

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

by Navayuga

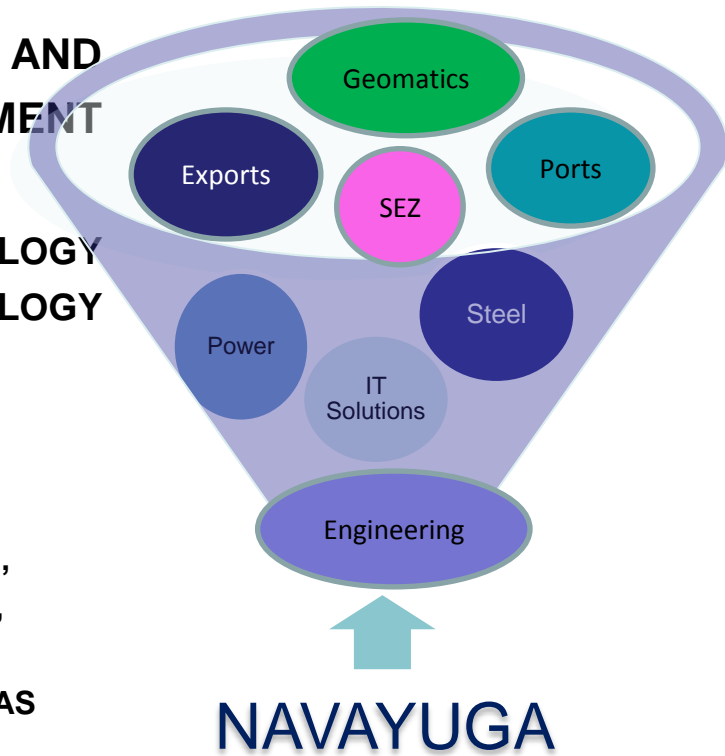
M.JAYACHANDRAN

Vice President, GIS Business Solutions

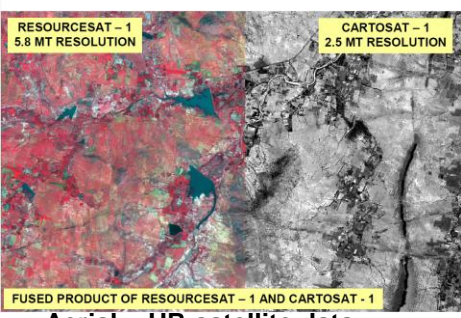
Feb 6, 2014

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



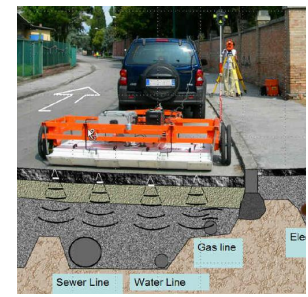
NAVAYUGA : EXPERT ON IT AND GEOMATIC SOLUTIONS AND TECHNOLOGY INTEGRATION



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



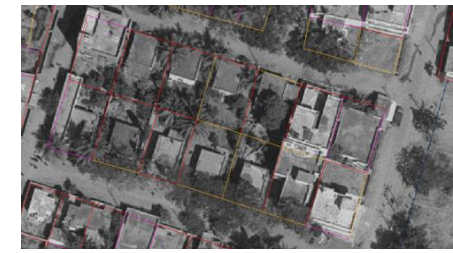
GPS / Total station



GPR Surveys



Ground Laser Scanner



Cadastral / Parcel Mapping



Field data collection



Image Processing & Thematic Mapping



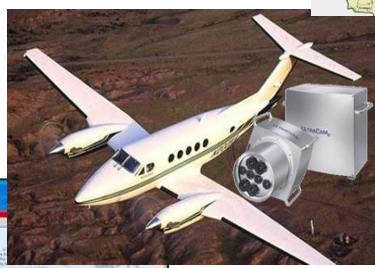
GIS Mapping



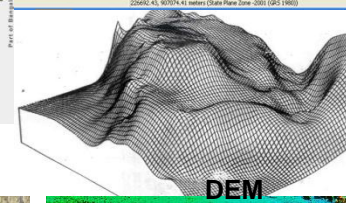
Data Inventory Scanning / migration



Capacity building & Facility Mgmt



Aerial Survey



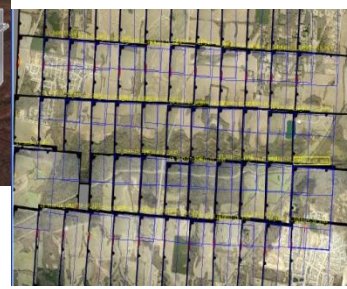
DEM



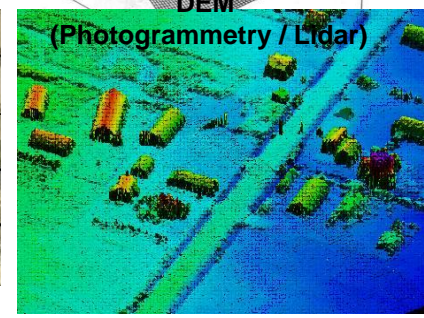
Ortho mosaic



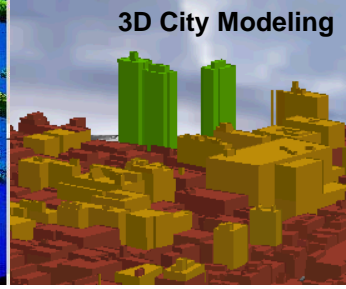
Enterprise GIS Database & Application Dev



Triangulation



(Photogrammetry / Lidar)



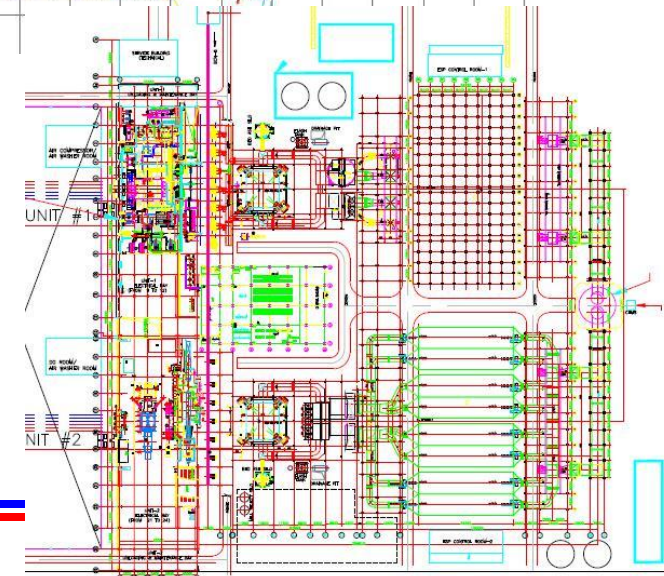
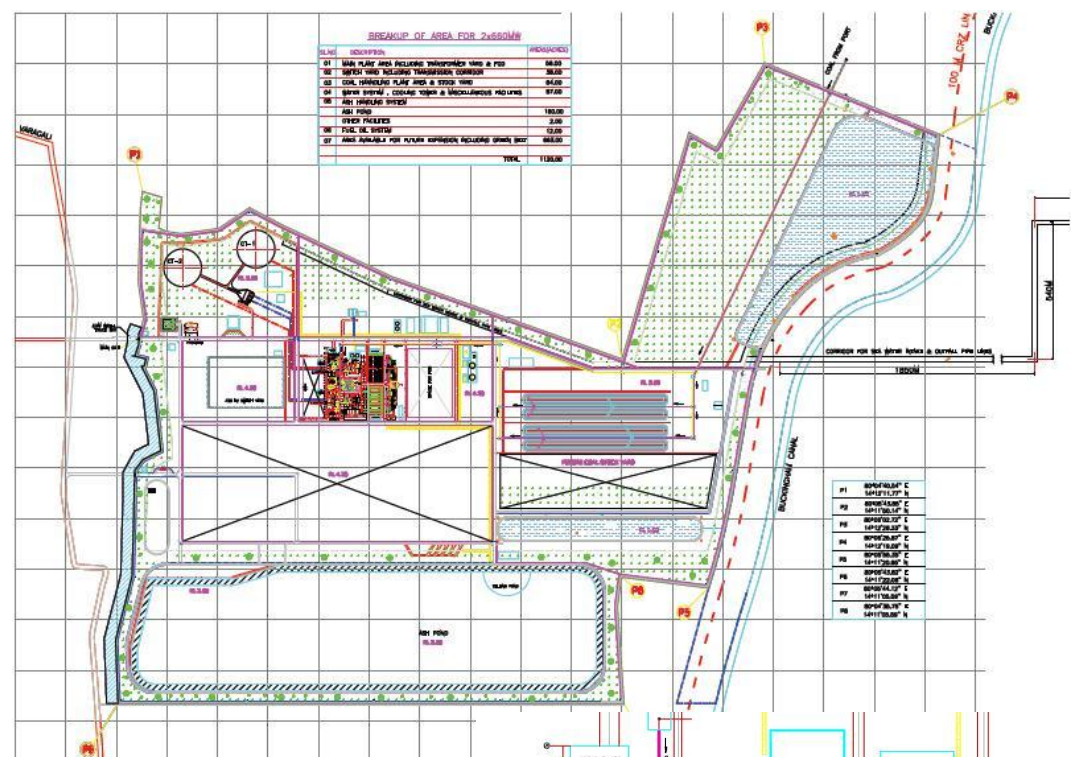
3D City Modeling

MAJOR UTILITY PROJECTS OF NAVAYUGA



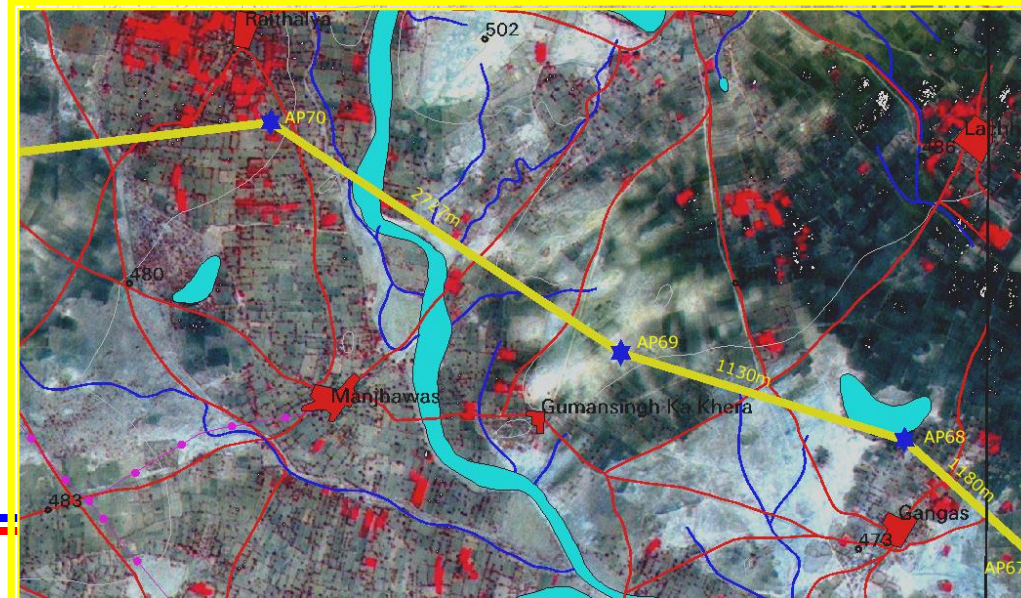
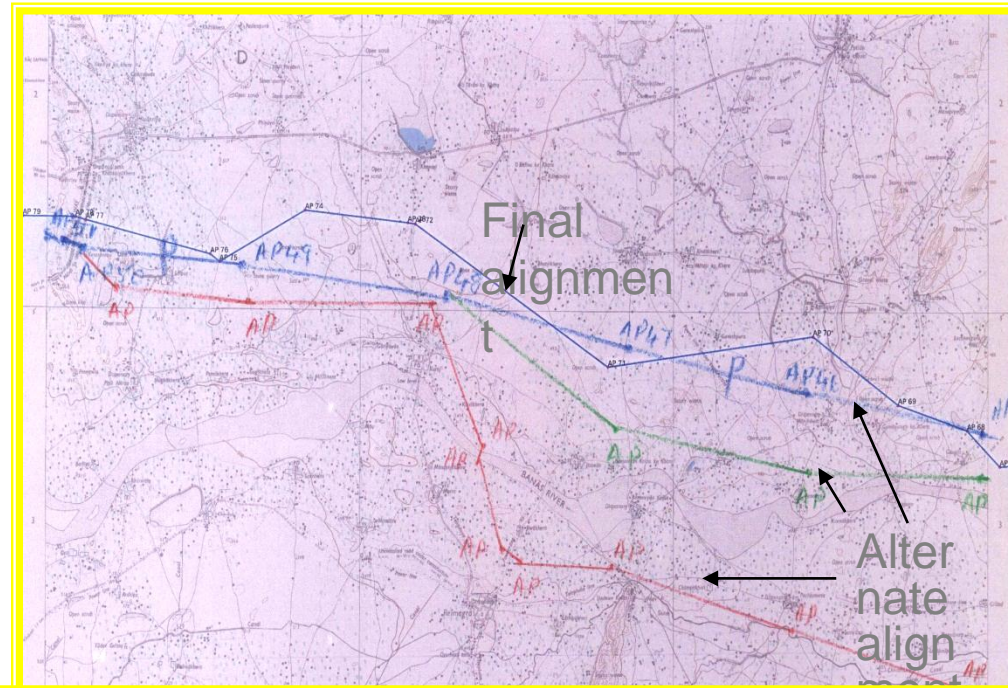
- FEWA – Federal Electricity and Water Authority
 - Survey, Mapping and GIS database development of complete Electrical and Water network and its Asset
- Delhi SDI – 30 Depts including water, Gas, Sewer, Power, Telephone utilities
- RAPDRP – 3 states in India
 - TamilNadu,
 - Uttarakhand and
 - Puducherry 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

