Spatial Data Standards

FOR THE CALIFORNIA DEPARTMENT OF WATER RESOURCES

Enterprise GIS Committee

Version 3.1

September 11, 2019

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SEPTEMBER 11, 2019

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Acronyms and Abbreviations

Atlas	Atlas geodatabase
CSDGM	Content Standard for Digital Geospatial Metadata
DEM	digital elevation model
DWR	California Department of Water Resources
EGC	Enterprise GIS Committee
FERC	Federal Energy Regulatory Commission
FGDC	Federal Geographic Data Committee
GIS	geographic information system
ISO	International Organization for Standardization
ISP	initial stewardship plan
NAD27	North American Datum of 1927
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGS	National Geodetic Survey
QA	quality assurance
QC	quality control
SDE	spatial database engine
Standards	(DWR) Spatial Data Standards
steward	data steward
TIN	triangulated irregular network
UTM	Universal Transverse Mercator
Web Atlas	DWR GIS Atlas

WGS84	World Geodetic System 1984
WMAS	WGS84 Web Mercator Auxiliary Sphere

Introduction

Where Are We Now?

The California Department of Water Resources' (DWR's) central repository for vector spatial data is the Atlas geodatabase (Atlas). When a graphics specialist, geographic information system (GIS) professional, or other staff member requires a current and reliable vector spatial data set for use in a project, that person queries Atlas to locate the most applicable data set available. When a staff person needs to locate spatial data not available on Atlas, that person has to contact whomever might have knowledge of the spatial data. If he or she is able to locate the sought-after data in a reasonable time frame (or at all), often the data is insufficient for the job. Though the best data set is selected from those retrieved, that data set is not always applicable.

Where Do We Want to Go?

The key to streamlining the process of locating vector spatial data sets by making them eligible for inclusion on Atlas — as well as enhancing the value of a greater number of data sets — is having a well-designed and robust set of standards for the data. Version 3.1 of DWR's Spatial Data Standards (Standards) for enterprise geospatial data sets replaces version 2.1, which was introduced in May 2016. The new Standards become effective August 2019. The signatories represent the DWR Enterprise GIS Committee (EGC), commissioned in 2010 by the DWR Governance Board to develop and maintain spatial data standards for DWR enterprise geospatial data sets. The EGC endorses these Standards to ensure that enterprise spatial data have known quality and availability, are organized and formatted in a consistent manner, and are adequately documented for important characteristics expressed in associated metadata.

This guide includes information specific to the substance of the Standards. The sections herein stipulate specific characteristics of spatial data sets, some of which must be followed for a data set to be considered as an "enterprise data set" and thus be eligible for inclusion in Atlas. Such required characteristics are referred to as "core Standards." Other components of the Standards are referred to as "Guidelines." Guidelines are recommended procedures or characteristics, particularly as related to methods of data development, but they are not firm requirements. In this document, core Standards are identified in section.number format (e.g., 12.2), whereas Guidelines are found in discussion text, formatted as bulleted lists, under headings that include the term "Guidelines."

What Will We Gain?

The many benefits of working in the new Standards environment can be summarized by category:

- **Importance of Spatial Data**. Not only is more spatial data being created every year, but the visualization of data is of increasing importance. Maps and other spatial representations of data are a simple, easy way to get the intended message to a wide audience.
- **Consistency**. Multiple copies of the same spatial data are often used throughout DWR, and in many cases each copy is slightly different. This environment does not provide a single answer for "the best available data," but instead produces competing answers that complicate the decision-making process. A single, authoritative data set would make analyses reproducible and consistent.
- **Efficiency**. The search for spatial data sets often involves a significant amount of time in the current environment, and the sought-after data is sometimes never located. Additional time is

wasted when modifications of a spatial data set, which other DWR staff may have, are repeated. An enterprise GIS data management system would eliminate these inefficiencies.

- **Accessibility**. DWR receives many spatial data set requests. An enterprise GIS data management system would provide easy access to spatial data by the public and DWR staff.
- **Security**. DWR does not have a consistent process for assigning levels of confidentiality to spatial data, nor does it have a single point of contact for spatial data requests. An enterprise GIS data management system would assign an accessibility level to each enterprise data set and a single point of contact for data requests.
- **Quality**. Anyone using a spatial data set must be apprised of the data quality. An enterprise GIS data management system would require data stewards (stewards) to document the quality of spatial data sets, which would make the data more useable by everyone.
- **Integration**. The spatial character of data allows for easy integration of data and shows relationships that would otherwise be difficult to understand.

How Do We Get There?

Enterprise vector data sets are promoted and maintained on Atlas by a designated steward. The steward is a person who formally accepts responsibility for a given enterprise vector data set. The steward conducts the basic work necessary to achieve compliance with the Standards. The steward will guide development of the data set to eventual promotion to Atlas by using prescribed work flows, which will be overseen by the EGC. As necessary, the steward will maintain the data set on an ongoing basis and serve as the DWR subject-matter expert and point of contact for any issues relating to the subject data set. In cases where a data set has complexity or geographic coverage warranting multiple staff involvement, the steward may have designated a team of sub-stewards who have formally accepted responsibility for development and maintenance of the data set. Figure 1-1 depicts the workflow of a steward.

DWR defines two types of vector spatial data sets: (1) enterprise and (2) program. The Standards apply only to enterprise data sets, not to program data sets, which generally are not sufficiently robust to meet the Standards. Enterprise data sets are those data sets for which all of the following must apply:

- The data set complies with the DWR Spatial Data Standards (this reference guide).
- The data set has an assigned data set steward (and, if applicable, sub-stewards).
- The data set has been promoted through the EGC-administered promotion and approval processes.
- The data set is available on DWR enterprise technology architecture (primarily the Atlas geodatabase).

Vector data that do not meet all of those requirements are considered program data sets. Program data sets are maintained by individual DWR programs and are not stored in Atlas. Although the enterprise data set Standards may be considered as useful recommendations for program data sets, there is no requirement that program data sets meet them.

One major purpose of the Standards is to facilitate the promotion of spatial data sets from program to enterprise status. Because enterprise data conform to the Standards, enterprise data sets serve as single-point, authoritative source data. Instead of staff having to search for each data set and store it locally, they can access the authoritative copy through a single point of access. Utilization of an enterprise approach ensures staff is using the latest version of a data set, instead of a copy that may or may not be current or

otherwise conflict with a different local copy stored elsewhere. A single-point approach also ensures that improvements and upgrades to data sets are captured in an organized, efficient manner, and are automatically broadcast to all staff without their needing to take specific search actions.

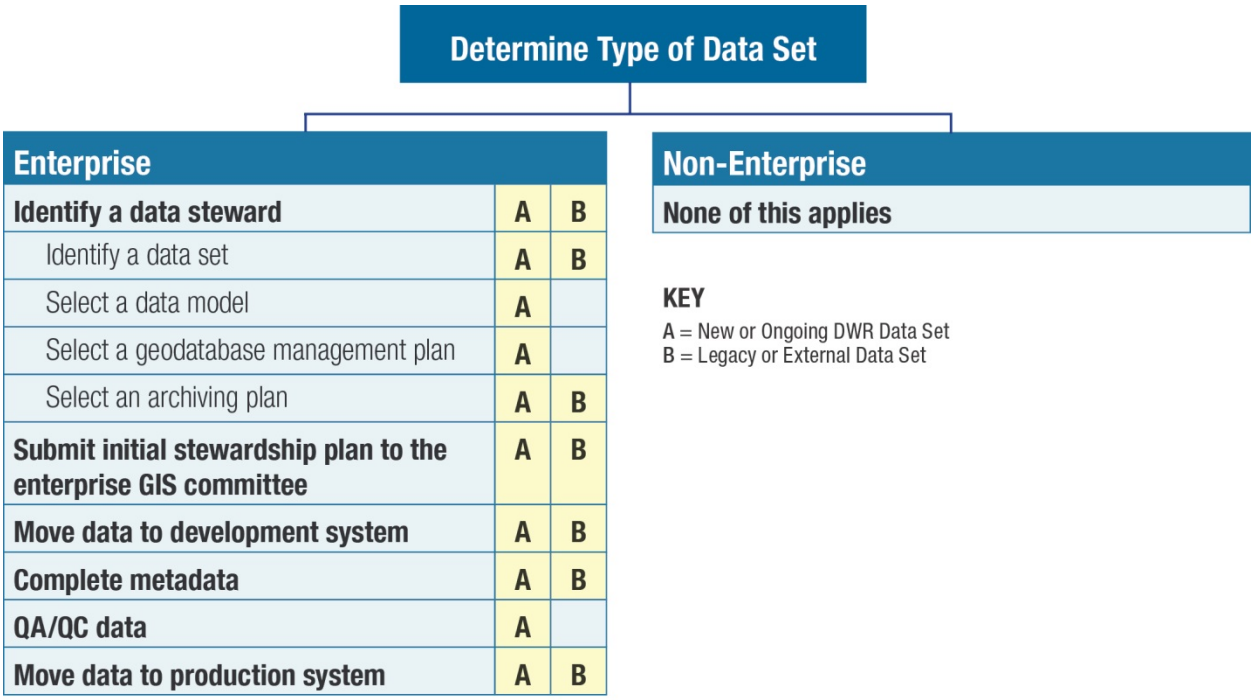
Among enterprise vector data sets are three categories of data. The first two categories are subject to Part 1 of the Standards, and the third category is subject to both Part 1 and Part 2 of the Standards. The data categories are:

1. **Legacy DWR-sourced ("legacy") data sets.** These vector data sets existed within DWR before adoption of the Standards, and are not actively maintained, edited, or updated. These data sets are described as static.
2. **Data sets whose source is external to DWR or DWR contractors ("external").** These vector data sets originate outside of DWR. They are considered external, regardless of whether they are static or active (continually updated).
3. **Data sets produced and maintained by DWR or DWR contractors on an ongoing basis ("DWR-created").** These vector data sets are new and produced by DWR or its contractors, or they are actively edited or improved by DWR or its contractors. In theory, a static data set that might once have been legacy or external to DWR could be converted to this third category type, if someone were to assume responsibility for developing improvements to the data set or become a steward.

In support of the promotion and maintenance processes, this reference guide includes various supporting appendices that guide data set selection, development, publication, and documentation workflows. These workflows and supplemental appendices are designed to foster adherence to the Standards. In particular, Appendix A dictates the data set promotion workflow that stewards use, which, in conjunction with EGC oversight, ensures that the steward complies with the Standards. While the workflow is required in order to achieve promotion of data sets to Atlas, it is not considered an inherent part of the Standards because it does not pertain to the intrinsic data set characteristics.

In addition, the current version of the Standards document has been expanded to include Standards for web services created from enterprise vector data sets, for services of raster geospatial data posted on the DWR Image Server, and for data produced during DWR emergency response activities. In addition, new guidelines are supplied for geospatial data produced by consultants working under contract to DWR.

Figure 1-1 Documentation Workflow of Stewards



Notes and Clarifications

When using this reference guide, particularly with the aim of becoming a steward, please keep in mind the following:

- All spatial data sets will be subject to the Standards as presented in sections 1-7 of Part 1 in this guide. DWR-created data sets will be subject to additional requirements, or Standards, as outlined in sections 8–15 of Part 2 in this guide.
- Use of the term “feature dataset” is specific to the ESRI geodatabase storage format/object corresponding to that term. Other uses of “data set” throughout this document refer to spatial data sets in general. The presence of a word space (“ ”) between “data” and “set” distinguishes the uses.
- “DataSpace” refers to a third-party extension software used by DWR available in ArcGIS Pro that facilitates data discovery and customizing file organization. Atlas data sets are part of the default DataSpace template available to all DWR GIS users.
- Although Atlas is available to all DWR GIS users, certain data sets may have security restrictions that make them accessible only to specified users. It is also possible that, in some cases, an enterprise data set will be physically stored in a separate DWR enterprise geodatabase.
- This reference guide is a living document. As such, it will be updated periodically. The EGC encourages feedback on the efficacy and utility of the Standards.

Moving Forward

The transition to the new working environment will be slow. The transition will require a commitment to being better caretakers of spatial data and supporting one another in the volunteer effort to make available

robust, accurate data sets. Creating a “community” of stewards and stewardship teams will help ease the transition, which will take some time, focused effort (completing metadata and processing paperwork), and conscious change in work habits (working in a multi-user environment, rather than on our desktops). Sharing work tips with one another and among other teams, engaging in discussions of the efficacy of applied process, and acquiring clear understanding of the Standards will ensure the steward community achieves the desired outcome. Doing so will benefit, directly or indirectly, all DWR staff; local, regional, and State water resource entities and other stakeholders and interested parties; and ultimately the residents of California.

Part 1. Core Spatial Data Standards that Apply to All Enterprise GIS Data Sets and Image Services

Section 1. Stewardship

Stewardship is an integral part of the entire California Department of Water Resources (DWR) enterprise geographical information system (GIS) approach. At its most basic level, stewardship implies that the enterprise data sets stored and used on the DWR Atlas geodatabase (Atlas) are treated as assets to the organization. Stewardship enables the end users to trust the data, creates workflows by which data may be systematically improved, and clearly establishes a recognized subject matter expert or data steward (steward) for the data. The assigned steward is responsible for all decisions regarding data improvement, use, and distribution.

1.1 All vector data sets will have an assigned steward. The steward will accept stewardship responsibility in writing. To ensure adequate resources exist for support of the data set, the steward will obtain signoff from the geodatabase manager, as appropriate. If the steward vacates a position related to data set management, or from DWR employment, that steward will notify DWR's Enterprise GIS Committee (EGC) and assist identification of a replacement steward.

1.2 Stewards will submit an initial stewardship plan (ISP) to the EGC for all vector data sets. The stewards will use forms included in Appendix B to prepare the plan, including the responsibility signoffs discussed in Standard 1.1. The ISP includes information about the candidate data set, expected geodatabase consumption, and an archiving/maintenance plan. The stewards will submit the ISP at the beginning of the stewardship process, before the data set is promoted to Atlas.

1.3 Stewards will verify that the candidate data set fully meets all appropriate sections of the Standards. Stewards will notify the EGC Chair when the candidate data set has been verified and transmit any data sharing or end user agreements that may pertain to the data set. Upon EGC confirmation that the candidate data set is in compliance with the Standards, the EGC Chair may instruct the geodatabase manager to promote the subject data set to the Atlas production environment.

Section 2. Names

This section applies generally to directory, file, feature class, table, and field names, and to any one of these, if specified.

2.1 Names will be restricted to alphabetic characters [a-z, A-Z], digits [0-9], underscores [_], and dots [.]. No other characters are allowed.

2.2 Names will not contain spaces.

2.3 Names will begin with a character.

2.4 Words in sequence will be written such that underscores join them or will be written in "camel case" (i.e., the first letter of each word is capitalized, the remaining characters are lowercase, and no spaces or underscores are used [e.g., ExampleDirectoryName]).

2.5 Dates will be written as YYYYMMDD in file names, and as MM/DD/YYYY in attribute tables.

2.6 Directory names will not contain a dot.

2.7 Feature class names will be in the following format:

[ISOCode]_[Name]_ {Version}

The ISOCode is one of the International Organization for Standardization (ISO) theme codes, as shown in Table 1-1. The name may include the program and/or the subject and should be as descriptive as possible. The version number is optional and may be in the form of a date.

2.8 The ISO Code name will be written as "iXX_". "XX" will represent the last two digits of the three digit codes listed in Table 1-1. For example, a roads feature class would be preceded by "i18_" in the name of the feature class (i.e., [i18]_[Transportation]).

Table 1-1 International Organization for Standardization (ISO) Themes

Name	Code	Description
Farming	i01	Rearing of animals or cultivation of plants. Examples: agriculture, irrigation, aquaculture, plantations, herding, pests and diseases affecting crops and livestock.
Biota	i02	Flora or fauna in natural environment. Examples: wildlife, vegetation, biological sciences, ecology, wilderness, sea life, wetlands, habitat, biological resources.
Boundaries	i03	Legal land descriptions. Examples: political and administrative boundaries, governmental units, marine boundaries, voting districts, school districts, international boundaries.
Climatology Meteorology Atmosphere	i04	Processes and phenomena of the atmosphere. Examples: cloud cover, weather, climate, atmospheric conditions, climate change, precipitation.
Economy	i05	Economic activities, conditions, and employment. Examples: production, labor, revenue, business, commerce, industry, tourism and ecotourism, forestry, fisheries, commercial or subsistence hunting, exploration and exploitation of resources such as minerals, oil and gas.
Elevation	i06	Height above or below sea level. Examples: altitude, bathymetry, digital elevation models, slope, derived products, digital elevation models (DEMs) or triangulated irregular networks (TINs).
Environment	i07	Environmental resources, protection, and conservation. Examples: environmental pollution, waste storage and treatment, environmental impact assessment, monitoring environmental risk, nature reserves, landscape, water quality, air quality, environmental modeling.
Geoscientific Information	i08	Information pertaining to earth sciences. Examples: geophysical features and processes; geology, minerals, sciences dealing with the composition, structure and origin of the earth's rocks, risks of earthquakes, volcanic activity, landslides, gravity information, soils, permafrost, hydrogeology, groundwater, erosion.
Health	i09	Health, health services, human ecology, and safety. Examples: disease and illness, factors affecting health, hygiene, substance abuse, mental and physical health, health services, health care providers, public health.
Imagery Base Maps Earth Cover	i10	Base maps. Examples: land/earth cover, topographic maps, imagery, unclassified images, annotations, digital orthoimagery.
Intelligence Military	i11	Military bases, structures, and activities. Examples: barracks, training grounds, military transportation, information collection.
Inland Waters	i12	Inland water features, drainage systems, and characteristics. Examples: rivers and glaciers, salt lakes, water utilization plans, dams, currents, floods and flood hazards, water quality, hydrographic charts, watersheds, wetlands, hydrography.
Location	i13	Positional information and services. Examples: addresses, geodetic networks, geodetic control points, postal zones and services, place names, geographic names.
Oceans	i14	Features and characteristics of salt water bodies (excluding inland waters). Examples: tides, tidal waves, coastal information, reefs, maritime, outer continental shelf submerged lands, shoreline.
Planning Cadastre	i15	Information used for appropriate actions for future use of the land. Examples: land use maps, zoning maps, cadastral surveys, land ownership,

Name	Code	Description
		parcels, easements, tax maps, federal land ownership status, public land conveyance records.
Society	i16	Characteristics of society and culture. Examples: settlements, housing, anthropology, archaeology, education, traditional beliefs, manners and customs, demographic data, tourism, recreational areas and activities, parks, recreational trails, historical sites, cultural resources, social impact assessments, crime and justice, law enforcement, census information, immigration, ethnicity.
Structure	i17	Human-made construction. Examples: buildings, museums, churches, factories, housing, monuments, shops, towers, building footprints, architectural and structural plans.
Transportation	i18	Means and aids for conveying persons or goods. Examples: roads, airports/airstrips, shipping routes, tunnels, nautical charts, vehicle or vessel location, aeronautical charts, railways.
Utilities Communication	i19	Energy, water and waste systems, and communications infrastructure and services. Examples: hydroelectricity, geothermal, solar and nuclear sources of energy, water purification and distribution, sewage collection and disposal, electricity and gas distribution, data communication, telecommunication, radio, communication networks.

Section 3. File Organization

Files will be organized according to the category type of the data set.

3.1 Legacy data sets generally will be organized into whatever format most closely approximates the existing format of the legacy data set. For example, a single shapefile will be stored as a standalone feature class in Atlas. A suite of related shapefiles that comprise a logical collection ideally might be grouped as feature classes loaded into a feature dataset. The steward will propose the most logical organizational approach for a subject data set during the promotion planning process; the proposed approach will be subject to EGC approval.

3.2 External data sets will conform to Standard 3.1. Nonetheless, if an external data set is already in geodatabase format, then no modification from the source-supplied format will be permitted. For example, if a source supplies data as a collection of standalone feature classes, those will be copied onto Atlas as a group of stand-alone feature classes only, regardless of whether the steward might prefer a different organizational approach.

3.3 If associated files (e.g., pictures, CAD drawings, scanned documents) are submitted with the subject data set or hyperlinked from the subject data set, files will be stored in the DWR file system location specifically dedicated to storage of non-Atlas library data set files.

Section 4. Projections and Datums

4.1 The following projections for vector and raster data may be used for California data sets:

- Unprojected Geographic (i.e., latitude and longitude).
- Universal Transverse Mercator (UTM) 10.
- UTM 11.
- UTM 10.5 or the California UTM.
- California/Teale Albers.
- California State Plane.
- Web Mercator Auxiliary Sphere (WGS_1984, EPSG:3857).
- State Water Project Oblique Mercator.

4.2 The horizontal datum to be used will be the North American Datum of 1983 (NAD83), until the new horizontal datum currently planned for 2022 becomes available from the National Geodetic Survey (NGS). Definitions of NAD83 horizontal datum will always be to the basic North American Datum of 1983, and not to an alternative NAD83 (e.g., HARN or NSRS2007). For North American Datum of 1927 (NAD27) to NAD83 conversions, the conversion will always be accomplished using a basic NAD27 to NAD83 NADCON algorithm. Subsequent to the release of the planned new NGS datum, all existing official DWR spatial Data will be converted to the new NGS datum, and new data will be created using the new NGS datum.

4.3 Data that include areal extents significantly beyond the California boundary and raster data that already exist in a projection other than those listed above in Standards section 4.1 may be stored in the current projection system to which they are already assigned.

