

UNIVERSITY OF
BALAMAND



جامعة
البلمند

**GIS CAPACITY BUILDING EXPERT FOR UNION
OF MUNICIPALITIES IN AKKAR
AND NORTH LEBANON**

Contract Number: R/N: D186 G2000 UE-S-OU-11/2020

GIS DATA GOVERNANCE

Issued by: Dr. Amal IAALY

GIS DATA GOVERNANCE

MARCH 5, 2021

Prepared by the GIS Center at the Faculty of Engineering at the University of Balamand.

Amal Iaaly

Phone: +961 6 930 250 | Ext: 3960

Email: amal.iaaly@balamand.edu.lb

Patrick Daou

Phone: +961 6 930 250 | Ext: 3984

Email: pedaou@balamand.edu.lb

TABLE OF CONTENT

| | |
|--|----|
| ABBREVIATIONS..... | 4 |
| EXECUTIVE SUMMARY..... | 6 |
| 1 INTRODUCTION | 7 |
| 2 GIS DATA GOVERNANCE..... | 8 |
| 2.1 OBJECTIVES OF DATA GOVERNANCE | 8 |
| 2.1.1 Purpose of Data Governance..... | 9 |
| 2.1.2 Why Geospatial Data Governance..... | 9 |
| 2.2 DEFINITION OF KEY TERMS..... | 10 |
| 3 GOVERNANCE PROCESS AND STRUCTURE | 13 |
| 3.1 GIS Technical Unit Stewardship Process | 13 |
| 3.1.1 Identify Stakeholders..... | 14 |
| 3.1.2 Identify Needs and Set Up a Work Plan | 15 |
| 3.1.3 Data Collection and Aggregation..... | 15 |
| 3.2 Data Stewardship Team..... | 16 |
| 3.2.1 Stakeholder/Governance Groups..... | 16 |
| 3.2.2 Standards enforcement..... | 16 |
| 3.2.3 Establishing Decision Rights..... | 16 |
| 3.3 Data Compilation/Maintenance..... | 17 |
| 3.3.1 Collecting and Centralizing Storage | 17 |
| 3.3.2 Quality Assurance / Quality Control of Data..... | 17 |
| 3.3.3 Compiling data into single data set | 18 |
| 3.3.4 Distribution..... | 18 |
| 3.3.5 Data Description | 19 |
| 3.3.6 Data Security | 19 |
| 3.4 Data Governance Standards and Policies..... | 19 |
| 3.4.1 Data Standards | 20 |

ABBREVIATIONS

| Acronym | Description |
|----------------|--|
| ACCD | Catalan Agency for Development Cooperation |
| UoM | Union of Municipalities |
| ToR | Terms of Reference |
| GIS | Geographic Information Systems |
| URISA | Urban and Regional Information Systems Association |
| ODK | Open Data Kit |
| NGO | Non-Governmental Organisation |
| INGO | International Non-Governmental Organisation |
| GPS | Global Positioning System |
| QA | Quality Assurance |
| QC | Quality Control |
| RDBMS | Relational Database Management Systems |

LIST OF FIGURES

| | |
|---|----|
| Figure 1 – Data Governance and Data Stewardship | 9 |
| Figure 2 – GIS Technical Unit Stewardship Process | 13 |

LIST OF TABLES

| | |
|---|----|
| Table 1 – Data Governance and Collaboration with Stakeholders | 14 |
| Table 2 - User Permissions and Restrictions..... | 19 |

EXECUTIVE SUMMARY

Data governance is considered a vital starting point for the successful implementation of any GIS initiative within both the public and private sector. It constitutes the foundation for any GIS work within a structured organization by defining *who can take what actions with what information, and when, under what circumstances, using what methods*. This report identifies the data stewardship process which will be handled by the GTU at the Union of the Oussat wa Sahel al Qaytaa or the municipalities at the UoM of Menieh. The plan identifies the data providers, data owners, and the primary data users and details a process of communication. It also proposes a set of standards and policies that must be developed by the GIS technical Coordinator and the GIS Technician to ensure a standardized and unified geospatial datasets. The plan also sets a procedure regarding data sharing policies. Various sets of standards and policies are recommended to be elaborated by the GIS coordinator. Without a data governance plan, the work of GIS will be chaotic, unorganized, and unstandardized. Employees will lack understanding of the proper way to get the data from the providers and what and how to share the data with stakeholders.

