

**Appendix A – Challenge trees**

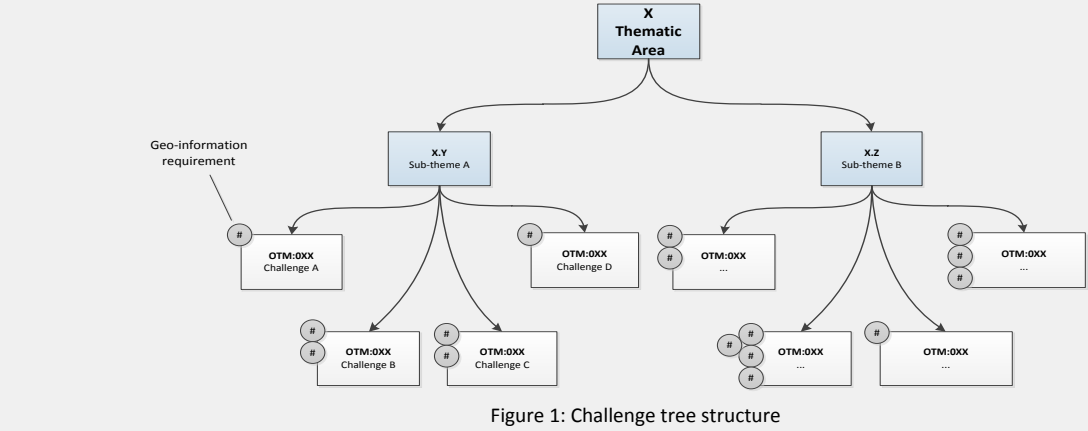
**Introduction**  
The following diagrams, hereafter referred to as challenge trees, should be read in conjunction with the OTM master challenge spreadsheet produced for the EO4OG projects and summarising report. The challenge trees depict the relationship between each of the O&G challenges and the thematic areas through which the investigation was carried out.

Each challenge has a unique ID (OTM:XXX) which can be used to locate the challenge on the master spreadsheet.

Each challenge has been allocated to at least one of the five thematic areas and within each of these, to at least one sub-theme as shown in Figure 1.