4.4 The projection will be selected so that spatial inconsistencies and horizontal inaccuracies are minimized given the coverage extent. For example, if a subject data set lies entirely within the city of San Diego, and State Plane is used, Zone 6 will be used.

4.5 Standard projection parameters and units will be used. Latitude and longitude may be in any common decimal degree or degrees/minutes/second unit system. UTM units will always be expressed in meters. California/Teale Albers and California State Plane may be expressed in feet or meters.

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Section 5. Metadata

Metadata will be developed for and attached to all enterprise data sets. The minimum metadata requirement that applies to all vector data sets is referred to as the "minimum DWR metadata standard." The minimum metadata requirement that applies to all image services available on the DWR Image server is referred to as the "DWR Image Server standard."

5.1 All vector data set metadata will include sufficient information for at least the metadata elements, as listed in Table 1-2.

Table 1-2 Metadata Elements

Element	Action
Item Description/Description	Briefly describe what the data set is about (who, what, where, when). Include any limitations of the data set, assumptions made, and whether there is anything special about which the user of these data should be aware.
Item Description/Title	Uniquely identify the data set. The name should be identical to the feature class/data set name used on Atlas.
Item Description/Summary	Briefly describe why the data set was created.
Extents/Temporal Extent/Date and Time	Use the date or range of dates the data are in reference to, or a major date of publication of the data set.
Citation Contacts/Contacts	Provide contact information for the steward. Include, at the least, the steward's name, and reference the California Department of Water Resources, the steward's program or administrative unit, and the steward's telephone number and email address.
Metadata/Contacts	Just as with primary contact information, provide contact information for the steward in the metadata contact elements. Include, at the least, the steward's name, and reference the California Department of Water Resources, the steward's program or administrative unit, and the steward's telephone number and email address.
Fields/Entity and Attribute Information	List and define each field.
Fields/Entity and Attribute Information/Attribute/Details/Attribute	For any field that contains numeric or alphabetic codes (e.g., SAC = Sacramento County), list each code/abbreviation and provide an unabbreviated definition.
Constraints/Access Constraints	Is there a need to limit who has access to see or read this data set? If so, specify. If not, put "None." Constraints/Use Constraints — Is there a need to limit the use of this data set to certain people or to specific tasks? If so, specify. If not, put "None." Also include how the data should be cited, if such specific information would be beneficial.
Distribution	Define distribution constraints. Also designate the location of the data. If the data is distributed as a Web service or end point, provide the URL or link to the service.
Resource Details/Status	Specify "Complete" or "Incomplete."

Element	Action
Resource Maintenance/Update Frequency	Specify possible values as: Continually, Daily, Weekly, Monthly, Annually, Unknown, As Needed, Irregular, None Planned, or Other.
Spatial Reference/ArcGIS Coordinate System	What is the Projected Coordinate System name? Define the complete projective information for the data here.
Spatial Reference/ArcGIS Coordinate System/Geographic Coordinate Reference	Specify which datum the data set is referenced to: • NAD83 (GCS_North_American_1983) (preferred) • NAD27 (GCS_North_American_1927) • WGS84 (WGS_1984)
Topics and Keywords/Topic Categories	Specify ISO Category and Category Code (see Table 1-1, above).
Topics and Keywords/Theme, Place, and Temporal Keywords	Specify keyword tags that define the data. For example: Forest Cover — trees, canopy, woodland, coniferous, etc.

Notes:
Atlas = Atlas geodatabase
ISO = International Organization for Standardization
NAD27 = North American Datum of 1927
NAD83 = North American Datum of 1983
steward = data steward
WGS84 = World Geodetic System 1984

5.2 All vector data set metadata will have the following standard language included in the summary section:

> The associated data are considered DWR enterprise GIS data, which meet all appropriate requirements of the DWR Spatial Data Standards, specifically the DWR Spatial Data Standard version 3.1, dated September 11, 2019.
>
> DWR makes no warranties or guarantees — either expressed or implied — as to the completeness, accuracy, or correctness of the data. DWR neither accepts nor assumes liability arising from or for any incorrect, incomplete, or misleading subject data.
>
> The official DWR GIS steward for this data set is ***, who may be contacted at ***-***-****, or at *.*@water.ca.gov. Comments, problems, improvements, updates, or suggestions should be forwarded to the official GIS steward as available and appropriate.

* — provides space for information that indicates the specific name and contact information for the particular steward for the subject data set.

If data are sourced externally from DWR, the following sentence will be included at the beginning of the second paragraph, prior to the “DWR makes no warranties…” sentence:

> This data set was not produced by DWR. Data were originally developed and supplied by ***.

* — provides space for information indicating the original data source.

If original data source was not DWR, but was a contractor developing the subject data set specifically as part of a DWR contract, the relationship of the contractor to DWR will be included with the following language at the end of the above sentence:

> , under contract to California Department of Water Resources.

5.3 All DWR image services supplied by the DWR image server from DWR raster data will include the following metadata:

> What (mosaic of aerial photography/Digital Elevation Model/quad map/geologic map/SAR image/etc) of Place from Date. Raster resolution is x units. (INSERT SPECIFIC PRODUCTION AND OVERVIEW INFORMATION HERE.)
>
> This is an official DWR Image Service, which meets all appropriate requirements of the DWR Spatial Data Standards, specifically the DWR Spatial Data Standard version 3.1, dated September 11, 2019.
>
> DWR makes no warranties or guarantees — either expressed or implied — as to the completeness, accuracy, or correctness of the data. DWR neither accepts nor assumes liability arising from or for any incorrect, incomplete, or misleading subject data.
>
> This Image Service was published on **/**/20**, by ** of the DWR Division of **, who may be contacted at ***-***-****, or at *.*@water.ca.gov.” Comments, problems, improvements, updates, or suggestions should be forwarded to the official DWR point of contact as available and appropriate.

Specific production and overview information should also be included as available. Production information can include information about when the time period of a survey was performed, information on the sensor platform, the sensor(s) used, other key equipment, ground control used, location of any quality assurance/quality control reports, information about thematic attributes and how those were generated, processing steps, definition of bands, accuracy, additional standards complied with, pixel value definitions, or any other information related to the development of the data set that can assist with end user understanding.

5.4 Geoprocessing history will be removed from all metadata prior to publication on Atlas.

5.5 If a standardized symbology system is required to be associated with the subject data, a brief explanation of the existence, purpose, and application of the related symbology will be provided in the metadata.

Section 6. Accessibility and Security Standards

The steward will establish the accessibility level for the subject spatial data set and the metadata. Different accessibility levels may be assigned to the data and metadata if warranted. Each accessibility level has two parts: access restriction and a reason for the restriction (if applicable). If the steward is unclear about what accessibility level to establish, assistance may be sought from various DWR agents, including the Public Records coordinator, the Office of the Chief Counsel, or the DWR Enterprise GIS Committee.

6.1 If any data licensing, usage, distribution, or other such agreements were signed in relation to the subject data set, such signed agreements will be referenced in the subject data set's metadata, in both the "Description" and the appropriate "Resource Constraints" metadata element sections. A scanned copy of the signed paperwork will be stored in the network attached storage space allocated for Atlas documents.

6.2 Beyond specific instructed signed agreements, other access restrictions may be warranted, as listed in Table 1-3.

Table 1-3 Access Restrictions for Spatial Data

Access Restriction	Reason
Not restricted (Public Domain)	
Restricted with Creative Commons license	Cite Creative Commons license.
Proprietary: Restricted to California Department of Water Resources (DWR) only	Cite reason from Public Records Act.
Restricted to anyone in DWR and consultants working with DWR	Cite reason from Public Records Act.
Available to an individual assigned a specific role or organizational group within DWR	Cite reason from Public Records Act.
Available only to a specific individual	Cite terms of confidentiality.
Available with appropriate permission	Cite terms of confidentiality.
Proprietary (commercial license) — according to the license agreement	Cite terms of license.

The Public Records Act of the State of California (California Government Code Sections 6250-6270) provides certain instances when access to public information may be restricted. Access may also be restricted because it is confidential under other parts of California law. A determination of accessibility may begin by reviewing the sections, below, excerpted from the California Government Code, particularly Section 6254. It should be noted that the entirety of the law will be complied with, and that these sections are merely an abbreviated list that indicate general situations commonly encountered by DWR GIS professionals:

6254. EXCEPT AS PROVIDED IN SECTIONS 6254.7 AND 6254.13, THIS CHAPTER DOES NOT REQUIRE THE DISCLOSURE OF ANY OF THE FOLLOWING RECORDS:
(A) PRELIMINARY DRAFTS, NOTES, OR INTERAGENCY OR INTRA-AGENCY MEMORANDA THAT ARE NOT RETAINED BY THE PUBLIC AGENCY IN THE ORDINARY COURSE OF BUSINESS, IF THE PUBLIC INTEREST IN WITHHOLDING THOSE RECORDS CLEARLY OUTWEIGHS THE PUBLIC INTEREST IN DISCLOSURE.
(B) RECORDS PERTAINING TO PENDING LITIGATION TO WHICH THE PUBLIC AGENCY IS A PARTY, OR TO CLAIMS MADE PURSUANT TO DIVISION 3.6 (COMMENCING WITH SECTION 810), UNTIL THE PENDING LITIGATION OR CLAIM HAS BEEN FINALLY ADJUDICATED OR OTHERWISE SETTLED.
(E) GEOLOGICAL AND GEOPHYSICAL DATA, PLANT PRODUCTION DATA, AND SIMILAR INFORMATION RELATING TO UTILITY SYSTEMS DEVELOPMENT, OR MARKET OR CROP REPORTS, THAT ARE OBTAINED IN CONFIDENCE FROM ANY PERSON.
(H) THE CONTENTS OF REAL ESTATE APPRAISALS OR ENGINEERING OR FEASIBILITY ESTIMATES AND EVALUATIONS MADE FOR OR BY THE STATE OR LOCAL AGENCY RELATIVE TO THE ACQUISITION OF PROPERTY, OR TO PROSPECTIVE PUBLIC SUPPLY AND CONSTRUCTION CONTRACTS, UNTIL ALL OF THE PROPERTY HAS BEEN ACQUIRED OR ALL OF THE CONTRACT AGREEMENT OBTAINED. HOWEVER, THE LAW OF EMINENT DOMAIN SHALL NOT BE AFFECTED BY THIS PROVISION.
(R) RECORDS OF NATIVE AMERICAN GRAVES, CEMETERIES, AND SACRED PLACES AND RECORDS OF NATIVE AMERICAN PLACES, FEATURES, AND OBJECTS DESCRIBED IN SECTIONS 5097.9 AND 5097.993 OF THE PUBLIC RESOURCES CODE MAINTAINED BY, OR IN THE POSSESSION OF, THE NATIVE AMERICAN HERITAGE COMMISSION, ANOTHER STATE AGENCY, OR A LOCAL AGENCY.
(Z) RECORDS OBTAINED PURSUANT TO PARAGRAPH (2) OF SUBDIVISION (F) OF SECTION 2891.1 OF THE PUBLIC UTILITIES CODE.
(AA) A DOCUMENT PREPARED BY OR FOR A STATE OR LOCAL AGENCY THAT ASSESSES ITS VULNERABILITY TO TERRORIST ATTACK OR OTHER CRIMINAL ACTS INTENDED TO DISRUPT THE PUBLIC AGENCY'S OPERATIONS AND THAT IS FOR DISTRIBUTION OR CONSIDERATION IN A CLOSED SESSION.
(AB) CRITICAL INFRASTRUCTURE INFORMATION, AS DEFINED IN SECTION 131(3) OF TITLE 6 OF THE UNITED STATES CODE, THAT IS VOLUNTARILY SUBMITTED TO THE CALIFORNIA EMERGENCY MANAGEMENT AGENCY FOR USE BY THAT OFFICE, INCLUDING THE IDENTITY OF THE PERSON WHO OR ENTITY THAT VOLUNTARILY SUBMITTED THE INFORMATION. AS USED IN THIS SUBDIVISION, "VOLUNTARILY SUBMITTED" MEANS SUBMITTED IN THE ABSENCE OF THE OFFICE EXERCISING ANY LEGAL AUTHORITY TO COMPEL ACCESS TO OR SUBMISSION OF CRITICAL INFRASTRUCTURE INFORMATION. THIS SUBDIVISION SHALL NOT AFFECT THE STATUS OF INFORMATION IN THE POSSESSION OF ANY OTHER STATE OR LOCAL GOVERNMENTAL AGENCY.

6254.10. NOTHING IN THIS CHAPTER REQUIRES DISCLOSURE OF RECORDS THAT RELATE TO ARCHAEOLOGICAL SITE INFORMATION AND REPORTS MAINTAINED

BY, OR IN THE POSSESSION OF, THE DEPARTMENT OF PARKS AND RECREATION, THE STATE HISTORICAL RESOURCES COMMISSION, THE STATE LANDS COMMISSION, THE NATIVE AMERICAN HERITAGE COMMISSION, ANOTHER STATE AGENCY, OR A LOCAL AGENCY, INCLUDING THE RECORDS THAT THE AGENCY OBTAINS THROUGH A CONSULTATION PROCESS BETWEEN A CALIFORNIA NATIVE AMERICAN TRIBE AND A STATE OR LOCAL AGENCY.

6254.16. NOTHING IN THIS CHAPTER SHALL BE CONSTRUED TO REQUIRE THE DISCLOSURE OF THE NAME, CREDIT HISTORY, UTILITY USAGE DATA, HOME ADDRESS, OR TELEPHONE NUMBER OF UTILITY CUSTOMERS OF LOCAL AGENCIES, EXCEPT THAT DISCLOSURE OF NAME, UTILITY USAGE DATA, AND THE HOME ADDRESS OF UTILITY CUSTOMERS OF LOCAL AGENCIES SHALL BE MADE AVAILABLE UPON REQUEST AS FOLLOWS:
(A) TO AN AGENT OR AUTHORIZED FAMILY MEMBER OF THE PERSON TO WHOM THE INFORMATION PERTAINS.
(B) TO AN OFFICER OR EMPLOYEE OF ANOTHER GOVERNMENTAL AGENCY WHEN NECESSARY FOR THE PERFORMANCE OF ITS OFFICIAL DUTIES.
(C) UPON COURT ORDER OR THE REQUEST OF A LAW ENFORCEMENT AGENCY RELATIVE TO AN ONGOING INVESTIGATION.
(D) UPON DETERMINATION BY THE LOCAL AGENCY THAT THE UTILITY CUSTOMER WHO IS THE SUBJECT OF THE REQUEST HAS USED UTILITY SERVICES IN A MANNER INCONSISTENT WITH APPLICABLE LOCAL UTILITY USAGE POLICIES.
(E) UPON DETERMINATION BY THE LOCAL AGENCY THAT THE UTILITY CUSTOMER WHO IS THE SUBJECT OF THE REQUEST IS AN ELECTED OR APPOINTED OFFICIAL WITH AUTHORITY TO DETERMINE THE UTILITY USAGE POLICIES OF THE LOCAL AGENCY, PROVIDED THAT THE HOME ADDRESS OF AN APPOINTED OFFICIAL SHALL NOT BE DISCLOSED WITHOUT HIS OR HER CONSENT.
(F) UPON DETERMINATION BY THE LOCAL AGENCY THAT THE PUBLIC INTEREST IN DISCLOSURE OF THE INFORMATION CLEARLY OUTWEIGHS THE PUBLIC INTEREST IN NONDISCLOSURE.

6254.23. NOTHING IN THIS CHAPTER OR ANY OTHER PROVISION OF LAW SHALL REQUIRE THE DISCLOSURE OF A RISK ASSESSMENT OR RAILROAD INFRASTRUCTURE PROTECTION PROGRAM FILED WITH THE PUBLIC UTILITIES COMMISSION, THE DIRECTOR OF HOMELAND SECURITY, AND THE OFFICE OF EMERGENCY SERVICES PURSUANT TO ARTICLE 7.3 (COMMENCING WITH SECTION 7665) OF CHAPTER 1 OF DIVISION 4 OF THE PUBLIC UTILITIES CODE.

If accessibility is restricted in accordance with California Government Code, that condition will be referenced in the subject data set's metadata, in both the "Description" and the appropriate "Resource Constraints" metadata element sections.

6.3 The steward will work closely with geodatabase administrators and the California Department of Technology technical support, as necessary, to control access to any data set subject to restrictions discussed above, in Standards sections 6.1 and 6.2.

6.4 Upon promotion to the Atlas production environment, subject data set will be included in the default DWR DataSpace template. (DataSpace is a ESRI software plug-in created by a U.S. Bureau of Reclamation contractor that supports data file virtualization; the template is DWR's default view of the contents of Atlas in this software plug-in.) The EGC Chair is responsible for ensuring that the DataSpace template has been modified to include the subject data set.

Section 7. Maintenance and Archiving

To ensure the ongoing reliability and currency of a data set that has been published to Atlas, the steward needs to employ an ongoing maintenance and archiving strategy. As defined here, “maintenance” refers to matters involving improvements and updates to the subject data and metadata. “Archiving” refers to how versions of the data set that once existed on the Atlas, but which have since been improved or updated, are stored for future access.

Legacy and external data sets may have fairly minimal requirements for maintenance and archiving, but consideration is still warranted. For example, a data set sourced from an external public agency, such as, for example, the U.S. Bureau of Reclamation, may be checked for an update on an annual basis. If an update is available, it should be posted to Atlas, and the older version of the data set should be stored as an archive copy.

7.1 A plan for maintaining and archiving the data will be submitted by the steward and approved by the DWR Enterprise GIS Committee. The maintenance and archiving plan should appropriately include any of the items below, plus any other information that may be warranted.

- Update procedures.
- Types and frequency of data updates.
- Estimated annual cost for data set maintenance.
- Frequency of re-certifying that data meet standards, including positional accuracy.
- Criteria for determining if EGC needs to be involved in evaluating maintenance or standard compliance.
- Metadata update plan.
- Requirement for archiving, if there is one.
- Frequency of archiving.
- Any naming conventions upon archiving.
- Portions of data set that need to be archived.

Part 2. Additional Spatial Data Standards and Guidelines that Apply to New DWR-Created Enterprise GIS Data Sets

Section 8. Stewardship

When planning to steward a new data set from scratch, or to make significant and ongoing improvements to an existing data set, the potential data steward (steward) should spend time carefully thinking about various aspects of the data set. Naturally, the data set needs to adequately capture aspects of the data that will sufficiently support primary end uses. In addition, proper choices need to be made with regard to database design and modeling impact characteristics of data quality, such as accuracy and consistency.

Consequently, the EGC requires that the database design process be formalized, and that the resulting products of the design process be captured in documentation submitted as part of the initial stewardship plan (ISP). These products include the data model and, if warranted, a data dictionary. Examples of data models are included in Appendix B. While there is no definitive way of developing a data model, data model development should include consideration of the best way to spatially represent the data to be captured, and how attribute data should be stored. DWR Spatial Data Standards (Standards) section 12 below discusses data modeling in more detail.

8.1 Stewards will submit an ISP for California Department of Water Resources (DWR)-created data sets to the Enterprise Geographic Information System (GIS) Committee (EGC). The ISP includes the forms in Standards section 1, along with a data model and a data dictionary. A data model should describe in words the spatial structure of the proposed data set; schematically show any tables related to the spatial portion of the data set and any relationships between the various tables; and reflect the file organization of any feature classes, whether stored as stand-alone or in feature datasets. A data dictionary should include lists and types of tables and fields, and any code sets, attribute descriptions, and relationship classes utilized in the data set.

The ISP will be submitted at the beginning of the stewardship process, before significant material editing/development work is undertaken, and prior to promotion to Atlas.

8.2 The steward may utilize sub-stewards who may assist in design, development, and improvement of the subject data set. To ensure adequate support resources exist for the data set, the steward will also obtain signoffs accepting responsibility from all sub-stewards, as appropriate, and submit these as part of the ISP.

8.3 Upon a steward's notification to EGC that a candidate data set is in compliance with the Standards, a signoff form will be submitted by the steward to EGC which attests that independent quality assurance (QA) review has been performed and the data set is fully in compliance with all relevant Standards and Guidelines. A template for the independent QA signoff is included in Appendix B.

Section 9. Names

9.1 Avoid abbreviations. Different disciplines may use the same abbreviation, such as ppt. For those working in water quality, this would be the abbreviation for “parts per thousand.” For those working with the hydrologic cycle, this would be the abbreviation for “precipitation.” When an abbreviation is used, it should be explained in the metadata.

9.2 Write all acronyms and initialisms in capital letters. All acronyms and initialisms will be explained in the metadata.

9.3 Use specific names. If a name is too vague, users must rely on supplemental documentation for definitions.

9.4 Use primary keys to uniquely identify every record in a table. If primary keys are used, the suffix “_ID” will be used in the field name (e.g., Site_ID, Plot_ID, Station_ID) for primary keys that are numeric. Use the same field name for foreign keys (e.g., Site_ID in one table may relate to Site_ID in another table).

9.5 For field names, use the suffix “_Code” for primary keys that are alphanumeric. For example, a field containing three-letter abbreviations of California counties would be County Code, not County ID.

9.6 Use singular nouns in field names. For example, use Life Stage rather than Life Stages.

9.7 Avoid a field name that is a word reserved for use by a database server or GIS software program. The list will differ depending on the software and version being used. For example, a field should not be named “Shape.” These are words used by ArcGIS.