1 INTRODUCTION

This report was prepared in accordance with the Scope of Work for the project entitled “GIS Capacity Building and Institutionalisation for Union of Municipalities” agreed between the Clients, the Catalan Agency for Development Cooperation (ACCD), and the Consultant, GIS Center at the University of Balamand.

The geographic scope of the assignment is the Union of Municipalities (UoM) of Oussat wa Sahel al Qaytaa located in the Governorate of Aakkar and the UoM of Menieh located in the Governorate of North Lebanon.

As stated in the ToR, the objectives of this assignment are (1) To support the UoMs in institutionalizing the GIS and the Technical Unit within the current socio-economic situation, (2) To support the UoMs in managing the GIS to fill the existing gaps in data, coordination, operations, decision making, and scenarios planning, (3) To build the institutional capacity of the local governments and better equip them to retain their human resources in the current economic crisis.

Five outputs have been specified for this assignment:

- **Output 1:** Set Up the structure for the Capacity Building Programme
- **Output 2:** Implement the GIS Capacity Building Programme
- **Output 3:** Workshop with mayors on GIS for decision-making
- **Output 4:** Roadmap for data collection and Municipal manual
- **Output 5:** Operationalize the GIS Technical Unit

This report corresponds to the deliverables of Output 5: “*Operationalize the GIS Technical Unit*”, and responds to objective 5.3: Set an action plan on how to operationalize the GIS unit.

