CONCEPT

Geographic Information Systems (GIS) for Infrastructure, Utilities and Planning

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Introduction:

Geographic Information Systems GIS often fail to pay back when spatial data sits in mismatched coordinate systems, asset layers lack attributes and metadata, and analysis stays in static maps nobody trusts. Engineers and planners then decide pipe renewals, site selections and service areas without reliable location evidence. This Core Concept course builds hands-on GIS skill across the whole spatial data workflow: projections, vector and raster data, GNSS and imagery capture, geodatabases, spatial analysis, web and mobile GIS, cartography and data quality. Participants produce a GIS Project Workbook with a validated geodatabase, analysis results and a published map set.

Course Objectives:

- Set up GIS projects with the correct coordinate reference system, datum and map projection and transform layers between them without positional error
- Capture and import spatial data from GNSS receivers, survey files, satellite and drone imagery and digitised plans into clean vector and raster layers
- Design a geodatabase with attribute domains, topology rules and relationships for infrastructure and utility network assets
- Perform buffer, overlay, network and multi-criteria suitability analysis to answer siting, service area and asset risk questions
- Publish layers as web map services and configure mobile field forms so field crews update asset records directly
- Produce map layouts and metadata records that meet cartographic conventions and ISO 19115-1:2014 metadata fundamentals

Target Audience:

- Engineers who maintain water, electricity, gas, telecom or drainage network records and plan asset works from them
- Planners who prepare land-use, site selection and development control evidence using location data
- GIS and data analysts responsible for spatial databases, layer maintenance and map requests across departments
- Surveyors and field data officers who collect GNSS points, as-built records and asset inspections
- Infrastructure and project engineers who need route, corridor and catchment analysis for design and construction
- Asset and maintenance planners who link work orders and condition data to asset locations

Course Outline:

Day 1: GIS Concepts, Spatial Reference and Data Models

- GIS Components: Hardware, Software, Data, People and Procedures
- Geodetic Datums, WGS 84 and Coordinate Reference System Selection
- Map Projections: Conformal, Equal-Area and UTM Zone Trade-Offs
- Vector Features, Raster Grids and Point Cloud Data Model Comparison
- Organisational Spatial Data Inventory and Layer Gap Assessment

Day 2: Data Capture, Geodatabases and Interoperability Standards

- GNSS Receiver Accuracy, Differential Correction and Survey Data Import
- Georeferencing Scanned Plans and Heads-Up Digitising Procedures
- Geodatabase Design: Feature Classes, Attribute Domains and Subtypes
- Topology Rules and Relationship Classes for Linear Network Assets
- OGC GeoPackage and Shapefile Exchange Formats With Attribute Joins

Day 3: Spatial Analysis Lab in QGIS and ArcGIS

- Buffer and Proximity Analysis for Easements and Exclusion Zones
- Vector Overlay: Intersect, Union, Clip and Spatial Join Workflows
- Network Analysis: Shortest Route, Service Area and Closest Facility
- Multi-Criteria Suitability Analysis With Weighted Raster Overlay
- Terrain Analysis: Slope, Aspect, Viewshed and Watershed Delineation

Day 4: Remote Sensing, Web GIS, Field Mobility and Data Quality

- Satellite and Drone Imagery: Resolution, Band Combinations and Classification
- Web Map Publishing With OGC WMS, WFS, WMTS and OGC API - Features
- Mobile Field Forms, Offline Editing and Synchronisation Conflict Handling
- Spatial Data Quality Checks: Positional Accuracy, Completeness and Consistency
- ISO 19115-1:2014 Metadata Records and Layer Lineage Documentation

Day 5: Sector Lab Cases and the GIS Project Workbook

- Utility Case: Water Main Break Analysis and Valve Isolation Tracing
- Asset Case: Linking Maintenance Work Orders and Condition Scores to Features
- Planning Case: Site Selection for a Public Facility Using Suitability Layers
- Cartographic Layout: Symbology, Labelling, Scale Bar and Map Series Export
- GIS Project Workbook Assembly and Peer Review of Analysis Results

Skills You Will Gain:

- Coordinate System Management
- Spatial Data Capture
- Geodatabase Design
- Network and Proximity Analysis
- Raster Suitability Modelling
- Web and Mobile GIS Configuration
- Spatial Data Quality Control
- Thematic Map Production

Why Attend This Course:

- Return with a GIS Project Workbook holding a validated geodatabase, analysis results and a map set built on data from your own work area
- Stop positional errors and broken layers by fixing projection, topology and attribute problems at source
- Answer siting, service coverage and asset risk questions in hours with repeatable analysis models instead of manual map reading
- Compare GIS practice with engineers, planners and analysts from water, power, telecom, municipal and consultancy organisations

Conclusion:

Reliable GIS depends on correct spatial reference, well-structured data and analysis that others can repeat and check. This course moves from GIS components, datums and projections, through data capture, geodatabase design and open exchange formats, to buffer, overlay, network, suitability and terrain analysis, remote sensing, web and mobile GIS, and data quality with metadata. The final day applies these methods to utility, asset and planning cases and produces a GIS Project Workbook ready for use in daily engineering and planning work.