9.8 Where appropriate, in fields storing values that have units write the units as {name}_{units} or as {units}.

Section 10. File Organization

10.1 Data sets created or maintained by DWR or DWR contractors on a going-forward basis will organize files according to a data design by the steward (and sub-stewards, if appropriate), documented in the data model submitted as part of the ISP, and approved by EGC. The data design will incorporate consideration of whether the subject data set(s) are best left as stand-alone feature classes or, if they are related feature classes, grouped into feature data sets that truly should be used and maintained as a group. If no clear relationship or need to use data sets as a related group exists, data will be stored as individual stand-alone feature classes.

Section 11. Vertical Datum for DWR-Created/Improved Data Sets

11.1 DWR specifies North American Vertical Datum of 1988 (NAVD88) as the vertical datum, until the new vertical datum from the National Geodetic Survey (NGS) planned for 2022 becomes available. California Public Resource Code Section 8853 states:

> 8853. THE OFFICIAL GEODETIC DATUM TO WHICH ORTHOMETRIC HEIGHTS ARE REFERENCED WITHIN THE STATE OF CALIFORNIA SHALL BE NAVD88.

Consequently, NAVD88 will be used as the vertical datum for all new or actively maintained data sets that DWR or DWR contractors develop. After the release of the new NGS vertical datum, creation of new vertical data will begin being referenced to the new datum as soon as is feasible.

Section 12. Spatial Data Creation Method Standards and Guidelines

The main goal in designing a data model and in planning development methods is to ensure that the subject data is sufficient for end user mapping and analysis applications. Clearly, the most basic decision that needs to be made about spatial data concerns is how the data are represented spatially. Spatial data sets are represented as discrete vectors (points, lines, or polygons), or as a continuous gridded surface often referred to by the graphical concept of a "raster." Beyond the basic representation type, additional specific considerations may affect details of how the data are modeled. For example, to map a forest, decisions need to be made whether to map individual trees or the forest as a whole. If individual trees are required, should they be mapped as polygons or as points (e.g., are they tree canopies or tree trunks)? Should the canopies be mapped individually or as canopy overlaps? What minimum size constitutes an individual tree?

Once the basic geometry representation type has been made and the nature of the spatial data model established, a data creation and editing method must be chosen that will maximize the consistency and accuracy of the final subject data set. Many issues may influence the selection of a creation method. Several standards and guidelines described below are intended to be used during the data development process to assist a steward in developing a good approach.

In addition, attribute data associated that with the spatial representation of the subject theme must also be planned with a careful design. End user requirements will drive the decision of which data set attributes to capture. Attribute data may be stored within tables and fields directly associated with the subject data set or may be linked via table joins or relationship classes to other existing attribute tables stored elsewhere in Atlas.

All Spatial Data Sets: Projection Standard

The projection used for the data set is subject to Standards section 4. Different projections have different abilities to preserve shape, distance, area, and directional cardinality. Consequently, the desired projection should be selected prior to the commencement of any data development, whether for vector or raster data.

12.1 The map projection chosen for the subject data set will be selected for optimizing known end uses (e.g., the *constant distance relationship* of UTM). If specific end uses that require a particular advantage of a given map projection are not known, and there is no source-based or data interoperability reason for selecting a particular projection, then unprojected Geographic is recommended.

Vector Data

Vector data may be created using a variety of creation/mapping methods. Some of the common creation methods include use of global positioning system equipment, geocoding, digitizing from imagery or other basemaps, conversion from tabular data that includes positions (e.g., latitude/longitude, or northing/ easting), as output from raster analysis, converting from other formats (e.g., CAD), or data created as output from other geoprocessing tools (such as a buffer process).

Both the choice of geometric data representation and the creation method used will affect various aspects of the quality of the subject data set. The data representation that is both appropriate and feasible for the features to be created in the database is critical and will have a direct bearing on the creation method,

positional accuracy, and spatial consistency. The mapping method itself, in turn, will affect data development cost, positional accuracy, and spatial consistency.

Positional accuracy and spatial consistency can suffer as a result of various causes. Poor or inconsistent quality of source/input data (often the case with data from multiple sources), inconsistent map scales, or data derived from where geodetic control quality not equivalent throughout a coverage results in inconsistency. Failure to use standard editing rules and tools can harm both accuracy and consistency. Selection of the wrong data creation/editing methodology (e.g., inappropriate scale for a specified minimum mapping unit, incorrect snapping rules, wrong topological rules) can cause inconsistency. Edge-matching errors lead to variable accuracy throughout a coverage, where the areal extent is larger than individual source tiles. The data model itself can lead to spatial inconsistency and positional errors if the designed data model is itself inappropriate for the features to be mapped. And, of course, even without the causes just listed, inconsistent creation/editing technique (e.g., resulting from human error, different analysts doing it their own way, eyestrain caused by fatigue) results in spatial inconsistency and positional error.

Standards for Vector Data Creation

12.2 Enterprise vector data created from source/reference imagery will be mapped only from imagery that has been orthorectified.

12.3 The edges of the source data set and the data set being created should be compared. The edges of the new derivative data set should not exceed the extent of the source data set. If they do not, corrective action should be taken before continuing.

12.4 Excepting emergency response or climate modeling purposes, derivative vector data sets will use imagery with cloud cover not in excess of 5 percent.

Guidelines for Vector Data Creation

Guidelines exist for best mapping practices, some of which may apply to the subject data set being developed.

- North American Datum of 1983 (NAD83) is the preferred horizontal datum for all new vector spatial data sets produced by DWR and DWR contractors.

- Data should be mapped at a scale appropriate to the source data. For example, if a map was created at a 1:24000 scale, on-screen digitizing should use that same scale. If source orthophotography is created at a specific scale, features should be digitized at that same scale.

- Spatial data sets should use an appropriate vertex-to-vertex distance (or “interval”). The nominal vertex distance should be determined before creation and/or editing has begun. This distance should be no smaller than what is required to create the smallest consistently discernable feature at mapping scale, and no larger than necessary to accurately capture accurate geometry at mapping scale.

- Spatial data sets should use a minimum mapping unit appropriate to the digitizing scale. The minimum size of a feature (minimum mapping unit) should be related to the appropriate vertex interval needed to achieve accuracy and spatial distinction. For line-feature-type data, the minimum

vertex interval and minimum mapping unit should be equal. For polygon-feature-type data, the minimum mapping unit should be no smaller than the smallest triangular area capable of being created by the minimum vertex interval.

- Vertex, edge, and end snapping tolerances should be set before and while creating data. Tolerances should be no more than the minimum vertex interval.

- Spatial data sets should use specific feature class types (point, line, or polygon) only if that feature class type can clearly be delineated as such throughout the entire data source (coverage) at the specified mapping scale.

- Data creation or editing should use any available logical constraints. For example, “levees will not cross waterways” or “new cable TV lines will not cross gasoline pipelines.” However, data should be created and/or edited only with logical constraints that apply equally throughout the entire coverage. While use of logical constraints can improve data quality and consistency, it can only achieve an improvement in consistency if the constraint itself is of a known, consistent quality itself. For example, if a rule is developed (such as “levees will not cross waterways”), it should first be verified that waterway data exists throughout the coverage, and that the waterway data are of a sufficiently consistent accuracy and completeness throughout the coverage to support use as a spatially consistent logical constraint.

- Use of topology is not required; but if used, it should be used consistently. Whenever possible and appropriate, data should be created and edited using topological tools to define topological relationships to other features within the subject feature data set or to other feature classes.

- The general topology rules for polygons, lines, and points are defined in Appendix E.

- When developing seamless data sets, usage of sources of comparable quality is strongly recommended. More specifically, when merging or mosaicking smaller subsets of data into a large, integrated, “seamless” data set covering a larger area, the accuracy, completeness, and projection/datum of the contributing data sets should be similar. If they are not, then spatial consistency will suffer. For example, if data from one county’s road network is accurate to 1 meter, and from a second county’s road network it is accurate to 5 meters, merging these data sources causes spatial inconsistency. While some cases may demand integrating subareas of data sets of substantially different quality, in general this should be avoided to the degree possible. Furthermore, the reported positional accuracy of the final seamless data set should generally correspond to the poorest accuracy among the input data sets, unless clearly proven otherwise by detailed quality assurance/quality control and positional accuracy analysis.

- If spatial data is synthesized from multiple map sources, and some sources overlap, conflict will likely exist among the original data sources. These may include duplicated features, conflicting locations, or attributes. A rule-based decision-support system should be used to determine which data sources have primacy in creating the new data set.

- Where mapping from imagery, and where multiple imagery data sets serve as sources, all source imagery should be from a similar time period, generally within same decade. It is recommended that source imagery be from the same year, and preferably from within the same season.

Raster Data

Several methods exist by which to create raster data. A few methods by which raster data may be created are remote sensing, analyzing imagery, approximation of mapped vector data, and derivation from other raster data. Moreover, variations in processing steps may affect the accuracy and consistency of the subject data set.

Standards for Raster Data Creation

12.5 Aerial imagery will undergo an orthorectification process, except in certain exceptional cases (e.g., historical aerial photo with no known photo-acquisition parameters or reference elevation model).

12.6 With the exception of imagery for support of emergency response or climate modeling purposes, imagery cloud cover will not be in excess of 5 percent.

Guidelines for Raster Data Creation

- NAD83 is the preferred horizontal datum for all new raster spatial-data sets produced by DWR and DWR contractors.

- If possible, when creating raster data, a check should be done of registration marks. If there is a large root mean square error between the source data and the data being created, corrective action should to be taken before continuing.

- Where mapping of features directly on Earth's surface with the intent to be free of overhead visual obstruction (e.g., forest canopy, bridges), the total coverage of obstructed surface area should not exceed 10 percent. This guideline obviously does not apply when mapping forests, urban areas, or features not directly on the ground.

Attribute Data

Attributes of spatial features may be stored as tabular data directly in the feature data set, or in related non-spatial tables. Attribute data have their own set of standards and guidelines rooted in the goal of maximizing data integrity, accuracy, and consistency. In addition, the data modeling process allows stewards to introduce good database design principles to further meet such goals. A significant part of the data-modeling design process involves deciding how attribute data will be stored. In some cases, data will be stored very simply, with all attribute data stored in the primary feature class table, or it may be all in one major separate stand-alone attribute table. In more complex cases, data storage may be spread across multiple tables residing throughout the Atlas geodatabase, and primary keys and relationship classes may need to be built into the database to support full attribute referencing to the subject data set. Best database design often favors storing spatial data and attributes in separate tables. That said, a downside to this approach is that, in some cases, it may needlessly complicate use of data. While specific standards for overall table designs do not exist, the required data model development process will seek to customize best database design practices for subject data sets.

Nonetheless, one aspect of database design is specifically required. Because a primary goal of Atlas is to standardize data and avoid the conflicts that arise from multiple sources for the same data, attribute data must not be duplicative of data that already exists in Atlas. The database design must be clearly integrated with any such attribute data, as warranted.

Standards for Attribute Data

12.7 **Minimum Mandatory Fields**. These six fields will be added to all database tables if they do not already exist and will be populated accordingly. While the exact field name may vary from the words used below, the essential meaning of the fields below must be captured somewhere in every table associated with the subject data set.

- A unique number to identify the record.
- Date data applies to.
- Source.
- Comments.
- Date record last edited.
- Record last edited by.

12.8 Stewards will check with the geodatabase administrator during data model development to see if proposed attribute data is already stored in existing Atlas attribute tables. If data are already stored in existing attribute tables, the data model will be designed to utilize those existing data rather than to create new attribute tables.

12.9 New fields that store comprehensive, authoritative attribute data already included elsewhere in the Atlas will not be added. “Comprehensive, authoritative” means that certain attributes that are known to be spatially adequate (e.g., statewide) and have been sufficiently attributed to serve as master records for the entire Atlas geodatabase’s use have been recognized as such by the EGC. For example, “California counties” and “agency names” data will not be repeated in additional new Atlas attribute tables, as master records for these already exist.

12.10 Dates will be stored in date type fields, not text fields. Dates will be in date format (International Organization for Standardization [ISO] Standard 8601) and not text format, unless an explanation is provided in the metadata. Minutes and seconds will be greater than or equal to zero, and less than or equal to 60. Hours will be greater than or equal to zero, and less than or equal to 24. Days will be greater than or equal to one. Days for January, March, May, July, August, October and December will be less than or equal to 31. Days for April, June, September and November will be less than or equal to 30. Days for February will be 28, except they will be 29 when the year is evenly divisible by 4 and not evenly divisible by 100, or if the year is evenly divisible by 400. Months will be greater than or equal to 1, and less than or equal to 12.

12.11. Area and length attributes will be the area and length data maintained by the software for geodatabases, and not separately stored in user-created area or length fields.

12.12. Significant figures will be properly applied to stored calculations.

12.13. All hyperlinks will be root-relative paths or absolute paths, not relative paths using a dot notation. All file system links will use universal naming convention (UNC), not mapped lettered drives.

12.14 OBJECTID will not be used as the link field for any relationship class.

12.15 Organization and agency attribute values will be identical to those used for subject organizations and attributes as they are stored in the Atlas's i99 organization master table.

Guidelines for Attribute Data

- Where feasible and appropriate, attribute data will be stored in stand-alone attribute tables that are subsequently related back to the primary spatial data feature class, rather than directly within the feature class table itself. In effect, the feature class should be storing only the geometry data, and attribute data should be maintained separately.

- Units of measure will be included in field names where appropriate.

- Units of measure should be metric, except as appropriate because of widely used professional practice.

- Fields should store single values, not complex chains or (aka "compound") values. For instance, do not store the entire address in a field. Instead, divide the address into its elemental parts: street address, city, state and zip code.

- Wherever possible, ranges, constraints, and domains should be used. Attributes values are defined in the appropriate definition (look-up) table, inclusive of their logical range or described in the appropriate data dictionary (code sets).

- Automated tools to populate databases should be used whenever possible. For example, if a subset of records is to have a common value applied, the ESRI Field Calculator will be used to create and/or update the subset of records, rather than manual line-by-line data entry.

Section 13. Metadata

New DWR-created data sets are subject to a metadata requirement far beyond that described in Standards section 5, and it is known as the “full DWR metadata standard.” The full DWR metadata standard is considered to be identical to the Federal Geographic Data Committee’s (FGDC’s) Content Standard for Digital Geospatial Metadata (CSDGM).

13.1. New data sets created by DWR or its consultants are subject to the full DWR metadata standard requirement, which is identical to the FGDC CSDGM metadata standard. The full DWR metadata standard requirement is included is available (as of publication of this document) here: https://www.fgdc.gov/metadata/csdgm-standard

Section 14. Accuracy

Positional Accuracy or Locational Quality

14.1 DWR-created enterprise data sets may have either a positional accuracy or locational quality statement included in the metadata when warranted. The current document describing in detail how to make such statements is included as Appendix F. Positional accuracy statements may only be made by a licensed land surveyor, under Public Resources Code Section 8726 (n). All other professional disciplines will be making locational quality statements. The statement should clearly distinguish which type of statement is being made, and whether a licensed land surveyor is making it. The suggested language for this statement is:

> Positional Accuracy: Determined to be ABC.D meters horizontal. This statement was derived with the benefit of a field survey adhering the standards of practice of the profession of land surveying as defined in the Business and Professions Code Sections 8700-8805 State of California and other applicable laws governing the profession of land surveying.
>
> Locational Quality: Determined to be no better than ABC.D meters horizontal.

Lastly, if a licensed land surveyor made a statement of positional accuracy for the data set, the exact version or applicable date for the data set for which the statement was made should be identified and included.

14.2 Subsequent to the metadata element for the positional accuracy/locational quality statement is a metadata element for providing explanation or a report providing more information about how the statement was determined. The report should indicate which method was used, any equipment and/or reference data used, and the published accuracy of the data used or manufactures' specified precision of equipment used in developing the data and in conducting the assessment.

Attribute Accuracy

Attribute accuracy is the agreement between the recorded and actual value. Errors occur for numerous reasons, but a major cause is because of object misclassification. There are many ways to calculate accuracy, and no single way to quantify the accuracy for all attributes in all cases.

The data custodian will have to select a reasonable measure to quantify the attribute accuracy based on the type of data collected (raster vs. vector), reference information for comparison, if any, and how the data is entered into the geodatabase.

Methods to quantify the attribute accuracy include

1. Error table. An error table is a matrix showing all possible true values and all actual database values in rows and columns, and the frequency of each combination in each cell. A sample error matrix is presented in Table 2-1.

The attribute accuracy is the portion of objects that were correctly assigned. The objects correctly classified is the sum of the diagonal cells is (85 + 985 + 2+ 44) = 1,116. The total number of objects is 1,155. The proportion of objects that were correctly classified is (1,116/1,155), or 96.6 percent.

2. Simple statistical values, including standard deviation, mean error (or total error), skewness or root mean square error.
3. Advanced statistical values, such as maximum likelihood estimator, Cohen's kappa coefficient, kriging, multi-Gaussian modeling, or simulated annealing.

Table 2-1 Sample Error Matrix

Actual Class	Assigned Class				Total
	Cherry	Oak	Redwood	Willow	
Cherry	85	10	3	2	100
Oak	4	985	2	9	1,000
Redwood	3	0	2	0	5
Willow	2	4	0	44	50
Total	94	999	7	55	1,155

In addition, the statistical values above can be supplemented with confidence intervals (ranges), percentile or proportions. These are not, in and of themselves, sufficient statistical measures of attribute accuracy for the metadata.

Stewards may utilize alternative approaches if warranted.

14.3 All attributes in all tables (except definition tables) do not require testing for accuracy. However, the steward will exercise good judgment in determining whether analyzing and reporting accuracy for specific critical attributes is of sufficiently significant impact on appropriate end use of the data set, including in legal proceedings. The steward should consider whether any reasonable end user will need to know the quantified accuracy of attributes in making derivative analytical, permitting, or other planning decisions. If appropriate, ANSI standards will be used for testing, as provided in Appendix F. The test methods and results will be documented in the metadata.

Temporal Accuracy Guideline

Temporary accuracy is defined as the agreement between the recorded and "actual" time. While high temporal accuracy is an ideal characteristic for a data set, measurement of this difference between the "real" time of the event and the time recorded is often practically impossible. Therefore, stewards will include statements about temporal accuracy in the metadata only to the degree feasible and where such comments are actually meaningful.

Section 15. Quality Assurance and Quality Control

Quality control (QC) and quality assurance (QA) are vital components of a data development strategy. QC is a process used when collecting and/or creating spatial data, where the goal is to put in measures to enhance consistency and accuracy. Specific QC procedures are developed by those who collect and create spatial data, and will vary from data set to data set. QC is used by the creators/editors of the data and is essentially a "self-policed" process. Among the goals of QC is that the Standards will be met when they are later checked independently.

There is no specific defined list of procedures that may be used for QC. However, some basic techniques do exist that are worth consideration. In general, data should be subject to the normal set of "expected end uses," such as mapping and querying. Symbolization and labeling should be performed on appropriate fields and evaluated. Any use of spatial joins should be reviewed to evaluate the success of the join process. All tables should be checked to eliminate duplicate records. Tests will be run to indicate each field's unique values, specifically whether values are out of range, simple data entry errors exist, entries are misspelled, and whether code sets are satisfactorily represented by the documented data dictionary.

15.1 Stewards and anyone working on creating or editing a subject data set will develop a QC plan prior to data development work. The QC plan will be used throughout the entire development process.

QA is a separate, post-development evaluation of the spatial data quality. QA is an independent check of the proposed final spatial data set and the associated metadata. The independent QA check is where Standards are actually verified as having been met. One of the important characteristics of QA is that a "different set of eyes" reviews the data, and so the independent QA check will not be done by the person producing the spatial data. Ideally, the independent QA check is performed by another subject matter expert for the subject data set.

15.2 An independent QA check will be performed on all subject data sets. The purpose of the independent QA check is to verify that all Standards have been addressed and satisfied. The independent QA check will be performed by someone other than the steward or any persons who performed the primary data development work. The independent QA reviewer will sign and submit an Independent QA Signoff form (included as part of Appendix B) to the steward prior to the subject data set's promotion to the Production environment of the Atlas.

Part 3. Standards, Guidelines, and Workflows for Web Services of DWR-Created Spatial Data

Since the time that the California Department of Water Resources (DWR) Spatial Data Standards (Standards) document was created in 2016, DWR has rapidly expanded into providing data as services. In addition, DWR has actively been producing web maps and applications that utilize these services that are sourced from the DWR Atlas geodatabase (Atlas). Furthermore, many of the data services are also provided via the California Natural Resources Agency Open Data Portal (https://data.cnra.ca.gov/) to satisfy the requirements of Assembly Bill 1755 (Dodd), The Open and Transparent Water Data Act. Consequently, Part 3 is a new requirement of DWR's Spatial Data Standards, beginning with this version, Version 3.1.

Section 16. Requirement for DWR Web Maps and Applications Use of Web Atlas

In most normal cases, DWR should strive to provide only up-to-date, authoritative, actively maintained, high-quality data to the public. Furthermore, complete documentation of data sets provided in the public domain is well warranted.

16.1 Public-facing web maps and web applications that use DWR-supplied services will be sourced by the Web Mercator Auxilliary Sphere version of the DWR GIS Atlas (Web Atlas).

Section 17. Production of Default Service Definition Files

Historically, web services of Atlas data sets used in web applications have been static snapshots. DWR's Enterprise Data Services Office (within the Division of Technology Services) and Geospatial Data Support Section (within the Division of Engineering) worked to develop a replica of the Atlas that re-projects most Atlas data sets into World Geodetic System 1984 (WGS84) Web Mercator Auxiliary Sphere (WMAS) for use in all DWR GIS web maps and web applications. This allows Atlas data services to function well with other non-DWR data services. By having the underlying data natively in this format, performance will noticeably increase, especially in applications with multiple layers. Additionally, having authoritative web versions of each data set will decrease versioning problems created by individual static copies.