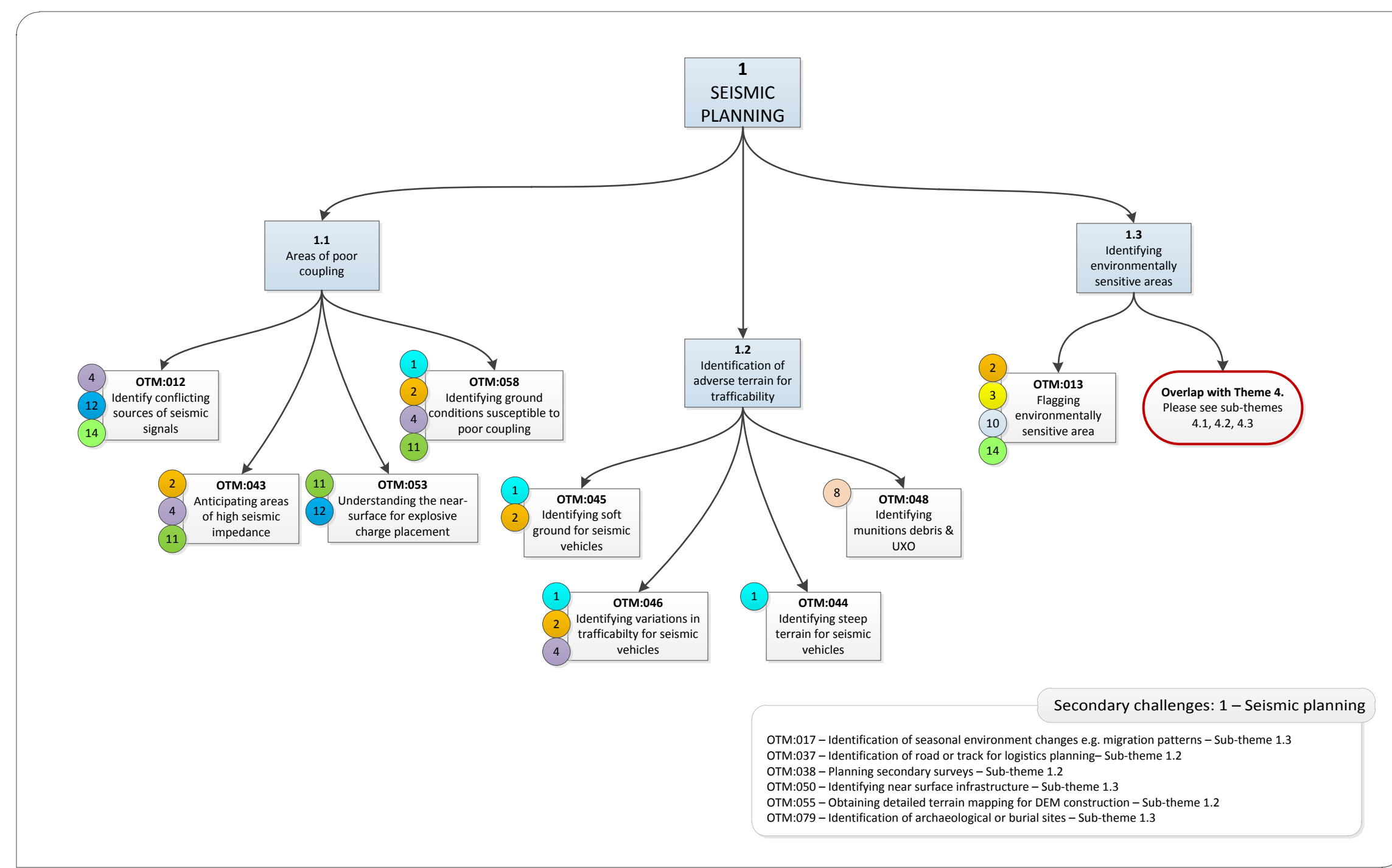
Challenges that bridge multiple thematic areas have been attributed to these respective themes as *secondary challenges*. For clarity, secondary challenges have not been displayed on the challenge trees. However, reference has been made to them at the base of the tree in a separate figure.

The geo-information requirements that may be required to satisfy a particular challenge are indicated by coloured and numbered bubbles. Each bubble colour and number corresponds to a specific geo-information requirement, as indicated in the key, titled: *Geo-information requirements*.



