



## **PropBase Query Layer: a single portal to UK subsurface physical property databases**

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Until recently, the delivery of geological information for industry and public was achieved by geological mapping. Now pervasively available computers mean that 3D geological models can deliver realistic representations of the geometric location of geological units, represented as shells or volumes. The next phase of this process is to populate these with physical properties data that describe subsurface heterogeneity and its associated uncertainty. Achieving this requires capture and serving of physical, hydrological and other property information from diverse sources to populate these models.

The British Geological Survey (BGS) holds large volumes of subsurface property data, derived both from their own research data collection and also other, often commercially derived data sources. This can be voxelated to incorporate this data into the models to demonstrate property variation within the subsurface geometry. All property data held by BGS has for many years been stored in relational databases to ensure their long-term continuity. However these have, by necessity, complex structures; each database contains positional reference data and model information, and also metadata such as sample identification information and attributes that define the source and processing. Whilst this is critical to assessing these analyses, it also hugely complicates the understanding of variability of the property under assessment and requires multiple queries to study related datasets making extracting physical properties from these databases difficult.

Therefore the PropBase Query Layer has been created to allow simplified aggregation and extraction of all related data and its presentation of complex data in simple, mostly denormalized, tables which combine information from multiple databases into a single system. The structure from each relational database is denormalized in a generalised structure, so that each dataset can be viewed together in a common format using a simple interface. Data are re-engineered to facilitate easy loading. The query layer structure comprises tables, procedures, functions, triggers, views and materialised views. The structure contains a main table PRB\_DATA which contains all of the data with the following attribution:

- a unique identifier
- the data source
- the unique identifier from the parent database for traceability
- the 3D location
- the property type
- the property value
- the units
- necessary qualifiers
- precision information and an audit trail

Data sources, property type and units are constrained by dictionaries, a key component of the structure which defines what properties and inheritance hierarchies are to be coded and also guides the process as to what and how these are extracted from the structure.

Data types served by the Query Layer include site investigation derived geotechnical data, hydrogeology datasets, regional geochemistry, geophysical logs as well as lithological and borehole metadata. The size and complexity of the data sets with multiple parent structures requires a technically robust approach to keep the layer synchronised. This is achieved through Oracle procedures written in PL/SQL containing the logic required to carry out the data manipulation (inserts, updates, deletes) to keep the layer synchronised with the underlying

databases either as regular scheduled jobs (weekly, monthly etc) or invoked on demand.

The PropBase Query Layer's implementation has enabled rapid data discovery, visualisation and interpretation of geological data with greater ease, simplifying the parametrisation of 3D model volumes and facilitating the study of intra-unit heterogeneity.





# PropBase QueryLayer:

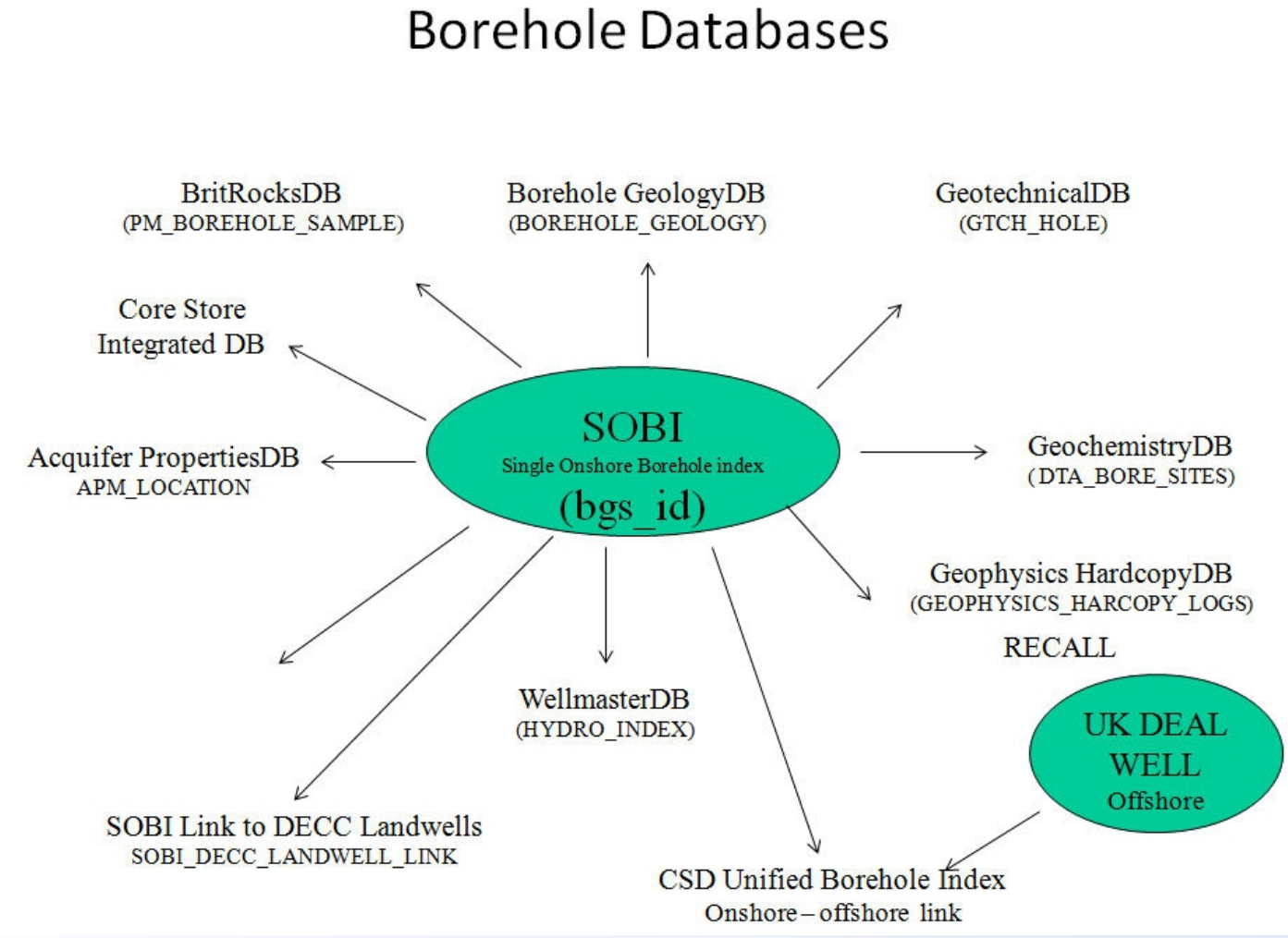
## a single portal to UK physical property databases

