IMTG
GIS Support Services Division

GIS Standards for LAWA Projects

Document History

revision letter	release date	major changes	approved by
A	September 2012	new version of standards	
B	June 2014	General Review	
C	August 2014	IMTG GIS Support Services Division	
D	August 2017		

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About this book

This document establishes the data standards for submitting Geographic Information System (GIS) data to LAWA and for organizing GIS data within the LAWA geospatial data repository. These standards help ensure efficient exchange of digital information between LAWA and all authorized users of LAWA GIS data.

Relation to existing standards

This LAWA GIS standard is directly based on the ANSI Spatial Data Standard for Facilities Infrastructure and Environment (SDSFIE), Release 2.60. SDSFIE is developed and maintained by the Federal CADD/GIS Technology Center, Vicksburg, MS.

This document presents the most important aspects of SDSFIE as it applies to LAWA. The LAWA GIS standards are based on SDSFIE, extended in certain areas to handle specific information relevant to LAWA.

Who should read this book

This book is intended for all LAWA employees, consultants, and contractors, especially for members of their staff who prepare GIS data; and for local, state, and federal government agencies including city, police, state DOT, FAA, and TSA.

How this book is organized

This book contains the following sections:

Introduction

Why these standards are important, what they are based on, how to suggest extensions or changes, and how compliance is assessed.

Standards in use at LAWA

Overview of LAWA specific standards and International standards

Data organization

The five elements of the classification hierarchy: entity sets, entity classes, entity types, attributes, and attribute domains

LAWA SDSFDIE data dictionaries

The two major reference sources to be used when applying the LAWA GIS standards.

File names

How filenames are to be constructed, based on the classification hierarchy.

Translating CAD layers to GIS layers

Mapping layers in the LAWA *CAD Layering Standard* to the GIS layering standard

Related documents

CAD, BIM, Meta Data, Survey and EDI standards along with other documentation related to these standards are available on the LAWA website. LAWA Standard Documents and Guidelines

Abbreviations

AEGIS	Airport Enterprise Geographical Information System
AIA	American Institute of Architects
ANSI	American National Standards Institute
BIM	Building Information Modeling
CAD	Computer Aided Design
CPPE	Capital Planning, Programming and Engineering
DDMS	Drawing and Document Management System
DOT	Department of Transportation
EDI	Electronic Data Interchange
EPA	Environmental Protection Agency
FAA	Federal Aviation Authority
GIS	Geographical Information System
GISSSD	GIS Support Services Division
NCS	National CAD Standards
LAWA	Los Angeles World Airports
SDSFIE	Spatial Data Standard for Facilities Infrastructure and Environment
TSA	Transportation Security Administration
USACE	U.S. Army Corps of Engineers

Introduction

These standards and specifications are intended to improve data consistency and availability of information, and facilitate spatial information dissemination and sharing within LAWA throughout the entire lifecycle of the airport infrastructure.

Tools for capturing geospatial data are provided within LAWA by the AEGIS application. This application enables users to create, view, and edit geospatial datasets

Geospatial data sets, allows LAWA to share information throughout the enterprise primarily through the AEGIS system. The geospatial element sets include topographic and utility/facility data.

By using these standards, LAWA will achieve a standardized approach to spatial data management and related record document(s) that will bring many benefits to both the organization and its staff. These benefits include, but are not limited to:

- consistent and more reliable data that will lead to more informed decision making
- closer integration with other LAWA information systems and LAWA spatial data users
- portability of staff skills
- greater interoperability with organizations outside of LAWA

❖ ❖	All files and documents submitted to LAWA must be accompanied by a transmittal form holding all required metadata. Transmittal forms along with other documentation related to these standards are available on the LAWA website. LAWA Standard Documents and Guidelines

Standards in use at LAWA

LAWA Standards

This section provides an overview of LAWA specific standards, plus related federal, local, and national standards. LAWA standards have been created to improve productivity and reliable information exchange through the full life-cycle of geospatial data, CAD and BIM files along with related documents.

LAWA Metadata Standards

Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called data about data or information about information.

LAWA CAD Standards

The LAWA CAD standards are based largely on the AIA CAD Layer Guidelines and the National CAD Standards (NCS), adapted where necessary to suit LAWA-specific requirements.

LAWA GIS Standards

The LAWA GIS standards are directly based on the ANSI Spatial Data Standard for Facilities Infrastructure and Environment (SDSFIE), Release 2.60, extended in certain areas to handle specific information relevant to LAWA. *GIS Standards for LAWA Projects* presents the most important aspects of SDSFIE as it applies to LAWA.

LAWA Survey Standards

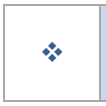
The LAWA Survey and Remote Sensing Standards are based on requirements laid out in Airport Circulars published by the FAA, adapted where necessary to suit LAWA-specific requirements.

LAWA BIM Standards

These guidelines focus primarily on adaptation of standards for practical and efficient application of BIM, particularly at the handover (Record - As-Built) stage of a project. Based on USACE_CAD-BIM_Technology Center: version 1.1 and National BIM standard (United States): version2

LAWA EDI (Electronic Data Interchange) Standards

This Standard provides a framework for all data requests and all hard copy or electronic data submittals to or from LAWA, thus ensuring a streamlined data exchange process



These standards along with other documentation related to these standards are available on the LAWA website. LAWA Standard Documents and Guidelines

National and International standards

ISO 19115 – 2: Geographic information - Metadata - Part 2

Fully endorsed by the FGDC, ISO 19115-2 has become the preferred standard for LAWA as it includes all of the elements of ISO 19115 as well as additional elements that are relevant to many geospatial data sets (raster, imagery, GPS, monitor stations, instruments, etc.).

FGDC-STD-001 June 1998

The Content Standard for Digital Geospatial Metadata (CSDGM) has been in use at LAWA for a long time, and legacy data will remain valid for many years.

SDSFIE 2.6

The overall structure of LAWA current geospatial repository is based on SDSFIE 2.6. SDSFIE organizes real world features such as runways, roads and water pipes into a hierarchical structure.

Compliance

Having timely up to date, accurate, fully compliant data available to the LAWA community forms an integral part of planning within any project. The aim of these standards is to ensure a smooth data transfer of information into the LAWA geospatial data base and efficient data maintenance through the complete data lifecycle. Accordingly, the terms and conditions of a LAWA contract require compliance with these standards.

Failure to comply with these standards may result in organizations being back-charged for any financial costs incurred by LAWA for rectifying inconsistencies and errors

❖	See EDI for standards governing data submitted to LAWA, this along with other documentation related to these standards are available on the LAWA website. LAWA Standard Documents and Guidelines

The individual or organization submitting the files is also responsible for ensuring that all links between non-graphic data and graphic data, and all relationships between database tables, shall be preserved or automatically reconstructed when data is transferred to the LAWA GIS environment.

Request of Variance

Compliance with the LAWA standards and data deliverables demands are the cornerstone of achieving trustworthy and relevant data.