Data stewards (stewards) will follow a prescribed workflow to prepare the default service definitions. The enterprise offices listed above will then use the default definition files to create a representative state transfer endpoint that will function as the service address.

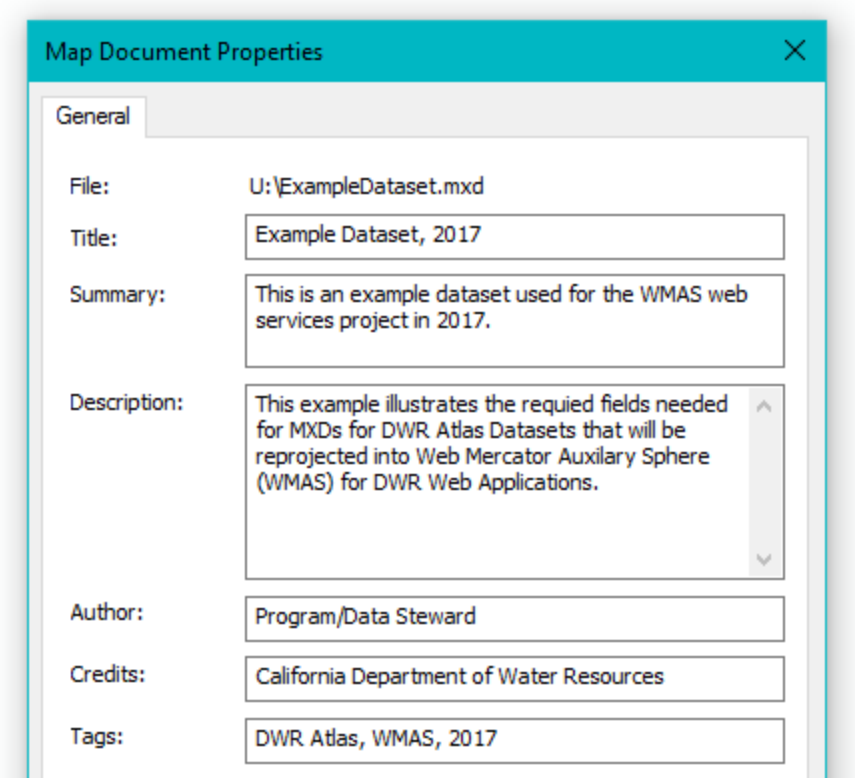
17.1 All default service definition files will use the WGS84 WMAS as the defined projection/datum. The Web Atlas will be the source of the data referenced by the service definition files.

17.2 Stewards are responsible for submitting service definition files, which as of release of version 3.1 of the Standards, will include:

- .MXD file for primary service definition, named as "*SubjectDatasetName.mxd*"
- Copy of metadata .xml, named as "*SubjectDatasetName.xml*"
- A README text file, named as "*README.txt*"

17.3 The steward will construct the mxd service definition file as follows:

- Only one layer per mxd.
- Name each.mxd exactly the same as the data set name used in the Atlas.
- For data frame properties, set the projection as WGS84 Web Mercator Auxiliary Sphere.
- Define symbology that best represents data to the public.
- For labels, use caution when using advanced labeling engines (such as Maplex), which may decrease performance. Testing should be undertaken to evaluate impacts of labeling on performance. Standard labeling should be used if possible.
- Data connections should be those supplied by enterprise GIS staff in either the Division of Technology Services or the Department of Engineering; currently, identified as "*GISWEBSERVICES*."
- A thumbnail should be created.
- A title, summary, description, author, credits, and tags dialog boxes should all be filled out in the Map Document properties window. See example on the following page:



17.4 The production requirements described herein may be updated at any time by the Enterprise GIS Committee.

Section 18. Service-level Metadata

While Atlas data sets have extensive documentation per the metadata requirements, much of the information is not relevant for casual members of the public and may do more to confuse and result in information overload. Metadata for services that will be consumed by the public should be simple, clear, and to the point, while preserving enough information about the data to provide a full picture.

18.1 Standard data disclaimer language specified previously in Section 5.2 and 5.3 will be included in service-level metadata.

18.2 The service-level metadata should utilize the generic gis@water.ca.gov as the email contact, unless there is justification for a particular individual (such as the steward) to be specifically identified. The enterprise GIS offices will forward any questions or other correspondence from the generic email inbox to the steward as needed.

18.3 Service-level metadata should include at least the following fields:

FIELD	EXAMPLE
FREQUENCY	WEEKLY
CONTACT NAME	WATER DATA LIBRARY
CONTACT EMAIL	GIS@WATER.CA.GOV
TEMPORAL COVERAGE	1900-PRESENT
SPATIAL COVERAGE	CALIFORNIA
PUBLIC ACCESS LEVEL	PUBLIC
LIMITATIONS	DWR MAKES NO WARRANTIES OR GUARANTEES - EITHER EXPRESSED OR IMPLIED - AS TO THE COMPLETENESS, ACCURACY, OR CORRECTNESS OF THE DATA. DWR NEITHER ACCEPTS NOR ASSUMES LIABILITY ARISING FROM OR FOR ANY INCORRECT, INCOMPLETE, OR MISLEADING SUBJECT DATA.
LANGUAGE	ENGLISH
LAST UPDATED	SEPTEMBER 11, 2019
LICENSE	OTHER (PUBLIC DOMAIN)

18.4 A brief description of the data set should be given. At least one specific use case should be provided for the data set to serve as an example of an appropriate end use.

18.5 If the data set has a specific symbology required for data set use, the metadata should explain the symbology system.

If a random symbolization scheme was selected for the data set, the data set should specify that in some way. For example, “no symbolization scheme was set up for this data set” or “random color ramp used simply for the purpose of publishing data set.”

If a specific symbolization pattern is desired, the steward should describe why it was selected. For example, “dashed lines selected, as this is the international standard for representing a county boundary.” A

And if any concerns arise, careful consideration should be given before making a change. For example, if purple chosen for consistency with messaging on critically overdrafted basins, do not change without first consulting with the Sustainable Groundwater Management Office.

Section 19. Data Service Performance

Although hard requirements for performance may be difficult to define and achieve in some cases for numerous reasons, the goal for every steward when building the default service definition files should be clear: Provide services that respond as quickly as possible and are easy to understand.

19.1 General time frames to try to shoot for are as follows:

- Simple boundaries, load/refresh while zooming or panning in 5 seconds or less.
- Moderately complex spatial data (e.g., U.S. General Services Administration boundaries), load/refresh while zooming or panning in 10 seconds or less.
- Complex layers with 1,000+ features, load/refresh while zooming or panning in 15 seconds or less.
- Extremely complex layers with special requirements (e.g., statewide data collection locations), load/refresh while zooming or panning in 30 seconds or less.

19.2 Data services will be configured taking advantage of caching. Testing of caching layers will occur when examining the service performance and changed as necessary.

19.3 Services will be considered with correct scale-dependency, possibly including multiple data sets that have been designed for optimal use at different scales. Vector complexity should be optimized based on the appropriate scale at which any service is most likely to be used.

19.3 Frequently queried fields will also be indexed as appropriate.

19.4 Annotation will be used in lieu of labels whenever possible. If labels are used, choice of label engines should be made with care and attention to labeling performance.

19.3 Spatial resolution will be set approximately equal to estimated data set accuracy.

Part 4. Standards and Guidelines that Apply to Spatial Data Created by DWR During Emergency Response

Emergency response situations present unique challenges to geospatial data practitioners. Time is generally short, demands are high, and consequences for producing work are such that fast turnaround of requests is paramount. While compliance with the full California Department of Water Resources (DWR) Spatial Data Standards (Standards) is simply not practical during an incident response, there are certain basic requirements that need to be followed. These minimal requirements during such situations benefit other initial geographic information system (GIS) emergency responders who will need the data, other emergency responders that come into the sometimes chaotic response at a later date and need to know about and can work with the previously produced data, and for later use as response turns to recovery and lawsuits begin. Metadata supports the relay of information in transition of shifts between GIS specialists, documents the data life cycle, and describes the underlying information about the use and distribution of incident data.

Section 20. Stewardship

20.1 The initial producer of a data set during an incident response will, by default, be considered the data set steward (steward).

20.2 If good cause exists for changing the assignment of a steward later during the incident response or recovery, the change in stewardship designation will occur with the concurrence and direction of a Planning Section Chief.

Section 21. Naming Conventions

21.1 The identification of main project folder, also known as the incident data folder, will follow this format: YYYY_incident_Number

21.2 The following sub-folders are contained in the template for the incident data folder:

- Archive – All archived data will be stored here.
- Base data – Data used from the data brick should be copied to this location.
- Documents – All documents pertaining to the incident and GIS.
- Incident Data – Data collected on or created during the incident.
- Products – PDF exports and tables used for production.
- Projects – ArcGIS Pro Projects saved to individual folders.
- Tools – Tools created for the incident.

21.3 The feature class name should contain a basic descriptor of the data. The ISO theme classification system should be used as the prefix of the feature class name, in the format of “i**”, where “**” refers to the theme classifications given in Standards section 2. Other information, such as date and data creator, should be listed in the metadata.

21.4 If layers are created, the feature class layer file should have the same name as the feature class to which it refers.

Section 22. Projections and Datums

22.1 All data sets created for the emergency response will use one of the projections and datums specified in Standards section 4. This requirement applies to projection/coordinate system, horizontal datum, and vertical datum. As soon as is feasible, the exact system to be used should be confirmed by the Planning Section Chief. The Planning Section Chief should make this determination as soon as is feasible after the initiation of the incident in consultation and guidance with DWR-licensed land surveyors, and ideally DWR's land surveyor of record.

22.2 Data collected using field data collectors should be collected in reference to the World Geodetic System 1984 coordination system and identified in units of feet, unless otherwise instructed.

Section 23. Emergency Response-grade Metadata

23.1. The metadata requirement for incident response is as follows:

- Title – Use titles that are short and as descriptive as possible. All titles should be consistent with the file name.

- Tags – Use single word phrases that relate to the subject of the underlying data. Include tags that will be easily searchable or queried. Separate tags with commas. Example: DWR, FERC, Habitat, Infrastructure.

- Summary – Include a statement that describes the incident including location, incident identifiers, and entities/agencies involved. Add general disclaimers as to the accuracy, timeliness, and completeness of the data in its current state.

- Description – General description of features may include where the data was collected/created, who collected/created the data, original and converted coordinate systems, and who the editors/contributors are. Any changes made to the data set will be logged into the description with MM/DD/YYYY date format along with a brief description of the change made.

- Credits – Give credit to authoritative data source when applicable. Include source title and contact.

- Use limitations – Add limitations based on the sensitivity of the data and may be added at the discretion of GIS Specialists or others within the incident command system. DATA CREATED FOR EMERGENCY RESPONSE USE PURPOSES ONLY, MAY NOT BE COMPLETE, AND ARE NOT QUALITY CONTROLLED NOR OF SURVEY STANDARDS. DWR makes no warranties or guarantees — either expressed or implied — as to the completeness, accuracy, or correctness of the data. DWR neither accepts nor assumes liability arising from or for any incorrect, incomplete, or misleading subject data.

- Thumbnail – Use thumbnails of features when possible. Other photos that may add to the visual description may be used.

Section 24. Minimum Required Fields

24.1 The minimum fields required for all incident response data sets are listed in Table 4-1 and will be added to all vector data sets.

Table 4-1 Vector Data set Fields

Name	Field Type	Field Length	Format
Data Source	Text	150-250	-
Last_Updated_Date	Text	10	YYYYMMDD
Date_Data_Applies_To	Text	10	YYYYMMDD
Last_Updated_By	Text	50	First Name Last Name
Comment	Text	250	-
Incident Name	Text	50	-

Section 25. Use of Base Data Portable Storage Device

25.1 A base data portable storage device will be available for GIS practitioner use during emergency response. The device may include the data set library known colloquially as the "CAL FIRE brick," owing to its original source from CAL FIRE. The portable data drive will contain many of the relevant data needed for map production and will be provided to GIS specialists during emergency incidents. When possible, the GIS specialist should use layers provided by the DWR SQL server (Atlas geodatabase) and the DWR Image Server. When using data from the portable data drive, the GIS specialist should apply necessary descriptions and fields to indicate the data source. If the CAL FIRE data used includes any sensitive and/or confidential information, the GIS specialist shall inform other users by making note of the sensitive/confidential status in any metadata created for derived datasets, to instruct in care, handling, and distribution of the data, and in being identified clearly as such on any maps developed using said information.

Part 5. Standards and Guidelines that Apply to Spatial Data Created by DWR Consultants

Section 26. Sections of DWR Spatial Data Standards that Apply to Data Produced by Consultants to DWR

Not all of the California Department of Water Resources (DWR) Spatial Data Standards (Standards) are applicable to data produced by consultants working on DWR contracts. While DWR contract managers will be given discretion as to which exact sections of the Standards to apply to consultant-produced data, below is considered an appropriate strong suggestion as to the sections of this documented that are warranted to the role of a consultant. Theoretically, the consultant would produce data complying with the portions specified here, and then the DWR contracting program would carry out the remaining portions of the full Standards in order to achieve promotion to the DWRAtlas geodatabase (Atlas). If a DWR contract manager elects to apply less than the sections stated here as a contract requirement, then the DWR contract manager would need to otherwise ensure compliance with such sections prior to promotion to the Atlas.

26.1 The sections of the Standards that apply to data supplied by consultants to DWR include:

All of the following sections: Section 2, Section 4, Section 9, Section 10, Section 11, Section 12, Section 13, Section 14, Section 15, Section 16, Section 17, Section 18, Section 21, Section 22, Section 23, and Section 24.

And subsections 5.2, 5.3, 5.5, 6.1, and 6.2.

Appendix A. Data Promotion Workflow

Appendix Contents Version Date: 2015.03.04

Specific workflows exist to promote data sets to the California Department of Water Resources (DWR) Atlas geodatabase (Atlas). Although the workflows are similar, slight differences exist that depend on whether one is working with new DWR data sets, legacy DWR data sets, or external, non-DWR data sets. The step-by-step workflow checklist below indicates the steps that are required. Exceptions for new DWR data sets are called out with parenthetical notes in the workflow. A companion document (Workflow for Enterprise Data.V1.2.20130718.doc), which has more elaborate explanations of these workflows, is available at https://dwrgis.water.ca.gov/library/-/document_library/view/4765964/5948?_20_redirect=https%3A%2F%2Fdwrgis.water.ca.gov%2Flibrary%2F-%2Fdocument_library%2Fview%2F4765964.

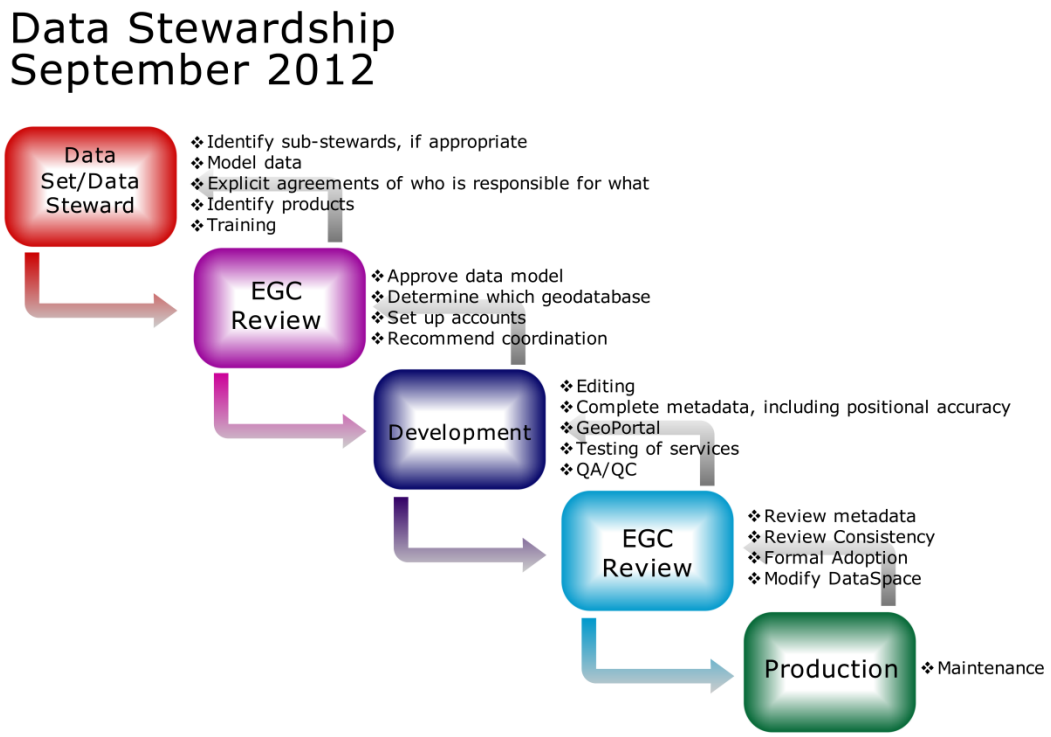
Data Promotion Workflow for Spatial Data Sets

1. Decide to become a data steward (steward) or accept a request to become one.
2. Identify appropriate relationships and explore capacity for staff to fill various roles.
3. Should there be sub-stewards? Who?
    a. Who will be the ArcGIS server/geodatabase administrator?
    b. Initiate formal indication to DWR Enterprise Geographic Information System (GIS) Committee (EGC) of intention to steward data set.
4. Develop draft initial stewardship plan (ISP).
5. Secure stewardship roles and obtain signoffs.
6. Identify the correct candidate data set for eventual promotion to Atlas.
    a. Compare various data sets. What are strengths and weaknesses of each?
    b. Discuss options with sub-stewards and select best candidate data set.
    c. Determine if candidate data set is legacy, external, or new DWR data set type.
    d. Develop draft data model. (**New DWR-created only.**)
    e. Identify final products (feature data service, map service, etc.).
7. Finalize the ISP. Submit ISP to EGC.
8. EGC will review and approve the ISP. Revise the ISP if necessary.
9. Determine permissions, data security policy, and security management approach.
10. Ensure everyone involved in stewardship and editing of data set has appropriate accounts/permissions.
11. Ensure everyone involved in stewardship of data set has necessary training.
12. Coordinate with any outside agencies, as necessary.
13. Provide copy of candidate data set to geodatabase administrator for copying into Development environment of Atlas.
14. As appropriate, develop and/or edit data set to comply with current version of DWR GIS Spatial Data Standards and as being consistent with approved ISP.
15. Complete required level of metadata for data set.
16. Develop any end user or data-sharing agreements, if necessary.
17. Have independent quality assurance (QA) conducted. Obtain signoff of independent QA certification. (**New DWR-created only.**)
18. Notify EGC that data set is ready for promotion to Production and submit data sharing/end user agreements and/or independent QA certification, if appropriate.

19. EGC review data set on Development and metadata. EGC provides comments to steward for any requisite revisions.
20. Notify EGC that metadata has been made consistent on Development.
21. EGC does final pre-production check. If acceptable, EGC will notify geodatabase administrator to promote data to Production.
22. Geodatabase administrator promotes data set to Atlas Production environment.
23. EGC ensures DWR DataSpace default template is updated to include subject data set.
24. Maintain data set on ongoing basis, if appropriate.

Figure A-1 depicts a graphical representation of the promotion workflow.

Figure A-1 Data Promotion Workflow



Appendix B. Enterprise Data Promotion Forms

Appendix Contents Version Date: 2019.06.12

Initial Stewardship Plan

The enterprise data promotion process requires stewards to submit completed forms to the Enterprise Geographic Information System (GIS) Committee (EGC) and obtain approval for them before engaging in major promotion tasks. All data sets require submission of an initial stewardship plan (ISP). The ISP is an opportunity for the stewards to propose an ideal candidate data set, ensure adequate resources and staffing exist for support, plan for future maintenance, and, in cases where the data are new data sets or are edited on an ongoing basis, design data models that will best support the various long-run end uses in the most powerful way. The submitted ISP will be reviewed by EGC and EGC sub-committees and will either generate requests for modifications or be approved by EGC signatures. Once EGC signatures are received, major tasks for promotion to the Atlas geodatabase (Atlas) may ensue.

The ISP includes the following sections:

- Stewardship roles and responsibilities signoff form.
- EGC Chair signoff form.
- Identified Candidate Data Set.
- Geodatabase Management Plan.
- Archiving and Maintenance Plan.
- Data Model (new DWR-created data sets only).

Stewards (and sub-stewards) should draft the ISP and sign the stewardship signoff section. The individual sections in the template of the form prompt for the types of information needed for each section. (The form is included in this appendix and is available as a separate blank MS Word document that stewards can fill out.) For new California Department of Water Resources (DWR)-created data sets, the data model section is a particularly important piece of the ISP. No single standard exists for what is incorporated in the data model section, though supplied text prompts for the type of information desired. Examples of ISPs and data model submittals are included as part of this appendix. Additional examples of actual DWR enterprise GIS data models, which might illustrate different cases, may be requested from EGC, as needed.

Independent Quality Assurance Signoff

New spatial data sets or data sets edited by DWR on a going-forward basis will require signoff from an independent quality assurance reviewer (who cannot be the steward). That form is supplied subsequent to the ISP document template, below, and is available as a stand-alone document for use by the steward.

