



EUROPEAN UNION SATELLITE CENTRE

TENDER REFERENCE: SATCEN-OP-02/17

Framework Contract for the provision of Reference Mapping Products

Tender Reference: SATCEN-OP-02/17

Appendix A to Annex 1
“Technical Requirements for Production”



EUROPEAN UNION SATELLITE CENTRE

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REFERENCE DOCUMENTS

- REF 1. EU SatCen Procurement Manual. Available online: https://www.satcen.europa.eu/key_documents/20170111_SatCen_procurement-manual587c8545f9d71d157ce2254e.pdf
- REF 2. Council Decision 2014/401/CFSP of 26 June 2014 on the European Union Satellite Centre and repealing Joint Action 2001/555/CFSP on the establishment of a European Union Satellite Centre. Available online: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014D0401>
- REF 3. Commission Delegated Regulation (EU) No 1268/2012 of 29 October 2012 on the rules of application of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council on the financial rules applicable to the general budget of the Union. Available online: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012R1268>
- REF 4. ISO/IEC 15288:2008 Systems and software engineering – System life cycle processes (Only available in English), 2nd Edition, 2008-02-01.
- REF 5. Regulation (EU, EURATOM) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002. Available online: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32012R0966>
- REF 6. Internet Engineering Task Force (IETF) – Request For Comments (RFC) 2119. Available online: <https://www.ietf.org/rfc/rfc2119.txt>

1. OVERVIEW

The present technical specifications document is attached to the Tender Specifications of the Invitation to Tender reference SATCEN-OP-02/17. The document provides to the tenderers further information on the technical elements required.

2. INTRODUCTION

This document aims at providing a detailed description of the products to be procured, along with the technical specifications and standards that they have to adhere. The procured products will **support the provision of Reference Mapping Service** included in the framework of the Service Level Agreement (SLA) signed between the EU SatCen and Frontex.

The products to be elaborated will be used as background of geographical context and representation of EU external border areas, including hydrography, topography, land cover, infrastructure and population relevant data. The updated geographic information is foreseen to be used for awareness purposes, in order to: i) improve the knowledge over certain Areas Of Interest (AOI) and ii) support other Services included in the SLA signed between the EU SatCen and Frontex.

The Box below provides an overview of the Tender and the technical baseline:

BOX 1 - Tender Overview (I)
<p>What is procured?</p> <p>The Contractor must produce High Resolution Vector Data (HRVD), following the Data Dictionary (DD) described in this document. For the sake of simplicity, we refer to the DD as Reference Mapping Data Dictionary (RMDD). RMDD is defined in Section 7 of this document. <u>Two types of Reference Mapping Products</u> are needed to be procured: i) Full Reference Mapping Product and, ii) Reduced Reference Mapping Product.</p>
<p>Which is the purpose of the Tender?</p> <p>Support the provision of Reference Mapping Products, which is delivered in the framework of the Service Level Agreement (SLA) signed between the EU SatCen and Frontex.</p>
<p>What means Reference Mapping? What is its purpose?</p> <p>Elaboration of products will provide a background of geographical context integrating High Resolution Vector Data (HRVD), based on the vectorisation of pre-defined features of interest derived from optical satellite imagery. The detailed list of Feature Classes to be included in the HRVD is provided in this document (see complete list in 'Annex I: Extraction Criteria Table').</p>
<p>What is the Reference Mapping Data Dictionary (RMDD)?</p> <p>The RMDD is an adapted version of the Multinational Geospatial Co-production Program (MGCP) standards and its Extraction Guidance TRD4 v4.0. It encompasses 197 Feature Classes from the MGCP plus 7 additional Feature Classes. Some adaptations relevant with the scale, density of extraction, geometry and accuracy were made to properly fit the needs of the current Contract. In this line, this document identifies some exceptions and defines specific delineation and attribution requirements for area, line and point geometry. Full Reference Mapping Products make full use of the RMDD, while the elaboration of the Reduced Reference Mapping Products only utilizes a subset of it.</p>

BOX 1 - Tender Overview (II)**Which are the minimum requirements?**

The following requirements must be fulfilled by the Contractor, which are integrated in the next Sections:

Minimum Requirement	Corresponding Section
ES: Extraction Source	Section 3
ME: Methodology	Section 4
PP: Production Process	Section 5
QC: Quality Control	Section 6
RM: Reference Mapping	Section 7
SC: Scale Considerations	Section 8
EC: Extraction Criteria	Section 9
TO: Topology	Section 10
DE: Delivery	Section 11

What is the minimum data quality?

The Contractor shall perform quality control of the products (following ISO 19157) before delivering them to SatCen and attach a Quality Report, which should include details on the methodology used and the results (more information in Section 6).

I have more questions. Where can I find answers?

If by reading this document you are still unsure about the specifications or any other procurement detail, then send your questions to procurement_satcen@satcen.europa.eu, according to the instructions provided in the Invitation to Tender.

2.1. KEY WORDS

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119¹:

MUST: This word, or the terms "**REQUIRED**" or "**SHALL**", mean that the definition is an absolute requirement of the specification.

MUST NOT: This phrase, or the phrase "**SHALL NOT**", mean that the definition is an absolute prohibition of the specification.

SHOULD: This word, or the adjective "**RECOMMENDED**", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

SHOULD NOT: This phrase, or the phrase "**NOT RECOMMENDED**" mean that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.

¹ RFC 2119: Key words for use in Requests for Comments (RFCs) to Indicate Requirement Level are available at: <http://www.rfc-base.org/rfc-2119.html>

MAY: This word, or the adjective "**OPTIONAL**", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option **MUST** be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation that does include a particular option **MUST** be prepared to interoperate with another implementation, which does not include the option (except, of course, for the feature the option provides).

3. EXTRACTION SOURCE, COLLATERAL DATA AND LANGUAGE

ES. 1 The Contractor must provide **High Resolution Vector Data (HRVD)** derived from the digitisation of satellite imagery (to be provided by the EU SatCen to the Contractor).

An indicative description of the satellite imagery to be used for extraction is given in the next Table:

Type of imagery	Optical satellite Imagery
Spatial Resolution	Very High Resolution, depending on availability but typically with Ground Sampling Distance between 0,5-1 m
Processing mode	Orthorectified
Number of bands	At least 3 bands, corresponding to the Red-Green-Blue, in order to enable an optical true-colour representation

Table 1. Indicative description of satellite imagery to be provided for the digitization

ES. 2 In addition to the main extraction source, the Contractor should use **collateral data** sources to obtain vector's geometry or ancillary information to complete the attribute table (i.e. Google Earth, OpenStreetMap, topographic maps, Digital Elevation Models, OpenRailwayMap, Mapcarta, Wikimapia, etc.).

The following Table provides a non-exhaustive and indicative list of collateral data sources:

Source	Comment
Google Maps, Google Earth	Populated places, neighbourhoods, land use, facilities, reference buildings, street names, geotagged photographs (through Panoramio), etc.
Bing Satellite Maps	Populated places, neighbourhoods, land use, facilities, reference buildings, street names, etc.
OpenStreetMap, OpenRailwayMap, Wikimapia	Names, reference building, etc.
SRTM, ASTER	These sources can be considered to create the elevation contour data
Other Open Sources	Official Open Sources: National Cadastral databases, National Cartography, etc. Others: DTED, OpenDEM, HERE Maps, Navteq, Teletlas, GMTED2010, WorldDEM, Elevation10, geonames, etc.