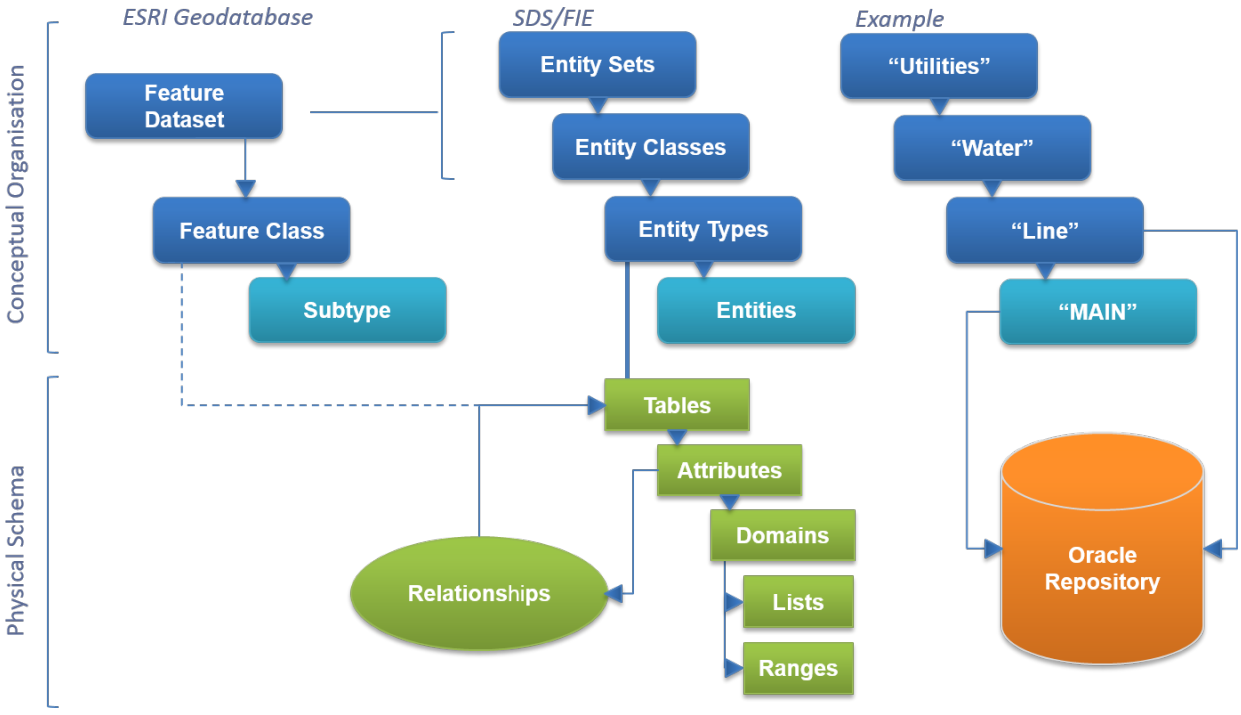
Suggestions for improvements or extensions to these standards and demands are encouraged, to meet unforeseen requirements and as a way to improve effectiveness and clarify any ambiguities; any such deviation must be approved by LAWA, in advance and in writing. . Requests need to be submitted on the “Request for variance” form, this form along with other documentation related to these standards are available on the LAWA website. LAWA Standard Documents and Guidelines

Data organization

The data organization described in this standard is based upon the ANSI standard Spatial Data Standards for Facilities, Installations and Environment (SDSFIE), Release 2.60.

The SDSFIE standard organizes real world features such as runways, roads and water pipes into a hierarchical structure. The data model for SDSFIE consists of five basic levels of hierarchy:

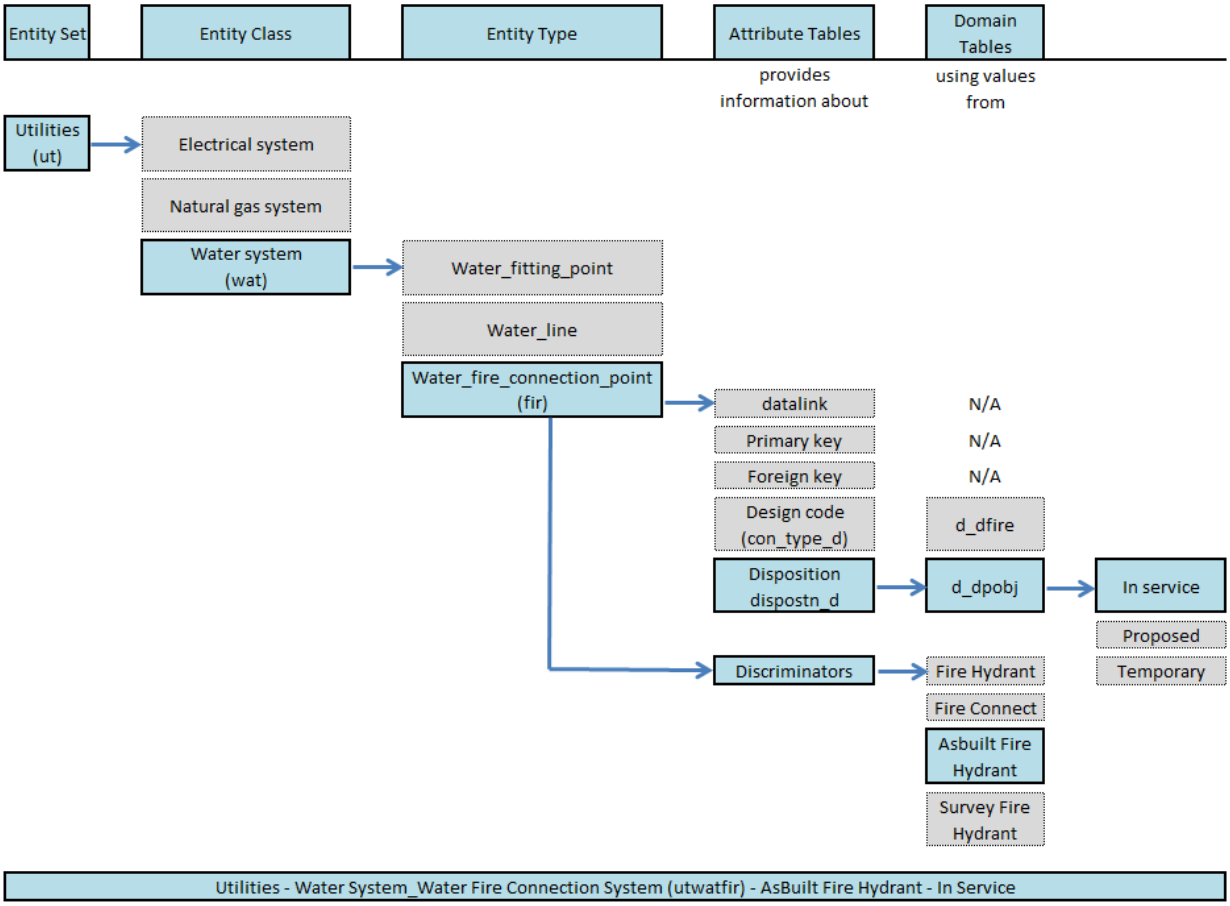
Entity Sets	group data by function, in line with SDSFIE
Entity Classes	group data within each entity sets
Entity Types	group entities – individual, real world features (such as runways, roads and water pipes) represented on a map or drawing
Attribute tables	contain non-graphic information, or attribute data, used to describe entities; **relationships** define which attributes may be used to describe a given entity type
Domains	limit possible values for a particular attribute; list domains define a list of valid values for text attributes, range domains set upper and lower limits for numeric attributes.



Spatial data standard hierarchy

Implementing SDSFIE at LAWA

Every entity type at the airport, and the entities that belong to it, will have a minimal set of attributes that identify it uniquely, plus a number of other attributes that explain how it fits into the structure of entity types, entity classes and entity sets.



Attributes common to most entity types include:

datalink

A unique identifier generated by the software, and used to link a database record to a specific graphic feature.

primary key

A unique, LAWA defined identifier for each record or instance of an entity.

foreign key

Used where an entity record held in one database table refers to information held in another table (building, project, owner and so on).

discriminator

Entities within the same entity type can be distinguished by using discriminators to describe them.

