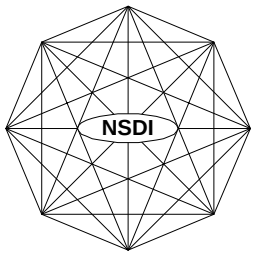

National Spatial Data Infrastructure

Utilities Data Content Standard - Draft

Facilities Working Group
Federal Geographic Data Committee

May 1999

Federal Geographic Data Committee
Department of Agriculture • Department of Commerce • Department of Defense • Department of Energy
Department of Housing and Urban Development • Department of the Interior • Department of State
Department of Transportation • Environmental Protection Agency
Federal Emergency Management Agency • Library of Congress
National Aeronautics and Space Administration • National Archives and Records Administration
Tennessee Valley Authority

Federal Geographic Data Committee

Established by Office of Management and Budget Circular A-16, the Federal Geographic Data Committee (FGDC) promotes the coordinated development, use, sharing, and dissemination of geographic data.

The FGDC is composed of representatives from the Departments of Agriculture, Commerce, Defense, Energy, Housing and Urban Development, the Interior, State, and Transportation; the Environmental Protection Agency; the Federal Emergency Management Agency; the Library of Congress; the National Aeronautics and Space Administration; the National Archives and Records Administration; and the Tennessee Valley Authority. Additional Federal agencies participate on FGDC subcommittees and working groups. The Department of the Interior chairs the committee.

FGDC subcommittees work on issues related to data categories coordinated under the circular. Subcommittees establish and implement standards for data content, quality, and transfer; encourage the exchange of information and the transfer of data; and organize the collection of geographic data to reduce duplication of effort. Working groups are established for issues that transcend data categories.

For more information about the committee, or to be added to the committee's newsletter mailing list, please contact:

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1. PARTS OF THE STANDARD

This Utilities Standard consists of a short main body and five appendices. The main body of the Utilities Standard defines the purpose of this standard, the process followed during its development, the organization(s) involved in its development and maintenance, and its relationship to other standards. Appendix A lists and defines the Feature Classes for this Utility Standard. Appendix B contains a comprehensive Feature Types report which lists the utilities feature type names and definitions, the object type, and their associated feature class and attribute table. Appendix C contains a comprehensive Attributes report which contains a complete listing of attributes associated with utilities feature types and each attribute's name and definition, data type, character length, and associated domain name. Appendix D contains a Domains report which contains a complete listing of domain names (and their definitions) and lists the potential values for each domain (and defines each value.)

In Appendix B, attribute tables for each feature type have been grouped by their anticipated usein manageing a utility database. This grouping, used in place of a single alphabetical attribute list for each attribute type, is intended to help in the maintenance of the standard over time. This Utility Standard groups attributes by the following subjects:

1. Database conectivity. (e.g., feature ID, foreign links, coordinate values, ...)
2. Physical Properties of utility item. (e.g., dimensions, model type, material, style, area, slope, ...)
3. Performance related information. (e.g., disposition, use, capacity, rate of flow, min/average/max use, ...)
4. Maintenance of the utility item. (e.g., date acquired, user flag, switch status, inspections, alarms, ...)

In Appendix D, a number of the domain lists are for proper names (e.g., reservoir names, utility company names, ...). The domains that list proper names are intended to be exemplary. The specific values (proper names) used by an organization or locality may vary geographically. Therefore, Appendix D is informative (not mandatory) and is not intended to standardize all domain values across the entire community of users of this standard. Whereas, Appendices A, B, and C are normative (i.e., mandatory parts of the standard.) The Utilities Standard also contains another informative appendix, Appendix E, that contains a series of entity relationship models for this Utilities Standard.

Appendix A	Utilities Feature Classes (normative)
Appendix B	Utilities Feature Types (normative)
Appendix C	Utilities Attributes (normative)
Appendix D	Utilities Domains (informative)
Appendix E	Utilities Entity Relationship Model (informative)

2. DEFINITIONS

For the purpose of this Utilities Standard, the following definitions apply.

1.1 **feature class** - a logical group of related feature types (e.g., grouping of water system components feature types such as water_hydrant, water_line, water_pump, water_reservoir, water_tank, etc. into a water system feature class).

1.2 **feature type** - definition and description of a set (class of real world phenomena) into which similar feature instances are classified (e.g., water_reservoir).

1.3 **feature instance** - real-world spatial phenomenon about which data is collected, maintained, and disseminated. (e.g., the McMillan Water Reservoir). Feature instances are the geospatial objects that are graphically delineated in a spatial database.

1.4 **attribute** - a defined characteristic of a feature type (e.g., an attribute of electrical cable feature type = electrical cable material).

1.5 **domain** - a finite list (or range) of permissible values for a specified attribute. Included are tables of: units of measure, types, styles, status, names, methods, materials, dispositions, sources, dimensions, data, classes, etc. (e.g., electrical cable material --Al, Fe, Pb, steel, Cu, . . .).