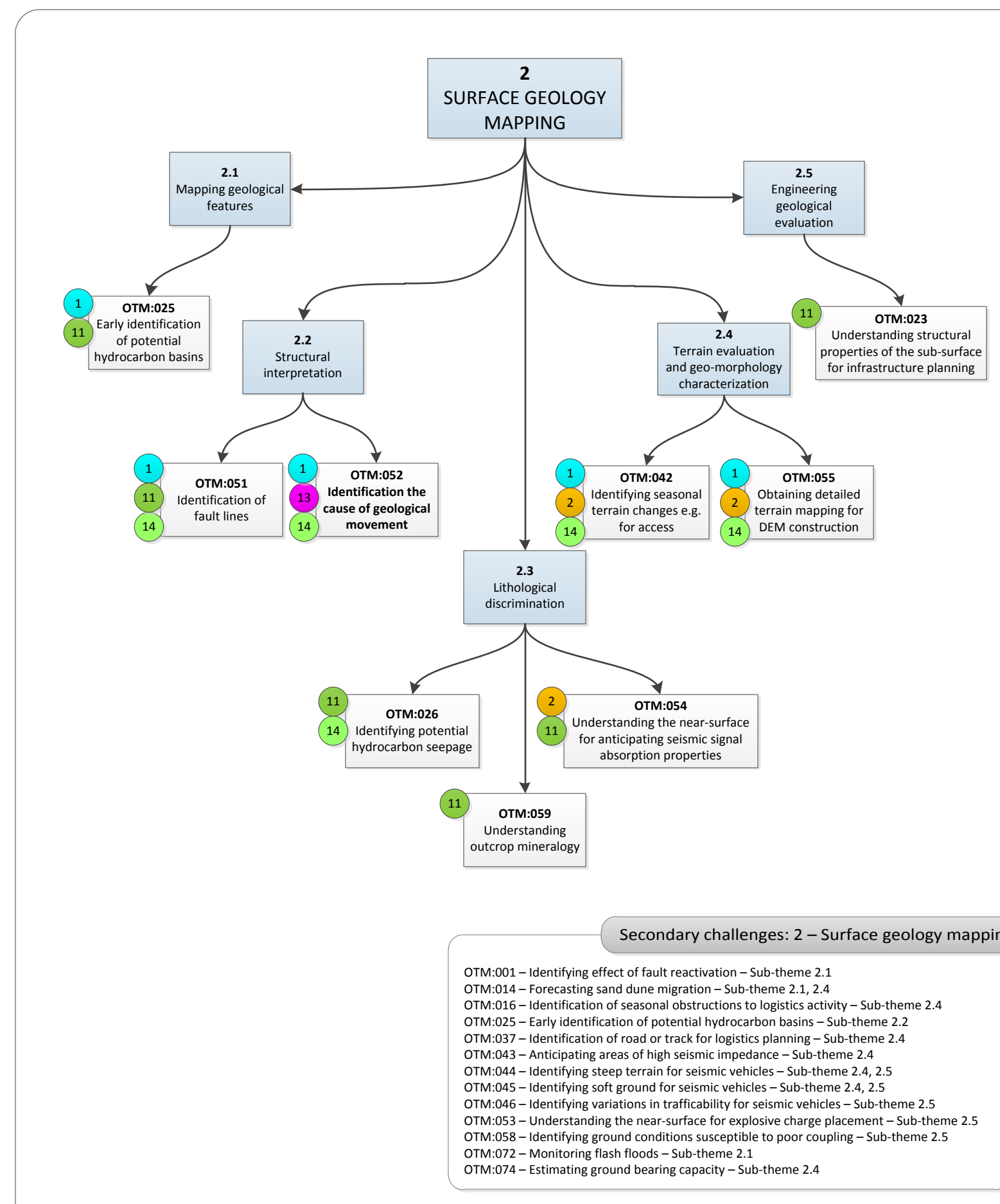
**KEY: Geo-information requirements**

- 1 Obtain detailed topographic characterisation
- 2 Obtain detailed terrain characterisation
- 3 Obtain detailed information about vegetation and flora
- 4 Obtain detailed land-use information
- 5 Identify location and condition of transport infrastructure
- 6 Identify inland water bodies and determining water quality
- 7 Determine air quality
- 8 Identify the presence and location of UXO
- 9 Obtain detailed imagery of assets
- 10 Identify fauna presence and patterns
- 11 Determine lithology, mineralogy and structural properties of the near surface
- 12 Identify the presence of sub-surface or covered infrastructure
- 13 Monitor ground movement (horizontal and vertical)
- 14 Obtain detailed imagery of the surface