Entity set

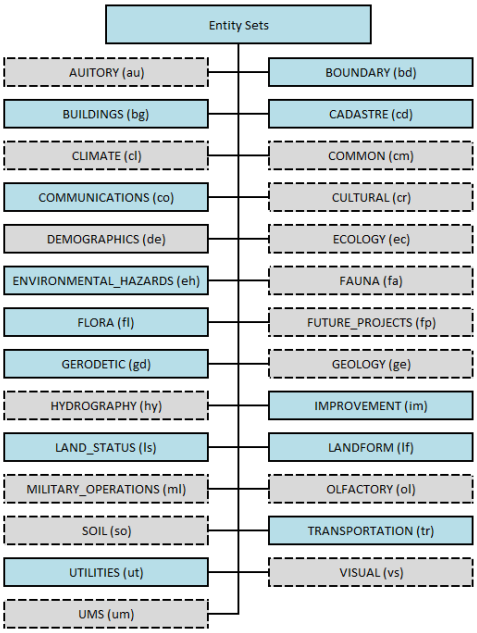
Entity sets are the highest level of the SDSFIE data model structure and represent data organised at the project level. Each entity set corresponds to a broad, generalized theme, and contains one or more entity classes.

SDSFIE identifies 26 top-level classifications or entity sets to classify GIS data at LAWA by function. LAWA uses the entity sets that are relevant to the airport and its surroundings.

At time of publication an additional UMS entity set has been added using the AEGIS application.

Entity sets:

- have a unique name, 2-character code and definition
- determine the entity classes (and related tables) that may be grouped in an entity set



Entity sets (active entity sets are highlighted)

Each entity set has an entity set code and definition: see the example in the next table.

Example of entity set information	
Entity set	Utilities
Entity set code	ut
Definition	The man-made components of a system that provides a service to the public. The components of each utility system in this entity set are located outside the foundation of a structure.

Entity classes

Entity classes are the second level of the hierarchy, and contain a number of entity types. The name of an entity class reflects the entity types the class contains.

In CAD applications, an entity class often corresponds to a drawing file.

Entity classes can be expanded and activated using the AEGIS application.

Example of entity class information

Entity Class Name	Entity Set Name	Entity Set Code	Entity Class Abbreviation	Description
Compressed Air System	utilities	ut	air	The components of a compressed air system.
Control & Monitoring System	utilities	ut	ecm	The components of an electronic monitoring and control (emcs) system including cables, devices, etc.
Electrical Exterior Lighting	utilities	ut	exl	The components of an electrical exterior lighting system including cables, switches, devices, transformers, etc.
Electrical System	utilities	ut	ele	The components of an electronic monitoring and control (emcs) system including cables, devices, etc.
Fuel System	utilities	ut	ful	The components of an electronic monitoring and control (emcs) system including cables, devices, etc.
General Utility Features	utilities	ut	gen	The components of an electronic monitoring and control (emcs) system including cables, devices, etc.
Heating & Cooling System	utilities	ut	hcs	The components of a heating and cooling distribution system consisting of pipes, fittings, fixtures, etc.
Industrial System	utilities	ut	inw	The components of an industrial waste collection system including pipes, fittings, fixtures, tanks,
Natural Gas System	utilities	ut	gas	The components of a natural gas distribution system consisting of pipes, fittings, fixtures, etc.
Saltwater System	utilities	ut	swt	The components of a salt water collection system.

Example of entity class information				
Entity Class Name	**Entity Set Name**	**Entity Set Code**	**Entity Class Abbreviation**	**Description**
Storm System	utilities	ut	sto	The components of a storm drainage collection system including pipes, fittings, fixtures, etc.
Wastewater System	utilities	ut	vwt	The components of a wastewater collection system including pipes, fittings, fixtures, treatment plants,
Water System	utilities	ut	wat	The components of a water system including pipes, fittings, valves, fixtures, treatment plants, etc.

Example of entity class information	
Entity Class Name	Water system
Entity Class Code	wat
Definition	The components of a water system including pipes, valves, fixtures, treatment plants, etc.

Examples of entity classes from entity set `utilities`

Entity types

An entity type is a name identifying a type of object that can be represented on a map or drawing. Each SDSFIE entity type has a text definition, a name that clearly identifies the entities it can contain, and a separate table in the database.

Entity types can be added and activated using the AEGIS application.

Every entity belonging to a particular entity type is represented on a map or drawing as an object type, using a point, a line or a polygon. Where an entity is represented as a point, an agreed symbol may also be used.

Entity set:		Utilities						
Entity Class Name:		Water System						
Entity Type Name	**Object Type**	**Polygon Coverage**	**Line Coverage**	**Point Coverage**	**Attribute Table Name**	**Discriminator Name**	**Domain Table**	**Definition**
Water anode point	Point			utwatand	utwatand	N/A	N/A	A material used for utility distribution systems that is electrically connected to a less electrolytically active material so that it will oxidize in the place of the less active material.
Water anode test station point	Point			utwatant	utwatant	N/A	N/A	A central location where anodes are tested for performance.
Water fire connection point	Point			utwatfir	utwatfir	con_type_d	d_dfire	An apparatus which dispenses fluids for use in fire management.
Water fitting point	Point			utwatfit	utwatfit	type_d	d_wgfit	A fitting is an item used to connect, cap, plug or otherwise alter a pipe.
Water hydrant point	Point			utwathyd	utwathyd	design_d	d_dhydnt	An apparatus which dispenses fluids.
Water intake point	Point			utwatinp	utwatsrc	N/A	N/A	The location where water is allowed into the water distribution system.
Water junction point	Point			utwatmh	utwatmh	use_d	d_dwatmh	A box or small vault (usually concrete, brick, or cast iron) located below grade with above grade access where pipes intersect. The manhole also houses associated fittings, valves, meters, etc.
Water line	String/ Chain		utwatpip		utwatpip	use_d	d_watpip	A pipe used to carry a substance from location to location (main line, service line, vent line, etc).
Water marker point	Point			utwatmrk	utgenmrk	N/A	N/A	A sign, concrete monument, etc. installed either directly above or immediately adjacent

Entity set:		Utilities						
Entity Class Name:		Water System						
Entity Type Name	**Object Type**	**Polygon Coverage**	**Line Coverage**	**Point Coverage**	**Attribute Table Name**	**Discriminator Name**	**Domain Table**	**Definition**
								to underground lines, bends, fittings, etc.
Water meter point	Point			utwatmtr	utwatmtr	N/A	N/A	A device installed in a line for measuring the quantity and or rate of water flowing to a facility or through a section of line.
Water pressure reducing station point	Point			utwatrst	utwatrst	N/A	N/A	A station consists of a box/pit containing one or more pressure regulators and appurtenant shutoff valves and fittings.
Water pump point	Point			utwatpmp	utwatpmp	N/A	N/A	A mechanical device that draws material into itself through an entrance port and forces the material out through an exhaust port.
Water pump station site	Point/ Polygon	utwatpsa		utwatpst	utwatpst	sta_ty_d	d_dwwtps	A building in which one or more pumps operate to supply material flowing at adequate pressure to or from a distribution system.
Water rectifier point	Point			utwatrec	utwatrec	N/A	N/A	A device that changes alternating current to direct current for an impressed current cathodic protection system on an element of the distribution system.
Water regulator reducer point	Point			utwatreg	utwatreg	type_d	d_dregty	A pressure regulator automatically reduces the pressure on the downstream side of the valve to a preset magnitude.
Water reservoir area	G/GT Polygon	utwatres			utwattnk	N/A	N/A	A body of water which supplies water to a water distribution system.
Water source site	Point/ Polygon	utwatsrc		utwatsor	utwatsrc	N/A	N/A	The point from which the utility is supplied a product for processing and distribution.
Water system flow direction arrow	Arrow			utwatarw	N/A	N/A	N/A	A flow direction arrow indicates the direction of flow through a line, valve, or component.
Water tank site	Point/ Polygon	utwattak		utwattnk	utwattnk	N/A	N/A	An above or below grade receptacle or chamber for holding components on a temporary basis prior to transfer or use.
Water treatment plant area	G/GT Polygon	utwattpt			utwattpt	N/A	N/A	A water treatment plant and all appurtenant equipment,

