The Mapping & Cadastral Geographic Information Systems (GIS) Handbook

National Wildlife Refuge System
Division of Realty
Cadastral Data Working Group

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Contents

Chapter 1 - Introduction

1.1 What is the purpose of *The Mapping and Cadastral Geographic Information Systems (GIS) Handbook*? This handbook establishes the procedures and guidance for creating cartographic products to support the management, acquisition, and disposal of U.S. Fish and Wildlife Service (Service or FWS) lands. The guidance includes the general procedures for the most common types of work Service cartographers encounter throughout the year.

Due to the creative nature of cartographic work and the many possible product requests, this handbook may not address all scenarios that face cartographers. The job of the Service cartographer is to follow the guidelines in this handbook to the maximum extent possible while still using cartographic expertise to create maps that satisfy customer requests and organizational needs.

The National Wildlife Refuge System (NWRS) Cadastral Data Working Group (CDWG) will update this handbook as policies, professional practices, and technologies change.

1.2 What are the objectives of this handbook? This handbook provides procedures and guidance to the Regional Realty Cartographers (RRC), cartographic technicians, geographers, and staff to perform the cartographic services necessary to support the mission of the Service. The handbook also provides cartographers an overall view of the types of work they must perform, the general procedures they must follow, and the expectations the Service has for their work. It's also intended to serve as a training guide.

1.3 What is the scope of the handbook? This handbook covers procedures for cartographic production pertaining to Service lands, which includes any lands where the Service holds fee title, partial interest, or is in the process of acquiring such an interest. Realty cartographers may also support Service programs on non-Service lands.

Chapter 2 - Authority and History

2.1 What are the authorities for this chapter?
See FWS Manual 343 FW 1 for a list of the authorities, general responsibilities, and definitions of terms for all the chapters in Part 343, including the land survey and mapping and cadastral GIS handbooks.

2.2 What is the history of the FWS Cartography and Cadastral GIS program?
Much of the history in this section comes from a paper written by Douglas Vandegraft, Chief Cartographer, U.S. Fish and Wildlife Service, 2001-2010.

FWS has been using GIS technology since the mid-1980s to map lands and waters for which it has management responsibility, including the National Wildlife Refuge System (NWRS), which consists of over 855 million acres located within 566 national wildlife refuges (as of 2017). FWS manages these lands and waters through a network of eight geographic regions, defined primarily by state boundaries and physical geography (e.g., Region 3 is the Midwest Region). While much of the day-to-day management of FWS lands occurs from field stations located near a particular wildlife refuge or other FWS property, most of the decisions affecting the entire Region are made from a designated Regional office located in a major city within the Region. Primary mapping capabilities are also located in these Regional offices. The responsibility for mapping the cadastral information for FWS lands has historically been assigned to the Division of Realty.

The FWS Division of Realty has maintained land status maps in a standardized fashion since the 1940s. Using traditional cartographic methods, the maps reflected the NWRS, national fish hatcheries, coordination (shared management) areas, and administrative sites. Most of the early (pre-1980) wildlife refuges were mapped on 1-3 sheets of paper or Mylar and included latitude/longitude coordinate tics along the map borders and a Public Land Survey System (PLSS) township and range grid, where applicable. Because of the dynamic nature of the FWS land acquisition programs, the maps required frequent revisions. The Alaska National Interest Lands Conservation Act of 1980 (Public Law 96-487, 12/2/1980) doubled the size of the NWRS, and provided an incentive to computer-automate the mapping processes for the FWS.

In the 1980s, several Regional offices began using AutoCAD software for their mapping activities. AutoCAD, made by Autodesk, was the first mapping software to be incorporated into the official FWS standards for the mapping of real property. As revised in 1995, the *Maps* chapter of the FWS Manual specified AutoCAD hatch patterns to display the various land status categories. It also included guidelines for specific Rapidograph pen sizes to use for the many line widths and types on the Realty maps.

Separate from the *Maps* chapter effort, an FWS GIS Steering Committee was formed in 1991. The Steering Committee consisted of one representative from each Region, and was chaired by the National Spatial Data Manager. In 1996, the *Service Lands Spatial Data Guidelines Project* was launched. An ad hoc subcommittee of the FWS GIS Steering Committee developed Standard Operating Procedure 97-01 (Process Description for Creating and Managing Service Lands Boundary Digital Data). The

objective of SOP 97-01 was to "provide an accurate, documented, and nationally consistent method for creating and updating a spatial data layer for National Wildlife Refuge boundary information." SOP 97-01 provided specific instructions for digitizing the Division of Realty land status maps. Process 1 described the use of Arc/Info, made by Environmental Systems Research Institute Inc. (ESRI), and Process 2 addressed the use of AutoCAD. Data digitized using AutoCAD was migrated to the Arc/Info coverage data model environment so that refuge boundaries and individual land status polygons could be attributed.

All FWS Regions adopted the methodology and attribution scheme described in SOP 97-01, which led to the digitizing of all external boundaries of the National Wildlife Refuges, and much of the internal land status. However, a complete dataset of all digital refuge boundaries combined with all digital land status for the entire NWRS was not completed under this effort.

In 2000, the NWRS hired a Chief Cartographer, who was given the primary charge of helping the Regions complete the digitizing of boundaries and land status within the NWRS. In 2002, an informal working group, comprised of representatives from each Region, was formed to develop new mapping standards for FWS that embraced GIS to streamline the production of map products. Over the next 3 years, the *Maps* chapter of the FWS Service Manual was completely rewritten (2006), and a new standard for NWRS maps was adopted.

In 2006, the informal working group was officially recognized as the Cadastral Data Working Group (CDWG). The group's primary objective was to produce a master ArcGIS geodatabase that would contain all land ownership, whether public or private, within the external approved acquisition boundaries of all FWS units nationwide. Implementation of the master geodatabase was based on Region-specific versions, maintained locally by each Region. Each Region's local version was then consolidated, or rolled-up, into the national master geodatabase on a regular schedule. While additional feature classes, fields, and domains could be added to a Regional version, all Regions would maintain a national version that would be consistent with the schema of the national, master geodatabase.

Beginning in 2007, the first roll-ups took place during a workshop held at the National Conservation Training Center. By 2009, each Region was sending their cadastral data to the Region 3 or 5 members of the CDWG, who would combine the national data set and send it to Denver. These national roll-ups demonstrated the power of combining data using agreed upon data standards and enabled nationwide geospatial analysis on the lands and waters managed by the Service. The challenge for the CDWG was that different technical implementations of the cadastral geodatabase across the Regions required custom scripts and hands-on attention to get the data rolled up. By 2012, the data was being successfully rolled up twice a year, but still depended on employees in two Regions to complete the final publication.

In 2013 the CDWG analyzed the work needed to update the data and systems architecture as well as business processes so all Regional offices could roll up their own data to servers in Denver. We used a variety of solutions, taking into account existing technical implementations. Some offices, for example, already had ArcSDE installed and were able to implement the parent/child/grandchild versioning and replication strategy on existing platforms. Other Regions without that same level of technical support used internet connections to move locally edited data directly to the child databases hosted in Denver and do the roll-up from there.

The movement to the new architecture improved the data refresh cycle from twice a year to four times a year. In 2017 we reduced it to three times a year with the implementation of the LRS/Cadastral reconciliation process (see chapter 5). Overall technical capacity and the CDWG members' understanding of the data and systems improved. The time needed for each roll-up was reduced to a couple days, which allowed for quicker publication and refresh of downloadable data and updated web maps.

The CDWG uses ServCat to store and host downloadable data. Along with Web Services, the cadastral data layers are available to internal and external users in multiple formats. The Division of Realty's cartography program has matured all segments of the data management lifecycle for cadastral data and is now focused on improving data layers, such as Encumbrances and Survey Monuments, that haven't had the same level of attention as other data layers, but which are an important record of activities that occur on Service-managed lands.

Overall, the Service's cadastral geodatabase (called the "FWSCadastral" geodatabase) helps the Service meet its mission requirements of working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people, by providing timely responses to questions posed by the FWS Directorate, Regional and Refuge Managers and staff, academia, industry, non-governmental organizations, other Federal and state agencies, and private individuals.

Chapter 3 – Organization, Administration, Requirements

3.1 What is the organization and administration of the Service cartographers?
The Service cartographers consist of a Chief Cartographer located in the Headquarters office, Regional Realty Cartographers (RRC) located in each Region, and a few cartographic technicians, geographers, and biologists in various Regions. The cartography program is organized in the Division of Realty under the NWRS. The Chief Cartographer reports to the Deputy Chief, Division of Realty. In almost all Regions, the RRC and other cartographic support staff are located in the Division of Realty for that Region. In most Regions the RRC reports to the Regional Land Surveyor.

3.2 What are the duties of the Chief Cartographer and Regional Realty Cartographers?

3.2.A Chief Cartographer
The Chief Cartographer oversees all cartographic activities relevant to the Division of Realty land acquisition program and boundary management of Service lands. He or she is responsible for national policy interpretation and Servicewide policy formulation, managerial leadership and technical guidance, program implementation and evaluation, and internal and external coordination necessary for the successful management of the cartography program. As needed, he or she issues technical and procedural program guidance to ensure adequate technical support and proficiency, and provides the final interpretation for the Service Manual regarding cartography. The Chief Cartographer serves as the principal data steward for publication of the national cadastral geodatabase, ensures the overall quality and timeliness of national map products, chairs the FWS Cadastral Data Working Group (CDWG), and serves as a deputy member representing the Department of the Interior on the U.S. Board of Geographic Names. The Chief Cartographer is also responsible for the contribution of the FWS Interest GIS layer to the Federal Geographic Data Committee's (FGDC) A-16 cadastre theme as a National Geospatial Data Asset (NGDA) and its availability on data.gov.

The Chief Cartographer also acts as the consulting specialist for the cartography program on related activities among the Service and other Federal, state, tribal, and private entities, and represents the Service on the National Boundaries Group and the Federal Lands Working Group.

3.2.B Regional Realty Cartographer
The RRC is responsible for:
(1) Managing the inventory of real estate parcel boundaries acquired and administered by the Service;
(2) Managing the inventory of legislative, specially designated, and approved boundaries under the Service's jurisdiction;
(3) Managing the inventory of permits and rights-of-way boundaries that the Service grants;
(4) Incorporating all cadastral survey and/or the most accurate source of boundary data into the cadastral geodatabase;
(5) Maintaining an up-to-date set of land status maps depicting land tenure and encumbrances at every unit defined in the Annual Report of Lands;

(6) Ensuring the quality and timeliness of Regional map products; and
(7) Serving as a member of the CDWG.

In addition, the RRC is responsible for the development and administration of the Region's overall realty cartography program. He/she is responsible for Regional policy interpretation, managerial leadership and technical guidance, program implementation and evaluation, and internal and external coordination necessary for the successful management of the Region's cartography program. This includes supporting land acquisition, realty management, water rights acquisition, construction, and boundary management. The RRC works closely with the Regional Land Surveyor and Realty Specialists to complete the end-of-year reconciliation of realty actions documented in the Lands Record System (LRS) and the cadastral geodatabase.

The Chief Cartographer may ask the RRC to assist on national committees with responsibility for defining standards, techniques, and methods for complex technical and scientific cartographic and GIS issues.

3.3 What is the Cadastral Data Working Group (CDWG)?
The CDWG is comprised of cartographers, GIS specialists, geographers, planners, and database managers from Headquarters and every Region with the responsibility of managing the spatial data layers contained in the FWSCadastral geodatabase, which represents the lands and waters managed by the Service. The Chief Cartographer chairs the CDWG, and each Region is represented by at least one person. Participation in the CDWG is a foundational requirement for the Chief Cartographer and the RRCs.