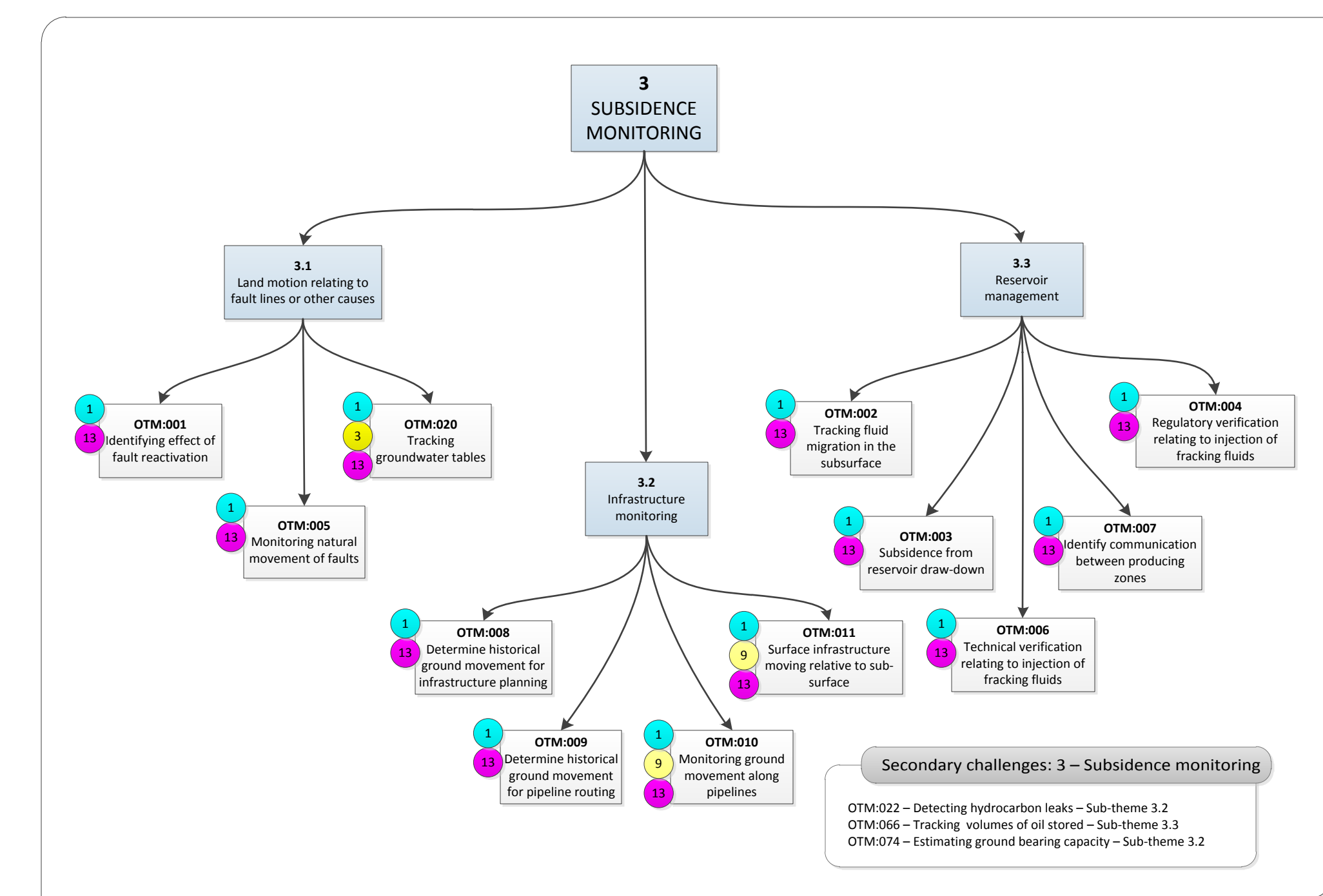
**Secondary challenges: 1 – Seismic planning**

- OTM-017 – Identification of seasonal environment changes e.g. migration patterns – Sub-theme 1.3
- OTM-037 – Identification of road or track for logistics planning – Sub-theme 1.2
- OTM-038 – Planning secondary surveys – Sub-theme 1.2
- OTM-050 – Identifying near surface infrastructure – Sub-theme 1.3
- OTM-055 – Obtaining detailed terrain mapping for DEM construction – Sub-theme 1.2
- OTM-079 – Identification of archaeological or burial sites – Sub-theme 1.3