Entity set:		Utilities						
Entity Class Name:		Water System						
Entity Type Name	**Object Type**	**Polygon Coverage**	**Line Coverage**	**Point Coverage**	**Attribute Table Name**	**Discriminator Name**	**Domain Table**	**Definition**
								buildings, and facilities relating to water treatment.
Water treatment unit area	G/GT Polygon	utwattpu			utwattpt	N/A	N/A	A water separation pond or other pool designed to allow solid material decomposition.
Water valve point	Point			utwatvlv	utwatvlv	use_d	d_dvlv	A fitting or device used for shutting or throttling flow through a line.
Water vent point	Point			utwatmsc	utwatmsc	N/A	N/A	A valve installed in a line to either release air trapped in the line, and/or allow air into a line to relieve a vacuum condition.

Examples of attributes for entity types in class `water system`

The attribute table for an entity type defines the attributes that may be used to describe that entity. One attribute for each entity type may be identified as the discriminator. The discriminator is used to determine which CAD layer is used for this entity type (see section attribute names for more details).

The table below illustrates metadata fields common within all entity types, using a water fire connection point as an example.

Entity Type: example for a water fire connection point				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Entity type name		SDSFIE type name		Water_fire_connection_point (Primary key cannot be changed)
Entity Type Label		type label		Water_fire_connection_point
Class Name		class name		utilities_water_system
FAA Class Name		class name from the FAA definitions		
Is Active?		set this value to “Yes” to allow this type of data to be stored in the database.		Yes
Attribute table name		choose the name of the table in the Oracle database that contains the attributes for this feature type	Yes	Utwatfir
Required for FAA eALP?		set this value to “Yes” if this entity is used in the eALP.		No
FAA group name		group name (FAA equivalent of SDSFIE set name) from the FAA definitions		
Geometry Type		choose from point/polygon, arrow, G/GT polygon, point, string/chain.	Yes	Point

Entity Type: example for a water fire connection point				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Default Discriminator		Entity types in the same class can be distinguished by using discriminators to describe them, for example Hydrant or Sprinkler for the entity-type, water-hydrant-point.	Yes	FIRE_CONNECT
Interior feature		set this value to “Yes” if this entity is or can be found inside buildings.		No
Mobile use		set this value to “Yes” if this entity is available on the mobile device.		Yes
Geodatabase Export Options				
Feature Class Name				Water_fire_connection_point
Abbr. Feature Class Name				
Create Feature Class?				Yes
Participate in Geometric Network?				No
Feature Class Role			Yes	Simple Edge
Source Sink?				No
SDSFIE definition		An apparatus which dispenses fluids for use in fire management.		
FAA definition				

Look-up tables for entity types

Attribute table name (examples)	
Value	**Description**
Utwathyd	water hydrant
utwatfir	Water fire connection
Utwatmtr	water meter
Utwatpip	water pipe
Utwatpmp	water pump

Geometry type	
Value	**Description**
Point / Polygon	point / polygon
Arrow	arrow
G/GT Polygon	g/gt polygon
Point	point
String / Chain	string / chain

Discriminator (table adjusts according to attribute table defined)	
Value	**Description**
As-built Fire hydrant	Fire hydrant, information from as-built records
Fire Connect	Fire connection point
Fire Hydrant	Fire Fire hydrant
Survey hydrant	Fire hydrant, information from as-constructed survey

Discriminators for entity types

Entities within the same entity type (for example, water fire connection points) can be distinguished by using discriminators (for example fire connector or fire hydrant).

Each discriminator of an entity type is assigned a CAD layer (and block, for point feature types) conforming to the LAWA CAD standards.

Within the AEGIS application the entity form displays the attributes and metadata fields that are relevant to each discriminator.

The table below illustrates discriminator fields common within all entity types, using a fire hydrant point as an example.

Entity				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Entity name		name of the discriminator that will be created in the database Strict rules apply, for example no spaces, no non-alphanumeric characters.		utwat_fire_hydrant_p (primary key cannot be changed)
Discriminator		Name used to describe this entity type.		FIRE_HYDRANT
Is active?		Default “Yes” – the attribute is available to enter data.		Yes
Interior feature?		Set this value to “Yes” if this discriminator is or can be used inside buildings.		No
Mobile Use?		May be used on mobile device		Yes
CADD Layer Name		The name of the CADD layer to be used for entities with this discriminator: see LAWA CADD standards.		C-WATR-HYDR-FIRE
FAA CAD layer		See FAA documentation.		
CADD geometry type		The CADD geometry type (polyline, point/block or polygon) for this discriminator.	YES	Point
CADD block name		Block used to represent entities of this type. Only active when the geometry type is “point/block”.		HYDRNT

Entity				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
FAA CAD layer description		See FAA documentation.		
Last updated by		Updated by		UMS
Last updated on		Date last updated		08/11/2012

Look-up tables entity discriminators

CAD geometry type	
Value	**Description**
Polyline	polyline
Point / Block	point / block
Polygon	polygon

Attributes for entity types

Attributes consist of a name and a value, for example attribute label = hydrant type code.

Domain tables are look-up tables containing all possible valid values for an attribute, guaranteeing consistency. You can specify a domain table when creating a new attribute for an entity-type, or when editing an existing attribute.

Use domain tables when the user needs to choose a value from a single-column list or within a range of numeric values.

The table illustrates attributes common within all entity types, using water hydrant point as an example.

Attributes				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Attribute label		Short, understandable name for use in data area and dialog boxes.		Hydrant Type Code
Attribute name		Name of the field that will be created in the database Strict rules apply, for example no spaces and no non-alphanumeric characters		hyd_ty_d
Position		Determines position of entry in attribute list in data area.		31
Data type		Data type, used for validation	Yes	Character
Max length		Number of characters for this field. Only relevant for Character data.		16
Domain table name		Predefined look-up table containing all possible valid values for this attribute	Yes	type list – hydrant (d_tyhyd)
Foreign key tablename		To make information in an external table available as a list of possible values for an attribute, select the external (foreign) table from the drop-down and then click on the show details icon to select a field from that table.	Yes	
Field name of foreign table				

Attributes				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Is Active?		Default “Yes” – the attribute is available to enter data.		Yes
Editable?		Default “Yes” – the value of the attribute can be edited.		Yes
Tooltip?		Default “No”. Set to “Yes” to include this attribute and its value in the tooltip.		No
Required?		Default “No”. Set to “Yes” to make this attribute mandatory.		No
Displayable?		Default “Yes” – the attribute is listed in the pop-up window.		Yes
Show in list view		Show in list view		Yes
Mobile use?		Available on mobile device		No
FAA Required?		Default “No”. Set to “Yes” to make this attribute mandatory for use in eALP		No
FAA attribute name		Attribute name given by FAA, if available.		
FAA common name		Name given by FAA, if available.		
FAA definition		Entity type definition provided by the FAA, if available		
SDSFIE definition		Attribute definition from SDSFIE.		The particular kind, class, or group of hydrant

