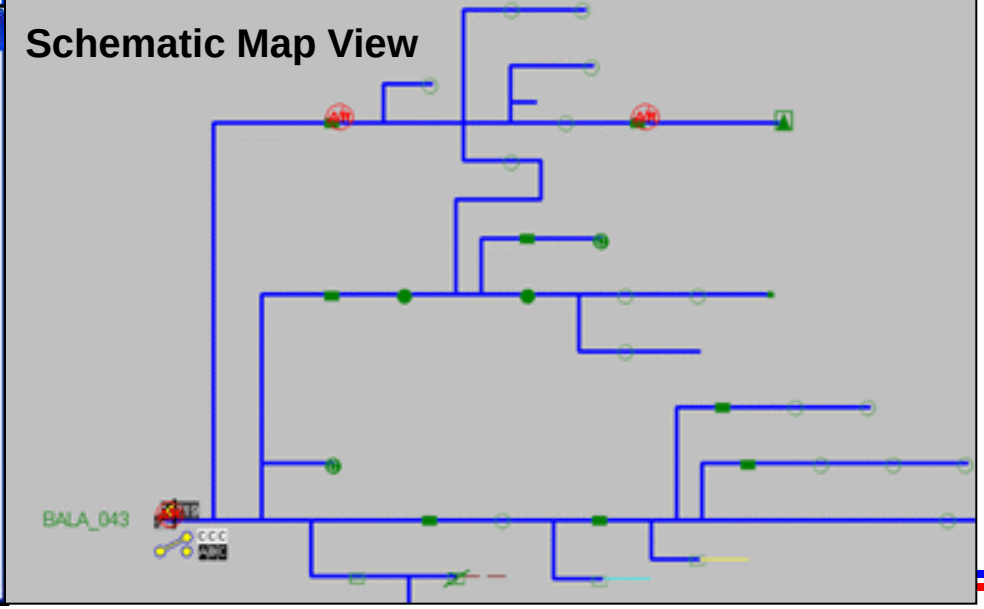
Display Main Map, Schematic Map, Substation Map









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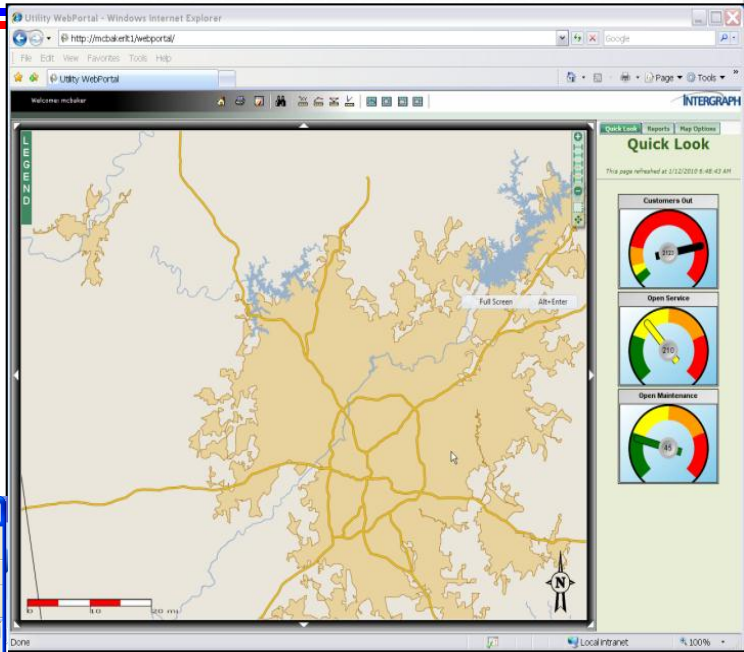
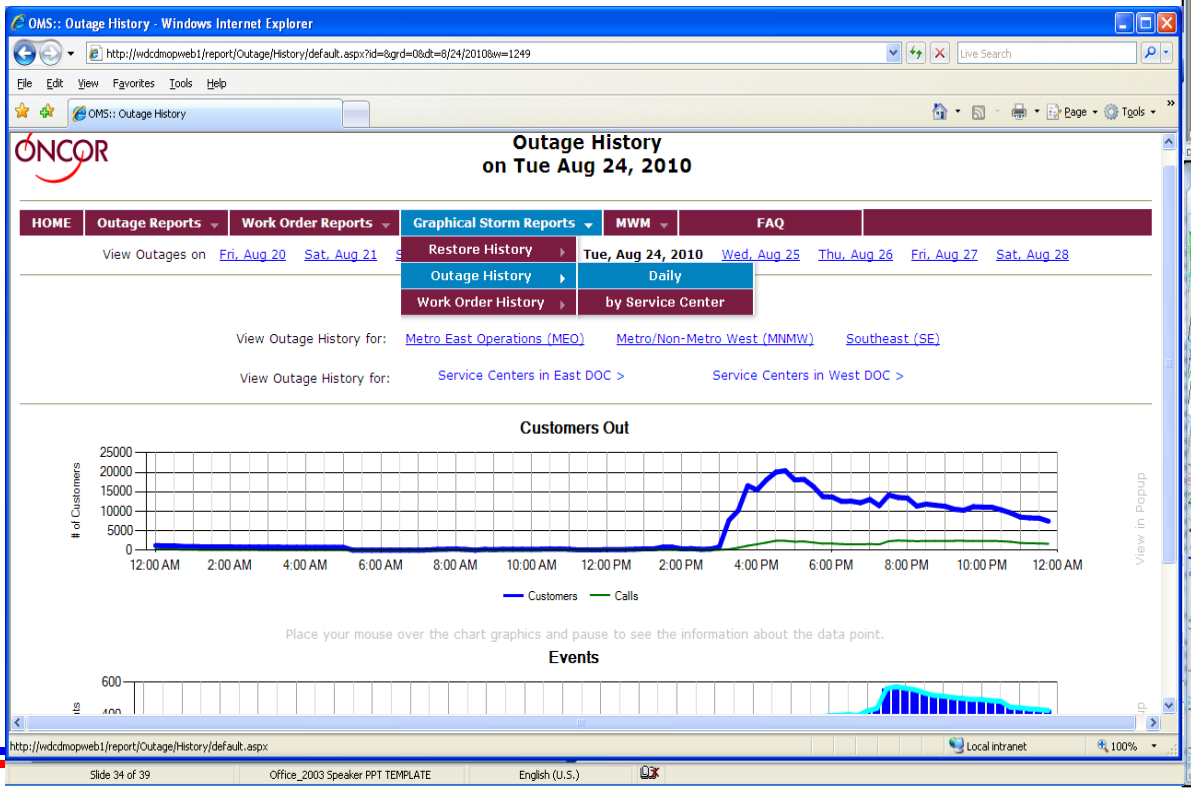
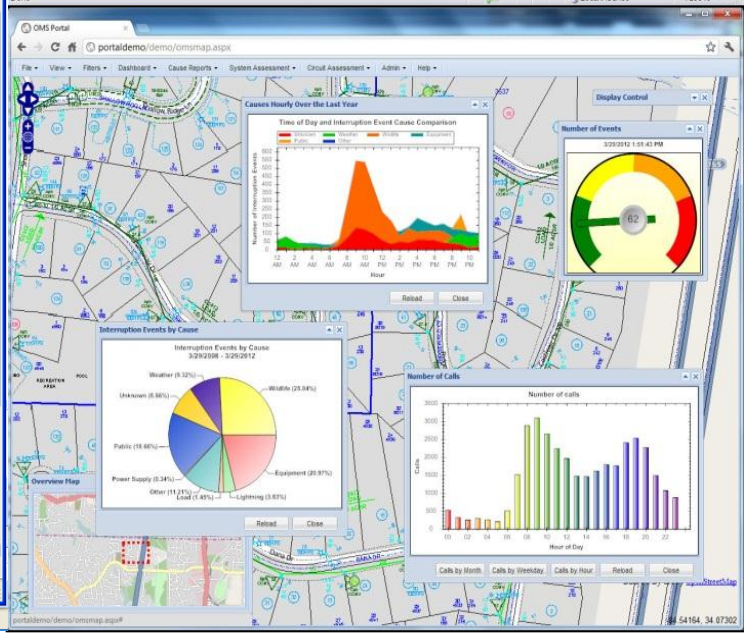
OMS @ Reporting on Web Portal

- Provide detailed, accurate, and analytical information through timely .
- Allows you to identify and correct trends before they become an issue.
- Industry standard reports and charts
  - System reliability
  - Outage analysis and crew history reports
  - Current workday or historical







