

Implementation Plan for the FGDC Wetlands Mapping Standard Version 1.0: First Approximation

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FGDC Wetlands Subcommittee

February 4, 2010

1.0 Executive Summary

Wetlands provide some of the nation's most ecologically and economically significant habitats and provide tangible benefits to water quality, fisheries, wildlife, biodiversity, and people. To conserve these valuable resources, our nation has developed laws that regulate the dredge and fill of wetlands, provide funding for conservation of wetlands on farmlands, and foster the restoration and protection of wetlands for wildlife habitat, among others. To be able effectively implement these laws, to regulate, plan, or prioritize the restoration or protection of wetlands, you have to know where they are. Wetlands maps provide the location, type, and extent of wetlands. To provide this information to the Nation on a landscape scale, the Fish and Wildlife Service's National Wetlands Inventory program maps, works with contributing partners, and distributes standards-compliant data to the public through the Internet.

In coordination with the wetland mapping needs of multiple Federal initiatives, a group of stakeholders working together under the auspices of the Federal Geographic Data Committee (FGDC) Wetland Subcommittee, a Working Group lead by the Environmental Protection Agency (EPA), has developed a new standard to support the accurate mapping of wetlands data to permit incorporation of that data into the National Wetlands Inventory (NWI), forming the Wetlands Layer of the National Spatial Data Infrastructure (NSDI). This implementation plan is designed to be a companion document to the FGDC endorsed Wetlands Mapping Standard (Standard) and is intended to outline the development of a communications framework to (1) inform affected wetland community stakeholders, States, and Tribes, of the requirements of the Standard and advise them on how to obtain additional information on the Standard, (2) disseminate funding information for wetland mapping projects in order to accelerate the incorporation of quality, current information into the Fish and Wildlife Service's NWI geodatabase, and (3) provide outreach and training activities designed to support the implementation of the Standard.

Long-term Objectives of the Wetlands Subcommittee include:

- 1) complete digital mapping for the country in conformance with the Standard (one-half acre target mapping unit (TMU) based on one meter resolution source imagery);
- 2) keep the national database populated with current data by refreshing the maps at five-year intervals for areas of wetland change.
- 3) increase Federal funding for wetland mapping to achieve mapping update goals.

The Implementation Plan outlines actions that will be taken, which include:

- The Wetlands Subcommittee will encourage wetland mappers from various Federal, State, Tribal, and non-government organizations (NGOs) to collaborate

and share technical information, with emphasis on accomplishing the technical and strategic recommendations identified in Appendix B.

- The Wetlands Subcommittee will continue dialog and coordination with related evolving Standard activities.
- Members of the newly-formed Wetlands Mapping Consortium will continue to build its membership, cooperation, and impact on technical mapping issues.
- NWI, the Association of State Wetland Managers (ASWM), and the Wetland Mapping Consortium will expand and improve communications through their websites, including such information as building mapping cooperatives, funding opportunities, and technical issues.
- NWI, working with Wetlands Subcommittee, the Environmental Protection Agency, the ASWM, and the Consortium, will incorporate the new Standard in the development and implementation of new web-based and instructor-led training for wetlands mapping.

2.0 Introduction

Wetlands provide some of the nation's most ecologically and economically significant habitats and provide tangible benefits to water quality, fisheries, wildlife, biodiversity, and people. Several Federal agencies share regulatory responsibility for managing the nation's wetland resources under the Clean Water Act including the U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), and Fish and Wildlife Service (FWS). The Natural Resources Conservation Service has responsibility for wetlands under the Farm Bills. The National Park Service, the Bureau of Land Management, the Forest Service, and the Fish and Wildlife Service, the Department of Defense, as well as other Federal agencies, all manage the wetlands on their lands. This is also true for the States, tribes, and local governments. According to EPA estimates, approximately 25% of the wetlands of the Nation may occur on public lands (as approximately 75% of properties are privately owned, <http://www.epa.gov/OWOW/wetlands/vital/protection.html>).

Numerous Federal laws and regulations have been put in place over time to conserve U.S. wetlands. These include the Federal Duck Stamp Program in 1934, the Clean Water Act in 1972, the Food Security Act in 1985 (which denies subsidies to agricultural lands converted from wetlands after 1985), and the North American Wetlands Conservation Act (as amended in 2009). Additionally in 1989, the executive branch set a new goal of "no overall net loss" of wetlands followed in 2004 by the new goal of reaching for an "overall increase" in wetlands acreage and quality. Together, these laws and goals provide an historic mandate that has grown over time to ensure that wetlands in the U.S. are protected for generations to come.