Look-up tables for entity attributes

Data type	
Value	**Description**
Character	Character
Integer number	Integer number
Decimal number	Decimal number
Date / Time	Date / Time

d_tyhyd - Type code	
Value	**Description**
Airport	airport hydrant
Building	Building hydrant
Drinkfountain	drink fountain
Drybarrel	dry barrel
Freezeproof	freeze proof
Fuel	Fuel hydrant
Natgas	natural gas hydrant
Other	other
Streetwash	street washer
TBD	To Be Determined
Unknown	unknown
Washtrack	wash rack hydrant
water	water hydrant
Wetbarrel	wet barrel
Yard	yard hydrant

Entity attributes

- Each entity then has its own individual/specific attributes.
- Within the AEGIS tool the entity attribute form displays the specific attributes and metadata fields that are relevant to each entity. A key advantage of using this tool is that it helps ensure valid values are entered into the database.
- The upper part of the attribute entry form is for information (metadata) common to all entities for all entity sets.
- The lower part of the attribute entry form has fields for all the attributes specific for this entity type, and therefore changes depending on the entity type you are working with.
- In the form:
  - fields labeled in red are required and must be filled in
  - other fields are optional
- Most fields have to be filled in using a selection mechanism.
  - drop-downs
  - look-ups
  - calendar
  - other tables

Common metadata fields

metadata fields common to all entity sets				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
UMS_ID	System	primary key unique to each entry		460965
SDSFIE entity	System	shows the SDSFIE “set name, class name, type name and discriminator value		Utilities, utilities_water_system, water_fire_connection_point, HYDRANT
Attribute table name	System	name of the table in the oracle database that contains the attributes for this feature type		utwatfir

metadata fields common to all entity sets				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Location	System	gives general geographical location of entity (airport)		LAX
Created by	System	name of data creator within UMS		Jadams
Date Created	System	the date when the geospatial properties of this entity were created		2005/06/09@07:58:20
Last edited by	System	ID of the user who last edited the geospatial properties of this entity		rrbracci
Date last edited	System	the date when the geospatial properties of this entity was last edited		2011/03/21@13:00:56
Reason code		a code for the reason why edits were last made to the geospatial properties of this entity	Yes	1 - Current survey
Quality level		the quality level assigned to this data as defined in the LAWA data qualities look-up tables for entity types	Yes	
Ddms source		primary key (from DDMS data record)		2013327
QA status		a code reflecting the current QC/QA status of this entity	Yes	2 – Partial Attribution
Owner Operator		the name associated with the owner of any easement rights to the parcel.	Yes	LAWA
Leaseholder name		name of the leaseholder, if applicable, to a facility		
Comments		comments		Sub-Surface FH.

metadata fields common to all entity sets				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Disposition		the state of readiness of the entity	Yes	
Is published*		the entity is available to view in ums		yes

* Required Field

Look-up tables for Entities

Reason code	
Value	**Description**
Current survey	a new survey has provided more accurate information on the entity.
Records research	new drawings and/or records have become available that provides additional or corrected information about the entity.
Correction	this value was corrected due to a prior error.

Quality level	
Value	**Description**
Abandoned	abandoned in place (not in use)
As built	final set of information produced at the completion of a construction project
Compiled	put together from information gathered from several sources
Design	taken from plans for works to be executed
Flyover	taken from flight over a specified area
GPS	information from a global positioning system
Survey	information from a LAWA approved survey

QA Status	
Value	**Description**
Geometry only	no attribute values have been populated, but the geometry has been created.
Partial attribution	the geometry has been created, and some attributes have been added to the entity. the record is not yet complete.
Complete	the geometry has been created, and the required attributes are current and complete.
Passed QA	the geometry and attributes have passed the QA process.
Data migration	data transferred between storage types or formats

Owner operator (sample only)	
Value	**Description**
AA	American Airlines
ATT	AT&T (Telecommunications)
CHVRN	Chevron
City_LA	City of Los Angeles
FAA	Federal Aviation Authority
GTE	GTE (Telecommunications)
LAFIRE	Los Angeles Fire Department
LAWA	Los Angeles World Airports
LAXFUEL	Laxfuel Corporation

Disposition	
Value	**Description**
ABANDONED	abandoned in place (not in use)
BURIED	buried
DEMOLOISHED	Demolished
INACTIVE	not currently in use
INCOMPLETE	incomplete or unfinished
IN_SERVICE	in service and being used.
OTHER	other
PERMANAENT	permanent
PROPOSED	proposed
REMOVED	Removed
RETIRED	permanently retired, or taken out of service
TBD	to be determined
TEMPORARY	temporary
UNKNOWN	unknown

Is published (Required Field)	
Value	**Description**
Y	Yes
N	No

Specific metadata fields

Attributes specific to a given entity can be modified (extended or reduced) by an administrator according to LAWA requirements. Example for a Fire hydrant

Attributes specific for a given entity (example water hydrant)				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Disposition Code		the operational status of the asset.	Yes	In-Service
Design Code*		Discriminator, This value differentiates fire connections by use or type.	Yes	Fire Hydrant
Hydrant Type Code		The particular kind, class, or group of hydrant.	Yes	
Valve Style Code		The style of the valve	Yes	
Size Code		The manufacture's designated size, or nominal diameter for the subject item (Fire Hydrant)	Yes	8
Invert Elevation		The elevation of the hydrant, measured at the hydrant outlet, in feet (English units) above some datum.		
Ground Elevation		The elevation of the ground surface in feet (English units) above some datum.		
Name (FAA)		Name of the feature.	Yes	
Description (FAA)		Description of the feature.		
Status (FAA)		A temporal description of the operational status of the feature. This attribute is used to describe real-time status.	Yes	

Attributes specific for a given entity (example water hydrant)				
Field Name	**Field Type**	**Description**	**Look-Up Table (LUT)**	**Example**
Utility type (FAA)		The type of utility the feature represents.	Yes	
User flag (FAA)		FAA user flag.		
Alternative (FAA)		Discriminator used to tie features of a plan or proposal together into a version.		
Narrative Text		A description or other unique information concerning the subject item, limited to 240 characters.		SquareLid36x36, VaultLid, Yes, Visual
Depth		depth		73

* Required Field

Look-up tables for Entity attributes

Disposition code (d-dpobj)	
Value	**Description**
ABANDONED	abandoned in place (not in use)
BURIED	buried
INACTIVE	not currently in use
INCOMPLETE	incomplete or unfinished
IN_SERVICE	in service and being used.
OTHER	other
PERMANAENT	permanent
PROPOSED	proposed
RETIRED	permanently retired, or taken out of service

Disposition code (d-dpobj)	
Value	**Description**
TBD	to be determined
TEMPORARY	temporary
UNKNOWN	unknown

Design code	
Value	**Description**
FIRE_CONNECT	Fire Connection point
FIRE_HYDRANT	Fire Hydrant

Hydrant Type code	
Value	**Description**
Airport	airport hydrant
Building	Building hydrant
Drinkfountain	drink fountain
Drybarrel	dry barrel
Freezeproof	freeze proof
Fuel	Fuel hydrant
Natgas	natural gas hydrant
Other	other
Streetwash	street washer
TBD	To Be Determined
Unknown	unknown
Washtrack	wash rack hydrant
water	water hydrant
Wetbarrel	wet barrel

