Ministry of Agriculture, Forestry and Water Economy

of the Republic of North Macedonia

METHODOLOGY FOR CREATION OF GEOSPATIAL DATA ON LEASED AGRICULTURAL LAND

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1. Introduction

1.1. Objective of the methodology

The objective of this methodology is to define a standardized and technically sound process for creating a unified geospatial layer representing the areas of state-owned agricultural arable land and pastures that are leased to private or legal entities. The methodology outlines the procedures, data sources, tools, and validation mechanisms required to ensure that the geospatial/graphical representation (in the follow-up text below is used either geospatial or graphical) of leased land is accurate, consistent, and suitable for integration into the State-owned Agricultural Land Management Information System (SALMIS) under the Agriculture Modernization Project (AMP).

This geospatial layer will support strategic planning, monitoring, policy implementation, and transparency in the management of state-owned agricultural land resources.

1.2. Institutional background

State-owned land designated for agricultural use in the Republic of North Macedonia is managed by two distinct institutions:

- The Ministry of Agriculture, Forestry and Water Economy (MAFWE) is responsible for the management and leasing of arable agricultural land owned by the state. Lease contracts for such land are awarded through public calls, and applicants are generally required to submit geodetic elaborates that precisely define the boundaries and location of the requested parcel(s). These elaborates serve as the basis for spatial representation in digital systems.
- The Public Enterprise for Management of Pastures (PEMP) is the institution responsible for the administration of state-owned pastures. Unlike the practice in MAFWE, the current procedures for leasing pastures do not require submission of geodetic elaborates or other formal graphical documentation from applicants. As a result, the spatial definition of many pasture leases remains vague or undocumented, particularly for older contracts.

The methodology takes into consideration these institutional differences and aims to provide a harmonized approach for processing both types of leases – those with complete geospatial documentation and those lacking it – by using appropriate techniques for verification, digitization, and attribution.

1.3. Importance of a harmonized geospatial layer for decision-making

A harmonized and up-to-date geospatial layer of state-owned agricultural arable land and pastures leased through publicly administered procedures is essential for improving transparency, efficiency, and accountability in land administration. It enables:

- Spatial planning and land-use analysis, including assessment of land availability and suitability for agricultural development;
- Monitoring of lease compliance, including area coverage, permitted land use, and location-specific constraints;

- Policymaking and program evaluation, through integration with other spatial and statistical data;
- Conflict prevention and resolution, by clearly defining lease boundaries and reducing overlaps and ambiguity;
- Support to inspection and field operations, allowing better coordination between institutions and more effective targeting of control activities.

In the long term, the geospatial layer contributes to evidence-based decision-making and enables better alignment of land management practices with national strategies and EU integration objectives.

1.4. Acronyms Used in The Draft Methodology

Acronym Table

Term	Explanation
AMP	Agriculture Modernization Project
AREC	Agency for Real Estate Cadastre
CRS	Coordinate Reference System
GIS	Geographical Information System
MAFWE	Ministry of Agriculture, Forestry and Water Economy
PEMP	Public Enterprise for Management of Pastures
QA/QC	Quality Assurance / Quality Control
SALMIS	State-Owned Agricultural Land Management Information System
WFS	WEB Feature Service
WMS	WEB Map Service

2. Scope and Applicability

2.1. Scope

This methodology applies to the creation of a geospatial layer that represents state-owned agricultural arable land and pastures currently leased to private or legal entities under the jurisdiction of two separate institutions:

- The MAFWE – responsible for leasing state-owned agricultural arable land.
- The PEMP – responsible for leasing state-owned pastures.

The methodology covers:

- Active lease contracts, regardless of whether they include geodetic elaborates.

- All geographical areas of North Macedonia, where such state-owned agricultural land is leased.
- Different types of leasing procedures, including public calls and direct agreements (where applicable by law).

2.2. Applicability

The methodology is intended for use by:

- Technical teams responsible for the implementation of the SALMIS under the AMP.
- Geographic Information System (GIS) professionals and subcontractors tasked with preparing the graphical layer.
- Staff from MAFWE and PEMP involved in land management, lease monitoring, land-use planning and inspection activities.

The methodology is applicable to:

- Leases supported by complete geodetic documentation, enabling direct import to GIS database.
- Leases without geodetic elaborates, where digitization is based on descriptive contract data, scaned maps and list of coordinates.
- Future lease agreements, where adherence to this methodology will provide consistent geospatial documentation for MAFWE contracts or information on leased cadastral parcel(s) or leased area sketch for PEMP contracts. .

The document also outlines procedures for regular updates, integration into national systems, and alignment with existing geospatial standards and cadastre data.

3. Data Sources

The graphical layer will be built from multiple data sources of varying structure and quality, reflecting differences in legal obligations and administrative practices between the two responsible institutions.

3.1. Agricultural Land Lease Contracts (MAFWE)

Leases managed by MAFWE are based on contracts concluded over different legal periods. As a result, the geodetic documentation submitted by applicants varies significantly in terms of detail, format, and spatial precision. The methodology recognizes the following types of geodetic documentation:

- Geodetic Elaborates for Special Purposes, prepared in accordance with the Rulebook on Geodetic Works for Special Purposes[1] adopted by the Agency for Real Estate Cadastre (AREC). This rulebook regulates the methodology, structure, and content of geodetic surveys and elaborates prepared for specific legal and administrative actions—including the leasing of state-owned agricultural land. These elaborates define the leased areas with high spatial accuracy and standardized documentation formats.

[1] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes

- Scan of Geodetic Elaborates for Special Purposes, prepared in accordance with the Rulebook on Geodetic Works for Special Purposes[2] adopted by the Agency for Real Estate Cadastre (AREC), not available in vector format, only PDF.
- Cadastral Plan Extracts or Annotated Maps: Older lease contracts may include only printed cadastral plans with handwritten annotations or indicative boundaries, often scanned and archived in PDF or image format. These documents require additional interpretation and digitization.
- Simplified or Informal Sketches: In a limited number of cases (mainly in older contracts), spatial delineation may be based on informal hand-drawn sketches or general descriptions lacking coordinate precision.
- Parcel Reference Only (No Vector Documentation): In some cases, contracts include only a reference to a cadastral parcel number without any geodetic elaborate or graphical documentation. For such cases, the parcel centroid or full cadastral parcel geometry may be used as a provisional spatial representation, clearly flagged as approximate.
- No Geospatial Documentation at All: A smaller number of contracts may lack any spatial reference or spatial description. Such contracts will be recorded in the database as “Unlocated” and temporarily excluded from the graphical layer until sufficient information is made available (e.g., during contract renewal or administrative verification), while ensuring that the level of additional effort remains reasonable and proportionate.

Each type of documentation will be reviewed individually and processed using appropriate GIS workflows. Where possible, geodetic elaborates will be digitized, validated, and aligned with official cadastral data. In cases with low-quality or missing geospatial information, additional validation steps will be applied.

According to the official position of the MAFWE, for lease agreements that do not include geodetic elaborates due to the absence of a legal requirement at the time of contract signing, the MAFWE will not request submission of such documents for the remaining duration of the contract. However, in cases where the lessee intends to renew or extend the lease agreement, the submission of a valid geodetic elaborate will be mandatory as part of the renewal process.