CALIFORNIA DEPARTMENT OF WATER RESOURCES
ENTERPRISE GIS DATA SET
INITIAL STEWARDSHIP PLAN (ISP)

DATA SET NAME:

ISP SUBMITTAL DATE:

DATA SET STEWARD NAME:

DATA SET STEWARD ORGANIZATION WITHIN DWR:

DATA SET SUB-STEWARD NAMES:

STEWARDSHIP ROLES AND RESPONSIBILITIES SIGNOFFS:

_____	_____
DATA SET STEWARD	DATE
_____	_____
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
_____	_____
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
_____	_____
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
_____	_____
DATA SET SUB-STEWARD, IF APPLICABLE	DATE

DWR ENTERPRISE GIS COMMITTEE SIGNOFF:

_____	_____
CHAIR, DWR EGC	DATE

ISP Section 1. Identified Candidate Data Set

Stewards should submit a brief description of the data set version they propose as the candidate data set for inclusion in Atlas. Information on source, completeness, methods, and other descriptions of how and where this data originates should be included. If appropriate, some discussion about alternative versions of the data and cursory comparisons with those alternatives should be included. [*Replace these instructions with your own description.*]

ISP Section 2. Geodatabase Management Plan

Data set stewards should provide a brief description of the geodatabase management plan. The plan should include at least the following elements (items in red are requirements):

- Proposed geodatabase feature class name.
- Estimated initial size and projected future size of data set.
- Data set format (e.g., raster, tables, vector, LIDAR, TIN, etc.).
- Describe workflow between steward and sub-stewards.
- Frequency of updates and how updates will flow to geodatabase managers.
- Required spatial data base engine (SDE) administration steps and tuning.
- Versioning approach.
- Does data need to be kept internal to DWR, or can it be made public?
- Do certain fields need to be made invisible for any public-facing portion of the data tables?
- Is there any reason why we should not create a feature service?
- Does default service require standardized symbology?

Other descriptions relevant to geodatabase administration not listed above may be included.

ISP Section 3. Archiving and Maintenance Plan

Stewards should describe the archiving and maintenance plan. Elements can include:

- Update procedures.
- Types and frequency of data updates.
- Estimated annual cost for data set maintenance.
- Frequency of re-certifying that the data meet DWR Spatial Data Standards (Standards), including positional accuracy.
- Criteria for determining whether EGC needs to be involved in evaluating maintenance or compliance with standards.
- Metadata update plan.
- Any applicable requirement for archiving and, if one exists, the specific requirement.
- Frequency of archiving, if applicable.
- Naming conventions upon archiving.
- Portions of data set that need to be archived.

ISP Section 4. Data Model (new DWR-created data sets only)

The steward should submit a data model. While there is no definitive way to compile a data model, a data model may include some or all of the following elements:

- Written description of the physical model. This includes a description of how the data are represented. For example, are roads a polygon of the road pavement, a road's centerlines, a series of parallel linear lanes, or etc.?
- Data model diagram (also known as a geodatabase schema).
- Data dictionary.
  - A data dictionary may include many things. The attached exampleoffers a very detailed data dictionary for a complex database (the California Levee Database). At a minimum, a data dictionary should include feature types; descriptions of abbreviations, codes, and numerical classifications used; a field list that includes descriptions, types, ranges, and domains of field values; aliases used; and attribute data units.
- Topology rules used.
- Linear referencing.
- Geometric networks.
- Relationship classes.

Because the six minimum mandatory fields are always required, the template for these fields may be inserted into the applicable data dictionary section (and modified as necessary):

Field	Data Type	Description
***ID	Object ID	Auto generated by ArcMap, or else may be supplied by other ID system in separate field.
COMMENTS	Text	Any user-provided comments.
SOURCE	Text	Original source of the boundary and attribute information.
LAST_MODIFIED_DATE	Date	Date record was last modified.
MODIFIED_BY	Text	Name of person who last modified the record.
DATE_DATA_REFERS_TO	Date	Date the data refers to, i.e. a sampling date, survey date, etc.

Examples of sample data model diagrams and actual data models submitted for DWR ISPs are included at the end of this appendix.

CALIFORNIA DEPARTMENT OF WATER RESOURCES
ENTERPRISE GIS DATA SET
INDEPENDENT QA SIGNOFF

DATA SET:

PRIMARY STEWARD:

PRIMARY STEWARD DIVISION/OFFICE/PROGRAM:

INDEPENDENT QA/QC CERTIFIER:

INDEPENDENT QA/QC DIVISION/OFFICE/PROGRAM:

I CERTIFY I HAVE REVIEWED THE SUBJECT DATA SET, AND TO THE BEST OF MY ABILITIES HAVE DETERMINED IT TO BE IN COMPLIANCE WITH THE DWR GIS DATA STANDARDS VERSION APPLICABLE AS OF THE DATE INDICATED BELOW.

_____ _____

INDEPENDENT QA/QC CERTIFIER DATE

Samples of Previously Submitted ISPs

Initial Stewardship Plan

ISP Section 1. Identified Candidate Data Set

This data set represents the Federal Energy Regulatory Commission (FERC) administrative boundaries around Department of Water Resources Hydroelectric Power generating facilities. These polygon boundaries were created from converting the CAD drawings on record in the Geodetic Branch into shapefiles that could easily be brought into a GIS environment. The size and shape of the boundary was created and agreed upon through the work of the Hydropower License Planning and Compliance Office (HELPCO) and FERC.

ISP Section 2. Geodatabase Management Plan

- Proposed geodatabase feature class name.
  - FERC Boundaries – i03 _FERCBoundaries
- Estimated initial size and projected future size of data set.
  - Initial size -70KB / Future size – 140KB
- Data set format (e.g., raster, tables, vector, LIDAR, TIN, etc.).
  - Vector
- Describe workflow between steward and any sub-stewards.
  - Primary steward would coordinate with the sub-steward to ensure that naming conventions and fields are properly filled in.
- Frequency of updates and how updates will flow to geodatabase managers.
  - Updates will only come to the boundary approximately every 50 years when the license granted by the FERC is reviewed. However, to keep the data set from getting lost in time, it should be updated whenever new software requires updating the file. Currently both the East and West branch boundaries are under review and WILL change from what is being presented in this data set. The updates will flow by having the geodatabase managers archiving the historic boundary and uploading the new boundary polygons to the atlas. The associated data as to how the boundary was created will need to be updated as well.
- Required SDE administration steps and tuning.
  - None
- Versioning approach.
  - Versioning will take place every time there is an update to the data set. The previous versions of the FERC boundaries will be stored in an archive location within the property management section of the Geodetic Branch. Each version will have a folder stating the version and data. i.e. Ver_1_FercBoundardy_XXXXBranch_20151101.
- How and whether data will be provided as a service and/or as a feature class.
  - The data will be a feature class that will be used by Department staff that need to know the location of the FERC boundary around their projects. As updates to facilities that happen within the FERC boundary have to be reviewed by FERC.

ISP Section 3. Archiving and Maintenance Plan

- Update procedures.
  - Updates will only come after an extensive relicensing process that will be done through coordination with the HELPCO office and FERC. When a new boundary is created it will be the authoritative source and will supersede whatever the boundary was before. This means that the new feature class shape will need to overwrite the previous shape for the boundary.
- Types and frequency of data updates.
  - The only type of update that will come from this will happen during the relicensing process. The frequency of this will be approximately every 50 years.
- Estimated annual cost for data set maintenance.
  - I do not see much maintenance taking place for this data set since it will only change when the license gets reviewed every 50 years.
- Frequency of re-certifying that the data meet the Standards, including positional accuracy.
  - I cannot foresee needing to re-certify the data for it to meet standards. The positional accuracy will be +/- 40 feet .
- Criteria for determining whether EGC needs to be involved in evaluating maintenance or compliance with standards.
  -
- Metadata update plan.
  - Metadata will be updated on an as needed basis.
- Any applicable requirement for archiving and, if one exists, the specific requirement.
  - No know requirement
- Frequency of archiving, if applicable.
  - Approximately every 50 years.
- Naming conventions upon archiving.
  - Name of data set, Version, and date archived
- Portions of data set that need to be archived.
  - All of it, the only data will be the geometry of boundary.

ISP Section 4. Data Model (new DWR-created data sets only)

- The data represents the polygonal boundaries of the administrative FERC Boundary Data Model.

I03_XXXX_FERCBOUNDARY
FEATURE CLASS
- ObjectID
- Shape
- Shape_Length
- Shape_Area
- Project_Number
- Project_Name
- Comments
- Source
- Last_Modified_Date
- Modified_By
- Date_Data_Refers_TO

California Department of Water Resources
Enterprise GIS Data Set
Independent QA Signoff

Data Set: FERC Boundaries

Primary Steward: Nathan Buchholz

Primary Steward Division/Office/Program: Division of Engineering – Geodetic Branch

Independent QA/QC Certifier:

Independent QA/QC Division/Office/Program:

I certify I have reviewed the subject data set, and to the best of my abilities have determined it to be in compliance with the DWR GIS Data Standards version applicable as of the date indicated below.

_____ _____

Independent QA/QC Certifier Date

CALIFORNIA DEPARTMENT OF WATER RESOURCES
ENTERPRISE GIS DATA SET
INITIAL STEWARDSHIP PLAN (ISP)

DATA SET NAME: 103_FERCBOundaries

ISP SUBMITTAL DATE: 11/3/2015

DATA SET STEWARD NAME: NATHAN BUCHHOLZ

DATA SET STEWARD ORGANIZATION WITHIN DWR: GEODETIC BRANCH-DOE

DATA SET SUB-STEWARD NAMES: KRIS KLIMA, JULIE ECKMAN

STEWARDSHIP ROLES & RESPONSIBILITIES SIGNOFFS:

DATA SET STEWARD	DATE 11/3/15
GEODATABASE ADMINISTRATOR	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE 11/3/2015
DATA SET SUB-STEWARD, IF APPLICABLE	DATE 11/5/2015
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE

DWR ENTERPRISE GIS COMMITTEE SIGNOFF:

CHAIR, DWR EGC	DATE

CALIFORNIA DEPARTMENT OF WATER RESOURCES
ENTERPRISE GIS DATA SET
INITIAL STEWARDSHIP PLAN (ISP)

DATA SET NAME: I17_DELTALEVEESGEOMETRYCLASSIFICATION

ISP SUBMITTAL DATE: 11/2/2015

DATA SET STEWARD NAME: KAREN TOLENTINO

DATA SET STEWARD ORGANIZATION WITHIN DWR: FESSRO/DELTA LEVEES/SPECIAL INVESTIGATION/GIS AND REMOTE SENSING

DATA SET SUB-STEWARD NAMES: NONE

STEWARDSHIP ROLES & RESPONSIBILITIES SIGNOFFS:

DATA SET STEWARD	11/2/2015 DATE
GEODATABASE ADMINISTRATOR	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE

DWR ENTERPRISE GIS COMMITTEE SIGNOFF:

CHAIR, DWR EGC	DATE

ISP Section 1. Identified Candidate Data Set

The candidate feature data set, i17_DeltaLeveesGeometryClassification contains one line feature class, i17_DeltaLeveesCenterlineClassification2012, that represents levee centerlines for 93 Levee Maintenance Agencies/Reclamation Districts in the Delta. The centerlines are derived from the 2007 Delta LiDAR and are divided into 1,000-foot segments. The features contain levee geometry classification that indicates whether a levee segment meets the FEMA's Hazard Mitigation Plan (HMP) or USACE's Public Law 84-99 (PL8499) Delta levee standards. The data associated with these centerlines were produced as results of the Levee Geometry Assessment analysis performed by the California Department of Water Resources Delta Levees and Environmental Engineering Branch in 2012.

ISP Section 2. Geodatabase Management Plan

The candidate data set has an initial file size of 2.8 MB. It contains one line feature class, i17_DeltaLeveesCenterlineClassification2012 and uses a coded value domain named GeometryClassification. The domain contains the different levee geometry classifications. See table below.

Coded Value	Description
PL 84-99	Levee geometry that meets USACE PL 84-99 levee standards
HMP	Levee geometry that meets FEMA's Hazard Mitigation Plan (HMP) levee standards
Below HMP	Levee geometry that does not meet FEMA's HMP levee standards
Minimally below HMP	Levee geometry that does not meet FEMA's HMP levee standards with minimum freeboard amounts less than one foot in deficit
No data	Levee section not included in the analysis due to lack of data

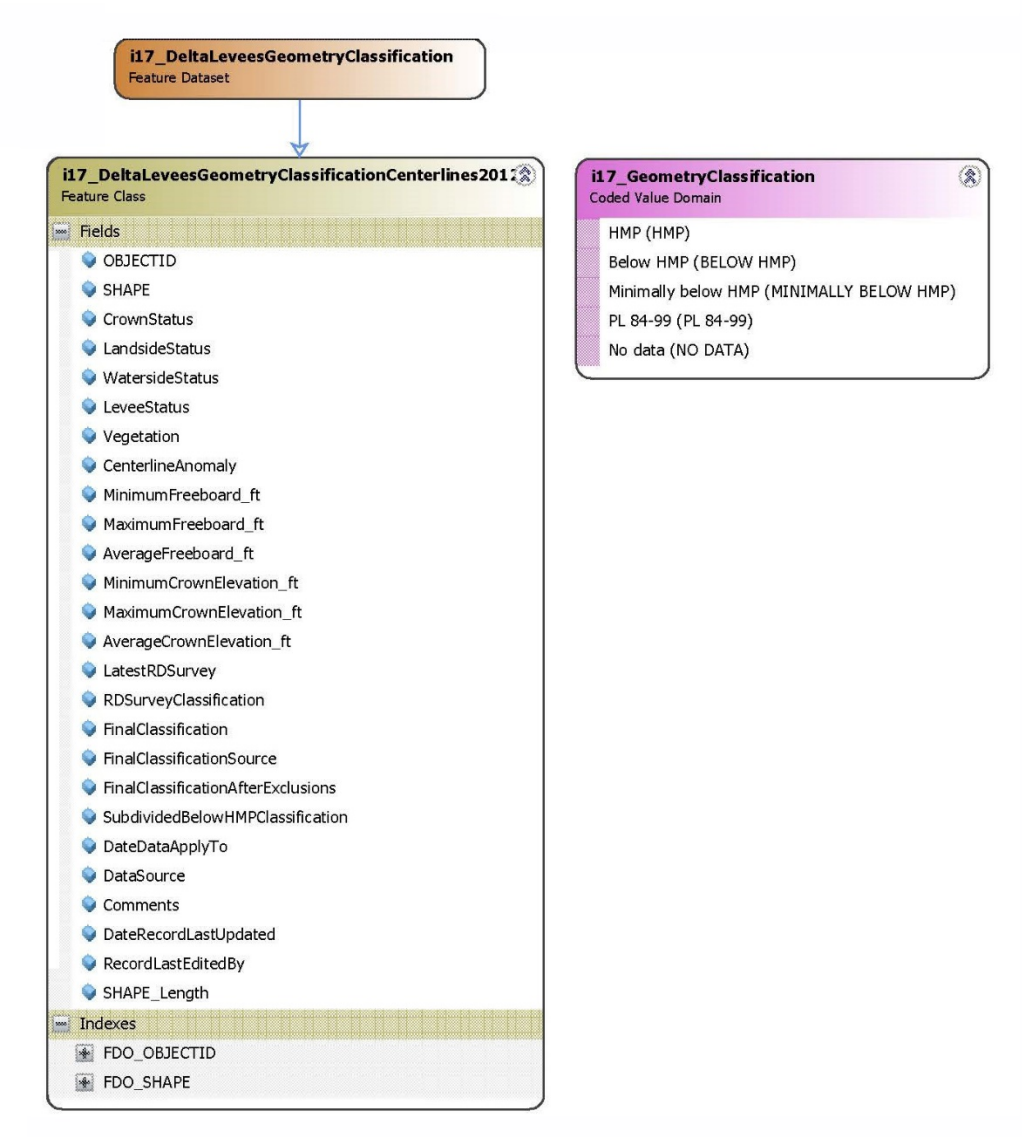
ISP Section 3. Archiving and Maintenance Plan

Updates will be made to the candidate data set on an annual basis following the completion of Delta levee improvement projects or acquisition of a new Lidar data set. To update the feature data set, a new line feature class will be created with the updated levee centerline classification. The primary steward will update the metadata if any of the following has changed:

- Contact information
- Positional and attribute accuracy
- Data model
- Centerline features

Any change or update made to the spatial data and attribute table will be noted in the metadata. EGC will be involved in reevaluating the data set only if the data model has changed or the primary steward is replaced.

ISP Section 4. Data Model (new DWR-created data sets only)



ARCGIS DIAGRAMMER

REPORT CREATION

	Date	Tuesday, November 03, 2015
SYSTEM INFORMATION	Author	ktolenti/WATER on FESSRO16-048
	Operating System	Microsoft Windows NT 6.1.7601 Service Pack 1
	.Net Framework	2.0.50727.5485
	Diagrammer	10.0.1.0
GEODATABASE		
	Workspace Type	Personal Geodatabase
	File	\\nasfessro\User_Files\ktolenti\Levee Geometry Assessment (Final)\Data promotion\Forms\New ISP forms\NEWSCHEMA.XML

Tuesday,

Table Of Contents

Domains

Domain Name	Owner	Domain Type
GeometryClassification		Coded Value

GEOMETRYCLASSIFICATION

Owner	
Description	Delta levee classification based on geometry
Domain Type	Coded Value
Field Type	String
Merge Policy	Default Value
Split Policy	Duplicate
Domain Members	
Name	**Value**
HMP	HMP
Below HMP	BELOW HMP
Minimally below HMP	MINIMALLY BELOW HMP
PL 84-99	PL 84-99
No data	NO DATA

ObjectClasses

ObjectClass Name	Type	Geometry	Subtype	
Stand Alone ObjectClass(s)				
i17_DeltaLeveesGeometryClassificationCenterlines	Simple FeatureClass	Polyline	-	SR

I17_DELTALEVEESGEOMETRYCLASSIFICATIONCENTERLINES

Alias	i17_DeltaLeveesGeometryClassificationCenterlines	**Geometry:** Polyline **Average Number of Points:** 0 **Has M:** No **Has Z:** No **Grid Size:** 460	
Data set Type	FeatureClass		
Feature Type	Simple		

Field Name	Alias Name	Model Name	Type	Precn	Scale	Length	Null	Field Description
OBJECTID	OBJECTID	OBJECTID	OID	0	0	4	No	Sequential unique whole numbers that are automatically generated
SHAPE	SHAPE	SHAPE	Geometr	0	0	0	Yes	Coordinates defining the features
CrownStatus	CrownStatus	CrownStatus	String	0	0	20	Yes	Levee crown geometry classification based on lidar 2007 analysis results
LandsideStatus	LandsideStatus	LandsideStatus	String	0	0	20	Yes	Levee landside slope geometry classification based on lidar 2007 analysis results
WatersideStatus	WatersideStatus	WatersideStatus	String	0	0	20	Yes	Levee waterside slope geometry classification based on lidar 2007 analysis results
LeveeStatus	LeveeStatus	LeveeStatus	String	0	0	20	Yes	Overall levee geometry classficiation based on lidar 2007 analysis results
Vegetation	Vegetation	Vegetation	String	0	0	10	Yes	Presence of excessive vegetation along the levee that could affect lidar analysis
CenterlineAnomaly	CenterlineAnomaly	CenterlineAnomaly	String	0	0	10	Yes	Errors in the lidar-derived levee centerline that could affect lidar analysis
MinimumFreeboard_ft	MinimumFreeboard_ft	MinimumFreeboard_ft	Double	0	0	8	Yes	Minimum freeboard along levee segment. Units are in feet.
MaximumFreeboard_ft	MaximumFreeboard_ft	MaximumFreeboard_ft	Double	0	0	8	Yes	Maximum freeboard along levee segment. Units are in feet.
AverageFreeboard_ft	AverageFreeboard_ft	AverageFreeboard_ft	Double	0	0	8	Yes	Average freeboard along levee segment. Units are in feet.
MinimumCrownElevation_ft	MinimumCrownElevation_ft	MinimumCrownElevation_ft	Double	0	0	8	Yes	Minimum crown elevation along levee segment. Units are in feet.
MaximumCrownElevation_ft	MaximumCrownElevation_ft	MaximumCrownElevation_ft	Double	0	0	8	Yes	Maximum crown elevation along levee segment. Units are in feet.
AverageCrownElevation_ft	AverageCrownElevation_ft	AverageCrownElevation_ft	Double	0	0	8	Yes	Average crown elevation along levee segment. Units are in feet.
LatestRDSurvey	LatestRDSurvey	LatestRDSurvey	Date	0	0	8	Yes	Date of recent cross section survey conducted and supplied by reclamation district (RD) engineers. Date with unknown month and day are entered as 1/1/YYYY.
RDSurveyClassification	RDSurveyClassification	RDSurveyClassification	String	0	0	20	Yes	Levee geometry classification determined by the RD engineer-supplied cross section surveys. The values in this field represent the initial consolidated classification for each levee cross section. The consolidation refers to looking at broth the DWR/lidar based classification and the RD engineer supplied survey derived classfication. The values in this field indicate whether the final classification is derived from the DWR/lidar based analysis or from the RD supplied surveys. If nothing is indicated, there is no final classficiation for the respective cross section and the cross section was excluded from further analysis.
FinalClassification	FinalClassification	FinalClassification	String	0	0	20	Yes	
FinalClassificationSource	FinalClassificationSource	FinalClassificationSource	String	0	0	20 0	Yes	
FinalClassificationAfterExclusions	FinalClassificationAfterExclusions	FinalClassificationAfterExclusions	String	0	0	20	Yes	Final levee geometry classification after removing lidar exceptions such as excessive vegetation and centerline anomalies. This only applies to cross sections classified by lidar and not those determined from RD engineer supplied surveys.
SubdividedBelowHMPClassification	SubdividedBelowHMPClassificat	SubdividedBelowHMPClassifica	String	0	0	20	Yes	Due to some of the accuracy issues inherent in using lidar data, the "Below HMP" classification was divided into two categories. "Minimally below HMP" is distinct from "Below HMP" for lidar based analysis cross sections which had minimum freeboard amounts less than one foot in deficit as determined from a more involved levee profile analysis. The levee profile analysis evaluated levee freeboard anywhere from halfway before the previous cross section location, through the cross section itself, to halfway towards the next cross section down the levee.
DateDataApplyTo	DateDataApplyTo	DateDataAppliesTo	Date	0	0	8	Yes	Date data apply to. Date with unknown month and day are entered as 1/1/YYYY.
DataSource	DataSource	DataSource	String	0	0	50	Yes	Name of agency that provided the data
Comments	Comments	Comments	String	0	0	250	Yes	User comments
DateRecordLastUpdated	DateRecordLastUpdated	DateRecordLastUpdated	Date	0	0	10	Yes	Date record was last updated by data steward. Date with unknown month and day are entered as 1/1/YYYY.
RecordLastEditedBy	RecordLastEditedBy	RecordLastEditedBy	String	0	0	10	Yes	Initials of the data steward who edited the record.
SHAPE_Length		SHAPE_Length	Double	0	0	8	Yes	Length of feature in internal units.