Hydrant Type code	
Value	**Description**
Yard	yard hydrant

Valve Style code	
Value	**Description**
Angle	Type of Valve
Ball	Type of Valve
Butterfly	Type of Valve
Check	Type of Valve
Drypipe	Type of Valve
Gate	Type of Valve
Globe	Type of Valve
Needle	Type of Valve
Other	Type of Valve
Other Post Ind	Type of Valve
Plug	Type of Valve
Pressreducing	Type of Valve
Press relief	Type of Valve
Quad	Type of Valve
Regulating	Type of Valve
Stop waste	Type of Valve
Swing check	Type of Valve
TBD	Type of Valve
Triple duty	Type of Valve
Unknown	Type of Valve

Size code (sample only)	
Value	**Description**
6	size code 6
8	size code 8

Status (FAA)	
Value	**Description**
Abandoned	abandoned
Active	active
Airspaced	air space
As_built	as-built
Broken	broken
Closed	closed
Condemned	condemned
Demolished	demolished
ENV_cleared	environmental cleared
Failed_AID	failed aid
Inactive	inactive
Limited	limited
Long_term	long term
Medium_term	medium term
Non_operational	non-operational
Occupied	occupied
Operational	operational
Other	other
Parked	parked
Permanent	permanent

Status (FAA)	
Value	**Description**
portable	portable
Released	released
Semi_permanent	semi-permanent
Short_term	short-term
S_power	sustainable power
TBD	TBD
Temporary	temporary
Terminated	terminated
Under_construction	under-construction
Unknown	Unknown
Unoccupied	Unoccupied
Work_in_progress	Work-in-progress

Utility Type (FAA)	
Value	**Description**
Communication_system	communication system
Compressed_air_system	compressed air system
Control_monitoring_ststem	control monitoring system
Electrical_ext_lights	electrical external lights
Electrical_system	electrical system
Fuel_system	fuel system
General_utility	general utility
Heat_cool_system	heat cool system
Industrial_system	industrial system
Natural_gas_system	natural gas system

Utility Type (FAA)	
Value	**Description**
Nuclear_reactor	nuclear reactor
Power_system	power system
Salt_water_system	salt water system
Storm_system	storm system
Transmission_system	transmission system
Waste_water_system	waste water system
Water_system	water system

Entity naming conventions

Using GIS effectively at LAWA relies on the ability to distinguish adequately between subtle differences between entities. This permits greater value in output products by displaying entities based on predetermined criteria.

Each entity belongs to one specific entity type. The object type used to represent an entity graphically depends on the entity type it belongs to.

Entity names:

- always begin with a prefix identifying the entity type and entity class the entity belongs to
- have a suffix from the list in the next table

Entity name suffixes		
non-text entities – each entity uses a layer which is unique within its entity class		
b	Boundary	The line string forming the perimeter of an area
c	Centroid	An electronic point within the boundary to which the attribute table is attached
l	String/Chain	A collection of vertices, when taken as a whole, represent a line string on a map
p	Point	A single point representing the geographical location of a entity
text entities – all text entities for a given entity class use the same layer		
a	Label	The placement and position of a displayable attribute within the attachment attribute code
t	Text	Any annotation relating to the entity that adequately conveys information about the map product

Examples of entities in entity class `water system`			
Set name	utilities		
Class name	Water system		
Type name	Water line		
Attribute table name	utwatpip		
Entity Name	**Discriminator Value**	**Cad Layer Names**	**Description**
utwat_line_abandoned_l	Abandoned	C-DOMW-ABND	Abandoned piping
utwat_line_fire_l	Fire	C-DOMW-FIRE	Fire lines
utwat_line_main_l	Main	C-DOMW-MAIN	Main domestic water piping
utwat_line_service_l	Service	C-DOMW-SERV	Domestic water service piping
utwat_line_sprinkler_l	Sprinkler	L-IRRG-PIPE	Piping (Lawn sprinklers)

Attribute tables

Attributes are the fields that can be used to describe each individual entity, and depend on the entity type the entity belongs to. The attributes available for each entity type are defined in attribute tables. All attribute tables are integrated in the AEGIS application.

Names for attribute tables

The names for LAWA attribute tables always start with the entity set and entity class prefix, for example `utwat`, and are always 8 characters long

Rows in attribute tables

Attribute tables always include contain:

- a Primary Key field; the name of this field ends in `_id`
- a `datalink` field

Attribute names

- end in `_d` if valid values are defined by an attribute domain
- end in `_id` if they contain a primary or foreign key

Each entity type has a corresponding table in the database. The attributes that can be used to describe a particular entity depend on the entity type, so several entities will refer to the same attribute table. For example, while a main water line and a fire water line are different entities, they use the same attribute table because they belong in the same entity type.

Example of (Water line) attribute table

Table Name	Water line	
Table Identifier	utwatpip	
Table Definition	This table contains data about a water system pipe.	
Attribute	**Oracle Type**	**Definition**
size_d	VARCHAR(16)	The manufacturer's designated size, or nominal (i.e., rounded to the nearest unit) diameter for the subject item (e.g., 1 gas hydrant 2" meter 6" pipe). "
type_d	VARCHAR(16)	The kind, class, or group of the subject item.
source_d	VARCHAR(16)	The source type for the origin of a water system's water supply.
use_d	VARCHAR(16)	The use code for water pipes.
watzone_id	VARCHAR(20)	Foreign Key. Used to link the record to the appropriate utility management zone.
watstat_id	VARCHAR(20)	Foreign Key. Used to link the record to an associated station (pump station, pressure reducing station).
watsrce_id	VARCHAR(20)	Foreign Key. Used to link the pipe to an optional source.
watsect_id	VARCHAR(20)	Foreign Key. Used to link the record to an associated pipe or cable section.
wattank_id	VARCHAR(20)	Foreign Key. An operator generated identifier used to locally identify the subject item.

Table Name	Water line	
Table Identifier	utwatpip	
Table Definition	This table contains data about a water system pipe.	
Attribute	**Oracle Type**	**Definition**
watpipe_id	VARCHAR(20)	Primary Key. A unique, user defined identifier for each record or instance of an entity.
watplnt_id	VARCHAR(20)	Foreign Key. The site specific unique identification name or number of the treatment plant.
w_util_id	VARCHAR(20)	FOREIGN KEY - Links the record to UTWATUTI through primary key W_UTIL_ID.
datalink	INTEGER	Graphic Key. A unique identifier generated by Computer-Aided Design and Drafting (CADD) or Geographic Information System (GIS) software that is used to link the database record to a specific graphic feature.
coord_z	DOUBLE	The z component of individual coordinate point.
dispostn_d	VARCHAR(16)	The status of the subject item (e.g., permanent, temporary, proposed, abandoned, etc.), from lists or entered from field inspections.
frcoord_y	DOUBLE	The y component of the ending (downstream/downgradient) coordinate point.
elv_u_d	VARCHAR(16)	The unit of measure for elevation, usually feet (ft) or meters (m).
facil_id	VARCHAR(20)	Foreign Key. Used to link the record to the Facility Record.
dim_u_d	VARCHAR(16)	The unit of measure for length dimensions.
manuf_id	VARCHAR(50)	Foreign Key. An operator generated identifier used to identify a specific manufacturer.
frcoord_x	DOUBLE	The x component of the ending (downstream/downgradient) coordinate point.
grnd_elv_1	DOUBLE	The elevation of the ground surface at node_id_1, in feet (English units) or meters (SI units) above some datum.
frcoord_z	DOUBLE	The z component of the ending (downstream/downgradient) coordinate point.
grid_value	RASTER	A numeric identification of a raster element in an image or grid that represents the feature.
inv_elv_2	DOUBLE	The elevation of the bottom of pipe (i.e., pipe invert) at node_id_2 in feet (English units) or meters (SI units) above some datum.
inv_elv_1	DOUBLE	The elevation of the bottom of pipe (i.e., pipe invert) at node_id_1 in feet (English units) or meters (SI units) above some datum.
instln_id	VARCHAR(20)	Foreign Key. Used to link the record to the applicable INSTALLATION record.
grnd_elv_2	DOUBLE	The elevation of the ground surface at node_id_2, in feet (English units) or meters (SI units) above some datum.
buildng_id	VARCHAR(20)	Foreign Key. Used to link the record to an associated facility (building, structure).