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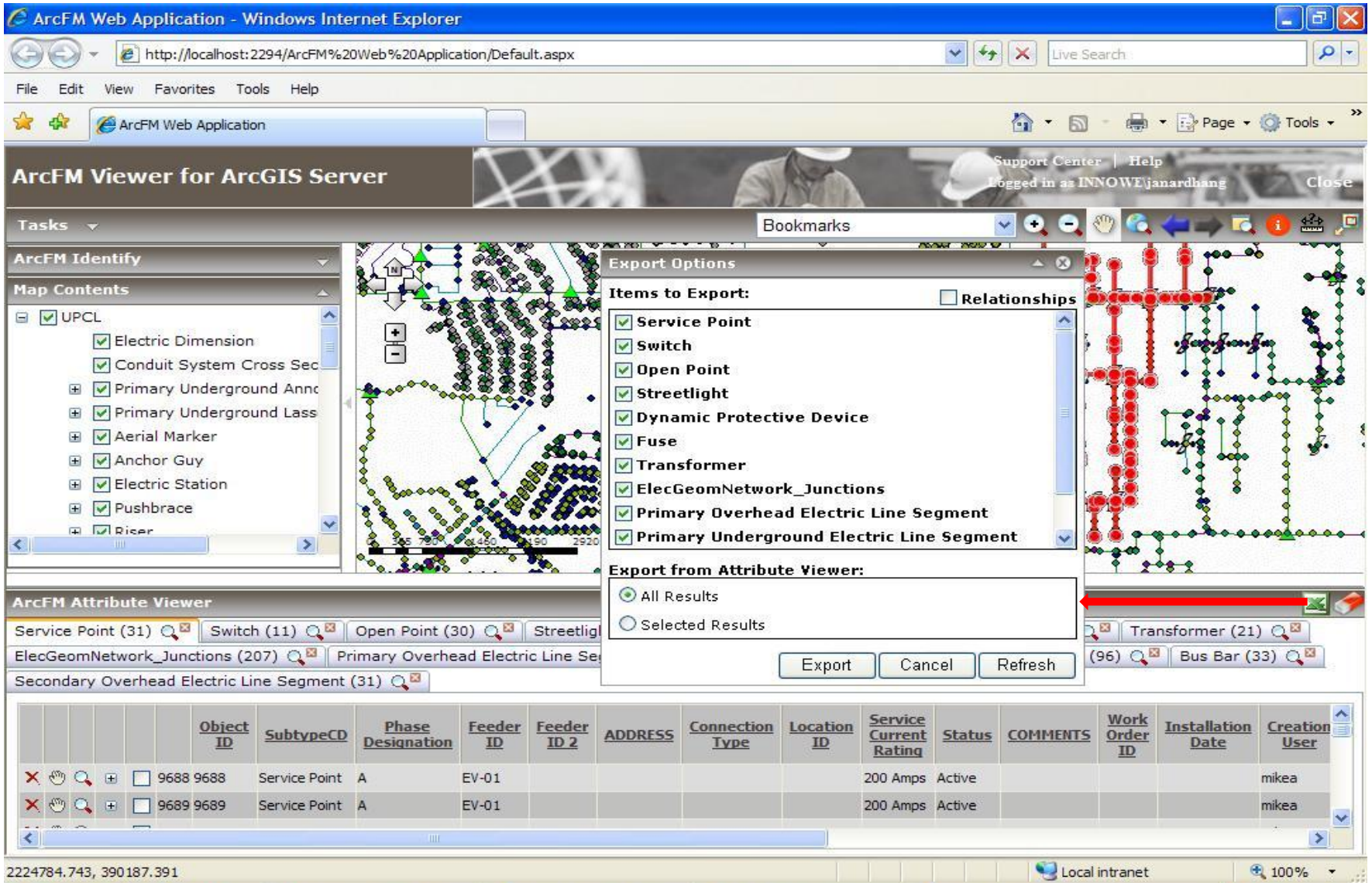
Network Trace, Search and Data management



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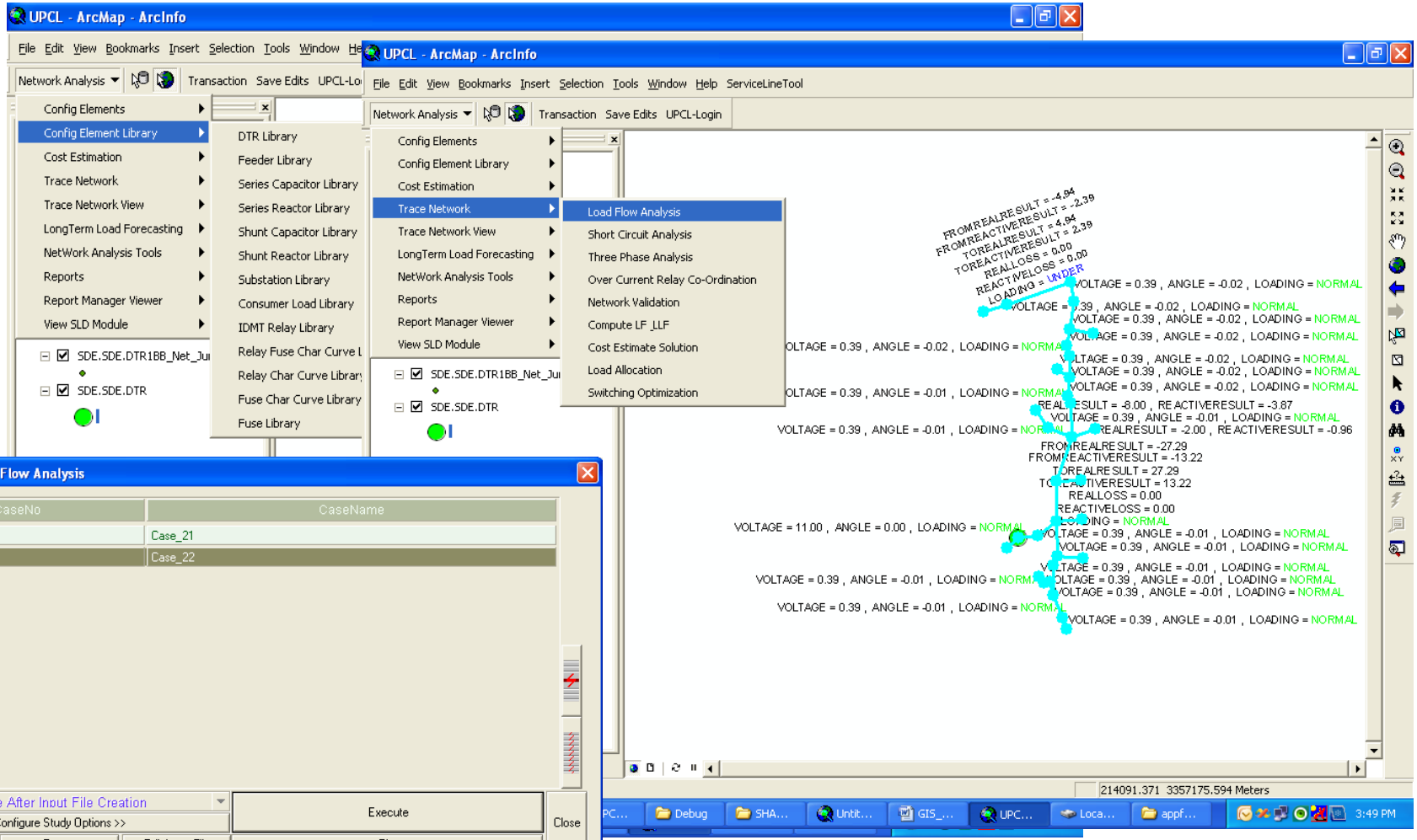
Load Flow analysis



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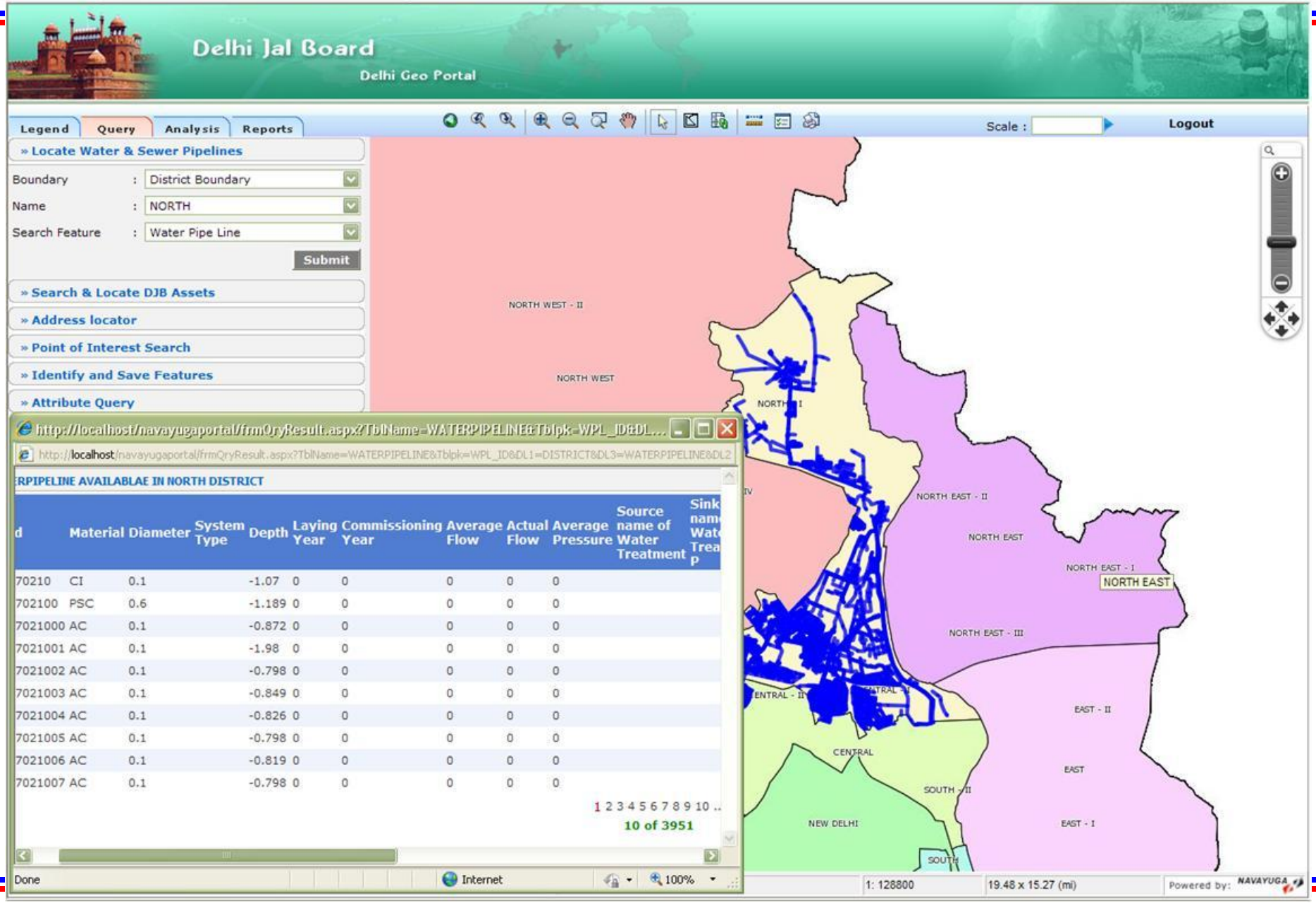
3 Query on depth and diameter of the utility pipes of DJB