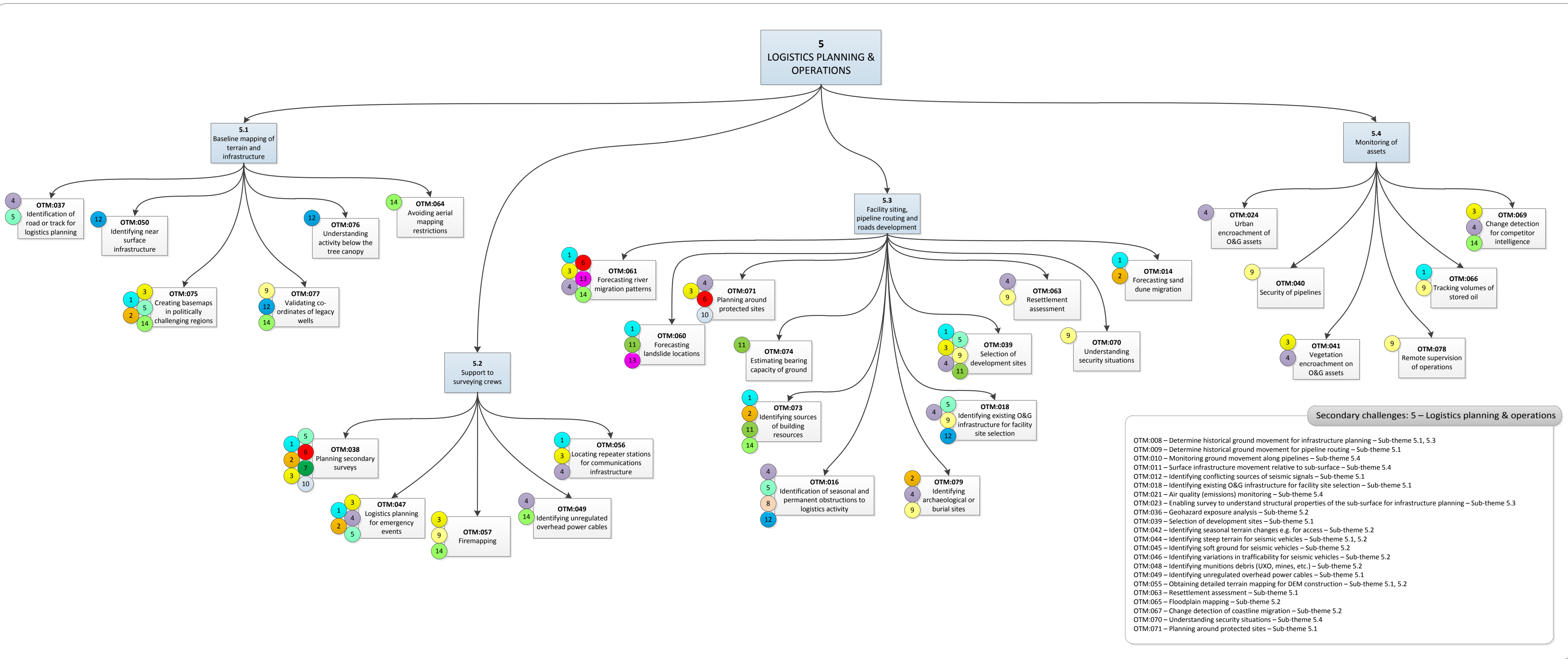
**Secondary challenges: 2 – Surface geology mapping**

- OTM-001 – Identifying effect of fault reactivation – Sub-theme 2.1
- OTM-014 – Forecasting sand dune migration – Sub-theme 2.1, 2.4
- OTM-016 – Identification of seasonal obstructions to logistics activity – Sub-theme 2.4
- OTM-025 – Early identification of potential hydrocarbon basins – Sub-theme 2.2
- OTM-037 – Identification of road or track for logistics planning – Sub-theme 2.4
- OTM-043 – Anticipating areas of high seismic impedance – Sub-theme 2.4
- OTM-044 – Identifying steep terrain for seismic vehicles – Sub-theme 2.4, 2.5
- OTM-045 – Identifying soft ground for seismic vehicles – Sub-theme 2.4, 2.5
- OTM-046 – Identifying variations in trafficability for seismic vehicles – Sub-theme 2.5
- OTM-053 – Understanding the near-surface for explosive charge placement – Sub-theme 2.5
- OTM-058 – Identifying ground conditions susceptible to poor coupling – Sub-theme 2.5
- OTM-072 – Monitoring flash floods – Sub-theme 2.1
- OTM-074 – Estimating ground bearing capacity – Sub-theme 2.4