3.2. Pasture Lease Records (PEMP)

Unlike MAFWE, according to the Law on Pastures[3], the PEMP currently does not require submission of geodetic elaborates or any standardized graphical representation when issuing lease contracts. However, a dedicated software application, JONGIS WEB has been developed and deployed to support the management of pasture lease data.

The JONGIS WEB system allows the responsible staff to:

- Record individual lease contracts;
- Link contracts with one or more cadastral parcel numbers intended for lease.

In practice, however, the system is underutilized, and cadastral parcel numbers are rarely entered, leading to incomplete spatial referencing of the leased pastures. At present, cadastral parcel numbers are recorded only for specific types of contracts, such as those related to the placement of beehives and the construction of temporary structures in support of pasture use. For the majority of pasture lease agreements, especially those related to collective grazing,

[2] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes
[3] See Annex 7: Reference Legal Documents – Law on Pastures.

parcel-level spatial referencing is not available. The limited use of parcel-level data is primarily due to the absence of geospatial visualization capabilities in the current system, which reduces the immediate operational value of such information for PEMP staff.

Within the existing operational framework, cadastral parcel information may be recorded for new lease agreements where such information is available in the contract documentation and where this is feasible in practice. However, the methodology does not assume systematic availability of parcel-level data for all pasture leases.

Accordingly, the methodology is based on the use of available information, without introducing additional mandatory requirements for PEMP, while enabling gradual improvement in the spatial referencing of pasture leases to the extent permitted by data availability and operational practices.

For pasture leases, spatial identification shall be based on the best available information, including:

- Cadastral parcels mentioned in the contract, where available.
- Any available descriptive information from the contract (e.g., cadastral municipality, surface area, place names, nearby landmarks);
- Cross-referencing administrative boundaries, pasture zones or indicative area sizes declared in the contracts;
- Visual interpretation of orthophoto imagery when necessary;

3.3. Auxiliary and Reference Data

The following reference data sources will support spatial validation and contextual analysis:

- Cadastral parcels and land use layers from the WEB Feature Services (WFS) provided by AREC;
- Orthophoto imagery acquired by the MAFWE with a capture date of 2023.
- Administrative boundaries at the national, municipal and cadastral levels, provided also like WFS services by AREC;
- Institutional records and registries maintained by MAFWE and PEMP, specifically:
    - The Temporary Inventory of State-Owned Agricultural Land application developed under AMP, containing alphanumeric records of lease contracts for state-owned arable agricultural land managed by MAFWE;
    - The JONGIS WEB ERP system used by PEMP, which maintains lease contract data for state-owned pastures.

All data on leases of state-owned agricultural arable land and pastures should be in the official state coordinate reference system (CRS) described in detail in the **Annex 3: Coordinate Reference System** and ready for entry into SALMIS.

4. Data Collection and Verification

The process of collecting and verifying data for the creation of the geospatial layer involves systematic steps adapted to the available documentation, legal requirements, and institutional practices. Due to budget limitations within the MAFWE and the PEMP, no field verification will be conducted during the data collection phase. Therefore, the methodology relies entirely on existing digital and scanned records, along with institutional registries and available validation tools.

4.1. Identification and Classification of Lease Contracts

All lease contracts will be identified, reviewed, and categorized based on:

- Managing institution (MAFWE or PEMP)
- Managing branch office
- Year of issuance (as different legal frameworks apply)
- Type and availability of spatial documentation under the MAFWE:
    - The contract includes a geodetic elaborate prepared in accordance with the Rulebook on Geodetic Works for Special Purposes[4], with spatial data available in vector (XML/GML) format
    - The contract includes a geodetic elaborate prepared in accordance with the Rulebook on Geodetic Works for Special Purposes[5], but only in scanned PDF format
    - The contract includes a geodetic elaborate for contracts concluded after 2013 (following the adoption of the Rulebook on Geodetic Works for Special Purposes), available only in scanned PDF format. Contract explicitly lacks geodetic elaborate
    - No information available regarding geodetic elaborate (minor group)

Each contract will be entered into a master database with relevant metadata: leasing institution, branch office in charge, year of issuance, contract number, contract date and spatial documentation status.

In the MAFWE, a single lease contract for agricultural arable land may include one or more cadastral parcels or one or more parts of one or more cadastral parcels. A single parcel may be included in more than one lease contract at the same time, provided that the parts of the parcel that are subject to the contract must be clearly demarcated and described in a geodetic elaborate that the lessee is obliged to submit when submitting the lease application.

- Type and availability of spatial documentation under the PEMP:
    - For certain lease contracts, such as those for the placement of beehives or for the construction of temporary structures intended to improve the use of pastures, the documentation may include cadastral parcel numbers that can serve as a spatial reference.
    - For contracts covering group grazing in areas near settlements, the documentation sometimes specifies only the cadastral municipality in which the pastures are located, without parcel-level detail.
    - In almost all other cases, no geodetic elaborates or graphical documentation are provided, since the Law on Pastures does not require their submission.

The same situations occur in pasture lease contracts, with the exception that, according to the Law on Pastures6, the lessee is not obliged to submit a geodetic elaborate. The area that is the subject of the contract is determined based on the quality of the pasture and the number of heads (large and/or small livestock) owned by the farmer. Pastures are divided into summer (high mountain) and winter (lowland), that is, pastures near settlements that are used for group grazing of livestock by all livestock farmers from the settlement.

[4] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes
[5] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes
[6] See Annex 7: Reference Legal Documents – Law on Pastures.

4.2. Verification of Geodetic Elaborates via WEB Application (MAFWE)

As part of the AMP, a dedicated WEB application has been developed to collect and validate geodetic elaborates for agricultural arable land lease contracts managed by the MAFWE. The application supports:

- Uploading of geodetic elaborates for each lease contract;
- Recording whether a geodetic elaborate exists, is missing, or the existence status of the geodetic elaborate is unknown;
- Validation of the uploaded files, including:
    - Matching the contract number in the geodetic elaborate to the one in the database;
    - Verifying whether a GIS format (vector data) is present;
    - Checking for the existence of a graphical sketch of the leased parcel;
    - Checking for the presence of a coordinate list.

Lease agreements accompanied by geodetic elaborates prepared in accordance with the Rulebook on Geodetic Works for Special Purposes[7] and containing both vector and alphanumeric data in XML/GML standard formats can be directly imported into the GIS database without further transformation. In contrast, geodetic elaborates available only in scanned (raster) format will require additional processing – described in the chapter 5. Geospatial Layer Creation – before they can be integrated into the GIS database.

4.3. Verification of Pasture Lease Information (PEMP)

The PEMP maintains a software tool that enables staff to record lease contracts and associate them with cadastral parcel numbers. In practice, cadastral parcel numbers are currently recorded only for specific types of agreements (e.g., placement of beehives and construction of temporary structures). For the majority of leasing contracts – especially for collective grazing pastures near settlements – no parcel-level spatial referencing exists, and in some cases only cadastral municipality information is recorded.