The CDWG holds monthly teleconferences on the 2nd Thursday of the month at 2:30 p.m. eastern time. The Chief Cartographer runs the calls. The agendas are available ahead of time on the CDWG shared google drive folder. Final meeting minutes are on the CDWG SharePoint site.

The CDWG also holds 3-day, in-person meetings approximately once a year. The meeting locations rotate among the Regions and Headquarters. Each meeting is an opportunity for the members to address issues in an in-depth manner, spending the necessary time to discuss technical, organizational, and cartographic details that impact the entire Service cartography community. The minutes of each meeting are on the CDWG SharePoint site.

3.4 What are publication requirements for maps and cadastral GIS data?

3.4.A Land Status Maps
Every 6 months the Region must furnish status maps to the Chief Cartographer on all units where there has been a change in land status. Submission due dates are May 1 and November 1. Regions directly submit such maps to the ServCat holdings for the refuge, fish hatchery, or other area managed by the Service, following the instructions on the CDWG SharePoint site in the shared documents, land status maps folder. A standard report that compares the most recent acquisition record in the LRS with the

most current land status map in ServCat is available to all ServCat users. RRCs may use the report to track the vintage of their land status maps.

3.4.B FWSCadastral Geodatabase

The FWSCadastral geodatabase is published three times a year. The publication follows the steps in the cadastral GIS chapter of this handbook. The standing schedule is the last Wednesday in March and July and the Wednesday that falls the week before Thanksgiving in November.

The November data publication is also known as the end-of-fiscal year version of the FWSCadastral geodatabase. It is subject to audit to ensure that all acquisitions within the fiscal year are included. We send the end-of-fiscal year FWSCadastral geodatabase to outside sources, such as PADUS, Science Base, and others, as we describe in the publication section of the [cadastral GIS chapter.](#)

3.4.C FWSCadastral Geodatabase Feature Classes

The specific guidance for the required and optional feature classes and their associated attributes are in the cadastral GIS chapter of this handbook.

3.4.D Document Storage and Archiving

The CDWG and the Chief Cartographer use a number of websites to store documents, guidance, templates, exhibits, geospatial data, and maps in various states of completion. The challenge is to keep the folders organized. In general, the schema is as follows:

> *3.4.D.1 CDWG folder on Google Drive* **–** Used for (1) draft documents or (2) files too large to email.
> https://drive.google.com/drive/folders/0B7gWBV26nENBZmFtVjNXcktaeGc
>
> *3.4.D.2 CDWG SharePoint* – Used for final versions of documents, such as meeting minutes, the calendar of meetings, guidance, and other internal CDWG management documents.
> https://fishnet.fws.doi.net/projects/gisnew/CDWG/SitePages/Home.aspx
>
> *3.4.D.3 Realty Cartography SharePoint on the DOI Portal* – Used for final map products, such as the NWRS National Map and other atlases available to FWS employees. Also contains the exhibits and templates used by the RRCs to construct maps following guidance published in the [mapping chapter](#) of this handbook. The Chief Cartographer also uses the site to store all PowerPoint presentations for others to use.
> https://portal.doi.net/usfws/realty/cartography/SitePages/Home.aspx
>
> *3.4.D.4 ServCat, or the Fish & Wildlife Service Catalog* – Used for long-term storage and availability of both scanned maps and geospatial datasets. All land status maps (mentioned above) are stored in ServCat, following guidance developed by the CDWG in cooperation with the ServCat managers in Fort

Collins, Colorado. In addition, the FWSCadastral geodatabase and shapefiles are stored in ServCat. The public facing versions have their metadata read by data.gov, where they are published. Although ServCat stores digital records, it is not a National Archives and Records Administration (NARA) facility (see below). https://ecos.fws.gov/ServCat/, https://catalog.data.gov/dataset?q=Realty&sort=none&metadata_type=geospatial &organization=fws-gov

3.4.D.5 NARA – NARA is the Nation's record keeper. Many scanned maps are stored at NARA. Every year the Chief Cartographer works with the Service Records Administrator to transfer a copy of the end-of-fiscal year cadastral geospatial data in the form of shapefiles to NARA. Guidance is found in the [cadastral GIS chapter](#) of this document. https://www.archives.gov/about

3.5 What is the recommended training for Realty Cartographers?
The CDWG has a list of orientation and training links saved on the CDWG SharePoint site (https://fishnet.fws.doi.net/projects/gisnew/CDWG/), in the shared documents "Training and Orientation" folder. The CDWG reviews the list annually to update links, documents, and other references.

We encourage all new cartographers to take the USFWS Foundations course and to attend the Realty Academy at the first available opportunity. See the National Conservation Training Center's website for more information.

Chapter 4 – Mapping

4.1 What is the purpose of this chapter?
This chapter defines the standards governing cartographic production for the NWRS.

4.2 What are the definitions for American National Standards Institute (ANSI) map sizes (width X height)?
A. "A" size maps are 8.5 x 11 in (21.59 x 27.94 cm).
B. "B" size maps are 11 x 17 in (27.94 x 43.18 cm).
C. "C" size maps are 17 x 22 in (43.18 x 55.88 cm).
D. "D" size maps are 22 x 34 in (55.88 x 86.36 cm).
E. "E" size maps are 34 x 44 in (86.36 x 111.76 cm).

4.3 What is "base data?" Base data depict selected fundamental cartographic and geographic information. Within the NWRS, base data are vector or raster data depicting roads, hydrography, political boundaries, or relief. Whenever possible, it is best to use the vector base data created by the Headquarters (HQ) Division of Realty, which can be edited to meet local needs. The vector base data is distributed in a map data package and contributes to a common "look" and "feel" in all NWRS maps. The vector base can be used alone or overlain on imagery or other online base maps to provide greater locational context. Examples of raster base data include gray background, roads, topography, ocean, and imagery online base maps.

4.4 What are the different types of boundaries?

4.4.A Approved Acquisition Boundary (AAB). The line(s) enclosing those lands that we have authority to acquire, in whole or in part. This boundary often encompasses both public and private land, but it does not imply that we are targeting all private parcels within the boundary for acquisition. The AAB can originate from a variety of means (for example: Executive Order, congressional legislation, Secretarial Order, Public Land Order, Service Director, Regional Director, or the Migratory Bird Conservation Commission).

4.4.B Interest Boundary. The line(s) enclosing those lands for which we have fee or less than fee interest. The interest boundary is also called the "refuge boundary."

4.4.C Wilderness Boundary. The line(s) enclosing those lands within a unit of the NWRS that Congress has designated as wilderness or that the Service has proposed as such.

4.4.D Encumbrance or Out-grant Boundary. The line(s) enclosing those lands for which the Service has granted temporary or perpetual rights to external parties for actions such as rights-of-way or utilities.

4.4.E National Monument Boundary. The line(s) enclosing those lands that the President of the United States has declared as having historic landmarks, historic and

prehistoric structures, and other objects of historic or scientific interest that are situated on the lands the Federal Government owns or controls. (American Antiquities Act, 16 U.S. Code (U.S.C.) 431-433)

4.5 What are the format specifications for official maps used in the NWRS?
For positioning specifications of the particular elements, see the Style Sheet (Exhibit 1: e01343fw5.pdf).

4.5.A Seals.
(1) The Service (duck & fish) logo and the NWRS (blue goose refuge sign) must appear in the upper left corner of the map. They always appear side by side.
(2) The Service logo is on the left, in full color, or black and white. The left edge of the Service logo is flush with the left border of the map extent.
(3) The NWRS logo is on the right, in full color, or black and white. The right edge of the NWRS logo is 1/10th up to ½ of an inch (dependent on size of map) from the edge of the identification bar and title of area administered.
(3) The top of the seals are flush with top of the identification bar.

4.5.B. Identification Bar (Line No. 1).
(1) The text "U.S. Fish & Wildlife Service" appears in the variable color bar on the top of the map. U.S. is shown with no space between the U. and S. An ampersand is used instead of spelling out the word "and."
(2) The top of the bar must be flush with the top of the two logos in the upper left corner of the map page.
(3) Font: Calibri, bold, upper and lower case.
(4) Type size: variable
(5) Type color: white.
(6) The height of the bar depends on the size of the map. The bar must extend from the right of the two logos to the width of the map, flush with the right border of the map extent. The color of the bar must be dark enough (minimum of 80% contrast) to contrast with the white text.

4.5.C. Title of Area Administered (Line No. 2).
(1) The name of the area the map depicts, including the specific name of the management unit as stored in the Corporate Master Table (CMT), appears directly below the identification bar and flush left with the "U" in Line No. 1. The entire name must fit on Line No. 2. Avoid abbreviations if possible (for example: Cape May National Wildlife Refuge - Great Cedar Swamp Division). Whenever possible, use the official name stored in the CMT.
(2) Line No. 2 does not need to be in line with the bottom of the logos.
(3) The text for Line No. 2 is the largest of all the text that appears in the map title area.
(4) Font: Calibri, bold, upper and lower case.
(5) Type size: variable.
(6) Type color: black.

4.5.D. Map Subject/Map Title/Map or Sheet Number. The subject or title of the map, as well as the map or sheet number (as needed), is positioned either within the bar (Line No. 1) or below the bar (Line No. 2) on the upper right side of the map.
(1) If you place the text <u>within the bar</u>:
      (a) Font: Times New Roman, italic, bold, upper and lower case.
      (b) Type size: variable.
      (c) Type color: white.
(2) If you place text <u>below the bar</u>:
      (a) Font: Times New Roman, italic, bold, upper and lower case.
      (b) Type size: variable.
      (c) Type color: black.

4.5.E. County and State (Line No. 3). The name of the county(ies) and state(s) appear directly below the name of the area administered and flush left with the text of Line No. 2. Line No. 3 does not need to be in line with the bottom of the logos. We encourage you to list the county name(s) (or similar local government name). Use the full state name(s).
(1) Font: Calibri, upper and lower case.
(2) Type size: variable.
(3) Type color: black.

4.5.F. Latitude/Longitude Grid. The magnitude and frequency of latitude/longitude tic marks depend on the size and scale of the map. Large scale maps should reference degrees, minutes, and seconds. Small scale maps may reference only degrees and minutes, or in some cases, only degrees. Regardless of the size and scale of the map, the number of latitude/longitude tic marks should be sufficient to adequately orient the map reader without being excessive. The following apply to the majority of maps described in this chapter:
(1) A minimum of two pairs of latitude and two pairs of longitude coordinates and the associated tic marks must appear along the borders of the map (data frame). Express the coordinates in degrees, minutes, and seconds, with the seconds in increments of 1 to 5, depending on scale.
(2) You can place coordinates either horizontally or vertically, but you must position them outside of the neatline (data frame). You can place the tic mark either outside or inside of the neatline (data frame).
(3) Font: Calibri, upper case.
(4) Type size: variable.
(5) Type color: black or gray.

4.5.G. Optional Grids. Township and Range, Universal Transverse Mercator (UTM), State Plane. Including the Township and Range, UTM projection zone, or State Plane rectangular coordinate tics or grid (or any other system) is optional. If you include these, we recommend the following specifications:
(1) Font: Calibri, upper case.
(2) Type size: variable.
(3) Type color: black, gray, or red.

(4) For positioning specifications, see the exhibits.

4.5.H. Map Borders and Neatline. An outer border that frames the entire map, or used as a trim line, is required on all maps. When using a neatline to frame the map extent (priority data frame), you should use a narrow line, such as 1 point.