d	Material	Diameter	System Type	Depth	Laying Year	Commissioning Year	Average Flow	Actual Flow	Average Pressure	Source name of Water Treatment	Sink nam Wat Trea p
70210	CI	0.1		-1.07	0	0	0	0	0		
702100	PSC	0.6		-1.189	0	0	0	0	0		
7021000	AC	0.1		-0.872	0	0	0	0	0		
7021001	AC	0.1		-1.98	0	0	0	0	0		
7021002	AC	0.1		-0.798	0	0	0	0	0		
7021003	AC	0.1		-0.849	0	0	0	0	0		
7021004	AC	0.1		-0.826	0	0	0	0	0		
7021005	AC	0.1		-0.798	0	0	0	0	0		
7021006	AC	0.1		-0.819	0	0	0	0	0		
7021007	AC	0.1		-0.798	0	0	0	0	0		

1 2 3 4 5 6 7 8 9 10 ..

10 of 3951

Done Internet 100%

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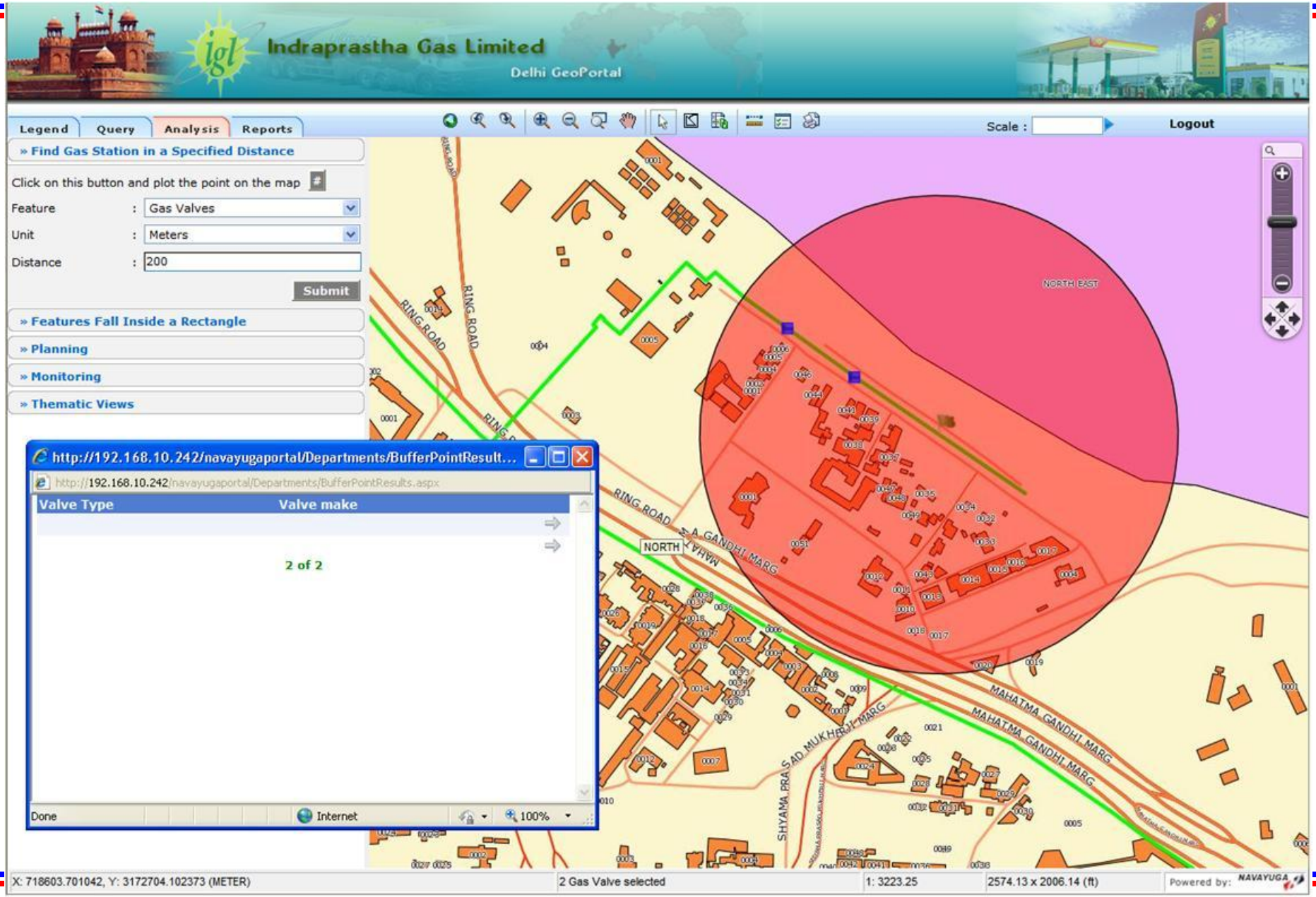
3 Query for identifying the nearest valves in the vicinity of a gas leak point.



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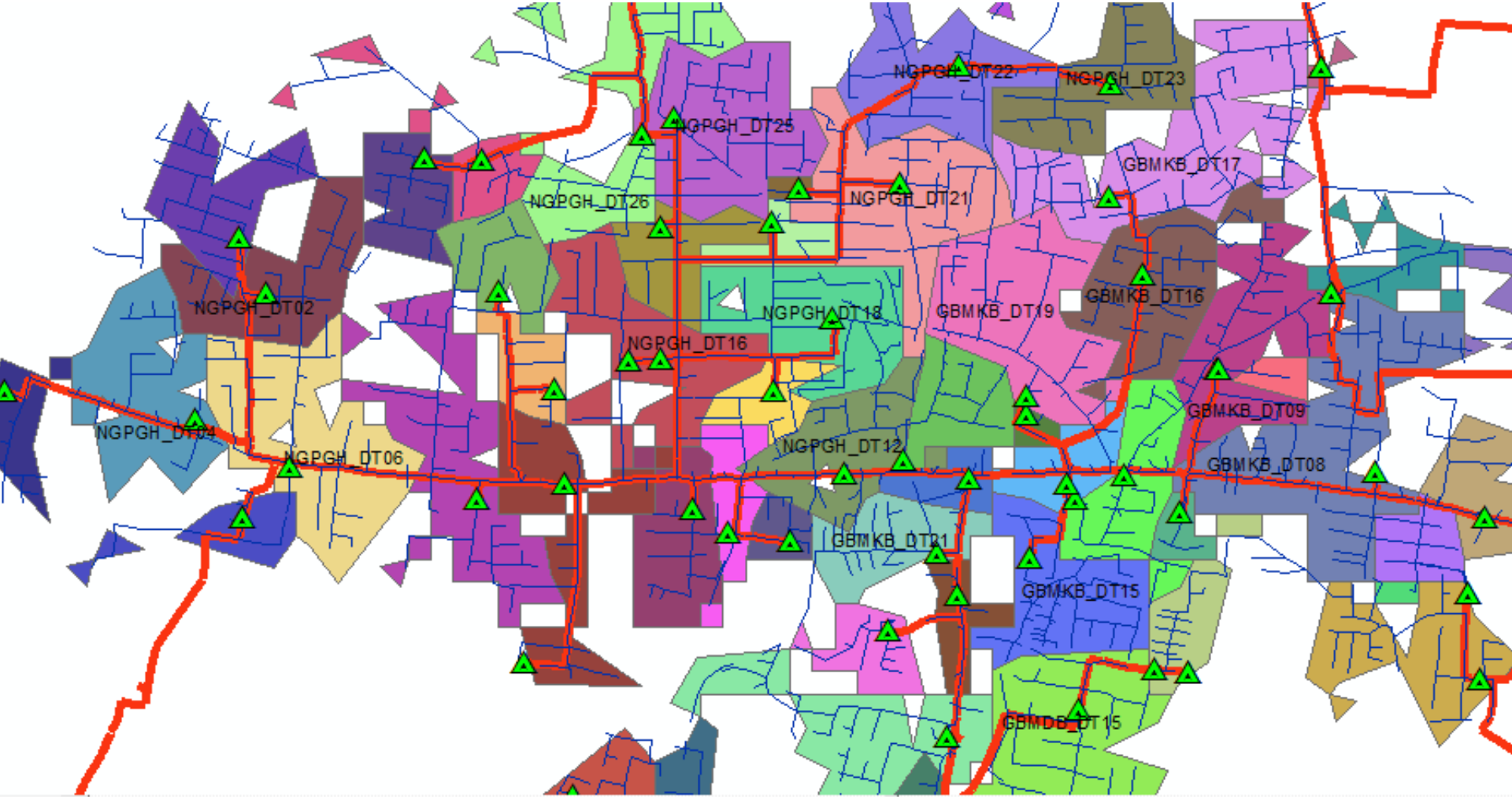
DT Energy Distribution