Subtype Name Object Class	DEFAULT VALUE	Domain
CrownStatus		GeometryClassification
LandsideStatus		GeometryClassification
WatersideStatus		GeometryClassification
LeveeStatus		GeometryClassification
RDSurveyClassification		GeometryClassification
FinalClassification		GeometryClassification
FinalClassificationAfterExclusions		GeometryClassification
SubdividedBelowHMPClassification		GeometryClassification

Index Name	Ascending	Unique	Fields
FDO_OBJECTID	Yes	Yes	OBJECTID
FDO_SHAPE	Yes	No	SHAPE

SPATIAL REFERENCES

Dimension	Minimum	Precision
i17_DeltaLeveesGeometryClassificationCenterlines		
X	-5120900	10000
Y	-9998100	
M	-	-
Z	-	-

Coordinate System Description

PROJCS["NAD_1983_UTM_Zone_10N",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION

["Transverse_Mercator"],PARAMETER["False_Easting",500000.0],PARAMETER["False_Northing",0.0],PARAMETER["Central_Meridian",-
123.0],PARAMETER["Scale_Factor",0.9996],PARAMETER["Latitude_Of_Origin",0.0],UNIT["Meter",1.0],AUTHORITY["EPSG",2

CALIFORNIA DEPARTMENT OF WATER RESOURCES
ENTERPRISE GIS DATA SET
INITIAL STEWARDSHIP PLAN (ISP)

DATA SET NAME: i15_SSJDD PARCELS

ISP SUBMITTAL DATE: 11-3-15

DATA SET STEWARD NAME: KRIS KLIMA

DATA SET STEWARD ORGANIZATION WITHIN DWR: GEODETIC/CADASTRAL

DATA SET SUB-STEWARD NAMES: NATHAN BUCHHOLZ, CLAYTON GUIRAUD

STEWARDSHIP ROLES & RESPONSIBILITIES SIGNOFFS:

DATA SET STEWARD	11-3 DATE
GEODATABASE ADMINISTRATOR	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	11/3/15 DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE
DATA SET SUB-STEWARD, IF APPLICABLE	DATE

DWR ENTERPRISE GIS COMMITTEE SIGNOFF:

CHAIR, DWR EGC	DATE

ISP Section 1. Identified Candidate Data Set

This data set is of **Sacramento and San Joaquin Drainage District (SSJDD) Parcels**. The parcels within this data set were derived from field surveys and boundary analysis procedures by the Geodetic Branch, of the Department of Water Resources (DWR). The purpose and creation of this data set is to show the results of vintage reclamation board deeds and map tracings and current SSJDD deeds adjusted to field surveys performed by DWR, depicting SSJDD fee and levee easement rights-of-way for the expressed purpose of the evaluation of levee and flood control rights.

There are currently four feature classes in three locations within this data set:

- **SAC ST3 Unit 1 -** a portion of the Sacramento River in Colusa County
- **Maintenance Area 9** - a portion of the Sacramento River in Sacramento County
- **Cache ST1 Unit 1 and 2** - a portion of Cache Creek (north and south banks) in Yolo County

This is the initial data set from Cadastral's ongoing process to provide a statewide data set of all SSJDD easement and fee parcel layer.

ISP Section 2. Geodatabase Management Plan

- Proposed geodatabase feature class name: ***SSJDD Parcels***
- Estimated initial size and projected future size of data set: *1MB currently. 100 MB estimated in* future.
- Data set format (e.g., raster, tables, vector, LIDAR, TIN, etc.): *Points, Polygons, Tables.*
- Describe workflow between steward and any sub-stewards: *New feature areas will be QC/QR by a Cadastral staff member and then steward or sub-steward create the feature class, add table information, and submit required documents to the geodatabase manager.*
- Frequency of updates: *These features within the data set are complete and need no updates. Future SSJDD parcel project areas will be added as completed.*
- Required SDE administration steps and tuning: *As determined by committee*
- Versioning approach: *As determined by committee*
- How and whether data will be provided as service and/or as feature class: *As determined by committee*

ISP Section 3. Archiving and Maintenance Plan

- Future SSJDD parcels will be added as overall "parcel project areas" are completed.
- Because these project areas require client funding, the frequency of data updates are unknown.
- If and when data is added, it will be a completed project area that will have little to no effect on the previous data within this set.

ISP Section 4. Data Model (new DWR-created data sets only)

- SSJDD Parcels are represented as polygons.

Field	Data Type	Description
***ID	Object ID	Auto generated by ArcMap, or else may be supplied by other ID system in separate field.
DEED	Text	SSJDD Deed Number
PARCEL_NO	Text	SSJDD Parcel Number
RIGHTS	Text	Easement, Fee, or Agreement language (SSJDD Rights 1-9)
SOURCE	Text	Cadastral Mapping
LAST_MODIFIED_DATE	Date	July 2015
MODIFIED_BY	Text	Steward and Sub-stewards
DATE_DATA_REFERS_TO	Date	Completed Survey Mapping Date

Samples of Other Data Model Diagrams

Figure B-1 Data Model Example 1

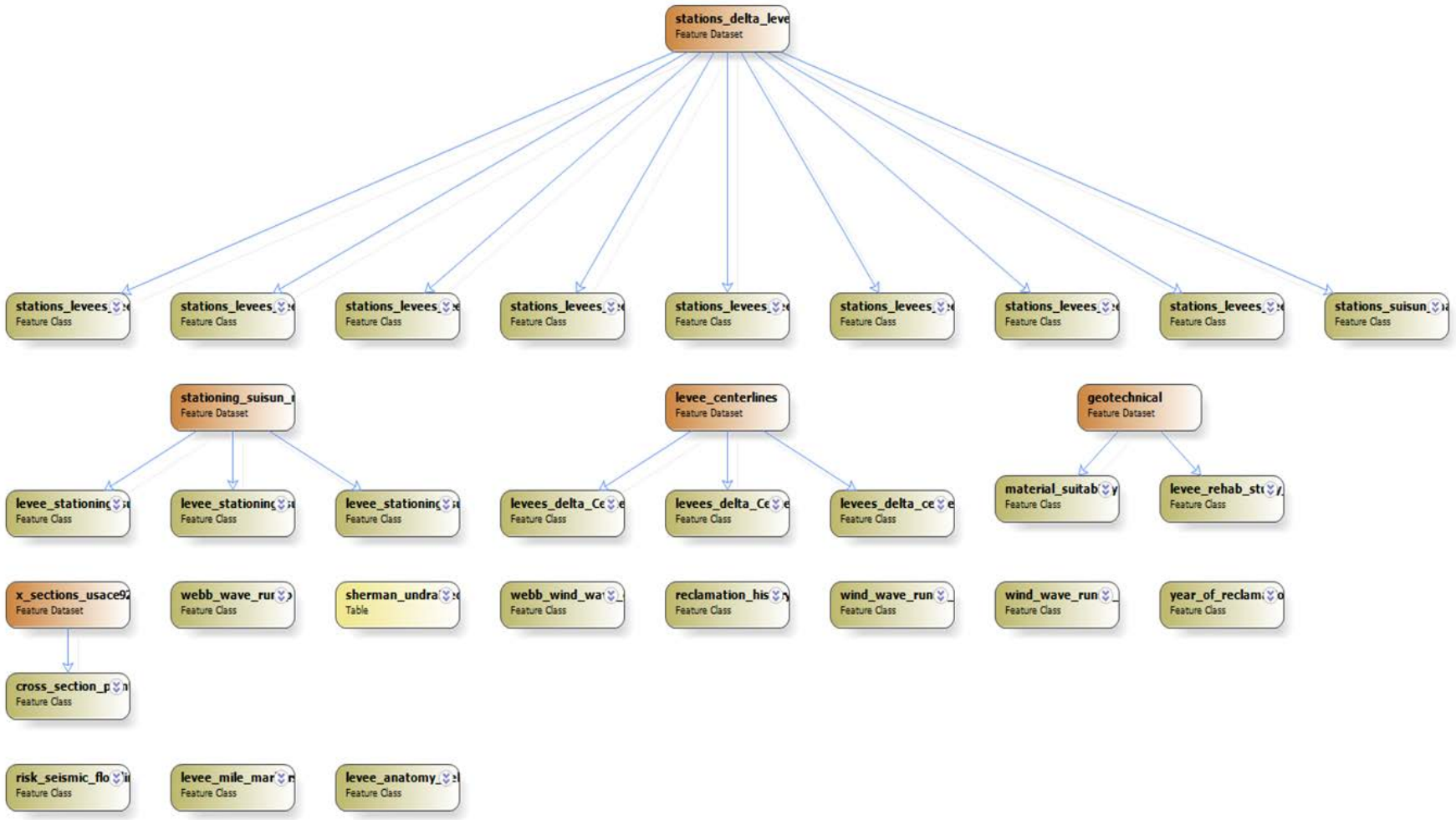


Figure B-2 Data Model Example 2

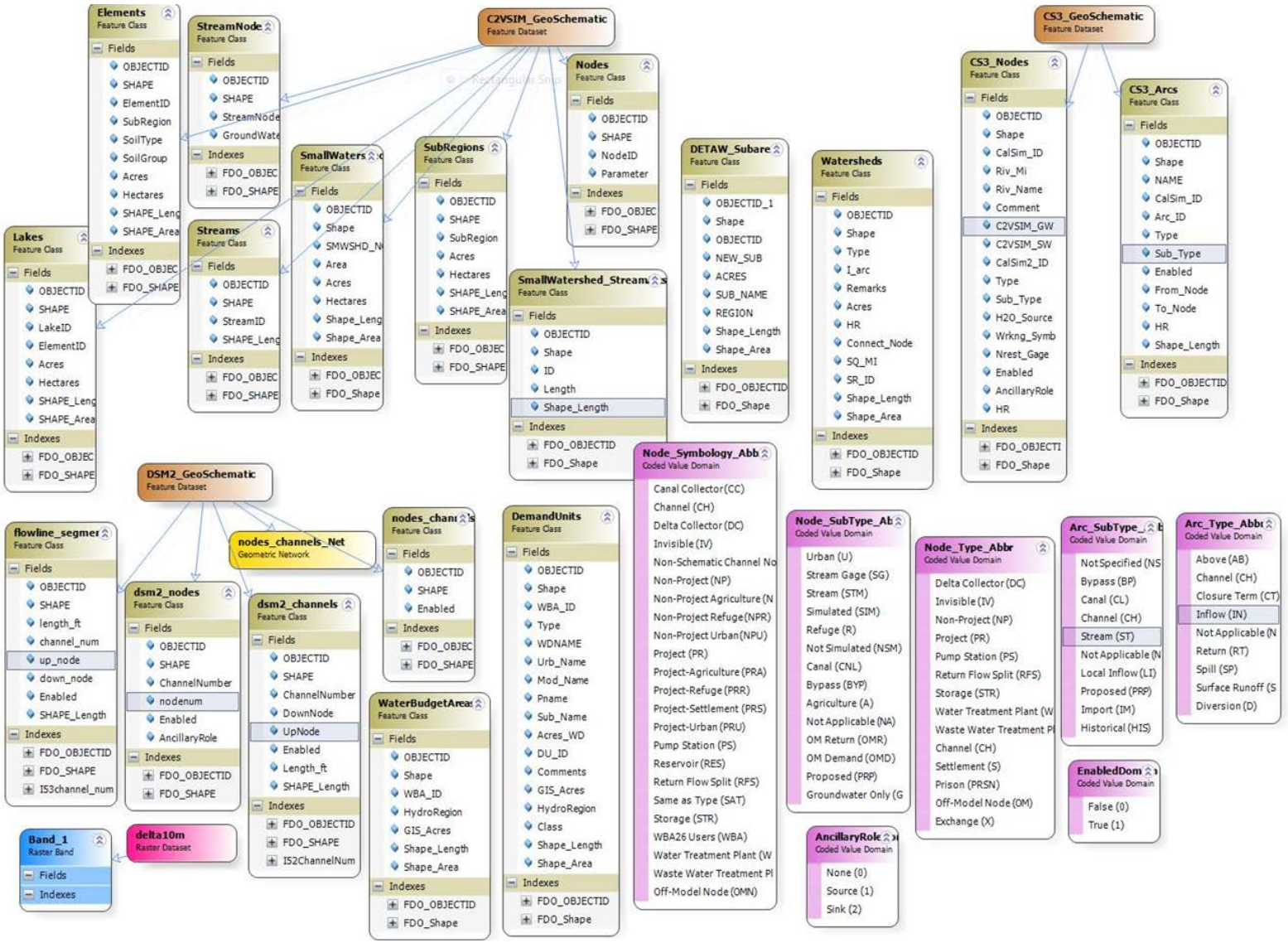
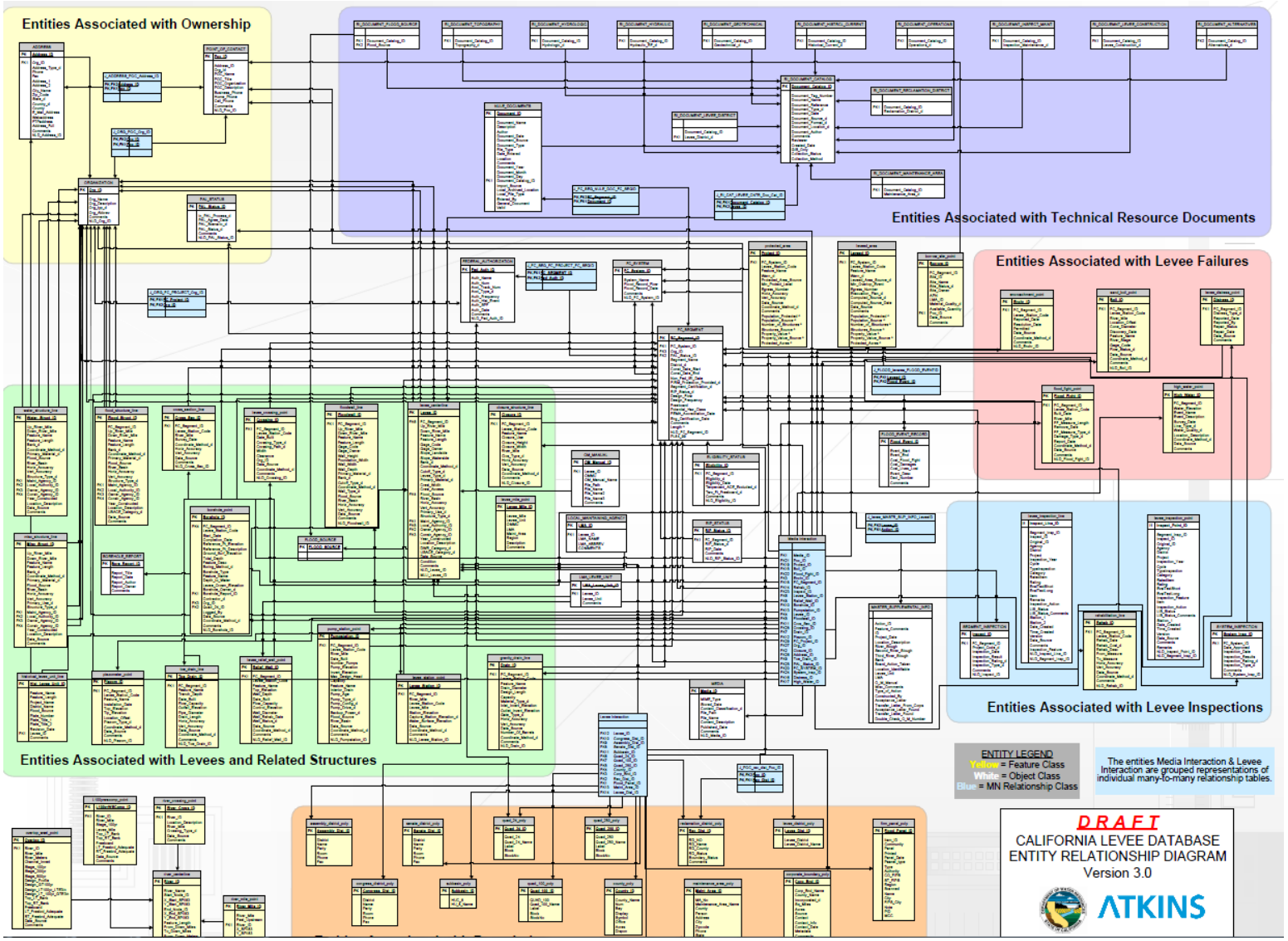


Figure B-3 Data Model Example 3



Appendix C. Positional Accuracy Calculation

Appendix Contents Version Date: 2019.09.11 (version 1.9)

Calculating Positional Accuracy for DWR Spatial Data Standards, Version 1.9

September 11, 2019

Online link: https://cawater.sharepoint.com/:w:/r/teams/egc/_layouts/15/Doc.aspx?sourcedoc=%7B4C8723ED-7731-4609-B952-EE96420B1954%7D&file=Positional%20Accuracy.v1.9.2019.09.11.docx&action=default&mobileredirect=true&DefaultItemOpen=1

Appendix D. Creating a Transactional Version for Editing on Atlas Development in ArcGIS Desktop

Appendix Contents Version Date: 2019.05.16

This appendix provides instructions for editing a data set on the Development Server.

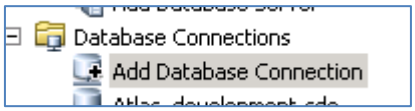
The California Department of Water Resources (DWR) utilizes a database called the DWR Atlas geodatabase (Atlas), one of a series of databases retained in the Enterprise platform. Atlas is a multiuser geodatabase housing many data sets. Each data set is managed by a primary data steward (steward) or subject matter expert who has gone through the process to promote his/her data to the atlas.

Atlas is a multi-user geodatabase (i.e., a versioned geodatabase). In a multi-user environment, many editors can edit the same data set or feature-class simultaneously. A transactional version of the geodatabase is created from an existing version by a steward; this version then becomes the child of the existing version. Stewards may have sub-stewards who have created geodatabase versions from those created by the steward. A transactional version holds all the changes (made by the steward or sub-steward) to a data set within a geodatabase until it is reconciled and posted through to Atlas QAQC and then to Default.

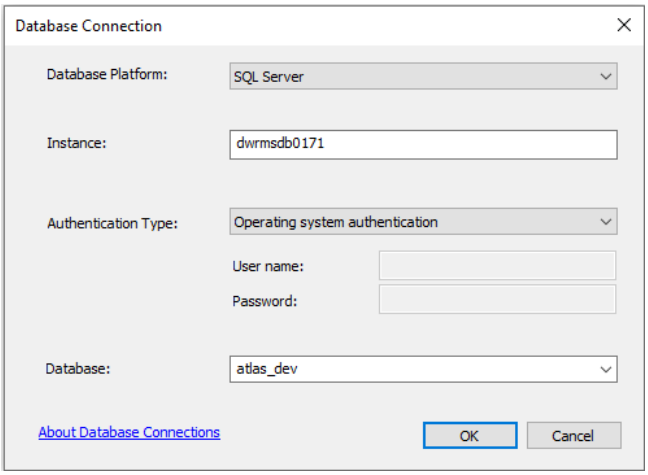
Setting Up a Database Connection

In ArcCatalog from the Catalog tree under Database Connections:

1. Double-click on Add Database Connection.



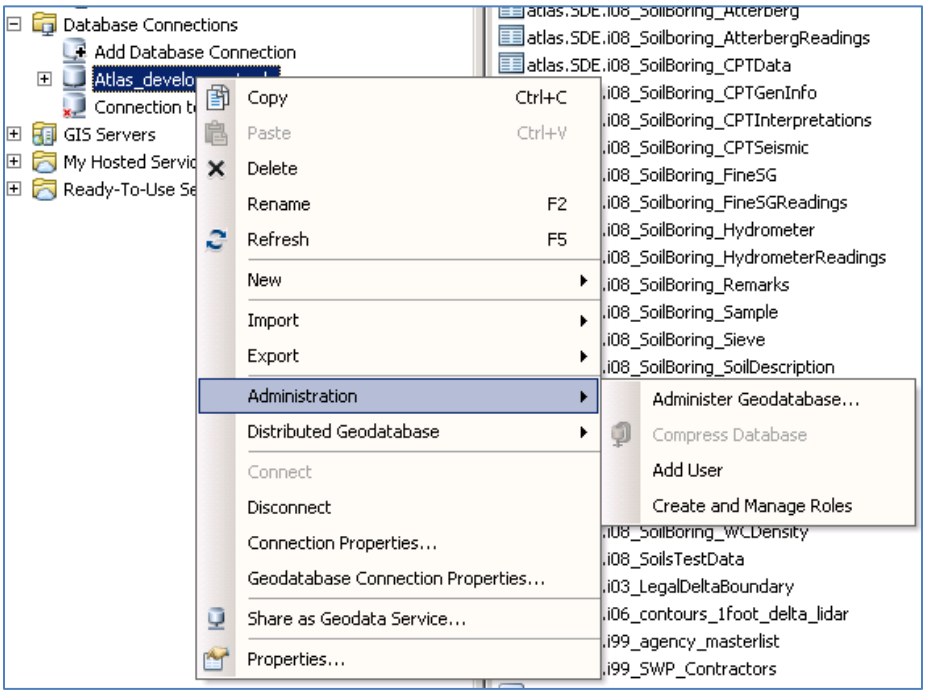
2. Fill out the dialog box shown below.