4.5.I. Map Data Notes.
(1) Position the text describing basic map data in the lower left corner of the map or legend box, preferably below the map neatline.
(2) Font: Calibri, upper or lower case.
(3) Type size: variable.
(4) Type color: black.
(5) You must include the following information:
      (a) PRODUCED IN THE DIVISION OF (name of Division)
      (b) CITY, STATE (2-letter abbreviation)
      (c) LAND STATUS CURRENT TO: (date)
      (d) BASE MAP SOURCE: (data source or sources, such as DOQs, and date of data)
(6) The following information is optional:
      (a) MERIDIAN (name of meridian)
      (b) DATUM and PROJECTION
      (c) OTHER DATES (when created, printed, published, etc.)
      (d) MAP NAME or NUMBER

4.5.J. Scale Bars.
(1) Position the scale bars at the bottom center of the map or legend box, preferably below the map neatline.
(2) The scale bars must have single alternating fills and be flush left with '0' at left.
(3) The primary data frame will reflect two scale bars, one in English units and the other in metric units. (Other data frames, such as the Location and Vicinity maps, can use a single scale bar). The top bar must show feet or miles; the bottom bar shows meters or kilometers. When using feet or miles, the corresponding metric measure must be meters and kilometers respectively. The increments for both the English and metric measurements should be whole, rounded values. Additionally, both the English and metric scale bars should use the same interval values and number of intervals. For example, if the English scale bar shows three 1-mile intervals, then the metric scale bar should show three 1-kilometer intervals. Use of a scale ratio is optional.
(4) Font: Calibri, upper or lower case.
(5) Type size: variable.
(6) Type color: black.

4.5.K. North Arrow. Position the north arrow at the lower right corner of the map or legend box, preferably below the map neatline. If you position the north arrow in the lower right corner of the map, it must be flush right with the map neatline. Do not make north arrows any larger than the logos used at the top of the map.

4.5.L. Location Map. Position a small inset map depicting the location of the subject area within a state(s) as appropriate to the map layout. Include the two letter state abbreviation(s), if not the entire state name. We encourage you to include the state capital or some other large city. If the location map is large enough, you should use the shape of the subject area as the locator symbol. If not, use a rectangular extent indicator referencing the main map frame. Additional elements such as a border, north arrow, or scale bar are optional.

4.5.M. Vicinity Map. A small inset map depicting the subject area with reference to state, county, city, and other prominent features is optional but should be used if it helps the reader understand the geographic context of the project. If the vicinity map is large enough, you should use the shape of the subject area as the locator symbol. Additional elements such as a border, north arrow, or scale bar are optional.

4.5.N. Format for Digital Output. All digital maps should be output in geopdf format at a minimum of 300 dpi resolution. Include the georeference information in the map when using ArcGIS by selecting Export Map|Options and choosing the advanced tab. Click on "Export Map Georeference Information." In ArcGIS Pro select Export Map and choose Export Options. Under PDF settings select "Export map georeferenced information." To reduce the file size but maintain legibility, load the exported .pdf maps into Adobe Acrobat DC, choose the Optimize PDF tool, and select "Reduce File Size," saving the new pdf to a known location.

4.6 What are the format specifications for maps published in the Federal Register and Code of Federal Regulations?
We use an "A" or smaller size map to depict official actions we have taken. The map is published in the Federal Register, Code of Federal Regulations, or similar official Government publication.

4.6.A. Size.
(1) Federal Register maps are Size "A" or smaller. (Exhibit 2: e02343fw5.pdf) Orientation is usually portrait within the space of one column (single column is 2.25 inches wide) and up to three columns (7 1/16 inches wide). We use the map to depict official actions we have taken.
(2) Code of Federal Regulations maps are printed in a single column (2.25 inches wide) or double column (4.67 inches wide). Data appearing on the map must be large enough to be readable when reduced to these dimensions.

4.6.B. Format. Keep maps that will go in the Federal Register or Code of Federal Regulations simple, showing only the necessary information. Although the Government Printing Office (GPO) might accept color illustrations, there is no guarantee the graphic will appear in the Federal Register in the same format as submitted. Because of this we recommend that all graphics sent to GPO be in black and white only. The Service Management Analyst responsible for Federal Register submissions also recommends against using gray shading.
(1) Use a single border to frame the map.
(2) Scale bars should reflect English and metric, if space allows.

(3) Position captions, all text, and legends on a white background.
(4) Include north arrow and location map.
(5) Do not use any agency seals or logos.
(6) The map can be embedded in the digital document. GPO receives both a digital version and printed copies from the project proponent.

4.6.C. Symbology. We recommend the use of black and white symbology when submitting maps to GPO for the <u>Federal Register</u> or the <u>Code of Federal Regulations</u>. GPO recommends the following:
(1) Use cross-hatching or dot patterns instead of shading. If you must use shading, do not use more than one shade of solid dark. Avoid using gray or half tones.
(2) Distinguish all line symbols clearly from each other.
(3) Identify all open water areas with text and with a wave pattern.

4.6.D. Text. Use a single, non-serif font (such as standard Arial). Italicize water areas. All words and numbers must be clear and legible, particularly on the <u>Code of Federal Regulations</u> page sizes. Take particular care when displaying highway numbers and latitude/longitude coordinates.

4.7 What thematic maps does the Service require and what are their specifications? We describe the thematic maps in 343 FW 5, section 5.6. The subsections below contain the specific requirements for each of the thematic maps.

4.7.A. Approved Acquisition Boundary Map.
(1) The approved acquisition boundary map must conform to the "A" size or use larger dimensions depicting the approved acquisition boundary and necessary base data. The format is as shown in Exhibits 3 and 4 of this handbook (e03343fw5.pdf and e04343fw5.pdf). The scale of the map must depict all necessary detail.
(2) We require that an approved acquisition boundary map be prepared and submitted to the Chief Cartographer when a new conservation area is established. Prepare the map as a geopdf and submit the original file, not a scanned copy. Upon review and approval by the Chief Cartographer, the Regional Realty Cartographer will load the map into ServCat.
(3) After the initial approved boundary map is submitted, further updates can be included on land status maps. See 4.7.B below for direction.

4.7.B. Land Status Map
Land status maps are a "C" or larger size map depicting lands on which we have acquired an interest (fee interest, less than fee interest). Although some cartographers have called them "status maps" in the past, we prefer the term "land status maps" to reduce confusion. Identify individual parcels of land by tract boundary and tract number. In addition, land status maps must depict the approved acquisition boundary, wilderness boundary, encumbrances and outgrants, as appropriate. Land status maps are generally suitable for use by the public.

(1) Standards.

(a) The land status map must conform to the size "C" dimensions (or larger) format, and specifications as shown in Exhibit 5 of this handbook (e05343fw5.pdf). The map must be big enough to depict all necessary detail.
(b) Topographic map symbols are specified in the Publication Map Symbols Standards prepared by the U.S. Geological Survey. You can find additional map symbols in the Service Graphics Standards document available on the FWS External Affairs website). Adjust the symbol dimensions appropriately for the scale of the map.
(c) A land status map must depict the approved acquisition boundary. If the mapped land status is confined to a minimal area within the approved acquisition boundary, it is not necessary to depict the entire boundary in the main map frame of the land status map. Every 6 months, the Region must create an updated land status map on all units where there have been changes in land status. The submission due dates are May 1 and November 1. The maps must be kept on ServCat, the Service Catalog, following procedures developed by the Cadastral Data Working Group (CDWG) and ServCat administrators. The maps must be in geopdf format.

(2) Categories and Associated Symbology. We describe the primary categories of land status maps below. Indicate the categories that are applicable in the map legend. A Region may require additional categories to represent any other interests. If the Service interest lands fall outside the approved acquisition boundary, the color and/or pattern must remain consistent with the particular land status category.

(a) *Fee*. Lands owned by the United States where the Service is the primary administering agency. These areas are shown with a variable transparent dark green color (map base dependent) and/or a pattern of thin solid lines positioned northwest-southeast.
(b) *Less than fee - Easements and Leases*. Federal and non-Federal lands for which the Service has an easement, lease, and/or administrative authority. For definitions of these interests, see 341 FW 2 and 340 FW 3. Easement areas are shown with a variable transparent orange color and/or a pattern of thin dashed lines positioned northwest-southeast. Lease areas are shown with a variable yellow color and/or a pattern of thin dashed lines positioned west-east.
(c) *Less than fee - Secondary or Partial Interest or Life Estate*. Federal and non-Federal lands for which the Service has a secondary or partial interest or life estate. For definitions of these interests, see 341 FW 2 and 340 FW 3. These areas are shown with a variable transparent blue color (map base dependent) and/or a pattern of thin solid lines positioned northeast-southwest.
(d) *Less than fee - Agreement.* Federal and non-Federal lands for which the Service has a memorandum of agreement (MOA), memorandum of understanding (MOU), and/or administrative authority to manage the subject lands. For definitions of these interests, see 341 FW 2 and 340 FW 3. These areas are shown with a variable transparent brown color (map base dependent) and/or a pattern of thin dashed lines positioned northeast-southwest.

(e) *Wilderness Area.* Land within a unit of the NWRS designated as part of the National Wilderness Preservation System. The exterior boundary of the wilderness area is shown as a black alternating long dash - dot (or short dash) - long dash line symbol with transparent gray fill or a salmon alternating long dash – dot (or short dash) – long dash line symbol with transparent salmon fill.

(3) Tract Labels. You can find the standards for numbering tracts in 342 FW 3 Exhibit 11, Standards for Numbering Fee Acquisition Tracts, at https://www.fws.gov/policy/e11342fw3.html.
> (a) Tract numbers can stand alone or be contained within a circle, ellipse, or other similar shape.
> (b) Font: Calibri, bold. If the tract number stands alone, we suggest that the number be italic.
> (c) Type size: variable.
> (d) Type color: black.

(4) Land Status Map Boundary Line Specifications. The lines representing boundaries of Service-administered areas or other interests, as well as linear interests, should be consistent, as described below:
> (a) *Approved Acquisition Boundary*. This boundary is shown as a solid black line with a transparent gray or yellow enhancement on the NWRS unit side of the boundary.
> (b) *Tract Boundary*. The boundary of individual tracts or parcels is a solid line, with a width smaller than the Approved Acquisition Boundary line. Where the tract boundary and the approved acquisition boundary share a common line, the approved acquisition boundary is dominant. The color of the line is variable depending on the base map. We encourage you to use either black or white lines.
> (c) *Outgrant*. Outgrant boundaries reflect uses that will encumber fee lands by granting a right to use them for short-term or long-term purposes. Examples of outgrants include rights-of-way and areas with permitted uses or special permitted uses. Outgrants are shown as a linear feature using a dashed red line or as a parcel feature with a variable transparent green color (map base dependent) with a pattern of thin dashed red lines positioned northeast-southwest. You can use specific utility line symbols (e.g., power line, pipeline, etc.) shown in red in place of the dashed red line.

(5) Status Atlas. The status atlas contains hard copy maps showing current status, approved acquisition boundaries, and other official maps for Service-administered areas. The maps are filed according to state or project name, or both. Each Regional office maintains a status atlas in either hard copy or digital format(s). All hard copy maps available in Regional offices should also be loaded into ServCat in geopdf format. The NWRS Realty Division in Headquarters maintains the National Status Atlas by accessing the current status maps from all the Regions through ServCat.

4.7.C. Land and Water Conservation Fund (LWCF) Briefing Book Map.

(1) We portray LWCF projects on maps and describe them in detail in a briefing statement. The maps must accurately reflect the content of the briefing statement, so it is important for the Regional Cartographer to coordinate with the appropriate Realty Specialist.