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)

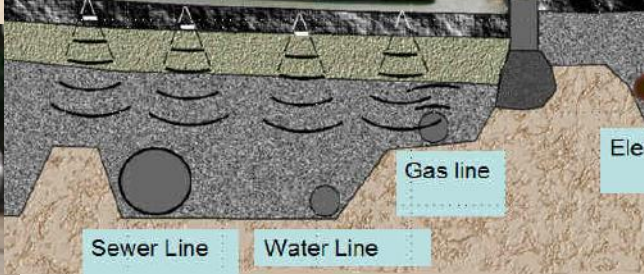


- Dual Frequency GPS for Base Control points
 - Accuracy of less than 5 cm
 - Average of 1 point per 2 km
 - DGPS data processing for manhole / Surface feature identification
- Total Station survey points on urban / Tree covered areas
- GPS Guided Direct Mapping
 - On the mobile mapper units
 - Marking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

GPR SURVEYS: UNDERGROUND ASSET MAPPING



6 Feet wide coverage
Scan grid geometry 5 inch x 1inch

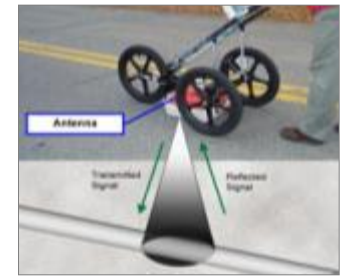
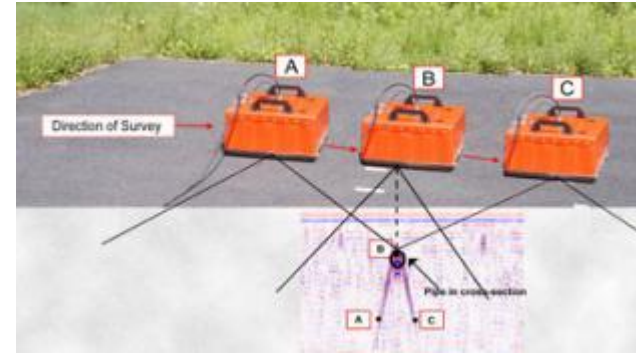
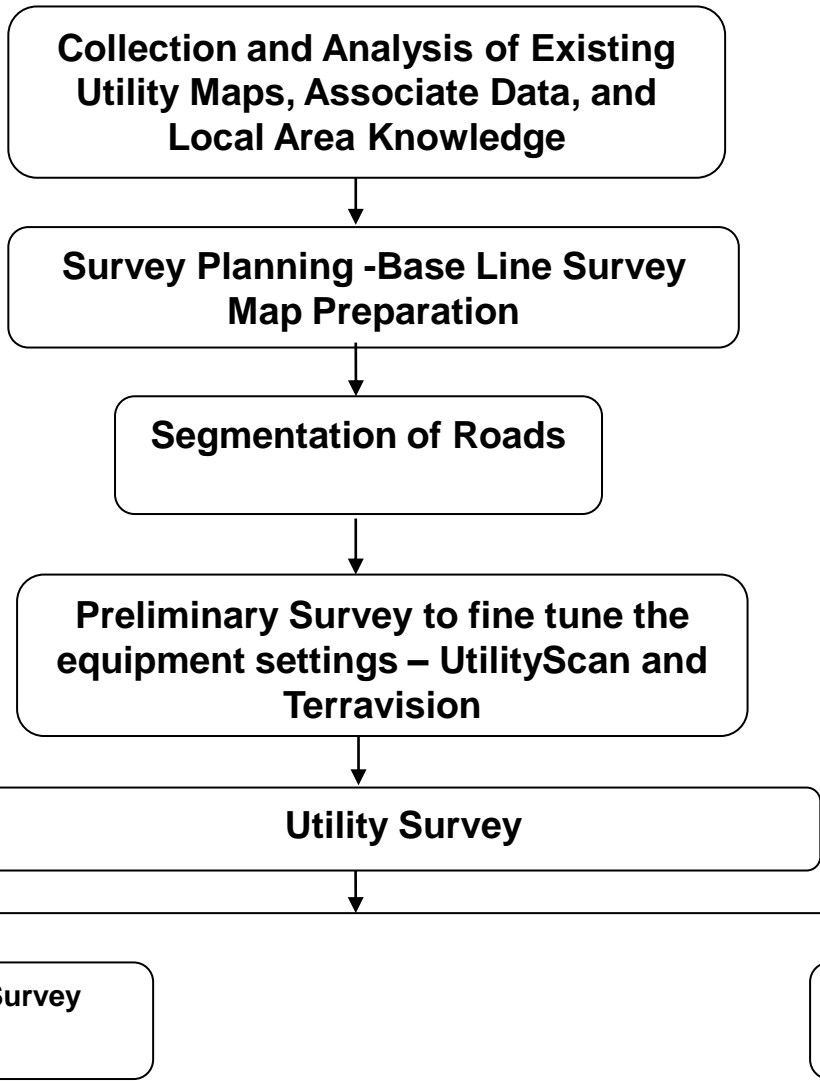


- PROFILING RADAR FOR ASSET MAPPING BELOW GROUND
- DETECTS METAL, CERAMIC MATERIALS ETC
- LINKED TO GPS FOR PRECISE LOCATION
- TRANSFORMED OVER ROADMAP TO MAKE A ASSET GIS