Table 2. Indicative list of collateral data sources

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- ES. 3 The Contractor must always indicate the **extraction source** (satellite imagery, DEM derived, administrative boundary, etc.) in the relevant feature attribute named “*Source_Description*”. E.g. WorldView-3, Pléiades-1A, GADM, SRTM, etc.
- ES. 4 The **extraction type** must be indicated in the attribute named “*Source_Type*”. E.g. Very High Resolution Commercial Monoscopic Imagery, International Boundaries, etc.
- ES. 5 All features must also have the “*Source_Date*” attribute filled out with the **date of the main source** (satellite imagery, DEM, administrative boundary, etc.) used. E.g. DD/MM/YYYY – 16/05/2017.
- ES. 6 Should collateral data be used from Open Sources as a complementary input of the main source of information (satellite imagery, DEM, administrative boundary, etc.), the **source of the collateral data used** must be included in the field “*IA_Comment*”. E.g. Google Earth, OSM, etc.
- ES. 7 In all cases, the Contractor must ensure **proper update of the collateral sources** according to the condition depicted in the satellite imagery.
- ES. 8 **Attribute tables must be filled in English** and the first letter must be capitalized. Whenever collateral sources are used to obtain attributes (e.g. names of cities, streets, etc.), which appear in a language other than English, the Contractor must ensure that the attributes of all features are also delivered in English (i.e. using Latin alphabet; transliteration).
- ES. 9 All features must have an **appropriate identifier** of the AOI in the field named “*Named_Feature_Identifier*” to be provided by EU SatCen. E.g. DZA 003.

4. METHODOLOGY, BEST PRACTICES AND STANDARDS

- ME 1. The Contractor shall perform in accordance with technical norms, **standards and procedures based on the best professional practice**. The following referenced documents are essential for the application of this Contract. The latest edition of the referenced documents (including any amendments) applies:
- MGCP Extraction Guidance TRD4 v4.0 20121231
 - ISO 19157 Geographic information - Data quality
 - “Appendix A to Annex 1. Technical Requirements for Production”, in particular ‘Annex I: Extraction Criteria Table’

5. PRODUCTION PROCESS

- PP 1. The Contractor must provide a description of the production workflow, starting from the production request and finishing with the provision of the procured products.
- PP 2. All the intermediate steps, including quality control procedures and information fusion, must be described and reported.
- PP 3. In addition, the Contractor must provide a **description of the methodology** to be followed for the feature extraction process (e.g. extraction grid size, production hierarchy, use of in-house software or equipment, etc.).

6. QUALITY CONTROL

- QC 1. The Contractor must perform **data quality control procedures before delivering the .gdb, based on ISO 19157**. A quality data report must be provided jointly with the intermediate and final product delivery.
- QC 2. The Contractor must clearly indicate:
- Quality report structure
 - Sampling size and sampling strategy for assessing the data quality measures defined in this document (i.e. Annex III), possibly including additional ones which might be regarded relevant by the Contractor
 - Test software tools used for evaluating the quality
- QC 3. Upon delivery of the final product, and as a minimum requirement, the contractor must report on the values of **data quality measures**, including the methodology to estimate them. The values of the data quality measures must reach the minimum data quality requirements described in Annex III of this document.
- QC 4. In order to ensure high quality standards, the Contractor shall include additional data quality measures or even commit to reach higher data quality thresholds.

7. REFERENCE MAPPING DATA DICTIONARY (RMDD)

- RM 1. The production of High Resolution Vector Data must comply with the Reference Mapping Data Dictionary (RMDD), taking into account that **there are two different product types**, which can be requested by the SatCen to the Contractor: i) the Full Reference Mapping and, ii) the Reduced Reference Mapping.
- RM 2. The **RMDD encompasses 197 Feature Classes from the MGCP**, plus 7 additional Feature Classes (listed in Annex I) that are not included in MGCP Extraction Guidance. To elaborate the Full Reference Mapping Product all the Feature Classes of the RMDD must be taken into consideration, meanwhile to develop the Reduced Reference Mapping Product a subset of the RMDD needs to be extracted, as listed in Annex I of this document.

The next Figure shows schematically the creation of RMDD as a subset of MGCP with the distinction of the two product types and the inclusion of additional Feature Classes.

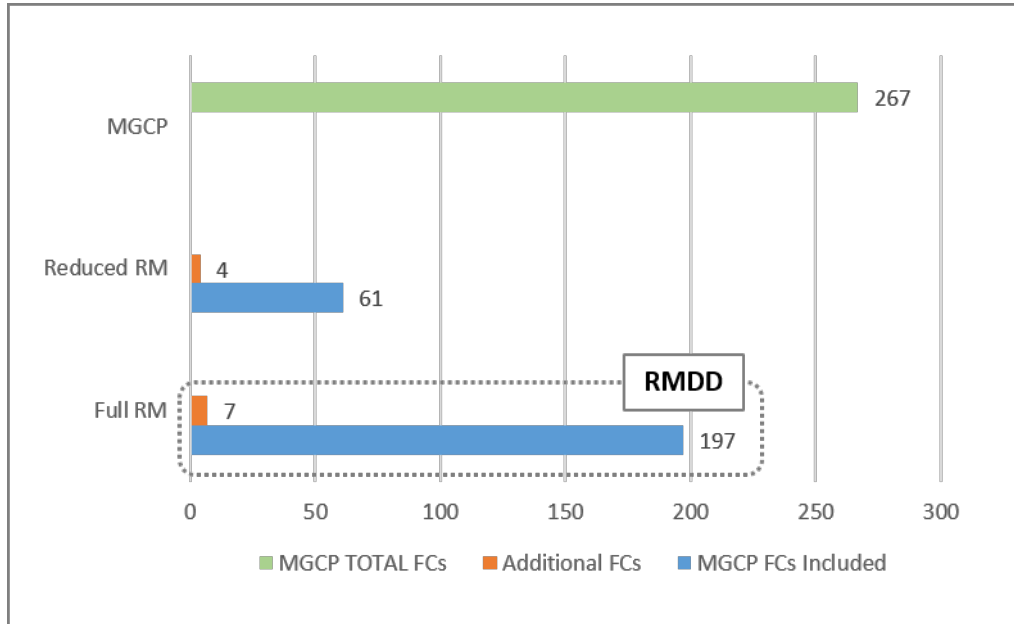


Figure 1. Scheme of the connection between RMDD and MGCP, differentiating the two types of Reference Mapping (RM) Products included in this Tender

- RM 3. The **DGIWG² Feature Data Dictionary (DFDD) code is used for reference**. The Contractor must deliver the Geodatabase using the DFDD code and adding an “A”, “L”, or “P” character in the beginning of the naming convention according to the geometry (Area, Line or Point accordingly). For example, the feature AA010-Extraction Mine can be delivered as PAA010 in case of Point geometry and/or as AAA010 in case of Area geometry.
- RM 4. ‘Annex I: Extraction Criteria Table’ of this document provides a complete list of the Feature Classes to be extracted and included in the RMDD per each product type.