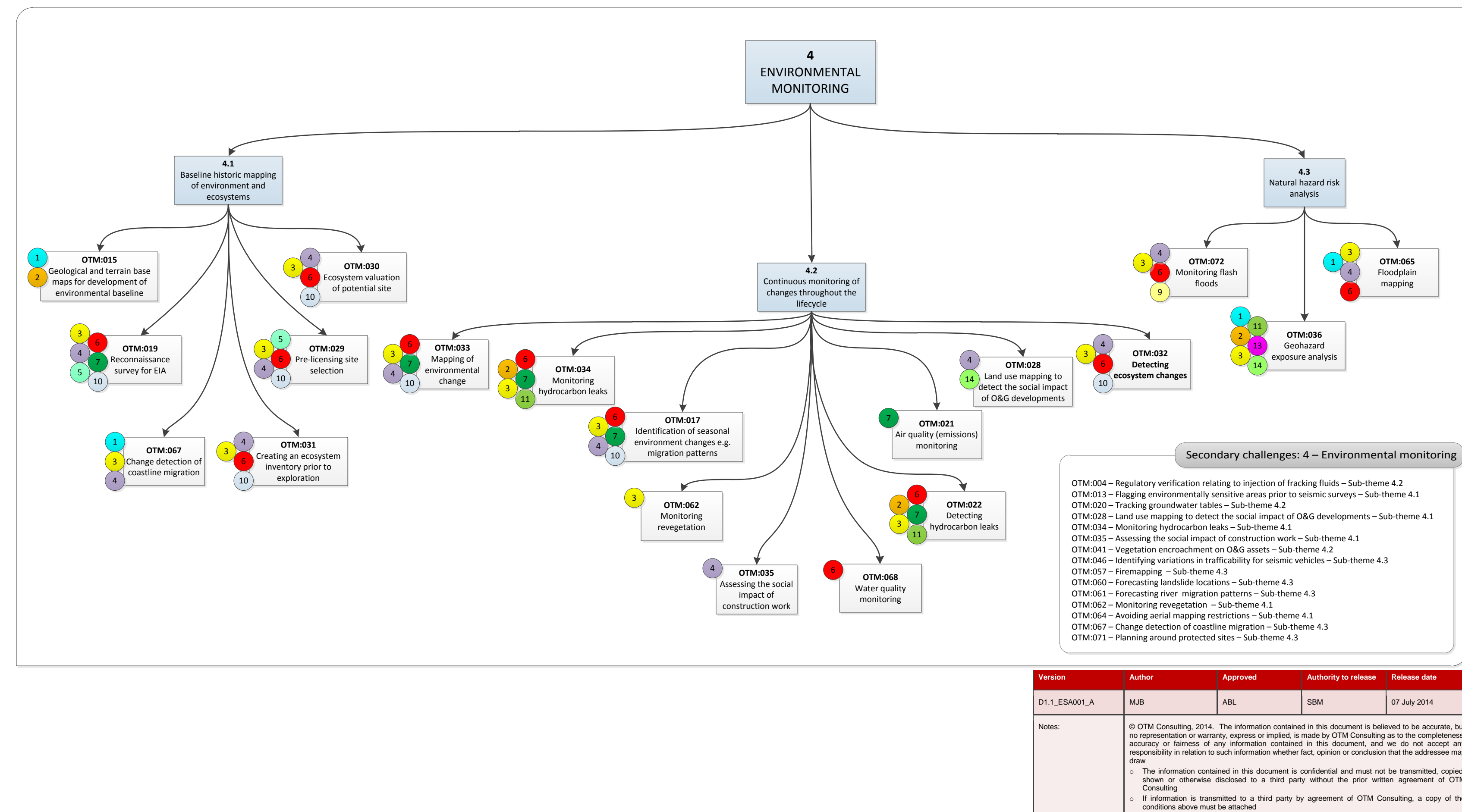
**Secondary challenges: 3 – Subsidence monitoring**