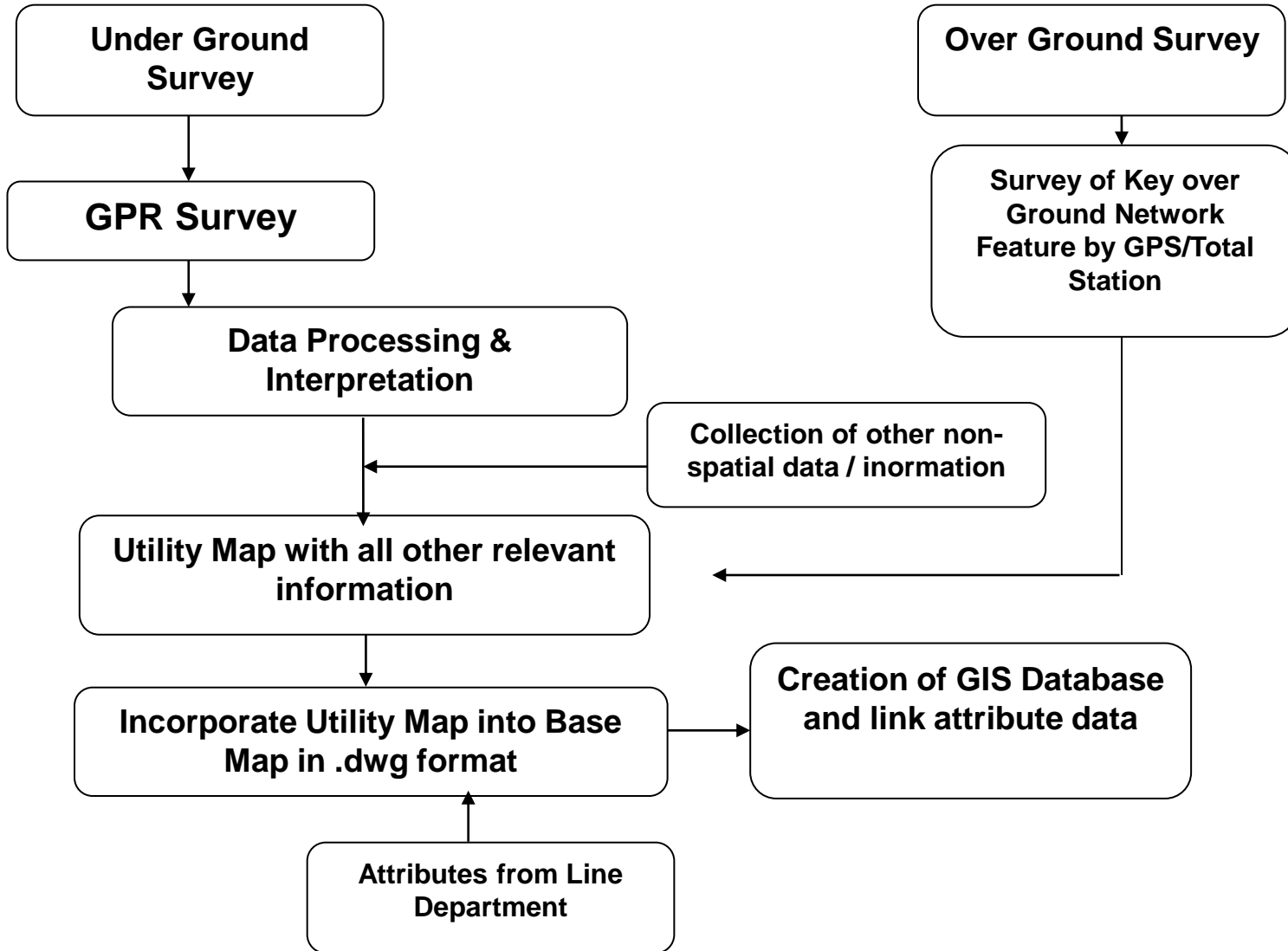


Multichannel cart radar system-Terravision

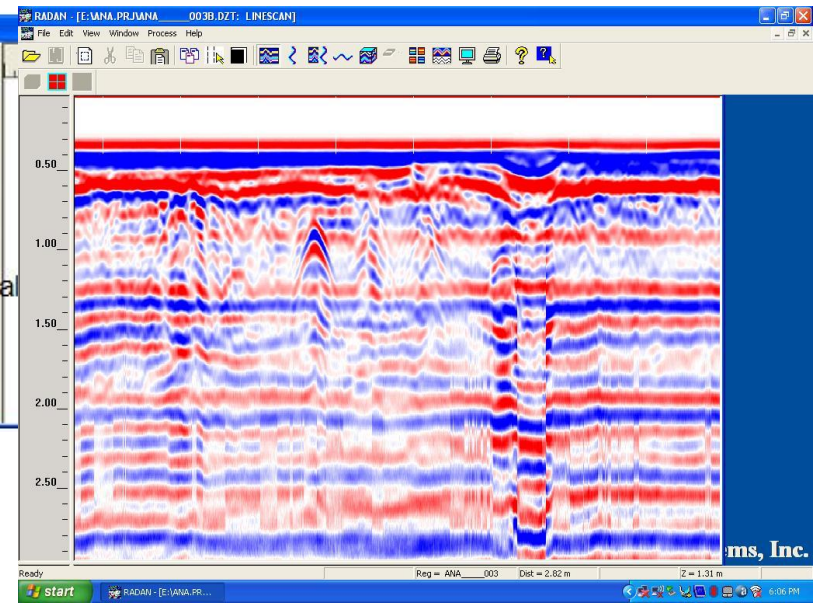
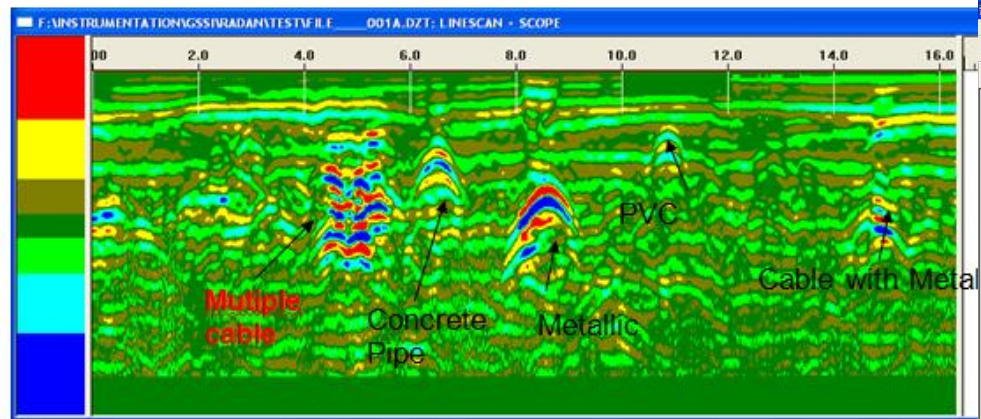
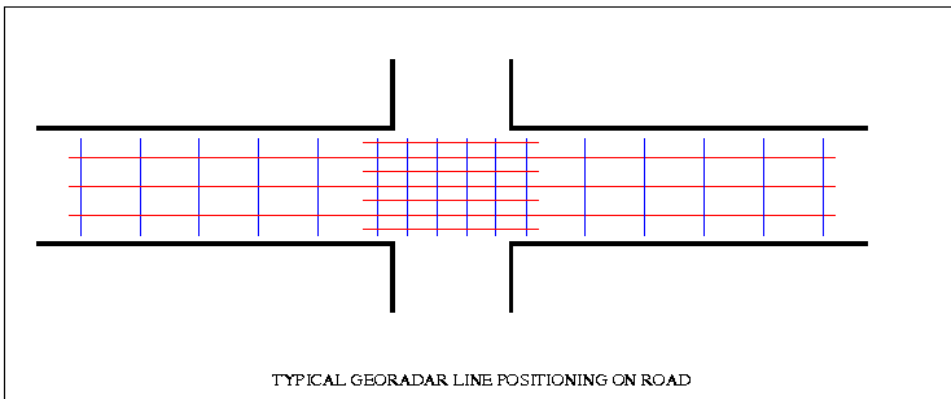
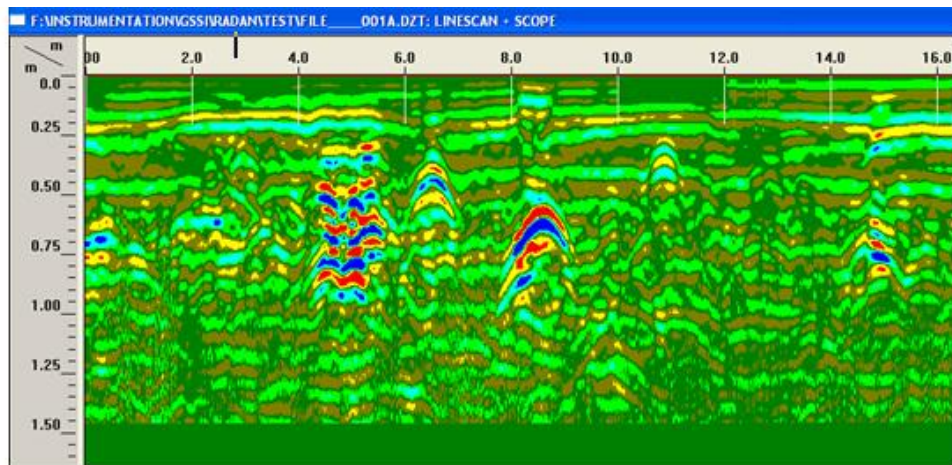
UTILITY SURVEY



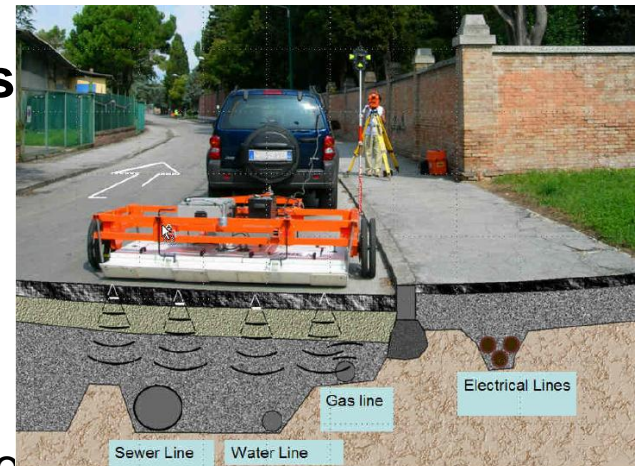
UTILITY SURVEY



GPR Data



- **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




MOBILE DATA ACQUISITION: SURFACE UTILITY MAPPING



IBI Group Route Mapper

File Edit Route Database Tools Help

Left Stereo Camera



Video Controls

▶ ◀ ■

Cam1 On	Cam4 On
Cam2 On	Cam5 On
Cam3 On	Cam6 On

Measurement Tools

Measurement Mode Cancel

Monoscopic Position

Van-Ref (X, Y) 242.65, 880.38

Map-Ref (X, Y) 590567.1,943508.9

Compute Height and Distance


Object Height (cm)

Object Distance (cm)

Drawing Controls


Add Line Delete last

Right Stereo Camera



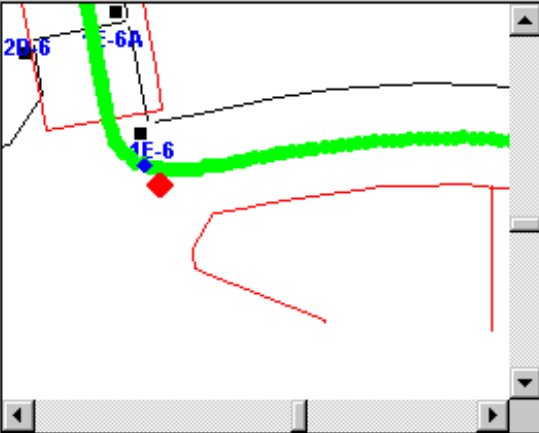
Expand Right Camera

Right Tilted Camera



Expand Right Tilted Camera

Map View



590687.93, 943557.81

IBI GROUP

MOBILE DATA COLLECTION for RAPDRP



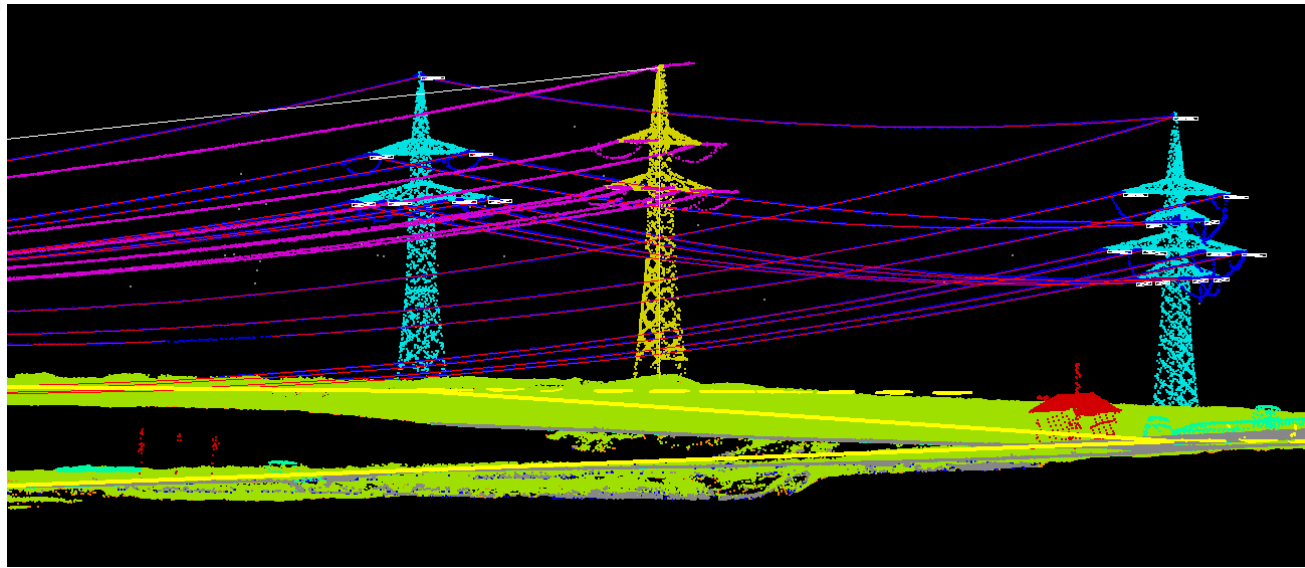
- Good for Surface data extraction, verification and planning, landmark collection
- Guaranteed Accuracy of location and pole info
- Difficult for attribute data updation of wires which was needed

Paper Based

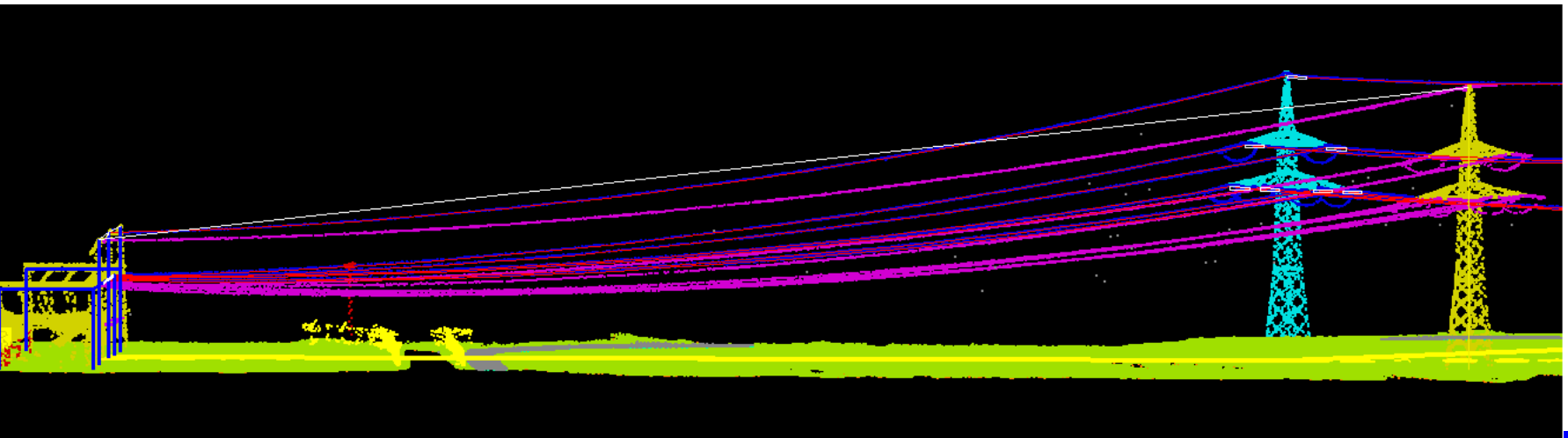
- Easy for data collection
- Low capital investment
- May lead to confusion due to hand writing
 - Avoided as much as possible by form design
- Lot of validation process to be built
- Highly Scalable
- Easy to train for large scale implementation

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



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



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



- Measurement range up to 2000 m
- Laser Class 1
- Laser beam divergence 0.15 mrad
- Measurement rate up to 11000 points/sec.
- Built-in inclination sensors (typ. accuracy 0.008°, tilt range ±10°)
- Accuracy 10 mm
- Field of View 80° x 360°



Power line surveys for inspection

- Corridor 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

Transmission Line Inspection Report

Line Name: Mill Creek - Switch #200 Tap Date Flown: 10/19/2008

Structure Number	30411110
Latitude	-41.4320662
Longitude	-83.4320662
Structure Type	2 pole
Structure Function	Angle
Material	Wood
Underused Type	Structure more than one type
Underused Type2	Communication wire attached(C/S)
Sub-Post Type	No
Light Pole Type	No
Revised	No
Video File	FA051019_A1_06.avi
Tag	NA081
Line Voltage	22 KV
Photo File	FA051019_0108.jpg