8. SCALE CONSIDERATIONS

The main purpose of the MGCP is to produce vector geospatial information at 1:50,000 scale of the whole world. In the framework of the MGCP, relevant and fixed thresholds were determined to define the minimum feature size and density for extraction and mapping.

- SC 1. The required density, geometry and accuracy of the features to be extracted in this Contract are tailored to the purpose of supporting the provision of Reference Mapping Products. As a result, features must fit a cartographic representation of **1:5,000** scale, and in some specific cases, the extraction scale can be **1:25,000**.

The Feature Classes (FC) are grouped into thematic categories to assist the Contractor during the extraction process. The following **thematic categories** are foreseen:

² DGIWG: Defence Geospatial Information Working Group

- Airports & Airfields
- Barriers
- Geography
- Industry
- Land Cover
- Lines of Communication & Associated Features
- Population (structures, areas & others)
- Ports, Harbours & Coastal Features
- Waterways
- Other features

SC 2. 'Annex I: Extraction Criteria Table' is organised according to the aforementioned thematic categories and must be compulsory used during the extraction process as a **guideline**.

9. EXTRACTION CRITERIA

The extraction criteria are adapted to fit the needs of the provision of Reference Mapping Products, based on the digitisation of satellite imagery (to be provided by the EU SatCen to the Contractor) and complemented with collateral data, if necessary.

- EC 1. Generally, the **vector extraction criteria** for the production of the High Resolution Vector Data (HRVD) must be done at 1:5,000 scale and in some particular cases at 1:25,000. Notwithstanding, specific requirements and related extraction criteria must be applied, as explained in Sections 9.1, 9.2, 9.3 and 9.4.
- EC 2. All the features must be **topologically corrected**.
- EC 3. **All polygons must be completely closed**.
- EC 4. The Landcover Area Features (LAFs) must compose a contiguous 100% land cover (gaps and sliver polygons are not permitted).
- EC 5. The lines must be properly connected, considering that any vector length must be captured to complete the component or establish network connectivity, or to connect BUAs or groups of buildings to the road network.
- EC 6. Attributes referring to length, width, and height must be measured and populated in real metres.
- EC 7. **Feature geometry must represent the reality**. Generally, features such as buildings, some types of sports grounds, etc. must portray an orthogonal geometry.
- EC 8. In addition, and especially for buildings, vectors must be captured at their projected ground level. This criterion must be especially taken into consideration as orthogonal geometry cannot be always perceived on the image due to image acquisition factors (i.e. acquisition angle).
- EC 9. The National Border Lines must be integrated using the feature *FA000 - Administrative Boundary* (as Line). This feature must be always extracted and included in the .gdb.

- EC 10. *ZD040 - Named Location* (as Point) must be used to collect local administrative names (districts, neighbourhoods, municipalities, etc.). This feature must be always extracted and included in the .gdb.
- EC 11. *CA010 - Elevation Contour* (as Line) should be extracted approximately every 20 m, Bathymetry to be included, if applicable. This feature must be always extracted and included in the .gdb.
- EC 12. 'Annex I: Extraction Criteria Table' specifies the required features by thematic areas, mandatory attributes and a summary of the mapping criteria to facilitate the Contractor the extraction works.
- EC 13. The extraction of all the features must be done with the same objective criteria along the AOI. Most of these criteria are included or referenced in this document. The Reference Mapping Products must provide a real and homogenous "look and feel". The Contractor should explain, if applicable, how it would deal with different production teams and the differences of criteria between different analysts over the same AOI.

9.1. FEATURE EXTRACTION

- EC 14. As a general rule, the minimum **Area** defined in the MGCP Extraction Guidance TRD4.0 for 1:50,000 scale with $\geq 15,625$ sqm must be transferred to **$\geq 1,500$ sqm** for the scope of 1:5,000 digitalisation scale, with a width of 10 m.
- EC 15. General rule for **Line** extraction is to capture any it with a **length ≥ 50 m**.
- EC 16. Exceptions to the general rule are described in 'Annex I: Extraction Criteria Table', which must be applied.

9.2. EXTRACTION CRITERIA FOR COASTAL AREAS

- EC 17. Special extraction requirements must be applied for features included in (or overlapping with) a **coastal buffer zone of 500 meters, which prevail over the extraction criteria** described within 9.1, 9.3 and 9.4. The feature BA010 (Coastline) must be used for the definition of the coastal buffer.
- EC 18. All the Area geometry features included in the thematic categories of Airports & Airfields; Industry; Population; Ports, Harbours & Coastal features must be extracted as A, independently of the Mandatory Extraction Criteria of 'Annex I: Extraction Criteria Table'.

