

## **2011 Project Abstract**

For the Period Ending June 30, 2015

**PROJECT TITLE:** Updating National Wetland Inventory for Minnesota - Phase III

**PROJECT MANAGER:** Steve Kloiber

**AFFILIATION:** Minnesota DNR

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**FUNDING SOURCE:** Environment and Natural Resources Trust Fund

**LEGAL CITATION:** M.L. 2011, First Special Session, Chp. 2, Art.3, Sec. 2, Subd. 03d

**APPROPRIATION AMOUNT:** \$1,500,000

### **Overall Project Outcomes and Results**

Updating the National Wetland Inventory (NWI) is a key component of the State's strategy to ensure healthy wetlands and clean water for Minnesota. This effort is a multi-agency collaborative under leadership of the Minnesota Department of Natural Resources. These data are intended to replace the original 1980s NWI data. The NWI data provide a baseline for assessing the effectiveness of wetland policies and management actions. These data are used at all levels of government, as well as by private industry and non-profit organizations for wetland regulation and management, land use, conservation planning, environmental impact assessment, and natural resource inventories. The update project is being conducted in phases with data released for each region as it is finalized.

In this third phase of the overall effort, we updated wetland inventory maps for 36 counties in southern Minnesota (23,856 square miles). The overall accuracy for wetland identification is 94%. We also acquired aerial imagery data for 39,625 square miles in central and northwestern Minnesota needed for the next phases of the update.

The updated NWI data was created in accordance with federal wetland mapping guidance. This update used spring aerial imagery acquired in 2011 and lidar elevation data as well as other ancillary data. Quality assurance of the data included visual inspection, automated checks for attribute validity and consistency, as well as a formal accuracy assessment based on an independent field data. Further details on the methods employed can be found in the technical procedures document for this project located on the project website ([http://www.dnr.state.mn.us/eco/wetlands/nwi\\_proj.html](http://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html)).

### **Project Results Use and Dissemination**

All wetland map data and aerial imagery are available free of charge to the public. The data have been made available through the Minnesota Geospatial Commons (<https://gisdata.mn.gov/>) as well as through an online wetland viewer (<http://www.dnr.state.mn.us/eco/wetlands/map.html>). A copy of the data has also been provided to the US Fish and Wildlife Service for inclusion in the national wetland database.

Use of the NWI data is being promoted through a variety of channels. The DNR is giving presentation about the updated NWI data at both the Minnesota Water Resources Conference and the Minnesota GIS/LIS Conference. The DNR and MnGeo are co-presenting at the Minnesota GIS/LIS Conference regarding the availability of the spring aerial imagery. A short news article was developed for the Minnesota Geospatial Commons news feed and posted in May 2015. A broader press release has also been drafted for an expected September release. Finally, a peer-reviewed journal article was published in the journal *Wetlands* based on the work from the previous NWI project phase.



## Environment and Natural Resources Trust Fund

### M.L. 2011 Work Plan Final Report

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**Date of Status Update:** 8/31/2015  
**Final Report**  
**Date of Work Plan Approval:** 8/11/2011  
**Project Completion Date:** 6/30/2015

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**Project Title:** Updating National Wetland Inventory for Minnesota - Phase III  
**Project Manager:** Steve Kloiber  
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**Location:**

**Counties Impacted:** Statewide

**Ecological Section Impacted:** Lake Agassiz Aspen Parklands (223N), Minnesota and Northeast Iowa Morainal (222M), North Central Glaciated Plains (251B), Northern Minnesota and Ontario Peatlands (212M), Northern Minnesota Drift and lake Plains (212N), Northern Superior Uplands (212L), Paleozoic Plateau (222L), Red River Valley (251A), Southern Superior Uplands (212J), Western Superior Uplands (212K)

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<b>Total ENRTF Project Budget:</b>	<b>ENRTF Appropriation \$:</b>	1,500,000
	<b>Amount Spent \$:</b>	1,495,991
	<b>Balance \$:</b>	4,009

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**Legal Citation:** M.L. 2011, First Special Session, Chp. 2, Art.3, Sec. 2, Subd. 03d

**Appropriation Language:**

\$1,500,000 the second year is from the trust fund to the commissioner of natural resources to continue the update of wetland inventory maps for Minnesota. This appropriation is available until June 30, 2015, by which time the project must be completed and final products delivered.

## **I. PROJECT TITLE:** Updating the National Wetland Inventory for Minnesota - Phase III

**II. PROJECT SUMMARY:** Over the past 100 years, about half of Minnesota's original 22 million acres of wetlands have been drained or filled. Some regions of the State have lost more than 90 percent of their original wetlands. Urban development, agricultural drainage, mining, road construction, and utility projects result in additional losses each year (attached figure). The function and quality of remaining wetlands are often impaired. Updating the NWI is a key component of the State's strategy to monitor and assess wetlands in support of efforts to assure healthy wetlands and clean water for Minnesota.

- NWI is the only comprehensive inventory of wetlands for Minnesota. To protect wetlands, we need to know how many wetland acres we have and where they are. We can't manage what we don't measure. Unfortunately, the current NWI is inaccurate in many places because it is 25-30 years out-of-date and some of the original imagery used was relatively coarse scale.
- NWI is an important screening tool for identifying potential wetland impacts. Wetland programs such as Minnesota's Wetland Conservation Act and the US Army Corps' Clean Water Act Permit Program rely on the NWI as the initial resource for identifying potential impacts of proposed projects. Having accurate maps upfront prevents problems later on; saving time and money for permit applicants and wetland program managers as well as preventing wetland impacts.
- NWI is useful for strategic wetland restoration planning. Funds for wetland restoration are limited; therefore, it is important to get the most benefit possible for our restoration dollars. Wetland maps provide useful information for strategic wetland restoration planning. The NWI includes information about partly drained and ditched wetlands that may be potential wetland restoration opportunities. In addition, the updated NWI will provide enhanced attributes to support assessment of ecosystem services. The updated and enhanced NWI will also help target wetland restoration in a way that complements the functions and values of existing wetlands.

This is the third phase of a multi-phase project to update the National Wetland Inventory (NWI) maps for Minnesota using modern, high-resolution imagery and elevation data. The NWI maps need to be updated because the original data are either severely out-of-date or in some instances they were not very accurately mapped in the first place. Benefits of this project include improved accuracy of wetland maps, improved compliance with wetland protection programs, and better wetland and water quality planning.

This project phase will: 1) update NWI maps for 36 counties in southern Minnesota, and 2) acquire aerial imagery data required for subsequent updating of NWI for follow-on phases. The data required for updating the NWI maps for the 36 counties in southern Minnesota is being acquired through a previously funded project phase and will be available by 2012. High-resolution elevation data are being acquired through a separate project. Wetland maps and aerial imagery will be produced by contractors under the supervision of the DNR. All wetland map data and aerial imagery will be available free of charge to the public. The University of Minnesota will assist in this effort by collecting independent field validation data for wetlands.

Funding for this project will become available on July 1, 2012 (start of FY13). No project activities will occur before this. The funding will be available through June 30, 2015 (end of FY15) at which time all project activities will be complete.

## **III. PROJECT STATUS UPDATES:**

### **Project Status as of January 2013:**

St. Mary's University (SMU) was selected to perform the update of the NWI data for southern Minnesota. The scope was expanded to include wetland mapping for an additional six counties. The contract was fully executed on November 2, 2012. A service level agreement has also been developed with the DNR Resource Assessment Program (RAP) to provide support services for the NWI update.