(2) Realty Headquarters distributes guidance documents in advance of each LWCF project cycle. The guidance includes deadlines, map content requirements, instructions for using templates, and how to send maps and data to Headquarters.

(3) The LWCF maps must conform to the size "A" dimensions and format as shown in Exhibit 6 of this handbook (e06343fw5.pdf). The scale of the maps must be big enough to depict all necessary detail. The maps have a consistent and specialized legend with associated color codes. Color codes identify those tracts we have acquired, tracts where funding is approved, and tracts where we are seeking funding for acquisition. The maps also reflect a boundary within which we may acquire lands using the LWCF.

(4) Cartographers must use consistent symbology on the LWCF maps and map legends. The project categories are:
> **(a)** *Project Boundary*: Project boundaries are shown as a solid red line.
> **(b)** *Acquisition through FY* (previous fiscal year): Parcels are shown using a variable dark green (map base dependent).
> **(c)** *Planned Acquisition in FY* (current fiscal year): Parcels are shown using a variable dark blue (map base dependent).
> **(d)** *Proposed FY* (next fiscal year): Parcels are shown using a variable dark orange (map base dependent).
> **(e)** *Future Exchanges, Donations, and State or other Public Lands*: Parcels are shown using a variable dark yellow (map base dependent).
> **(f)** *Proposed Beyond FY* (beyond next fiscal year): Parcels are shown in white or other neutral color (map base dependent).

(5) The map legend should list all of the categories in the order stated above, regardless of whether the category appears on the map. Include the statement, "All categories are shown in the above legend. However, some of these categories may not be present on this map," underneath the legend.
> **(a)** The map legend must have full color examples of the categories positioned on the left side of the legend box.
> **(b)** Font: Calibri, upper or lower case.
> **(c)** Type size: 12 point.
> **(d)** Type color: black.

4.7.D. Migratory Bird Conservation Commission (MBCC) Map.

(1) We submit various MBCC projects for approval at meetings of the Commission in Washington D.C. usually held twice a year in April and September. Acquisitions can only occur within the MBCC-approved boundary or the boundary to be approved.

(2) Realty Headquarters distributes guidance documents in advance of each MBCC project cycle. The guidance includes deadlines, map content requirements, instructions for using templates, and how to send maps and data to Headquarters.

(3) The MBCC maps must conform to the size "A" dimensions and format shown in [Exhibit 7 to this handbook (e07343fw5.pdf)](#) and depict a consistent and specialized legend with associated color codes. The color codes identify lands that we have acquired or may acquire pending MBCC approval. The maps also identify a boundary, approved by the MBCC, within which we may acquire lands using the Migratory Bird Conservation Fund. The scale of the maps must be big enough to depict all necessary detail.

(4) The proposal categories reflected on the map and in the map legend, as applicable, are:

    (a) *MBCC-Approved Boundary:* This boundary is shown as a blue dashed line with alternating short dashes.

    (b) *Boundary to be Approved*: This boundary is shown as a dashed red line.

    (c) *Approved Acquisition Boundary*: This boundary is shown as a solid black line with a transparent gray or yellow enhancement on the NWRS unit side of the boundary. The approved acquisition boundary is shown when it is not coincident with the previously approved MBCC boundary. When the approved acquisition boundary is coincident with the MBCC approved boundary, the MBCC approved boundary is shown on top of the approved acquisition boundary. Likewise, when the approved acquisition boundary is coincident with the MBCC boundary to be approved, both boundaries are shown. The boundary to be approved will be shown on top.

    (d) *Previously Acquired Fee:* This area is shown with a pattern of thin solid green lines positioned northwest-southeast.

    (e) *Previously Acquired Easement or Lease*: This area is shown with a pattern of thin dashed salmon colored lines positioned northwest-southeast.

    (f) *For Approval Fee*: Parcels are shown with a variable dark red color (map base dependent).

    (g) *For Approval Easement or Lease:* Parcels are shown with a pattern of thin solid red lines positioned northwest-southeast.

    (h) *Date of MBCC Meeting*: The month/day/year is positioned on the left side of the legend box.

(5) The map legend must include full color examples of only those categories that are on the map and are positioned on the left side of the legend box.

    (a) Font: Calibri, upper and lower case.

    (b) Type size: 12 point.

    (c) Type color: black.

(6) All final MBCC maps must be loaded into ServCat by Headquarters.

A wilderness map is a size "C" or larger map depicting an area within a unit of the NWRS that is part of the National Wilderness Preservation System.

(1) The Wilderness Act requires that we file the map and a legal description with the Senate Committee on Energy and Natural Resources and the House Committee on Natural Resources. The Regional Cartographer distributes wilderness maps to the Chief Cartographer at Headquarters and the managing field offices. The Regional office maintains the maps for the Service and the public.

(2) Wilderness maps must conform to the size "C" dimensions and format shown in Exhibit 8 of this handbook (e08343fw5.pdf).

(3) Wilderness maps must reflect the approved acquisition boundary and the wilderness area at the time of the designation. The exterior boundary of the wilderness area is shown as a black alternating long dash - dot (or short dash) - long dash line symbol. The width of the boundary line should be less than the width of the approved acquisition boundary line symbol. If the approved acquisition and wilderness boundary lines are coincident, the wilderness line symbol should be red and shown on top of the approved acquisition boundary line. Line enhancement and fill or patterns for the wilderness area are optional. The scale of the map must be big enough to depict the entire wilderness area on one map (except in extreme cases).

(4) The legend for each map must state the following information (Figure 5-1):

Figure 5-1: Legend for Wilderness Maps

```
                 OFFICIAL MAP
AS CITED IN PUBLIC LAW:
SECTION:
DATED:
STAT. NO.:
NUMBER OF ACRES:
```

  (a) Font: Calibri, bold, upper or lower case.
  (b) Type size: 12 point.
  (c) Type color: black.

(5) You should include a separate legend to depict the wilderness boundary, the approved acquisition boundary, and any non-Federal lands within the boundary of the wilderness area. After a wilderness area is officially designated, the area must be depicted on the status map.

(6) The Regional Cartographer must submit wilderness maps to the Chief Cartographer for approval at least 8 weeks before any scheduled congressional hearings about them.

(7) The Regional office provides a copy of the final map in geopdf format to the Chief Cartographer to file in ServCat. The Regional office also files the map in the Regional Status Atlas.

4.7.F. Official Maps for Specially Legislated Areas.
(1) These are maps of a conservation area or unit that exists because of special legislation by an act of Congress.

(2) Special legislation maps must conform to the size "C" or larger dimensions and format shown in Exhibit 9 of this handbook (e09343fw5.pdf).

(3) The scale of the maps must be big enough to depict the entire conservation area on one map (except in extreme cases).

(4) The legend for each map must state the following information (Figure 5-2):

Figure 5-2: Legend for Maps for Specially Legislated Areas

```
OFFICIAL MAP
AS CITED IN PUBLIC LAW:
SECTION:
DATED:
STAT. NO.:
NUMBER OF ACRES:
```

    (a) Font: Calibri, bold, upper or lower case.
    (b) Type size: 12 point.
    (c) Type color: black.

(5) The Regional Cartographer must submit specially legislated area maps to the Chief Cartographer for approval at least 8 weeks before any scheduled congressional hearings about them.

(6) The Regional office provides a copy of the final map in geopdf format to the Chief Cartographer to file in ServCat. The Regional office also files the map in the Regional Status Atlas.

4.8 What additional maps are produced to support the NWRS?

4.8.A Categorical Exclusion (CE) Map (see Exhibit 10 (e10343fw5.pdf)**)**. An "A" size map in a CE ("Cat Ex") document that identifies the addition of a specific tract(s) proposed for acquisition and subsequent expansion of a refuge-approved acquisition boundary.

4.8.B Comprehensive Conservation Plan (CCP) Maps (see Exhibit 11 (e11343fw5.pdf))**.** Various sized maps in a CCP document that depict the habitats, resources, and

proposed management plans for an approved project. Not all maps in a CCP must meet the specifications in section 4.5. Maps that are part of a CCP document don't need to have all required map elements if the document already includes those elements (FWS title bar, seals, map title included in the Figure Name, etc.). Standalone maps (versions outside of documents) must have all required elements.

4.8.C Environmental Assessment (EA) Map (see Exhibit 12 (e12343fw5.pdf)). Various sized maps in an EA document that depict the habitats, cultural resources, hazards, and possible management alternatives of a proposed project. Not all maps in an EA must meet the specifications in section 4.5. Maps that are part of a EA document don't need to have all required map elements if the document already includes those elements (FWS title bar, seals, map title included in the Figure Name, etc.). Standalone maps (versions outside of documents) must have all required elements.

4.8.D Exchange Map (see Exhibit 13 (e131343fw5.pdf)). An "A" or larger size map depicting lands that we are proposing for exchange or that are being exchanged between the Service and a non-governmental organization.

4.8.E Inholdings/Emergencies and Hardships Funding Request Map (see Exhibit 14 (e14343fw5.pdf)). An "A" or larger size map depicting lands we will acquire within an approved acquisition boundary using funding from the Emergencies and Hardships or Inholdings accounts.

4.8.F Land Protection Plan (LPP) Maps (see Exhibit 15 (e15343fw5.pdf)). Various sized maps in an LPP document. We use these maps to inform the public about the lands proposed for acquisition. We identify the subject lands with tract boundaries and numbers. Not all maps in an LPP must meet the specifications in section 4.5. Maps that are part of an LPP document don't need to have all required map elements if the document already includes those elements (FWS title bar, seals, map title included in the Figure Name, etc.). Standalone maps (versions outside of documents) must have all required elements.

4.8.G Land Protection Strategy (LPS) Maps (see Exhibit 16 (e16343fw5.pdf)). An "A" or "B" size map in an LPS document depicting the study area with vicinity maps identifying the location of the proposal in the context of the larger landscape including the project's contribution to the conservation estate. Not all maps in an LPS must meet the specifications in section 4.5. Maps that are part of an LPS document don't need to have all required map elements if the document already includes those elements (FWS title bar, seals, map title included in the Figure Name, etc.). Standalone maps (versions outside of documents) must have all required elements.

4.8.H Location Map. (see Exhibit 17 (e17343fw5.pdf)). A small scale map, usually shown in the form of an inset depicting the location of the subject area within a state(s). See section 4.5 for more information.

4.8.I Ownership Map (see Exhibit 18 (e18343fw5.pdf)). A "C" or larger size map depicting inholdings (i.e., lands within the approved acquisition boundary for which we have yet to acquire an interest) that may be identified by tract boundary and tract number in addition to all the information found on a status map. Ownership maps sometimes include information that may be confidential and not suitable for disclosure to the public.

4.8.J Recreational Access Acquisition Map (see Exhibit 19 (e19343fw5.pdf)). An "A" size map depicting possible acquisitions to achieve recreational access. Colors and symbols follow the same structure as the Emergencies/Inholdings maps and are clarified by a memorandum that Headquarters annually distributes at the beginning of each project cycle.

4.8.K Transfer Map (see Exhibit 20 (e20343fw5.pdf)) An "A" or larger size map depicting lands that we are proposing for transfer or that are being transferred to or from the Service and another Federal agency.

4.8.L Vicinity Map (see Exhibit 21 (e21343fw5.pdf)). A small scale map usually shown in the form of an inset depicting the subject area with reference to state, county, city, and other prominent features as appropriate. See section 4.5 for more information.

4.8.M Water Rights Map (see Exhibit 22 (e22343fw5.pdf)). A "C" or larger size map depicting existing water rights or water rights application information.