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1: BGS Keyworth, 2: BGS Edinburgh

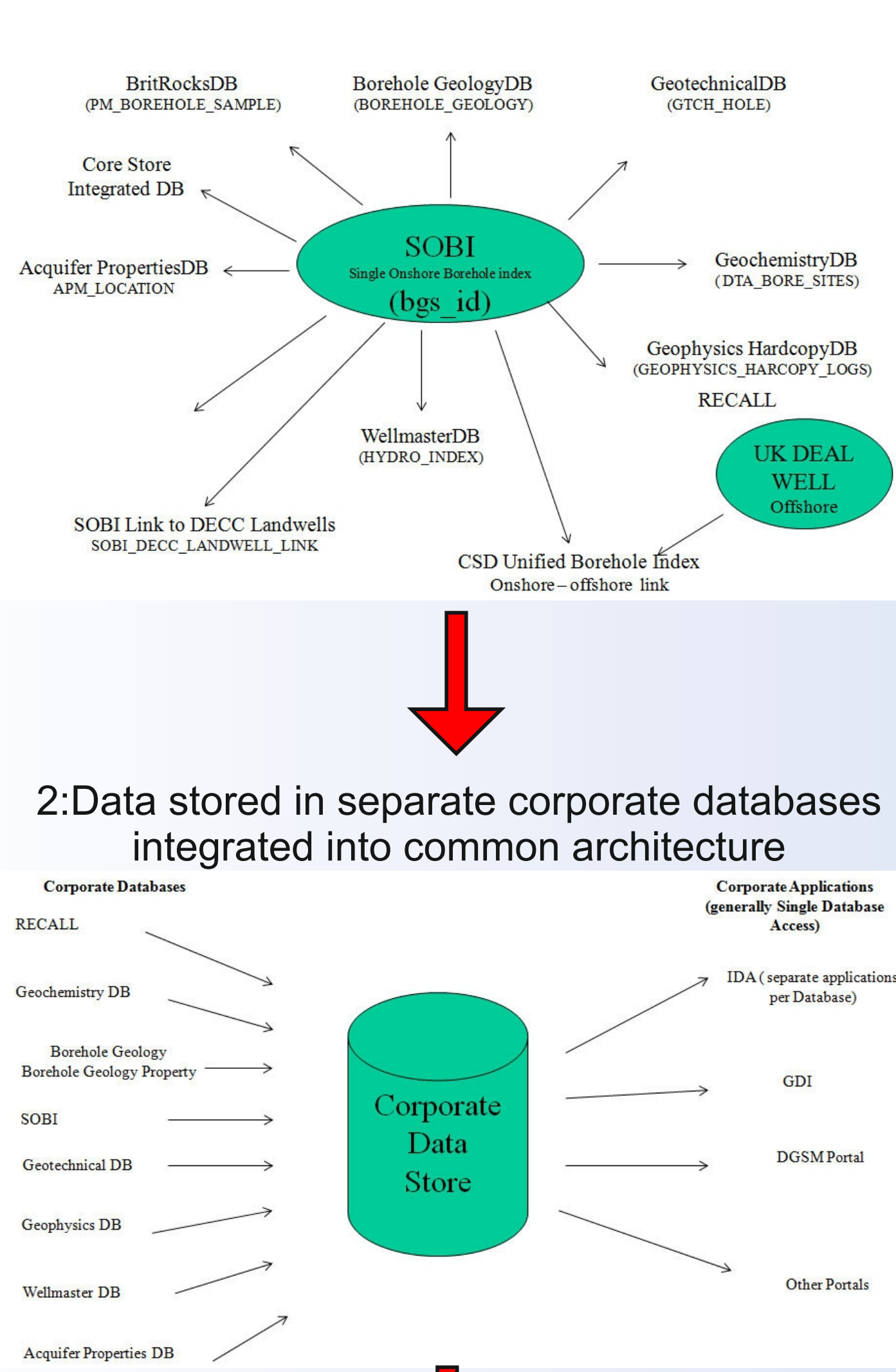
Until recently, the delivery of geological information for industry and public was achieved by geological mapping. Now pervasively available computers mean that 3D geological models can deliver realistic representations of the spatial location and geometry of geological units, represented as shells or volumes. The next phase of this process is to populate these with physical properties data that describe subsurface heterogeneity and its associated uncertainty. Achieving this requires capture and serving of physical, hydrological and other property information from diverse sources to populate these models. The PropBase QueryLayer seeks to achieve this by presenting a denormalised structure for a single access point of this diverse series of property data.