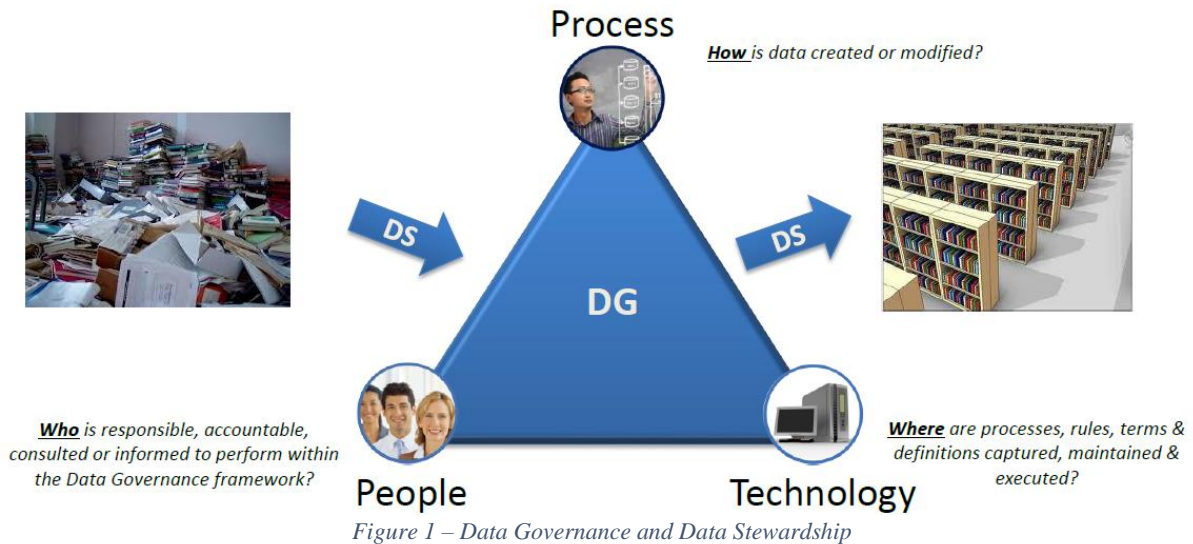
2 GIS DATA GOVERNANCE

This document intends to develop a Data Governance (DG) Plan to provide a starting point and set a roadmap for the effective management of the UoMs geospatial data assets within the proposed newly established GIS Technical Unit (GTU) and GIS Technical Committee (GTC). The plan elaborates the actions that should be taken to establish accurate, complete, timely, secure, and authoritative data sources that can be utilized within the GTU or individual municipalities and shared with the various municipalities and stakeholders. The plan set the standards relative to the collection, management, and distribution of spatial data. Data Governance is considered an essential part of the institutionalization and operationalization of GIS. It provides clear answers associated with the who – what– how – when – where and why.

2.1 OBJECTIVES OF DATA GOVERNANCE

Data Governance Plan indicates *who can take what actions with what information, and when, under what circumstances, using what methods*. This definition highlights how the design of a data governance plan concerns more organizational design than technology in itself, and in particular, the design of the relationships between people, technologies, and processes related to data. Therefore, Data Governance and Information Technology (IT) Governance are indeed two separate dimensions. The governance of IT systems concerns the management of IT resources (hardware, software, databases) belonging to the organization.

An important element of DG is Data Stewardship (DS) which refers to the practice of managing data and providing users access to that data. Processes supporting geographic data stewardship will be based on clear, inclusive, and well-documented data architecture. Geographic data should be shared widely among the primary and secondary user community with proper consideration to sensitivity, legal, and policy concerns that may restrict access and distribution. Figure 1 shows the architect of the DG model within an organizational structure.



2.1.1 Purpose of Data Governance

The purpose of the Data Governance Plan is to achieve the following:

- To take ownership of information as a team where everyone clearly understands their role, and the data they are responsible for;
- To define expectations, set authority, monitor and verify performance;
- To increase the consistency and coordination between existing and new data programs;
- To consolidate various data sources and resources;
- To eliminate redundancy in data collection.

In a nutshell, data governance includes principles and processes, standards and rules, roles and responsibilities.

2.1.2 Why Geospatial Data Governance

Geospatial data differs somewhat from other data in that:

- Geospatial data is often widely shared and developed with the intent to be *shared*;
- Comprehensive data often is built from *multiple contributors*;
- Several data sets that are used routinely don't have clear *owners*, so specific mechanisms for the integration of data and defining owners versus stewards become key issues.

Therefore, the main reason for developing a GDG policy is *to improve data sharing* among the GTU and the municipalities by:

- Making authoritative data known and discoverable;

- Improving the reliability of data because its quality is known;
- Defining a consistent system for identifying access or security restrictions for data rather than individual ad hoc decisions.

Additional reasons for pursuing GDG policy are: protecting the investment, securing data, improving decision making.

2.2 DEFINITION OF KEY TERMS

Data Stewardship

Data stewardship is the practice of managing data and providing users access to that data. Geographic data should be shared widely among the primary and secondary user community with proper consideration to sensitivity, legal, and policy concerns that may restrict access and distribution.

Metadata

Metadata is information about the content, format, quality, authority, and availability of geographic data is vital, and this metadata should be updated along with the data itself.

Primary Data User

Primary data users are the organizations or employees that are the high-priority customers for the geospatial data. There must be a formal agreement, contract, or mandate between the organization providing the data and the data users. For example, the GTU is the data provider, while the UoM of Oussat wa Sahel al Qaytaa and the municipalities are the primary data users. If these municipalities require data related to the road network, zoning, or land registry from the GTU, hence, they are considered primary data users. The GIS Coordinator and the GIS Technician at the GTU, that use the Geospatial data for analysis and decision making, may also be primary data users. NGOs can also be considered primary data users if they request specific geospatial data production related to specific projects such as solid waste management or road safety.