4.8.N Wild and Scenic River Map (see Exhibit 23 (e23343fw5.pdf)). An "A" or larger size map of a river or river corridor within a unit of the NWRS that is part of the National Wild and Scenic River System.

4.8.O Other Maps. Other maps are required for special projects and purposes. The size, scale, format, and content of these maps will vary. However, we should use the specifications of the various map elements described in this chapter when appropriate.

Chapter 5 – Cadastral GIS

5.1 What is the purpose of this chapter in the handbook?
This chapter provides documentation and guidance to FWS Realty Cartographers, Geographic Information System (GIS) specialists, and others who will be using the cadastral geodatabase for mapping, data analysis, data maintenance, and various queries.

Keeping the cadastral data current and as accurate as possible is a major undertaking. The bulk of the responsibility occurs at the Regional level. Each Regional Realty office has a Regional Realty Cartographer as the lead assigned to update their Regional FWSCadastral data and roll up the data to the national container. The Chief Cartographer is the data steward for the national FWSCadastral geodatabase and publishes the data internally and externally. The national Information Resources and Technology Management (IRTM) GIS database manager provides essential services in design, management, roll-up, and publication of the data.

5.2 What are the objectives of this chapter? Our objectives are to:

- Document to the fullest degree possible the technical and data architecture of the FWSCadastral geodatabase, including the feature classes, fields, domains, subtypes, and topological relationships; and
- Provide a guide to editing, maintaining, publishing, and using the geodatabase.

5.3 What is the FWSCadastral geodatabase? The FWSCadastral geodatabase is a product of the Cadastral Data Working Group (CDWG). The CDWG is comprised of Regional Realty Cartographers, the Chief Cartographer, GIS specialists, and IRTM specialists from all Regions who work together to create, manage, and update the geospatial database, aka "geodatabase," to store data for the Service's land and water real property interests. The FWSCadastral geodatabase contains the boundary and parcel information to support all aspects of NWRS management. The data can be used to answer boundary and land status queries on any scale.

Cadastral data describes the past, current, and future right, title, and interest in real property, including the spatial information necessary to describe the geographic extent. The geodatabase, a data storage framework developed by ESRI, can store attribute tables, geographic features, satellite and aerial imagery, surface modeling data, and survey measurements.

5.4 Why is the FWSInterest feature class a National Geospatial Data Asset? The FWSInterest feature class in the FWSCadastral geodatabase is registered as a National Geospatial Data Asset Dataset under the Office of Management and Budget's (OMB) Circular A-16, Coordination of Geographic Information and Related Spatial Data Activities. The Chief Cartographer is the dataset manager for FWSInterest. The cadastre theme lead is the Lead Surveyor for the Bureau of Land Management (BLM).

5.5 What are the FWSCadastral geodatabase data format requirements?

5.5.A What is the spatial reference of the FWSCadastral geodatabase?
Coordinate System: Geographic Coordinate System (GCS)
Projection: Not projected. The GCS is a non-projected spherical coordinate system that locates points on the surface of a reference ellipsoid, a wireframe approximation of the earth at sea level. Each point has a latitude and longitude coordinate value.
Unit: Decimal degrees
Datum: North American Datum of 1983 (NAD83)
Spheroid: Geodetic Reference System 1980 (GRS80)

5.5.B How is data edited and acres calculated in a projected space?
Because the spatial reference of the FWSCadastral geodatabase is GCS/NAD83, a non-projected coordinate system, cartographers must first apply a projection to the data to accurately make edits and also to calculate acreage which is stored in the GISACRES field of all feature classes. Projections can be defined as a property of the ArcGIS map frame, and its parameters are automatically incorporated into the many functions of the application. Cartographers generally use standard coordinate systems such as UTM and State Plane, but occasionally use systems developed by various state agencies for the purpose of high precision mapping in specific areas. Occasionally, cartographers must define custom projection parameters that facilitate reliable calculations and reduce planar distortion on maps. It is the cartographer's responsibility to select the most appropriate projection and coordinate system that provide the best and most accurate result.

5.5.C What native GIS file format is used?
Each Regional office is responsible for maintaining the spatial features present in the FWSBoundary feature dataset for their jurisdictional area. The FWSBoundary feature dataset contains feature classes, described below, which share the same geometry, attributes, and spatial reference. The Regions store and maintain their data in a proprietary ESRI spatial database structure called the Spatial Database Engine (SDE), a component of ArcGIS for Server. SDE uses a Relational Database Management System (RDBMS) to store spatial data.

The FWSCadastral geodatabase contains the FWSBoundary feature dataset, consisting of the 13 feature classes described in section 5.6 below. The data is published in both geodatabase and shapefile format, the latter of which satisfies open data requirements.

5.6 What are the data structure and standards?

5.6.A What is the FWSCadastral data model and structure?
The purpose of the FWSCadastral data model is to integrate boundary data between the Regions and provide a single, consistent land ownership layer on a national scale. The feature classes are representative of the different business processes of the Realty program and are specifically designed for use in national applications or to function independently in field-based GIS projects.

There are 13 feature classes in the FWSBoundary feature data set**.** Seven are required, three are optional, and three are derived from the required data layers. The required feature classes represent the core data that each Region must maintain and use to publish standard cartographic products. The required feature classes are combined nationally and shared with other agencies and partners and directly support land acquisition, management, and conservation planning efforts on a daily basis. The optional feature classes are considered 'value added' features intended to improve the accuracy and depth of the cadastral data as time and funding become available for their development. In the short term, the optional feature classes are not combined between Regions, but instead exist as a container for storing information as the data is developed on a Regional and national scale.

5.6.B What are the required feature classes?

5.6.B.1 FWSApproved - Areas approved for acquisition by FWS

5.6.B.2 FWSInterest - Tracts owned, managed, or approved for acquisition by FWS

5.6.B.3 FWSEncumbrance – Outgrant permits issued by the Realty program

5.6.B.4 MBCCBoundary – Boundaries approved by the Migratory Bird Conservation Commission

5.6.B.5 National Monuments – Boundaries of the terrestrial and marine national monuments

5.6.B.6 SpecialDesignation - Boundaries that contain federally recognized designations

5.6.B.7 Wilderness – Boundaries of designated wilderness, proposed wilderness, and wilderness study areas

5.6.C What are the optional feature classes?

5.6.C.1 AcqApproval - Establishing/expansion authorities

5.6.C.2 SurveyMonument - Inventory of survey monuments

5.6.C.3 TractBoundary - Linear feature attributes of tract boundaries

5.6.D What are the derived feature classes?

The derived feature classes are created after the national roll-up takes place. They are simplifications of the national data where features with equivalent attributes are merged or which create single geographic points of reference. They make some analytic and cartographic processes easier.

5.6.D.1 FWSInterestSimplified – The FWSInterest feature class, showing all acquired lands (Status=0), merged by IntType1

5.6.D.2 FWSInterestSimplifiedMerged – The FWSInterest feature class, showing all acquired lands (Status=0), merged regardless of Interest type

5.6.D.3 NWRSLocationPoint – A single point per field station that the Natural Resource Program Center can use to link to ServCat records

5.6.E What are the standard data fields for all feature classes?

The FWSCadastral data model is a Regionally-based data repository combined into a national system. Redundant data fields are necessary to preserve adequate levels of

detail within the feature classes for different analytical purposes as well as to retain coded descriptions for exporting into other formats such as shapefiles. Currently, there are eight standard fields that occur in all of the feature classes. These help group the data at different levels and provide foreign keys to other systems and tables.

5.6.E.1. Name: CMPXNAME
Alias: Complex Name
Type: String
Length: 85
Definition: National Wildlife Refuge Complex name

5.6.E.2. Name: ORGNAME
Alias: Organization Name
Type: String
Length: 75
Definition: Official name of the facility
Source: USFWS Corporate Master Table
Domain: OrgName

5.6.E.3. Name: ORGCODE
Alias: Organization Code
Type: Long Integer
Precision: 0
Definition: USFWS 5 character numeric organizational code assigned to facility
Source: USFWS Corporate Master Table
Domain: OrgCode

5.6.E.4. Name: IFWS
Alias: IFWS
Type: String
Length: 10
Definition: Alpha numeric identifier used in LRS and assigned by Realty
Source: USFWS LRS

5.6.E.5. Name: LIT
Alias: Station Literal
Type: String
Length: 3
Definition: Three letter literal used in LRS and assigned by Realty
Source: USFWS Corporate Master Table
Domain: Lit

5.6.E.6. Name: COMMENTS
Alias: Comments
Type: String

Length: 100
Definition: General comments related to the mapped feature that might be of interest

5.6.E.7. Name: RSL_TYPE
Alias: RSL Type
Type: String
Length: 8
Definition: Facility type based on ORGTYPE in Corporate Master Table
Domain: RslType

5.6.E.8. Name: FWSREGION
Alias: FWS Region
Type: String
Length: 1
Definition: FWS Region number
Domain: FwsReg

5.7 What are the FWSCadastral geodatabase feature class descriptions?
The FWSCadastral geodatabase's FWSBoundary feature data set contains feature classes that represent boundaries and point features that are mapped and maintained by the Realty cartography program.

5.7.A FWSApproved Feature Class
The FWSApproved feature class contains approved acquisition boundaries for refuges and other facilities we administer. Approved acquisition boundaries represent the extent of lands authorized for purchase by the Government for inclusion in the NWRS.

Feature Class Name: FWSApproved
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 5 additional fields, which are listed below.

Name: GISACRES
Alias: GIS Acre
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0

Definition: Acres described in deed or other official documents.

Name: MAXACRES
Alias: Maximum Acres
Type: Double
Precision: 0
Scale: 0
Definition: The maximum amount of acres that are authorized for acquisition.

Name: APPTYPE
Alias: Approval Type
Type: Short Integer
Precision: 0
Definition: Defines an approval area as either 'Limited' for facilities with acreage caps or 'Inclusive' for areas where all the lands within the boundary are authorized for acquisition.
Subtype: The value of 0 = Inclusive (Default) and 1 = Limited

Name: COMMENTS
Alias: Comments
Type: String
Length: 100
Definition: General comments related to the mapped feature that might be of interest.

5.7.B FWSInterest Feature Class
The FWSInterest feature class contains polygons representing tracts of land (parcels) we administer as refuges, hatcheries, FWS administrative sites, and other conservation areas.

Feature Class Name: FWSInterest
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 14 additional fields, which are listed below.

Name: DIVNAME
Alias: Division Name
Type: String
Length: 85
Definition: Name of official refuge division.

Name: UNITNAME
Alias: Unit Name
Type: String
Length: 75

Definition: Name of refuge administrative unit.

Name: SUBUNA
Alias: Sub-unit Name
Type: String
Length: 50
Definition: Name of refuge administrative/management unit.

Name: MGMTCODE
Alias: Management Code
Type: Long Integer
Precision: 0
Definition: Organization code of managing station (for facilities without an orgcode).
Source: USFWS Corporate Master Table

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official documents.

Name: SURACRES
Alias: Survey Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres from cadastral survey records.

Name: STATUS
Alias: Status Code
Type: Short Integer
Precision: 0
Definition: Defines a tract as either being acquired or an inholding (not acquired).
Subtype: The value of 0 = 'Acquired' (default) and 1 = 'Inholding'

Name: INTTYPE1
Alias: Primary Interest Type

Type: String
Length: 1
Definition: Alpha code for interest type (rights) held by FWS.
Domain: IntCode1

Name: INTTYPE2
Alias: Secondary Interest Type
Type: String
Length: 3
Definition: Alpha code for easement type or less-than-fee rights held by FWS.
Domain: IntCode2

Name: TRACTNO
Alias: Tract Number
Type: String
Length: 15
Definition: FWS tract number as recorded in LRS.