PropBa

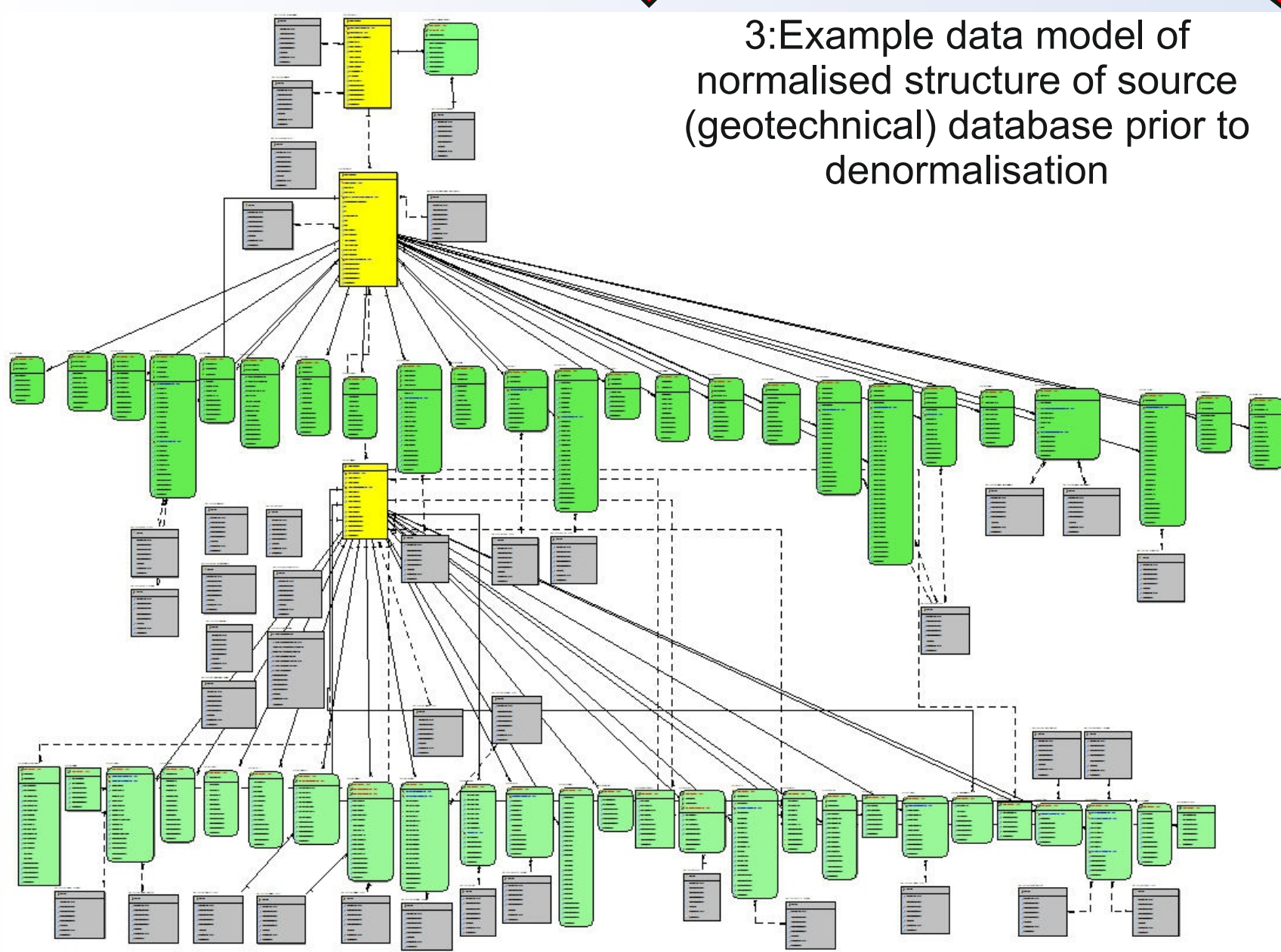
1: Linking of completely separate corporate databases by creation of common keys