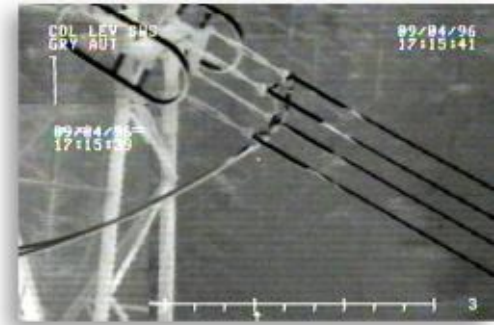


Condition	Fault
AI	<ul style="list-style-type: none"> • Damaged Structure • Damaged Crossarm • Damaged Structure • Damaged Structure • Damaged Structure • Damaged Aerial Crossarm Parts • Damaged Aerial Crossarm • Other

Comments: Top of crossarm splitting

Date Reported: _____ By: _____

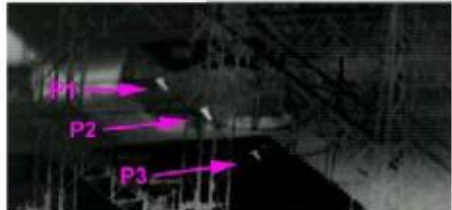
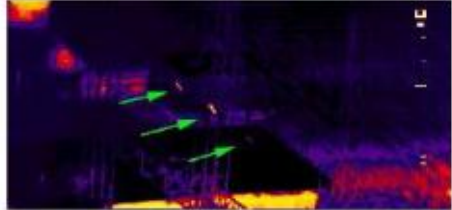




Infrared Conditions

Severity: Intermediate Problem Description: Heater jumper connections all phases

GAT: 58°F

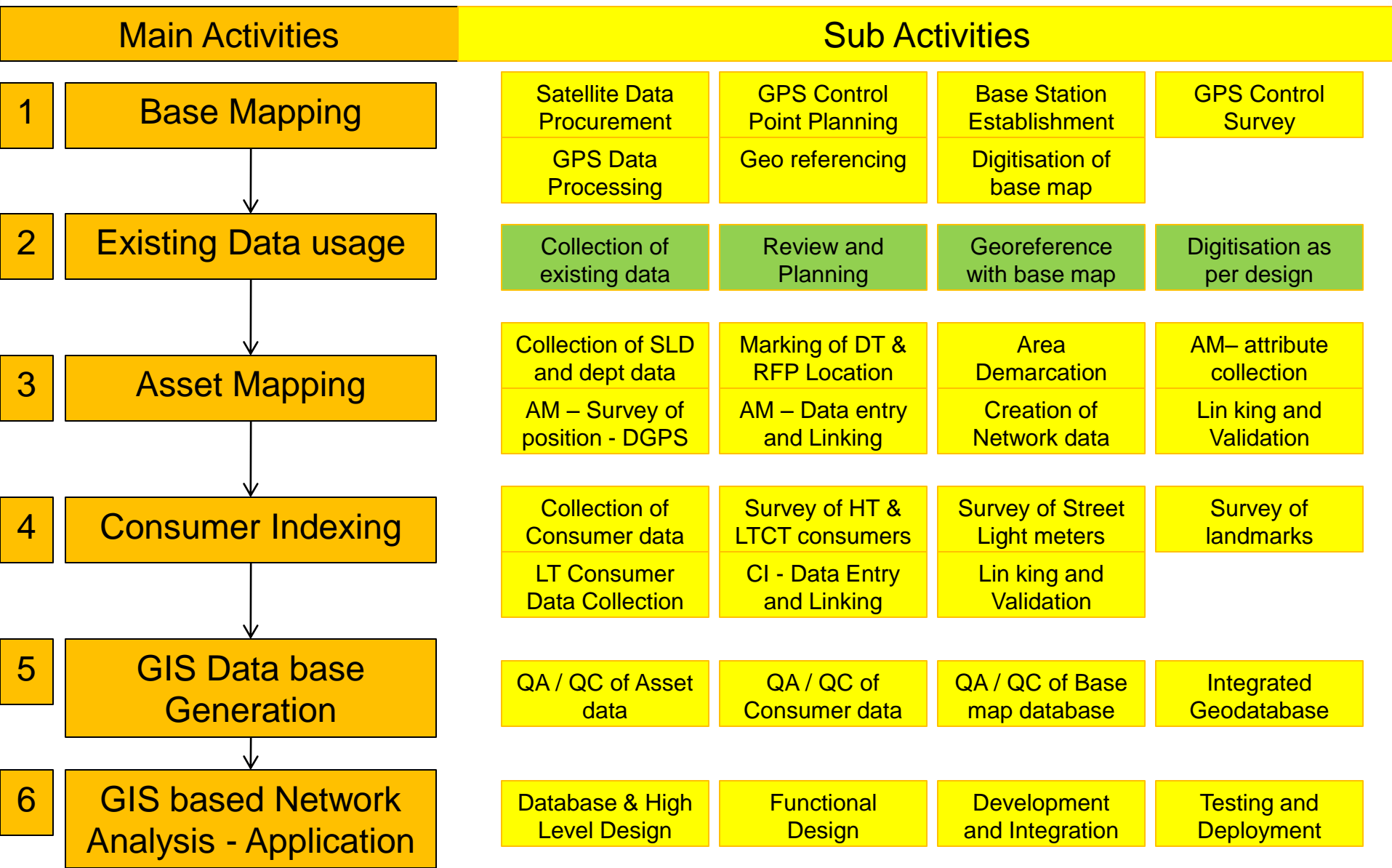



Point	Temp	Max Allow (Delta)	Max Allow (Celsius)	Calculated Current
P1	55°F	27°F	35°F	35
P2	55°F	27°F	40°F	35
P3	55°F	27°F	0°F	25
P4				
P5				



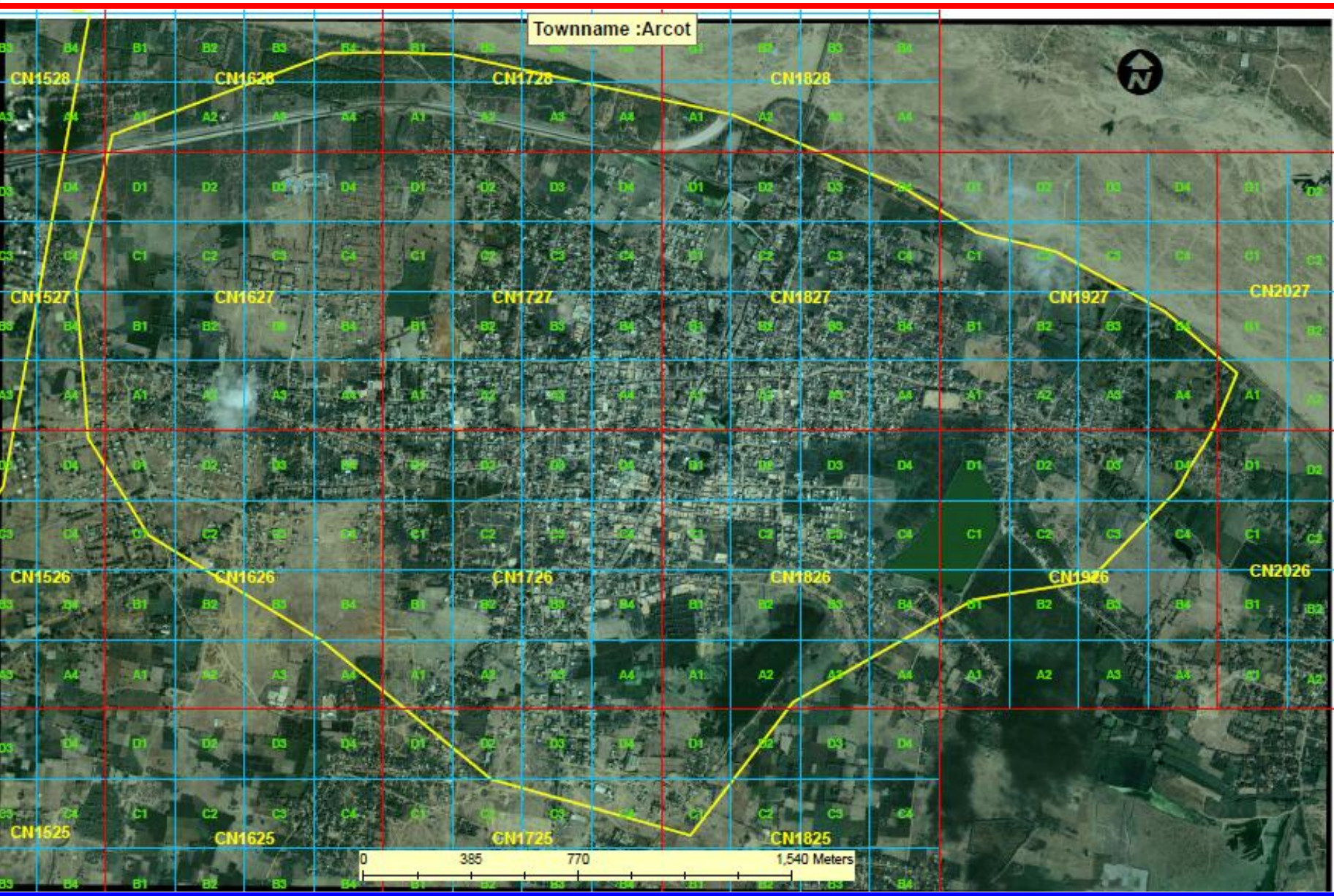
Source: GeoDigital

RAPDRP : Components and Process Flow

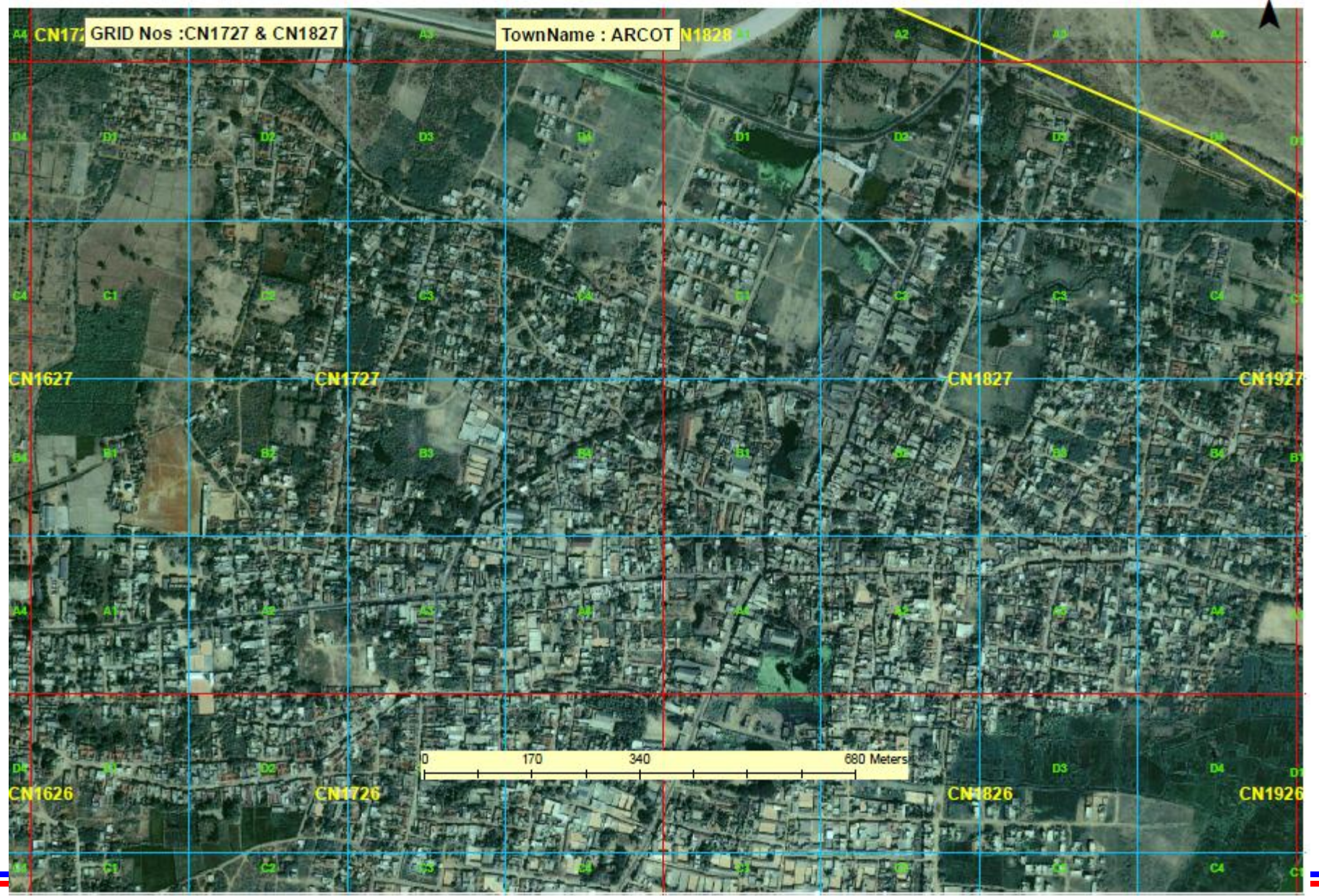


- Use of Geodetic GPS receivers
- Use of Google Data in the initial days
 - Establishment of transformation matrices
- Boundary study
- Clear spatial indexing of the project area
- Paper based data collection process along with GPS data
 - Flexibility in increasing more manpower
 - GPS only for location 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