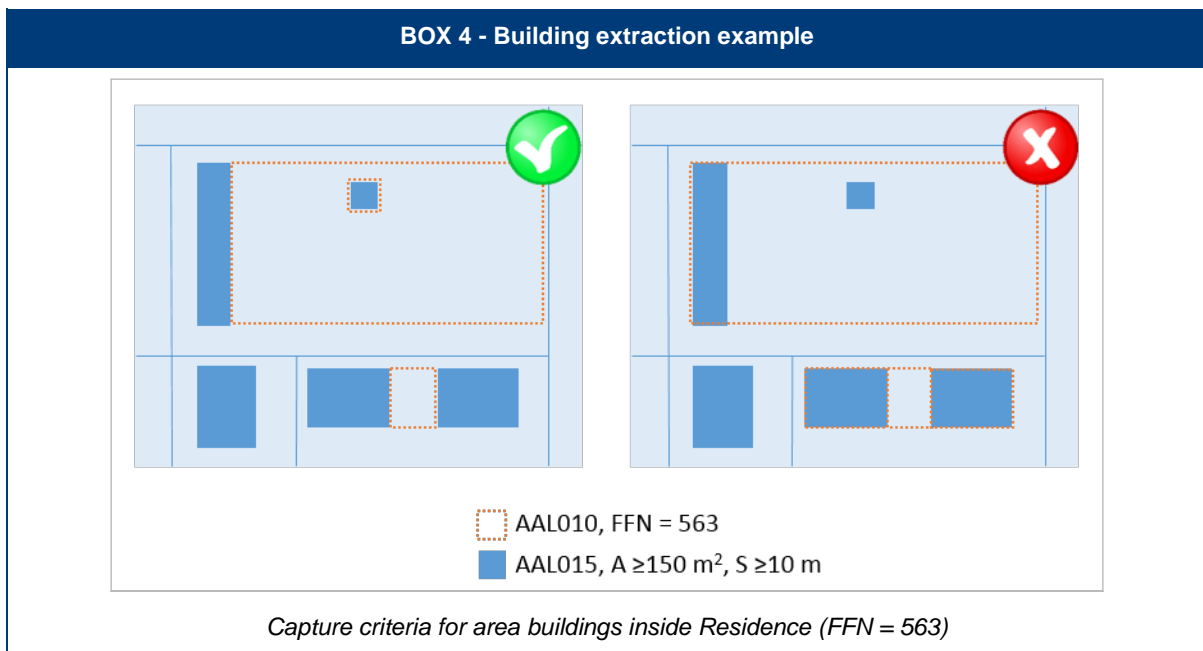
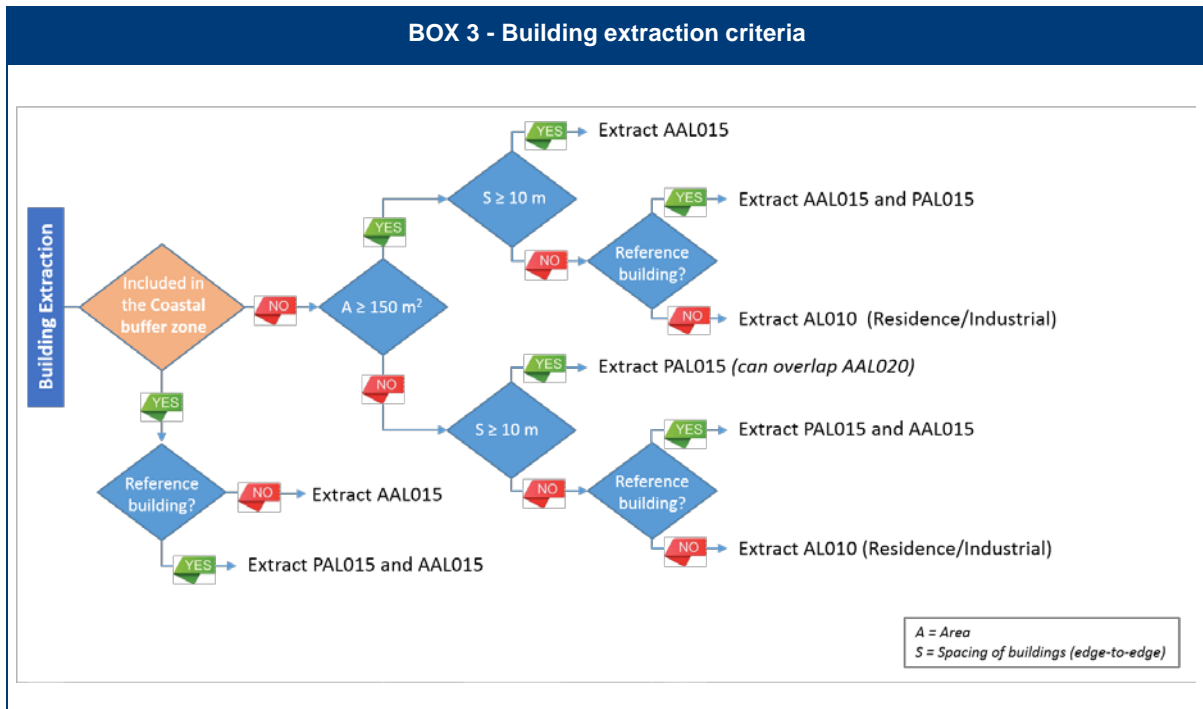
9.3. EXTRACTION CRITERIA FOR BUILDINGS

- EC 19. A **Building** must be digitized as a polygon if the area is **≥ 150 sqm**, if not as a point. This rule should not be followed with the special conditions mentioned in 9.2 apply (extraction of coastal areas).
- EC 20. Special effort is required in the extraction of **AL015 (Building)**. The following categories of buildings are regarded as reference buildings and must be digitized as both **Area and Point**:

- Administrative buildings: town hall, local administration, airport, etc.
- Correctional buildings: prison, etc.
- Diplomacy: embassy, consulate, international delegation (i.e. United Nations)
- Educational buildings: school, higher education, scientific research and development, library and universities, etc.
- Governmental buildings: ministry, presidential palace, government court, judicial activity, etc.
- Medical buildings: hospitals, in-patient care, medical centre, etc.
- Public accommodation: hotel, motel, hostel, touristic apartment, etc.
- Religious/Places of Worship: church, mosque, synagogue, pagoda, stupa, etc.
- Refuelling station or Petrol Station.
- Security-related buildings: police station, firefighting, military buildings (headquarter, barrack), emergency (civil protection), etc.
- Telecommunications and Satellite Ground Control buildings: TV/radio broadcasting, satellite emission/reception, etc.
- Transportation buildings: passenger terminal for different transportation means (bus, train, airplane, maritime, etc.).

EC 21. The following **exceptions** must be taken into consideration:

- PAL015 can overlap the AAL020 feature where the previous referred general extraction criteria are met.
- Reference buildings (previously listed) with an area ≤ 150 sqm must always be captured as point and polygon, and can overlap all facility functions, including residential and industrial facilities.
- When a building meets the criteria to be captured individually and it is located inside a facility polygon with a defined Feature Function (FFN) = 563-Residence; 99-Industrial-Manufacturing; 350-Industrial-Utilities, the area building cannot overlap the facility feature. On the contrary, buildings inside facilities different from [FFN]: 563, 99, or 350, can overlap the facility feature.



9.4. LINES OF COMMUNICATION & ASSOCIATED FEATURES EXTRACTION CRITERIA

EC 22. Regarding **roads in populated areas** with central reservation, the extraction must be done using two vectors, one per driving direction. If no central reservation exists, it must be captured as one vector.

EC 23. Also, in the case of transportation features (LAP010/LAP030/LAP050), any length needed to complete the connectivity of the network must be captured.

10. TOPOLOGY

- TO 1. Regarding topological rules, all the features must be topologically corrected according to the MGCP TRD4 v4.0 and the MGCP Semantic Information Model (SIM).
- TO 2. All polygons must be completely closed, and with no overlap between elements of the same Feature Class.
- TO 3. Minimum mandatory topology rules to be applied in the validation of the products are provided in the following Table. The EU SatCen reserves the right to add or modify the topology rules that considers necessary to verify the application of the technical requirements.
- TO 4. Additional topology rules must be considered by the Contractor to improve the quality of the final product.

Feature Geometry Type	Rule	Notes
AREA	Must Not Overlap	Requires that the interior of polygons in the Feature Class not overlap at the same scale. The polygons can share edges or vertices
	Must Not Have Gaps	No voids within a single polygon or between adjacent polygons. All polygons must form a continuous surface. Guarantee full land cover
	Must Not Overlap With	Guarantee that each point is covered by a single polygon, simplifying the vectors visualization over the reference image (annotated satellite images)
LINE	Must Not Have Dangles	Requires that a line feature must touch lines from the same Feature Class at both endpoints
	Must Not overlap	Requires that lines not overlap with lines in the same Feature Class. This rule is used where line segments should not be duplicated; for example, in a stream Feature Class. Lines can cross or intersect but cannot share segments
	Must Be Covered by Feature Class Of	A line from one layer must coincide with the lines from another layer
POINT	Must Not Have Pseudo-nodes	The rule exception is when two segments of the same feature have different attribution
	Must Be Properly Inside	No points were captured outside the corresponding areas. This is important specifically for Reference Buildings (captured both as Polygons and Points).