SMU has begun compiling the input data for the NWI update. RAP has processed all of the terrain data for the southern MN project area generating various derivatives from LiDAR. The derived data have been delivered to SMU. Field work has been initiated. In total, 128 sites have been visited so far. Additional field work is scheduled for this spring. SMU has been preparing a draft technical procedures document and conducting preliminary wetland mapping for a series of 40 quarter quads across the study area. The draft data and procedures document will be reviewed by the technical advisory committee for the NWI project. SMU and DNR also participated in a technical workshop hosted by the University of Minnesota Remote Sensing and Geospatial Analysis Laboratory (RSGAL).

An interagency agreement was developed with MnGeo to assist with managing a competitive bid contract for imagery acquisition of central Minnesota. An RFP was developed and noticed in December. Proposals are due in January. Several potential local partners have indicated an interest in participating in the imagery acquisition effort. In addition, we have developed a contract with the University of Minnesota to acquire field validation data for central Minnesota. This field work will be conducted this summer.

### **Project Status as of July 2013:**

A technical advisory committee meeting was held in February to go over comments from the initial draft data. The meeting included the contractors for both the east-central phase (Ducks Unlimited) and the southern phase (St. Mary's University) in an effort to ensure consistency in the wetland mapping across project phases. Additional field work was conducted in May. Approximately 100 sites were visited. An additional 40 quarter quads of data were developed by SMU and submitted to the DNR for review. Production level work on the NWI is progressing with initial mapping done for about 30% of the project area. Further processing (such as edge-matching and mosaicking) has been performed for 8 counties.

Aerometric, Inc. was selected to acquire spring leaf-off imagery through a competitive bidding process. The final price for the selected vendor was well below the estimated price which was based on past aerial imagery contracts. As such the area of acquisition was significantly expanded. The original request for proposal was to acquire imagery for 22,207 square miles of imagery in central Minnesota. This was increased to include acquisition of all remaining 39,625 square miles of the state, including both central and northwestern Minnesota. Several local partners have agreed to participate in the project by buying enhanced resolution imagery for their specific area of interest.

In addition, we have developed a contract with the University of Minnesota to acquire field validation data for central Minnesota. This field work will be conducted this summer.

Most of the project funds will be spent on three contracts. These contracts came in under budget by \$33,788. We anticipate submitting a work program amendment in the future to re-allocate the savings to advance the overall project.

### **Amendment Request (9/9/13) – Approved (9/11/13)**

Cost savings were achieved for the imagery acquisition task of this project in the amount of \$27,127.00. We are requesting an amendment to direct \$8995.78 of these savings into an effort to accelerate the overall project by completing the data pre-processing for the remainder of the state. Previously, this work was being done on a phase-by-phase approach. The DNR Resource Assessment Office (RA) would process the LiDAR and soils data to create a number of customized derivative data sets that are used for the update of the NWI. The LiDAR derived products include slope, curvature, topographic position index, and the compound topographic index. The derived soils data include percent hydric soils and the water regime class. This work has already been completed for east-central and southern Minnesota. With phase 4 of the project just getting underway, RA will be pre-processing the LiDAR and

soils data for northeastern MN. This work program request will partially fund the data preprocessing for the rest of the state. The total additional cost will be \$19,171. We are also proposing to use the remaining \$10,175.22 from the phase 2 grant of this project. In addition, we are requesting to redirect \$9000 from the savings in the imagery acquisition to cover an under estimate of the salary cost for the project manager.

#### **Project Status as of January 2014:**

Staff from St. Mary's University (SMU) and the DNR conducted joint field work in November visiting approximately 140 sites. This field work was primarily focused in the southwestern part of the project area. Field work was impacted by a 10-inch snow fall which obscured some of the target wetland sites.

SMU has provided draft data for DNR and stakeholder review for Pipestone, Rock, Nobles, Murray, Jackson, Martin, and Wantonwan Counties. The draft data for Rock and Nobles Counties has been fully reviewed by the DNR and other project stakeholders. The review comments were compiled, summarized, and transmitted to SMU. A joint meeting was held between DNR and SMU to discuss the review comments and clarify procedures.

Aerometric acquired imagery for about 63% of the northwest and central project area (26,768 square miles). The imagery have been fully orthorectified and checked for quality. The data have been delivered to the State. Imagery for the remaining 37% of the project area will be acquired this spring (15,969 square miles) and orthorectified.

The University of Minnesota completed acquisition of field validation data for central Minnesota and delivered the data to the DNR. The data provided includes approximately 2100 additional points bringing the statewide total of field validation points to approximately 6700. The DNR has accepted the data.

#### **Amendment Request (5/8/14) – Approved (5/12/14):**

The current budget for imagery acquisition in central and northern Minnesota is \$438,004. The cost of the imagery acquisition contract and contract administration is \$415,688. Of the \$22,316 of unspent funds for imagery acquisition in central and northern Minnesota, we propose to redirect \$9,100 toward additional specialized data processing for a section of northeast Minnesota. This data processing involves going back to the raw lidar data to extract information on the signal intensity. Previously, we have just been relying on the elevation data extracted from lidar. Research has shown that there may be some additional value for wetland mapping in the lidar intensity data. In particular, we believe that the lidar intensity data may help reduce confusion between tree shadows and water in areas with forested wetlands.

#### **Project Status as of July 2014:**

Staff from St. Mary's University (SMU) and the DNR conducted joint field work in May 2014 visiting 226 sites. This field work was primarily focused in the southeastern and central parts of the project area.

SMU has provided draft data for DNR and stakeholder review for Lincoln, Lyon, Brown, Nicollet, Dodge, LeSueur, Cottonwood, Faribault, Waseca, Fillmore, Freeborn, Mower, and Steele Counties. Including previous deliverables, draft data has been provided to the state for a total of 21 counties and preliminary draft data has been developed for another two counties. The draft data for Lincoln, Lyon, Pipestone, Murray, Jackson, Martin, and Watonwan Counties has been reviewed by the DNR and other project stakeholders. The review comments were compiled, summarized, and transmitted to SMU.

The DNR Resource Assessment Office (RA) has completed statewide processing of the LiDAR and soils data to create a number of customized derivative data sets that will be used for the update of the NWI.

Aerometric has acquired spring, leaf-off imagery for the remaining 37% of the project area. The imagery has undergone an initial quality control review to check the overall image quality and Aerometric is proceeding with the orthorectification process. The final imagery deliverable is expected this fall. The State will perform its own final QAQC review after receiving the data.

**Amendment Request (8/14/14) - Approved (8/18/14):**

The purpose of this amendment request is to shift funding from the imagery acquisition task, which came in under budget, to three other budget items. Project manager costs came in slightly over the anticipated costs by \$2,997. Also, the cost for wetland data processing and quality control services provided by the DNR Resource Assessment Office is expected to come in \$32 high than the earlier budget estimate. In addition, we are proposing to shift \$4000 to office equipment to cover the replacement cost for specialized software for 3D visualization (stereo imagery). This software is used specifically to support the quality control review of the NWI data. Our previous software no longer works with our GIS system (a result of the incompatibility with the most current version of ArcGIS) and the vendor has been unable to resolve the issue within the past year. We have found a software alternative that would allow us to continue to take advantage of the stereo imagery acquired for this project to conduct a thorough quality control review of the updated NWI data. The total shift of funds from the imagery acquisition task will be \$7,029 (\$2,997 + \$32 + \$4000).