Gridlayout – Sample



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

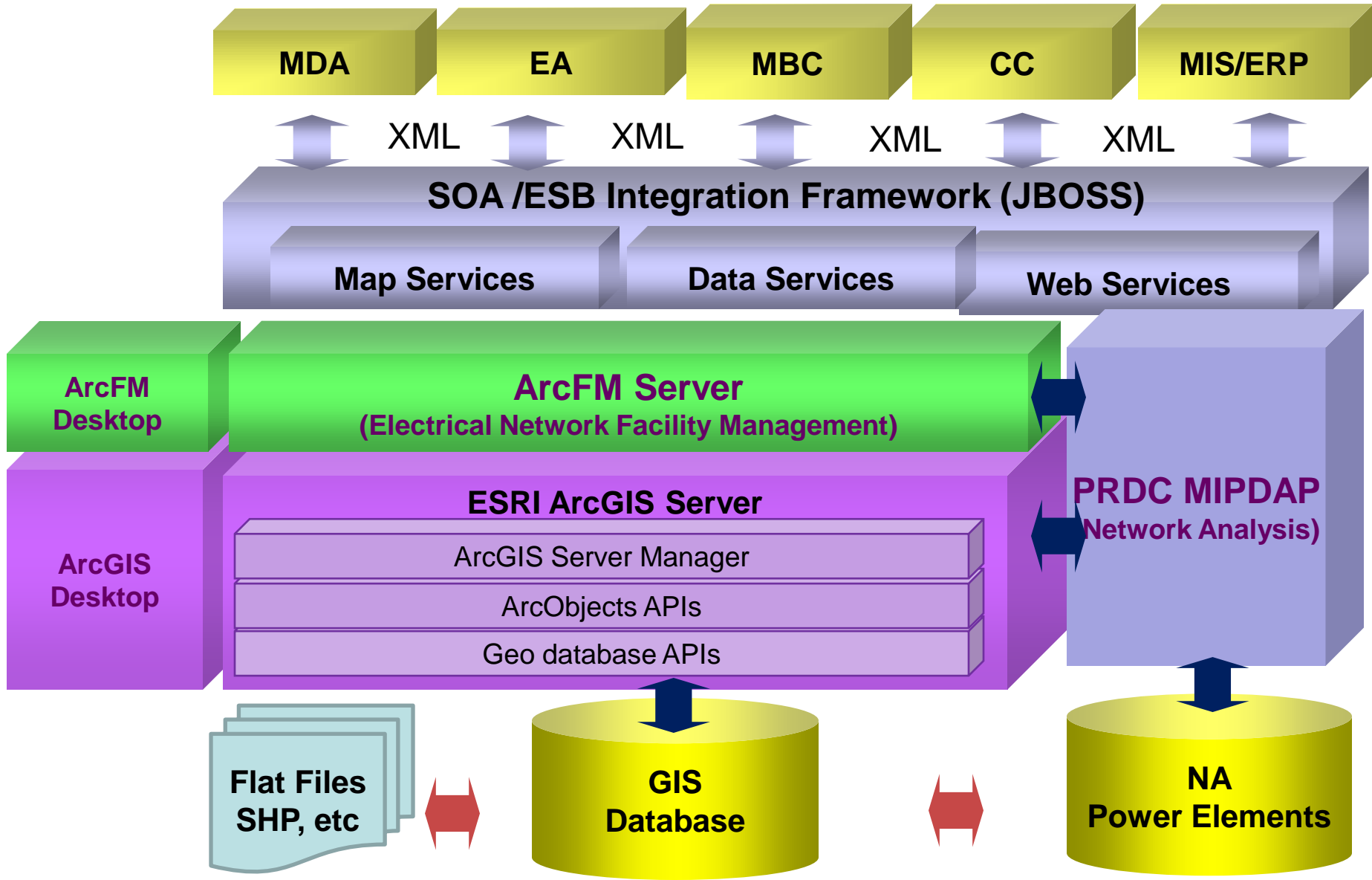


250 m grid – layout for Asset mapping and consumer indexing



- 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

GIS SOLUTION ARCHITECTURE



Integrated Solutions @ Utility Industry



Capture Real World



Deliver



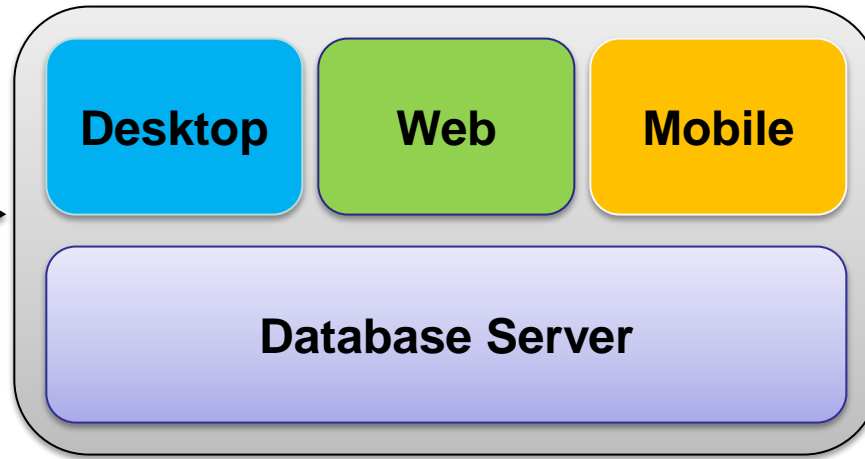
Accurate – Authoritative – Actionable Information

Process



Sensors

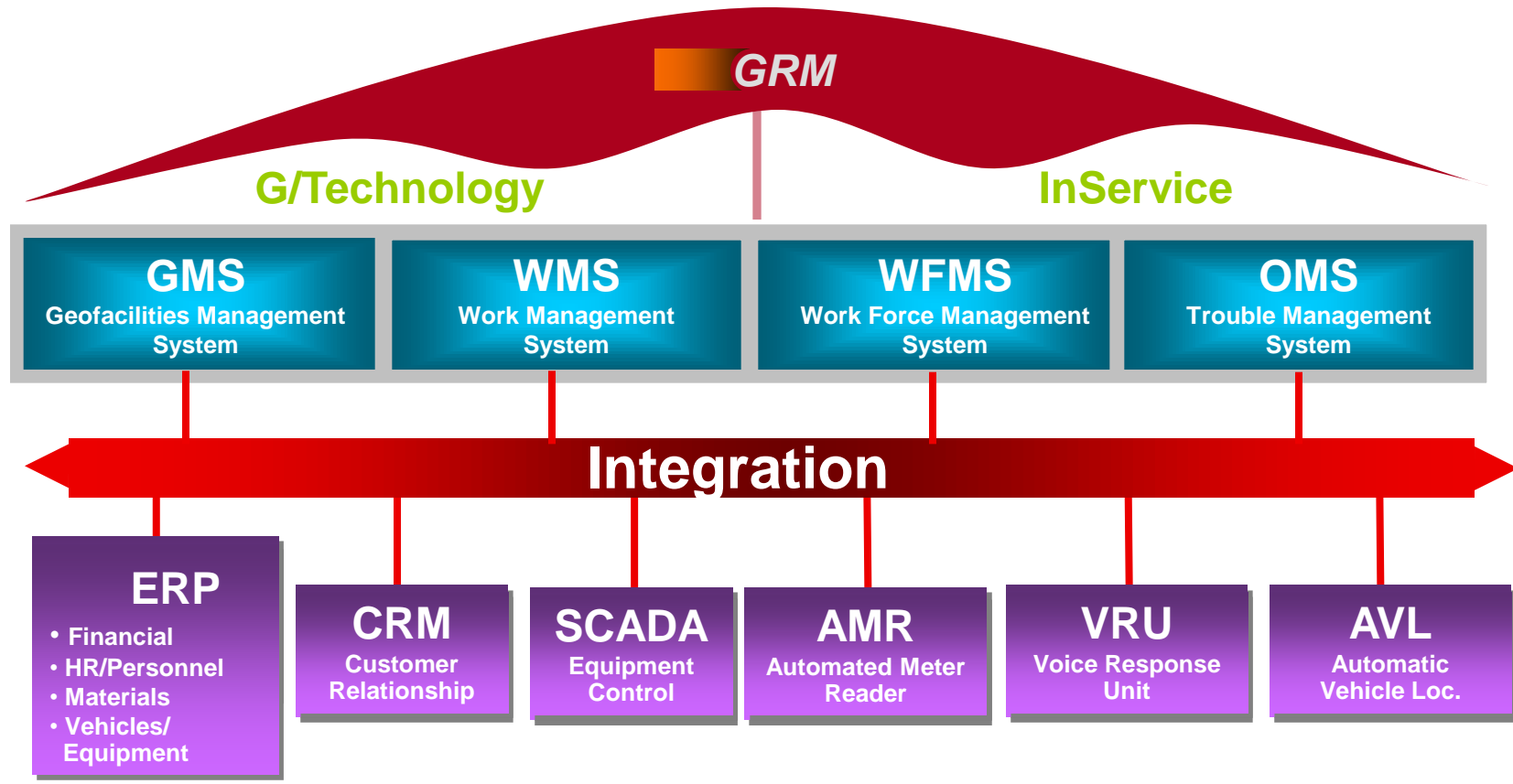
Data →



Geospatial Portfolio

Store

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

Display Main Map, Schematic Map, Substation Map

Map View 3 - Feeder Map 1

Main Map View

Map View 2 - EZACH

Substation Map View

East Zorcha
216.250000
84.800000

Substation Schematic Diagram showing busbars (Bus 1, Bus 2), breakers (F1-F8), and various electrical components.