However, one central challenge remains in meeting these regulations: How can we successfully monitor, restore and/or regulate wetlands without detailed, quality data that support our ability to inventory existing wetlands and track changes over time with

transparency and accountability? An updated NWI will of necessity be the vehicle used to support these laws and monitor changes over time.

The NWI is the most comprehensive collection of wetland information available for the U.S. The NWI is invaluable in providing quality data to support the ability to monitor several emerging conservation issues. Issues including global climate change, sea-level rise, increasing storm severity, droughts, energy development, species' decline, and water rights are driving the need for accurate geospatial resource information that reflect changes over time. The NWI data make it possible for the Environmental Protection Agency (EPA), Department of the Interior (DOI), and many other government organizations and NGOs to evaluate the condition of wetlands resources, inform planning and restoration efforts, and improve and inform the Clean Water Act Section 404 regulatory program overseen by the U.S. Army Corps of Engineers. To facilitate this work, the FWS, with support from the U.S. Geological Survey (USGS), is committed to making NWI data more current and refined as well as publicly available via the Internet.

2.1 Background

The FGDC is designated as the coordinating entity responsible for developing and implementing national strategies to advance the goals of the NSDI. As detailed in the Office of Management and Budget (OMB) Circular A-16, the NSDI “assures that spatial data from multiple sources (Federal, State, local and tribal governments, academia, and the private sector) are available and easily integrated to enhance the understanding of our physical and cultural world.” The OMB Circular A-16 Supplemental Guidance provides the foundation for a portfolio management approach to nationally significant geospatial data themes and associated data sets under the auspices of the Circular (<http://www.fgdc.gov/policyandplanning/A-16-supplemental-guidance-endorsed-dec08.pdf> ; [PDF 1.8MB]).

The FGDC Wetlands Mapping Standard specifies a core set of data quality components necessary to add wetland data to the NWI in a way that promotes data consistency and supports multiple uses of the data, and meets the requirements of the NSDI.

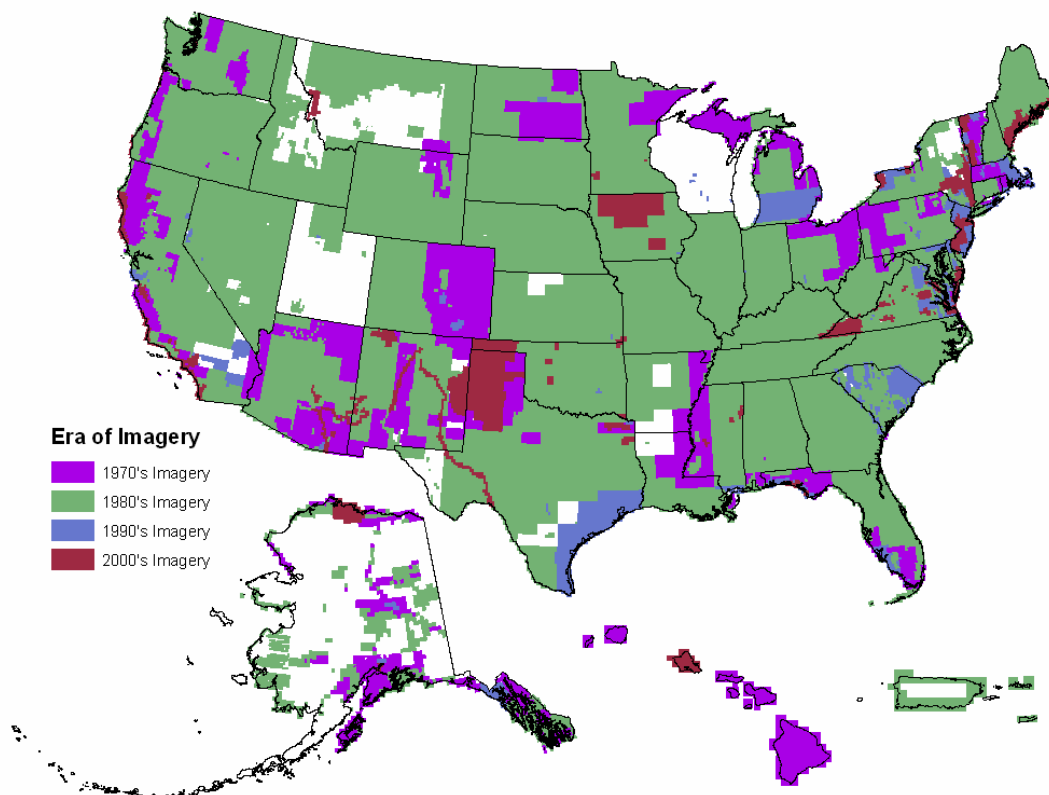
In addition to facilitating the modernization and accelerating the updating of NWI data, the Standard also supports critical decision-making processes related to:

- water resource management,
- coastal watersheds and estuaries,
- species movement in response to climate change,
- loss of coastal wetlands and sea-level changes,
- habitat conservation planning,
- nutrient management, and
- other ecosystem processes.

Conformance with the Standard is now required for all NWI wetland mapping activities that are conducted by the Federal government or by other organizations receiving Federal funds for wetland mapping. Use of the Standard for wetland inventory mapping activities that are not Federally-funded is strongly encouraged, but not required. The Standard does not apply to NWI data produced or initiated prior to the Standard's approval (July 2009). Standards-compliant wetlands data enable Federal agencies to better implement Federal laws relating to wetlands conservation.

The NWI, in a wetlands geodatabase, houses all FWS digital geospatial wetlands data, including digital data contributed by outside cooperators, and forms the Wetlands Layer of the NSDI. The national Wetlands Layer (geodatabase) is contained in five map areas that are populated with digital vector data and is a seamless digital data layer in ArcSDE geodatabase format. The geodatabase also contains raster images of hard-copy NWI maps that have not been digitized. The FWS has lead agency responsibility for the coordination, management, and dissemination of spatial wetlands data. The pertinent enabling authority resides in the Emergency Wetlands Resources Act of 1986. The FWS has designated its NWI to undertake the responsibilities to satisfy the requirements of OMB Circular A-16. In carrying out Federal government-wide leadership in spatial wetland data coordination, the FWS is directly responsible to the FGDC, and the NWI ensures compliance with the objectives and guidance provided by the FGDC.

In 2007, FWS published a Nationwide Data Theme Population Plan to provide information on the development, content, availability, and phased approach for completion and modernization of the Wetlands Layer (*Wetlands Layer - National Spatial Data Infrastructure: A Phased Approach to Completion and Modernization*; <http://www.fws.gov/wetlands/documents/gNSDI/WetlandsLayerNSDIPhasedApproachtoCompletionModernization.pdf>). Currently, the wetlands data layer for the lower 48 States contains information for about 33,000 7.5-minute map areas, which represent wetland map data for approximately 73 percent of the conterminous U.S., plus 30 percent of Alaska, 77 percent of Puerto Rico, and 100 percent of Hawaii, Guam, Saipan, and the U.S. Virgin Islands.



As shown in the status map, less than ten percent of the wetlands data layer was created from source materials less than 10 years old. Due to the time and cost required, each year only one to two percent of the data layer is updated by the FWS and contributors with more recent wetland map information.

In order to increase the usefulness of the NWI, the FWS has focused on three key objectives:

- 1) Work with States and other organizations to ensure the best available data will be included in the wetlands layer of the NSDI,
- 2) Provide scalable wetland map products to complete the lower 48 States, and
- 3) Provide updated or refurbished data at the rate of five percent per year (2,650 quadrangles) starting in 2010 with the goal of refreshing the entire data set at twenty-year intervals.

It is well understood that at a twenty-year refresh interval, as previously targeted, even with a projected increase in mapping by data contributors, the NWI will not be able support the demand for high quality, up-to-date digital wetlands mapping data needed to meet current environmental initiatives. Therefore an accelerated goal to refresh the NWI data on a five-year cycle has been recommended by EPA and others, especially in areas of change. The twenty-year refresh cycle is already heavily dependent on Federal, State,

and private sector data contributors, so additional funding sources would have to be found in order to meet this goal.

As planning for NWI updates proceeds, it is important to note that in recent years much of the digital NWI data came from cooperators and other organizations, both public and private, because FWS priority was to complete another legislative mandate during those years. These contributors are expected to continue to play a critical and increasing role in building the national wetlands data layer going forward. For the NSDI wetlands geospatial data theme, it is clear that contributed data from partner organizations and collaborators will become increasingly important in maintaining a viable data layer given current Federal funding constraints. FWS maintains a list of recent wetlands data contributors at: <http://www.fws.gov/wetlands/WetlandsLayer/DataContributors.html>.