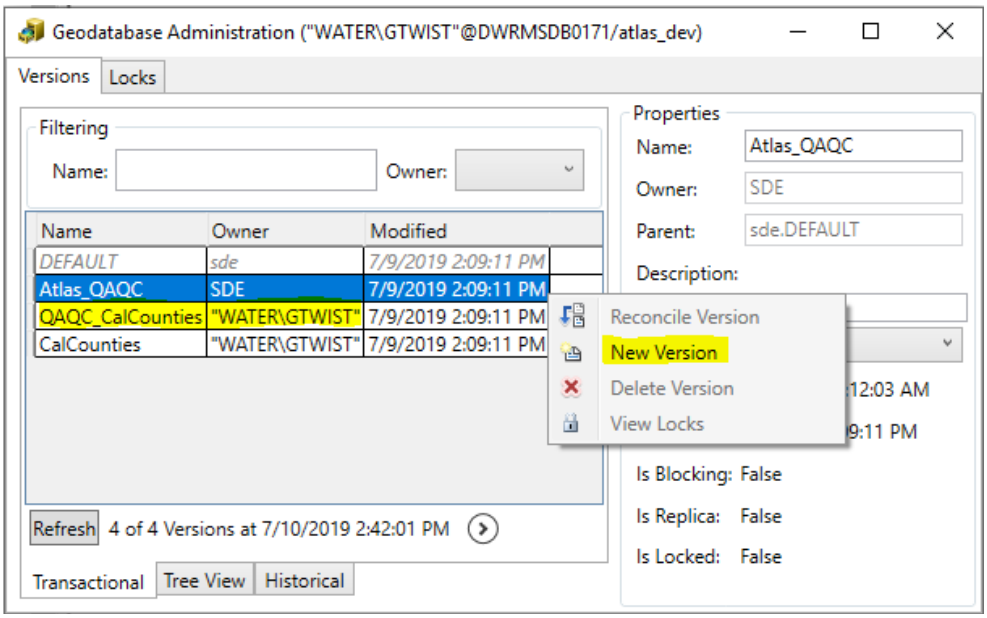
3. Rename the connection to something identifiable. Suggested name, **dwr_atlas_dev**.

Creating a New Transactional Version

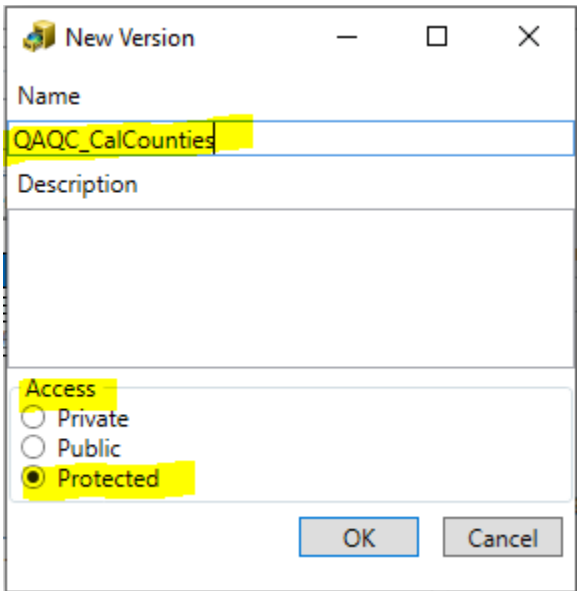
1. Double-click Database Connection to connect to the geodatabase.
2. Right-click on the new Database Connection and select Administration > Administer Geodatabase.



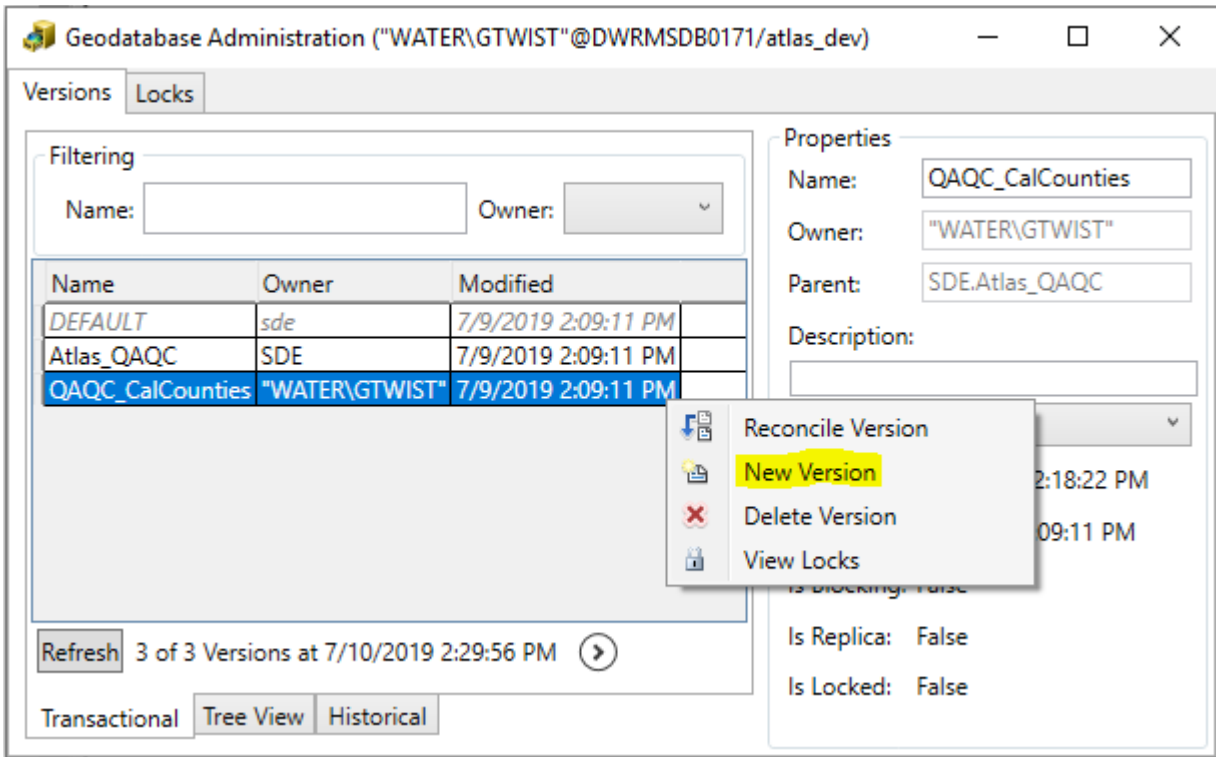
3. In the resulting dialog box shown below, right-click Atlas_QAQC (highlighted in blue) and select New Version (highlighted in yellow).



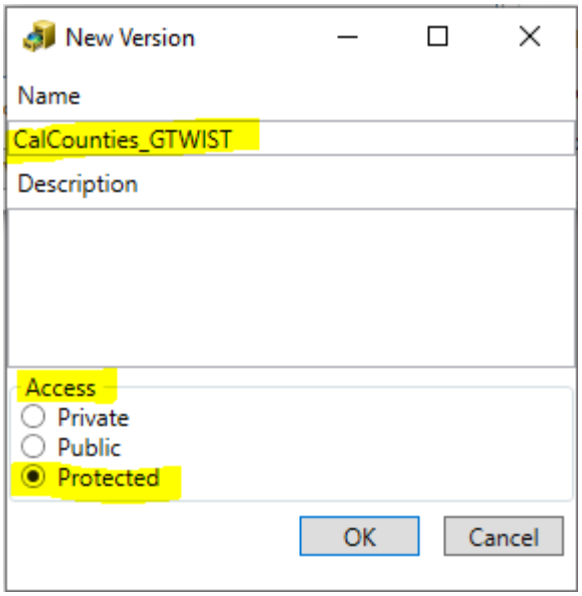
4. From the popup dialog in the name field, give this version the name, QAQC_xxxx" and replace FeatureClassName (highlighted in yellow below) with the name of the feature-class that is being stewarded. Be sure to select the Protected Access option, then click OK.



5. In cases where there is more than one editor of the same feature class, the steward will create the version as explained above, and the sub-stewards will create their versions from the steward's version as shown below.

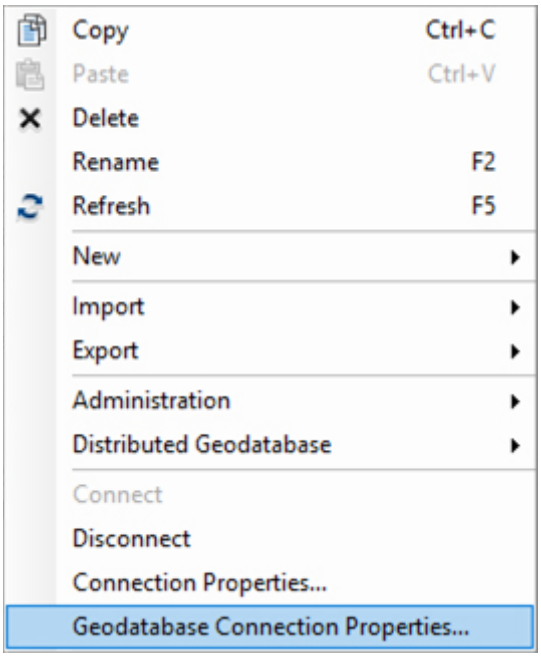


6. Be sure to select the Protected Access option.

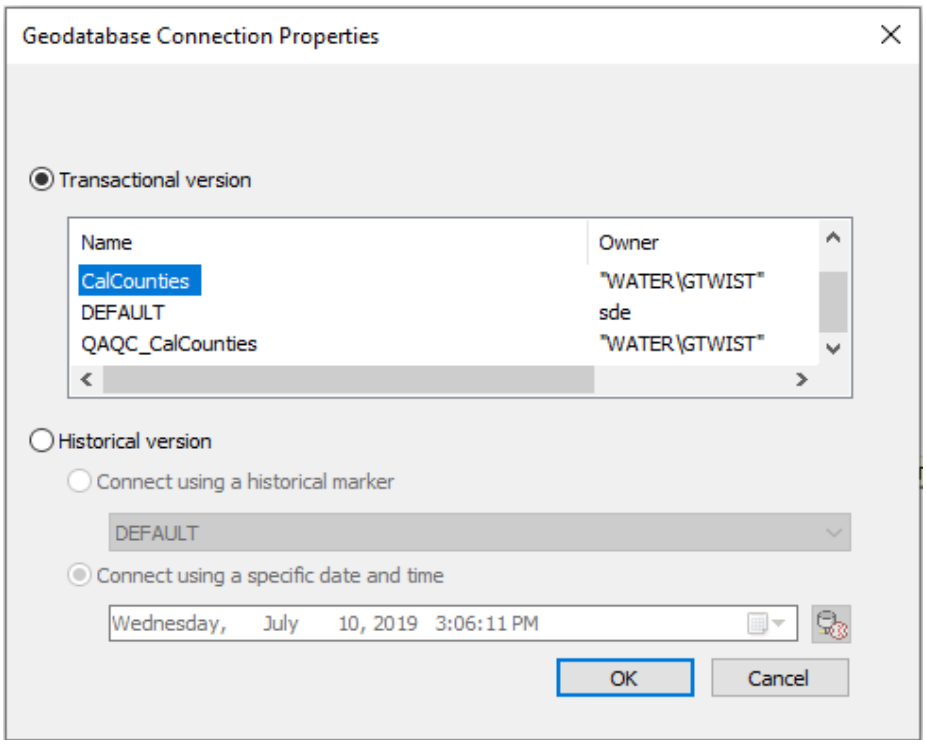


Setting Up the Transactional Version for Editing

1. Right-click the Atlas Geodatabase and click Geodatabase Connection Properties shown below.

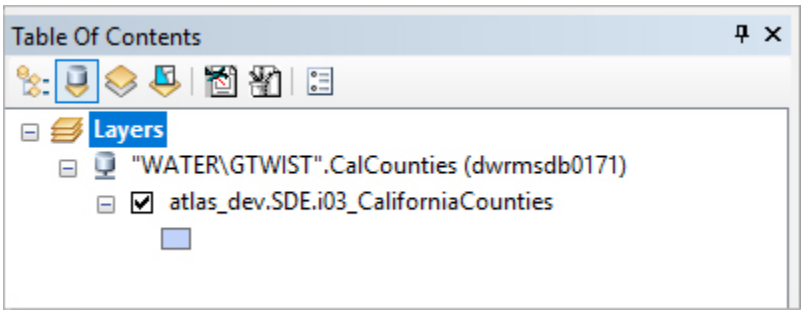


2. From the dialog box (shown below) select the version just created and click OK.

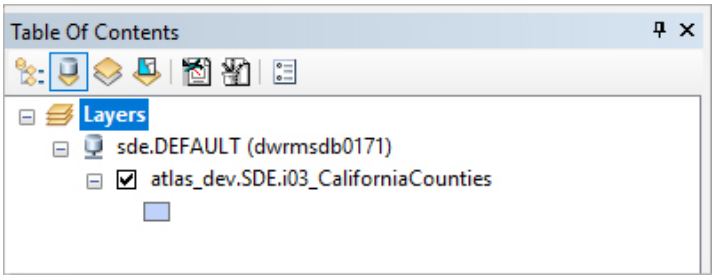


3. Add the data you will be editing to ArcMap.

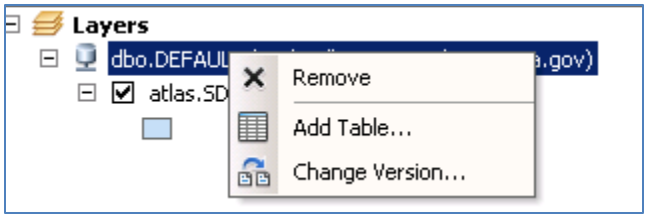
4. The newly created version is now ready for editing. When the stewarded data is added to ArcMap, the steward will be editing the correct version of the atlas geodatabase. The editor can check this in ArcMap by clicking the Source Tab in the Table of Contents, as indicated below.



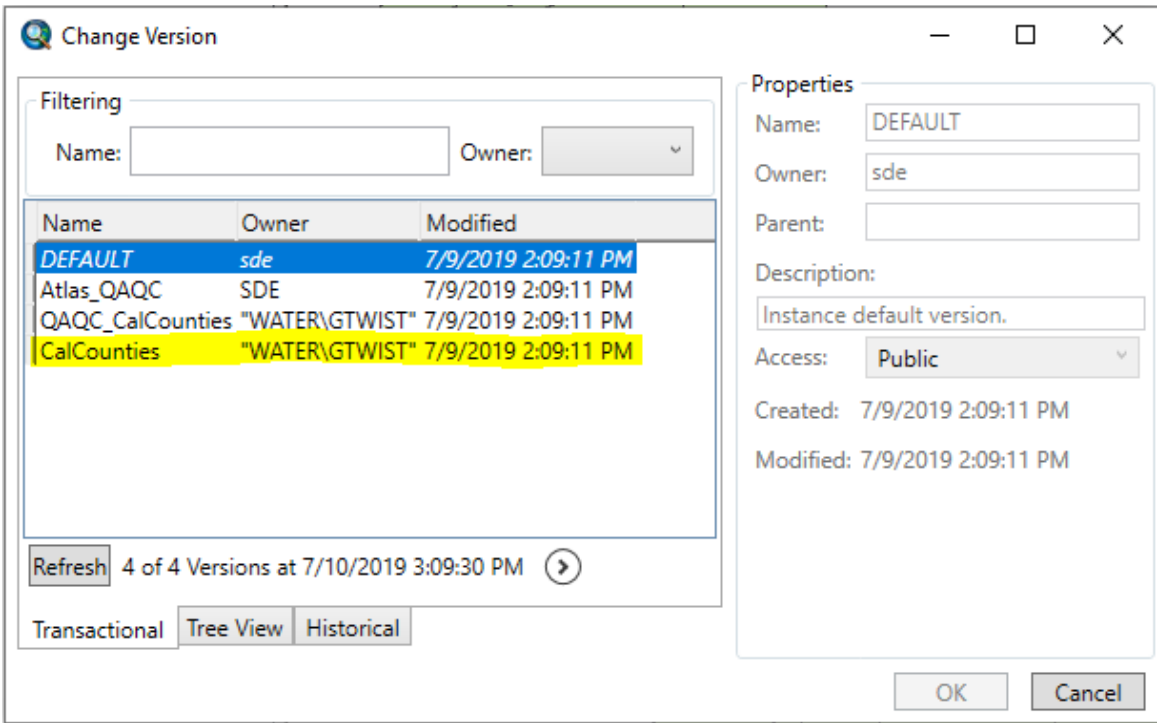
Editing the Transactional Version

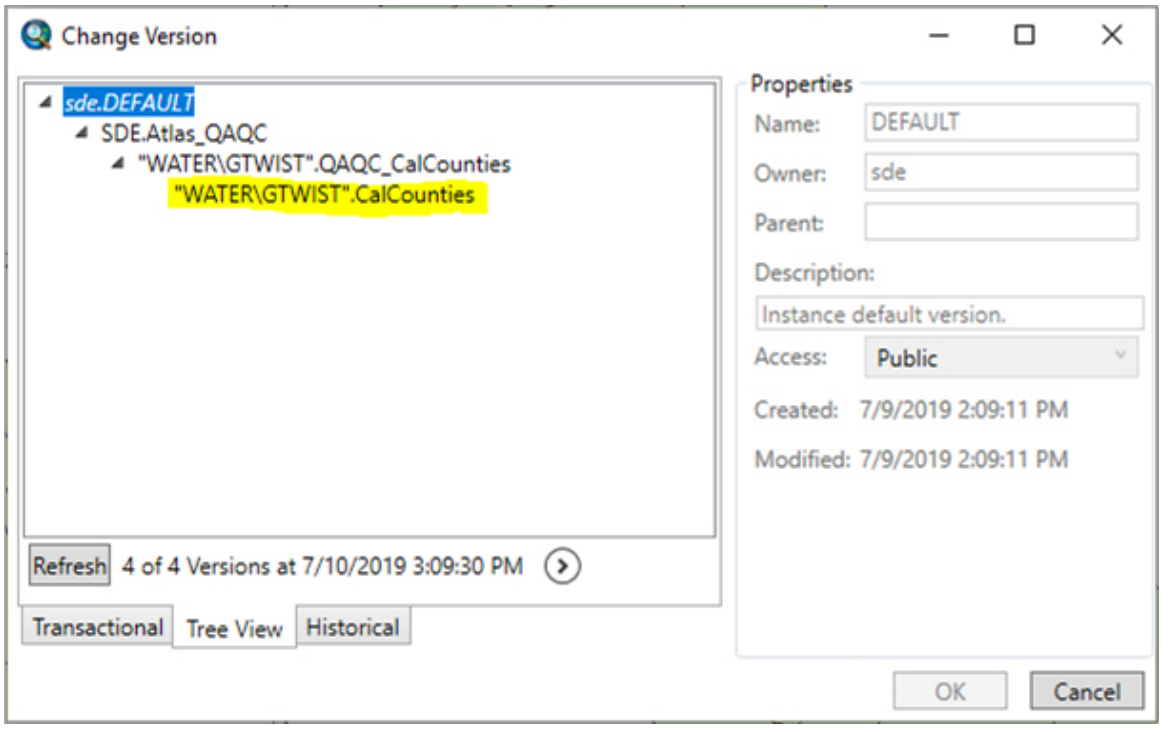


1. Note: It is a good idea to check the sourced version before editing. If the source is not the version created previously, from the List By Source icon in the Table of Contents in your map session. Right click on the source, dbo.DEFAULT (dwrmsdb0171.ad.water.ca.gov), version and click Change Version.