- HT & LT Network of one town with DT & its network / boundaries



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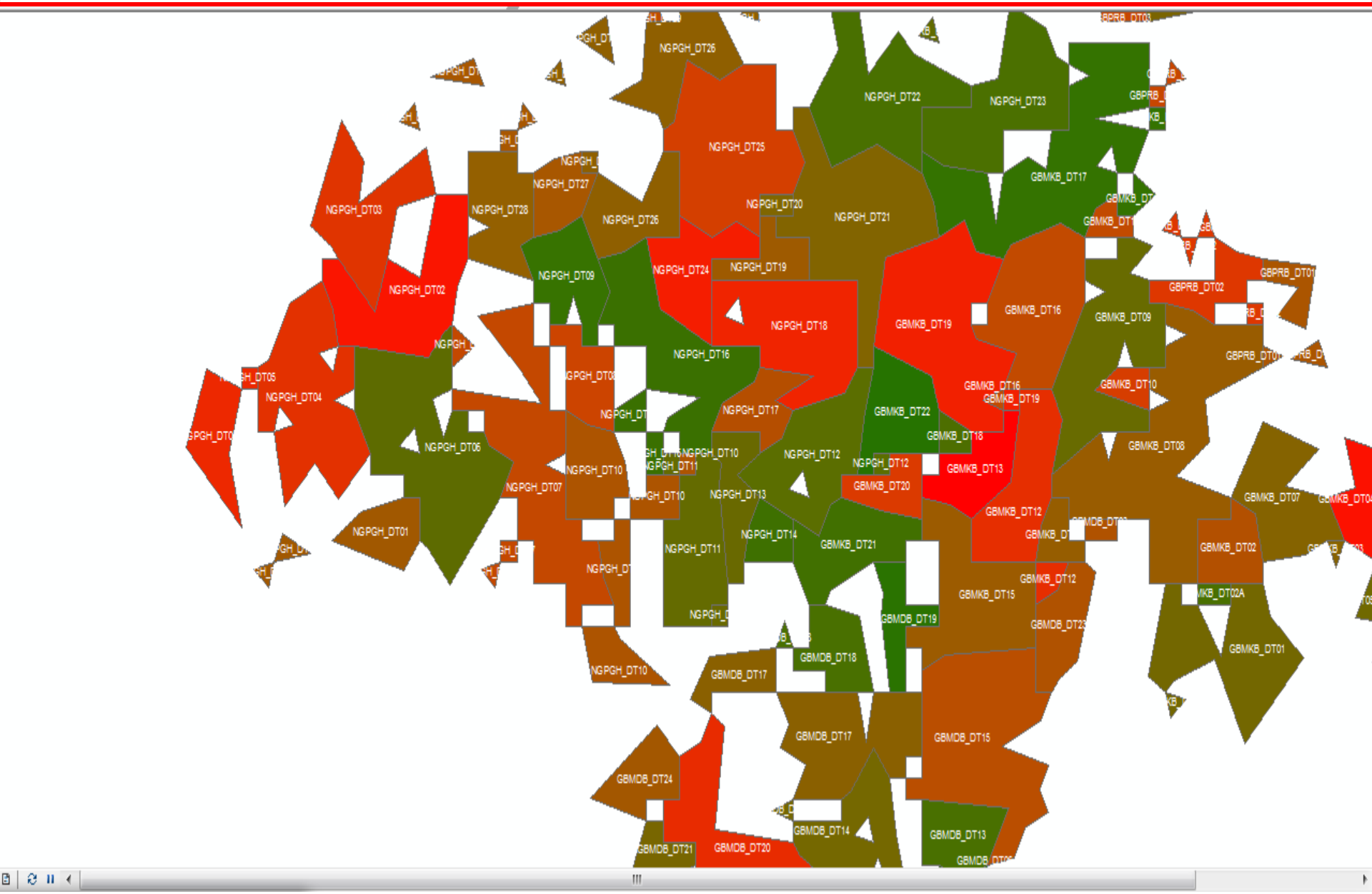
12 – 01 – 2014 01:00



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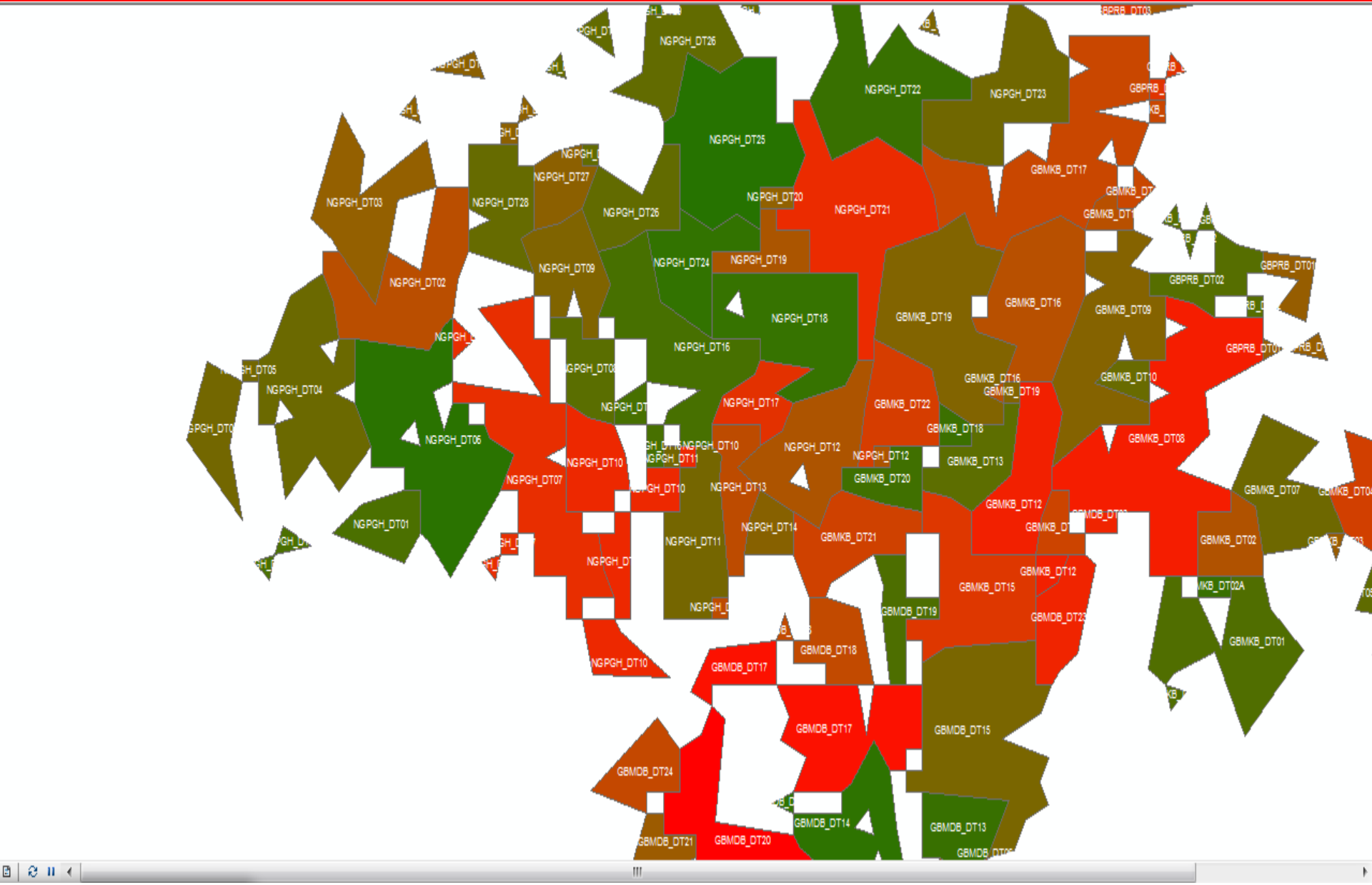