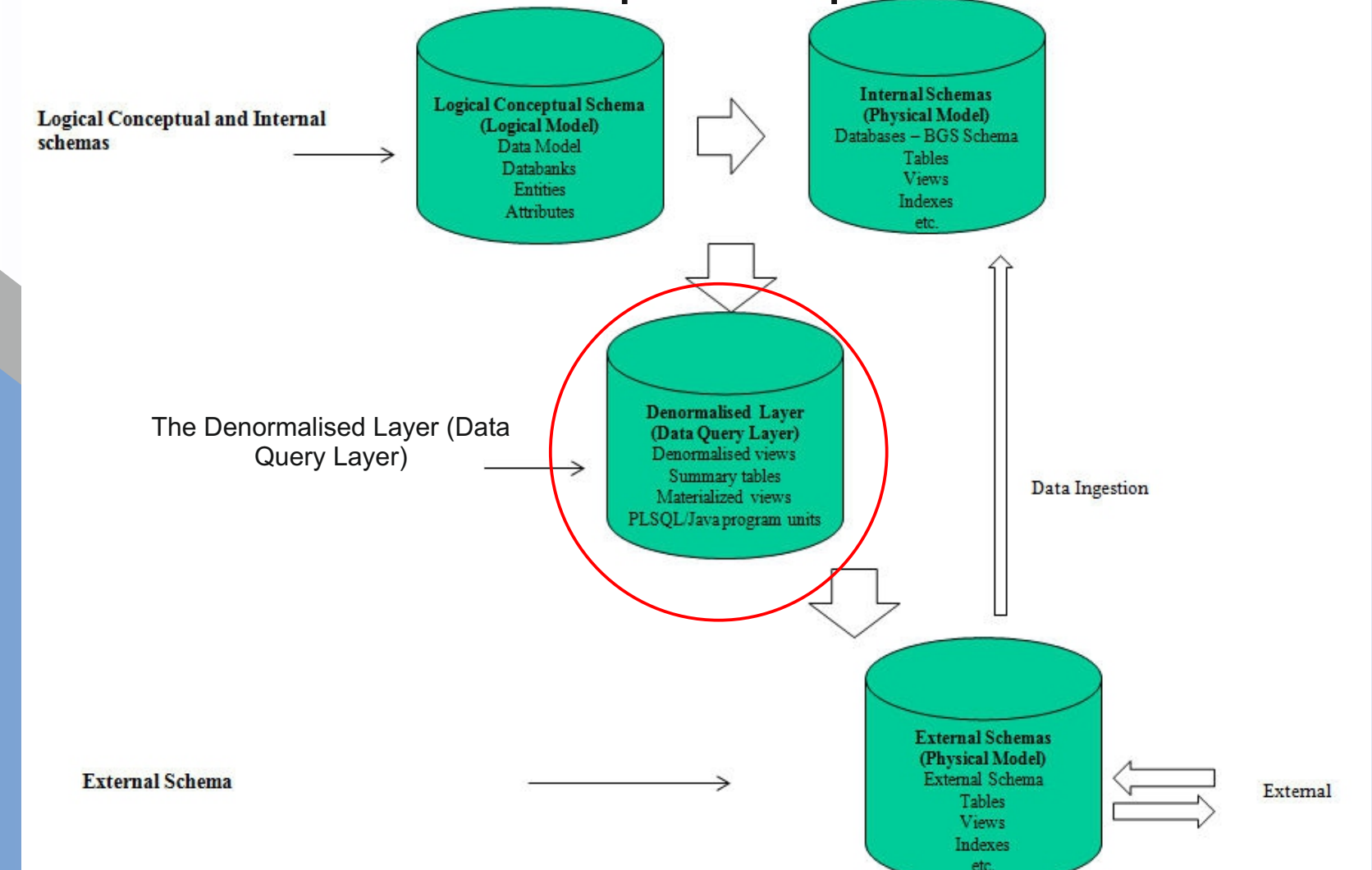
2: Data stored in separate corporate databases integrated into common architecture