Name: INTIDNO
Alias: Interest ID Number
Type: String
Length: 25
Definition: Unique ID used as a foreign key for joining to the LRS.

Name: RELICODE
Alias: Reliability Code
Type: String
Length: 2
Definition: Reliability codes of the tract lines
Domain: RelCodes

Name: LM_View
Alias: LandsMapper View
Type: Text
Length: 5
Definition: Whether the parcel appears in LandsMapper Lite.

5.7.C FWSEncumbrance Feature Class

The FWSEncumbrance feature class contains polygon features representing areas where the Realty program has issued an outgrant. Outgrant boundaries reflect uses that will encumber fee lands by granting a right to use them for short-term or long-term purposes. Examples of outgrants include easements, rights-of-way, Colonial Ordinances, and areas with permitted uses or special permitted uses.

Feature Class Name: FWSEncumbrance
Topology Type: Polygon

Data Fields:
Data fields 1-8 are standard fields and are listed above
This feature class has 10 additional fields, which are listed below.

Name: DIVNAME
Alias: Division Name
Type: String
Length: 85
Definition: Name of official refuge division.

Name: UNITNAME
Alias: Unit Name
Type: String
Length: 75
Definition: Name of refuge administrative unit.

Name: SUBUNA
Alias: Sub-unit Name
Type: String
Length: 50
Definition: Name of refuge administrative/management unit.

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official documents.

Name: SURACRES
Alias: Survey Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres from cadastral survey records.

Name: ENCBTYPE
Alias: Encumbrance Type
Type: String

Length: 5
Definition: Type of permit issued (road, electrical, telecom).
Domain: IntType2

Name: ISUDATE
Alias: Permit Issue Date
Type: Date
Definition: Date the permit was issued by Realty.

Name: EXPDATE
Alias: Permit Expiration Date
Type: Date
Definition: Date of permit expiration.

Name: ENCIDNO
Alias: Encumbrance ID Number
Type: String
Length: 25
Definition: Unique ID used as a foreign key for joining to the LRS.

5.7.D MBCC Boundary Feature Class

The MBCC Boundary feature class contains polygon features that have been placed on the lands and waters we administer in North America. These boundaries are approved by the MBCC.

Feature Class Name: MBCCBoundary
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 4 additional fields, which are listed below.

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official documents.

Name: ORIG_BND_DATE Original (First) Boundary Date

Alias: Created Date
Type: Date
Definition: This field identifies when the original feature was created.

Name: CURR_BND_DATE Current (Last) Boundary Date
Alias: Created Date
Type: Date
Definition: This field identifies when the most recent MBCC feature was created.

5.7.E. National Monuments Feature Class

The National Monuments feature class contains polygon features representing areas within the boundaries of refuges and hatcheries that have national monuments, including marine national monuments.

Feature Class Name: NationalMonuments
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 6 additional fields, which are listed below.

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official documents.

Name: DOCNUM
Alias: Document Number
Type: Text
Length: 25
Definition: Textual description of the law or order creating the designation.

Name: DESNAME
Alias: Designation Name
Type: Text
Length: 85
Definition: Official name of the designated area.

Name: NMDESTYPE
Alias: Designation Type
Type: Text
Length: 50
Definition: The type of National Monument (Terrestrial, Marine)

Name: DESDATE
Alias: Designation Date
Type: Date
Definition: Date of designation.

5.7.F. AcqApproval Feature Class

The AcqApproval feature class contains polygon features representing different areas of expansion within an approved acquisition boundary since the initial establishment of the refuge.

Feature Class Name: AcqApproval
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 4 additional fields, which are listed below.

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official doc.

Name: AUTHTYPE
Alias: Authorization Type
Type: Text
Length: 2
Definition: The type of authority approving the expansion area.
Domain: ApprType

Name: DATEAPPR
Alias: Approval Date
Type: Date

Definition: Date of expansion approval.

5.7.G TractBoundary Feature Class

The TractBoundary feature class contains line features representing attributes of the adjacent tract polygon as well as data quality information regarding the reliability of tract boundaries.

Feature Class Name: TractBoundary
Topology Type: Line
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 2 additional fields, which are listed below.

Name: INTLCODE
Alias: Interest Line Codes
Type: Text
Length: 2
Definition: Two character abbreviations for tract polygon interest types.
Domain: LinCodes

Name: RELICODE
Alias: Reliability Codes
Type: Text
Length: 2
Definition: Reliability codes defining the lineage and accuracy of the tract boundaries.
Domain: RelCodes

5.7.H SurveyMonument Feature Class

The SurveyMonument feature class contains point features that serve as an inventory of cadastral survey monuments in and around refuges, hatcheries, and other FWS-administered facilities.

Feature Class Name: SurveyMonument
Topology Type: Point
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 10 additional fields, which are listed below.

Name: DESIGNAT
Alias: Designation
Type: Text
Length: 50
Definition: The name of the monument.

Name: TYPE

Alias: Type
Type: Text
Length: 50
Definition: The type of monument (calculated, established, etc.).
Domain: MonType

Name: DESCRIPT
Alias: Description
Type: Text
Length: 255
Definition: Textual description of the monument (PLSS corner, 3D, etc.).

Name: LOCATION
Alias: Location
Type: Text
Length: 255
Definition: Description of the monument's location.

Name: SETBY
Alias: Set By
Type: Text
Length: 30
Definition: The agency that set the monument.
Domain: SetMon

Name: SETYEAR
Alias: Set Year
Type: Text
Length: 10
Definition: The year the monument was set.

Name: YEARFND
Alias: Year Found
Type: Text
Length: 10
Definition: The year the monument was found.

Name: CONDITN
Alias: Condition
Type: Text
Length: 15
Definition: Condition of the monument.
Domain: MonCond

Name: PROBLEM
Alias: Problem

Type: Text
Length: 5
Definition: Yes or no, problem with the monument (damaged, moved, etc.).
Domain: MonPyn

Name: PROBDESC
Alias: Problem Description
Type: Text
Length: 255
Definition: Description of the problem with the monument.

5.7.l SpecialDesignation Feature Class

The SpecialDesignation feature class contains polygon features representing areas within the boundaries of refuges and hatcheries that contain federally recognized special designations; such as Research Natural Areas and Wild & Scenic River corridors, etc.

Feature Class Name: SpecialDesignation
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 7 additional fields, which are listed below.

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official documents.

Name: DOCNUM
Alias: Document Number
Type: Text
Length: 25
Definition: Textual description of the law or order creating the designation.

Name: DESNAME
Alias: Designation Name
Type: Text

Length: 85
Definition: Official name of the designated area.

Name: DESTYPE
Alias: Designation Type
Type: Text
Length: 50
Definition: The type of designation (Research Natural Area, Wild and Scenic River, etc.)

Name: DESDATE
Alias: Designation Date
Type: Date
Definition: Date of designation.

Name: REACHMIL
Alias: Reach Miles
Type: Long Integer
Precision: 0
Definition: Miles of stream reach included in the designation (if applicable).

5.7.J Wilderness Feature Class

The Wilderness feature class contains polygon features representing areas within the boundaries of refuges and hatcheries that contain designated wilderness boundaries, proposed wilderness boundaries, and wilderness study areas.

Feature Class Name: Wilderness
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 6 additional fields, which are listed below.

Name: GISACRES
Alias: GIS Acres
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated in acres by GIS.

Name: DOCACRES
Alias: Document Acres
Type: Double
Precision: 0
Scale: 0
Definition: Acres described in deed or other official documents.

Name: DOCNUM
Alias: Document Number
Type: Text
Length: 25
Definition: Textual description of the law or order creating the designation.

Name: DESNAME
Alias: Designation Name
Type: Text
Length: 85
Definition: Official name of the designated area.

Name: NMDESTYPE
Alias: Designation Type
Type: Text
Length: 50
Definition: The type of designation (Wilderness Area, National Monument, etc.).

Name: DESDATE
Alias: Designation Date
Type: Date
Definition: Date of designation.

5.7.K FWSInterest_Simplified Feature Class

The FWSInterest_Simplifed feature class contains the records from the FWSInterest feature class, merged by IntType1.

Feature Class Name: FWSInterest_Simplified
Topology Type: Polygon
Data Fields: Data fields 1-8 are standard fields and are listed above.
This feature class has 8 additional fields, which are listed below.

Name: DIVNAME
Alias: Division Name
Type: String
Length: 85
Definition: Name of official refuge division.

Name: UNITNAME
Alias: Unit Name
Type: String
Length: 75
Definition: Name of refuge administrative unit.

Name: MGMTCODE
Alias: Management Code

Type: Long Integer
Precision: 0
Definition: Organization code of managing station (for facilities without an orgcode).
Source: USFWS Corporate Master Table

Name: STATUS
Alias: Status Code
Type: Short Integer
Precision: 0
Definition: Defines a tract as either being acquired or an inholding (not acquired).
Subtype: The value of 0 = 'Acquired' (default)

Name: INTTYPE1
Alias: Primary Interest Type
Type: String
Length: 1
Definition: Alpha code for interest type (rights) held by FWS.
Domain: IntCode1

Name: INTTYPE2
Alias: Secondary Interest Type
Type: String
Length: 3
Definition: Alpha code for easement type or less-than-fee rights held by FWS.
Domain: IntCode2

Name: LM_View
Alias: LandsMapper View
Type: Text
Length: 5
Definition: Whether the parcel appears in LandsMapper Lite.

Name: Sum_GISACRES
Alias: SUM_GISACRES
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated by adding the GIS acres from the merged features.

5.7.L FWSInterest_SimplifiedMerged Feature Class
The FWSInterest_SimplifedMerged feature class contains the records from the FWSInterest feature class, merged by Status=0(acquired). The feature class is requested by the Natural Resource Program Center for analysis of all acquired lands.

Feature Class Name: FWSInterest_SimplifiedMerged
Topology Type: Polygon
Data Fields:
Data fields 1-8 are standard fields and are listed above.
This feature class has 6 additional fields, which are listed below.

Name: DIVNAME
Alias: Division Name
Type: String
Length: 85
Definition: Name of official refuge division.

Name: UNITNAME
Alias: Unit Name
Type: String
Length: 75
Definition: Name of refuge administrative unit.

Name: MGMTCODE
Alias: Management Code
Type: Long Integer
Precision: 0
Definition: Organization code of managing station (for facilities without an orgcode).
Source: USFWS Corporate Master Table

Name: STATUS
Alias: Status Code
Type: Short Integer
Precision: 0
Definition: Defines a tract as either being acquired or an inholding (not acquired).
Subtype: The value of 0 = 'Acquired'

Name: LM_View
Alias: LandsMapper View
Type: Text
Length: 5
Definition: Whether the parcel appears in LandsMapper Lite.

Name: Sum_GISACRES
Alias: SUM_GISACRES
Type: Double
Precision: 0
Scale: 0
Definition: Polygon area calculated by adding the GIS acres from the merged features.

5.7.M NWRSLocationPoint

The NWRSLocationPoint feature class contains a point feature for each field station, with the point placed on the acquired lands. The feature class is requested by the Natural Resource Program Center to create links to other data records.

Feature Class Name: NWRSLocationPoint
Topology Type: Point
Data Fields: Data fields 1-8 are standard fields and are listed above.
No other fields are included in the feature class.

5.8 What are domain names?

5.8.A What is a domain?

Basically, a domain is a list of acceptable values in an attribute field. Using domains helps ensure data integrity by limiting the choice of values for a particular field.