For these cases:

- Available descriptive data from the contracts (cadastral municipality, indicative surface area, pasture zone, nearby landmarks) will be used for approximate localization;
- Additional data enrichment will be carried out using available administrative maps, institutional knowledge, and the latest available orthophotos (2023) and cadastral overlays, in order to support consistent and approximate spatial identification of records.

4.4. Quality Assurance and Quality Control (QA/QC)

For validation of geodetic elaborates for agricultural arable land lease contracts managed by the MAFWE a structured QA/QC framework is in place, based on the validation through the WEB application for uploading geodetic elaborates:

- QA checks via the WEB application:
    - Contract-elaborate number consistency

[7] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes

    - Presence of valid geometry (vector data)
    - Inclusion of key components: sketch, coordinates
- Manual review and classification:
    - For scanned documents requiring digitization
    - For inconsistencies noted into the system
- Logging and traceability:
    - Validation action within the WEB application is recorded with a timestamp and user identity
    - A tracking log supports transparent progress monitoring and future auditability

This digital-first QA/QC approach ensures optimal use of available resources while setting the stage for improved data quality in future phases.

5. Geospatial Layer Creation

The geospatial layer preparation phase involves transforming, digitizing, and harmonizing various types of source data into a unified, structured spatial dataset. The process must accommodate diverse formats and levels of completeness, especially when integrating geodetic elaborates from different time periods, scanned elaborates, scanned plans and descriptive lease data.

The process of creating the geospatial (graphical) layer representing state-owned agricultural arable land and pastures leased through the MAFWE and the PEMP shall begin with preparatory activities aimed at establishing an appropriate data storage and processing environment.

As a first step, a dedicated geospatial database shall be established in accordance with the structure and schema defined in **Annex 1: Data Model for Geospatial Layer on Leased Agricultural Land**. This database will serve as a centralized structure for storing, managing, and processing both spatial and alphanumeric data for leased state-owned agricultural land. While the term “geospatial database” is commonly used, alternative designations such as “data repository” or “data structure for managing spatial and tabular information” may also be appropriate depending on implementation preferences.

To minimize errors during manual data entry, most attribute fields in the core tables of the geospatial layer will be populated using predefined value lists. These value domains and classification schemes are detailed in **Annex 2: Codebooks and Classification Tables**. This approach ensures consistency and standardization across all datasets integrated into the SALMIS platform.

The Supplier is required to set up the geospatial environment using technologies and formats that ensure compatibility with the offered SALMIS GIS platform and the National Spatial Data Infrastructure (NSDI) standards. In accordance with the Law on the NSDI, all public institutions, including ministries, are obliged to prepare and publish spatial datasets and related services that participate in the NSDI portal, maintained by the Agency for Real Estate Cadastre (AREC). This implies that:

- Geospatial services (e.g., WMS, WFS) must comply with INSPIRE Directive requirements and ensure interoperability across institutions;
- All datasets must be accompanied by standardized metadata that describes the origin, structure, and quality of the data in detail;

- Data formats and reference systems must follow the official technical specifications defined under the NSDI framework;
- Prepared services and metadata must be ready for publication and integration into the national NSDI portal.

This approach ensures that the outputs of the methodology are not only technically aligned with the SALMIS platform but are also fully compliant with national and EU standards for spatial data interoperability.

As part of the data preparation process, geodetic elaborates uploaded to the temporary application must be processed and imported into the geospatial database in an appropriate and standardized format. Acceptable input formats include:

- GML/XML (in compliance with the national Rulebook on Geodetic Works for Special Purposes[8])
- ESRI File Geodatabase (.GDB)
- PostgreSQL database with PostGIS extension
- ESRI Shapefile (.SHP)

All imported data must be referenced using the official national coordinate reference system, as defined in **Annex 3: Coordinate Reference System**, specifically EPSG:6316 – MGI 1901 / Balkans Zone 7.

Each imported dataset must include or be accompanied by sufficient metadata to enable accurate referencing, validation, and linkage to the leasing contracts via unique identifiers. To ensure consistency and traceability, metadata for each dataset included in the initial data load must conform to the structure defined in **Annex 4: Metadata Template for Initial Import of Geospatial Data**.

While creating the geospatial layer, it should be acknowledged that not all input data, particularly from older geodetic elaborates, meet current technical standards. Various anomalies – such as missing coordinate digits, incorrect ordering, or incomplete attribute data – may be present and must be carefully identified and corrected prior to import into the SALMIS platform. A list of the most frequently observed issues is provided in **Annex 6: Quality Issues Identified in Geodetic Elaborates**.

5.1. Processing of GIS-Compatible Geodetic Elaborates

For lease contracts that are accompanied by geodetic elaborates prepared in accordance with the national Rulebook on Geodetic Works for Special Purposes[9] and submitted in standard GIS-compatible vector formats (e.g., GML, SHP, DXF), the following processing steps shall be carried out to integrate the spatial data into the official geospatial layer:

- Retrieval of Reference Parcel Geometry
    - For contracts where the entire cadastral parcel is subject to lease:
        - Retrieve the cadastral parcel geometry via the WFS service provided by the AREC.
    - For contracts where only a portion of the parcel is subject to lease:

[8] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes
[9] See Annex 7: Reference Legal Documents – Rulebook on Geodetic Works for Special Purposes

        - Retrieve the complete cadastral parcel via WFS.
        - Extract and validate the leased section based on the geodetic elaborate.

- Coordinate System Verification and Transformation
    - Verify the CRS of the geodetic elaborate.
    - If required, transform the geometry into the target CRS compatible with the SALMIS GIS environment and national spatial data standards.
- Import and Geometry Validation
    - Import the vector data into the GIS environment using standard tools.
    - Validate the geometry to ensure correctness, including closed polygon rings, absence of self-intersections, and overall structural integrity.
    - Perform topology validation to ensure:
        - No overlaps or gaps between polygons
        - Non-duplicated and spatially valid features
    - **Note:** Overlaps may occur in practice due to the lack of validation at the time of submission and the absence of automated integration of elaborates into AREC's cadastral database.
- Attribute Assignment
    - Assign attributes to each spatial feature according to the structure defined in **Annex 1: Data Model for Geospatial Layer on Leased Agricultural Land**, including:
        - Institution code
        - Branch office code
        - Leasing contract number
        - Reference to the original source document
- Data Integration into Geospatial Database
    - Insert the validated features into the designated geospatial database, ensuring that spatial and alphanumeric data are linked through unique identifiers.
- Quality Assurance and Documentation
    - Conduct a final verification of each processed dataset.
    - Document all validation steps and record any inconsistencies or corrections applied, prior to migration to the production environment.

5.2. Digitization of Non-GIS Documents

For lease contracts where geodetic elaborates are available only in scanned form (e.g., PDF or image-based formats), and not in structured GIS-compatible formats, a semi-automated digitization process shall be applied to extract spatial data suitable for integration into the

official geospatial layer. This process combines manual and automated steps and ensures traceability to the original document source.