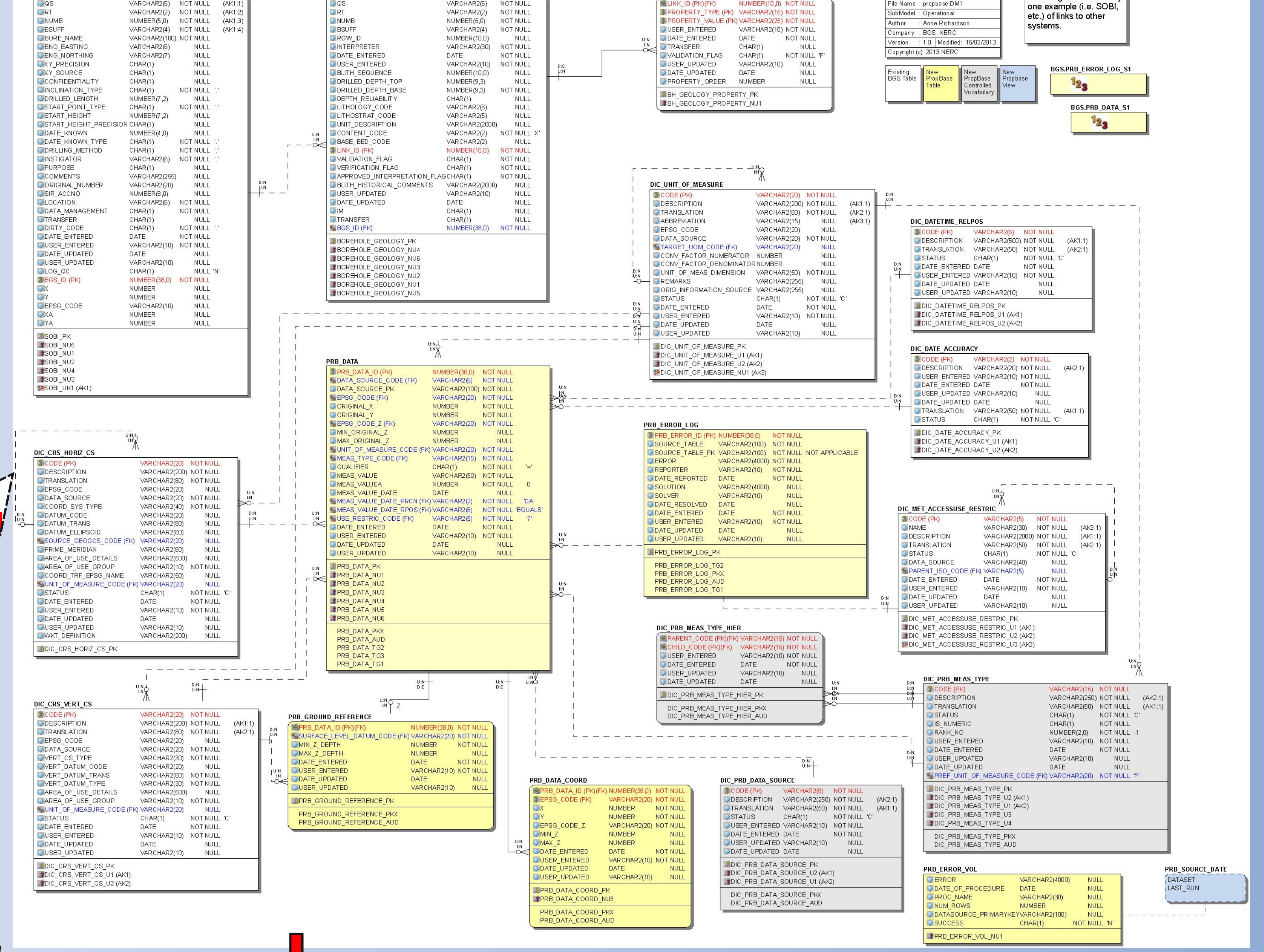
3: Example data model of normalised structure of source (geotechnical) database prior to denormalisation



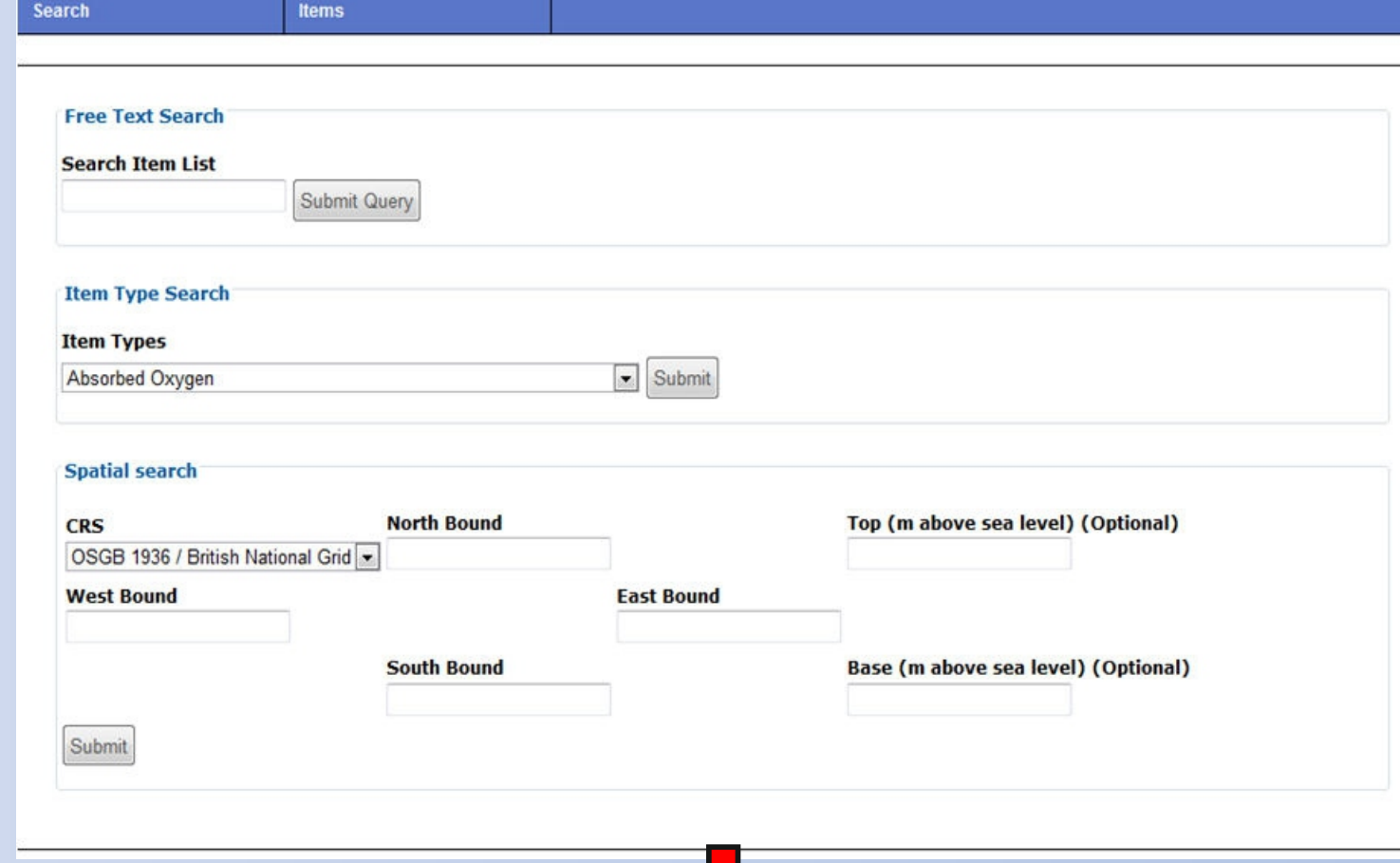
4: Creation of Denormalised Data Architecture from component parts