1.6 **attribute value** - a specific quality or quantity assigned to an attribute for a specific feature instance (e.g., electrical cable material = Cu).

1.7 **IDEF modeling** - Integrated Definition (IDEF) is the name given to a family of over 30 graphical modeling techniques. The $IDEF_o$ and $IDEF_{1x}$ are the best known of these techniques. $IDEF_o$ techniques are used to describe business processes or activities for reengineering a function. $IDEF_{1x}$ techniques are used to define business rules and create a logical data model.

1.8 **geospatial data** - data with implicit or explicit reference to a location relative to the earth.

1.9 **data content standard** - provides the semantic definitions for a set of real world spatial phenomena of significance to a community. Data Content Standards may be organized and presented in a specified logical data model such as an entity-relationship model or and IDEFIX model

1.10 **utilities** - a manmade component of a system that provides a service to the public.

3. INTRODUCTION

3.1 OBJECTIVE

The purpose of this Utilities Geospatial Data Content Standard (hereafter in this document abbreviated to Utilities Standard) is to standardize geospatial information for utility systems. This standard specifies the names, definitions and domains for utility system components that can be geospatially depicted as feature types and their non-graphical attributes. This Utilities Standard is classified as a **Data Content Standard** in the Federal Geographic Data Committee (FGDC) Standards Reference Model.

3.2 SCOPE

This Utilities Standard supports large-scale, intracity applications such as engineering and life-cycle maintenance of utility systems. The components of each utility system described in this Utility Standard are considered to represent features located outside the foundation of an enclosed structure. This Utilities Standard describes eleven feature classes: **compressed air, electrical distribution, electical monitoring/control, fuel distribution, heating/cooling systems, industrial waste, natural gas distribution, saltwater, storm drainage collection, wastewater collection, and water distribution**. This standard does not contain all features nessesary to describe or model communications, alarm systems, or long distance utilities networks that stretch between cities. As with the Spatial Data Transfer Standard (SDTS), this Standard uses a logical data model (described in section 3).

3.3 APPLICABILITY

This Utilities Standard is applicable for any system that captures or uses spatial data about utility systems (i.e., **compressed air, electrical distribution, electical monitoring/control, fuel distribution, heating/cooling systems, industrial waste, natural gas distribution, saltwater, storm drainage collection, wastewater collection, and water distribution**.) in supports of life-cycle management applications i.e., planning, design, construction, and facilities management (FM). For example, this standard is applicable to support life-cycle management of a building complexes' natural gas distribution system or to support the management/maintenance of a private/public water distribution system.

3.4 STANDARDS DEVELOPMENT PROCESS

This standard was developed by the Utilities project team under the guidance of the Facilities Working Group. Much of the utilities system information contained in this standard was extracted from the Tri-Services Spatial Data Standards (TSSDS). During the development process the project team examined the information and structure of the TSSDS and decided to use only the logical data model (feature, attribute, domain information) from the TSSDS. The project team decided that the physical data model contained in the TSSDS, which supports specific implementations (i.e., generates feature schemas for a number of common relational GIS/CADD systems), was inappropriate for a NSDI standard. Also, the initial feature, attribute, domain information from the TSSDS was revised by the Utilities project team. For example, common names were added to each of the attribute codes extracted from the TSSDS and some new features and attributes were defined. Many of the revisions made for this Utilities Standard will also be incorporated into future versions of the TSSDS.

During the period of public review, the draft Utility Standard did not yet include compressed air and saltwater utility classes as listed in the TSSDS. These classes have since been added. The current FGDC Utility Standard includes changes introduced into the 1.8 version of the TSSDS. Four organizations contributed comments by providing a set of their own standards. These independent standards were analysed and used to update the FGDC Utility Standard.

Comments were received by:

Commonwealth Gas Company, Southborough, MA.
NorthCarolina Geographic Information Coordinating Council.
Louisville and Jefferson County (Kentucky) Information Consortium GIS.
The Second Joint Government/Industry Mapping Quality Action Team.

The Utilities project team had participants from Federal agencies, professional societies, and local governments, and private industry. Specifically the following organizations were significantly involved in the development of this standard:

U.S. Army Corps of Engineers
American Public Works Association
Environmental Protection Agency
Applied Geographics, Inc.

3.5 RELATED STANDARDS

As previously mentioned this Utilities Standard closely parallels the utilities information contained in the TSSDS. Other standards were also eveluated during the public comment period of the Standard's development. They include: The National Pipeline Mapping System, The Data Dictionary for the Louisville and Jefferson County Information Consortium GIS, Content Standard for the North Carolina Corporate Geographic Database, and Commonwealth Gas Company, Southborough, MA.