Option 1:

- Text Recognition (OCR Processing)
    - Use OCR (Optical Character Recognition) software to extract coordinate data (Y, X) from the scanned elaborate.
    - The extracted coordinates represent spatial definitions of the leased area in the national CRS.
    - Output formats should be in structured text: .TXT or .CSV.
- Coordinate Correction and Standardization
    - The extracted coordinates must be verified and formatted according to the official national CRS defined in **Annex 3: Coordinate Reference System**.
    - Coordinates should have seven digits before and two after the decimal point (e.g., 7456231.28, 4548987.36).
    - A predefined tool (custom script or spreadsheet) shall be used to correct and reorder the coordinate list into a standardized structure, typically:

```
Tn,Y,X
1,7646626.80,4543222.51
2,7646599.60,4543208.77
...
```

- Generation of Parcel Geometry
    - The cleaned and standardized coordinate data is used to construct the geometry of the leased area within a GIS environment.
    - The resulting spatial feature must accurately represent the parcel boundary and comply with the defined structure for further integration.
    - Basic validation is performed to ensure the geometry is topologically correct and suitable for inclusion in the geospatial layer.

Option 2:

- Digitization from Raster Overlays
    - Where no coordinate list exists, perform manual digitization:
        - Georeference the scanned sketch using identifiable control points (from orthophotos or cadastral parcel layers).
        - Trace the leased area based on visual or descriptive data (parcel IDs, boundaries).
        - Mark such geometries with metadata flag: "digitized from sketch" and assign an appropriate precision level.
- Attribute Assignment

    - Assign attributes to each spatial feature according to the structure defined in **Annex 1: Data Model for Geospatial Layer on Leased Agricultural Land**, including:
        - Institution code
        - Branch office code
        - Leasing contract number
        - Reference to the original source document

- Integration and Documentation
    - Integrate the final geometry and attribute data into the central geospatial database.
    - Maintain traceability by linking the dataset to the scanned document (file name, page number).
    - Document the processing steps in a QA log, including OCR quality, manual corrections, and digitization notes.

Note: All geometries generated via this workflow must be clearly flagged and reviewed before inclusion in the production system.

5.3. Processing of Pasture Lease Data

Due to the limited availability of formal geospatial documentation for pasture lease contracts, alternative methods will be applied to derive spatial representations of leased areas. The objective is to ensure the inclusion of pasture lease information in the geospatial layer, while explicitly documenting the level of spatial precision.

- Cadastral Parcel Linkage
    - Where pasture lease records include cadastral parcel identifiers, the corresponding geometries shall be retrieved via the WFS service provided by the Agency for Real Estate Cadastre (AREC).
- Estimation Based on Administrative and Environmental Data
    - In the absence of parcel-level references, pasture zones will be estimated using a combination of:
        - Administrative boundaries (e.g., municipality, village, grazing unit)
        - Existing land cover datasets
        - Publicly available maps or thematic layers related to pasture use
- Manual Delineation from Descriptive Sources
    - Where lease contracts or archives include descriptive spatial information (e.g., sketches, textual boundary descriptions, old maps), manual digitization will be performed to approximate the location and extent of the leased pasture area.
- Assignment of Confidence Levels

- Each polygon generated through the above methods shall be assigned a confidence level indicator, reflecting the reliability of its spatial accuracy:
  - High – parcel-linked geometry
  - Medium – derived from descriptive or mapped sources
  - Low – approximated from general administrative areas

Notes:

- This methodology ensures maximum inclusion of pasture lease data into the geospatial layer, despite limitations in source documentation.
- The use of confidence levels allows data users to distinguish between precisely defined and estimated spatial entities, supporting transparency and future updates when higher-precision data becomes available.

5.4. Coordinate Reference System

All spatial data processed and integrated within the geospatial layer must be referenced in the official national CRS, as defined in **Annex 3: Coordinate Reference System**. This ensures consistency, interoperability, and alignment with national geospatial datasets and services.

6. Attribute Data Linking

Linking attribute data with geospatial features is a critical step to ensure that each polygon representing leased agricultural arable land or pasture is accurately associated with its corresponding administrative and contractual information. This linkage enables the seamless integration of the geospatial layer into institutional workflows, reporting dashboards, and analytical tools, thereby enhancing data usability, traceability, and decision-making support.

6.1. Source of alphanumerical data: Temporary Inventory Application

As part of the Agriculture Modernization Project (AMP), a dedicated application titled Temporary Inventory of State-Owned Agricultural Land has been developed. This system serves as the central repository for all alphanumeric data related to land lease contracts, including:

- Institution
- Branch office
- Lease contract number
- Applicant information (entity type, name, contact details)
- Contracted surface area
- Cadastral data (municipality, parcel numbers)
- Contract dates and status

The Temporary Inventory is continuously updated and serves as the primary source of attribute data for integration with the geospatial layer derived from geodetic elaborates.

The system is designed to facilitate the collection and validation of alphanumeric data from all lease contracts, enabling accurate linkage with corresponding geospatial features created through the parallel application used for uploading geodetic elaborates.

Following the establishment of the State Agricultural Land Management Information System (SALMIS), the validated data from both temporary systems – the Temporary Inventory and the Application for Uploading Geodetic Elaborates – will be migrated into the SALMIS. Upon successful migration and verification, the databases of both temporary applications will be securely backed up and archived, and the applications themselves will be decommissioned.

6.2. Linking Mechanism

Each graphical feature (polygon) in the geospatial layer will be linked to its attribute record from the Temporary Inventory using a composite key, formed by:

[Branch Office Code] + [Contract Number]

This key is unique and consistent across the inventory system and the contract documentation. It ensures unambiguous association of each spatial record with its corresponding administrative entry.

6.3. Handling Incomplete or Conflicting Records

In cases where attribute records cannot be matched to a spatial feature due to missing or inconsistent identifiers:

- The polygon will be marked as "Unlinked", and a log entry will be created;
- A review procedure will be applied to attempt manual matching based on available clues (e.g., surface area, cadastral location);
- If no match is found, the feature will be excluded from the final layer but retained in a “pending” dataset for future integration.

7. Data Harmonization and Standardization

The geospatial and attribute data collected from different sources and institutions must be harmonized to ensure consistency, interoperability, and readiness for integration into the SALMIS. This includes aligning data models, codebooks and classification schemes, RCS and metadata standards.

7.1. Harmonization Between Institutions

Given the differences in data practices between MAFWE and PEMP, special care will be taken to:

- Unify classification logic;
- Ensure that pasture data, even if approximate, follows the same geometric and attribute schema as arable land data;
- Maintain transparency in precision and source, to allow end-users to understand data quality limitations.

This harmonization ensures that the final geospatial product is both technically robust and institutionally neutral, allowing for seamless integration, cross-institutional analysis, and future scalability.

8. Quality Control and Validation

To ensure the accuracy, consistency, and reliability of the final geospatial layer, a multi-level quality control (QC) and validation process will be applied. Given the diversity of input data and the lack of field verification in the initial phase, quality control will focus on logical, geometric, and attribute validation, leveraging existing tools and institutional procedures.

8.1. Quality Control Strategy

The quality control process will be implemented in three main phases:

- Input-level validation – during data collection and entry;
- Processing-level validation – during digitization, transformation, and linking;
- Output-level validation – upon completion of the geospatial layer.

Each phase will involve automated checks, manual review, and documentation of issues encountered.