When considering the task of providing scalable wetland maps, it is important to note that not all older maps should be considered outdated, as many existing wetland maps encompass areas where wetlands are experiencing little change and might be easily refurbished (updated) to represent a more contemporary segment of the data layer with little effort. Such areas also may not need refreshing as often as areas under development pressure (e.g., coastal zone).

Once the initial mapping is complete and attention turns to refresh activities, it is possible that groups will naturally want to prioritize their updates and focus activity on those areas experiencing the most change. Alternatively, groups with better access to funding may refresh maps for their areas of interest at the expense of areas which are changing but lack the leadership or opportunities to acquire funds for mapping. Priorities will also be influenced by various local program and mission goals.

FWS has developed a prioritization process to support FWS's mission goals. EPA's Office of Water (OW) has identified program activity measures that identify and quantify wetland acres that have been restored and improved. The EPA OW is also responsible for conducting a base-line National Wetland Condition Assessment beginning in 2011.

More Wetlands Will Be Mapped

With the higher resolution imagery required by the standard, the total acreage of wetlands *mapped* is expected to increase as additional smaller wetland areas which were not previously mapped will be identified using the ½ acre TMU. The resulting increase in the wetland acreage mapped is a result of the greater detail of the new maps, and does not as such reflect any increase in wetland acreage on the ground.

2.2 Goals and Objectives

This implementation plan is designed to be a companion document to the FGDC endorsed Wetlands Mapping Standard (Standard) and is intended to outline the development of a communications framework to (1) inform affected wetland community stakeholders, States, and Tribes, of the requirements of the Standard and advise them on how to obtain additional information on the Standard, (2) disseminate funding information for wetland mapping projects in order to accelerate the incorporation of quality, current information into the Fish and Wildlife Service's NWI geodatabase, and (3) provide outreach and training activities designed to support the implementation of the Standard.

Because the condition of our wetlands is not static, the NWI is presently not up-to-date and detailed enough to monitor some important changes in our natural resources. In order to monitor the effects of climate change, sea-level rise, and other changes, NWI data must be routinely updated to quantify changes in our wetlands. With the growth of new GIS technologies and semi-automated interpretation of digital aerial photographs, it is possible to map and track changes with greater detail than ever before.

Three long-term objectives must be met in order to fulfill user-needs for the wetlands layer:

- 1) complete digital mapping for the country in conformance with the standard (one-half acre target mapping unit (TMU) based on one meter resolution source imagery);
- 2) keep the national database populated with current data by refreshing the maps at five-year intervals for areas of wetland change.
- 3) increase Federal funding for wetland mapping to achieve mapping update goals.

2.3 Maintenance Responsibility for the Implementation Plan

The Wetlands Subcommittee of the FGDC is responsible for maintaining this Implementation Plan and promulgating updated versions. This Implementation Plan is considered a dynamic (living) document to be revised and updated as needed by the Wetlands Subcommittee; please check for the most recent version online at <http://www.fws.gov/wetlands/>.

3.0 Implementation Approach

In order to continue to build wetland mapping capacity with our wetland partners, this implementation plan focuses on two core areas:

- 1) Administrative Assistance, and
- 2) Technical Support.

3.1 Administrative Assistance

The Standard advises wetland mapping entities to consult with FWS. It is the responsibility of the FWS Regional Wetland Coordinators to coordinate mapping activities in each FWS region (<http://www.fws.gov/wetlands/Organization/RWC.html>). The Coordinators are key to avoid duplication of effort, assure efficiency and technical soundness of mapping, and provide quality control to ensure accurate implementation of the Standards.

The Wetlands Subcommittee will provide coordination among Federal agencies, with the participation of other organizations, to advise the FWS on the direction, content, organization, and evolution of the wetlands layer and associated datasets and serve as subject matter experts for best practices as required in OMB Circular A-16 Supplemental Guidance. The Wetlands Subcommittee will meet periodically to provide the venue for coordination and expand participation by using web conferencing.

Despite efforts to minimize the impacts of the FGDC endorsed Wetlands Mapping Standard on the wetlands community, it is acknowledged that the Standard does place additional requirements on wetland mappers for improved and documented data quality. These requirements will necessarily increase the overall expense of mapping activities. In support of wetland data collection efforts, grants and seed monies are expected to play an increasingly important role in funding local, State, and regional mapping efforts.