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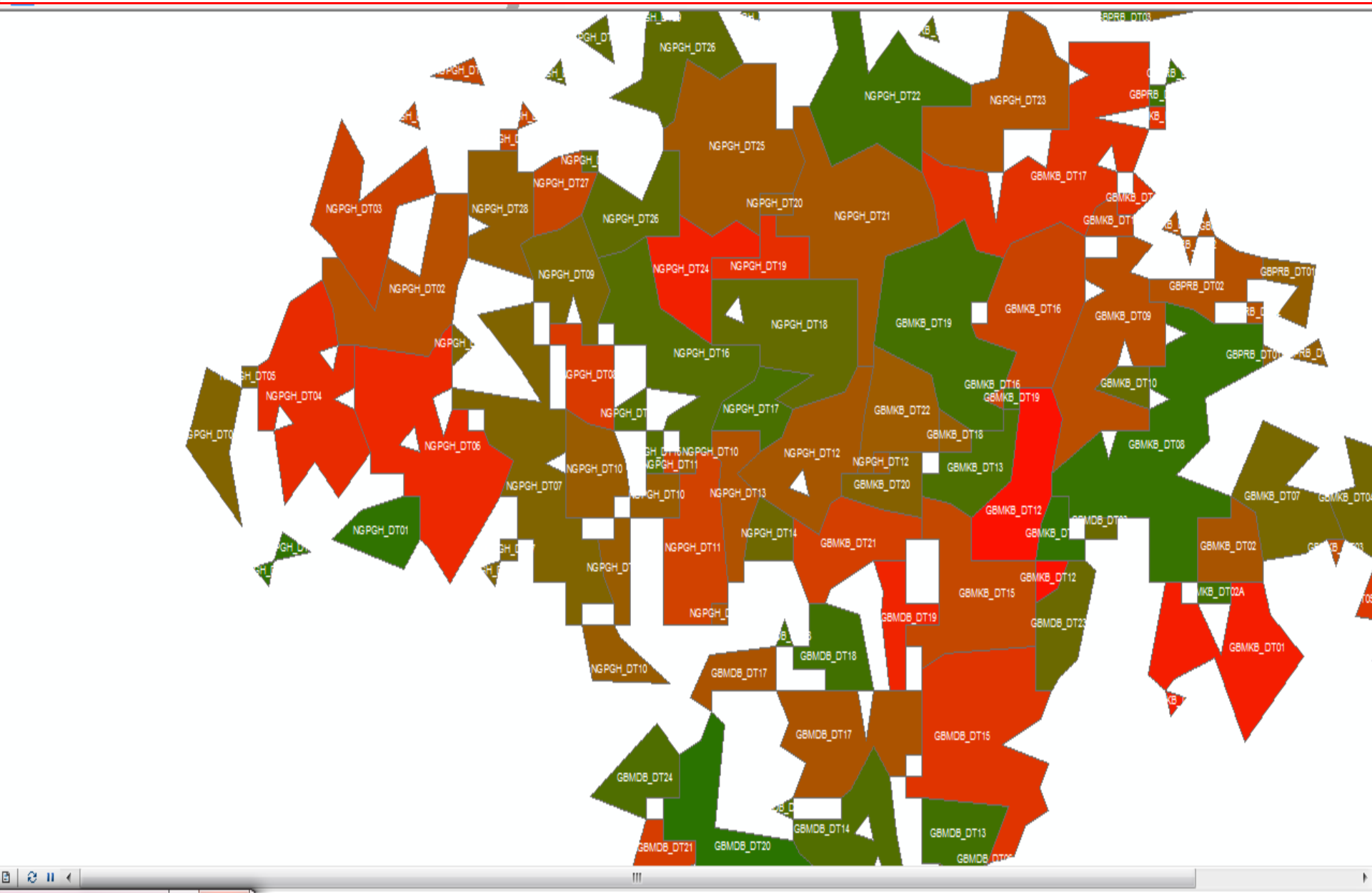
12 – 01 – 2014 10:00



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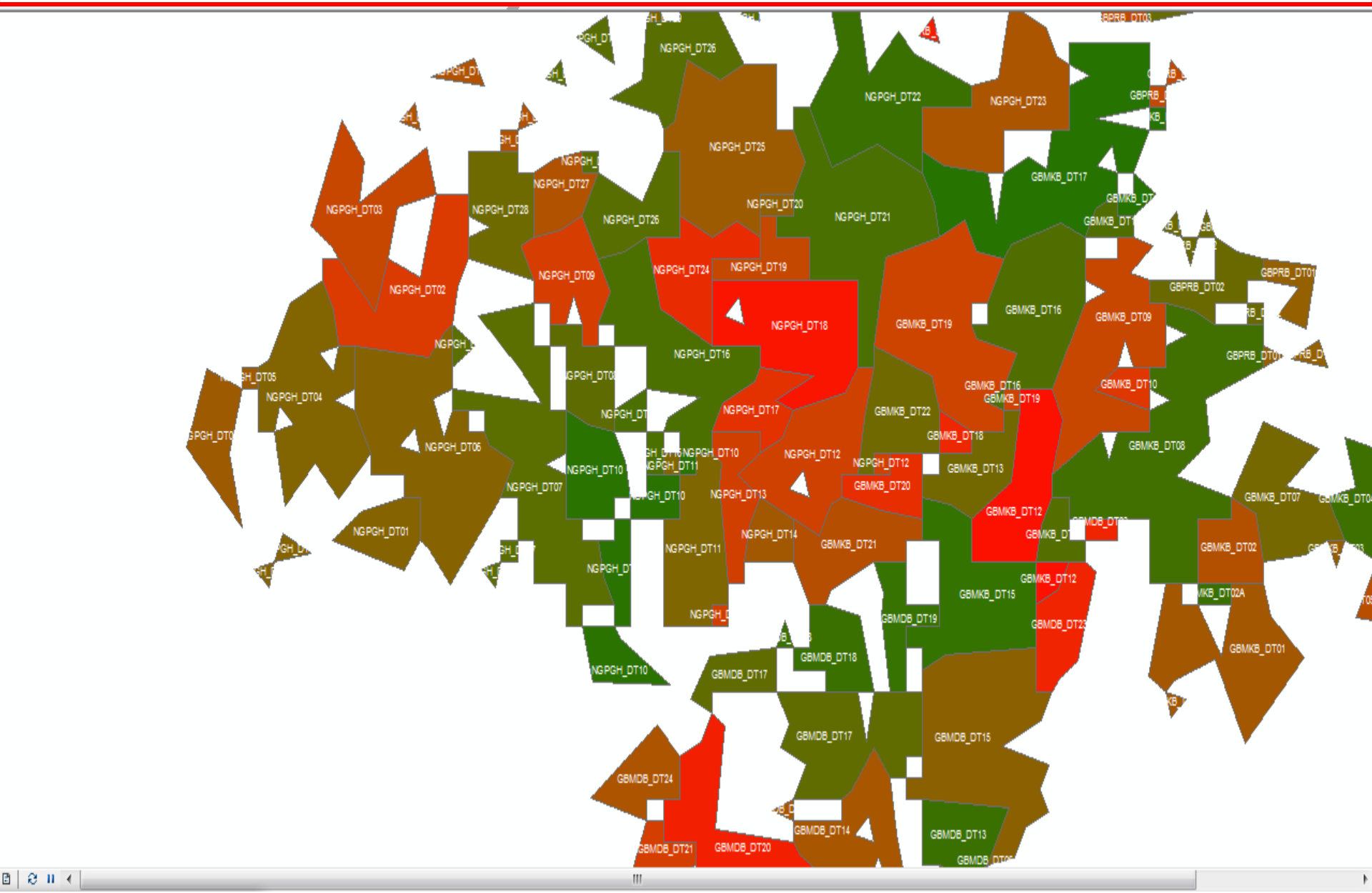
12 – 01 – 2014 15:00



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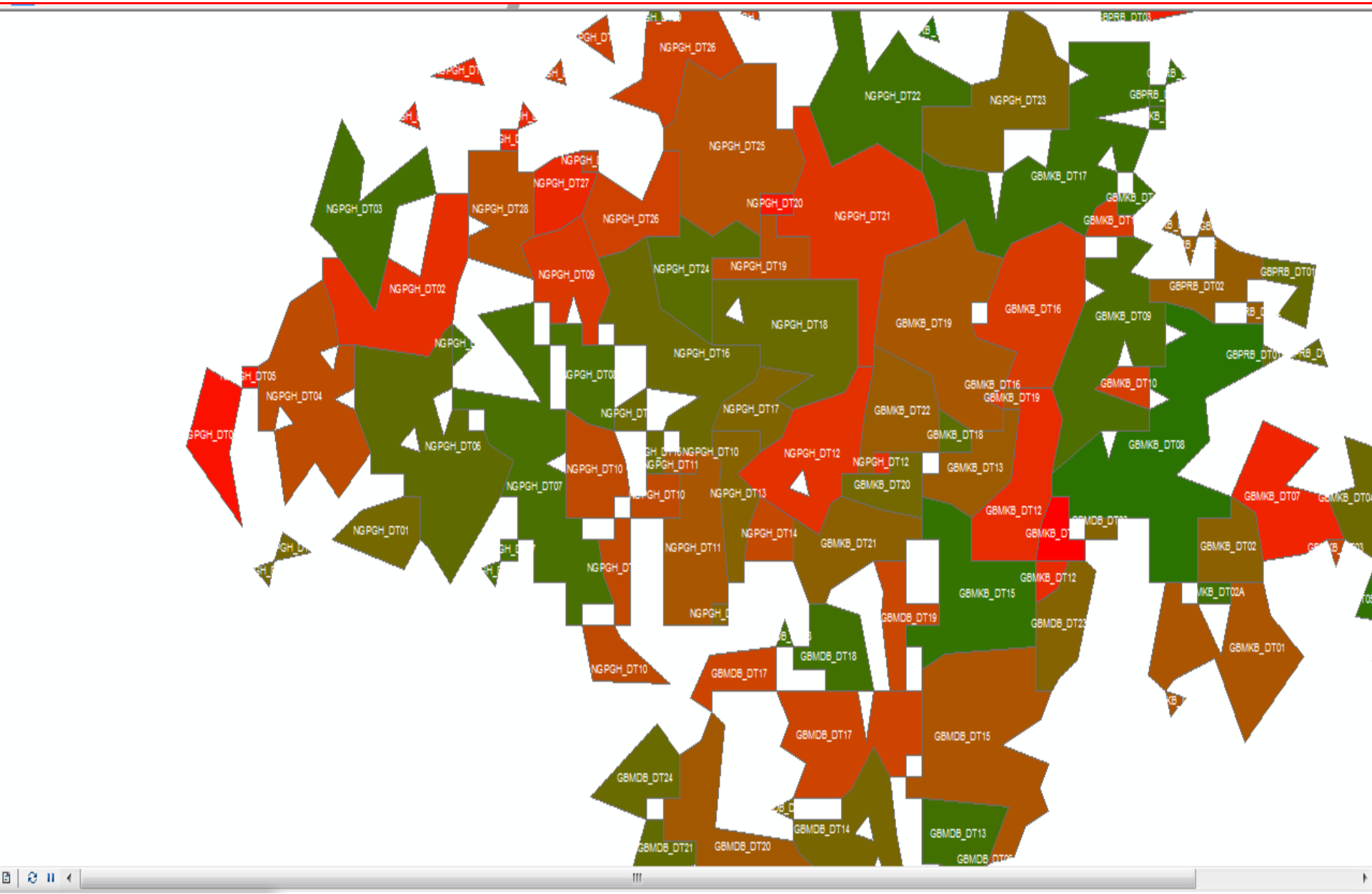