8.2. Validation of Spatial Geometry

For all spatial features (polygons), the following validations will be performed:

- Topology checks: detection of overlapping polygons, gaps, slivers, self-intersections, and unclosed shapes;
- Area checks: comparison of calculated area with declared area in lease contract or inventory;
- Projection checks: confirmation that all data is correctly projected in the standard CRS

Spatial features that fail validation will be flagged, reviewed manually, and corrected before inclusion in the final dataset.

8.3. Validation of Attribute Consistency

Attribute values will be validated against predefined rules and reference lists:

- Unique key matching: verification that the composite key (Branch Office Code + Contract Number) is present, consistent, and linked;
- Mandatory fields and codebooks validation: Each attribute dataset must undergo validation to ensure that all mandatory fields – such as institution, branch office, contract number etc. – are properly completed. Additionally, all fields that serve as foreign keys referencing predefined codebooks (e.g., fk_source_type, fk_confidence_level, fk_validation_status, fk_linking_status) must be cross validated to confirm that their values exist within the respective codebooks. This ensures data integrity and prevents invalid or unrecognized classifications from being imported into the system.
- Cross-reference checks: comparing values (e.g., calculated surface area, parcel numbers) with entries in the Temporary Inventory or pasture database;

Identified discrepancies will be logged and subjected to additional manual verification using available supporting data sources before being resolved.

8.4. Review and Approval Process

A review and approval process will be applied to all data before formal delivery:

- Technical validation by GIS staff or subcontractors;
- Administrative validation by MAFWE and/or PEMP, depending on the data source;
- Final sign-off by the central AMP implementation team, confirming readiness for integration into SALMIS.

All steps and decisions in the validation process will be documented in a Quality Control Log, which will serve as an audit trail and reference for future updates. Only records that pass validation and receive a 'Validated' status will be imported into SALMIS. Records classified as 'Pending Review', 'Approximate', or 'Rejected' will require correction or reprocessing before they can be accepted.

9. Integration into the SALMIS

The final geospatial and attribute datasets will be integrated into the SALMIS, developed under the AMP, to enable centralized access, visualization, and analysis of leased state-owned agricultural arable land and pastures.

9.1. Integration Objectives

The integration will support:

- Centralized spatial representation of all lease contracts under MAFWE and PEMP;
- Advanced filtering, querying, and reporting based on both geographic and alphanumeric parameters;
- Support to inspections, planning, monitoring, and institutional coordination;
- Public transparency, where applicable, via map viewers or dashboards.

9.2. Developing the APIs to support data import

APIs or batch import scripts will be developed to support the following operations related to geospatial data management:

- Initial bulk loading of validated geospatial layers into the SALMIS platform, based on acceptable formats defined in Chapter 5 and Annex 3;
- Incremental updates, if necessary, during implementation phases before the full deployment of real-time data entry through SALMIS;
- Automated validation and logging, where each import is automatically checked against the metadata requirements (Annex 4), spatial structure, and attribute integrity rules (Chapter 8);
- Rollback capability, through dedicated scripts that allow full deletion of the graphical layer contents from the geospatial database in case the bulk import fails validation or results in data corruption;
- Import logging and traceability, ensuring that each batch operation (import or deletion) is recorded with user identity, timestamps, and operation details.
- These capabilities are essential for controlled and transparent data onboarding during the initial system population phase, and for supporting any future re-import scenarios where datasets may need to be refreshed or replaced.

9.3. System Testing and Verification

Before going live, the integrated datasets will undergo:

- Staging environment testing, including loading, querying, and rendering;
- Validation against business rules defined in SALMIS (e.g., geometry validity, attribute logic);
- Functional testing to ensure compatibility with map viewers, inspection tools, and dashboards.

Any errors identified will be addressed and resolved before the data is promoted to production.

10. Maintenance and Updates

Once established, the geospatial layer of leased state-owned agricultural arable land and pastures will be maintained on a continuous basis through daily updates performed via the SALMIS platform. These updates will reflect key administrative processes such as the signing or termination of lease contracts, land consolidation, or changes in land ownership. This dynamic integration ensures that the geospatial layer remains current, accurate, and fully aligned with institutional workflows, thereby supporting its long-term relevance and utility for planning, monitoring, and decision-making purposes.

10.1. Update Triggers

Updates to the geospatial layer may be triggered by any process described in the Law on Agricultural Land[10] and Law on Pastures[11]:

- New lease contracts signed by MAFWE or PEMP;
- Amendments or terminations of existing contracts;
- Submission of updated geodetic elaborates (e.g., upon renewal or correction);
- Discovery of errors or data gaps during inspections or user feedback;
- Integration of field verification results, if implemented in future project phases.

10.2. Institutional Responsibilities

The institutional responsibilities differ depending on the phase of the project: (a) prior to the import of data into SALMIS (implementation period) and (b) after the SALMIS platform is fully operational.

Before SALMIS go-live (Implementation Phase):

- MAFWE will be responsible for:
  - Ensuring that each new lease contract is recorded in the Temporary Inventory;
  - Uploading the associated geodetic elaborate via the WEB application for uploading geodetic elaborates;
  - Reviewing and validating spatial data in the Temporary Inventory before the transfer to SALMIS.
- PEMP will be responsible for:
  - Keeping its internal lease database updated with all new agreements;

[10] See Annex 7: Reference Legal Documents – Law on Agricultural Land
[11] See Annex 7: Reference Legal Documents – Law on Pastures

  - Recording cadastral parcel information for new pasture contracts where applicable;
  - Coordinating with the AMP PMT IT Consultant and GIS teams to support the preparation of pasture-related data spatial, where applicable.

After SALMIS go-live (Operational Phase):

- MAFWE will be responsible for:
  - Recording all new lease contracts directly in SALMIS;
  - Uploading and validating associated geodetic elaborates through SALMIS;
  - Reviewing and approving the correctness of spatial data generated or linked within SALMIS.
- PEMP will be responsible for:
  - Recording all new pasture lease agreements in SALMIS;
  - Entering cadastral parcel numbers for newly signed contracts where such information is available and applicable;
  - Reviewing and approving spatial representations of pasture leases in SALMIS in cooperation with GIS teams.
- Both institutions will be jointly responsible for:
  - Initiating updates when contracts are amended, terminated, or extended;
  - Providing feedback on detected errors or data gaps;
  - Ensuring institutional workflows are aligned with the automatic update mechanisms embedded in SALMIS.

This approach ensures alignment with current institutional practices while enabling gradual improvement of spatial data quality through the implementation of SALMIS.

10.3. Update Workflow

Once SALMIS becomes fully operational, updates to the geospatial layer will be triggered automatically through the platform's internal workflows. Each event — such as the registration of a new lease, termination, parcel adjustment, or other administrative action — will initiate a sequence of automated processes that include:

- Geospatial validation (topology and geometry checks);
- Attribute consistency validation;
- Metadata logging;
- Automated update of the corresponding graphical features in the GIS database.

This significantly reduces the need for manual notifications or external validation, ensuring a streamlined and reliable update process embedded within the system.

10.4. Changes made during the Implementation Phase

Prior to SALMIS go-live, changes in leasing status (e.g. new contracts, terminations, parcel adjustments) will continue to be managed within existing institutional systems and records.