Ultimately, providing grants and other funding sources for wetlands mapping should directly support the purpose of the Standard — to make sure all these wetlands mapping activities can be applied towards updating the NWI. As the number of potential mapping contributors and funding sources increases, the need for coordination will become even more imperative. Our ability to identify and communicate grant and cooperative agreement programs to and through our partners will enhance the wetlands mapping community's ability to access available funding sources and increase the quality of data supporting the NWI.

3.1.1 Funding Opportunities

For each mapping project, in order to identify potential partners, the information needs for these core areas is shaped by carefully considering the following questions:

- Who could use similar data or imagery (e.g., natural resources, FWS, counties, and industry)?
- What needs to be mapped to meet the users' goals (e.g., wetlands, streams, watershed, soils, utilities, and infrastructure)?
- What resolution is required for the different users (the wetlands mapping standard requires one meter source data, while some users may need a different resolution)?

Several Federal funding sources are available but they can only supply a small part of the needed funds. A list of Federal funding sources is provided in Appendix A.

Whenever possible, a mixture of State and other resources should be pooled to fund the needed imagery and data storage/retrieval costs, as well as allow others to share in the benefits. Because of the limited availability of Federal funds, wetland mapping entities are encouraged to creatively seek out multi-organization partnerships with other State and local government organizations as well as utilities, conservation groups, and other businesses and NGOs that have a need for wetlands maps or for the detailed aerial imagery that is needed to produce the maps. In fact, when shared, such imagery can be used to develop geospatial information that can be used to defend the nation, assist first responders, address climate change, protect floodplains, develop energy sources, track disease and navigate vehicles. For example, Indiana wetlands mappers teamed with local county groups that needed 0.5 meter resolution aerial photographs to identify infrastructure and asset mapping at sufficient detail to “see” light poles and man holes. Such details can then be used to plan for homeland security safety and emergencies. Other potential funding sources include private environmental groups and private industry. British Petroleum (BP) has provided some funding to Iowa’s mapping update as the detailed maps will allow the company to identify environmental sensitive lands that lie along their gas lines. BP will use the information to anticipate and improve their response to maintenance activities and leaks.

Coordination with USDA’s digital mapping effort, the National Agriculture Imagery Program (NAIP), could also be used to reduce the cost of obtaining imagery. Wetland mappers have a keen interest in using USDA’s infrared layer. However, for most wetland mapping the imagery is needed from a leaf-off time of year when hydrology under plant canopy is visible, while the imagery normally collected by the USDA is leaf-

Creative Funding Partnerships

Indiana-

To update aero-aerial photography, funds were gathered from city and county homeland security funds sources, the Indiana Dept. of Environmental Management, the clean Water Act and EPS Section 319. The cities and counties will use the aero-mapping aerial photographs to identify manholes, light poles, roads, bridges and cellular towers.

Iowa-

Due to the piecemeal method of identifying funding, total project time was longer than expected. In addition to teaming with cities, counties and the EPA funds, their funding partners included private energy firms who hoped to use the updated photography to locate sensitive lands near their facilities.

on imagery. An effort should be made to coordinate with the providers of NAIP imagery in order to improve the chances of a leaf-off imagery collection.

Despite all these potential sources of collaboration, the biggest problem for wetland mappers is ensuring that funding is available to complete a project. Identifying the funding resources up front allows for better management control and oversight. The delays incurred as a result of funding projects on a piecemeal basis can increase the affected project times by years. Updating NWI data could be accelerated if Federal agencies contributed annual funds to the NWI effort for producing updated wetland data in their priority areas. A national multi-organization Wetlands Mapping Coalition has been established to initiate this cooperative venture.

3.1.2 Specifying use of the Standard in Contract Language

In addition to funding, it is important that contracts and project descriptions contain language that supports the standard. Such language may be similar to:

A "National Wetlands Mapping Standard" was endorsed in July 2009 by the Federal Geospatial Data Committee (FGDC). This document provides a national standard for wetland mapping which must be used in all mapping projects that are funded through the Federal government, and is a requirement for adding wetlands geospatial data to the Fish and Wildlife Service's (FWS) National Wetlands Inventory database. Non-Federally funded wetland mapping projects are encouraged to comply with the standard. The National Wetlands Mapping Standard can be found at: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/wetlands-mapping/2009-08%20FGDC%20Wetlands%20Mapping%20Standard_final.pdf

3.2 Technical Support

In the course of developing the Wetlands Mapping Standard, an array of technical and strategic recommendations were identified. A summary list of these important issues is included in Appendix B. Given the constantly changing nature of GIS technology and tools, it is not practical to provide detailed technical specifications in this plan. The Wetlands Subcommittee will encourage the development of technical support tools for NWI mapping by supporting the sharing of information among the various mapping partners. Actions that will be taken to encourage technical support, communication, and training, are discussed in the following sections.