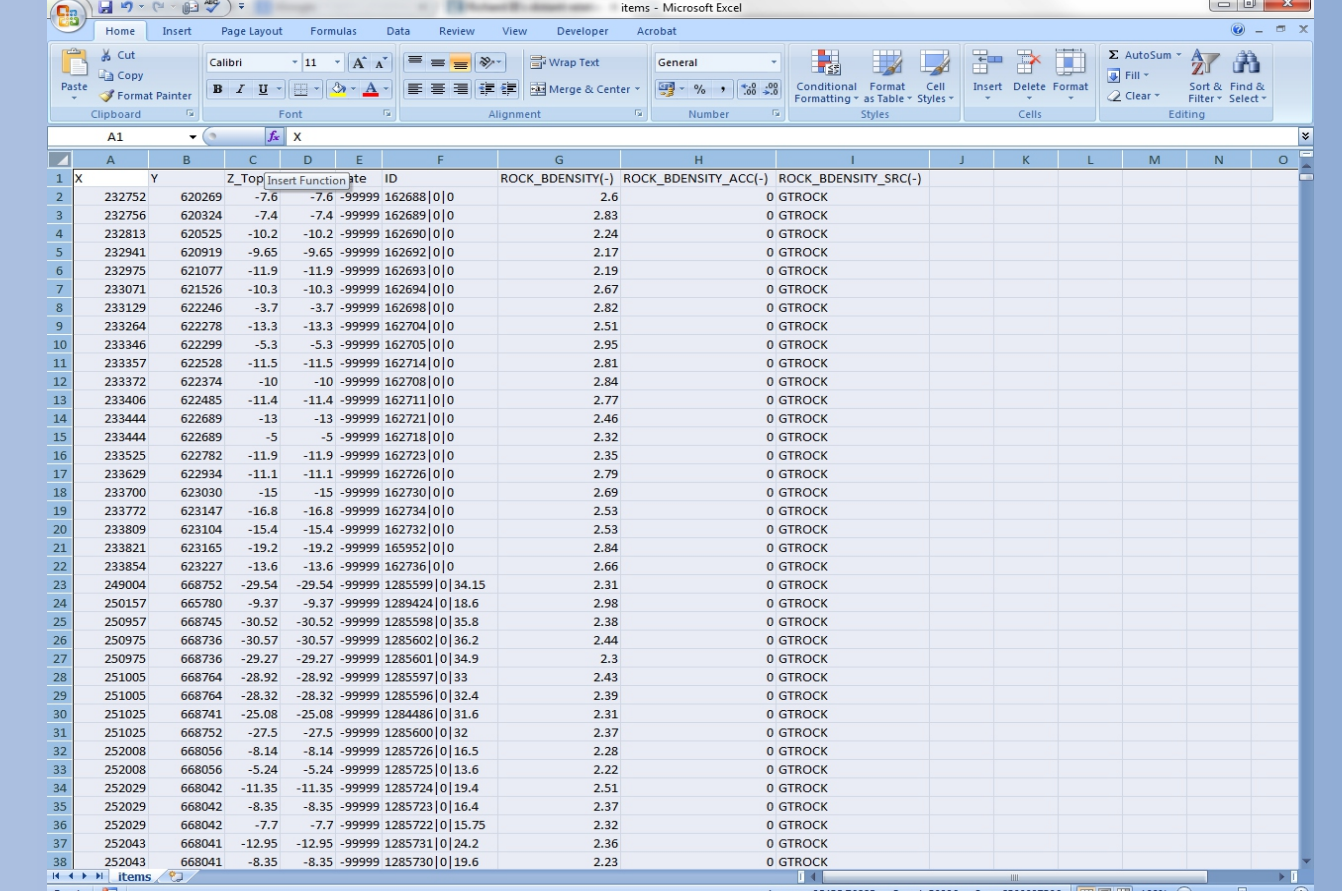
5: Creation of new denormalised data structures to produce simplified single access point for property data