Where relevant, such changes may be consolidated and prepared for inclusion in SALMIS, to the extent permitted by data availability and quality, with the objective of ensuring that the system reflects the most up-to-date information at the time of its operational launch.

Annexes

The annexes provide supporting documentation, technical specifications, and templates referenced throughout the methodology. These materials serve as a practical reference for implementers, GIS analysts, and institutional staff involved in the preparation and maintenance of the geospatial layer.

Annex 1: Data Model for Geospatial Layer on Leased Agricultural Land

This annex provides a detailed description of the data structure used in the geospatial layer representing leased state-owned agricultural arable land and pastures. The data schema includes field names, data types, descriptions, and allowed values.

Contract: Table Structure

Field Name	Data Type	Description	Allowed Values
contract_id	UID	Unique identifier	System generated
fk_institution	UID	Foreign key to the Institution table	Institution Codebook
fk_branch_office	UID	Foreign key to the BranchOffice table	BranchOffice Codebook
contract_number	Text	Contract number	
has_geodetic_elab	Boolean	Whether a geodetic elaborate exists	True / False
fk_source_type	UID	Foreign key to the SourceType table	SourceType Codebook
fk_confidence_level	UID	Foreign key to the ConfidenceLevel table	ConfidenceLevel Codebook
fk_validation_status	UID	Foreign key to the ValidationStatus table	ValidationStatus Codebook
fk_linking_status	UID	Foreign key to the LinkingStatus table	LinkingStatus Codebook

Contract Parcel: Table structure

Field Name	Data Type	Description	Allowed Values / Format
contract_parcel_id	UID	Unique identifier	System generated
fk_contract	UID	Foreign key to the Contract table	Contract Table
fk_cadastral_municipality	UID	Foreign key to the CadastralMunicipality table	CadastralMunicipality Codebook
parcel_number_arec	Text	Parcel number from AREC	
parcel_number_elab	Text	Parcel number from the geodetic elaborate	
Shape	Geometry	Parcel geometry (polygon)	

This schema must be consistently applied across all geospatial datasets submitted to or produced by the SALMIS platform. All attribute data must comply with these definitions to ensure integrity, interoperability, and compatibility with the inventory system and national standards. The structure is designed to support both MAFWE and PEMP use cases: for MAFWE contracts, where geodetic elaborates are mandatory, the model allows linking each contract with one or more cadastral parcels or parts of parcels; for PEMP contracts, cadastral parcel numbers can be recorded where available, while for collective grazing agreements polygons of used pasture areas can be delineated and analyzed against cadastral parcels through SALMIS.

Annex 2: Codebooks and Classification Tables

This annex provides standardized codebooks and classification tables used in the geospatial data layer of leased state-owned agricultural arable land and pastures. These codes ensure consistency and facilitate interoperability between institutional systems.

Institution: Codebook

institution_id	institution_name
1	Министерство за земјоделство, шумарство и водостопанство
2	Јавно претпријатие за пасишта

BranchOffice: Codebook

fk_institution	branch_office_id	branch_office_name
1	1	Берово
1	2	Битола
1	3	Боговиње
1	4	Босилово
1	5	Брвеница
1	6	Валандово
1	7	Василево
1	8	Вевчани
1	9	Велес
1	10	Виница
1	11	Врапчиште
1	12	Гази Баба
1	13	Гевгелија
1	14	Гостивар
1	15	Дебар
1	16	Делчево
1	17	Демир Хисар
1	18	Долнени
1	19	Јегуновце
1	20	Кавадарци
1	21	Карпош
1	22	Кисела Вода
1	23	Кичево

1	24	Кочани
1	25	Кратово
1	26	Крива Паланка
1	27	Кривогаштани
1	28	Крушево
1	29	Куманово
1	30	Македонски Брод
1	31	Неготино
1	32	Ново Село
1	33	Охрид
1	34	Пехчево
1	35	Прилеп
1	36	Пробиштип
1	37	Радовиш
1	38	Ресен
1	39	Росоман
1	40	Свети Николе
1	41	Струга
1	42	Струмица
1	43	Тетово
1	44	Чаир
1	45	Штип
2	46	Бит Пазар - Скопје
2	47	Виница - Виница
2	48	Еленица - Струмица
2	49	Кожуф - Кавадарци
2	50	Кораб - Дебар
2	51	Кратово
2	52	Лера - Гостивар
2	53	Ниџе - Битола
2	54	Свети Николе
2	55	Шара - Тетово

SourceType: Codebook

source_type_id	source_type_name
1	Geodetic Elaborate (GIS format)
2	Scanned Elaborate
3	Cadastral Municipality/Cadastral Parcel Number
4	Digitized from Descriptive Sources

ConfidenceLevel: Codebook

confidence_level_id	confidence_level_name
1	High (based on official documents)
2	Medium (based on descriptive matching)
3	Low (based on approximation or estimate)

ValidationStatus: Codebook

validation_status_id	validation_status_name
1	Validated
2	Pending Review
3	Approximate Geometry
4	Rejected (Not usable)

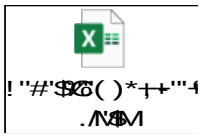
LinkingStatus: Codebook

linking_status_id	linking_status_name
1	Linked
2	Unlinked
3	Not Linkable

CadastralDepartment: Codebook

cadastral_department_id	cadastral_department_name
01	Берово
02	Битола
04	Валандово
29	Велес
05	Виница
06	Гевгелија
07	Гостивар
08	Дебар
09	Делчево
10	Демир Хисар
11	Кавадарци
12	Кичево
13	Кочани
14	Кратово
15	Крива Паланка
16	Крушево
17	Куманово
03	Македонски Брод
18	Неготино
19	Охрид
20	Прилеп
21	Пробиштип
22	Радовиш
23	Ресен
24	Свети Николе
25	Скопје
26	Струга
27	Струмица
28	Тетово
30	Штип

CadastralMunicipality: Codebook



Annex 3: Coordinate Reference System

In accordance with the Law on Real Estate Cadastre[12], specifically **Article 39** and **Article 42**, all geospatial data used within this project shall be aligned with the **State Horizontal Reference System** and the **State Cartographic Projection**. The designated projection for data collection, processing, and integration is **EPSG:6316 – MGI 1901 / Balkans Zone 7**, as officially adopted by the Agency for Real Estate Cadastre. This projection ensures consistency and spatial accuracy across all layers incorporated in the SALMIS GIS environment.

The coordinate system to be used in the project will have the following properties:

Attribute	Value
Projection Type	Gauss-Kruger (Transverse Mercator)
False Easting	500,000.00
False Northing	0.0
Central Meridian	21.0
Scale Factor	0.9999
Latitude of Origin	0.0
Linear Unit	Meter (1.0)
Prime Meridian	Greenwich (0.0)
Datum	Hermans Kogell
Spheroid	Bessel 1841

This coordinate reference system will be used to ensure the accuracy and proper processing of project data. All data collection, mapping, and drawing operations will be carried out in accordance with this coordinate reference system.