Data Steward

A data steward is a person or organization delegated the responsibility for managing a specific set of data resources entrusted to them by data providers and/or data owners. *Within the GTU, both the GIS Coordinator and the GIS Technician are considered Data Stewards.*

Best practices for geographic data stewardship will be based on the following principles:

- 1) The GIS data should be maintained over time through an effective and efficient update/upgrade program. It is highly recommended to schedule an update every six months.
- 2) Organizations or persons responsible for data collection should have a lead role in updating and providing that geographic data.
- 3) The processes supporting geographic data stewardship will be based on a clear, inclusive, and well-documented data architecture.
- 4) Policies, procedures, and technical processes for data updates should be well documented and widely communicated.
- 5) Metadata providing information about the content, format, quality, authority, and availability of geographic data is vital, and this metadata should be updated along with the data itself.
- 6) Maintaining a high level of geographic data quality is critical. Data should be maintained at a specified quality level that is well documented. This quality level should be met unless there is a good reason to deviate from it, and any deviations should be documented.
- 7) Geographic data should be shared when requested by municipalities integrated into the UoM with proper consideration to legal and policy concerns that may restrict access and distribution.

Data Provider

A data provider is a person or organization that functions as the primary custodian and/or owner of a data source made accessible to a wide audience of users. This includes organizations or persons with missions encompassing or requiring geographic data collection, management, or publication. Data providers should have a lead role in updating and providing geographic data in an environment and format that can be accessed and used by a larger audience, with proper consideration to sensitivity, legal, and policy concerns that may restrict access and distribution. A geographic data provider should agree upon a specific level of data quality for the data that is going to be shared, and this level should be maintained unless there is a good reason to

deviate from it, and any deviations should also be well documented. *For example, within the GTU both the Data Collector/Enumerator and the Data Entry Clerk are considered data providers especially when they are asked to generate primary data by carrying field surveys. Municipalities are also data providers as they will provide data such as AutoCAD maps, land ownership, taxation, zoning, etc. It is highly advisable to identify a Data Provider within each municipality to manage the data sharing between the GTU and the municipality. In case the municipality has no data provider, the GIS Technician can be delegated to acquire the data. Local authorities such as the land registry, Directorate of Land Registration and Cadastre, the Urban Planning, among others are also data providers. It is highly recommended that the GIS Coordinator establish a written long-term agreement with these public institutions to maintain a systematic provision of data.*

Data Owner

A data owner is a person or organization having the responsibility and authority for an entrusted data resource. Entrusted data is data owned by an entity that can authorize or deny access to this data, and is responsible for its accuracy, integrity, and timeliness, and maintenance/production of record-level metadata. Policies, procedures, and technical processes for the accuracy, integrity, timeliness, and satisfying standards of metadata should be documented and widely communicated. *The GTU and the UoM are the Data Owners.*

3 GOVERNANCE PROCESS AND STRUCTURE

3.1 GIS Technical Unit Stewardship Process

A structure for governance of geospatial data includes a standard set of steps for stewarding data sets. Stewarding data within the GTU should not necessarily pursue all the steps in each group, but such groups do clarify the process. The steps may be thought of as increasing levels of maturity in stewarding data from basic coordination types of activities to full data integration. The steps in data stewardship are:

- Identify stakeholders and Perform a needs assessment
- Carry data collection and integration
- Establish and maintain a data stewardship team to define processes, standards enforcement, establishing decision rights, conflict management.
- Perform data compilation and maintenance potentially including collecting data, centralizing data, assessing the quality of data, compiling data into single data sets, and integrating edits to data on an ongoing basis
- Support data distribution
- Identify data governance policies and standards appropriate for data sets

The first two steps listed should be the first tasks undertaken when engaging in the stewardship of a data set, while all the steps must be cyclic and carried in a continuous cycle as illustrated in Figure 2.