**Amendment Request (12/4/14) - Approved (12/5/14):**

The purpose of this amendment request is to shift funding from the imagery acquisition task, which came in under budget, toward additional mapping effort. We are proposing to enhance the NWI including more watercourses than are presently captured under the mapping standard. The current standard calls for mapping features that are at least 5 meters wide. This amendment shift \$6000 in savings from the imagery acquisition budget and combine that with other funds to map all of the watercourses as defined by the Public Waters Inventory in the 38 county, southern MN project area. This addition would help support additional conservation efforts; particularly those that require information about the location of stream banks (e.g. stream bank buffers and erosion).

**Project Status as of January 2015:**

Draft data have been completed and delivered for approximately 85% of the area. Deliveries have been made for 14 counties since the last status report, including: Chippewa, Freeborn, Houston, Lac Qui Parle, Olmsted, McLeod, Mower, Redwood, Renville, Sibley, Steele, Wabasha, Winona, and Yellow Medicine. The final counties of Big Stone, Kandiyohi, Meeker, and Swift are anticipated for delivery in early February 2015. The DNR and other project stakeholders completed data review for 15 counties and submitted the compiled comments to SMU. The data review covered Blue Earth, Brown, Nicollet, Redwood, Cottonwood, Le Sueur, Waseca, Faribault, Dodge, Freeborn, Mower, and Steele counties. St. Mary's University and the DNR participated in a two-day project workshop focused on improving hydro-geomorphic wetland classification.

Aerometric has completed the ortho-rectification of the imagery and created the tiled imagery mosaics. The State's quality assurance review identified some image quality issue possibly related to a light hazy smoke from wild fire. The imagery passed the initial QA review in all other respects. The State is working with the vendor to review options to minimize the impact on the overall quality of the final deliverable. We now anticipate wrapping up this task and deliverable by February 2015.

**Amendment Request (6/22/15) – Approved (6/23/15):**

The purpose of this amendment request is to shift \$600 from unspent funds for field supplies to the line item for office supplies. There is no change to the overall cost of the project and no change in the deliverables. The project closes out on June 30, 2015. We are requesting permission to make this change and any other minor changes between budget line items to ensure that the final report does not have any negative balances in any line item.

**Final Report July 2015:**

The final updated NWI data for the southern Minnesota project area was delivered to the DNR in a single seamless GIS data layer to the DNR along with the metadata and a final version of the project technical procedures document. The data were reviewed and accepted by the DNR. The overall wetland identification accuracy was 94% and the overall wetland classification accuracy was 83%. The DNR made a few formatting changes to the data and the metadata to ensure consistency with earlier

phases of the project. Subsequently, the data were posted to the State's enterprise GIS system and have been made available more generally through the Minnesota Geospatial Commons (<https://gisdata.mn.gov/>) as well as through an online wetland viewer. The DNR also forwarded a copy of the data to the US Fish and Wildlife Service for inclusion in the national database for the NWI.

St. Mary's University also completed and delivered an enhanced version of the southern MN NWI with additional watercourse features, including all the watercourses that are part of the Minnesota Public Waters Inventory. The DNR will also incorporate this into the State enterprise GIS system.

The final orthorectified spring aerial imagery was delivered to the DNR and MnGeo. The state performed a final quality assurance review and accepted the imagery data. MnGeo is serving all of the spring aerial imagery from this project and all the previous projects through their online imagery service.

Use of the data developed by the project is being promoted through a variety of channels. The DNR is giving presentation about the updated NWI data at both the Minnesota Water Resources Conference and the Minnesota GIS/LIS Conference. The DNR and MnGeo are co-presenting at the Minnesota GIS/LIS Conference regarding the availability of the spring aerial imagery. A short news article was developed for the Minnesota Geospatial Commons news feed and posted in May 2015. A broader press release has also been drafted for an expected September release. Finally, a peer-reviewed journal article was published in the journal *Wetlands* based on the work from the previous NWI project phase.

### **Overall Project Outcomes and Results**

Updating the National Wetland Inventory (NWI) is a key component of the State's strategy to ensure healthy wetlands and clean water for Minnesota. This effort is a multi-agency collaborative under leadership of the Minnesota Department of Natural Resources. These data are intended to replace the original 1980s NWI data. The NWI data provide a baseline for assessing the effectiveness of wetland policies and management actions. These data are used at all levels of government, as well as by private industry and non-profit organizations for wetland regulation and management, land use, conservation planning, environmental impact assessment, and natural resource inventories. The update project is being conducted in phases with data released for each region as it is finalized.

In this third phase of the overall effort, we updated wetland inventory maps for 36 counties in southern Minnesota (23,856 square miles). We also acquired aerial imagery data for 39,625 square miles needed for the next phases of the update in central and northwestern Minnesota.

The updated NWI were mapped in accordance with federal wetland mapping guidance. This update used spring aerial imagery acquired in 2011 and lidar elevation data as well as other ancillary data. Quality assurance of the data included visual inspection, automated checks for attribute validity and consistency, as well as a formal accuracy assessment based on an independent field data. Further details on the methods employed can be found in the technical procedures document for this project located on the project website ([http://www.dnr.state.mn.us/eco/wetlands/nwi\\_proj.html](http://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html)).

## **IV. PROJECT ACTIVITIES AND OUTCOMES:**

### **ACTIVITY 1: Updated Wetland Maps for Southern Minnesota**

**Description:** Produce updated wetland maps for 18,000 square miles within 30 counties in southern MN (attached figure). The map production will be conducted by contractors under the supervision of the DNR and will be based on recommendations for wetland mapping developed by the University of Minnesota through a previous phase of this project. This work will consist of digital photo-interpretation, topographic analysis of LiDAR data, and analysis of ancillary data such as soils maps and forest inventory maps, as well as quality control review. This activity will also include additional data processing of lidar intensity data. Completed digital map data will be available to the public through several websites, including the DNR and the U.S. Fish and Wildlife Service.

### **Summary Budget Information for Activity 1:**

**ENRTF Budget: \$948,526**

**Amount Spent: \$947,004**  
**Balance: \$1,522**

**Activity Completion Date:**

Outcome	Completion Date	Budget
1. Data preprocessing for 30 counties in southern MN	6/30/2013	\$136,428
2. Wetland map production for 30 counties in southern MN	12/2014	\$812,098