3.2.1 Partners in Technical Support

Numerous Federal, State, Tribal, and NGOs have greatly contributed to the development of the Standard. The continued assistance of these groups is vital to the success of

implementing the Standard as they represent many of the groups that actively develop data for contribution to the NWI.

Federal agencies and groups involved in wetland mapping and data:

- Fish and Wildlife Service (FWS at <http://www.fws.gov>)
- Federal Emergency Management Agency (FEMA at <http://www.fema.gov>) - flood plain data
- U.S. Geological Survey (USGS at <http://www.usgs.gov>) National Wetland Research Center (<http://www.nwrc.usgs.gov/index.html>) - hydrologic data set
- Federal Geographic Data Committee (FGDC at <http://www.fgdc.gov>)
- Army Corps of Engineering (Corps at <http://www.usace.army.mil>)
- Environmental Protection Agency (EPA at <http://www.epa.gov>)
- Bureau of Land Management (BLM at <http://www.blm.gov>)
- Natural Resources Conservation Service (NRCS at <http://www.nrcs.usda.gov>)
- National Park Service (NPS at <http://www.nps.gov>)
- U.S. Forest Service (at <http://www.fs.fed.us>)
- U.S. Department of Transportation (DOT at <http://www.dot.gov/>)
-

State agency partners:

- State Geographical Information System (GIS) committees
- State Natural Resource organizations
- State Departments of Environmental Quality

Other partners:

- National States Geographic Information Council (NSGIC at <http://www.nsgic.org/>)
- National Governors Association (NGA at <http://www.nga.org/>)
- Association of State Wetlands Managers (ASWM at <http://www.aswm.org/>)
- Association of State Floodplain Managers (ASFPM at <http://www.floods.org>)
- National Association of Counties (NACo at <http://www.naco.org>)
- ASWM Wetlands Mapping Consortium (WMC)– a newly formed technical group

In order to better implement the wetlands mapping standards, stakeholders such as ASWM are organizing to help:

- 1) provide on-going support for implementing new technologies used in wetland mapping, such as data collection procedures;
- 2) assist in the development of online and instructor-lead training programs covering topics such as implementing and using the mapping standard, technical requirements of the standard, NWI data collection requirements and procedures, using NWI verification tools and other FWS processes, technical support, and other associated technical and strategic issues (see Appendix B);
- 3) add discussion group capabilities to address technical mapping challenges;

- 4) foster coalitions that may purchase imagery;
- 5) post maps of imagery status;
- 6) publish case studies of applications that use the wetlands data; and
- 7) help develop and provide a gateway to training opportunities.

The overall goal of the newly-established Wetlands Mapping Consortium (WMC) is to “improve the management of wetland resources through enhanced wetland mapping and monitoring, ultimately resulting in increased conservation of wetlands and the enhanced delivery of wetland ecosystem services via the evaluation of wetland properties and the dissemination of this information to natural resource managers.” In order to meet this goal, the WMC will foster collaborations and disseminate data and findings for the purpose of enhanced wetland mapping and monitoring. More specifically, the WMC is providing on-going support for implementing new technologies used in wetland mapping, adding discussion group capabilities to address technical mapping challenges, and developing new applications for wetland maps to meet the needs of decision makers.

3.2.2 Communication of Technical Issues

The FWS has developed a web page to enable and encourage organizations and individuals to contribute Standard-compliant data to the Wetlands Layer (<http://www.fws.gov/wetlands/WetlandsLayer/ContributedData.html>). This webpage contains all the data submission requirements, standards, procedures, forms, and contact information for anyone who has questions. To facilitate and ensure quality data collection, the FWS has also developed and provided online the *Data Collection Requirements and Procedures for Mapping Wetland, Deepwater and Related Habitats of the United States* (<http://www.fws.gov/wetlands/documents/gNSDI/DataCollectionRequirementsProcedures.pdf>). FWS will continue to update and improve this page to meet the changing technology and needs of the contributors.