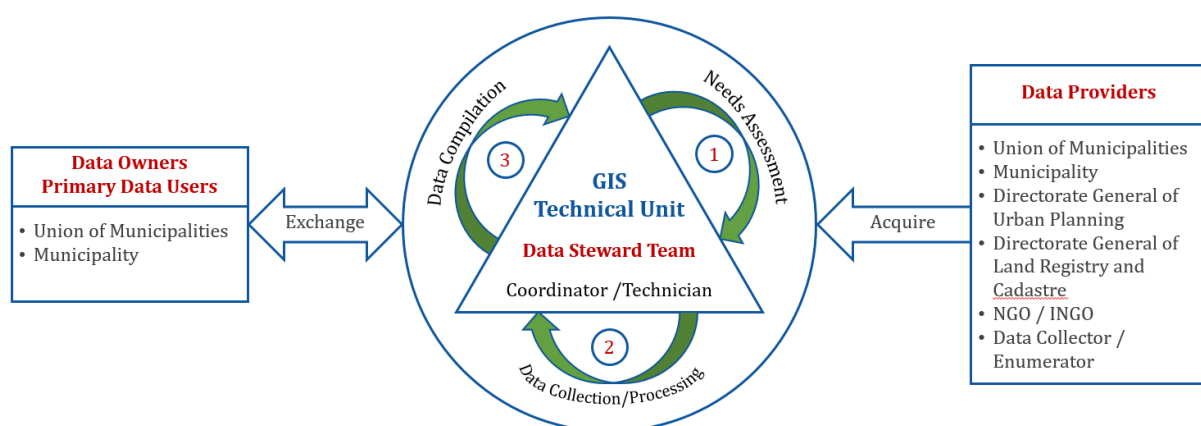


Figure 2 – GIS Technical Unit Stewardship Process

3.1.1 Identify Stakeholders

It is essential during the need assessment phase to identify stakeholders to ensure that the right stakeholders are involved in future processes. The most common way to identify stakeholders is to look at who is providing inputs to data products and then look at who is receiving the outputs of these products. Also, in this step, the roles and responsibilities of stakeholders must be defined.

When categorizing the stakeholders, it is important to recognize that some stakeholders may fit into more than one classification. Stakeholders can be classified into the following groups: Data Owner, Data Provider, Data Steward, and Primary Data User.

A written agreement must be done between the GTU and the various stakeholders to guarantee the proper inflow and outflow of data. This step is vital for the institutionalization and operationalization of GIS within the GTU since the long-term use of GIS depends on the proper collaboration between various stakeholders.

Table 1 – Data Governance and Collaboration with Stakeholders

| | Data Owner | Data Provider | Data Steward | Primary Data User |
|---|------------|---------------|--------------|-------------------|
| GIS Technical Unit | X | X | X | X |
| UoM | X | X | | X |
| Municipalities | X | X | | X |
| Directorate General of Land Registry and Cadastre | | X | | |
| Directorate of Urban Planning | | X | | |
| Surveyors | | X | | |
| Engineering Offices | | X | | |
| NGOs / INGOs* | X | X | | X |

** NGO/INGO could claim ownership of the data based on the term of the agreement made between the GTU and the NGO/INGO.*

3.1.2 Identify Needs and Set Up a Work Plan

The needs of various stakeholders especially the primary data users must be identified to prioritize the data collection plan. The needs assessment is considered a vital first step within the GTU to ensure the proper development of the geospatial database.

This step must be carried by the **GIS Coordinator** through a series of scheduled individual meetings with:

- The Mayor of the Municipalities
- The Head of the UoM
- The active NGOs / INGOs
- The local Community representative, since they provide valuable info regarding the needs' identifications

The GIS Coordinator must create a list of needs and rank them by priority. The list must be discussed with the various involved stakeholders for their consent. *This step will help the GIS Coordinator produce a **work plan for the GTU** in both the short term and long term. The work plan can serve as a reference for assessing the work of the GTU.*

3.1.3 Data Collection and Aggregation

The needs assessment and the work plan will lead to the identification of the various data sources needed for the implementation phase. The **GIS Coordinator** is the one responsible within the GTU for establishing contact with various data providers to acquire the necessary data. This requires the aggregation of many data sources. A data model and data dictionary should be developed. It is necessary to create an excel sheet to keep records and traces of the data elements back to the point of initial collection and data source. For example, if the Directorate General of Land Registry and Cadastre provided AutoCAD maps that serve as a base layer in GIS, then they will be the source of data for the parcels or property maps. In case the Data Collector at the GTU collected the data, then the GTU is the data source. Metadata must also be well documented to keep traces (to be discussed in section 3.4.1).