Annex 4: Metadata Template for Initial Import of Geospatial Data

This template defines the minimum metadata requirements to accompany each dataset submitted for import into the SALMIS GIS platform during the initial data loading phase. The metadata ensures traceability, institutional accountability, and consistency across data batches. It refers to metadata at the dataset (batch) level, rather than for individual records. For each bundle of records prepared for import (e.g., 500 or 1,000 records), a single metadata description will be created. It is not intended for real-time updates, which will be managed through the SALMIS system.

Metadata Template Table

Field Name	Description
Dataset ID	Unique identifier for the dataset or feature batch

[12] See Annex 7: Reference Legal Documents – Law on Real Estate Cadastre

Source Institution	Name of the institution providing or validating the data (MAFWE, PEMP)
Prepared By	Individual or team responsible for compiling or processing the dataset
Preparation Date	Date on which the dataset was processed or finalized. After import into SALMIS, a visual control of at least 20% of the records will be performed within the platform before final approval.
Coordinate Reference System	EPSG code and name of the CRS used (EPSG:6316 – MGI 1901 / Balkans Zone 7)
Source Document Reference	Reference to associated documentation (internal register, list of contracts, etc.)
Quality Control Status	General QA/QC result for the dataset (e.g., Validated, Partial, Rejected)
Comments / Notes	Any relevant remarks on dataset-level quality, limitations, or scope

Note: After the initial import phase, all future data entry and updates will be performed directly through the SALMIS platform on a record-by-record basis. Since no further bulk imports are foreseen, the maintenance of metadata at dataset level will no longer be required. Instead, SALMIS will ensure traceability through its built-in audit trail, validation rules, and logging mechanisms applied to individual records.

Annex 5: Geodetic Elaborate Validation Checklist (WEB Application)

This annex outlines the functionalities and validation logic implemented in the WEB application used to collect and validate geodetic elaborates for leased state-owned agricultural land managed by MAFWE. The application is part of the digital infrastructure developed under the AMP and serves as a core tool for quality control.

Purpose of the Application

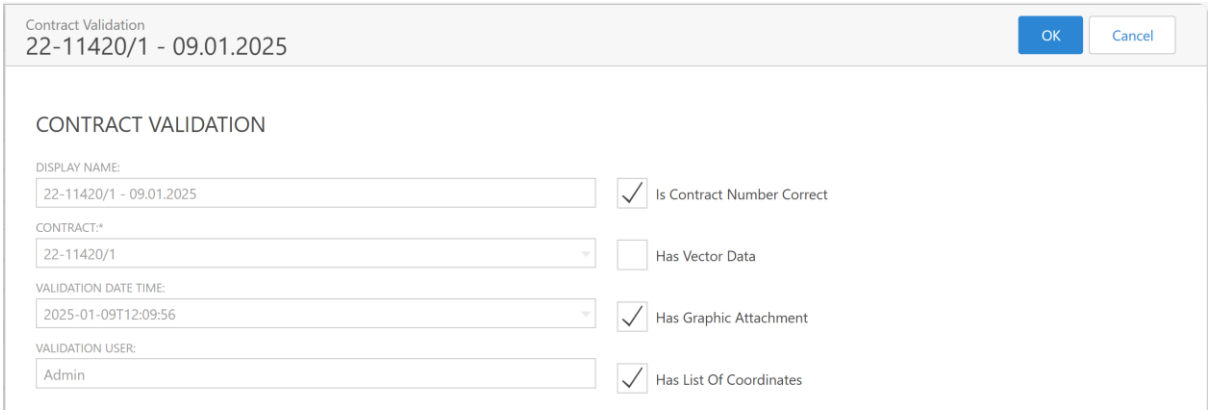
The WEB application enables centralized uploading, classification, and validation of geodetic elaborates submitted by MAFWE regional offices or contractors. It facilitates structured digital intake of documents and supports traceable, rules-based evaluation of their technical content.

Functional Workflow

- Upload Interface: Users upload a set of files for each lease contract, including GIS vector files (SHP, DXF, GML), scanned PDFs, and related metadata.
- Validation Engine: Upon upload files, the validator performs several checks:
  - Matching the contract number in the file with entries in the Temporary Inventory.
  - Verifying the presence of vector geometry (e.g., polygon layers).
  - Confirming inclusion of a graphical sketch (usually a PDF).
  - Detecting a coordinate list, either in tabular form or embedded in the files.
- Validation Status Classification: Based on the above, the system assigns one of the following statuses:
  - Validated (V): All key elements are present and consistent.
  - Pending Review (PR): Some components are missing or inconsistent.
  - Approximate (A): No vector data, only sketch or coordinates.
  - Rejected (R): Not usable for GIS processing.

- Logging and Traceability: Each submission is timestamped, user-tagged, and stored for audit. Only records with a 'Validated' status will be imported into SALMIS, while those classified as 'Pending Review', 'Approximate', or 'Rejected' will require correction or reprocessing before acceptance.

The picture below shows the validation rules implemented in the WEB application for uploading geodetic elaborates:

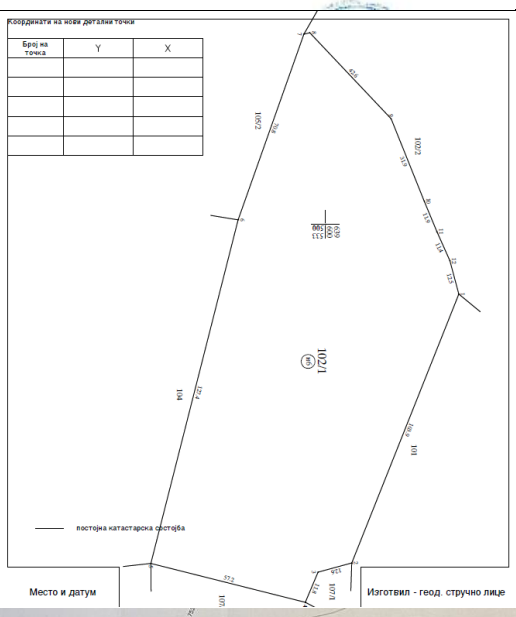
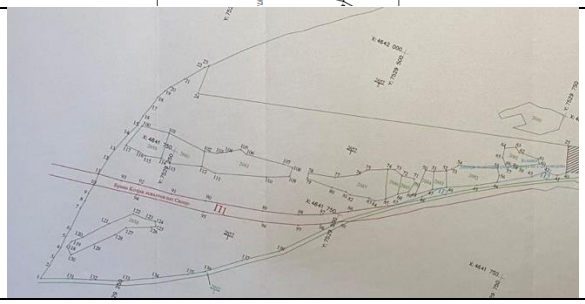


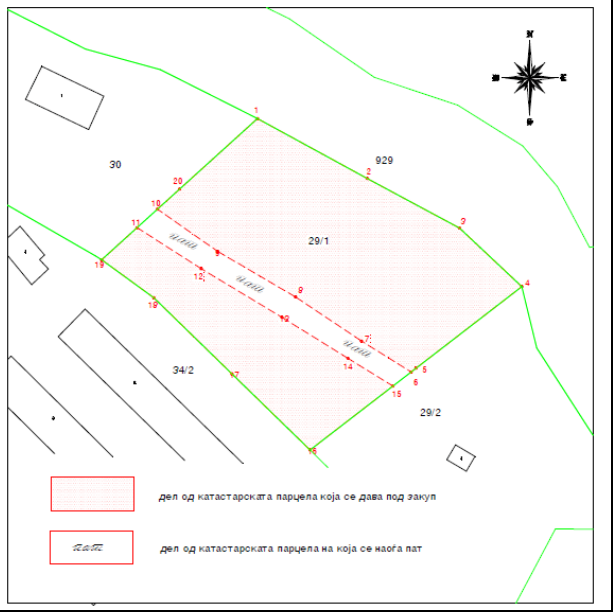
Annex 6: Quality Issues Identified in Geodetic Elaborates