6: Simplified Data portal for easy property searching



9: Property data output in CSV for easy manipulation in EXCEL

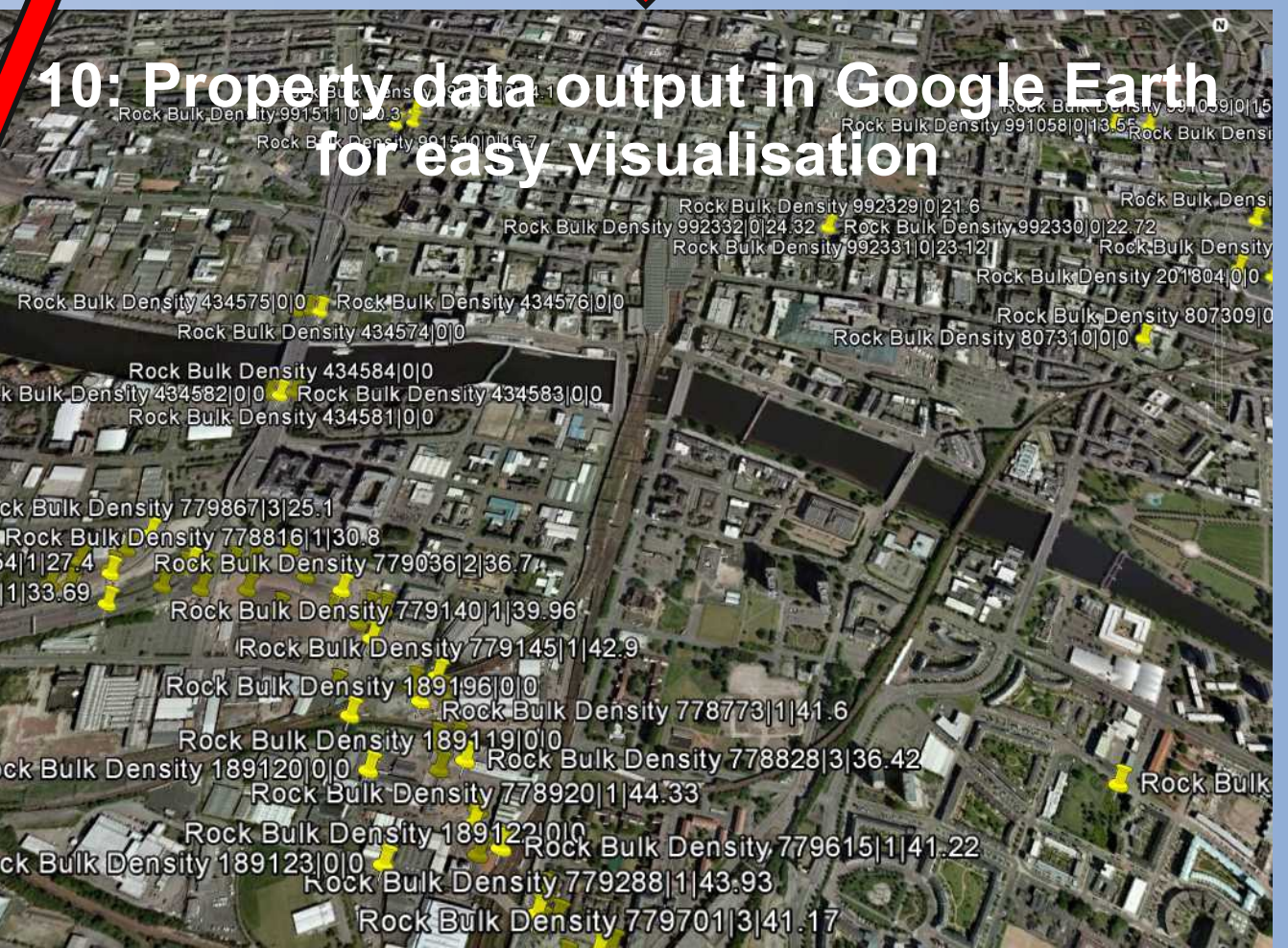


7: All data outputs in standard formats simplifying data extraction and loading into other applications