Schematic Filter

Schematic Type: Schematic Device [Set to Default]

Filter Criteria:

- Schematic Device
- Schematic Downstream
- Schematic Outage
- Schematic Substation

Available Device:

- Fuse
- Regulator
- Step Transformer
- other
 - Conductor Node
 - Generator
 - Light
 - Substation
- Transformer
 - Primary Meter
 - Transformer_bank

Selected Device Type(s):

- Breaker
- Capacitor
- Capacitor
- Primary Conductor
- Recloser
- Sectionalizer
 - Net Sectionalizer
 - Sectionalizer
- Switch
 - Elbow
 - Switch

Check Device type(s) to Stop

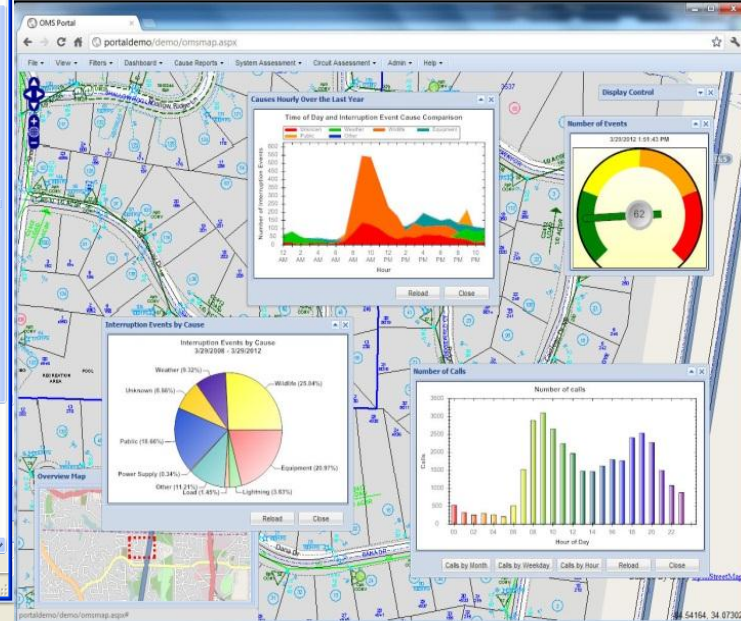
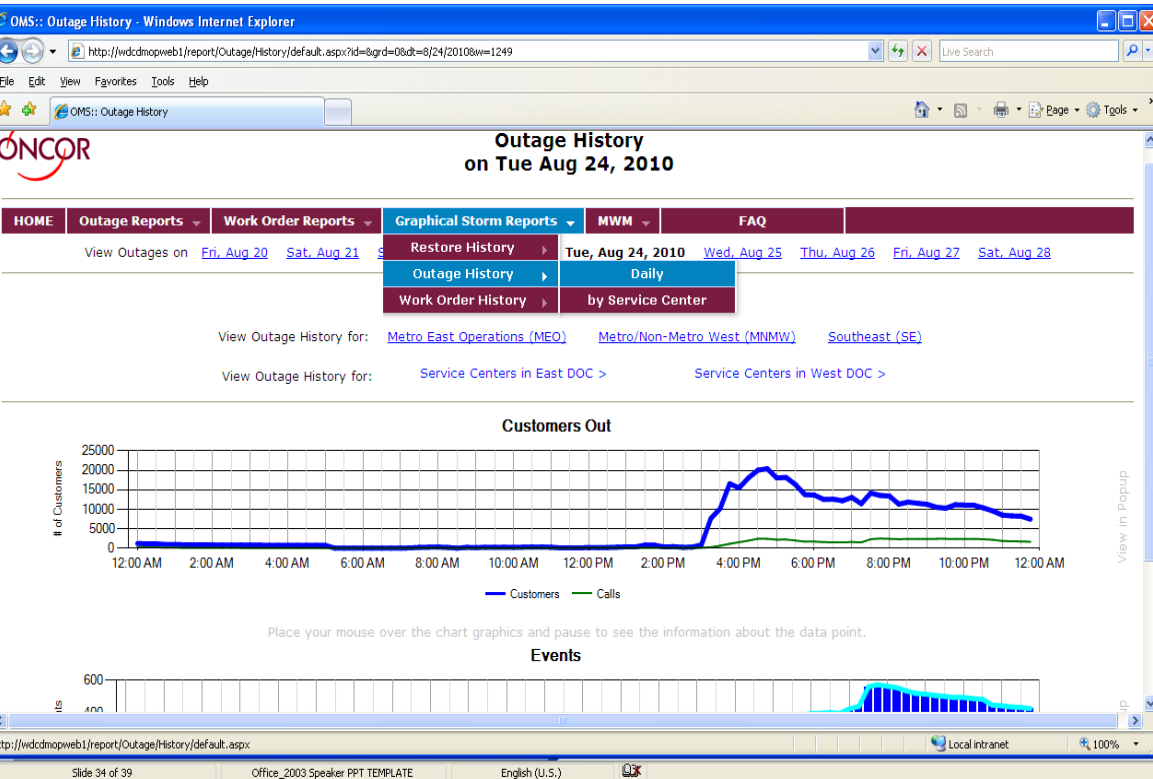
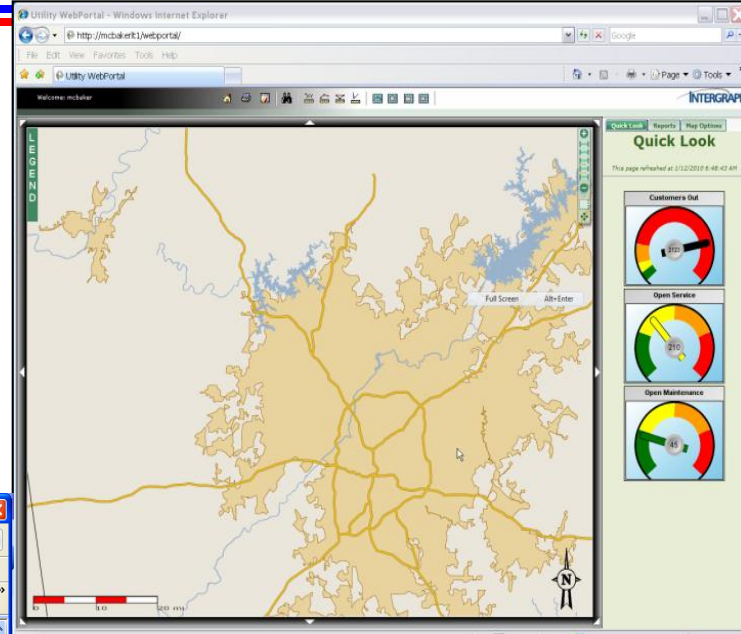
Buttons: OK, Cancel, Apply, Reset

Schematic Map View

BALA_043

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



Network Trace, Search and Data management



ArcFM Web Application - Windows Internet Explorer

http://localhost:2294/ArcFM%20Web%20Application/Default.aspx

ArcFM Viewer for ArcGIS Server

Support Center | Help
Logged in as INNOWE\janardhang

Tasks

Bookmarks

ArcFM Identify

Map Contents

- UPCL
 - Electric Dimension
 - Conduit System Cross Sec
 - Primary Underground Annc
 - Primary Underground Lass
 - Aerial Marker
 - Anchor Guy
 - Electric Station
 - Pushbrace
 - Riser

ArcFM Attribute Viewer

Service Point (31) | Switch (11) | Open Point (30) | Streetlight (96) | Transformer (21) | Bus Bar (33)

Export Options

Items to Export: Relationships

- Service Point
- Switch
- Open Point
- Streetlight
- Dynamic Protective Device
- Fuse
- Transformer
- ElecGeomNetwork_Junctions
- Primary Overhead Electric Line Segment
- Primary Underground Electric Line Segment

Export from Attribute Viewer:

All Results
 Selected Results

Export | Cancel | Refresh

	Object ID	SubtypeCD	Phase Designation	Feeder ID	Feeder ID 2	ADDRESS	Connection Type	Location ID	Service Current Rating	Status	COMMENTS	Work Order ID	Installation Date	Creation User
X	9688	9688	Service Point	A	EV-01				200 Amps	Active				mikea
X	9689	9689	Service Point	A	EV-01				200 Amps	Active				mikea

2224784.743, 390187.391

Local intranet 100%

Load Flow analysis

The screenshot shows the ArcMap interface with the 'Network Analysis' menu open. The 'Trace Network' option is selected, leading to a sub-menu where 'Load Flow Analysis' is highlighted. The main map area displays a network diagram with various nodes and lines. Each node is annotated with technical data, such as 'VOLTAGE = 0.39, ANGLE = -0.02, LOADING = NORMAL' and 'REAL RESULT = -4.84'. A specific node is labeled 'LOADING = UNDER'. The interface also includes a 'Case Study - Load Flow Analysis' dialog box in the bottom-left corner, which contains a table of cases and execution options.

CaseNo	CaseName
21	Case_21
22	Case_22

Execute After Input File Creation: [Dropdown]

Configure Study Options >> [Execute]

Report | Edit Input File | Plot

```

15:30:14:458 :: CASE [22] :: Case_22
15:30:14:458 :: IN-[C:\PRDC\appfolder\lfa_22_0_0_11_01_2011_15_30_14.dat]
15:30:14:458 :: OUT-[C:\PRDC\appfolder\lfa_22_0_0_11_01_2011_15_30_14.out]
15:35:41:910 :: LFA Data File Preparation Status [1]
15:35:42:159 :: LFA Application Execution Status [1] Error [-1] Reason [SUCCESS]
15:35:42:237 :: Case [22] :: Contingency [0] :: Schedule [0] :: Clean Up Status [1]
15:35:42:237 :: ELEMENT COUNT Result Count = [1] RecordStartIndex = [1]
15:35:42:237 :: BUS Result Count = [25] RecordStartIndex = [1]
15:35:42:300 :: SERIES ELEMENT Result count = [1] RecordStartIndex = [1]
15:35:42:300 :: SERIES ELEMENT Result count = [23] RecordStartIndex = [2]
15:35:42:409 :: SHUNT ELEMENT Result Count = [1] RecordStartIndex = [1]
15:35:42:409 :: SHUNT ELEMENT Result Count = [7] RecordStartIndex = [2]
15:35:42:474 :: SIMM&RY Result RecordStartIndex = [1]
  
```

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



Delhi Jal Board
Delhi Geo Portal

Legend
Query
Analysis
Reports

Scale :
Logout

» Locate Water & Sewer Pipelines

Boundary :

Name :

Search Feature :

Submit

» Search & Locate DJB Assets
» Address locator
» Point of Interest Search
» Identify and Save Features
» Attribute Query

» Attribute Query

URL: http://localhost/navayugaportal/frmQryResult.aspx?TblName=WATERPIPELINE&Tblpk=WPL_ID&DL1=DISTRICT&DL2=...

» PIPELINE AVAILABLAE IN NORTH DISTRICT

Id	Material	Diameter	System Type	Depth	Laying Year	Commissioning Year	Average Flow	Actual Flow	Average Pressure	Source name of Water Treatment	Sink name of Water Treatment
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%
1: 126800
19.48 x 15.27 (mi)
Powered by: NAVAYUGA