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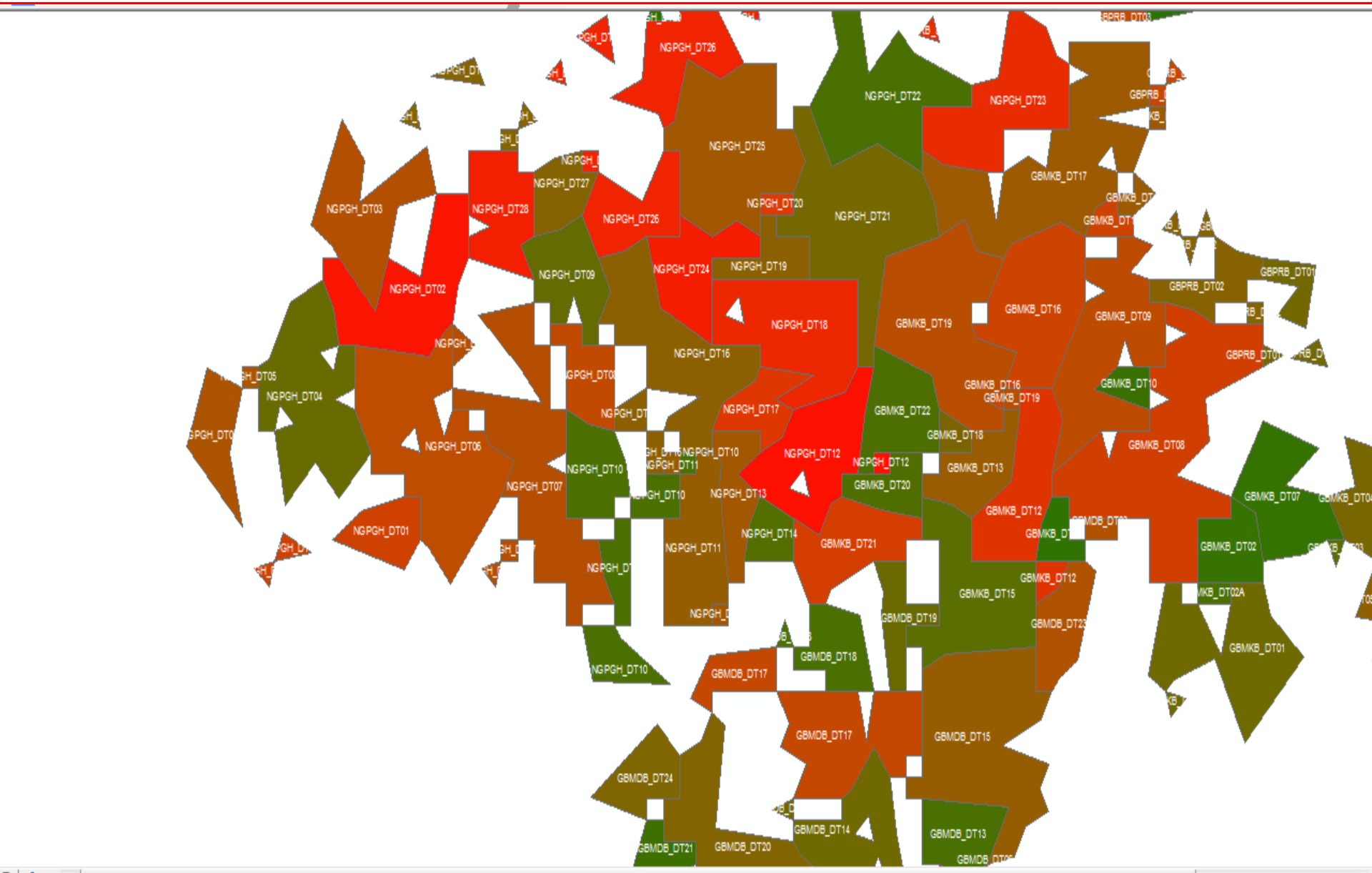

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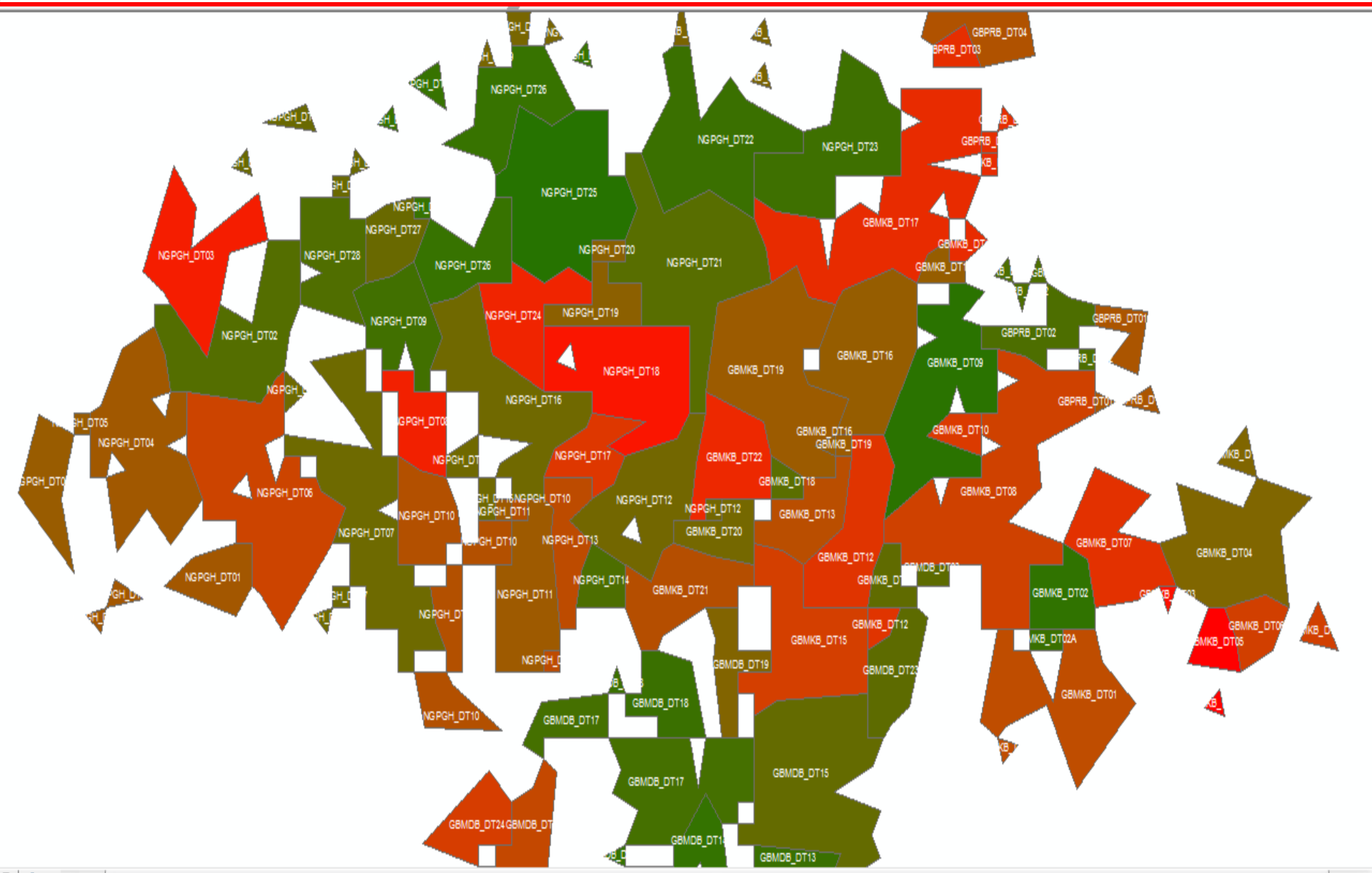