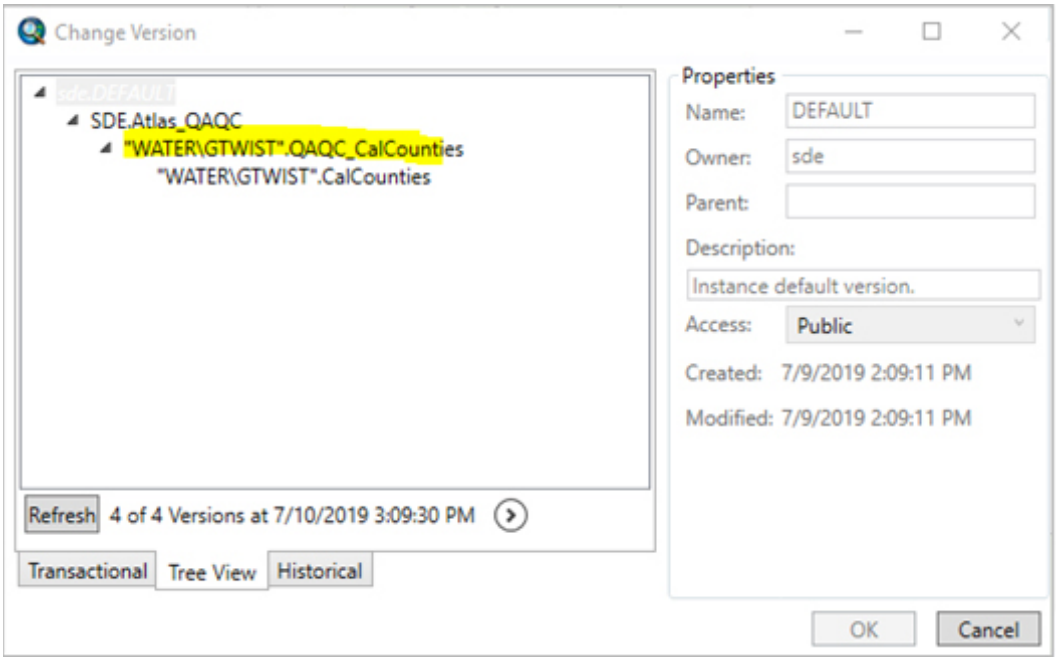
7. The Geodatabase version window will appear. You can select the Transactional Tab or the Tree View tab. Select the version created for editing and click OK.





8. Now when any editing of the data set in ArcMap takes place it will be pointing to the correct version.

9. After editing, email the steward or database administrator and he/she will reconcile and post your version through to default.

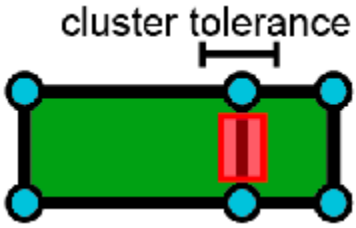
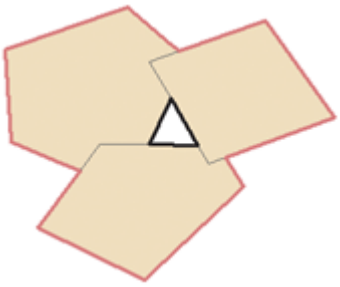


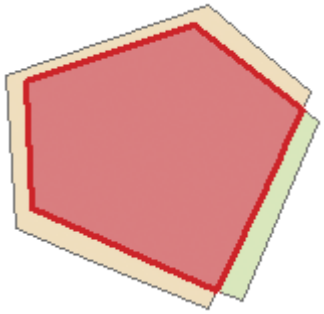
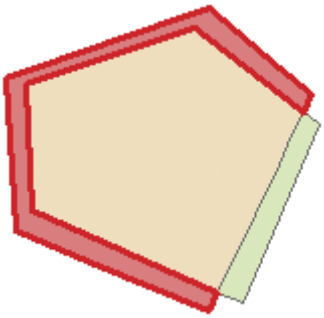
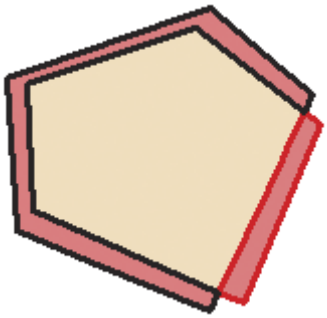
Appendix E. Topology Rules

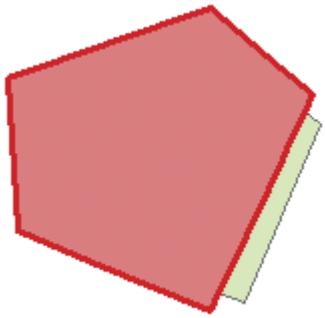
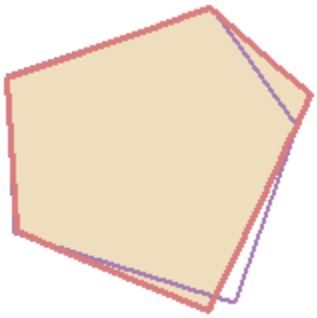
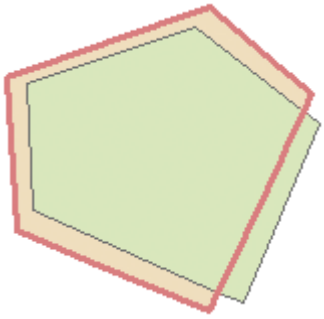
Appendix Contents Version Date: 2015.03.05

The rules included in Tables E-1, E-2, and E-3 originate from: http://webhelp.esri.com/arcgisserver/9.3.1/dotNet/index.htm#geodatabases/topology_in_arcgis.htm.

Table E-1 Polygon Rules

Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Larger Than Cluster Tolerance	Requires that a feature does not collapse during a validate process. This rule is mandatory for a topology and applies to all line and polygon feature classes. In instances where this rule is violated, the original geometry is left unchanged.	Delete	 Any polygon feature, such as the one in red that would collapse when validating the topology, is an error.
Must Not Overlap	Requires that the interior of polygons in the feature class not overlap. The polygons can share edges or vertices. This rule is used when an area cannot belong to two or more polygons. It is useful for modeling administrative boundaries, such as ZIP Codes or voting districts, and mutually exclusive area classifications, such as land cover or landform type.	Subtract, Merge, Create Feature	
Must Not Have Gaps	This rule requires that there are no voids within a single polygon or between adjacent polygons. All polygons must form a continuous surface. An error will always exist on the perimeter of the surface. You can either ignore this error or mark it as an exception. Use this rule on data that must completely cover an area. For example, soil polygons cannot include gaps or form voids; they must cover an entire area.	Create Feature	 You can use Create Feature to create a new polygon in the void in the center. You can also use Create Feature or mark the error on the outside boundary as an exception.

Topology Rule	Rule Description	Potential Fixes	Examples
Must Not Overlap With	Requires that the interior of polygons in one feature class must not overlap with the interior of polygons in another feature class. Polygons of the two feature classes can share edges or vertices or be completely disjointed. This rule is used when an area cannot belong to two separate feature classes. It is useful for combining two mutually exclusive systems of area classification, such as zoning and water body type, where areas defined within the zoning class cannot also be defined in the water body class and vice versa.	Subtract, Merge	
Must Be Covered By Feature Class Of	Requires that a polygon in one feature class must share all of its area with polygons in another feature class. An area in the first feature class that is not covered by polygons from the other feature class is an error. This rule is used when an area of one type, such as a state, should be completely covered by areas of another type, such as counties.	Subtract, Create Feature	
Must Cover Each Other	Requires that the polygons of one feature class must share all of their area with the polygons of another feature class. Polygons may share edges or vertices. Any area defined in either feature class that is not shared with the other is an error. This rule is used when two systems of classification are used for the same geographic area, and any given point defined in one system must also be defined in the other. One such case occurs with nested hierarchical data sets, such as census blocks and block groups or small watersheds and large drainage basins. The rule can also be applied to non-hierarchically related polygon feature classes, such as soil type and slope class.	Subtract, Create Feature	

Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Covered By	Requires that polygons of one feature class must be contained within polygons of another feature class. Polygons may share edges or vertices. Any area defined in the contained feature class must be covered by an area in the covering feature class. This rule is used when area features of a given type must be located within features of another type. This rule is useful when modeling areas that are subsets of a larger surrounding area, such as management units within forests or blocks within block groups.	Create Feature	
Boundary Must Be Covered By	Requires that boundaries of polygon features must be covered by lines in another feature class. This rule is used when area features need to have line features that mark the boundaries of the areas. This is usually when the areas have one set of attributes and their boundaries have other attributes. For example, parcels might be stored in the geodatabase along with their boundaries. Each parcel might be defined by one or more line features that store information about their length or the date surveyed, and every parcel should exactly match its boundaries.	Create Feature	
Area Boundary Must Be Covered By Boundary Of	Requires that boundaries of polygon features in one feature class be covered by boundaries of polygon features in another feature class. This is useful when polygon features in one feature class, such as subdivisions, are composed of multiple polygons in another class, such as parcels, and the shared boundaries must be aligned.	None	

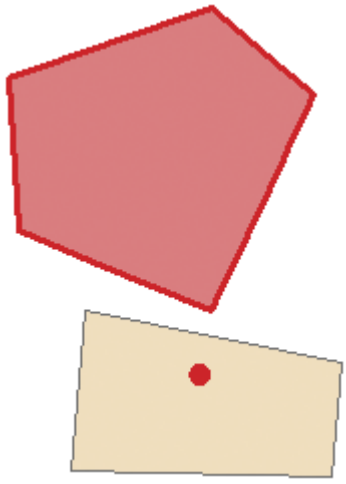
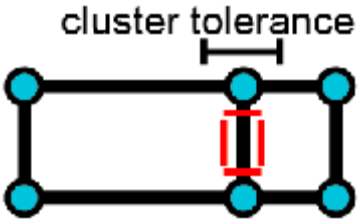
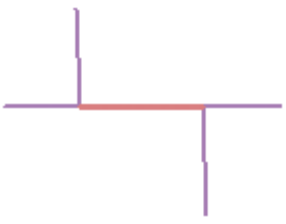
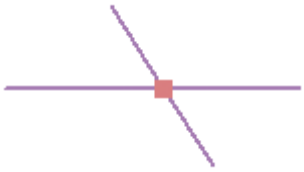
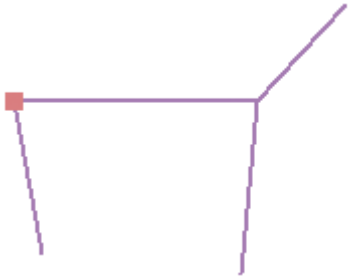
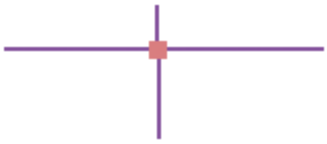
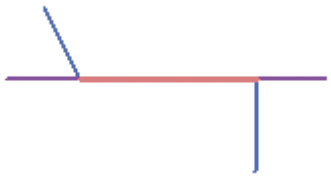
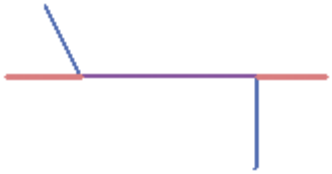
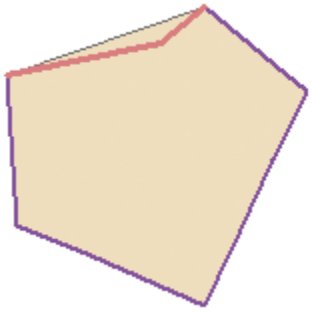
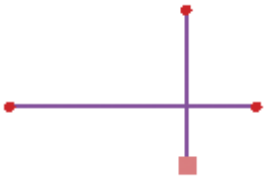
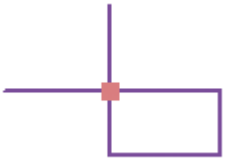
Topology Rule	Rule Description	Potential Fixes	Examples
Contains Point	Requires that a polygon in one feature class contain at least one point from another feature class. Points must be within the polygon, not on the boundary. This is useful when every polygon should have at least one associated point, such as when parcels must have an address point.	Create Feature	 The top polygon is an error because it does not contain a point.

Table E-2 Line Rules

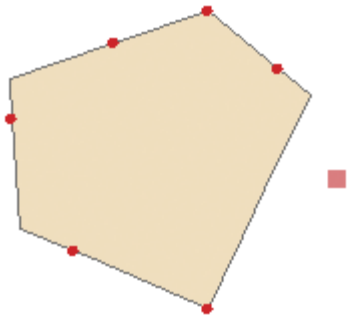
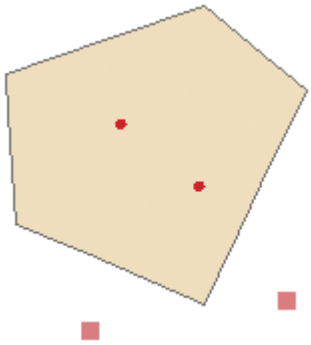
Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Larger Than Cluster Tolerance	Requires that a feature does not collapse during a validate process. This rule is mandatory for a topology and applies to all line and polygon feature classes. In instances where this rule is violated, the original geometry is left unchanged.	Delete	 Any line feature, such as these lines in red that would collapse when validating the topology is an error.
Must Not Overlap	Requires that lines not overlap with lines in the same feature class. This rule is used where line segments should not be duplicated (e.g., in a stream feature class). Lines can cross or intersect but cannot share segments.	Subtract	

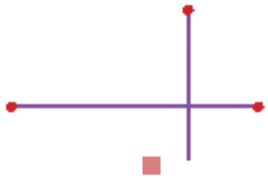
Topology Rule	Rule Description	Potential Fixes	Examples
Must Not Intersect	Requires that line features from the same feature class not cross or overlap each other. Lines can share endpoints. This rule is used for contour lines that should never cross each other or in cases where the intersection of lines should only occur at endpoints, such as street segments and intersections.	Split, Subtract	
Must Not Have Dangles	Requires that a line feature must touch lines from the same feature class at both endpoints. An endpoint not connected to another line is called a dangle. This rule is used when line features must form closed loops, such as when they are defining the boundaries of polygon features. It may also be used in cases where lines typically connect to other lines, as with streets. In this case, exceptions can be used where the rule is occasionally violated, as with cul-de-sac or dead-end street segments.	Extend, Trim, Snap	
Must Not Have Pseudonodes	Requires that a line connect to at least two other lines at each endpoint. Lines that connect to one other line (or to themselves) are said to have *pseudonodes*. This rule is used where line features must form closed loops, such as when they define the boundaries of polygons or when line features logically must connect to two other line features at each end, as with segments in a stream network, with exceptions being marked for the originating ends of first-order streams.	Merge to Largest, Merge	
Must Not Intersect or Touch Interior	Requires that a line in one feature class must only touch other lines of the same feature class at endpoints. Any line segment in which features overlap or any intersection not at an endpoint is an error. This rule is useful where lines must only be connected at endpoints, such as in the case of lot lines, which must split (only connect to the endpoints of) back lot lines and which cannot overlap each other.	Subtract, Split	
Must Not Overlap With	Requires that a line from one feature class not overlap with line features in another feature class. This rule is used when line features cannot share the same space. For example, roads must not overlap with railroads or depression subtypes of contour lines cannot overlap with other contour lines.	Subtract	 Where the purple lines overlap is an error.

Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Covered By Feature Class Of	Requires that lines from one feature class must be covered by the lines in another feature class. This is useful for modeling logically different but spatially coincident lines, such as routes and streets. A bus route feature class must not depart from the streets defined in the street feature class.	None	 Where the purple lines don't overlap is an error.
Must Be Covered By Boundary Of	Requires that lines be covered by the boundaries of area features. This is useful for modeling lines, such as lot lines, which must coincide with the edge of polygon features, such as lots.	Subtract	
Endpoint Must Be Covered By	Requires that the endpoints of line features must be covered by point features in another feature class. This is useful for modeling cases where a fitting must connect two pipes, or a street intersection must be found at the junction of two streets.	Create Feature	 The square at the bottom indicates an error, because there is no point covering the endpoint of the line.
Must Not Self Overlap	Requires that line features not overlap themselves. They can cross or touch themselves, but must not have coincident segments. This rule is useful for such features as streets, where segments might touch in a loop, but where the same street should not follow the same course twice.	Simplify	 The individual line feature overlaps itself, with the error indicated by the coral line.
Must Not Self Intersect	Requires that line features not cross or overlap themselves. This rule is useful for lines, such as contour lines, that cannot cross themselves.	Simplify	

Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Single Part	Requires that lines have only one part. This rule is useful where line features, such as highways, may not have multiple parts.	Explode	 Multipart lines are created from a single sketch.

Table E-3 Point Rules

Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Covered By Boundary Of	Requires that points fall on the boundaries of area features. This is useful when the point features help support the boundary system, such as boundary markers, which must be found on the edges of certain areas.	None	 The square on the right indicates an error because it is a point that is not on the boundary of the polygon.
Must Be Properly Inside Polygons	Requires that points fall within area features. This is useful when the point features are related to polygons, such as wells and well pads or address points and parcels.	Delete	 The squares are errors where there are points that are not inside the polygon.

Topology Rule	Rule Description	Potential Fixes	Examples
Must Be Covered By Endpoint Of	Requires that points in one feature class must be covered by the endpoints of lines in another feature class. This rule is similar to the line rule, "Endpoint Must Be Covered By," except that, in cases where the rule is violated, it is the point feature that is marked as an error, rather than the line. Boundary corner markers might be constrained to be covered by the endpoints of boundary lines.	Delete	 The square indicates an error where the point is not on an endpoint of a line.
Must Be Covered By Line	Requires that points in one feature class be covered by lines in another feature class. It does not constrain the covering portion of the line to be an endpoint. This rule is useful for points that fall along a set of lines, such as highway signs along highways.	None	 The squares are points that are not covered by the line.

Appendix F. ANSI/ASQC Z1.4. Sampling Plans

Appendix Contents Version Date: 2015.03.05

Data stewards (stewards), sub-stewards, or independent quality assurance reviewers may choose to utilize standardized sampling procedures to help assess data quality. These sampling plans are not required but are available for cases where the steward may require them. The ANSI sampling plans make three assumptions.

1. Sampling presumes that the population being sampled is homogeneous. That is, the items being sampled and tested are made up of similar items, and the items were created in similar ways.
2. Sample sizes must be large enough to provide a statistically valid evaluation and must vary with the population. The larger the population, the larger the sample size.
3. The sampling plan assumes that errors are normally distributed in the population.

Inspection Procedures

This procedure is known as stratified, random sampling.

1. Separate the population of all items into categories that are homogenous. Each category must then be tested.
2. Determine the acceptable quality limit from the California Department of Water Resources Spatial Data Standards.
3. Determine the number of items in the population to test.
4. Start with the normal inspection table, Table F-1. Select the row corresponding to the size of the category population. This will tell provide the number of samples needed.
5. Select the column for the acceptable quality limit.
6. The cell (intersection of the row and column) will tell you the maximum allowable number of errors in your test. If you have this number or less, the test succeeds. If you have more than this number, the test fails.
7. If the test fails, you can re-test again, using Table F-2 for tightened inspection. Follow the same process as with Table F-1. If this test also fails, then testing should be stopped, the process should be evaluated, and the process and the data should be corrected.

Table F-1 Single Sample Plans for Normal Inspection

Population Size		Sample Size	Acceptable Quality Level																		
Minimum	Maximum		60.0	75.0	85.0	90.0	93.5	96.0	97.5	98.5	99.0	99.35	99.60	99.75	99.85	99.90	99.94	99.96	99.975	99.985	99.990
2	8	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	15	3	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	25	5	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	50	8	7	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	90	13	10	7	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
91	150	20	14	10	7	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0
151	280	32	21	14	10	7	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0
281	500	50	21	21	14	10	7	5	3	2	1	0	0	0	0	0	0	0	0	0	0
501	1,200	80	21	21	21	14	10	7	5	3	2	1	0	0	0	0	0	0	0	0	0
1,201	3,200	125	21	21	21	21	14	10	7	5	3	2	1	0	0	0	0	0	0	0	0
3,201	10,000	200	21	21	21	21	21	14	10	7	5	3	2	1	0	0	0	0	0	0	0
10,001	35,000	315	21	21	21	21	21	21	14	10	7	5	3	2	1	0	0	0	0	0	0
35,001	150,000	500	21	21	21	21	21	21	21	14	10	7	5	3	2	1	0	0	0	0	0
150,001	500,000	800	21	21	21	21	21	21	21	21	14	10	7	5	3	2	1	0	0	0	0
500,001	6.022e23	1,250	21	21	21	21	21	21	21	21	21	14	10	7	5	3	2	1	0	0	0

Table F-2 Single Sample Plans for Tightened Inspection

Population Size		Sample Size	Acceptable Quality Level																	
Minimum	Maximum		60.0	75.0	85.0	90.0	93.5	96.0	97.5	98.5	99.0	99.35	99.60	99.75	99.85	99.90	99.94	99.96	99.975	99.985	99.990
2	8	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	15	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	25	8	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	50	13	8	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	90	20	12	8	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
91	150	32	18	12	8	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0
151	280	50	18	18	12	8	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0
281	500	80	18	18	18	12	8	5	3	2	1	0	0	0		0	0	0	0	0	0
501	1,200	125	18	18	18	18	12	8	5	3	2	1	0	0	0	0	0	0	0	0	0
1,201	3,200	200	18	18	18	18	18	12	8	5	3	2	1	0	0	0	0	0	0	0	0
3,201	10,000	315	18	18	18	18	18	18	12	8	5	3	2	1	0	0	0	0	0	0	0
10,001	35,000	500	18	18	18	18	18	18	18	12	8	5	3	2	1	0	0	0	0	0	0
35,001	150,000	800	18	18	18	18	18	18	18	18	12	8	5	3	2	1	0	0	0	0	0
150,001	500,000	1,250	18	18	18	18	18	18	18	18	18	12	8	5	3	2	1	0	0	0	0
500,001	6.022e23	2,000	18	18	18	18	18	18	18	18	18	18	12	8	5	3	2	1	0	0	0

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