Table Name	Water line	
Table Identifier	utwatpip	
Table Definition	This table contains data about a water system pipe.	
Attribute	**Oracle Type**	**Definition**
catprot_d	VARCHAR(16)	Indicates whether or not the pipe has been provided with cathodic protection? (yes or no).
coord_id	VARCHAR(20)	Foreign Key. Used to link the record to the appropriate point coordinate record(s).
mat_d	VARCHAR(16)	The material composition of the subject item, such as wood, concrete, steel, cast iron, plastic, etc.
meta_id	VARCHAR(20)	Foreign Key. Used to link the record to the applicable feature level metadata record(s).
model_no	VARCHAR(12)	The Model, Product, Catalog, or Item Number of subject item.
media_id	VARCHAR(20)	Foreign Key. Used to link the record to associated multimedia records that reference data such as imagery, video, audio, scanned documents, drawings, and other digital
map_id	INTEGER	Foreign Key. Used to link the record to the appropriate map.
narrative	VARCHAR(240)	A description or other unique information concerning the subject item, limited to 240 characters.
press_norm	DOUBLE	The normal operating pressure of the water system pipe.
press_max	DOUBLE	The manufacturer's or industry standard's maximum pressure rating of the subject item.
project_id	VARCHAR(50)	Foreign Key. Used to link the record to the appropriate project or contract under which the item was studied, collected, installed, purchased, or managed.
pipe_lgth	RASTER	The length of pipe, measured from node to node along the pipe centerline .
owner_id	VARCHAR(50)	Foreign Key. Used to link the record to the owner.
user_flag	VARCHAR(20)	An operator defined work area. This attribute can be used by the operator for user defined system processes. It does not effect the subject item's data integrity and should not be used to store the subject item's data.
press_u_d	VARCHAR(16)	The unit of measure for pressure.

Domain values

Domains place a limit on the values that can be assigned to a specific attribute. SDSFIE contains two tables that define list domains and range domains.

Note: domain tables all have the prefix d_ in the name of the table, for example `d_watpip` or `d_headng`

- list domains contain a list of valid values

When an attribute is associated with a list domain, it is not possible to type in a value directly. The user has to select a pre-defined value from a pull-down.

- range domains apply only to numeric value; they define a maximum value, a minimum value, or both. When an attribute is associated with a range domain, values outside the specified limits are not accepted.

example of a list domain.

Domain Table Name	d_watpip
Domain Type	List
Domain Definition	Discriminator - Values that differentiate the general use of a water pipe.
Value	**List Domains_Definition**
ABANDONED	abandoned/inactive pipe
FIRE	fire protection
MAIN	main line
RAW_WATER	raw water line
SERVICE	building/facility service
SPRINKLER	sprinkler head

LAWA SDSFIE data dictionaries

The LAWA SDSFIE data dictionary for GIS attribute tables is integrated in the AEGIS application. Only attributes defined in this dictionary can be used. If additional attributes are found to be necessary, a variance form must be submitted and approved before the new attribute can be added to the data dictionary. The variance form is available from the LAWA website.

All LAWA GIS projects use this dictionary. It is organised by attribute table, and each table corresponds to an entity type. For each entity type, the dictionary gives:

- attribute table information
- valid attributes and their data types
- the definition of each attribute

There is a separate LAWA SDSFIE data dictionary for graphical entities. Only entities defined in this dictionary can be used. If additional entities are needed, requests need to be submitted on the “Request for variance” form, this form along with other documentation related to these standards are available on the LAWA website. LAWA Standard Documents and Guidelines

example of a graphical properties for a waterline.

Graphical Properties for a waterline								
Feature Type	List							
Domain Definition	Allowable input for the disposition of an object							
Table Identifier	utwatpip							
Table Definition	A pipe used to carry water from location to location (main line, service line, vent line etc.)							
Discriminator Value	**Entity Name**	**Layer**	**Entity Alpha**	**Line Type**	**Line Width**	**Color**	**Symbol Library**	**Symbol Name**
ABANDONED	utwat_line_abandoned_a	10	utwatlnaba	0	1	3	N/A	N/A
ABANDONED	utwat_line_abandoned_l	9	utwatlnabl	41	2	3	tssdslin	N/A
ABANDONED	utwat_line_abandoned_t	10	utwatlnabt	0	1	3	N/A	N/A
FIRE	utwat_line_fire_a	54	utwatfirea	0	1	3	N/A	N/A
FIRE	utwat_line_fire_l	54	utwatfirel	67	2	3	N/A	N/A
FIRE	utwat_line_fire_t	54	utwatfiret	0	1	3	N/A	N/A
MAIN	utwat_line_main_a	2	utwatlnmna	0	1	3	N/A	N/A
MAIN	utwat_line_main_l	1	utwatlnmnl	67	2	3	tssdslin	N/A
MAIN	utwat_line_main_t	2	utwatlnmnt	0	1	3	N/A	N/A
RAW_WATER	utwat_line_nonpotable_a	6	utwatlnnpa	0	1	3	N/A	N/A
RAW_WATER	utwat_line_nonpotable_l	5	utwatlnnpl	53	2	3	tssdslin	N/A
RAW_WATER	utwat_line_nonpotable_t	6	utwatlnnpt	0	1	3	N/A	N/A
SERVICE	utwat_line_service_a	4	utwatlnsva	0	1	3	N/A	N/A
SERVICE	utwat_line_service_l	3	utwatlnsvl	67	2	3	tssdslin	N/A

Graphical Properties for a waterline								
Feature Type	List							
Domain Definition	Allowable input for the disposition of an object							
Table Identifier	utwatpip							
Table Definition	A pipe used to carry water from location to location (main line, service line, vent line etc.)							
Discriminator Value	**Entity Name**	**Layer**	**Entity Alpha**	**Line Type**	**Line Width**	**Color**	**Symbol Library**	**Symbol Name**
SERVICE	utwat_line_service_t	4	utwatlnsvt	0	1	3	N/A	N/A
SIPHON	utwat_line_siphon_a	56	utwatsipaa	0	1	3	N/A	N/A
SIPHON	utwat_line_siphon_l	55	utwatsipal	0	1	3	N/A	N/A
SIPHON	utwat_line_siphon_t	56	utwatsipat	0	1	3	N/A	N/A
SPRINKLER	utwat_line_sprinkler_a	8	utwatlnspa	0	1	3	N/A	N/A
SPRINKLER	utwat_line_sprinkler_l	7	utwatlnspl	20	2	3	tssdslin	N/A
SPRINKLER	utwat_line_sprinkler_t	8	utwatlnspt	0	1	3	N/A	N/A

Data dictionary for graphical entities

All LAWA GIS projects use this dictionary. For each entity type, it gives:

- discriminator value
- entity name
- CAD layer
- Entity alpha

  Unique alphabetic code (10 characters) for each entity. These codes always start with the map prefix for the entity class, and end with the letter corresponding to the entity type suffix.