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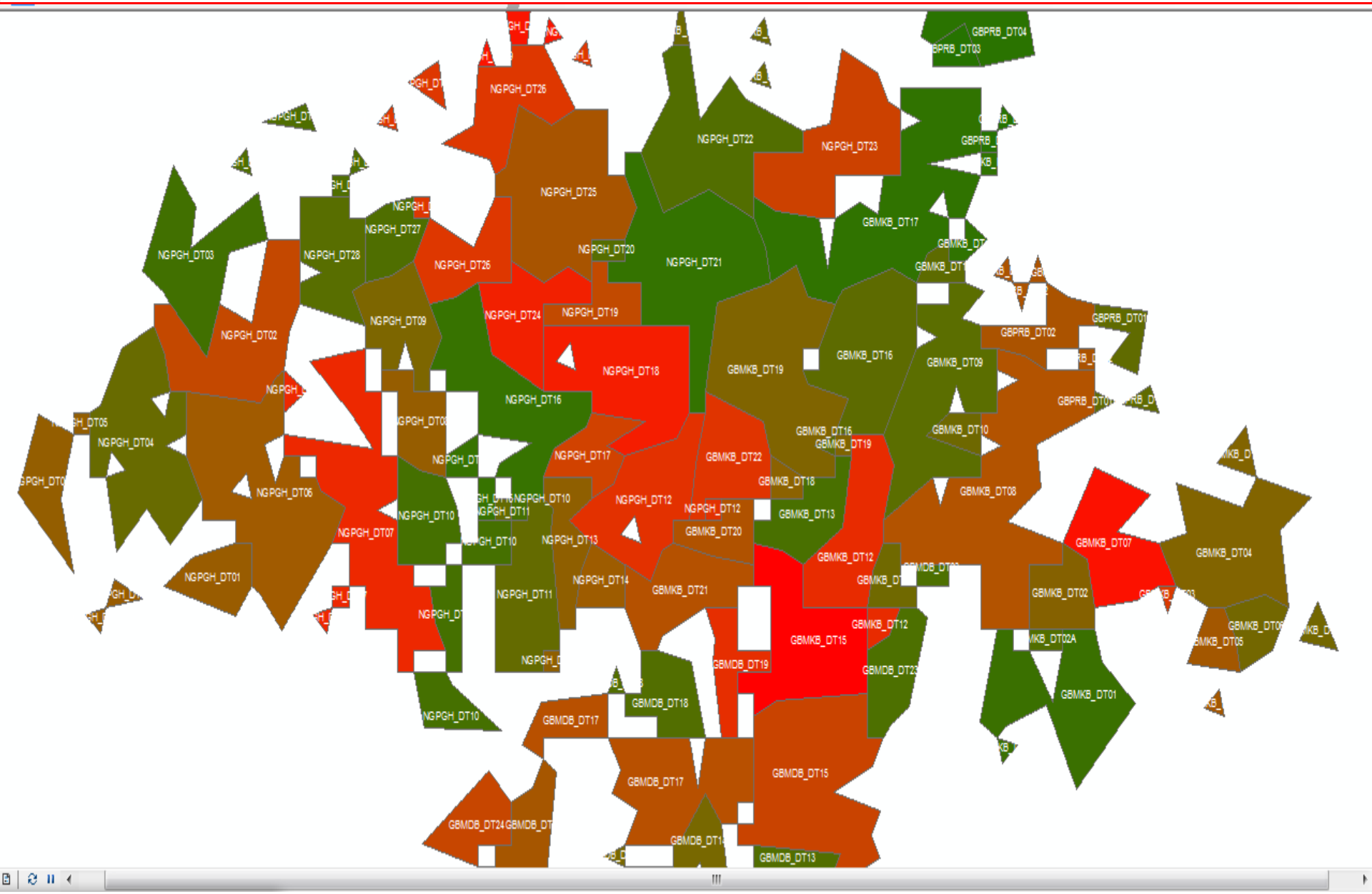

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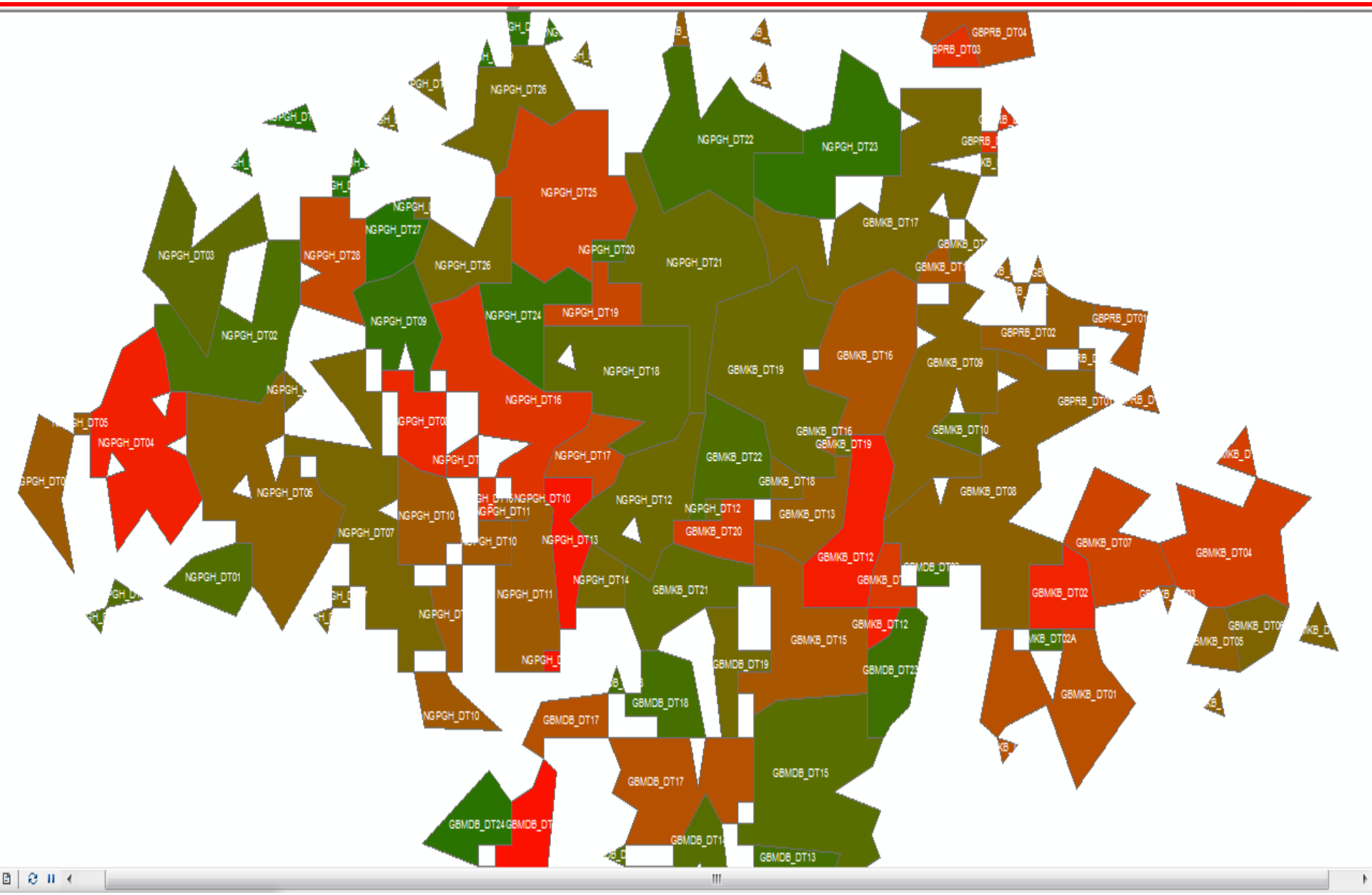

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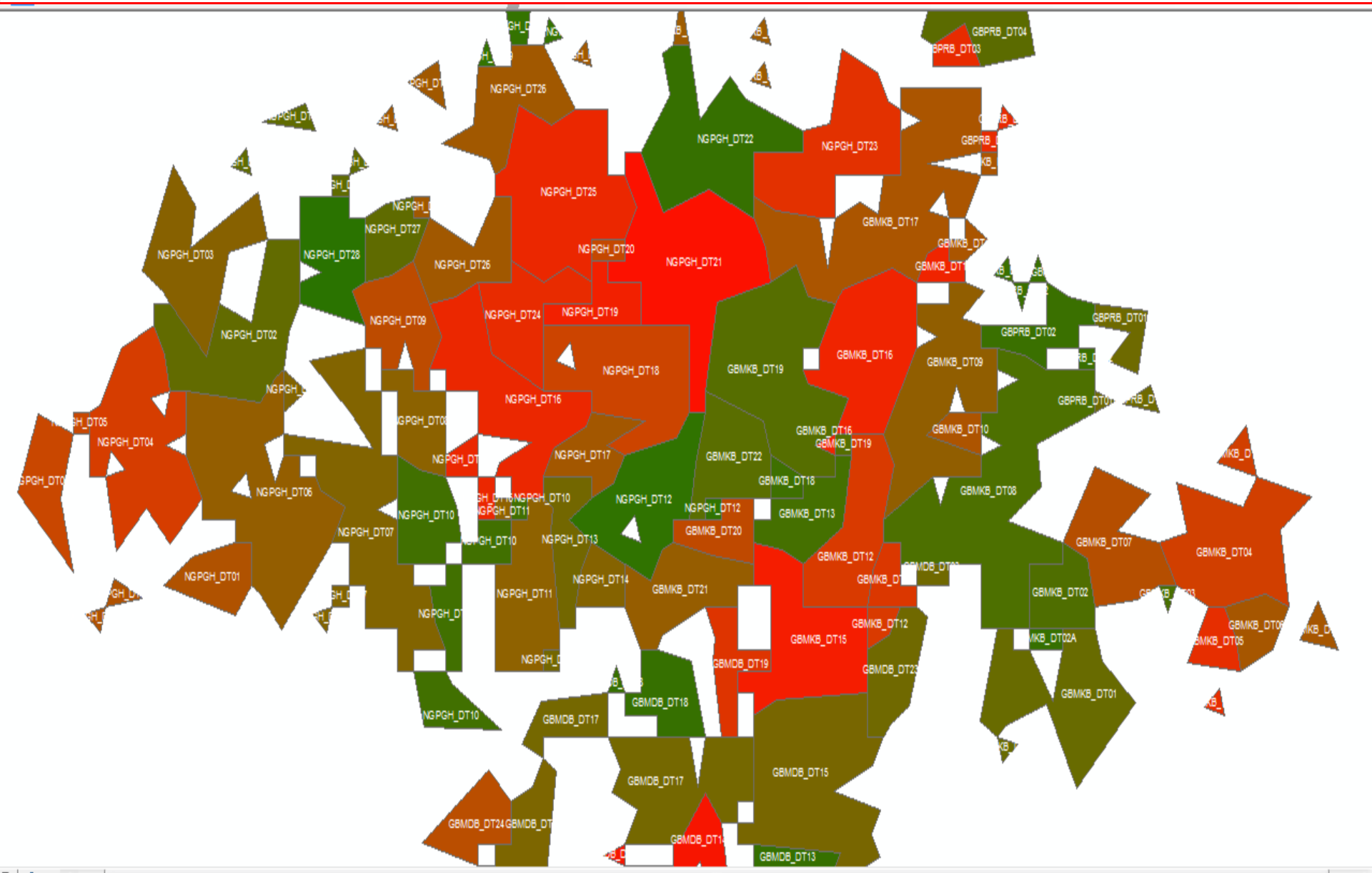