Despite the legal and technical framework regulating the preparation of geodetic elaborates, a significant number of submitted documents—especially older ones—contain various inconsistencies, omissions, or formatting errors that hinder their direct use in the geospatial database. This annex summarizes the most encountered issues observed during the review of uploaded elaborates. These examples highlight the importance of quality control and the need for manual corrections or clarification prior to data import into SALMIS. The resolution of such inconsistencies will be the responsibility of the Supplier contracted to implement SALMIS, as regional office staff do not have the required expertise to assess or correct geodetic documentation.

Illustrative Examples of Data Anomalies

Issue Type	Description	Screenshot

Missing digits in coordinates	Certain Y/X values lack leading digits	1: Y = 545487.203 X = 644986.275 2: Y = 545499.832 X = 644983.497 3: Y = 545641.180 X = 644955.101 4: Y = 545653.676 X = 644947.426 5: Y = 545649.799 X = 644935.328 6: Y = 545634.559 X = 644888.266 7: Y = 545634.288 X = 644886.750 8: Y = 545624.736 X = 644838.815 9: Y = 545576.298 X = 644852.423 10: Y = 545544.313 X = 644860.490 11: Y = 545504.274 X = 644871.098 12: Y = 545457.015 X = 644884.613 13: Y = 545449.774 X = 644886.978 14: Y = 545461.126 X = 644916.366 15: Y = 545473.654 X = 644948.595
No coordinate list	Elaborate includes a sketch but no coordinate table	
Incorrect coordinate order	X and Y values are swapped or not in sequence	

Rounded values	Coordinates rounded to 4 decimals	**К.О Батање** -Координати за катастарска парцела (дел) КП 168 Бр. Y X 1 7598114.6057 4631797.3502 2 7598169.2515 4631825.1177 3 7598184.5740 4631793.0080 4 7598141.2030 4631769.2210 5 7598131.4460 4631764.6770 -Координати за катастарска парцела (дел) КП 141/1 Бр. Y X 1 7597949.9693 4631667.0768 2 7598021.9900 4631698.6500 3 7598041.8700 4631703.5700 4 7598104.3100 4631740.6500 5 7598124.1955 4631757.8013 6 7598150.2749 4631770.8028 7 7598150.8540 4631770.1170 8 7598177.0116 4631715.2284 9 7598139.5800 4631696.0400 10 7598079.0400 4631663.0100 11 7598070.7385 4631659.0222 12 7598068.8070 4631663.0430 13 7598064.5980 4631660.9360 14 7598052.6840 4631654.9730 15 7598039.4590 4631648.3530 16 7597994.1510 4631623.7460 17 7597981.5200 4631616.6800 18 7597964.6690 4631607.4230 19 7597961.4120 4631622.7840 20 7597955.7790 4631649.3560
Excluded land	Manual exclusion of infertile areas from parcel, not clearly defined	ТЕРЕНСКА СКИЦА НА ПРЕМЕРУВАЊЕ НА КП 29/1 КО МАРКОВА СУШИЦА Размер 1:1000 

Annex 7: Reference Legal Documents

This annex lists the key legal and regulatory instruments that provide the legal foundation for the methodology. These documents govern the procedures for leasing state-owned agricultural arable land and pastures, prescribe the technical standards for geodetic works, and establish the framework for spatial data interoperability. All institutions and contractors

involved in data processing and system development are expected to comply with these legal references.

Document Title: **Law on Agricultural Land**

URL: www.mzsv.gov.mk/CMS/Upload/zakon%20za%20zemjodelsko%20zemjishte/Закон%20за%20земјоделското%20земјиште.PDF

Reference / Year: „Official Gazette of the Republic of Macedonia" No. 135/07, 17/08, 18/11, 42/11, 148/11, 95/12, 79/13, 87/13, 106/13, 164/13, 39/14, 130/14, 166/14, 72/15, 98/15, 154/15, 215/15, 7/16, 39/16 and „Official Gazette of the Republic of North Macedonia" No. 161/19, 178/21, 91/23, 218/24 and 235/24

Relevance: Regulates leasing of state-owned agricultural arable land

Document Title: **Law on Pastures**

URL: https://jppasista.mk/wp-content/uploads/2023/05/ЗАКОН-ЗА-ПАСИШТАТА-LIGJI-I-KULLOSAVE.PDFwww.mzsv.gov.mk/CMS/Upload/zakon%20za%20zemjodelsko%20zemjishte/Закон%20за%20земјоделското%20земјиште.PDF

Reference / Year: „Official Gazette of the Republic of Macedonia" No. 3/98, 101/00, 89/08, 105/09, 42/10, 116/10, 164/13 , 193/15 and 215/15 and „Official Gazette of the Republic of North Macedonia" No. 110/21

Relevance: Governs leasing and use of public pastures by PEMP

Document Title: **Law on Real Estate Cadastre**

URL: https://www.katastar.gov.mk/wp-content/uploads/Regulativa/zakoni/zakoni/Zakon_za_katastar_na_nedviznosti_2019_juni_08102019.pdf

Reference / Year: „Official Gazette of the Republic of Macedonia" No. 55/2013, 41/2014, 115/2014, 116/2015, 153/2015, 192/2015, 61/2016, 172/2016, 64/2018, 124/2019 and 155/2024;

Relevance: Legal framework for the use of the official CRS and the structure of geodetic documentation. All spatial data prepared or imported within the scope of this project must comply with the national geodetic standards and legal provisions governed by this law.

Document Title: **Law on National Spatial Data Infrastructure of the Republic of Macedonia**

URL: https://www.katastar.gov.mk/wp-content/uploads/Regulativa/zakoni/zakoni/zakon%20za%20nipp%20mk-sluzben%20vesnik.PDF

Reference / Year: "Official Gazette of the Republic of Macedonia", No. 38/2014, 106/2016, 129/2023 and 74/2025

Relevance: Legal framework for geospatial data interoperability

Document Title: **Rulebook on Geodetic Works for Special Purposes**

URL: https://www.katastar.gov.mk/wp-content/uploads/Regulativa/Pravilnici/precisteni_2024/pravilnik%20za%20geodetski%20raboti_konsolidiran_tekst_02092024.PDF

Reference / Year: „Official Gazette of the Republic of Macedonia“ No. 159/2013, 88/2014, 110/2014, 132/2014, 56/2015, 195/2016, 2/2017, 41/2018 and „ Official Gazette of the Republic of North Macedonia“ No. 48/2019, 183/2019,265/2020, 69/2021 and 52/2023

Relevance: Technical specifications for geodetic elaborates