3.2 Data Stewardship Team

The Head of the UoM along with ACCD must establish a data stewardship team who will be responsible for defining the processes of data governance, generating standards and enforce them, establish decision rights, and conflict management. For the head of the UoM and ACCD to establish the data stewardship team, it is recommended to include the primary Data Steward, a stakeholder group, and a data governance group. However, pragmatically and based on experience and best practices in data governance, it is recommended to form a compatible team with the necessary expertise and technical background that can provide consensus on high-level data standards and application of those standards.

3.2.1 Stakeholder/Governance Groups

A Stakeholder/ Governance Group should consist of those who use, create, and have sets of rules and requirements for the data to be stewarded. They also have insight on issues related to data accuracy, content, and use of the data within the data community. Hence, municipality *engineers and/or volunteers* must be appointed by the mayors with the proper IT background in DBMS, data standards, and data quality to be part of the Data Stewardship group.

The GIS Coordinator must work closely with these groups to create data standards related to metadata, spatial accuracy, and publication of the data standards. This is considered an essential step to unify the data.

3.2.2 Standards enforcement

It is the responsibility of the *GIS Coordinator* with the help of the *GIS Technician* to make sure that any stewarded data set should comply with the standards that must be defined by the Stakeholder and Governance group.

3.2.3 Establishing Decision Rights

The *GIS Coordinator* with the stakeholder and governance group must establish decision rights for a data governance program related to potential changes to the data, its structure, or its required handling or access to stakeholders.

3.3 DATA COMPILATION / MAINTENANCE

These steps are related to the process of centralizing a data set for access and use by the data stakeholders.

3.3.1 Collecting and Centralizing Storage

This is the simplest step in centralizing the distribution and maintenance of data and does not include any modifications to the geometry of the data.

This step may involve the following issues:

- Identifying data sources – This is generally done through the needs assessment step, but it is an ongoing process and is more rigorously documented in this effort.
- Data sharing agreements – Data sharing agreements may be necessary to make data available to multiple agencies.
- Access/distribution – The purpose of collecting data in a central location is to provide access to these multiple data sets from a single location.

This step does not have to involve the normalization of data attributes, but that may be a follow-up to the centralization. If normalization is desired, data may be translated to a standard model through an extract, transform and load (ETL) process or some other process.

This step is the responsibility of the *GIS Technician* at the GTU to collect and centralize these data.

The data must be located on a single server with a high level of security. The server can be any computer with two hard disks. One of the hard disks is only allocated for data storage. Encryptions and security measures must be set to protect the data.

3.3.2 Quality Assurance / Quality Control of Data

This step involves assessing and documenting the *consistency, accuracy, or timeliness of the data*. The quality must be expressed in a way to assess the fitness of the data for their use. As described in the standards section below, it is desirable to have a standard way of representing data quality.

The QA/QC step includes two tasks:

- Monitor data quality – This involves routinely assessing the quality of data according to the metrics decided on by the stakeholder group and the data steward.
- Report data quality status – The assessment of data quality should be communicated to the stakeholders and the data governance group. In particular, trends or changes in the quality of the data should be highlighted.

This step is the responsibility of the *GIS Technician* at the GTU to perform QA/QC of the collected data

3.3.3 Compiling Data into a Single Data Set

This step involves combining the geometric features of the smaller data sets, but it does not have to involve editing these features to correct differences in the geometry or topology. In its simplest form, it requires standardizing and combining the attributes.

The tasks involved in this compilation step are:

- Combine sub data sets into a seamless geometric data set with standardized attributes.
- Assess topological, semantic, and geometric differences in the data, such as overlaps or gaps in adjacent data, different definitions of features, and different levels of generalization in data features.
- Edit the data to correct the differences identified in the previous point to create a topologically seamless data set.