- OTM-022 – Detecting hydrocarbon leaks – Sub-theme 3.2
- OTM-066 – Tracking volumes of oil stored – Sub-theme 3.3
- OTM-074 – Estimating ground bearing capacity – Sub-theme 3.2



**Secondary challenges: 5 – Logistics planning & operations**

- OTM-008 – Determine historical ground movement for infrastructure planning – Sub-theme 5.1, 5.3
- OTM-009 – Determine historical ground movement for pipeline routing – Sub-theme 5.1
- OTM-010 – Monitoring ground movement along pipelines – Sub-theme 5.4
- OTM-011 – Surface infrastructure movement relative to sub-surface – Sub-theme 5.4
- OTM-012 – Identifying conflicting sources of seismic signals – Sub-theme 5.1
- OTM-018 – Identifying existing O&G infrastructure for facility site selection – Sub-theme 5.1
- OTM-021 – Air quality (emissions) monitoring – Sub-theme 5.4
- OTM-023 – Enabling survey to understand structural properties of the sub-surface for infrastructure planning – Sub-theme 5.3
- OTM-036 – Geohazard exposure analysis – Sub-theme 5.2
- OTM-039 – Selection of development sites – Sub-theme 5.1
- OTM-042 – Identifying seasonal terrain changes e.g. for access – Sub-theme 5.2
- OTM-044 – Identifying steep terrain for seismic vehicles – Sub-theme 5.1, 5.2
- OTM-045 – Identifying soft ground for seismic vehicles – Sub-theme 5.2
- OTM-046 – Identifying variations in trafficability for seismic vehicles – Sub-theme 5.2
- OTM-048 – Identifying munitions debris (UXO, mines, etc.) – Sub-theme 5.2
- OTM-049 – Identifying unregulated overhead power cables – Sub-theme 5.1
- OTM-055 – Obtaining detailed terrain mapping for DEM construction – Sub-theme 5.1, 5.2
- OTM-063 – Resettlement assessment – Sub-theme 5.1
- OTM-065 – Floodplain mapping – Sub-theme 5.2
- OTM-067 – Change detection of coastline migration – Sub-theme 5.2
- OTM-070 – Understanding security situations – Sub-theme 5.4
- OTM-071 – Planning around protected sites – Sub-theme 5.1



**Secondary challenges: 4 – Environmental monitoring**

- OTM-004 – Regulatory verification relating to injection of fracking fluids – Sub-theme 4.2
- OTM-013 – Flagging environmentally sensitive areas prior to seismic surveys – Sub-theme 4.1
- OTM-020 – Tracking groundwater tables – Sub-theme 4.2
- OTM-028 – Land use mapping to detect the social impact of O&G developments – Sub-theme 4.1
- OTM-034 – Monitoring hydrocarbon leaks – Sub-theme 4.1
- OTM-035 – Assessing the social impact of construction work – Sub-theme 4.1
- OTM-041 – Vegetation encroachment on O&G assets – Sub-theme 4.2
- OTM-046 – Identifying variations in trafficability for seismic vehicles – Sub-theme 4.3
- OTM-057 – Fingerprinting – Sub-theme 4.3
- OTM-060 – Forecasting landslide locations – Sub-theme 4.3
- OTM-061 – Forecasting river migration patterns – Sub-theme 4.3
- OTM-062 – Monitoring revegetation – Sub-theme 4.1
- OTM-064 – Avoiding aerial mapping restrictions – Sub-theme 4.1
- OTM-067 – Change detection of coastline migration – Sub-theme 4.3
- OTM-071 – Planning around protected sites – Sub-theme 4.3

Version	Author	Approved	Authority to release	Release date
D11_ESA001_A	MJB	ABL	SBM	07 July 2014

**Notes:**

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