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

Indraprastha Gas Limited
Delhi GeoPortal

Legend Query Analysis Reports

» Find Gas Station in a Specified Distance

Click on this button and plot the point on the map

Feature : Gas Valves
Unit : Meters
Distance : 200

Submit

» Features Fall Inside a Rectangle
» Planning
» Monitoring
» Thematic Views

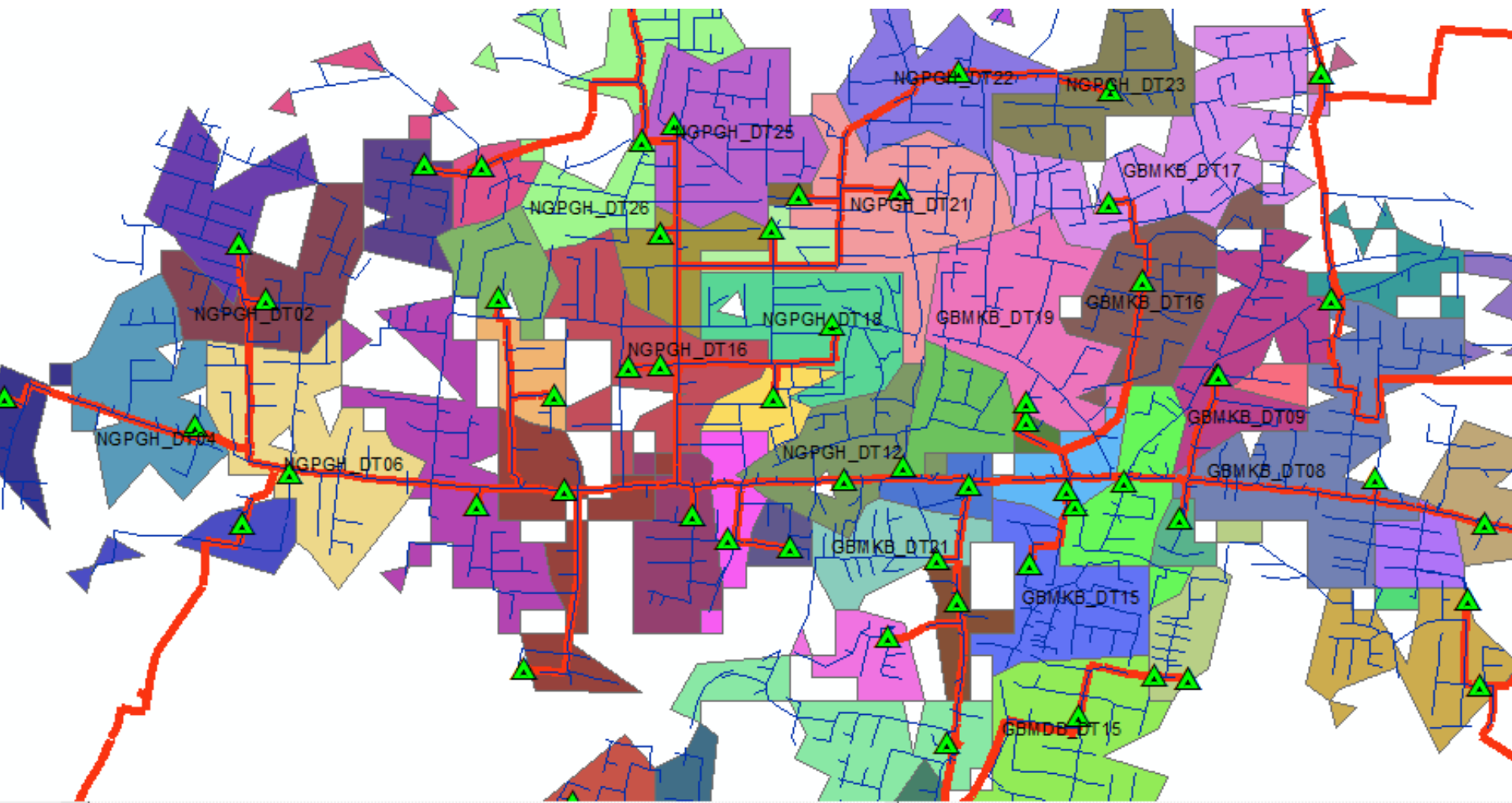
Scale : [Slider]
Logout

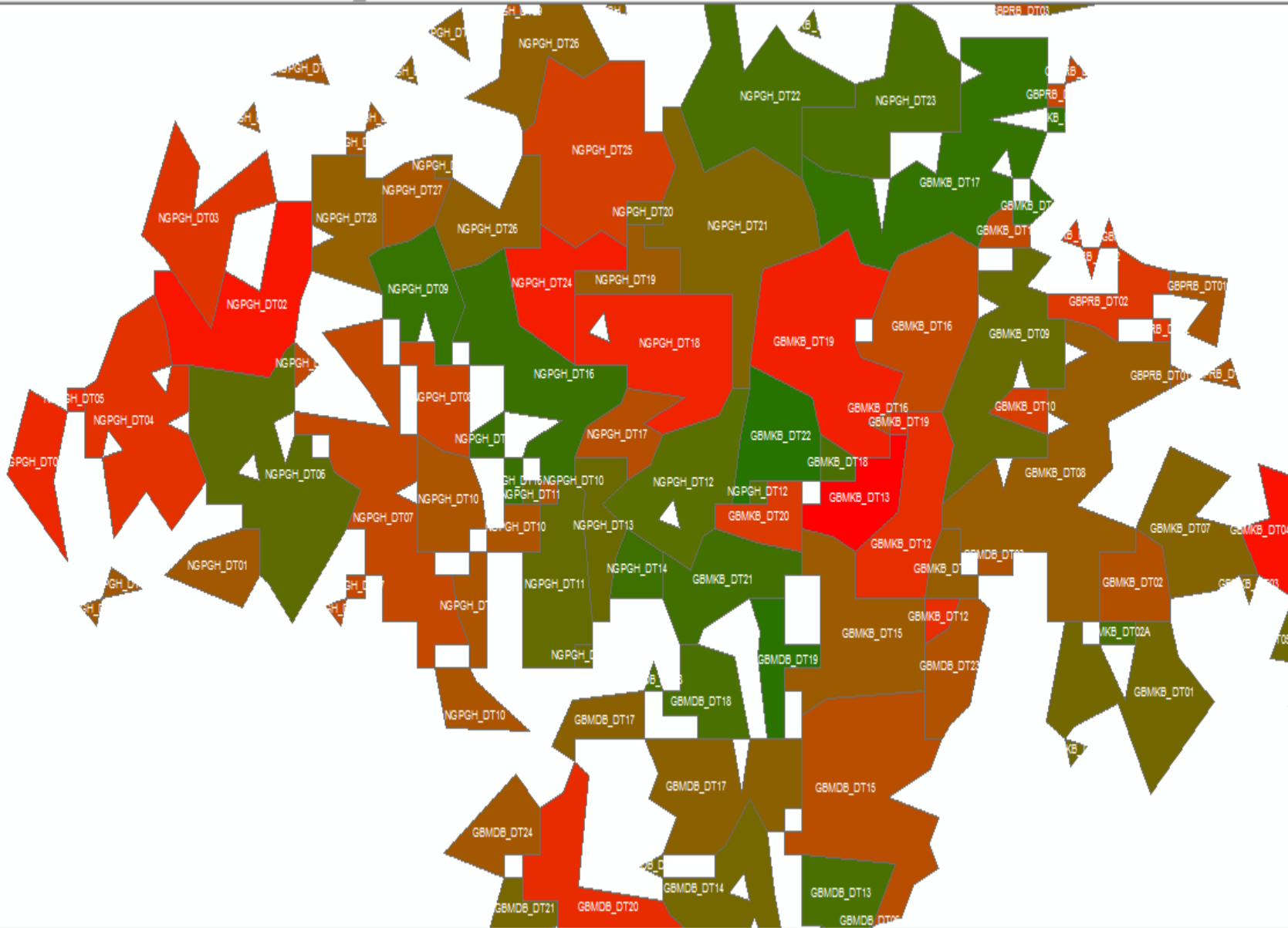
Valve Type Valve make
2 of 2

X: 718603.701042, Y: 3172704.102373 (METER)
2 Gas Valve selected
1: 3223.25
2574.13 x 2006.14 (ft)
Powered by: NAVAYUGA