This step is the responsibility of the *GIS Technician* at the GTU to compile the data.

3.3.4 Distribution

Distribution of spatial data requires two levels of approval from both the **GIS Coordinator and the Head of the UoM**. Data will only be given based on a written request. Data privacy and data security must be respected while sharing geospatial data. No confidential information is allowed to be shared.

3.3.5 Data Description

Metadata standards must be defined to allow for the complete discovery of data in the most efficient manner possible. Metadata standards are detailed in section 3.4.

3.3.6 Data Security

Based on the sensitivity of data being provided, it will be necessary to implement some level of control to data assets. The **GIS Coordinator** must provide different GIS users with different rights to use data, with varying levels of access constraints, that are role-based access and information classifications may provide adequate controls. Some examples would include restricting the rights a user has to access information and restricting the rights a user has to perform certain functions (Create, Read, Update, Delete - CRUD).

Table 2 - User Permissions and Restrictions

| | Create | Read | Update | Delete |
|--------------------------------------|-----------------------------|------|--------|--------|
| GIS Coordinator | X | X | X | X |
| GIS Technician | X | X | X | X |
| Data Entry Clerk | X | X | X | |
| Data Collector / Enumerator | X | | | |
| Geospatial Subject Matter Specialist | Depends on the project type | | | |

It is highly advisable to have a **data privacy agreement** signed by all the GTU permanent staff and volunteers and to share with them the GIS “Code of Ethics” to ensure the security of the data.

3.4 Data Governance Standards and Policies

This step deals with the way standards and policies are selected. A well-defined set of policies and standards that establishes expectations for data collection assists decision-makers in the review and acceptance of new data. The policy should also serve to establish rules of sharing

data and contain a mechanism to periodically review how data is being acquired and shared to the larger community and whether user needs are being accommodated.

While standards and policies are important for the ongoing maintenance of authoritative data, it is important to recognize that successful development and maintenance of data depends on solid, mutually beneficial relationships between the data stewardship effort and data providers. The long-term goals of data governance should include creating agreements, processes, and relationships, which together will lead to the long-term improvement of data both for the providers and to the distributors of data.

There is a hierarchical relationship among data policies, standards, and procedures as shown in figure 3. Data policies are high-level statements that represent a desired state or outcome consistent with the established strategic goals and objectives. The data standards provide further detail on how the GTU/ Municipalities intend to implement the various policies. Finally, the data procedures contain detailed descriptions of data rules and their application.

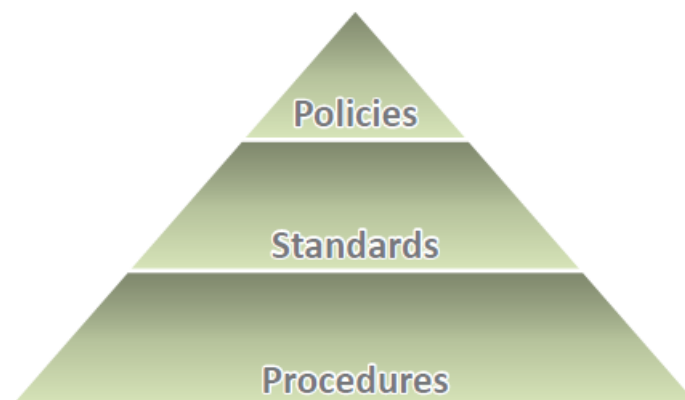


Figure 3 -Data Governance Framework Hierarchy

The GIS Coordinator, the GIS Technician, and the Stakeholder / Governance group must work together to generate data policies, standards and detailed procedures.

3.4.1 Data Policies

The following Data Policies are recommended to foster consistent expectations as to how data are to be treated and managed throughout GTU/ Municipalities. The proposed policies guide data creation, acquisition, storage, quality, integrity, interoperability, security, and privacy. Adoption of the policies ensures the successful development of procedures to identify and

rectify data management deficiencies, and create a set of GTU/ Municipalities -wide data standards.