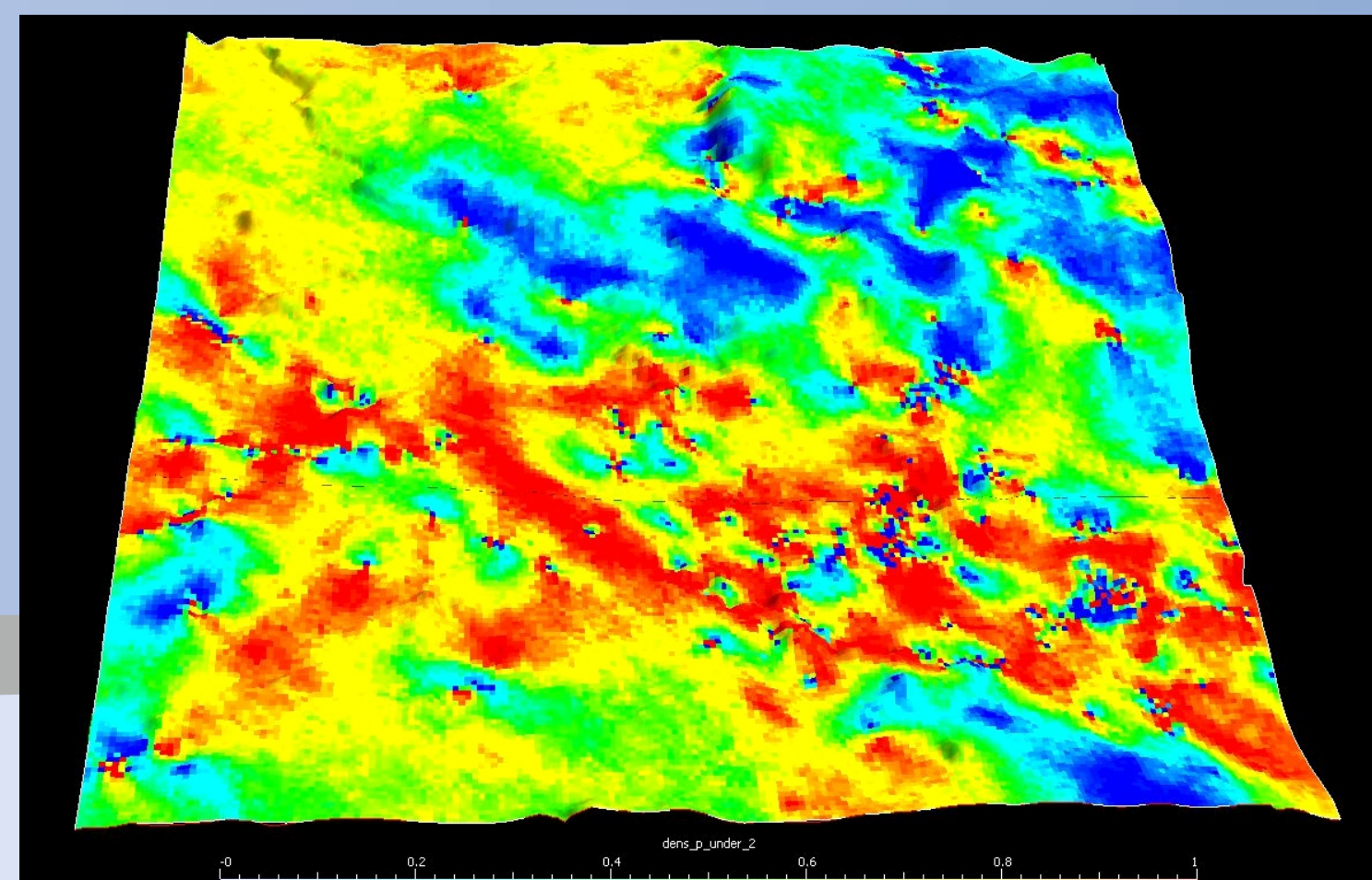
Source	Type	Location	Value	Date	Source ID
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	606339.0, 271895.0, 0.0	-3.137518 + 0	381451143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	600253.0, 274625.0, 0.0	-3.2307843 + 0	381452143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	615501.0, 270490.0, 0.0	-3.4232263 + 0	381453143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	613747.0, 276603.0, 0.0	-3.7801324 + 0	381454143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	609644.0, 276132.0, 0.0	-3.7829834 + 0	381456143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	606729.0, 279091.0, 0.0	-3.8136208 + 0	381457143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	627475.0, 273501.0, 0.0	-3.8249864 + 0	381458143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	606607.0, 273872.0, 0.0	-3.1127745 + 0	381459143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	600721.0, 271826.0, 0.0	-3.162311 + 0	381461143337	
Geotechnical GBASE Soil Overburden Analyses	total inorganic carbon	610815.0, 271429.0, 0.0	-3.2062083 + 0	381462143337	

8: Example of single row with full metadata from original normalised datasets fully retained

Propbase Item	Geotechnical GBASE Soil Overburden Analyses
Date Type	total inorganic carbon
Date Value	total inorganic carbon
Location	606339.0, 271895.0, 0
Value	-3.137518
Units	parts per million
Date Accuracy	day
Date Relative Position	source
Source	Geotechnical GBASE Soil Overburden Analyses
Source ID	381451143337
User	not entered



10: Property data outputs visualised in GOCAD



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The PropBase Query Layer's implementation has enabled rapid data discovery, visualisation and interpretation of geological data with greater ease. Data is now available in common outputs format for easy parameterisation of 3D model volumes and facilitating the study of intra-unit heterogeneity.