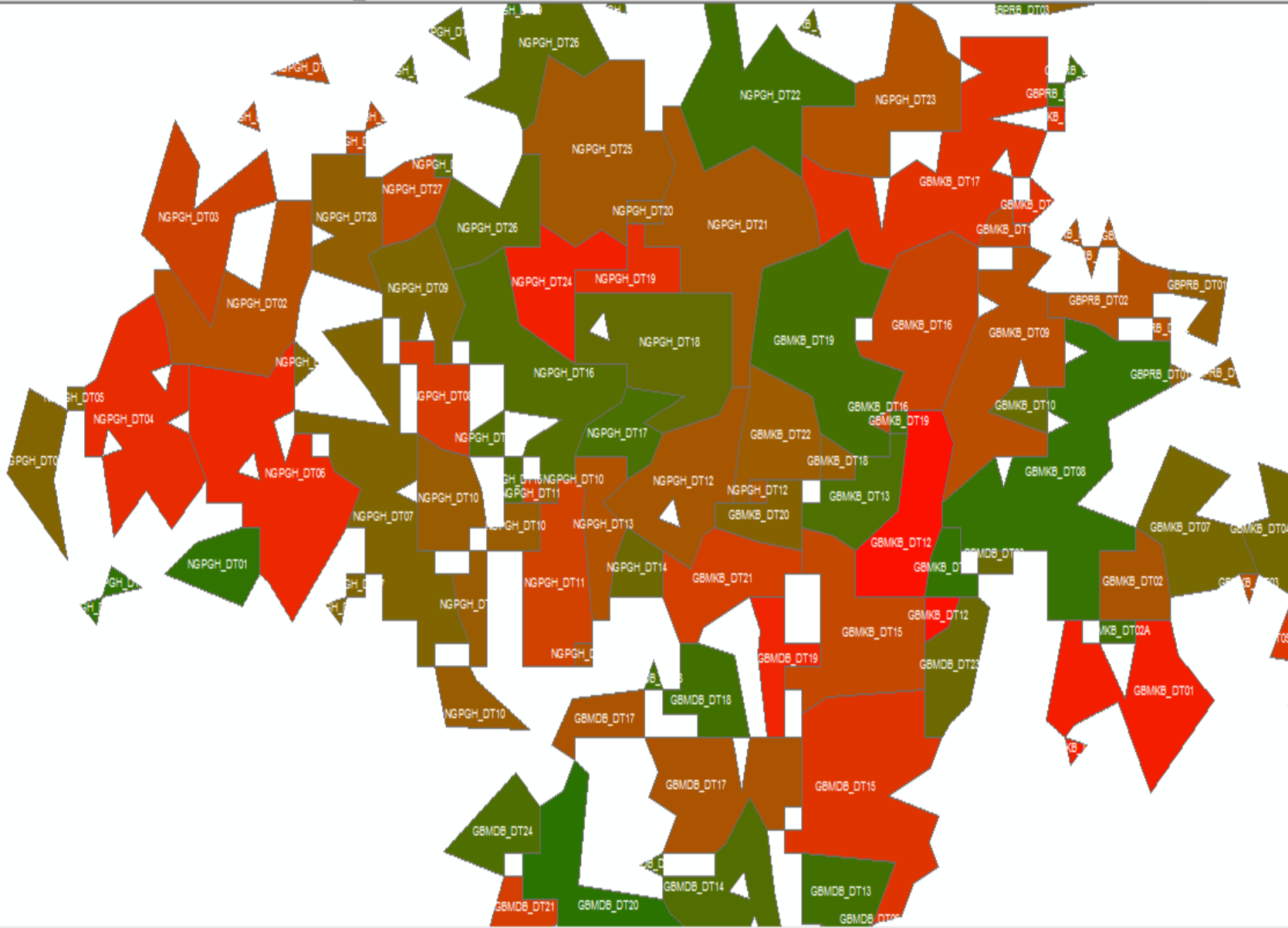
DT Energy Distribution

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

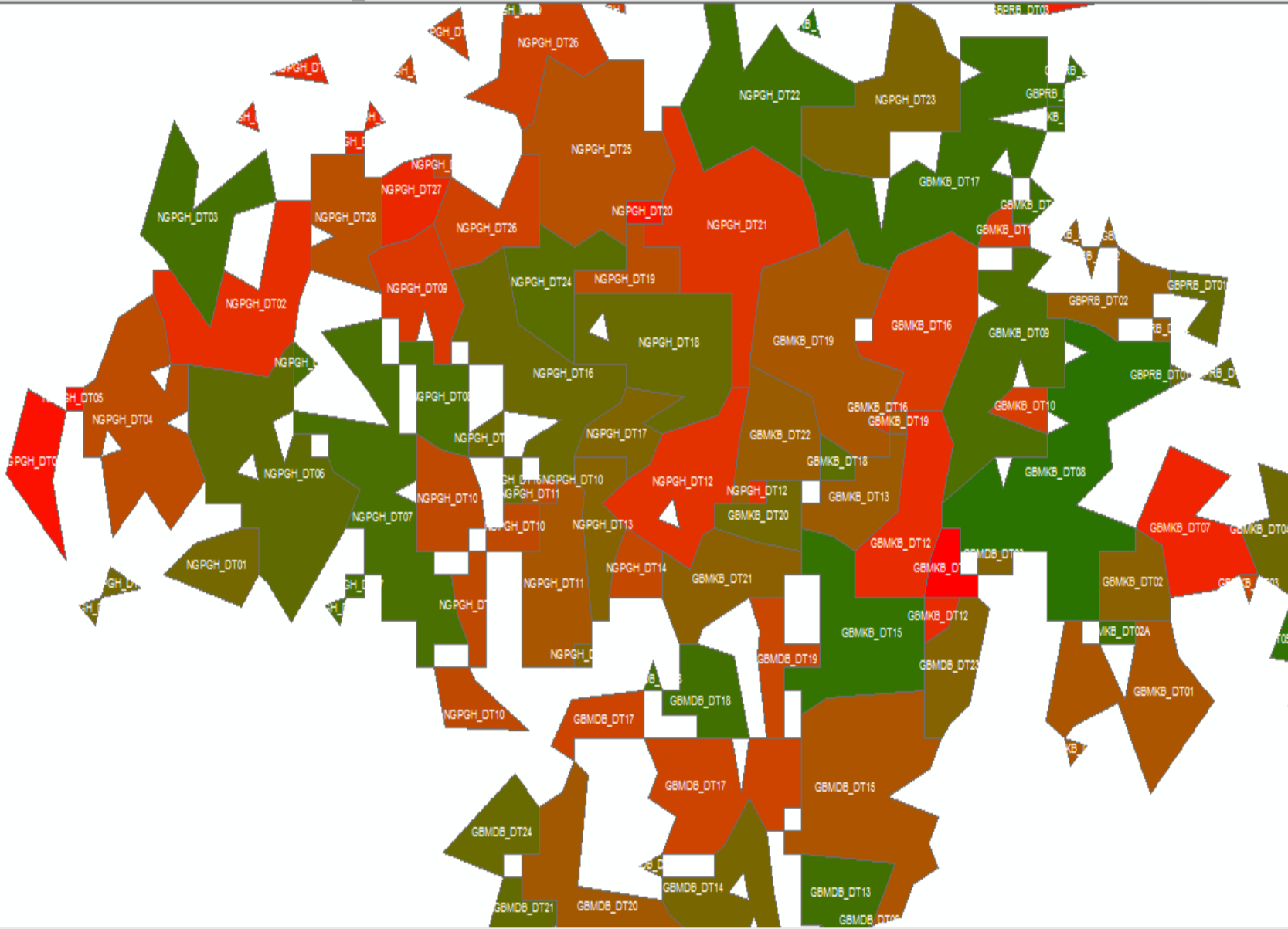


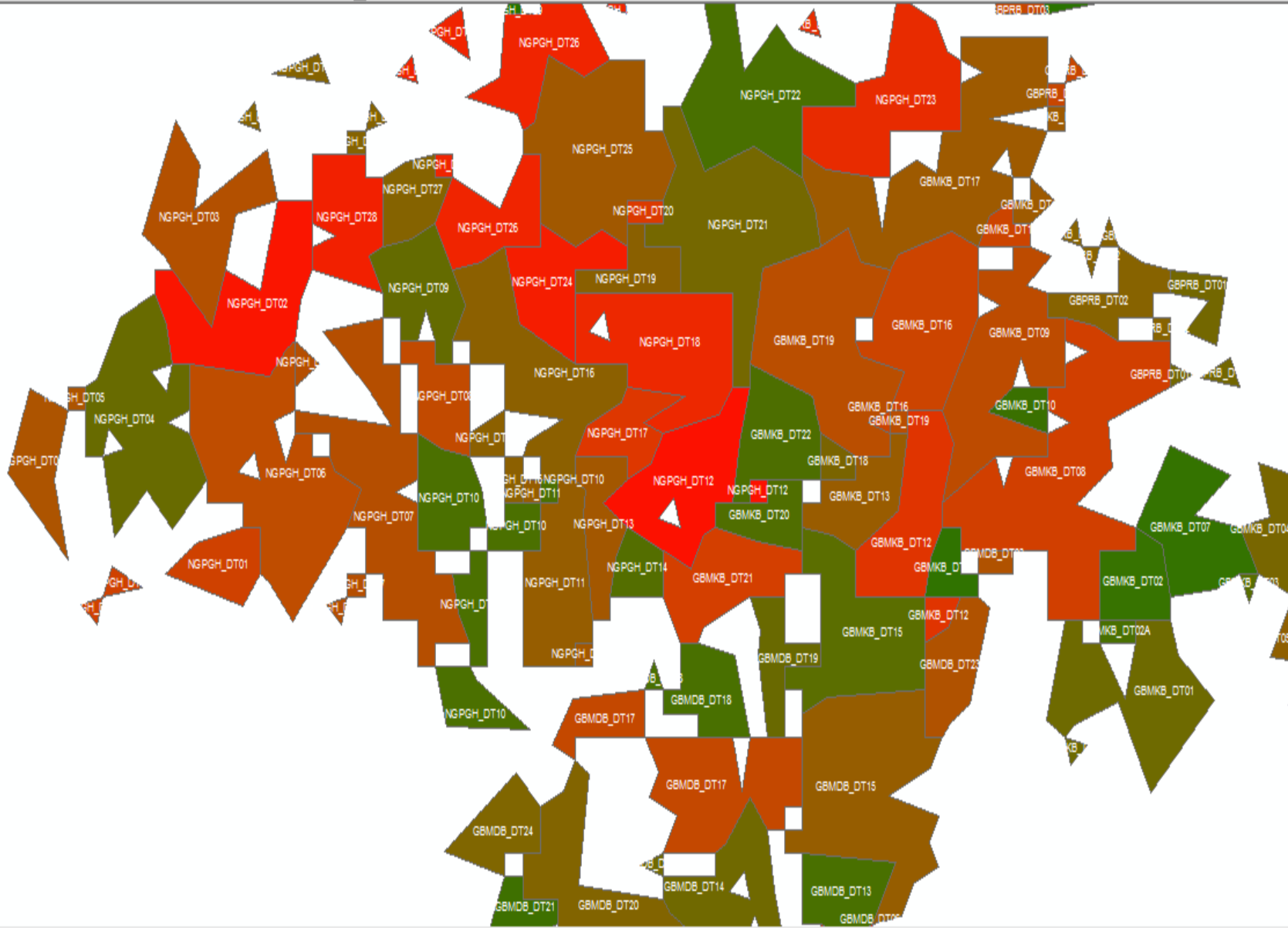








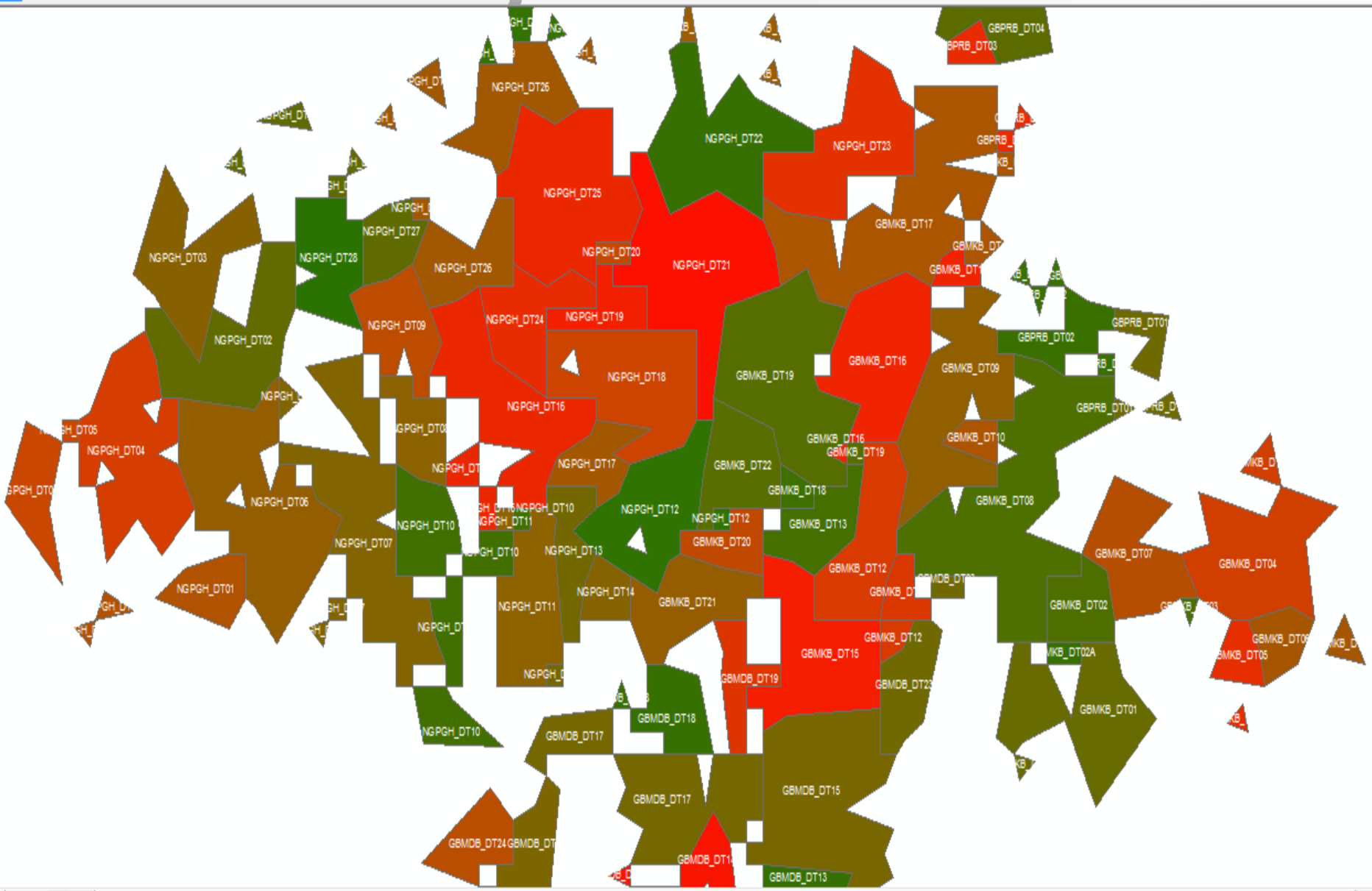




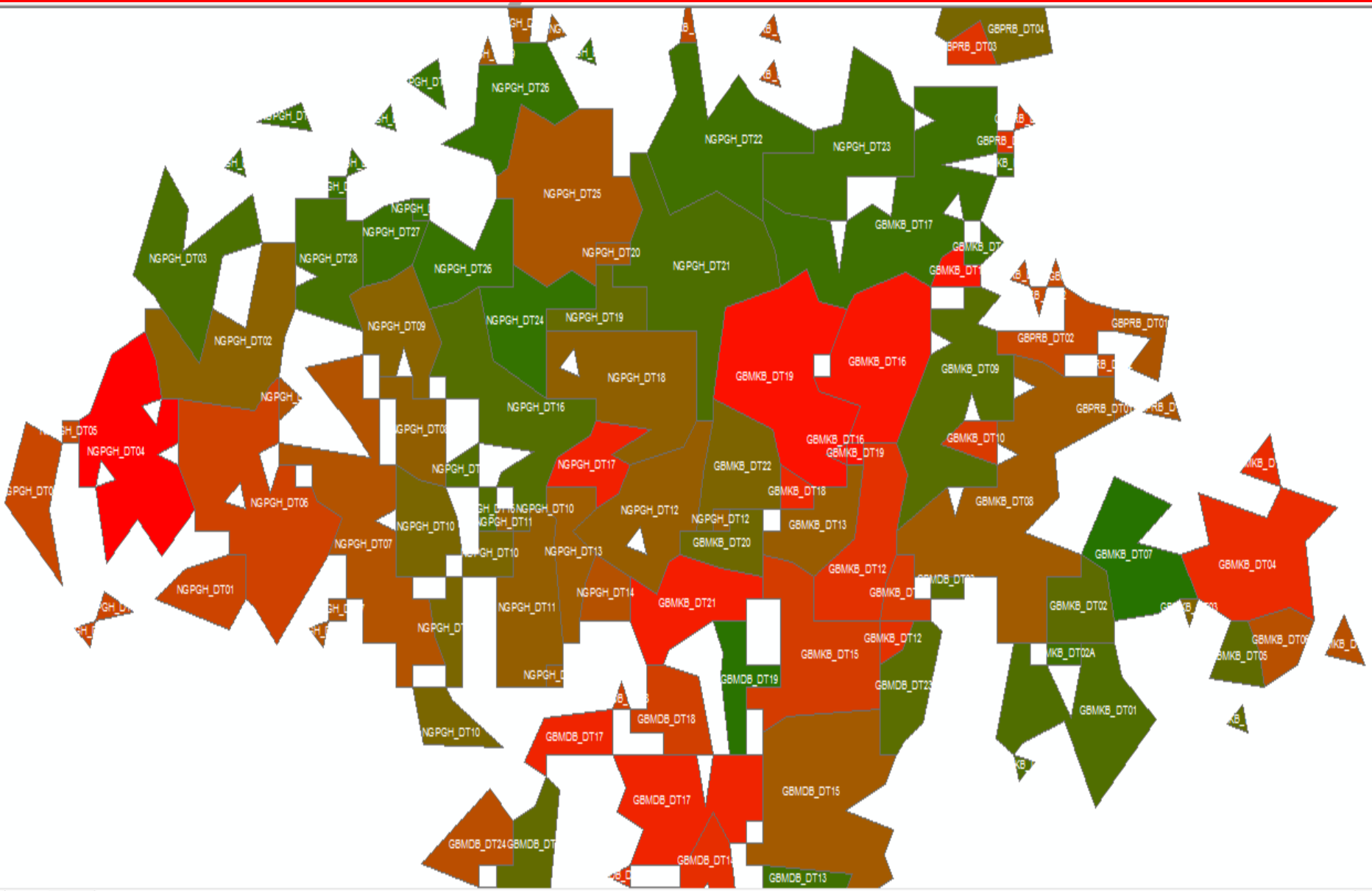












- **Navayuga**
 - A one stop solution provider for all ICT- Spatial technology / Geomatic needs
 - Industry best Top Technical and Management team
 - End to End Solution from experienced Geomatic professionals
 - State-of-the-art technology and Infrastructure
 - Best Practices includes not the use of advanced technology but use of judicious use of resources and technology based on the requirements and terrain
 - Success of Projects depends on Proper Planning, Monitoring and Budgets along with educating the clients and training the team on Geospatial technologies

Thank you