**Activity Status as of January 2013:**

- St. Mary's University (SMU) was selected to perform the update of the NWI data for southern Minnesota. Due the fact that the winning bid came in well under the initial estimate, the scope was expanded to include wetland mapping for an additional six counties. The contract was fully executed on November 2, 2012. A service level agreement has also been developed with the DNR Resource Assessment Program (RAP) to provide support services for the NWI update.
- SMU has begun compiling the input data for the NWI update including SSURGO soils, LiDAR-derived digital elevation models, various imagery datasets, USGS topographic quad maps, and the original NWI data. RAP has assisted with compiling and processing input data. RAP has processed all of the terrain data for the southern MN project area generating various derivatives from LiDAR including slope, curvature, topographic position index (TPI), and compound topographic index (CTI). These derived data have been delivered to SMU.
- Field work has been initiated. An examination of the project aerial imagery was used to identify typical and atypical wetland image signatures and generate a series of field locations for use in correlating wetland image signatures to ground conditions. In total, 128 sites have been visited so far. The first field investigation conducted by SMU involved a series of four, single-day trips. The second investigation was focused on sites in the western most portion of the study area and included SMU staff along with a representative from the DNR and the Minnesota Board of Water and Soil Resources (BWSR). Additional field work is scheduled for this spring.
- SMU has been preparing a draft technical procedures document and conducting preliminary wetland mapping for a series of 40 quarter quads across the study area. The technical procedures document will be completed by January 18, 2013 and will be delivered with a sample of 10 quarter quads for review. A further 30 - 40 quarter quads are scheduled for delivery by January 31, 2013. The draft data and procedures document will be reviewed by the technical advisory committee for the NWI project.
- SMU and DNR also participated in a technical workshop hosted by the University of Minnesota Remote Sensing and Geospatial Analysis Laboratory (RSGAL). The purpose of this meeting was to introduce project team members and to exchange information on wetland mapping methods and identify any technical issues that might impact the success of the project.

**Activity Status as of July 2013:**

- A technical advisory committee meeting was held in February to go over comments from the initial draft data. The meeting included the contractors for both the east-central phase (Ducks Unlimited) and the southern phase (St. Mary's University) in an effort to ensure consistency in the wetland mapping across project phases.
- Additional field work was conducted in May. Approximately 100 sites were visited. The Minnesota DNR, US Fish and Wildlife Service, and Blue Earth County participated in the field assessment, which was led by St. Mary's University (SMU).
- An additional 40 quarter quads of data were developed by SMU and submitted to the DNR for review. The DNR and SMU held a teleconference in June to go over review comments. Production level work on the NWI is progressing with initial mapping done for about 30% of the



project area. Further processing (such as edge-matching and mosaicking) has been performed for 8 counties.

#### **Activity Status as of January 2014:**

Staff from St. Mary's University (SMU) and the DNR conducted joint field work in November visiting approximately 140 sites. This field work was primarily focused in the southwestern part of the project area. Field work was impacted by a 10-inch snow fall which obscured some of the target wetland sites.

SMU has provided draft data for DNR and stakeholder review for Pipestone, Rock, Nobles, Murray, Jackson, Martin, and Wantonwan Counties. The draft data for Rock and Nobles Counties has been fully reviewed by the DNR and other project stakeholders. The review comments were compiled, summarized, and transmitted to SMU. A joint meeting was held between DNR and SMU to discuss the review comments and clarify procedures.

#### **Activity Status as of July 2014:**

Staff from St. Mary's University and the DNR conducted joint field work in May 2014 visiting 226 sites. This field work was primarily focused in the southeastern and central parts of the project area.

SMU has provided draft data for DNR and stakeholder review for Lincoln, Lyon, Brown, Nicollet, Dodge, LeSueur, Cottonwood, Faribault, Waseca, Fillmore, Freeborn, Mower, and Steele Counties. Including previous deliverables, draft data has been provided to the state for a total of 21 counties and preliminary draft data has been developed for another two counties. The draft data for Lincoln, Lyon, Pipestone, Murray, Jackson, Martin, and Watonwan Counties has been reviewed by the DNR and other project stakeholders. The review comments were compiled, summarized, and transmitted to SMU.

The DNR Resource Assessment Office (RA) has completed statewide processing of the LiDAR and soils data to create a number of customized derivative data sets that will be used for the update of the NWI.

#### **Activity Status as of January 2015:**

Draft data have been completed and delivered for approximately 85% of the area. Data for another 5% or so of the project area have had initial edits completed and are under internal review by the contractor. Deliveries have been made for 14 counties since the last status report, including: Chippewa, Freeborn, Houston, Lac Qui Parle, Olmsted, McLeod, Mower, Redwood, Renville, Sibley, Steele, Wabasha, Winona, and Yellow Medicine. The final counties of Big Stone, Kandiyohi, Meeker, and Swift are anticipated for delivery in early February 2015.

St. Mary's University and the DNR participated in a two-day project workshop focused on improving hydro-geomorphic wetland classification. The workshop included one day centered on presentations and round table discussions from various project partners and the author of the HGM classification system, Ralph Tiner. The second day centered on a series of field site visits looking at examples of various HGM classes.

The DNR and other project stakeholders completed data review for 15 counties and submitted the compiled comments to SMU. The data review covered Blue Earth, Brown, Nicollet, Redwood, Cottonwood, Le Sueur, Waseca, Faribault, Dodge, Freeborn, Mower, and Steele counties.

#### **Final Report July 2015:**

The final updated NWI data for the southern Minnesota project area was delivered to the DNR in a single seamless GIS data layer to the DNR along with the metadata and a final version of the project technical procedures document. The data were reviewed and accepted by the DNR. The overall wetland identification accuracy was 94% and the overall wetland classification accuracy was 83%. The DNR made a few formatting changes to the data and the metadata to ensure consistency with earlier phases of the project. Subsequently the data were posted to the State's enterprise GIS system and have been made available more generally through the Minnesota Geospatial Commons

(<https://gisdata.mn.gov/>) as well as through an online wetland viewer. The DNR also forwarded a copy of the data to the US Fish and Wildlife Service for inclusion in the national database for the NWI.

St. Mary's University also completed and delivered an enhanced version of the southern MN NWI with additional watercourse features, including all the watercourses that are part of the Minnesota Public Waters Inventory. The DNR will also incorporate this into the State enterprise GIS system.

**ACTIVITY 2: Data Acquisition for Phase 4 (Central Minnesota)**

**Description:** This component will include acquisition of imagery along with field verification data for the next anticipated mapping phase in central Minnesota. We will acquire high-resolution, spring leaf-off, multi-spectral aerial photography for 22 counties (attached figure). The imagery will be used as a base for updating the NWI maps for central Minnesota. Data acquisition will also include a field-based assessment of wetland type for 400 to 500 sites chosen using a stratified random selection process. The field data will be used to assess the accuracy of the wetland maps developed from remote sensing data. To maintain the independence of the field data, the field data acquisition will be managed by the University of Minnesota, Remote Sensing and Geospatial Analysis Laboratory and the data will not be shared with the mapping contractor.

**Summary Budget Information for Activity 2:**

**ENRTF Budget: \$551,474**  
**Amount Spent: \$548,987**  
**Balance: \$2,487**

**Activity Completion Date:**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Acquisition of spring, high-resolution, digital aerial imagery for 22 counties in Central MN	12/2013	\$456,474
2. Field validation data acquisition for 22 counties in Central MN	09/2014	\$95,000

**Activity Status as of January 2013:**

An interagency agreement was developed with MnGeo to assist with managing a competitive bid contract for imagery acquisition of central Minnesota. DNR worked with MnGeo and other partners to develop a Request for Proposal (RFP) for this work. Several potential local partners have indicated an interest in participating in the imagery acquisition effort. The RFP was noticed in December and proposals are due in January. Under this contract, the imagery for central Minnesota will be acquired in spring 2013 and spring 2014. In addition, we have developed a contract with the University of Minnesota to acquire field validation data for central Minnesota. This field work will be conducted this summer.