Table 3. General topology rules that must be applied

11. DELIVERY

- DE 1. The High Resolution Vector Data must be provided in ESRI Geodatabase (.gdb) format, a proprietary database structure used in ESRI GIS platform. The .gdb file is a container to hold the feature datasets and associated tables that are related to each other. The Geodatabase must be compliant with version 10.3.1.

- DE 2. Feature nomenclature: indicate the feature code and the feature name.
- E.g. Name: PAL020, Alias: PAL020-Built-Up Area
Name: PZD040, Alias: PZD040-Named Location
- DE 3. Empty features must be deleted for the delivery of both intermediate and final .gdb.
- DE 4. The High Resolution Vector Data must be provided in both Universal Transverse Mercator (UTM) using WGS84 for the Datum with the corresponding Zone and WGS84 Web Mercator (Auxiliary Sphere) (EPSG: 3857) for the intermediate and final delivery. It should be highlighted that the EU SatCen retains the right to alter the geodetic reference system, according to its needs during the duration of the Contract.
- DE 5. The delivery of the final .gdb must be under a FTP to be provided by the Contractor. The FTP server must have a directory structure named after the Service Request with a number of sub-directories for each of the requested deliveries. In addition, the delivery of the final .gdb must follow this naming convention: SATCEN_ServiceRequestNumber_AOIName_Projection_DeliveryDate.gdb.
Example: "SATCEN_RM15_Algeria_UTM31N_20170829.gdb"
- DE 6. Jointly with the delivery of both intermediate and final .gdb the Contractor must attach the following:
- **Topology report**, including the topological rules, errors and exceptions applied to the .gdb.
 - **Geometry report**, including geometry checks.
 - **Feature Classes extracted**, in a list format, including the number of items for each Feature Class.
 - **MXD** structured in thematic categories, images used in the vectorisation, plus appropriate symbology.
 - **Quality Report** (see Section 6 and Annex III of this document).
- DE 7. For the **intermediate delivery, only cells completed at 100% will be delivered**. The quality verification must to be done before delivering this intermediate .gdb.
- DE 8. **Progress Reports must be delivered weekly** (see "Annex 1. Tender Specifications"), delivery date to be specified by SatCen after the Contract award.
- DE 9. **If satellite image mosaicking is required**, the Contractor should deliver jointly with the final version of the gdb, and must comply with the following characteristics:
- Georeferenced image in Earth geometry, corrected from off-nadir acquisition and terrain effects.
 - Coregistered, orthorectified and projected (in the corresponding UTM Zone and Web Mercator).
 - Product encoding: 12 bits for JPEG 2000 format or 16 bits for GeoTIFF format
 - Seamlines created according to specific features in image geometry (mainly roads, rivers), including radiometric adjustments (colour stretching, contrast enhancement, etc.).

Annex I. *Extraction Criteria Table*

The following Table shows the required features to be integrated in the High Resolution Vector Data (HRVD), which are divided by 'Thematic Category'. The 'Feature Code' and the 'Feature Name' are also included, jointly with the 'Mandatory Attribute Code' and 'Mandatory Attribute Name'.

As described in previous Sections of this document, as a general rule the extraction scale must be done at 1:5,000 scale and in some particular cases at 1:25,000. The 'Extraction scale' is indicated in blue for each feature geometry type (Area, Line and/or Point) and per feature.

The features to be extracted per product (Full Reference Mapping Product and Reduced Reference Mapping Product) are indicated in the last 2 columns of the Table.

It is necessary to underline that additional Feature Classes listed in the next Table are not part of MGCP Extraction Guidance TRD4 v4.0. These Feature Classes are highlighted in bold, which definition is included in Annex II.



Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
Airports & Airfields	GB005	Airport	CAA	Controlling Authority	■						All required	All required
			COD	Delineation								
			FPT	Airfield Type								
			FUN	Status								
			NAM	Name								
			IKO	ICAO								
	ZVA	Elevation										
	GB015	Apron	FUN	Status	■						All required	N/A
			RST	Surface Type								
	GB030	Helipad	FUN	Status	■		■				All required	All required
			RST	Surface Type								
	GB035	Heliport	CAA	Controlling Authority	■						All required	All required
			NAM	Name								
			FUN	Status								
			IKO	ICAO								
GB045	Overrun Stopway	FUN	Status	■						All required	N/A	
		RST	Surface Type									
GB055	Runway	AOO	Orientation Angle	■						All required	N/A	
		FUN	Status									
		LEN	Length									
		RST	Surface Type									
GB065	Water Aerodrome	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	N/A	
		IKO	ICAO									
GB075	Taxiway	FUN	Status	■						All required	N/A	
		RST	Surface Type									
GB230	Aircraft Hangar	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	N/A	
Barriers	AL070	Fence	FUN	Status	■	■				Length ≥ 50 m	All required (only in Checkpoint area and along the border line)	
			WID	Width								
	AL260	Wall	FUN	Status	■	■				Length ≥ 50 m	All required (only in Checkpoint and along the border line)	
			WID	Width								
	EA020	Hedgerow	WID	Width	■	■				Length ≥ 50 m	N/A	
GB050	Revetment ³	WID	Width	■	■				Length ≥ 50 m, otherwise as Point	N/A		

³ Please consider not only a barricade that protects an aircraft or fighting vehicle (military asset), but also an equipment (for example, radar station), and/or facility (for example surface-to-air missile site) from hostile action.

Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping	
					1:5K			1:25K					
					A	L	P	A	L	P			
Geography	AA050	Well	FUN	Status							All required	N/A	
	BA030	Island	NAM	Name							Area ≥ 1500 sqm	N/A	
	BE020	Depth Spot Elevation	ZVA	Elevation							All required	N/A	
	BH090	Land Subject to Inundation	AZC	Man-made							Area ≥ 1500 sqm	All required	
	BH155	Salt Evaporator	AZC	Man-made							Area ≥ 1500 sqm	N/A	
	BH170	Natural Pool	HYP	Hydrologic Persistence								All required	All required
			SWT	Pool Type									
	CA010	Elevation Contour	CRV	Contour Value								Always (the preferable step per contour depends on the local topography; approx. every 20 m). Bathymetry to be included, if applicable	Always (the preferable step per contour depends on the local topography; approx. every 20 m). Bathymetry to be included, if applicable
			HQC ⁴	Portrayal									
	CA030	Spot Elevation	ZVA ⁵	Elevation								All required	N/A
DB010	Cliff	NAM	Name								Line ≥ 50 m	N/A	
DB160	Rock Formation	NAM	Name								All required	N/A	
EC020	Oasis	NAM	Name								All required	N/A	
Industry	AC000	Processing Facility	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A	
			NAM	Name									
	AC030	Pond	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A	
	AD010	Power Station	FUN	Status								Area ≥ 1500 sqm, otherwise as Point	N/A
			NAM	Name									
			PPC	Power Station Type									
	AD030	Power Substation	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A	
	AF020	Conveyor	FUN	Status							Length ≥ 50 m	N/A	
	AJ051	Wind Turbine	FUN	Status							All required	N/A	
	AJ110	Greenhouse	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A	
AM010	Storage Area	LOC	Location							Area ≥ 1500 sqm	N/A		
AM020	Grain Storage Silo	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A		
AM060	Surface Bunker	PPO	Product							Area ≥ 1500 sqm, otherwise as Point	N/A		

⁴ HQC: 1-Master Contour, 2-Intermediate Contour, 5-Depression Master Contour, 6-Depression Intermediate Contour and 16-Auxiliary Contour.