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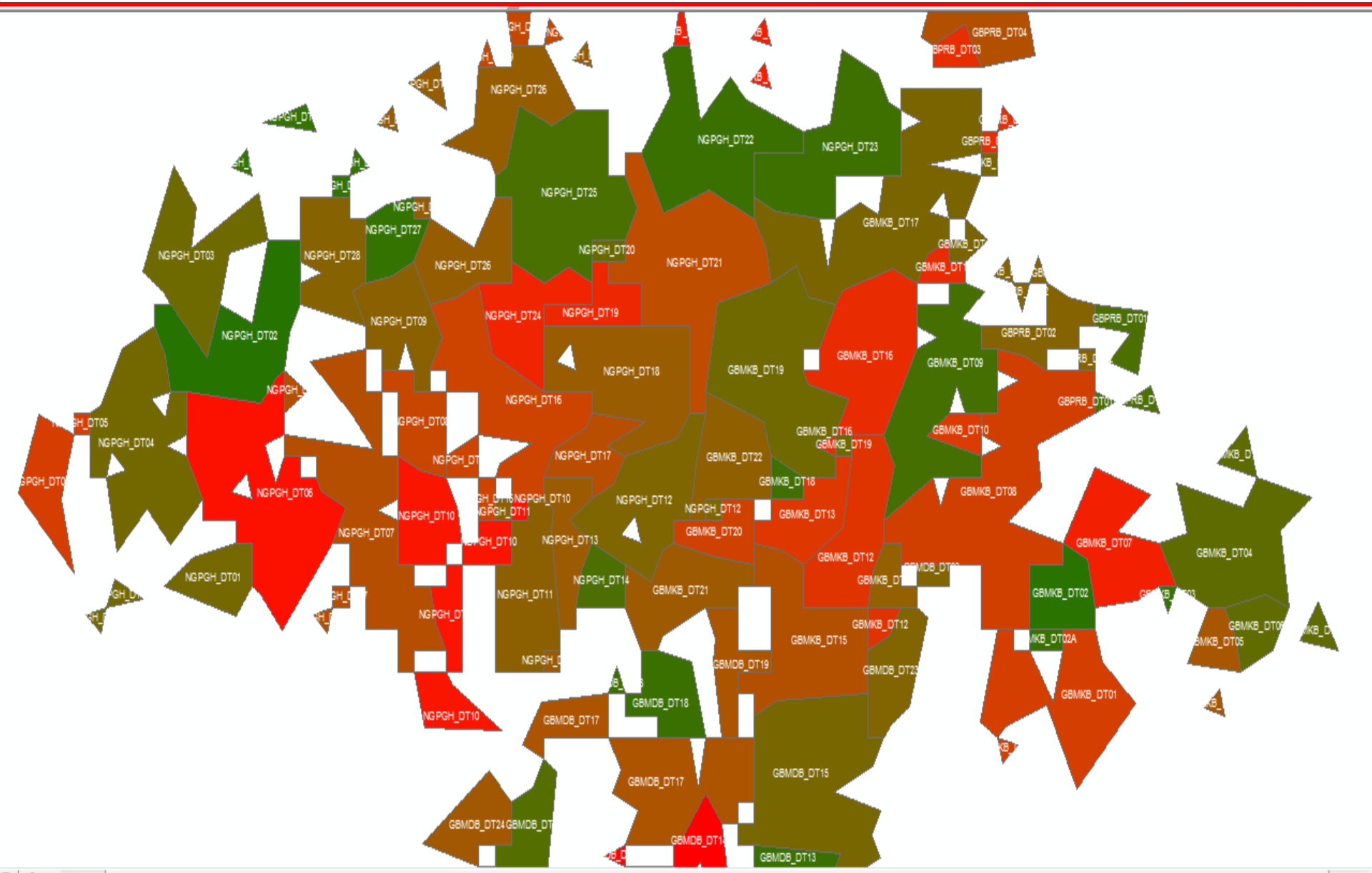

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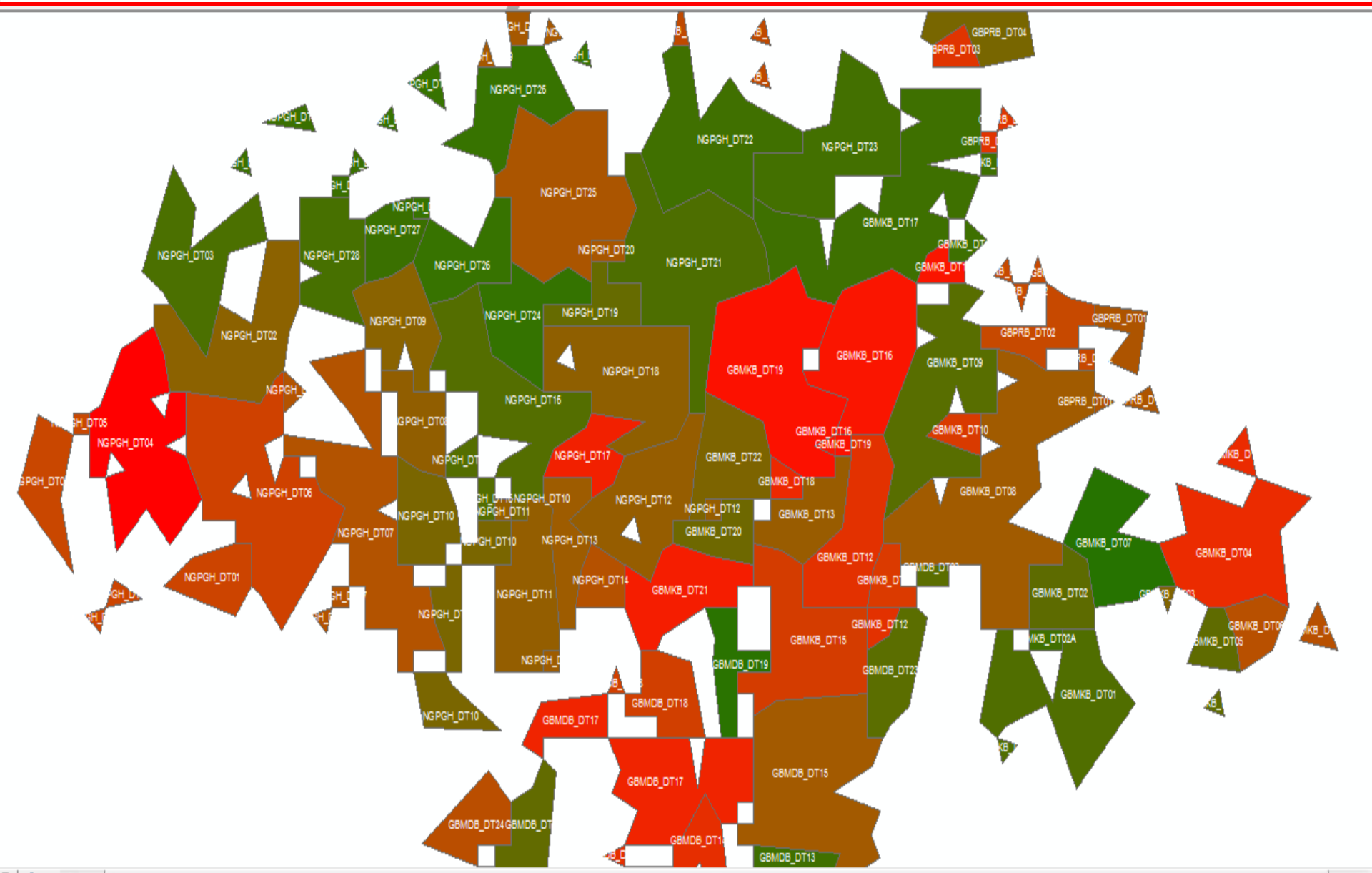

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