- Line, color and symbol information

File names

SDSFIE uses a five-character prefix for map names and drawing-file names. This prefix is made up from the entity set code and the entity class code.

Example Map/file-name prefix

Entity Set Name	Utilities		
Entity Set Code	ut		
Entity Class Name	**Entity Class Abbreviation**	**Map Prefix**	**Definition**
Compressed Air System	air	utair	The components of a compressed air system.
Control & Monitoring System	ecm	utecm	The components of an electronic monitoring and control (emcs) system including cables, devices, etc.
Electrical Exterior Lighting	exl	utexl	The components of an electrical exterior lighting system including cables, switches, devices, transformers, etc.
Electrical System	ele	utele	The components of an electrical distribution system including cables, switches, devices, motors, transformers, etc.
Fuel System	ful	utful	The components of a fuel distribution system consisting of pipes, fittings, fixtures, pumps, tanks, etc.
General Utility Features	gen	utgen	The components of a utility system which are universal in use and purpose and do not belong to a specific utility.
Heating & Cooling System	hcs	uthcs	The components of a heating and cooling distribution system consisting of pipes, fittings, fixtures, etc.
Industrial System	inw	utinw	The components of an industrial waste collection system including pipes, fittings, fixtures, tanks, lagoons, etc.
Natural Gas System	gas	utgas	The components of a natural gas distribution system consisting of pipes, fittings, fixtures, etc.
Saltwater System	swt	utswt	The components of a salt water collection system.
Storm System	sto	utsto	The components of a storm drainage collection system including pipes, fittings, fixtures, etc.
Wastewater System	wwt	utwwt	The components of a wastewater collection system including pipes, fittings, fixtures, treatment plants, collection locations, etc.
Water System	wat	utwat	The components of a water system including pipes, fittings, valves, fixtures, treatment plants, etc.

Entity Set Name	Utilities (ut)
Entity Class Name	Water system (wat)
Map Prefix	utwat
Definition	The components of a water system including pipes, valves, fixtures, treatment plants, etc.

Each user/installation can use unique suffixes to identify different versions and updates of map and drawing files.

By Date	utwat20000516 or utwat51600
By Year	utwat2000
Sequence Number	utwat01

All files submitted must be compatible with LAWA hardware and software as follows:

- GIS data files: ArcView Shape File, ESRI SDE, AutoCAD Map (a recent version)
- vector graphics: AutoCAD (a recent version)
- raster graphics: TIF, ECW, SID
- digital media: CD-ROM, DVD-ROM, Flash drive, USB HD

Translating CAD layers to GIS layers

The standard for GIS layers is based on the major groups of the SDSFIE data standard. The next figure illustrates how a layer is named from the entity set, entity class, and entity type that it belongs to.

CAD and GIS systems are similar because both of them may contain a mix of graphical and tabular data. In a CAD-based GIS, each entity is assigned a particular set of layers or levels. Each layer represents a particular discriminator and graphic property for that entity, which means there can be a many-to-one relationship between layers and entities. As a result, multiple CAD layers may translate into one GIS layer.

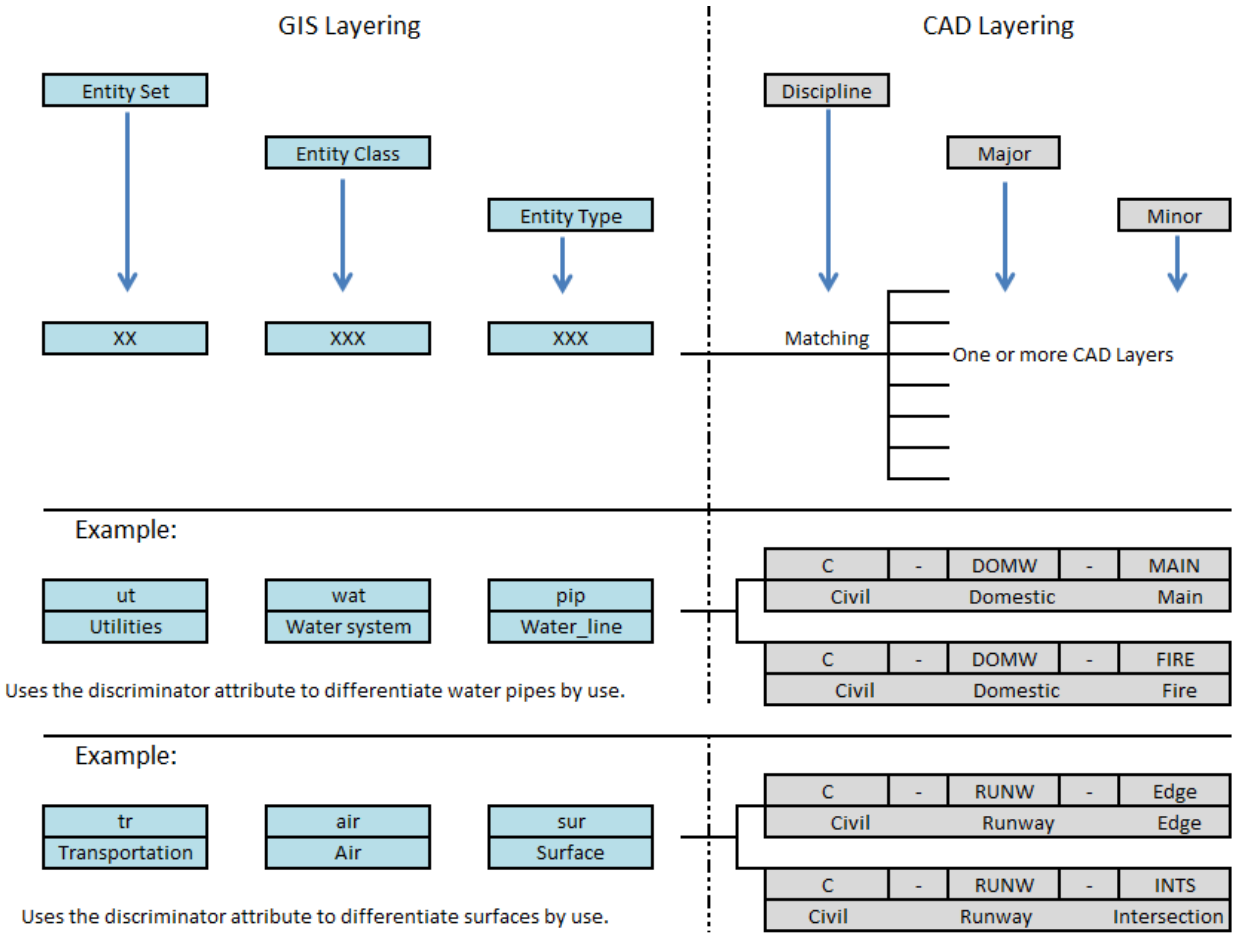
Example

CAD uses different layers to represent water lines with different functions, for example:

- CAD layer C-DOMW-MAIN for a domestic water main
- CAD layer C-DOMW-FIRE for a fire line

GIS uses the single entity type `utwatpip` (water pipe line) to represent both of these water lines, and uses attributes to identify the difference between them.

LAWA uses the Feature Classification tool in AutoDesk Map to make it easier to convert CAD based drawings into useable GIS features.



GIS conventions and CAD conventions for layers and naming compared