⁵ Spot Elevation is a designated location with an elevation value relative to a vertical datum. ZVA = the vertical distance above Mean Sea Level (MSL) of the highest point of the landing area.

Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
Industry	AM070	Storage Tank	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	N/A
			LOC	Location								
			PPO	Product								
			SSC	Structure Shape								
	AQ113	Pipeline	FUN	Status	■	■					Length ≥ 50 m	N/A
			LOC	Location								
			PPO	Product								
			RTA	Linear Arrangement								
	AQ116	Pumping Station Facility	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	N/A
	AT030	Power Line	FUN	Status		■					Length ≥ 50 m	N/A
	AT042	Pylon	CAB	Cable Type			■				All required	N/A
	AT045	Radar Station	FUN	Status			■				All required	N/A
	AT050	Communication Station	FUN	Status	■						All required	N/A
	BH011	Intake/Discharge Facility	-	-			■				All required	N/A
BH040	Water Treatment Bed	FUN	Status	■						Area ≥ 1500 sqm	N/A	
BH050	Mariculture Site	FUN	Status	■						Area ≥ 1500 sqm	N/A	
BH051	Fish Farm Facility	FUN	Status	■						Area ≥ 1500 sqm	N/A	
DB090	Embankment	FIC	Embankment Type	■	■					Area ≥ 1500 sqm, otherwise as Line	N/A	
		TRS	Transportation System									
SU001	Military Installation	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	N/A	
		NAM	Name									
Land Cover	AA010	Extraction Mine	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	All required (as Area)
			MZN	Mine Type								
	AA012	Quarry	FUN	Status	■		■				Area ≥ 1500 sqm, otherwise as Point	All required (as Area)
	AL020	Built-Up Area	BAC	Density Category	■		■				Area ≥ 1500 sqm, otherwise as Point	All required (as Area)
			FUC	Functional Use								
			ORD	Relative Importance ⁶ (only for Point)								
			FUN	Status								
NAM	Name											
BA040	Ocean Sea	NAM	Name	■						All required	All required	

⁶ *Unknown*: The attribute value is unknown; *First*: Primary or first order. For a country is the Capital; *Second*: secondary or second order. For a country is a City; *Third*: Tertiary or third order. For a country is a Town; *Fourth*: Quaternary or fourth order. For a country is Village; *Fifth*: Quintary or fifth order. For a country is a Hamlet/Encampment; and *Other*: The attribute value is known, but is not currently a valid member of the attribute range.

Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping	
					1:5K			1:25K					
					A	L	P	A	L	P			
Land Cover	BH010	Aqueduct	FUN	Status							Area ≥ 6000 sqm, otherwise as Line if ≥ 50 m, or otherwise as Point	All required (as Area)	
	BH015	Bog	BOC	Bog Type							Area ≥ 6000 sqm	All required	
	BH020	Canal	FUN	Status							Area if Width ≥ 10 m and Length ≥ 50 m, otherwise as Line	All required (as Area)	
	BH030	Ditch	FUN	Status							Area if Width ≥ 10 m and Length ≥ 50 m, otherwise as Line	All required (as Area)	
	BH080	Lake	HYP	Hydrologic Persistence								All required	All required
			NAM	Name									
	BH130	Reservoir	FUN	Status								All required	All required
	BH135	Rice Field	FFP	Farming Pattern								Area ≥ 6000 sqm	All required
	BH140	River	HYP	Hydrologic Persistence								Area if Width ≥ 10 m and Length ≥ 50 m, otherwise as Line	All required (as Area)
			NAM	Name									
			WCC	Channel Type									
	BH150	Salt Flat	NAM	Name								Area ≥ 6000 sqm	All required
	BH160	Sabkha	NAM	Name								Area ≥ 6000 sqm	All required
	BJ030	Glacier	NAM	Name								Area ≥ 6000 sqm	All required
	BJ100	Snow Ice-Field	NAM	Name								Area ≥ 6000 sqm	All required
	BJ110	Tundra	NAM	Name								Area ≥ 6000 sqm	All required
	DA010	Soil Surface Region	SMC	Material Type								Area ≥ 6000 sqm	All required
	DB170	Sand Dunes	SDO	Orientation								Area ≥ 6000 sqm	All required
			SDT	Dune Type									
	DB180	Volcano	NAM	Name								Area ≥ 1500 sqm, otherwise as Point	N/A
	EA010	Crop Land	CSP	Crop Species								Area ≥ 6000 sqm	All required
	EA040	Orchard	CSP	Crop Species								Area ≥ 6000 sqm	All required
	EA050	Vineyard	NAM	Name								Area ≥ 6000 sqm	All required
	EA055	Hop Field	-	-								Area ≥ 6000 sqm	All required
	EB010	Grassland	VEG	Vegetation Characteristic								Area ≥ 6000 sqm	All required
	EB020	Thicket	-	-								Area ≥ 6000 sqm	All required
	EC010	Cane	-	-								Area ≥ 6000 sqm	All required
	EC030	Wood	VSP	Vegetation Species								Area ≥ 6000 sqm, Line if Width ≥ 50 m in a row, otherwise as Point	All required (as Area)
EC040	Cleared Way	-	-								Area ≥ 6000 sqm	All required	
EC060	Forest Clearing	-	-								Area ≥ 6000 sqm	N/A	

Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping	
					1:5K			1:25K					
					A	L	P	A	L	P			
	ED010	Marsh	TID	Tide Influenced							Area ≥ 6000 sqm	All required	
	ED020	Swamp	VEG	Vegetation Characteristic							Area ≥ 6000 sqm	All required	
			VSP	Vegetation Species									
	ED030	Mangrove Swamp	TID	Tide Influenced							Area ≥ 6000 sqm	All required	
	ZD020	Void Collection Area	-	-							All required	All required	
<i>Lines of Communication & Associated Features</i>	AH125	Choke Point	FUN	Status							All required	All required	
	AN010	Railway	FUN	Status								All required	All required
			NAM	Name									
			LOC	Location									
			LTN	Number of Tracks									
			RGC	Gauge Classification									
			RIR	Railway in Road									
			RRA	Power Method									
	AN060	Railway Yard	FUN	Status								All required	N/A
			NAM	Name									
	AN075	Railway Turntable	FUN	Status								All required	N/A
			WTC	Weather Restriction									
	AP010	Cart Track	NAM	Name								Line ≥ 50 m. EXCEPTION: All Cart Tracks are required to extract in the coastal buffer	All required
			FUN	Status									
	AP030	Road	HCT	Thoroughfare Class ⁷								Length ≥ 200 m. EXCEPTION: All Roads are required to extract in the coastal buffer	All required
			LOC	Location									
			LTN	Number of Lanes									
			MES	Median Present									
			NAM	Name									
			RST	Surface Type									
			WD1	Minimum Width									
			WTC	Weather Restriction									
	AP050	Trail	NAM	Name								Line ≥ 50 m. EXCEPTION: All Trails are required to extract in the coastal buffer	All required
WTC			Weather Restriction										
AQ040	Bridge	FUN	Status								All required as Line if an associated transportation feature is captured. If Area ≥ 1500 sqm to be also captured as Area	All required (as Line)	
		NAM	Name										
		TRS	Transportation System										

⁷ Thoroughfare Class: it is mandatory to fill out this attribute, not taking into account 'Unknown' value.

Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
Lines of Communication & Associated Features	AQ063	Causeway Structure	TRS	Transportation Type							Line ≥ 50 m	All required
			WLE	Water Level Effect								
	AQ065	Culvert	WID	Width							All required	All required
	AQ070	Ferry Crossing	FUN	Status							On Area Drainage Features only	All required (as Point)
			TRS	Transportation Type								
	AQ125	Transportation Station	FUN	Status							All required as Point. If Area ≥ 1500 sqm to be also captured as Area	All required (as Point)
			TRS	Transportation System								
			NAM	Name								
	AQ130	Tunnel	FUN	Status							Area ≥ 1500 sqm, otherwise as Line	All required (as Line)
			NAM	Name								
	AQ135	Roadside Rest Area	RST	Surface Type							Area ≥ 1500 sqm	All required
	AQ140	Vehicle Parking	FUN	Status							Area ≥ 1500 sqm	All required
			RST	Surface Type								
	BH070	Ford	RST	Surface Type							Line if Length ≥ 50 m, otherwise as Point	All required (as Point)
BI010	Cistern	FUN	Status							All required	N/A	
DB070	Cut	SMC	Surface Material							Line ≥ 50 m	All required	
		TRS	Transportation System									
DB071	Cut Line	-	-							Line ≥ 50 m	N/A	



Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
Population (structures, areas & others)	AB000	Disposal Site	FUN	Status							Area ≥ 1500 sqm	N/A
	AH050	Fortification	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A
			NAM	Name								
	AH070	Border Crossing Point	NAM	Name							All required	All required
			FUN	Status								
	AI030	IDP Refugee Camp	NAM	Name							All required	N/A
			FUN	Status								
	AJ030	Holding Pen	-	-							Area ≥ 1500 sqm, otherwise as Point	N/A
	AK040	Sports Ground	FUN	Status							Area ≥ 1500 sqm, otherwise as Point	N/A
			NAM	Name								
	AK060	Camp Site	NAM	Name							All required	N/A
	AK120	Park	NAM	Name							Area ≥ 1500 sqm	N/A
	AK160	Stadium	CCT	Cover Type							Area ≥ 1500 sqm, otherwise as Point	N/A
			NAM	Name								
			FUN	Status								
	AK170	Swimming Pool	-	-							Area ≥ 1500 sqm, otherwise as Point	N/A
	AL010	Facility	FUN	Status							Area ≥ 1500 sqm	N/A
			NAM	Name								
			FFN	Feature Function								
	AL015	Building	FFN	Feature Function							Area ≥ 150 sqm, otherwise as Point. See Box 3 for special considerations	N/A
NAM			Name									
FUN			Status									
HWT			House of Worship Type									
AL019	Shed	-	-							Area ≥ 150 sqm, otherwise as Point. EXCEPTION: All Sheds are required to extract in the coastal buffer as Area	N/A	
AL030	Cemetery	NAM	Name							Area ≥ 1500 sqm, otherwise as Point	N/A	
		REL	Religious Designation									
AL099	Hut Temporary Dwelling	DDC	Dwelling Type ⁸							Length or Diameter ≥ 1 m	N/A	

⁸ *Unknown*: The attribute value is unknown; *Caravan*: A trailer that is used as a dwelling, has no permanent foundation, and is designed to be easily moved; *Hut*: A small, simple, or crude house or shelter; *Emergency Shelter*: A facility for temporary accommodation of homeless people subject to disasters, war, persecution, or for other reasons; *Tent*: A portable shelter consisting of canvas or other flexible material stretched over and supported on poles; *Temporary Structure*: A non-permanent structure that is used for relatively temporary occupancy; *Support Infrastructure*: The set of interconnected structural elements needed to sustain an organization in its daily operations; *Other*: The attribute value is known, but is not currently a valid member of the attribute range.



Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
	AL105	Settlement	FUC	Functional Use							Area ≥ 1500 sqm, otherwise as Point	N/A
			NAM	Name								
			FUN	Status								
	AL170	Public Square	NAM	Name							Area ≥ 1500 sqm	N/A
			FUN	Status								
	AL208	Shanty Town	NAM	Name							Area ≥ 1500 sqm	N/A
			FUN	Status								
AL241	Tower	FUN	Status							All required	All required (extract only the Guard Tower)	
		TTC	Tower Type									
<i>Ports, Harbours & Coastal Features</i>	AK190	Recreational Pier	FUN	Status						Area ≥ 1500 sqm, otherwise as Line	All required (as Line)	
	BA050	Beach	NAM	Name						Area ≥ 1500 sqm, otherwise as Point	All required (as Area)	
			SMC	Surface Material								
	BB005	Harbour	FHC	Harbour Function						All required	All required	
			NAM	Name								
			FUN	Status								
	BB041	Breakwater	MCC	Structural Material						Area ≥ 1500 sqm, otherwise as Line	All required (as Area)	
			FUN	Status								
	BB043	Groin	FUN	Status						Area ≥ 1500 sqm, otherwise as Line if ≥ 50 m	N/A	
	BB090	Dry Dock	FUN	Status						Area ≥ 1500 sqm	N/A	
BB140	Training Wall	FUN	Status						Area ≥ 1500 sqm, otherwise as Line if ≥ 50 m	N/A		



Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
<i>Ports, Harbours & Coastal Features</i>	BB155	Maritime Signal Station	FUN	Status							All required	N/A
			NAM	Name								
			STA	Station Type								
	BB190	Berthing Structure	FAC	Solid Construction							Area ≥ 1500 sqm, otherwise as Line	All required (as Area)
			MCC	Material Type								
			FUN	Status								
			PWC	Shoreline Construction								
	BB230	Seawall	FUN	Status							Line ≥ 50 m	N/A
			MCC	Material Type								
			WID	Width								
	BB240	Slipway	FUN	Status							Area ≥ 1500 sqm	N/A
	BD100	Structural Pile	-	-							Area ≥ 1500 sqm, otherwise as Point	N/A
BD110	Offshore Platform	AFA	Available Vessel							All required	N/A	
		FUN	Status									
		OPC	Platform Type									
BD120	Reef	NAM	Name							Area ≥ 1500 sqm, otherwise as Line if ≥ 50 m	N/A	
BA010	Coastline	SLT	Shoreline Type							All required	All required	
BD130	Hazardous Rock	-	-							All required	N/A	
BD180	Wreck	-	-							All required	N/A	
<i>Waterways</i>	BH120	Rapids	-	-						Area if Width ≥ 10 m and Length ≥ 50 m Line if Width < 10 m and Length < 50 m, otherwise as Point	N/A	
	BH165	Spillway	-	-						Area ≥ 1500 sqm, otherwise as Line (along the centre)	N/A	
	BH180	Waterfall	NAM	Name						Line if Length ≥ 50 m, otherwise as Point	N/A	
	BI020	Dam	FUN	Status							Area if Width ≥ 10 m and Length ≥ 50 m Line if Width < 10 m and Length < 50 m, otherwise as Point	N/A
NAM			Name									
			TRS	Transportation System								