**Activity Status as of July 2013:**

Aerometric, Inc. was selected to acquire spring leaf-off imagery through a competitive bidding process. The final price for the selected vendor was well below the estimated price which was based on past aerial imagery contracts. As such the area of acquisition was significantly expanded. The original request for proposal was to acquire imagery for 22,207 square miles of imagery in central Minnesota. This was increased to include acquisition of all remaining 39,625 square miles of the state, including both central and northwestern Minnesota. Several local partners have agreed to participate in the project by buying enhanced resolution imagery for their specific area of interest. These partners and their expected contributions are as follows:

Beltrami County	\$54,499.37
Mille Lacs County	\$13,769.20
Camp Ripley	\$3,925.62
White Earth Reservation	\$34,231.43

Clay County	\$31,090.93
Wilkin County	\$23,265.85
Carlton County	\$23,475.22
Itasca County	\$79,366.49

In addition, we have developed a contract with the University of Minnesota to acquire field validation data for central Minnesota. This field work will be conducted this summer.

**Activity Status as of January 2014:**

Aerometric acquired imagery for about 63% of the northwest and central project area (26,768 square miles). The imagery have been fully orthorectified and checked for quality. The data have been delivered to the State. Imagery for the remaining 37% of the project area will be acquired this spring (15,969 square miles) and orthorectified.

The University of Minnesota completed acquisition of field validation data for central Minnesota and delivered the data to the DNR. The data provided includes approximately 2100 additional points bringing the statewide total of field validation points to approximately 6700. The DNR has accepted the data.

**Activity Status as of July 2014:**

Aerometric has acquired spring, leaf-off imagery for the remaining 37% of the project area. The imagery has undergone an initial quality control review to check the overall image quality and Aerometric is proceeding with the orthorectification process. The final imagery deliverable is expected this fall. The State will perform its own final QAQC review after receiving the data.

**Activity Status as of January 2015:**

Aerometric has completed the ortho-rectification of the imagery and created the tiled imagery mosaics. The State's quality assurance review identified some image quality issue possibly related to a light hazy smoke from wild fire. The imagery passed the initial QA review in all other respects. The State is working with the vendor to review options to minimize the impact on the overall quality of the final deliverable. We now anticipate wrapping up this task and deliverable by February 2015.

**Final Report July 2015:**

The final orthorectified spring aerial imagery was delivered to the DNR and MnGeo. The state performed a final quality assurance review and accepted the imagery data. MnGeo is serving all of the spring aerial imagery from this project and all the previous projects through their online imagery service.

**V. DISSEMINATION:**

**Description:** The plan for disseminating the project results primarily relies on distribution of the wetland maps through web-based data distribution hubs and online viewing of wetland maps through web mapping applications. Primary data access websites for the State of Minnesota include the Minnesota Geospatial Commons (<https://gisdata.mn.gov/>). An online mapping application for viewing the data will be made available through <http://www.dnr.state.mn.us/eco/wetlands/map.html>. Furthermore, the data are likely to be picked up and served by other sites and applications beyond the ones listed here. In particular the data will be provided to the US Fish and Wildlife Service for distribution through their Wetland Mapper application. Publicity for this effort will include presentations at professional conferences as well as publication in selected newsletters and journals. Conference presentations will include at least two of the following venues; the Minnesota Water Resources Conference, the Minnesota GIS/LIS Conference, the Annual Minnesota Wetlands Conference, and the Conference of the Minnesota Association of Watershed Districts.

**Status as of January 2013:**

Presentations on the status of the NWI update were given in October 2012 at the Minnesota Water Resources Conference and the Minnesota GIS/LIS Conference as well as at the EPA Region 5 State and Tribal Wetlands Meeting.

**Status as of July 2013:**

Two presentations on the mapping methods developed under a previous phase of this project were given June 6, 2013 at the annual meeting of the Society of Wetland Scientists.

**Status as of January 2014:**

An overview of the NWI update project was given as part of a larger presentation on wetland monitoring and mapping activities at the DNR Round Table on January 10, 2014.

**Status as of July 2014:**

The DNR has continued to contact various project stakeholder in an effort to engage them in the review of draft data. When the contractor delivers a new county of draft data, the DNR has been reaching out to the county soil and water conservation district as well as the local NRCS office to offer an opportunity to review and comment on draft data.

**Status as of January 2015:**

The DNR has received a couple of inquiries regarding the availability of the data from this project. In response the DNR is provided draft data to Blue Earth County and to researchers at the University of Minnesota for a portion of the overall project area. Final NWI data will be provided when it becomes available.

**Final Report July 2015:**

The DNR has published the final updated NWI data for southern MN. All state agency staff have access to the GIS data through a statewide GIS enterprise system. The public has access to the GIS data via download from the Minnesota Geospatial Commons. In addition, the DNR has developed a web service for the data that feeds into an online web map viewer that allows non-GIS users to view and use the data.

Use of the data developed by the project is being promoted through a variety of channels. The DNR is giving presentation about the updated NWI data at both the Minnesota Water Resources Conference and the Minnesota GIS/LIS Conference. The DNR and MnGeo are co-presenting at the Minnesota GIS/LIS Conference regarding the availability of the spring aerial imagery. A short news article was developed for the Minnesota Geospatial Commons news feed and posted in May 2015. A broader press release has also been drafted for an expected September release. Finally, a peer-reviewed journal article was published in the journal Wetlands based on the work from the previous NWI project phase.

**VI. PROJECT BUDGET SUMMARY:**

**A. ENRTF Budget:**

<b>Budget Category</b>	<b>\$ Amount</b>	<b>Explanation</b>
Personnel:	\$ 150,997	DNR project manager, 0.65 FTE for 2 yrs, unclassified
Professional/Technical Contracts:	\$1,340,003	Aerial photography, data processing/modeling, wetland map production, field data acquisition
Equipment/Tools/Supplies:	\$ 6,000	Field supplies (GPS batteries, insect repellent, sunscreen, protective equipment, paint for photo control points). Office supplies/equipment (printing, shipping, digital storage media)
Travel Expenses in MN:	\$ 3,000	In-state mileage, lodging and travel expenses for project coordination and outreach meetings.

<b>TOTAL ENRTF BUDGET: \$ 1,500,000</b>
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**Explanation of Use of Classified Staff:** NA

**Explanation of Capital Expenditures Greater Than \$3,500:** NA

**Number of Full-time Equivalent (FTE) funded with this ENRTF appropriation:** 0.65-FTE for two years – 1.3 FTE total

**B. Other Funds:**

<b>Source of Funds</b>	<b>\$ Amount Proposed</b>	<b>\$ Amount Spent</b>	<b>Use of Other Funds</b>
<b>Non-state</b>			
Beltrami County	\$54,499.37	\$54,499.37	Enhanced resolution imagery
Mille Lacs County	\$13,769.20	\$13,769.20	Enhanced resolution imagery
Camp Ripley	\$3,925.62	\$3,925.62	Enhanced resolution imagery
White Earth Reservation	\$34,231.43	\$34,231.43	Enhanced resolution imagery
Clay County	\$31,090.93	\$31,090.93	Enhanced resolution imagery
Wilkin County	\$23,265.85	\$23,265.85	Enhanced resolution imagery
Carlton County	\$23,475.22	\$23,475.22	Enhanced resolution imagery
Itasca County	\$79,366.49	\$79,366.49	Enhanced resolution imagery
<b>State</b>			
General fund and other funds as appropriate	\$120,340	\$120,340	Shared Services (operations support governance) are services that DNR relies on in order to conduct business and support the work of the department. These services are more efficient when shared.
<b>TOTAL OTHER FUNDS:</b>	<b>\$383,964.11</b>	<b>\$383,964.11</b>	

The DNR and its partners will also provide approximately \$20,000 of in-kind staff time in support of this project (but not tracked for reporting purposes). Other sources of funding for this project phase have not been identified at this stage. However, based on previous project phases, we anticipate that additional funding from other sources will likely become available as we begin to initiate activities for this project phase, especially for aerial imagery acquisition. See spending history section for further details.