Ensuring that accurate and up-to-date information is available to all wetland mappers and interested parties is essential for seeing that the best possible data is gathered and entered into the NWI. To facilitate the sharing of technical information, the WMC is establishing a website to be hosted by Virginia Tech University in Blacksburg, VA. The website is a communications tool for sharing technical, grant, and research information. Web based wiki's, discussion threads, and forums will be used to share data and inform the wetland community.

The ability of all the partners, cited above, to work effectively in communicating the requirements of wetland mapping, has been demonstrated through grant applications to Google Earth and the NSDI Cooperative Agreement Program. These grant applications have dealt with both outreach and training needs.

3.2.3 Technical Training

Training for wetland mappers is necessary to ensure that the FGDC standards are met and the best possible data are entered into the NWI. At minimum, training materials should be designed to foster outreach to at least three primary audiences: administrators (who are responsible for budgets and resource allocation), GIS technicians (who will be involved in processing the data), and wetland scientists (who may include both data providers and end-users). ASWM and other partners have the capability to assist in providing training and materials. Such training, provided by experienced wetlands mappers, takes advantage of partners' varied skills and leverages limited financial and technical resources. These partnerships also expand the range of approaches available to achieve wetlands protection goals and complement a traditional regulatory framework. This ability to build and enhance the capacity of States, Tribes, and local governments to conduct wetland mapping is an indispensable component of a national wetland conservation effort.

FWS Regions have been providing instructor-led wetland mapping training on request for many years on a project-by-project basis. Several wetland partners have also previously developed training/resource materials. The USGS National Wetlands Research Center has developed aerial photo interpretation and National Wetlands Inventory training that has been presented to several groups including the Confederated Salish and Kootenai tribes on the Flathead Reservation in Montana and others. Ducks Unlimited has created a photo interpretation key for work with updating the NWI in the Great Lakes States of Wisconsin, Illinois, Indiana, Michigan, and Ohio. In addition, FWS's NWI Program has routinely provided training in wetland classification and mapping to cooperators and will continue to do so. Many commercial concerns and universities have courses that complement image interpretation training, on such subjects as wetland plant identification and wetland delineation suitable for field verification of imagery interpretation. To make training more effective and more widely available, the FWS training working group is developing web-based and instructor-led wetlands mapping training in partnership with EPA, the ASWM, and others. Discussions are underway for regional instructor-led Standard training provided through web-conferencing.

At this time, no training certification requirements exist for wetland mappers. After procedures are finalized and training is developed, the Wetlands Subcommittee will examine the need for certification.

APPENDIX A. Potential Sources of Federal funding for Wetland Mapping Activities

- EPA 5 Star Grant program
- EPA National Estuary Program
- EPA Section 319 Nonpoint Source program
<http://www.fgdc.gov/grants>
- NSDI Cooperative Agreements Program (CAP)
<http://www.fgdc.gov/grants>
- EPA's "Catalog of Federal Funding Sources for Watershed Protection"
<http://cfpub.epa.gov/fedfund/>
- Coastal Impact Assistance Program CIAP
<http://www.mms.gov/offshore/CIAPmain.htm>
- Wetlands Program Development Grants
<http://www.epa.gov/owow/wetlands/grantguidelines>
- EPA 106 Clean Water Act (if combining activities with water groups)
- FWS National Wetlands Inventory Program
<http://www.fws.gov/wetlands/>
- FWS Wildlife and Sport Fish Restoration Program
<http://wsfrprograms.fws.gov/>

APPENDIX B. Technical and Strategic Recommendations for Consideration During the Current Implementation Phase.

The following recommendations have been identified as being important to supporting the effective implementation of Wetlands Mapping Standard and/or accomplishing long-term goals of implementing the Wetlands Mapping Standard. These issues were identified during the development of the Wetlands Mapping Standard and Implementation Plan as a result of Public Comments and other information provided to the Wetlands Subcommittee.

- 1) Development of definitions, data collection requirements and procedures, and verification tools (quality control), for landscape position, landform, water flow path and water body type (LLWW) descriptors which are helpful for understand the potential functions of wetlands.
- 2) Improved coordination between NWI Regional Coordinators, States, Tribes, NGOs and other partners and cooperators for wetlands mapping. This would likely necessitate the establishment of regular workshops/coordination meetings, conference calls, liaison roles, and webcasts technical discussion forums (used effectively by EPA for improving regional coordination).
- 3) Annual collection and sharing of status and location (project footprint) information for wetland mapping projects in development and in progress—this information is needed for better planning, prioritizing, and identifying future data needs. Surveys administered by NGO partners, development of a website to collect voluntary updates from mapping entities, and/or increased coordination with states and tribes.
- 4) Work to investigate and enhance system interoperability between federal agencies, states, tribes, and contracted partners, to facilitate data sharing, data verification, and move towards real-time update of the data. Increase coordination with Information Technology (IT) programs within federal agencies, states, and tribes.
- 5) Accelerated technological modernization or re-design of the FWS database which is growing exponentially and rapidly outpacing the technology on which it is based. Increased coordination with ESRI and other vendors is needed to deal with the technical constraints, maintenance issues, and data-update complications related to the national scope, current size, and anticipated future growth of the database. Process automation and long-term maintenance issues need to be considered.
- 6) Development of improved database-capabilities to track polygon lineage and polygon change over time.
- 7) Development of capabilities to serve past temporal versions of the wetlands data and metadata to partners and to the public.
- 8) Development of tools to allow users to query projects by year and generate data and statistics by year.

- 9) Addition of a new attribute (e. g., landscape position) to denote the presence of different vegetative communities where multiple contiguous wetland polygons exist. Such an attribute would aid the prediction of wetland functionality and enhance wetland managers' ability to consider connectivity and the cumulative impact of resource disruptions to the complex as a whole.
- 10) Development of more user-friendly Cowardin code attribute "parsing" methods -- needed to further end-user spatial analysis of the NWI data. This would possibly be handled by some kind of tool or joinable data-dictionary table due to constraints in the Wetlands Master Geodatabase.
- 11) Collection and integration of wetland loss data into the database.
- 12) Development of procedures for addition of wetland data from field observations and groundtruthing.
- 13) Development of a means to review accuracy differences within and between project areas, and identify the impacts on various users. Development of information on how best to measure the accuracy of the mapping both initially and in the update process.
- 14) Development of a cross-walk between the wetlands codes in the Standard and the National Vegetation Classification Standard endorsed by FGDC [STD-005 V2 (NVCS)] which is often used by groups such as Forest Services and NatureServe.
- 15) Standardization of methods to remotely map wetlands which can't be "seen" (interpreted) on the typically-used aerial imagery but which might be identified using emerging wetland mapping technologies and alternative data sources such as radar, LiDAR, infrared and thermal imagery, GIS Modeling, etc. The Wetlands Mapping Consortium is designed to aid in the integration of these emerging technologies.
- 16) Development of online mapping tools which would allow more thorough analysis of the NWI data.
- 17) Additional alignment of wetland mapping goals with the National Hydrologic Dataset (NHD) and other Federal agencies.
- 18) Development of standardized wetlands mapping training programs and a means to document wetland mappers' experience and/or certification.
- 19) Development of a resource library to document the experience of various interpreters and/or track their mapping certifications.
- 20) Increased coordination, briefing and education of Federal, Tribal, and State Agency executive and management personnel about the role and function of the FGDC and the importance and values of adhering to the Wetlands Mapping and Classification Standards, and maintaining the data long-term, in order for adequate funds and other resources to be allocated to do the necessary work within each organization. Since these standards are being prescribed laterally through FGDC rather than coming top-down through the agencies, the importance and degree of work necessary to meeting the FGDC standards may not be obvious, and need to be better-communicated to higher management levels.
- 21) Development of protocols for the Wetland Subcommittee to link FDGC wetlands-related standards to applicable NWI internal process documents; this might be accomplished by utilizing standard open references to documents FWS would be

tasked with maintaining/updating as needed and providing current versions online (examples of related NWI documents include *Data Collection Requirements and Procedures for Mapping Wetland, Deepwater and Related Habitats of the United States U.S.*

(<http://www.fws.gov/wetlands/documents/gNSDI/DataCollectionRequirementsProcedures.pdf>), and *Wetlands Layer - National Spatial Data Infrastructure: A Phased Approach to Completion and Modernization*

(<http://www.fws.gov/wetlands/documents/gNSDI/WetlandsLayerNSDIPhasedApproachtoCompletionModernization.pdf>).

- 22) Implement all requirements in the Office of Management and Budget Circular A-16 Supplemental Guidance for the Wetlands Layer of the NSDI, both by the Wetlands Subcommittee of the FGDC and by the FWS as the Lead Agency for the theme.
- 23) Development of creation of a design-led grant fund through a multi-Federal agency partnership.
- 24) Increased coordination between the U.S. and Canada Wetland Inventories.