Thematic Category	Feature Code	Feature Name	Mandatory Attribute Code	Mandatory Attribute Name	Extraction scale						Full Reference Mapping	Reduced Reference Mapping
					1:5K			1:25K				
					A	L	P	A	L	P		
	BI030	Lock	FUN	Status							Area if Width ≥ 10 m and Length ≥ 50 m Line if Width < 10 m and Length < 50 m, otherwise as Point	N/A
	BI040	Sluice Gate	FUN	Status							All required and across area drain features only	N/A
			WID	Width								
	BI041	Water Gate	FUN	Status							All required and across area drain features only	N/A
BI050	Water Intake Tower	HGT	Height							All required		
<i>Other Features</i>	FA000	Administrative Boundary	NM3	First Name							All required (includes National Border Lines)	All required
	XA020	Area of Interest (AOI)	NAM	Name							All required	All required
	ZD040	Named Location	NAM	Name							All required	All required

Annex II. *Feature Class Definition*

Due to several Feature Classes listed in the Table of Annex I are not part of MGCP Extraction Guidance TRD4 v4.0, the definition of each one is included in this Annex.

Feature Code and Name	Definition	Related Attribute Code and Name	Definition
AH125 - Choke Point	A length or single point along a route that due to its width, surface quality, alignment, fixed human activity or fixed human feature is likely to impede movement at a constant speed resulting in slowing, and either by vehicular bunching or by type may cause temporary halts	N/A	N/A
BE020 - Depth Spot Elevation	A spot depth or drying height that has been referenced to a vertical datum	ZVA - Elevation	The vertical distance above Mean Sea Level (MSL) of the highest point of the landing area
BH011 - Intake/Discharge Facility	A place where water is taken or discharged into or from a channel or pipe from a waterbody	UCC - Utility Facility Type	A coded domain value denoting a utility facility type. Attribute values: 0-Unknown (The attribute value is unknown) 5-Discharge (The outlet or structure through which reclaimed water or treated effluent is finally discharged to a receiving body of water. For example, the end of the pipe leading from a sewage treatment plant that delivers the wastewater to the environment, often via a diffuser) 6-Intake (A structure where water is channelled from a body of water for use. For example, to drive a mill, supply a canal, cool a power station, or feed a water purification plant)
CA010 - Elevation Contour	A line connecting points having the same elevation value relative to a vertical datum	CRV - Contour Value	A specified value assigned to a particular depth curve or contour
		HQC - Hypsography Portrayal Type	The type of a hypsographic portrayal line (for example: a contour line) based on the topography represented and/or portrayal interval. Attribute values: 1-Master Contour (An accentuated subset of the contour lines, typically every fourth or fifth contour line depending on the contour interval, as an aid in identifying contour lines of different elevations) 2-Intermediate Contour (One of the three or four contour lines between adjacent index contour lines) 5-Depression Master Contour (A closed index contour line delimiting an area of lower elevation than the surrounding terrain (a terrain depression) out of which there is no surface drainage)



Feature Code and Name	Definition	Related Attribute Code and Name	Definition
			<p>6-Depression Intermediate Contour (A closed intermediate contour line delimiting an area of lower elevation than the surrounding terrain (a terrain depression) out of which there is no surface drainage)</p> <p>16-Auxiliary Contour (A contour line that is used to portray important relief characteristics that would not otherwise be shown by index and intermediate contour lines)</p>
CA030 - Spot Elevation	A designated location with an elevation value relative to a vertical datum	ZVA - Elevation	The vertical distance above Mean Sea Level (MSL) of the highest point of the landing area
FA000 - Administrative Boundary	A boundary between administratively controlled regions	NM3 - Boundary First Name	The name of the political entity on the first side of a boundary line
XA020 - Area of Interest (AOI)	The limit of an area of interest	N/A	N/A

Annex III. *Minimum data quality requirements*

As stated in Section 6, the Contractor must perform data quality control procedures based on ISO 19157. The following data quality measures must be included in the quality control procedure. The quality of the delivered products should comply with the minimum data quality thresholds defined here. In order to ensure high quality standards, the Contractor shall include additional data quality measures or even commit to reach higher data quality thresholds.

Data quality Element	Data quality Sub-element	Definition	Evaluation Scope	Measure Name(s)	Proposed evaluation method	Target Result(s)
Completeness	Commission	Excess data present in the dataset	All spatial objects	Rate of excess spatial items	Sample-based with sample size adjusted according to the population size (Annex F, ISO19157) for AQL of 99%.	< 1 %
Completeness	Omission	Data absent from the dataset, as described by the scope	All spatial objects	Rate of missing spatial items	On-screen visible check of possible omissions	< 1 %
Positional accuracy	Absolute or external accuracy	Closeness of reported coordinate values to values accepted as or being true	All spatial objects	CE98 i.e. circular error at 98% significance level	Sample-based with sample size adjusted according to the population size (Annex F, ISO19157) for AQL of 99%.	Scale 1:25,000 – CE98 ≤ 5m Scale 1:5,000 – CE98 ≤ 1m
Thematic accuracy	Missing attributes	Mandatory attributes missing from the Table	All spatial objects	Number of missing/empty attribute values	Full inspection	False (zero)
Thematic accuracy	Non-quantitative attribute correctness	Correctness of the non-numeric values contained in attributes	All spatial objects	Number of incorrect non-numeric attribute values	Sample-based with sample size adjusted according to the population size (Annex F, ISO19157) for AQL of 99%.	False (zero)
Thematic accuracy	Quantitative attribute correctness	Correctness of the numeric values contained in attributes	All spatial objects	Number of incorrect numeric attribute values	Sample-based with sample size adjusted according to the population size (Annex F, ISO19157)	False (zero) in the sample
Thematic accuracy	Classification correctness	Comparison of the classes assigned to features or their attributes to a universe of discourse	Land Cover features	Overall error (Land Cover)	Stratified random sampling	Overall accuracy of error matrix ≥ 90 %
Logical consistency	Conceptual consistency	Adherence of values to the value domains	All spatial objects	Conceptual schema non-compliance	Full inspection	False (zero)
Logical consistency	Topological consistency	Correctness of the explicitly encoded topological characteristics of the dataset	All spatial objects	Number of invalid self-intersect errors	Full inspection	False (zero)
Logical consistency	Topological consistency	Correctness of the explicitly encoded topological characteristics of the dataset	All spatial objects	Number of invalid self-overlap errors	Full inspection	False (zero)



Data quality Element	Data quality Sub-element	Definition	Evaluation Scope	Measure Name(s)	Proposed evaluation method	Target Result(s)
Logical consistency	Topological consistency	Correctness of the explicitly encoded topological characteristics of the dataset	All spatial objects	Number of invalid slivers	Full inspection	False (zero)
Logical consistency	Topological consistency	Correctness of the explicitly encoded topological characteristics of the dataset	All spatial objects	Number of missing connections due to undershoots	Full inspection	False (zero)