**VII. PROJECT STRATEGY:**

**A. Project Partners:** The University of Minnesota, Remote Sensing and Geospatial Analysis Laboratory will receive \$88,000 for Activity 2 (field data acquisition). Other partners providing in-kind services for this project include the Minnesota Pollution Control Agency, the Minnesota Board of Water

and Soil Resources, the U.S. Fish and Wildlife Service, and the Minnesota Dept. of Administration's Geographic Information Office.

**B. Project Impact and Long-term Strategy:** This is the third phase of a multi-phase project to update the NWI for the entire state of Minnesota. We anticipate initiating a new phase every other year for two additional phases. The estimated total budget for the project is \$7.5 million. With this appropriation, the total amount received from ENTRF to date will be \$3,150,000 (42% of the estimated total project budget). Upon completion of this phase, our progress will be approximately 75% completion for imagery and field data acquisition and about 30% completion for wetland mapping.

**C. Spending History:**

<b>Funding Source</b>	<b>M.L. 2008 or FY 2009-10</b>	<b>M.L. 2010 or FY 2011-12</b>
ENTRF	\$550,000 Chap. 367, Sec. 2, Subd. 5a	\$1,100,000 Chap. 362, Sec. 2, Subd. 3b
USGS/NGA	\$25,000	
St. Louis County	\$24,999	
MPCA Clean Water Legacy	\$111,000	
DNR – Heritage Enhancement Fund	\$ 181,064	
DNR/NOAA – Coastal Zone Program	\$ 24,227	
USGS/NGA	\$75,000	
Metropolitan Council	\$ 65,750	
Metropolitan Mosquito Control District	\$ 7,000	
McLeod County		\$24,000
Sibley County		\$29,000
Murray County		\$35,000

**VIII. ACQUISITION/RESTORATION LIST: NA**

**IX. MAP(S): NA**

**X. RESEARCH ADDENDUM: NA**

**XI. REPORTING REQUIREMENTS:**

Periodic work plan status update reports will be submitted not later than January 31, 2013, July 31, 2013, January 31, 2014, July 31, 2014, January 31, 2015 and July 31, 2015. A final report and associated products will be submitted between July 31 and August 31, 2015 as requested by the LCCMR.

**Attachment A: Budget Detail for M.L. 2011 (FY 2012-13) Environment and Natural Resources Trust Fund Projects**

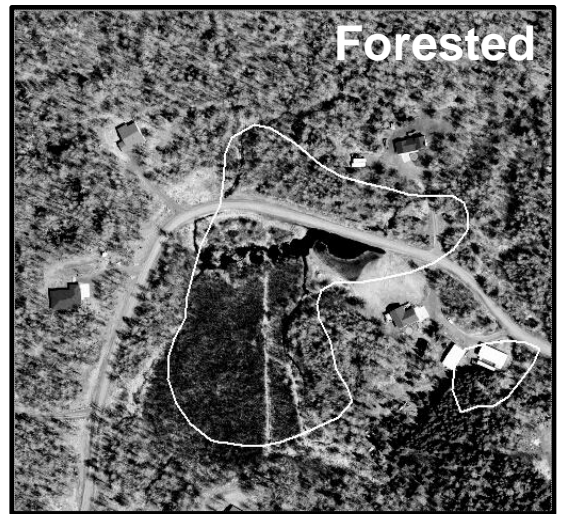
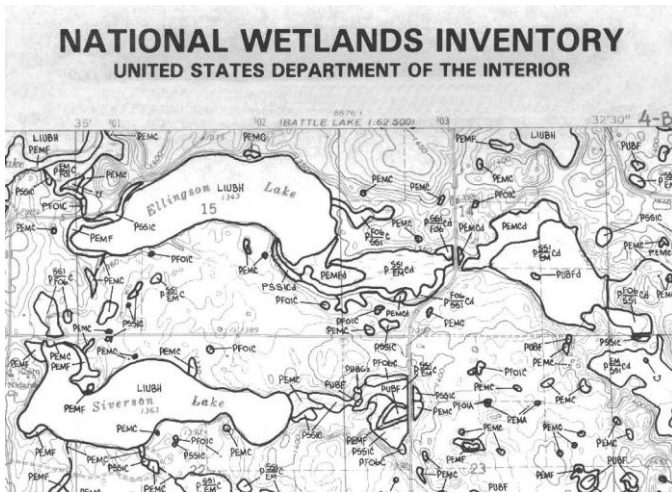
**Project Title:** *Updating the National Wetland Inventory for Minnesota - Phase III*  
**Legal Citation:** *M.L. 2011, First Special Session, Chp. 2, Art.3, Sec. 2, Subd. 03d*  
**Project Manager:** *Steve Kloiber*  
**M.L. 2011 (FY 2012-14) ENRTF Appropriation:** \$ 1,500,000  
**Project Length and Completion Date:** *June 30, 2015*  
**Date of Final Report:** *August 31, 2015*

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Balance	Activity 2 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
<b>BUDGET ITEM</b>	<i>Wetland Mapping</i>			<i>Data Acquisition</i>				
<b>Personnel (Wages and Benefits)</b>								
Steve Kloiber, Project Manager \$139,000 (78% salary, 22% benefits); 0.65FTE for 2 years	\$ 105,698	\$ 105,698	\$ 0	\$ 45,299	\$ 45,299	\$ 0	\$ 150,997	\$ 0
<b>Professional/Technical Contracts</b>								
Aerometric/MnGeo: Aerial Imagery Acquisition				\$ 415,875	\$ 415,688	\$ 187	\$ 415,875	\$ 187
DNR Resource Assessment Office (fee for service office): Data Preprocessing and Wetland Modeling	\$ 118,491	\$ 118,491	\$ -				\$ 118,491	\$ -
St. Mary's University: Wetland Inventory Map Production	\$ 718,000	\$ 717,707.00	\$ 293				\$ 718,000	\$ 293
University of Minnesota, Remote Sensing and Geospatial Analysis Laboratory -- for field validation data acquisition and quality control consulting.				\$ 88,000	\$ 88,000	\$ -	\$ 88,000	\$ -
<b>Equipment/Tools/Supplies</b>								
Field supplies (GPS batteries, insect repellent, sunscreen, protective equipment, paint for photo control points)	\$ -	\$ -	\$ -	\$ 800	\$ -	\$ 800	\$ 800	\$ 800
Office supplies/equipment (printing, shipping, digital storage media)	\$ 4,900	\$ 4,838	\$ 62	\$ 300	\$ -	\$ 300	\$ 5,200	\$ 362
<b>Travel expenses in Minnesota</b>	\$ 1,437	\$ 270	\$ 1,166	\$ 1,200	\$ -	\$ 1,200	\$ 2,637	\$ 2,366
In-state mileage, lodging and travel expenses for project coordination and outreach meetings.								
<b>Other</b>								
<b>COLUMN TOTAL</b>	<b>\$948,526</b>	<b>\$947,004</b>	<b>\$1,522</b>	<b>\$551,474</b>	<b>\$548,987</b>	<b>\$2,487</b>	<b>\$1,500,000</b>	<b>\$4,009</b>