3.6 MAINTENANCE

The Department of Defense, U.S. Army Corps of Engineers maintains the Utilities Standard for the Federal Geographic Data Committee with support from the Tri-Service CADD/GIS Technology Center. All general questions and comments concerning this standard should be addressed to:

U. S. Army Corps of Engineers
General Engineering Branch
20 Massachusetts Avenue, NW
Washington, DC 20314-1000

All technical question and comments pertaining to this standard should be directed to:

Tri-Service CADD/GIS Technology Center
ATTN: CEWES-IM-DA
3909 Halls Ferry Road
Vickburg, MS 39180-6199

4. LOGICAL DATA MODEL

Agreement on a common format is not sufficient to ensure that the geospatial information transferred is meaningful to both the sender and the receiver. In order to share spatial data (and as part of a SDTS data transfer process) a common data model must be defined and used. In addition, semantic content of a spatial database (i.e., the entities and associated attribute and attribute value information) must be well defined and agreed upon by an application community and specified in either an off-line document (i.e. data content standard and/or in the metadata for a given database.) Part 2 of the SDTS is a formal attempt to develop a standardized list of entities. Additionally application communities that want to share geospatial information are developing data content standards modeled after the SDTS data model.

This Utilities Standard data model (figure 1.) is based upon the SDTS geospatial data model as presented in Parts 1 and 2 of that standard. The SDTS data model depicts the real world represented by features which are characterized by attributes that are assigned attribute values. This Utilities Standard defines utility system feature types and their attributes and specifies the domain (range or list) of attributes values. It also incorporates several additional extensions to the SDTS data model including the concept of grouping utilites system components (feature types) into feature classes and linking specific attributes to specific feature types. Therefore, a Feature Class is defined as a collection of Feature Types. A particular Feature Type may also be present in many Feature Classes. Thus, a Feature Class list maintains a many-to-many relationship with a Feature Type list, also refered to as a Registry.

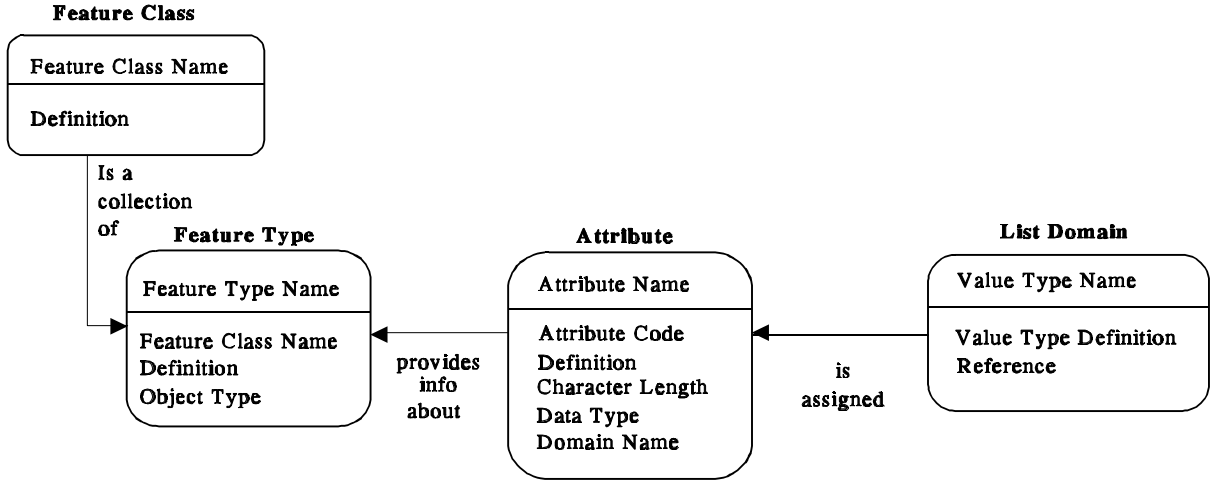

Figure 1.

5. IMPLEMENTATION

This Utility Standard has been implemented in hundreds of GIS and CADD/Facilities Management systems using the TSSDS for specific implementation guidance. Detailed information about implementing this Utilities Standard using the TSSDS physical data model is available for ESRI's ARC/INFO and Integraph's MGE GIS systems. This information is available as an example of how to implement this Utilities Standard and is not intended to mandate or recommend any vendors software.

6. REFERENCES

Tri-Service CADD/GIS Technology Center (1997) "Tri-Service Spatial Data Standards," release 1.6.

Tri-Service CADD/GIS Technology Center (1996) "Tri-Service Spatial Data Standards ARC/INFO Technical Implementation Guide."

Tri-Service CADD/GIS Technology Center (1997) "Tri-Service Spatial Data Standards Modular GIS Environment Technical Implementation Guide."

National Institute of Standards and Technology (1992) Federal Information Processing Standard Publication 173 (Spatial Data Transfer Standard), U.S. Department of Commerce.