Table 3 - Data Policies

| Policy Name | Policy Creator | Policy Description |
|--|--|--|
| Data must be consistent | GIS Coordinator, GIS Technician and Stakeholder / Governance group | All GIS data shall be modeled, named, and defined consistently, according to standards, across the organization. Efforts must be to not maintain redundant data without justification. |
| Data must be of acceptable quality | GIS Coordinator, GIS Technician and Stakeholder / Governance group | Quality data are critical to ensuring success. Data Stewards are responsible for ensuring that GIS data at the GTU/ Municipalities are accurate and correct for the intended purpose and use, and that data providers follow all reporting requirements regarding the collection, processing, and reporting of GTU, and meet all requirements of the Data Quality. |
| Data must be interoperable with dependent systems | GIS Coordinator, GIS Technician and Stakeholder / Governance group | All GIS data (structured and unstructured) must conform to a common set of standards and schemas across all data sharing parties. |
| Data must be maintained at the source | GIS Coordinator, GIS Technician and Stakeholder / Governance group | All data must be maintained at the source to reduce the collection and storage of redundant data. |
| Data must be safe and secured | GIS Coordinator, GIS Technician and Stakeholder / Governance group | Data, in all electronic formats, shall be safeguarded and secured. Appropriate backups and disaster recovery measures shall be administered and deployed. The GTU data must adhere to the privacy rules. |
| Data must be accessible | GIS Coordinator, GIS Technician and Stakeholder / Governance group | GTU data, information, and metadata shall be readily accessible to all, except where determined to be restricted. When restrictions are made, stewards of the data are accountable for defining specific individuals and levels of access privileges that are to be enabled. |
| Metadata will be recorded and utilized | GIS Coordinator, GIS Technician and Stakeholder / Governance group | All GTU GIS data and projects will utilize the defined metadata program for data naming, data modeling, and logical and physical database design purposes. |
| Data stewards will be accountable by job description | GIS Coordinator, GIS Technician and Stakeholder / Governance group | Individuals designated as stewards will have specific GIS data accountabilities incorporated into their job descriptions. |
| Timeliness of data | GIS Coordinator, GIS Technician and Stakeholder / Governance group | Data must be obtained, processed and be made available in a timeframe consistent with its intended use. |
| Data Update | GIS Coordinator, GIS Technician and Stakeholder / Governance group | Data must be updated in a cyclic manner to ensure its viability and usefulness. |

3.4.2 Data Standards

Standards are required to define data structures, mapping or data compilation procedures, definitions of features and formats for transfer of data, among others. Based on an extensive review of the literature relative to geospatial data governance, the following recommended standards were selected:

- **Metadata** – All datasets should contain metadata that conforms to some minimal set of mandatory elements. Metadata content details various characteristics of the data description, the processing steps, attribute content, and the quality of the data. Metadata is also critical for making the data set discoverable and informs users how to access the data. Metadata must also provide sufficient information to allow the user to determine if the geographic data set will meet the user’s intended purpose.
- **Data Quality Description** – A description of data quality is a required field in the metadata. Standard approaches to describing data quality should be developed. Such approaches may include the traditional map accuracy statements or it can be based simply on a detailed description of compilation methods or both. This description can be included in the metadata. Data quality statements may include Horizontal accuracy and data resolution.
- **Data Security/Access Constraints** – Data security or access constraints again depend on individual agency discretion. The GIS Coordinator must set the data security and access constraints to both employees and volunteers.
- **Data Sharing Agreements** – A formal data sharing agreement outlining the specific data shared, how it is shared, who may have access to it, how often data is shared, and responsibilities for updating the data are often requested by data providers. A standard agreement should be used as much as possible to reduce the overhead in executing such an agreement and to ensure all parties are protected in a standard manner. Also, clarification of **who may execute these agreements** is necessary to protect all involved. The GIS Coordinator and the UoM president can be the ones responsible for the execution of the agreement.