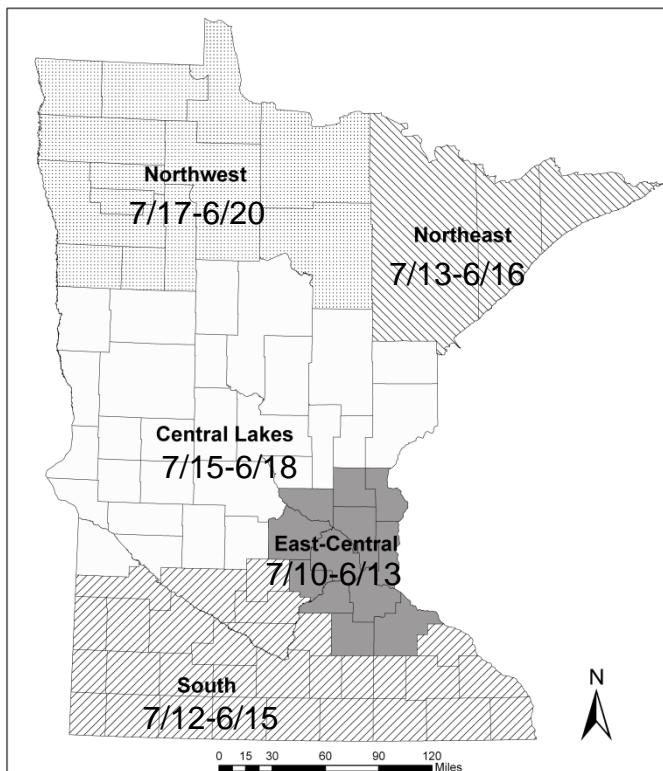
\* A small shift in the budget of \$363 from travel expenses to the P/T contract for DNR Resource Assessment was made to eliminate a negative balance in that line item (as per the work program amendment requested approved on June 23, 2015. This shift had no effect on the overall positive balance of \$4,009.

The original NWI maps for Minnesota were developed 25 to 30 years ago as hard copy paper maps.

Examples of inaccuracies in the original NWI maps resulting from development are shown on top of modern aerial photos.



NWI update schedule by geographic region



The NWI will be updated using modern, high-resolution digital imagery, digital elevation data from LiDAR, and the best-available ancillary GIS data.



# Schedule for the National Wetland Inventory Update

## Mapping Region

East-Central

South

Northeast

Central Lakes

Northwest

FY09-11  
\$550,000  
Approp.  
ML2008  
367/2/5a

Acquire Input Data  
- Imagery  
- Field Data

Acquire Input Data

FY11-13  
\$1,100,000  
Approp.  
ML2010  
362/2/3b

Map Production  
- Preprocessing  
- Delineation  
- Classification

Quality Review  
- Inspection  
- Automated Checks  
- Error Analysis

Data Delivery  
- Web Servers  
- Web Maps  
- Outreach

Acquire Input Data

FY13-15  
\$1,500,000  
Recomm.