5.8.B How are domains values updated?

Few if any domain values are added throughout the year. The Chief Cartographer keeps a spreadsheet on the CDWG google drive folder located at https://sites.google.com/a/fws.gov/cartography/ to capture changes, such as refuge name changes, new LIT or IFWS codes, or other codes not anticipated. The values will be added to the national database and loaded to the Regional children databases during reconciliation.

5.8.C What domains are used in the FWSCadastral geodatabase?

5.8.C.1 Domain name: ApprType

Domain description: Acquisition Authority Description
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
CL   Congressional Legislation
EO   Executive Order
FD   FWS Director
MB   MBCC
OT   Other
PL   Public Law
PO   Public Land Order
PR   Proclamation
SO   Secretarial Order

5.9.C.2 Domain name: FwsReg
Domain description: List of Regions
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
1   Pacific
2   Southwest
3   Midwest
4   Southeast
5   Northeast
6   Mountain-Prairie
7   Alaska
8   Pacific Southwest

5.8.C.3 Domain name: IntCode1
Domain description: Primary Interest Codes
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
A   Agreement
E   Easement
N   None
O   Fee
P   Partial Interest
R   Lease
S   Secondary
T   Permit
U   Unknown

5.8.C.4 Domain name: IntCode2
Domain description: Secondary Interest Codes
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
A   Agriculture
C   Conservation
CO   Colonial Ordinance
D   Ditch
E   Electrical Power Transmission Line
ET   Electrical & Telephone

F	Flowage
FX	Flowage & Wetland
G	Grassland
GU	All Minerals (includes gas & oil)
GX	Grassland/Wetland Easement
H	Occupancy
L	Levee, Dike, or Jetty
LF	Life Use Reservation
M	Miscellaneous
MA	Memorandum of Agreement
MU	Memorandum of Understanding
N/A	Not Applicable
O	Other
P	Pipeline
R	Road
T	Telephone or Telegraph
TR	Transfer
U	Underground Materials
W	Water
WD	Withdrawal
X	Wetland
XL	Land in exchange for FWS receiving title to land
XT	Timber in exchange for FWS receiving title to land
17B	Easement across native owned land

5.8.C.5 Domain name: LinCodes
Domain description: Interest Codes for Tract Lines
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description

E	Easement/Easement
EA	Easement/Approved Acquisition Boundary
EL	Easement/Life Estate
EM	Easement/Agreement
EN	Easement/Inholding
EP	Easement/Partial Interest
ER	Easement/Lease
ES	Easement/Secondary
EU	Easement/Uncertain
L	Life Estate/Life Estate
LA	Life Estate/Approved Acquisition Boundary
LM	Life Estate/Agreement
LN	Life Estate/Inholding
LP	Life Estate/Partial Interest

LR   Life Estate/Lease
LS   Life Estate/Secondary
LU   Life Estate/Uncertain
M   Agreement/Agreement
MA   Agreement/Approved Acquisition Boundary
MN   Agreement/Inholding
MU   Agreement/Uncertain
O   Owned/Owned
OA   Owned/Approved Acquisition Boundary
OE   Owned/Easement
OL   Owned/Life Estate
OM   Owned/Agreement
ON   Owned/Inholding
OP   Owned/Partial Interest
OR   Owned/Lease
OS   Owned/Secondary
OU   Owned/Uncertain
P   Partial Interest/Partial Interest
PA   Partial Interest/Approved Acquisition Boundary
PM   Partial Interest/Agreement
PN   Partial Interest/Inholding
PS   Partial Interest/Secondary
PU   Partial Interest/Uncertain
R   Lease/Lease
RA   Lease/Approved Acquisition Boundary
RM   Lease/Agreement
RN   Lease/Inholding
RP   Lease/Partial Interest
RS   Lease/Secondary
RU   Lease/Uncertain
S   Secondary/Secondary
SA   Secondary/Approved Acquisition Boundary
SM   Secondary/Agreement
SN   Secondary/Inholding
SU   Secondary/Uncertain
U   Uncertain/Uncertain
UA   Uncertain/Approved Acquisition Boundary
UN   Uncertain/Inholding

5.8.C.6 Domain name: Lit
Domain description: Three Letter Literals
Field type: Text (https://www.fws.gov/stand/standards/de_literals_WWW.html)
Domain type: Coded values
Merge policy: Default values

5.8.C.7 Domain name: MonCond
Domain description: Survey Monument Conditions
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
Bad
Fair
Good
Missing
N/A

5.8.C.8 Domain name: MonPyn
Domain description: Survey Monument Problem (Yes/No)
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
No
Yes

5.8.C.9 Domain name: MonType
Domain description: Survey Monument Type
Field type: Text
Domain type: Coded values
Default values

Coded Value Description
Monumented
Survey Evidence
Calculated
Possession Evidence

5.8.C.10 Domain name: OrgCode
Domain description: Organization Codes
Field type: Text
Domain type: Coded values
Merge policy: Default values
Source: The FWS Corporate Master Table: https://intranet.fws.gov/cmt/index.cfm

5.8.C.11 Domain name: OrgName
Domain description: Official Organization Names
Field type: Text
Domain type: Coded values

Merge policy: Default values
Source: The FWS Corporate Master Table: https://intranet.fws.gov/cmt/index.cfm

5.8.C.12 Domain name: RelCodes

Domain description: Tract Line Reliability Codes
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
P1   Primary Reliability; geometry extracted from an FWS survey or FWS contracted survey; referencing a standard coordinate system/datum; accepted by the Regional Land Surveyor
P2   Primary Reliability; geometry extracted from an FWS survey or FWS contracted survey; referencing an unknown or local coordinate system/datum; accepted by the Regional Land Surveyor; moved and rotated into a standard coordinate system using the best available control source
P3   Primary Reliability; geometry created by a qualified technician from an FWS report of survey, legal description, or survey notes; closes within an acceptable tolerance; moved and rotated into a standard coordinate system using the best available control source
S1   Secondary Reliability; geometry extracted directly from the Geographic Coordinate Database (GCBD)
S2   Secondary Reliability; geometry extracted from USGS digital line graphs (1:24,000, DLG)
S3   Secondary Reliability; geometry digitized from digital ortho-photography (1:24,000 or larger)
S4   Secondary Reliability; geometry digitized from USGS digital raster graphics (7.5 minute series DRG)
S5   Secondary Reliability; geometry digitized from existing FWS status maps
S6   Secondary Reliability; geometry digitized from General Land Office (GLO) plats
S7   Secondary Reliability; geometry digitized/extracted from other sources such as county tax lot data or maps, other agency status maps, etc., with unknown spatial accuracy
U   Unknown

5.8.C.13 Domain name: RslType

Domain description: Facility Type
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value Description
AS   Administrative Site
CA   Conservation Area
COORD   Coordination Area

FR	Fisheries Research Station
FSA	Farm Service Agency Transfer Parcel
FTC	Fish Technology Center
NFH	National Fish Hatchery
NM	National Monument
NWR	National Wildlife Refuge
WMA	Wildlife Management Area
WMD	Wetland Management District
WPA	Waterfowl Production Area
WRC	Wildlife Research Center

5.8.C.14 Domain name: SetMon

Domain description: Monument Establisher
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value	Description
BLM	BLM Surveyor
City	City Surveyor
County	County Surveyor
FWS	US Fish & Wildlife Service
GLO	General Land Office
OFED	Other Federal Surveyor
Private	Private Surveyor
State	State Agency Surveyor
WDNR	Washington Dept. of Natural Resources

5.8.C.15 Domain name: YesNo

Domain description: BinaryData
Field type: Text
Domain type: Coded values
Merge policy: Default values

Coded Value	Description
No	
Yes	

5.9 How does roll-up of the Regional data to the national container work? When the Regions have populated their portion of the cadastral geodatabase, we can begin to combine all of the Regional data into a national dataset. We call this a "roll-up."

The Chief Cartographer maintains roll-up guidance and includes instructions on accessing the datasets hosted in Denver, updating the metadata, publishing to ServCat, updating web services, and publishing to data.gov.

5.9.A What is the roll-up schedule?

The roll-ups take place three times a year. The target dates are:

1. The last Wednesday in March.
2. The last Wednesday in July.
3. The Wednesday that falls on the week before Thanksgiving in November. This roll-up is performed after the "end-of-fiscal year review of the LRS and cadastral geodatabase" (see below). The November roll-up is considered the end of fiscal year roll-up and we use it to provide a yearly update to external organizations (see the "Publication" section below.)

5.9.B What is the roll-up process?

The roll-up process is primarily coordinated between the Headquarters IRTM GIS database specialist and the Regional Realty Cartographers. Each Regional Realty Cartographer emails the IRTM GIS database specialist and the Chief Cartographer when the roll-up is complete. The Chief Cartographer tracks roll-up status.

When the Regions complete their roll-ups, the IRTM GIS database specialist processes the data into one national database container on the staging server. The Regional Realty Cartographers and the Chief Cartographer review the consolidated data. The IRTM GIS database specialist moves the consolidated data to the publishing server when all parties are satisfied and the Chief Cartographer approves it.

5.9.C How is the metadata updated?

The metadata for data layers published both internally and externally is updated after the national roll-up. The Chief Cartographer is responsible for updating the metadata. The metadata meets the Federal Geographic Data Committee's (FGDC) requirements necessary for publication on data.gov. In most circumstances, the edits include updating any date fields (publication date, next expected update, etc.) and verifying contact information. In addition to being embedded in the geodatabase or accompanying a shapefile, metadata for each feature class is exported as an .xml (Extensible Markup Language) file and loaded into ServCat independent of the geospatial data. The .xml file is automatically loaded into a Web Accessible Folder (WAF) that is registered with data.gov. Data.gov harvests records stored in the WAF, creating a data.gov record with links to the FWSCadastral geodatabase and shapefiles stored in ServCat.

The Chief Cartographer maintains roll-up guidance, including instructions on accessing the datasets hosted in Denver, updating the metadata, publishing to ServCat, updating web services, and publishing to data.gov.

5.10 How is the FWSCadastral geodatabase published?
The Service publishes the FWSCadastral geodatabase for internal and external users. The data layers are published as web services and downloadable data, in both geodatabase and shapefile format.

5.10.A Publication of Internal and External Data Sets

There are two versions published of the FWSInterest feature class, one for internal use and one for external use. By default, all data is visible in both versions. Records with the field LM_View = N are not shown in the external facing data. This is a conscious choice the Regions make in situations where the record may be an inholding placeholder, be unnecessarily confusing, or create a public safety issue.

The Chief Cartographer emails the CDWG when each data roll-up is available in ServCat.

5.10.B Publication as Web Services

The FWSCadastral geodatabase FWSInterest feature class is published as a web service at: https://gis.fws.gov/arcgis/rest/services/FWSCadastral_Internet/MapServer. Additional layers may be published on ArcGIS Online and FWSInsideMaps.

5.10.C Publication to ServCat

The Chief Cartographer loads the FWSCadastral geodatabase containing all feature classes and individual GIS shapefiles into ServCat after each roll-up cycle. All internal feature classes are published in geodatabase format. All external facing data is published in geodatabase, shapefile, and KML format. Shapefiles and KML files are created to meet open data standard requirements.

5.10.D Publication to Data.gov

FWSCadastral datasets that are stored in ServCat with lifecycle = "active" and visibility = "public" have their metadata published into a WAF that is harvested by data.gov. Once harvested, the public can find the FWSCadastral data layers to download on data.gov. This is the link: https://catalog.data.gov/dataset?q=Realty&sort=none&metadata_type=geospatial&organization=fws-gov.

5.10.E Publication to the Protected Area Database of the United States (PAD-US)

The Chief Cartographer sends the end-of-fiscal year externally facing FWSInterest Simplified GIS data to USGS to update the Protected Area Database of the United States (PAD-US). Sending USGS the GIS data satisfies agreements made with the FGDC A-16 Administrative Units Theme National Boundaries Group and the A-16 Cadastre Theme Federal Lands Working Group. The data is used, along with other Federal agency submissions, to create a fabric of protected Federal lands and is joined with state, regional, local, and not-for-profit data to create a national layer of protected lands. The PAD-US data is a foundational layer that can be used in landscape design and land use planning. The website is: https://gapanalysis.usgs.gov/padus/

5.10.F Publication to USGS Science Base

The Chief Cartographer publishes the end-of-fiscal year externally facing FWSInterest shapefile to USGS ScienceBase. The data is published under the U.S. Fish and Wildlife Service, National Wildlife Refuge System National Data folder. The ScienceBase record

stores the link to the downloadable dataset on ServCat, to the web service, and to the national cadastral data download page.
https://www.sciencebase.gov/catalog/folder/597224cae4b0ec1a4885eda5

5.10.G Publication to the Library of Congress

The Chief Cartographer works with the Library of Congress Geography and Map (G&M) Division to store a copy of the yearly public facing FWSCadastral geodatabase. The G&M has custody of the largest and most comprehensive cartographic collection in the world, including digital holdings.

5.10.H Publication to National Archives and Records Administration (NARA)

The Chief Cartographer works with the Service Records Officer to send the end-of-fiscal year externally facing FWSCadastral data layers to NARA. NARA prefers shapefiles to meet open data format requirements. The Chief Cartographer ensures a yearly copy of the FWSCadastral geodatabase and all associated shapefiles are sent to NARA.

5.10.I Publication to Google Maps

The Chief Cartographer publishes the end-of-fiscal year externally facing FWSInterest Simplified shapefile to the Google Base Map Partner Program. https://partnerdash.google.com/partnerdash/d/basemap or https://www.google.com/help/maps/mapcontent/basemap/. For edits to individual names or lines on Google maps, https://support.google.com/maps/answer/3094088

5.10.J Publication to Here.com

"Here" is the company that provides base maps to GIS and GPS vendors. ESRI uses their base maps, as do most in-vehicle navigation systems. The Chief Cartographer provides the end-of-fiscal year externally facing FWSInterest Simplified to Here.com to update their maps. We prefer that Here.com use the PAD-US aggregated Federal Lands layer, but we've just begun conversations with them about this preference.

5.10.K Publication to Airmap.com

Airmap provides UAV (drone) operators with airspace intelligence, including advisories, wind, and weather. The Chief Cartographer provides the end-of-fiscal year externally facing FWSInterest Simplified data, filtered to show only fee lands to Airmap.com. This supports efforts by the U.S. Department of the Interior's Office of Aviation Services.

5.11 How is quality controlled and monitoring implemented?
A critical component of managing a national geospatial data set is monitoring data quality and availability. There are both internal and external processes in place to evaluate and adjust the spatial data and attributes stored in the FWSCadastral geodatabase.

We expect that the highest quality data source will take precedence over lesser quality data. For example, we use survey quality data, when available, over resource-grade data such as PLSS-derived data and digitized status maps. When possible, the level of quality for any particular line should be included in the TractBoundary feature class using the Reliability Code field.

Each Region is responsible for quality control of the data. All checks should be made at the Regional level prior to data roll-up. The Chief Cartographer and Regional Realty Cartographers share tools and processes that assist in quality control.

5.11.A What are the required fields and attributes?
This is a listing of the fields and attributes for all feature classes that should be completed when a feature is added to the database.

5.11.A.1. FWSApproved Required Fields:
Complex Name*
Organization Name
Organization Code*
IFWS
LIT
GISAcres
Maximum Acres**
Approval Type
RSL Type
FWSRegion

* When a value exists
** Maximum Acres must be included for all Limited Acquisition boundaries

5.11.A.2. FWSInterest Required Fields:
Complex Name*
Organization Name
Division Name*
Unit Name*
Organizational Code*
Management Code
IFWS
LIT
GIS Acres
Status
IntType1*
IntType2*
TractNo
InitIDNo (concatenate IFWS & "." & TractNo)
RSLType
FWSRegion
* When a value exists

5.11.A.3. FWSEncumbrance Required Fields:
Complex Name*
Organization Name

Division Name*
Unit Name*
Organizational Code*
IFWS
LIT
GIS Acres
EncType1
Issue Date
Expiration Data
TractNo
EncbIDNo (concatenate IFWS & "." & TractNo)
RSLType
FWSRegion
* When a value exists

5.11.A.4. MBCCBoundary Required Fields:
Complex Name*
Organization Name
Division Name*
Unit Name*
Organizational Code*
Management Code
IFWS
LIT
GIS Acres
ORIG_BND_DATE
CURR_BND_DATE
RSLType
FWSRegion
* When a value exists

5.11.A.5. NationalMonuments Required Fields:
Complex Name*
Organization Name
Organization Code*
IFWS
LIT
GISAcres
DocNum
Designation Name
Designation Type
Designation Date
RSL Type
FWSRegion
* When a value exists

5.11.A.6. AcqApproval Required Fields:

Complex Name*
Organization Name
Organization Code*
IFWS
LIT
GISAcres
Authority Type
Date Approved
RSL Type
FWSRegion
* When a value exists

5.11.A.7. TractBoundary Required Fields:

Complex Name*
Organization Name
Organization Code*
IFWS
LIT
Interest Line Code
Reliability Code
RSL Type
* When a value exists

5.11.A.8. SurveyMonument Required Fields:

Complex Name*
Organization Name
Organization Code*
IFWS
LIT
Designation
Type
RSL Type
* When a value exists

5.11.A.9. SpecialDesignation Required Fields:

Complex Name*
Organization Name
Organization Code*
IFWS
LIT
DocAcres*
GISAcres
Designation Name
Designation Type
Designation Date

RSL Type
FWSRegion
* When a value exists

5.11.A.10. Wilderness Required Fields:

Complex Name*
Organization Name
Organization Code*
IFWS
LIT
GISAcres
Designation Name
Designation Type
Designation Date
RSL Type
FWSRegion
* When a value exists

5.11.A.11. FWSInterest_Simplified Required Fields:

Complex Name*
Organization Name
Division Name*
Unit Name*
Organizational Code*
Management Code
IFWS
LIT
SUM_GISACRES
Status
IntType1
IntType2*
RSLType
FWSRegion
* When a value exists

5.11.A.12. FWSInterest_SimplifiedMerged Required Fields:

Complex Name*
Organization Name
Division Name*
Unit Name*
Organizational Code*
Management Code
IFWS
LIT
SUM_GISACRES
Status

RSLType
FWSRegion
* When a value exists

5.11.A.13. NWRS Location Point Required Fields:
Complex Name*
Organization Name
Division Name*
Unit Name*
Organizational Code*
Management Code
IFWS
LIT
RSLType
FWSRegion
* When a value exists

5.11.B How is topology applied in the FWSCadastral geodatabase?

One quality control goal is for the data to conform to the topology rules in the geodatabase. Topology validation compares the data to rules that govern data behavior. Although we continue to implement the topology rules as staffing levels allow, it will take time to bring all Regions and data to 100% compliance. We recognize that differing Regional staffing levels result in varying levels of compliance initially.

Feature Class	Rule	Feature Class	Possible Exceptions
AcqApproval	Must Be Covered By	FWSApproved	
FWSInterest	Must Not Have Gaps		Always have 1 "exterior" exception; also Exclusions.
FWSInterest	Must Not Overlap		
FWSInterest	Must Be Covered By	FWSApproved	Uneconomic remnants, potential acquisitions via the 10% rule, Farm Service Agency (FSA) parcels, hatcheries
TractBoundary	Must Be Covered By Boundary Of	FWSInterest	
TractBoundary	Must Not Have Dangles		
TractBoundary	Must Not Overlap		
TractBoundary	Must Not Self-Overlap		

5.11.C How do we manage multipart polygons?

Cartographers should create multipart polygons wherever multiple, disconnected features should be a single record in the database. For example, in the FWSApproved feature class, there should only be a single record for each approved boundary.

Likewise, there should only be one record per INTIDNO (IFWS & TractNo combination). This allows us to establish a link to LRS via a unique value.

5.11.D How are FWSInterest and LRS reconciled at the end of each fiscal year?

At the end of each fiscal year, the Chief of Realty sends an instruction memo to the Regions for the "End-of-Fiscal Year Review of the Land Record System and Cadastral Geodatabase." The goal is to achieve a one-to-one match between LRS records and the GIS parcels for fee simple land acquisitions, as well as a one-to-one match between fiscal year changes to historical land records and GIS parcels. We encourage non-fee parcel reconciliation, but because some LRS easement records store multiple easements for one parcel, a one-to-one match isn't always possible. The end-of-fiscal-year cadastral roll-up from the Regions to the national dataset takes place after the reconciliation of FWSInterest and LRS.

5.11.E What is the National Geospatial Data Asset (NGDA) Lifecycle Maturity Assessment (LMA) and what is the relationship to the FWSInterest feature class?

Approximately every 2 years the Federal Geographic Data Committee (FGDC) distributes a Lifecycle Maturity Assessment (LMA) to NGDA dataset managers. The Chief Cartographer is the dataset manager for the FWSInterest data layer. He/she completes the Lifecycle Maturity Assessment and submits it after review by the Chief, Division of Realty.

Reporting on the status of each NGDA dataset is an OMB requirement, and assessing the developmental maturity of the NGDA provides managers the ability to support NGDA datasets in a more universal and transparent manner. The LMA is based on the OMB Circular A-16 seven stages of the geospatial data lifecycle, with associated benchmark activities for each stage. Each benchmark has a range of activities, from no activity to significant activity, which provide the interpretation of maturity for that benchmark. The cumulative level of activity determines the maturity of the each NGDA dataset. https://www.fgdc.gov/policyandplanning/a-16/stages-of-geospatial-data-lifecycle-a16.pdf

TABLE OF EXHIBITS

NUMBER	Exhibit Title	Exhibit File Name
1	Style Sheet	e01343fw5.pdf
2	Federal Register/Code of Federal Regulations	e02343fw5.pdf
3	Approved Acquisition Boundary Gray	e03343fw5.pdf
4	Approved Acquisition Boundary Yellow	e04343fw5.pdf
5	Land Status Map	e05343fw5.pdf
6	LWCF Briefing Book	e06343fw5.pdf
7	MBCC	e07343fw5.pdf
8	Wilderness	e08343fw5.pdf
9	Specially Legislated Area	e09343fw5.pdf
10	Categorical Exclusion (CE)	e10343fw5.pdf
11	Comprehensive Conservation Plan (CCP)	e11343fw5.pdf

12	Environmental Assessment (EA)	e12343fw5.pdf
13	Exchange	e13343fw5.pdf
14	Inholdings/Emergencies and Hardships Funding Request	e14343fw5.pdf
15	Land Protection Plan (LPP)	e15343fw5.pdf
16	Land Protection Strategy (LPS)	e16343fw5.pdf
17	Location Map	e17343fw5.pdf
18	Ownership	e18343fw5.pdf
19	Recreational Access Maps	e19343fw5.pdf
20	Transfer	e20343fw5.pdf
21	Vicinity Map	e21343fw5.pdf
22	Water Rights	e22343fw5.pdf
23	Wild and Scenic River	e23343fw5.pdf