Map Production

Quality Review

Data Delivery

Acquire Input Data

FY14-16  
\$1,630,000  
Future

Map Production

Quality Review

Data Delivery

Acquire Input Data

FY16-18  
\$1,760,000  
Future

Map Production

Quality Review

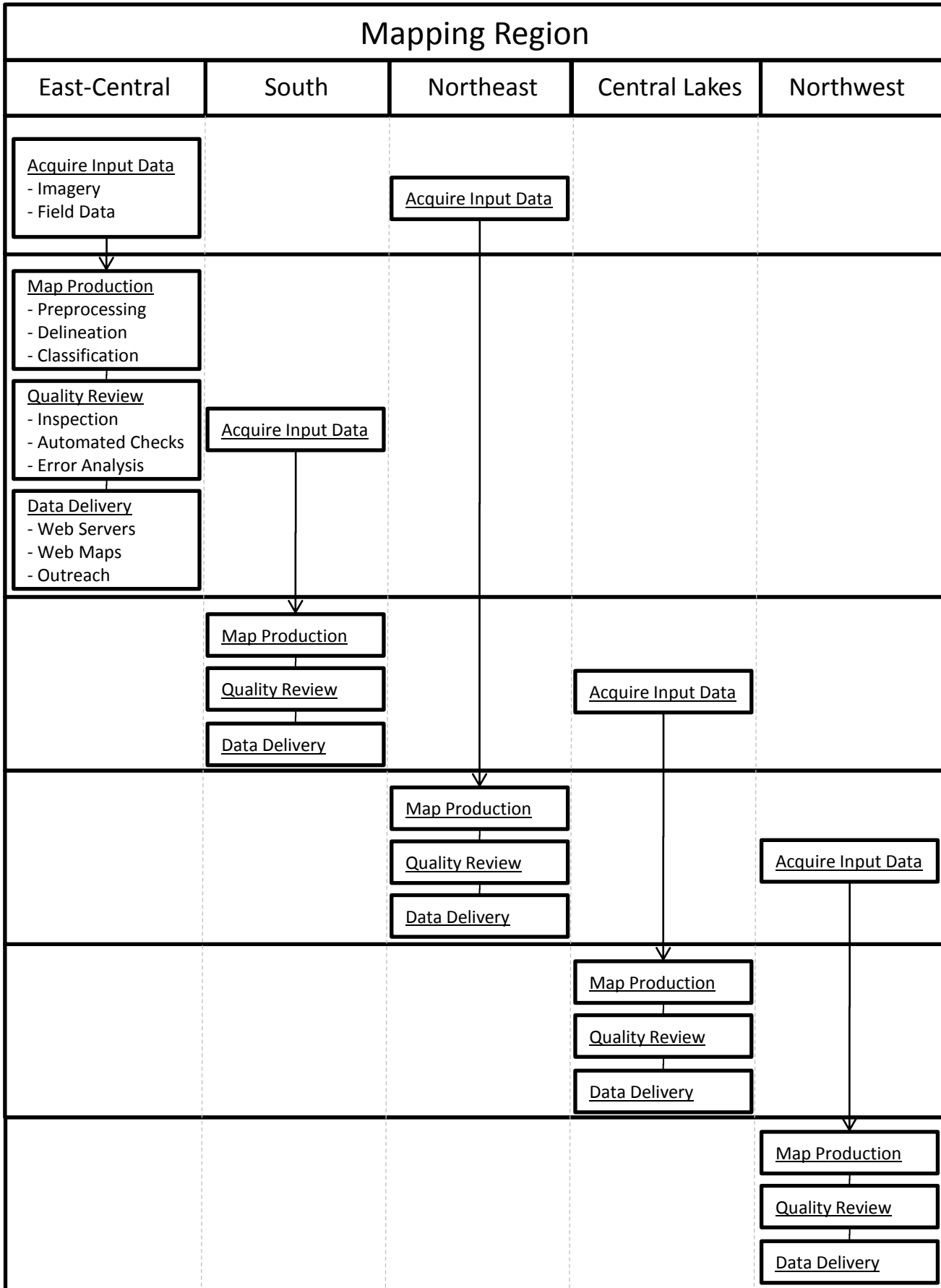
Data Delivery

FY18-20  
\$1,580,000  
Future

Map Production

Quality Review

Data Delivery



## Selected news websites with stories about the updated NWI data

The screenshot shows the Minnesota Geospatial Commons website. At the top left is the logo for Minnesota Geospatial Commons. To the right of the logo are navigation links: Resources, Organizations, Categories, News, About, and Help. Further right is a search box with the text "Search" and a magnifying glass icon. Below the navigation is a breadcrumb trail: Home / New Wetlands Data for Southern Minnesota. The main content area features a news feed story. On the left side of the story is a vertical list of navigation links: Help Home, What is a resource?, Search, Accessing & Using Resources, Becoming a Publisher, Publishing Resources on the Commons, Maintaining Resources, Library, and Keep in Touch. The main text of the story is as follows:

A second region of updated National Wetland Inventory (NWI) data, covering 36 counties in southern Minnesota, is now available through the Minnesota Geospatial Commons. NWI data are used at all levels of government and by private industry and non-profit organizations for wetland regulation and management, land use and conservation planning, environmental impact assessment, and natural resource inventories.

The project to update Minnesota's 1980s NWI data is being conducted in geographic phases, with data for each region released as it is finalized. This newest release is based primarily on 2011 spring aerial imagery and LiDAR elevation data, as well as other modern ancillary data. The updated NWI classify wetlands according to the Cowardin system, and the data also contains a simplified plant community classification and a simplified hydrogeomorphic classification. This is a multi-agency, collaborative effort under the leadership of the Minnesota Department of Natural Resources. Major funding was provided by the Environmental and Natural Resources Trust Fund.

Data are also available for the first region of updated NWI data, which includes 13 counties in east-central Minnesota. To find NWI data for both regions, go to the NWI page on the Geospatial Commons.

At the bottom of the page, there is a dark grey footer. On the left, it contains contact information: "Contact us: [gisinfo.mngeo@state.mn.us](mailto:gisinfo.mngeo@state.mn.us)", "The Minnesota Geospatial Commons is administered by the Minnesota Geospatial Information Office - A program of MN.IT Services", and "Data access API". On the right, it says "Powered by" followed by the CKAN logo.

Figure 1: Minnesota Geocommons new feed story



- Wetlands programs
- Main page
- Status and trends
- NWI project
- Wetland program publications

## National Wetlands Inventory Update



### Project overview

The update of the National Wetlands Inventory (NWI) for Minnesota is being conducted through a collaborative effort coordinated by the Minnesota Department of Natural Resources. The original NWI for Minnesota was created through a U.S. Fish and Wildlife program and was based on aerial photographs that primarily date from 1979 to 1984. The NWI data are used at all levels of government, as well as by private industry and non-profit organizations for variety of uses including wetland regulation and management, land use planning, environmental impact assessment, and natural resource inventories. The NWI is the only spatially comprehensive wetland inventory for Minnesota, but it is now considerably out-of-date.

Updating the NWI was one of three key recommendations from an interagency task force that developed the Comprehensive Wetland Assessment Mapping and Monitoring Strategy (CWAMMS). The primary funding source for this effort is the Environmental and Natural Resources Trust Fund.

### Project News

#### May 1, 2015

The final updated NWI data for the southern region have been incorporated into a single geodatabase along with the data from the east-central region. These data have been posted to the Minnesota Geospatial Commons website for public access.

#### October 1, 2013

Ducks Unlimited is beginning work on updating the NWI for northeastern Minnesota.

#### June 18, 2013

The final updated NWI data for the east-central region have been posted to the DNR Data Deli for public access.

#### Status Map (May 2015)

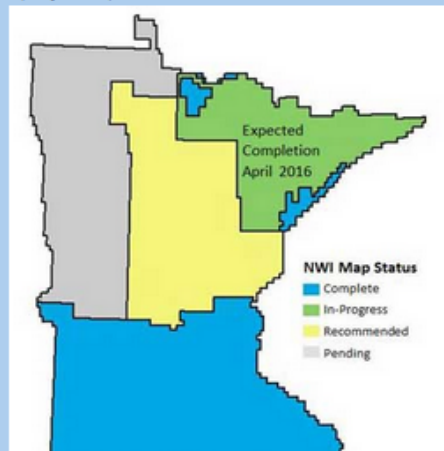


Figure 2: Notice of data availability on the DNR project website.



Minnesota Department of Natural Resources  
**NEWS RELEASE**

WWW.MNDNR.GOV

DNR NEWS – FOR IMMEDIATE RELEASE

August 19, 2015

*Media contact: Steve Kloiber, Wetlands Monitoring Coordinator, phone 651-259-5164, [steve.kloiber@state.mn.us](mailto:steve.kloiber@state.mn.us); Doug Norris, Wetlands Program Coordinator, phone 651-259-5125, [doug.norris@state.mn.us](mailto:doug.norris@state.mn.us).*

## **New wetland map data available**

The Minnesota Department of Natural Resources (DNR) has released updated wetland map data for 36 counties in southern Minnesota. The newly-released data are the first updates to the National Wetlands Inventory (NWI) for southern Minnesota.

The U.S. Fish and Wildlife Service originally mapped Minnesota wetlands in the late 1970s and early 1980s. Those maps are still widely used for land use planning, wetland permit screening and natural resource management. Landscape alterations have made them increasingly out-of-date, and improvements in technology have made the new data much more accurate.

The new map data cover a 23,900 square-mile area. 49 Minnesota counties now have updated NWI data, including the 36 in southern Minnesota and 13 previously released counties in east-central Minnesota.

The data are available through an interactive mapping application on the [DNR's website](http://www.dnr.state.mn.us/eco/wetlands/map.html) ([www.dnr.state.mn.us/eco/wetlands/map.html](http://www.dnr.state.mn.us/eco/wetlands/map.html)). The data can also be downloaded, free of charge, for use in geographic information system applications through the [Minnesota Geospatial Commons](https://gisdata.mn.gov/) (<https://gisdata.mn.gov/>).

The new maps reflect the latest technology in remote sensing and mapping including high-resolution aerial imagery and Light Detection and Ranging (LiDAR) data.

“The original NWI was so outdated that it really wasn’t a useful resource anymore. This new NWI data will give land-use planners, regulators, and landowners valuable information about wetlands on the landscape. This information will ultimately aid in the restoration and protection of this vital natural resource,” said Kane Radel, a wetland specialist for the Board of Water and Soil Resources in southern Minnesota.

Besides showing the location, size and type of each wetland, the updated map data include information on the wetland’s landscape position and characteristics. This can be useful in assessing benefits such as water quality improvement, flood storage, and fish and wildlife habitat.

The release of the wetland map data for southern Minnesota marks completion of the second phase of a statewide update of the NWI. New, high resolution aerial imagery has been acquired for the entire state and wetland mapping is underway for the northeastern region of the state.

The DNR is planning to complete the entire state by 2020. The NWI update project is being funded by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources.