

Guidebook to: Priority GIS Data

Minnesota Governor's Council  
on Geographic Information

JULY 1999

The **Minnesota Governor's Council of Geographic Information** was created to provide leadership in the development, management and use of geographic information and related technology in Minnesota. With support from Minnesota Planning, the council provides policy advice and makes recommendations regarding efficient investments, management practices, institutional arrangements, and data standards and education.

**Minnesota Planning** is charged with developing a long-range plan for the state, stimulating public participation in Minnesota's future and coordinating activities with state agencies, the Legislature and other units of government.

Upon request, the *Guidebook to Priority GIS Data* will be made available in alternate formats, such as Braille, large print or audiotape. For TTY, contact Minnesota Relay Service at 800-627-3529 and ask for Minnesota Planning.

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MINNESOTA PLANNING LAND MANAGEMENT INFORMATION CENTER



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# Guidebook to: Priority GIS Data

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## **We need your feedback and input!**

As this report tries to document, there has been considerable activity since 1994 in developing Minnesota GIS layers. However, there is still much work that needs to be done at both the state and local level to bring needed information into digital map form and then make it available.

If you have data that you would like others to know about, please inform the Minnesota Geographic Data Clearinghouse. Contact LMIC at [clearinghouse@mnplan.state.mn.us](mailto:clearinghouse@mnplan.state.mn.us) or (651) 296-1211 for information on how to create and submit documentation for your data to the Clearinghouse. See <http://www.lmic.state.mn.us/chouse.html> for links to Clearinghouse activities.

We are looking for your information and feedback. Please tell us if there is data that you need that is not available at all, that is incomplete or that needs improvements to meet your needs. Please send your comments to the Governor's Council on Geographic Information via e-mail at [gc@mnplan.state.mn.us](mailto:gc@mnplan.state.mn.us) or through the regular mail at:

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# History

A survey of GIS data needs in Minnesota was conducted in 1994 in a cooperative effort between the Governor's Council on Geographic Information and the Minnesota GIS/LIS Consortium. In this survey, some 230 users, from all levels of government and from the private sector, identified the need for new or improved GIS data.

The 1994 survey results that were summarized across the various government sectors identified digital soil and parcel mapping as the two most important needs, followed in sequence by wetlands, land use/cover, elevation, Public Land Survey, satellite/orthophoto and road and utility mapping. The 1994 survey was summarized in a technical report entitled "Survey of Current GIS Data and Needs" published jointly in 1995 by the Governor's Council and the GIS/LIS Consortium. Contact the Governor's Council for a photocopy of the report at [gc@mnplan.state.mn.us](mailto:gc@mnplan.state.mn.us).

## Prioritized Listing of 1994 Survey Highest

1. [Digital County Soil Surveys](#)
2. [Parcel Mapping](#)
3. [Wetlands](#)
4. [Land Use/ Land Cover Mapping](#)
5. [Digital Elevation Data](#)
6. [Public Land Survey \(PLS\)](#)
7. [Orthophoto and Satellite Data](#)
8. [Transportation Basemap and Right of Way Data](#)
9. [Utilities](#)
10. [Hydrography](#)
11. [Well Informantion](#)

[Do you have any additional data to share?](#)

[Do you have any comments?](#)

Analysis of the 1994 survey showed that state and federal government units favor smaller scale map products, while county and city units have the need for more detailed large scale data. Soils data was the top ranked item for federal, state and county agencies. While parcel mapping data ranked second in overall need, it was rated of high importance by the city, county and private respondents.

## 1999 Update

In this report we will attempt to update what has been happening since the 1994 survey was conducted in those areas with the highest rated GIS data needs identified in the above list. The report updates small-scale statewide data

collection programs. For many of the reviewed datasets, the small-scale, statewide coverages provide an interim source of information until more comprehensive local programs are completed.

With the time and resources available to the workgroup, it was not able to do a comprehensive inventory of the many large-scale or highly detailed data collection efforts (on topics such as parcels, land records and public utilities) that have been developed by local units of government or on a project basis by larger government units. Usual sources for this type of data are larger cities and many counties. The Governor's Council encourages local government units that have developed large-scale data to both document and promote the availability of their data through the Minnesota Geographic Data Clearinghouse. See <http://www.lmic.state.mn.us/chouse.html> for links to Clearinghouse activities, or contact LMIC at [clearinghouse@mnplan.state.mn.us](mailto:clearinghouse@mnplan.state.mn.us) or (651) 296-1211 for information on how to create and submit documentation for your data to the Clearinghouse.

## Digital County Soil Surveys

Development of digital soil information has rapidly accelerated in the last few years. Minnesota's soils have been mapped at various scales and complexities ranging from page-sized state maps with general soil features to site mapping with great detail. This effort began before the turn of the century and continues today. A survey of Minnesota GIS users in 1994 found that digital soil data was the number one data need. Probably the most widely known set of soil maps in Minnesota is the County Soil Survey series (<http://www.statlab.iastate.edu/soils/soildiv/ncss/ncss.html>) coordinated by the US Department of Agriculture's Natural Resources Conservation Service (NRCS). To help focus a plan for obtaining statewide, seamless soil databases from these surveys, a committee of the Minnesota Governor's Council on Geographic Information published *County Soil Surveys: Guidelines for Digitizing*. The report is on the web at: <http://www.mnplan.state.mn.us/press/soilsrpt.html> or call LMIC at (651) 296-1211 for a printed copy. The report classified each county's soil survey into one of four categories and made recommendations for various digitization options. It also discussed intermediate digital product options that can be used until better data becomes available. The county soil surveys were grouped into four categories based on the vintage of the soil classification scheme and the type of base maps used to present the data. Over the past few years, five efforts have developed to expand the use of existing digital soils data and to produce better data in the future.

**RASTER SOIL DATA FROM THE BOARD OF WATER AND SOIL RESOURCES** In 1991, the Minnesota Board of Water and Soil Resources (BWSR) saw the need to supply local water planners with a host of digital data, including whatever soil data was available. For the effort, BWSR is compiling previously digitized county soil surveys into a county data set of approximately 60 variables. BWSR is working with LMIC and the University of Minnesota to compile the University's Soil Survey Information System (SSIS) data into county EPPL7 files. The county files are raster-based with a cell resolution of 5 meters. They will be folded into BWSR's county data sets at a resolution of 20 meters. There are also efforts at BWSR to make the SSIS data available in vector format. EPPL7 soil files have been sent to six counties, 15 more counties will be delivered in 1999, and 10 counties will be delivered later. For more information, contact Tim Ogg at BWSR 651-297-8024 or e-mail: [tim.ogg@bwsr.state.mn.us](mailto:tim.ogg@bwsr.state.mn.us)

**COUNTY SOIL DATA DISTRIBUTED BY LMIC** The Land Management Information Center at Minnesota Planning (LMIC) distributes derivatives of the SSIS files to users who do not obtain their data from BWSR (see previous paragraph). This data is meant to be used for general township level or county level planning, rather than for site-specific analysis. For some counties, LMIC distributes both raster and vector formats. This data includes only the soil unit boundaries and soil names; it does not include a database of soil characteristics. The University of Minnesota's Department of Soil, Water and Climate and LMIC converted the SSIS files to EPPL7 GIS format for 31 counties. Once converted to EPPL7 format, LMIC conducted several basic quality checks on most of the files. The checks were limited to: standardizing file names and values assigned to off-site areas, labeling unlabeled polygons, filling sliver areas created when the section data was mosaicked, and documenting any obvious distortions (most of which could not be corrected). The checked data was returned to the U of M which then created ARC/INFO coverage versions for some of the counties, retaining the township file unit. For more information, contact Nancy Rader at LMIC 651-297-3281 or e-mail: [nancy.rader@mnplan.state.mn.us](mailto:nancy.rader@mnplan.state.mn.us). Note: all of these counties are outside of the 7-county Twin Cities metro area. For soil information in the metro area, contact Dave Vessel at the Metropolitan Council 651-602-1642 or [david.vessel@metc.state.mn.us](mailto:david.vessel@metc.state.mn.us).

**NRCS SOILS WORK IN MINNESOTA** In mid-1998, the Washington D.C. office of the Natural Resources Conservation Service announced the NRCS Soil Survey Digitizing Initiative. NRCS plans to digitize about 2,600 high priority soil surveys over the next five to eight years, depending on available resources. The goal of NRCS in

Minnesota is to produce Soil Survey Geographic (SSURGO) data for all counties. SSURGO is the most detailed level of digital soils data available from the NRCS. The map extent for a SSURGO data set is a soil survey area, which may consist of a county, multiple counties, or parts of multiple counties. A SSURGO data set consists of map data, attribute data and documentation.

Before a soil survey area can be digitized, the soil survey must be modern and the mapping base must meet National Map Accuracy Standards. Nationally, acceptable bases are either orthophoto quadrangles (DOQ's) or 7.5-minute quadrangles. Minnesota has a great advantage over most other states because of the statewide availability of DOQs. If a survey area was originally mapped on another base, the lines are manually transferred to a DOQ base. Digitizing is done by line segment (vector) format in accordance with NRCS digitizing standards and specifications. In Minnesota, work on this effort will be concentrated in Categories 1 and 2 counties as defined in the Governor's Council report. As of April 1, 1999, ten Minnesota counties are SSURGO Certified and four more are in progress. For more information, see the NRCS Minnesota soils home page: <http://www.mn.nrcs.usda.gov/soils/soils.html> or the federal NRCS site: [http://www.ftw.nrcs.usda.gov/ssur\\_data.html](http://www.ftw.nrcs.usda.gov/ssur_data.html).

SSURGO map data are available in modified Digital Line Graph (DLG-3) optional and Arc interchange file formats. Attribute data are distributed in ASCII format with DLG-3 map files and in Arc export format with Arc export map files. Metadata are in ASCII format. SSURGO data is available for free on-line download via: [http://www.ftw.nrcs.usda.gov/ssur\\_ftp.html](http://www.ftw.nrcs.usda.gov/ssur_ftp.html) or on CD for \$50.00 at: [http://www.ftw.nrcs.usda.gov/ssur\\_order.html](http://www.ftw.nrcs.usda.gov/ssur_order.html) or 800-672-5559.

**UNIVERSITY OF MINNESOTA RESEARCH** Important research regarding soil survey mapping in Minnesota is taking place at the University of Minnesota Department of Soil, Water and Climate's Soil and Landscape Analysis Lab. Over the past year researchers have focused on developing cost-effective methodologies to convert soil surveys on distorted map bases to geometrically correct map bases that can be utilized in a GIS. A major bottleneck in the process of soil survey digitizing has been recompiling the soil boundary lines from the distorted photo map base to an orthophoto map base that is appropriate for use in a GIS.

The research has focused mainly on Category 2 soil survey data. Category 2 surveys are compiled on rectified photo base maps, which may contain significant spatial errors due

to terrain relief displacement. There are currently 42 counties in Minnesota that fall under this category. If digitized without proper orthorectification, these soil boundary lines will not properly align with other orthorectified data layers in a GIS. Many soil surveys have been digitally "warped" to try to fit correct mapping bases (such as DOQs) using 2-dimensional interpolation techniques, often referred to as "rubber sheeting." This approach does not account for terrain displacement errors and will not provide accurate rectification in landscapes where topographic relief exceeds approximately 15 meters.

The researchers have developed an orthorectification software program using photogrammetric principles to remove existing soil survey base map errors by considering the effect of terrain displacement. The software uses a USGS digital orthophoto (DOQ), a scanned soil survey mapsheet, and a USGS 30-meter digital elevation model (DEM) as input. Preliminary work suggests that this approach is considerably more cost effective, efficient and possibly more accurate than the manual recompilation currently used by the NRCS. As such, this approach could greatly expedite the creation of digital soil survey databases by providing a cost effective and rapid technique for compiling distorted surveys onto orthophoto bases. The research team is currently scaling the approach up to a county to document cost and potential savings of using the approach developed in the Soil and Landscape Analysis Laboratory. For more information contact Dr. Jay Bell ([jbelle@soils.umn.edu](mailto:jbelle@soils.umn.edu)) or Matt Krusemark ([mkrusmar@gis.umn.edu](mailto:mkrusmar@gis.umn.edu)) in the Department of Soil, Water, and Climate at the University of Minnesota.

**UPDATING OUTMODED SOIL SURVEYS** The Governor's Council Soil Report (<http://www.mnplan.state.mn.us/press/soilsrpt.html>) identified more than 20 counties with outmoded soil surveys. Before these surveys should be digitized to high precision, work is needed on both the soils classification and basemaps.

In 1998, BWSR made a request to the Legislative Commission on Minnesota Resources (LCMR) to begin this process. The 1999 Legislature funded a pilot study for updating and digitizing these soil surveys in two or more counties which will be started in the next biennium. Each of the outdated county soil surveys must be evaluated for current soils classification and recompiled on an orthophoto basemap.

When digitized, the updated soil survey will meet national NRCS Soil Survey Geographic (SSURGO) Database standards and be part of the State of Minnesota digital soil database. Initially, the project will focus on southeastern

Minnesota. Other counties will be undertaken as time and funding permit. Participating counties will be asked to provide matching funds. Work will be started by NRCS and BWSR, with quality assurance provided by NRCS soil scientists in cooperation with the University of Minnesota Department of Soil, Water and Climate. For more information, contact: Greg Larson, Board of Water and Soil Resources, 1 West Water Street, Suite 200, St. Paul, MN 55107, 651-296-0882, [greg.larson@bwsr.state.mn.us](mailto:greg.larson@bwsr.state.mn.us)

## Parcel Mapping

Many counties and cities along with some state agencies have been advancing their efforts for digital mapping of parcels over the last several decades. In addition, private firms have developed products, such as scanned plat maps, that are of use to the GIS community. At the county level, surveyors, auditors, assessors and recorders all have an interest in these efforts. It is felt that quite a bit of progress has been made since the findings that were reported in the 1995 report referenced below, however there has been no systematic tracking of activity since then.

### Soil Data (SSURGO Standard)

Scale: 1:12,000

Agency/Contact: NRCS State Office, 651-602-7861 or <http://www.mn.nrcs.usda.gov/soils/soils.html>

Vintage: Varies, most field work done since the 1970s

Description: Digital version of published County Soil Surveys

Extent of Coverage: Eventually statewide, county files.

Software/file type: ARC/INFO coverage, ARC export, or DLG3 format

Funding for Development: federal, state, and local match, if available.

Attribute Data: see

[http://www.ftw.nrcs.usda.gov/ssur\\_data.html](http://www.ftw.nrcs.usda.gov/ssur_data.html)

Coordinate System: UTM

Fees: free on-line; or \$50 on CD

Shortcomings: Only 10 counties completed, will likely take 10 or more years to complete state

Data Quality: very good. See national information site at:

<http://www.ftw.nrcs.usda.gov/ssurgo.html>

Maintenance: reworking old surveys to modern standard for next decade or more.

### Issues, Needs and Recommendations:

There is a need to complete a modern statewide seamless GIS layer from county-based soil surveys that is compliant with the federal SSURGO standard.

COUNTY AND STATE PROGRAMS In the “[Report of Findings - Needs Assessment and Implementation Study](#)” (NAIS) an attempt was made to gather information on parcel-based GIS implementations in Minnesota. Contact the Governor’s Council to obtain a copy of the report at [gc@mnplan.state.mn.us](mailto:gc@mnplan.state.mn.us). In this survey, completed in December 1995, 22 counties reported having parcel-based GIS implementations. Surveys were returned to the consultant by 83 of 87 counties. Sixty-four percent of the users responding to the survey reported their base maps were seventy-five percent or more complete. The extent of coverage for the mapping was the county. A description of the data included in the database was not asked for, however, the general assumption is that the parcel lines are included. Some of the reporting agencies also reported they were working on the parcel identification numbers (PINs). The software reported being used most often was ESRI products and the PC was the most common platform reported.

Forty-four percent of the parcel-based users reported using the NAD 1983 datum for their horizontal control. Fourteen percent were using the NAD 1927 datum. The remaining forty-two percent were either using no datum or did not respond. Of the coordinate systems reported in use, fifty-one percent were using the county coordinate system and twenty-two percent were using the State Plane coordinate system. Seven percent of the users were using the Universal Transverse Mercator system. The remaining twenty percent did not respond.

The reported accuracy of the parcel lines was quite high. Nearly twenty-four percent reported an accuracy of plus or minus 2 feet while twenty-one percent reported an accuracy of plus or minus 5 feet. The rest were scattered between plus or minus 10 to 40 plus feet.

The status of the use of PINs in the parcel-based GIS had twenty-six percent of the counties completed, twenty-six percent mostly complete, and another twenty-six percent mostly incomplete. Of the remaining 22%, about 15% had not begun a PIN system and 7% did not respond.

It was also evident that parcel-based GIS are following two corridors in Minnesota. One corridor follows the Iron Range counties and the other follows the I-94 corridor. The exceptions to this pattern are Cook County, Lake of the Woods County and Red Lake County. This area is currently changing as more local government units are beginning to create parcel-based mapping. Since the last attempt to gather information on the creation of parcel-based mapping (NAIS), there have been new efforts started. Therefore some sort of focused survey to update what is known about parcel data is needed.

## Wetlands

DIGITAL WETLANDS DATASET In accordance with the Emergency Wetland Resources Act of 1986, the US Fish and Wildlife Service (FWS) developed a national series of 1:24,000 scale wetland maps, the National Wetlands Inventory (NWI). FWS has mapped approximately 90% of the lower 48 states and more than 30% of Alaska. All of Minnesota was mapped except for portions of eight

### Parcel Data

**Scale:** Varies, contact the agency creating the data for information

**Agency/Contact:** Local government or regional planning agency

**Vintage:** Varies, this data is updated as needed by the agency

**Description:** Data is a map of the cadastre, usually including a parcel identification number (PIN)

**Extent of Coverage:** Usually coverage is by county or city, but it may cover a region

**Software/file type:** Varies, but ARC/INFO by ESRI is the most commonly reported software

**Funding for Development:** Local unit based

**Attribute Data:** May vary - contact custodian agency

**Coordinate System:** County Coordinates, State Plane and UTM are most prevalent

**Fees:** Varies by governmental unit

**Shortcomings:** Adjoining coverages may be different scales and data quality

**Data Quality:** See metadata as provided by custodian agency

**Maintenance:** Varies

### Issues, Needs and Recommendations:

There is a need to develop a good mechanism to inventory and keep current the status of parcel mapping at the local level.

The Governor’s Council in the past has recommended a land records modernization program that would include digital parcel data. The Governor’s Council should continue to promote seeking mechanisms to fund land records modernization.

Most of the large scale parcel data is very local in nature or is project specific. Developers should be encouraged to document this data and to make it available to others that need it.

quadrangles for which photography was unavailable. While there were no minimum size limits for mapping wetlands, there was no attempt to include all wetlands. Many seasonal and farmed wetlands were not included in the NWI as these are difficult to delineate based on photography from a single year. FWS used the Cowardin system of wetland classification; for more information on this system, see <http://www.nwi.fws.gov/classman.html>.

The Act also required FWS to produce digital NWI data. With accelerated funding from the Legislative Commission on Minnesota Resources (LCMR), the digital NWI was completed for Minnesota in the early 1990's. FWS placed NWI files on-line in 1994 and these can be accessed and downloaded for free from: <http://www.nwi.fws.gov/download.htm>. The data can be downloaded by 7.5' quads in either DLG or Arc Export format. *Note: these files do not contain the enhancements made for the CD sets described below.*

**CD SETS FOR MINNESOTA** In 1997, LMIC and the Minnesota Department of Natural Resources, Division of Waters cooperated to enhance the files available from FWS. Files were kept as 7.5' quads, but they were edge-matched and converted to the NAD83 datum. UTM Zone 14 and 16 quads were converted to extended Zone 15. Cowardin codes that were incorrectly entered as all uppercase were converted to mixed case; DNR also changed codes that they judged to be incorrectly applied in Minnesota. The files now contain the Cowardin codes as originally assigned by FWS, the Cowardin codes changed by DNR, and the simpler Circular 39 system codes determined by DNR. In addition, there are separate items for each part of the Cowardin code to make it easier for the user to search for specific wetland types.

Two three-CD sets are available that contain all of the digital NWI maps for Minnesota. One set provides the files in Arc/INFO coverage format; the other provides shapefile format. The shapefile CDs require ArcView 3.0 or 3.1 and an Internet Browser to fully utilize all the data available. Some of the FWS documentation requires Adobe's Acrobat 3.0 viewer. The data on the shapefile CD-ROMs have been compressed using the pkzip utility and the 'pkunzip' utility is on each CD. DNR had funds to produce only a limited number of the shapefile CD sets and they have all been distributed. LMIC, working in agreement with DNR, has reproduced them and made them available for purchase. There are no efforts to update the statewide data. There are some local efforts, either by county or smaller areas, to identify all wetlands. Also, USDA-NRCS has delineated farmed and seasonal wetlands on USDA-Farm Services Agency photography, but there is no effort planned to digitize this data.

## Wetlands Data

Scale: 1:24,000

**Agency/Contact:** Fish & Wildlife Service (FWS) (1-800-USA-MAPS) ([www.nwi.fws.gov](http://www.nwi.fws.gov)) or MN Land Management Information Center (LMIC) (651-296-1211) ([www.lmic.state.mn.us](http://www.lmic.state.mn.us))

**Vintage:** Digitizing was done by FWS from NWI maps created from 1974-1984

**Description:** National Wetlands Inventory

**Extent of Coverage:** 100% of Minnesota (by 7.5' quad)

**Software/file type:**

FWS: DLG (tarred and compressed) and Arc Export format

LMIC: Arc coverage and shapefile formats

**Current Funding for Development:** None for MN

**Attribute Data:** FWS: Cowardin code

LMIC: Cowardin code with corrections

from FWS labels and Circular 39 code.

**Coordinate System:** FWS: UTM; CD sets: extended UTM Zone 15

**Fees:** FWS: Free if downloaded from Internet, fees for CD or tape

LMIC: Fee for CD (3 CDs to cover state, individual CDs may be purchased)

**Shortcomings:** Farmed wetlands and some seasonal wetlands not mapped. Portions of eight quads missing.

**Data Quality:** FWS: Metadata on website

LMIC: Metadata on CD and at

<http://lucy.lmic.state.mn.us/metadata/mnwimeta.html>, quads are edge matched, Cowardin codes are corrected, files converted to NAD83.

**Maintenance:** None

## Issues, Needs and Recommendations:

The NWI is based on photography over a short timespan. Additional wetlands (especially on agricultural land and of a seasonal nature) are apparent on Farm Service Agency photography that represents a longer period of time. There is the need to look at a larger span of years to establish a more comprehensive wetland inventory.

## Land Use / Land Cover Mapping

In several major efforts, land use and land cover have been mapped statewide during the last thirty years. Other efforts have mapped smaller portions of the state.

**1969 MINNESOTA LAND USE / LAND COVER** Until recently, the most comprehensive statewide land use / land cover mapping was done in 1969 by the University of Minnesota Land Management Information System (MLMIS) at the Center for Urban and Regional Affairs (CURA). This project resulted in the development of one of the key data layers in the forty-acre raster-based MLMIS geographic information system. High altitude photography and traditional air photo interpretation techniques were used to identify one of nine basic land use / land cover categories as the predominant type for each forty-acre parcel in the state. A statewide 1:500,000 scale map was published and has been used by many people over the last several decades. The data is available from LMIC as one of the many layers in the MGC (Minnesota GeoCorrected) CD collection. See <http://lucy.lmic.state.mn.us/metadata/mgc100.html> for more information.

**MINNESOTA LAND USE AND COVER: 1990'S CENSUS OF THE LAND** During the 1990's, a continuing project funded by the Legislative Commission on Minnesota Resources (LCMR) produced a newer and higher resolution land use and cover digital map of the state. This is now the most recent, although not consistently collected, view of statewide land use. Information used to create the map layer was collected by several different groups using somewhat different technical approaches using either aerial photography or Landsat Thematic Mapper satellite imagery. Most recently, the Association of Minnesota Counties (AMC) oversaw the effort. DNR staff took the various products generated by the data collectors and reduced the information into an eight-category statewide Land Use and Cover map. The state map was published at 1:550,000 scale, through a joint effort involving CURA, AMC and DNR. The data that was used to generate the map is available and documented at LMIC at <http://mapserver.lmic.state.mn.us/landuse> or (651) 296-1211.

### Issues, Needs and Recommendations:

Local and state agencies need to work together to develop mechanisms and funding to update and improve a statewide land use / land cover inventory on an ongoing basis.

A proposal for a program to continually work on updating these coverages was submitted to the 1999 Minnesota legislature but did not receive funding. AMC proposed to coordinate this project working with CURA at the University of Minnesota, several state agencies and several Minnesota State Universities. The work would include updates based on individual county and agency needs. If you would like more information on the proposed legislation, contact Dave Weirens at AMC: (651) 224-3344, [dweirens@mncounties.org](mailto:dweirens@mncounties.org) or George Orning at CURA: (612) 625-0081, [ornin002@tc.umn.edu](mailto:ornin002@tc.umn.edu).

**GENERALIZED LAND USE FOR THE TWIN CITIES METROPOLITAN AREA, 1990** The 1990 Generalized Land Use data set is an ARC/INFO polygon coverage that encompasses the seven county Twin Cities (Minneapolis and St. Paul) metropolitan area in Minnesota. The data set was developed by the Metropolitan Council, a regional governmental organization that deals, in part, with regional issues and long range planning for the Twin Cities area. The data were interpreted from 1990 air photos and include the generalized land use classes of: single-family residential, multi-family residential, commercial, industrial, public/semi-public, airports, parks & recreation, vacant/agricultural, highways, open water bodies, farm homesteads, industrial parks not developed, and public land not developed.

A 1997 land use layer is in the process of being developed. This layer is expected to be completed in 1999. In addition, a 1984 land use layer exists in digital form, but problems have been found with this data set. This 1984 layer will be made available when the problems have been corrected. This is also expected in 1999.

The data set is available to anyone for a fee from the Metropolitan Council. For more information and a sample graphic of the data, see <http://lucy.lmic.state.mn.us/metadata/luse90.html> or contact the Metropolitan Council at (651) 602-1140.

### Other land use and land mapping efforts

■ A nationwide dataset is being created from 1991-92 Landsat imagery. LMIC expects to receive the portion covering Minnesota sometime in 1999. The USGS Fact Sheet describing this can be found at <http://mapping.usgs.gov/mac/isb/pubs/factsheets/fs04897.html> and the site where the data will be available is <http://www.epa.gov/mrlc/Regions.html>.

■ Gap Analysis Program land cover / vegetation information. GAP is a nationwide project coordinated by

the Biological Resources Division of the U.S. Geological Survey and is aimed at setting priorities for protection of critical wildlife habitat. GAP brings together three critical data elements: vegetation maps, land ownership maps, and ranges of wildlife species. Vegetation mapping of Minnesota for GAP is being carried out by the Minnesota DNR Forestry Resource Assessment unit in Grand Rapids using digital Thematic Mapper imagery from the Landsat series of resource satellites. Contact Bill Befort (218-327-4449) at the DNR Resource Assessment unit in Grand Rapids for additional information on GAP data or see the Upper Midwest GAP website: <http://www.emtc.nbs.gov/umgap/home.html> or the national website: <http://www.gap.uidaho.edu/gap> .

## Digital Elevation Data

When GIS users talk about the need for elevation data, they generally are talking about two very different datasets. Federal, state and other 'large area' users are usually talking about Digital Elevation Models (DEMs) produced by the US Geological Survey. County, local and other 'small area' users generally want higher resolution data, such as 5, 2 or even 1-foot contours.

**30-METER ELEVATION DATA** Minnesota is now completely covered by DEMs produced by USGS (see <http://www.lmic.state.mn.us/bmap90/dem/dem.htm>). As part of the program to produce statewide digital orthophoto quads (DOQs - see data need #7 following), the U.S. Geological Survey produced topographic information consisting of an array of regularly spaced (30-meter) elevations over a standard 1:24,000-scale quadrangle map sheet. These elevations are based on the contours as published on the 1:24,000 USGS topographic maps. DEMs contain only elevation values associated with a series of x and y coordinates and header information; the user will need additional software to create viewable products such as contour maps. DEMs are produced using the UTM zone and datum of the source map, and the vertical units may be either in feet or meters. DEM files are available from the USGS or the Land Management Information Center. LMIC has also used the DEMs to produce one statewide raster file that is standardized on NAD83, extended UTM Zone 15, with vertical units in feet.

Production of the USGS DEMs has gone through several technology changes since production began for Minnesota in the 1980s. About one-quarter of the state, largely in southeastern Minnesota, was initially developed with an older, now-obsolete technology. This technology produced data now called level 1 DEMs and can show some data

problems (see <http://www.lmic.state.mn.us/bmap90/dem/demprob.htm> for explanation). The remainder of the state was produced with a newer technology called level 2. Through a pooling of state agency funding, 366 'problem' DEMs have been revised to level 2 standards and are available while slightly over 100 more 'problem' DEMs still need revision. To join an effort to complete this valuable revision process, call Don Yaeger (651) 297-2490 or e-mail: [don.yaeger@mnplan.state.mn.us](mailto:don.yaeger@mnplan.state.mn.us).

**HIGHER RESOLUTION ELEVATION DATA** Higher resolution digital elevation data would be extremely expensive for the entire state. Consequently, it is usually developed by county and local governments in areas of highest need: developed and developing urban areas, flood plains, active mining areas, etc. A few counties and several cities, especially in the Twin Cities metro area, have contracted for the production of such data. The Minnesota DNR office in Hibbing has coordinated an effort to develop 5-foot contour data for the area of the Mesabi Iron Range. There is no known effort to organize the production of this high resolution elevation data over large areas of the state. The best source of information on the existence of these data is probably your county or city surveying or planning office.

## Public Land Survey

During the past thirty years, a variety of projects have created digital GIS files of Minnesota's Public Land Survey. PLS line and section corner mapping has been a high priority since it provides a foundation for recording land ownership and management information. Minnesota's earliest attempts in the late 1960s created statewide quarter-quarter sections in a raster format (the MLMIS data set) with each cell representing a 40-acre area. Since then, LMIC, DNR, Mn/DOT, and other agencies have improved upon the early 40 acre raster portrayal of the PLS. The most detailed PLS information, however, is likely kept in the county courthouse records of the surveyor, assessor, or land office.

Various attempts to capture the PLS can be grouped into three types: point, line and polygon.

### Point Data Sets

■ **SECTIC-24K SECTION CORNER DATABASE** The SECTIC-24K database includes coordinates for all PLS section corners within Minnesota as displayed and recorded

from the U.S. Geological Survey's 1:24,000-scale 7.5-minute topographic quadrangle map series. These points were digitized in the early to mid 1980s. In addition, LMIC developed software utilities that: (1) provide user-specified section corner extraction from the SECTIC-24K database by county, 1:24,000-scale quadrangle or PLS township, (2) convert among PLS, UTM and latitude/longitude coordinates, and between NAD27 and NAD83 datum values, and (3) create user-defined output files in dBASE format. The database and utilities are available free on-line at: <http://lucy.lmic.state.mn.us/metadata/sectic.html>

■ **MN/DOT BASEMAP PLS LAYER** The Mn/DOT BaseMap CD contains a point layer for PLS section corners. The layer does not contain attributes. See further information about the BaseMap CD under "Line Data Sets" below.

■ **CONTROL POINT INVENTORY** The Public Land Survey Control Point Inventory is a repository database system of the public land survey corners for the state of

#### USGS Digital Elevation Models (DEM) Data

**Scale:** 1:24,000

**Agency/Contact:** USGS, Rolla, Missouri 573-308-3500 or LMIC 651-296-1211 (contact LMIC for statewide raster file).

**Vintage:** Varies, see date of individual USGS 1:24,000 quads.

**Description:** Elevation data

**Extent of Coverage:** Statewide; slightly over 100 quads are still in old level 1 technology format.

**Software/file type:** DEM (need software to process) or statewide 30-meter raster

**Current Funding for Development:** None.

**Attribute Data:** DEM: Elevation in either feet or meters; statewide raster is in feet.

**Coordinate System:** DEM is in UTM; statewide raster is in UTM extended Zone 15

**Fees:** DEM: Set up fee, plus cost per file; statewide raster will be on-line soon from LMIC

**Shortcomings:** Old data in areas of terrain change, like mining or urban construction areas.

**Data Quality:** See metadata at:

[http://edcwww.cr.usgs.gov/glis/hyper/guide/7\\_min\\_dem](http://edcwww.cr.usgs.gov/glis/hyper/guide/7_min_dem)

**Maintenance:** None

#### Issues, Needs and Recommendations:

The need for a high resolution statewide DEM should be examined.

State and local partners should work together on project standards for high resolution DEM data.

Minnesota. The CPI is a multi-agency effort that began in 1991 when the LCMR funded LMIC to create a database that provides a comprehensive source for public land survey point referencing information. The CPI's goal is to hold the most current and accurate set of coordinate points that can be used as a GIS base layer. This means eventually replacing the approximate section corners provided by LMIC's SECTIC 24K (the section corners from the USGS 7.5' quadrangles) with more accurate corners determined by surveyors.

In the early 1990s, DNR was developing a database to keep track of its 4,000+ corner certificates. In the planning meetings to develop a CPI database, the DNR system was demonstrated and was used as the pilot for the project. The base set of coordinate data for the Control Point Inventory were SECTIC coordinates that were converted from NAD27 - UTM Zone 15 to NAD83 - latitude and longitude and county coordinates. This version of CPI was distributed to all counties that had county surveyors.

In the mid-1990s, Mn/DOT took over development and eventual implementation of the Control Point Inventory System. The Public Land Survey Control Point Inventory database is being redesigned as a client-server database system that can be accessed through the Internet. The new system is being modeled using the corporate data model standards established by Mn/DOT. The existing CPI will be maintained and updated as a tool for those who do not have access to the new system and as a source for updated information. The data in the existing control point inventory system is being updated from the information from Mn/DOT's GIS BaseMap data set. The date and surveyor of the original public land survey has been added to the information about each PLS township. Another update that will be implemented over the next couple of months is a direct link to the scanned corner certificates images and histories. For more information about the CPI, contact: Mar Alojado, R.L.S., Geodetic Services Land Surveyor, [mar.alojado@dot.state.mn.us](mailto:mar.alojado@dot.state.mn.us), or 651-296-9069. Also see Mn/DOT's Office of Land Management Website at: <http://rocky.dot.state.mn.us>

#### Line Data Sets

■ **MN/DOT BASEMAP PLS LAYERS:** The Mn/DOT BaseMap CD contains layers for PLS section lines and township lines. The layers are lines rather than polygons, do not extend across water bodies, and contain no attributes. The lines were digitized from maps during the 1980s through the early 1990s using the current edition of the USGS 1:24,000 topographic maps. They are an appropriate and least-cost GIS layer for users who need PLS for display

purposes only. For further information, contact Mn/DOT's Office of Right of Way and Surveys, Surveying and Mapping Section at: [gisinfo@dot.state.mn.us](mailto:gisinfo@dot.state.mn.us) or 651-215-1973. Also see: <http://lucy.lmic.state.mn.us/metadata/basemap.html>

## Polygon Data Sets

■ **100K TOWNSHIP, RANGE, SECTION (TRS) DATA SET** - The TRS data set contains all PLS section and township boundaries as well as county boundaries for Minnesota. The data were digitized at LMIC from USGS 1:100,000-scale topographic quadrangle maps on stable-base material, published between 1977 and 1986. *(Note: The TRS section lines are more accurate than those in TRSQ for all TRSQ quads that were digitized from paper maps.)* All survey lines were extended across water bodies as described in the TRSQ entry above. PLS attribute information is added to allow this base layer to be related to any tabular data set that has PLS information. TRS is intended to be used for regional studies conducted at the county or multi county level. The lines in this data set are not meant to be used as legal records.

LMIC is currently making some final adjustments to TRS to add several items to the attribute tables to enhance analysis capabilities and to dissolve the sections to create township and county boundary coverages. County-based NAD83 TRS coverages will be included on a forthcoming PLS CD set in both ARC/INFO export and shapefile format. A statewide TRS file is currently available.

■ **100K TOWNSHIP, RANGE, SECTION, QUARTER-QUARTER (TRSQ) DATA SET** - The TRSQ data set represents the Township, Range, Section, Quarter section, and Quarter-quarter section divisions of the state. The data were digitized at LMIC from USGS 1:100,000-scale 30-minute by 60-minute topographic quadrangle maps, some printed on paper and some on stable-base material, published between 1977 and 1986. All survey lines were extended across water bodies despite the fact that USGS base maps depict them only on land. This addition allows all sections and townships to be represented as closed polygons ensuring that township and range location can be determined for any point in the state. It also means that the data set is not affected if lake levels change over time.

Quarter section and quarter-quarter section subdivisions were calculated using digitized section corners. (see above) They were not digitized from original plat book survey lines or from the meandered lines that surveyors laid out around water bodies. PLS attribute information is added to allow

this base layer to be related to any tabular data set that has PLS information. The existence of government lots within a quarter-quarter section was recorded in the data set; however, the government lot boundaries were not digitized. If a quarter-quarter section contains more than one government lot, the number of lots was recorded. TRSQ is intended to be used for regional studies conducted at the county or multi-county level. The lines in this data set are not meant to be used as legal records. For more information, see: <http://lucy.lmic.state.mn.us/metadata/trsq.html>

LMIC is currently making some final adjustments to TRSQ to resolve some minor boundary problems, to add several items to the attribute tables to enhance analysis capabilities, and to dissolve the quarter-quarter sections to create section, township, and county boundary coverages. County-based NAD83 TRSQ coverages will be included on a forthcoming PLS CD set in both ARC/INFO export and shapefile format. *(Note: users who need data only to the section level should use the more consistently produced TRS data set described next.)*

■ **DNR MINERAL'S HIGHER RESOLUTION PLS LAYER** - This effort was started in 1994 by the DNR Division of Minerals to assist in their mineral leasing and exploration activities. The land survey information in this database is constructed using section corner coordinates (and other PLS corners if available) from the Control Point Inventory as well as information from the original surveyors' notes and plat maps. The scale is 1:24,000 or larger. Quarter-quarter section and government lot boundaries and meander corners are proportioned using Cadastral Measurement Management software from the U.S. Bureau of Land Management. Meander lines are added with ArcCOGO using the bearings and distances from the original survey notes. The section lines and Indian reservation boundaries are extended across water bodies, but the smaller subdivision lines are not. PLS attribute information is added to allow this base layer to be related to

### Issues, Needs and Recommendations:

The Control Point Inventory (CPI) should be completed and made available to all GIS users.

Several different PLS layers have been developed at different times for different purposes (examples - for assisting with digitizing data at 1:24,000 and other scales; for "broad-brush" referencing and mapping of statewide land ownership and other land survey referenced data; and for local government large scale parcel mapping and land records management). There is a need to work toward a single high resolution PLS layer.

any tabular data set that has PLS information. This data set when completed will likely cover all of Minnesota including the seven county Twin Cities metropolitan area. The distributor for this data set is MnDNR Division of Minerals. Contact Jill Bornes at: [jill.bornes@dnr.state.mn.us](mailto:jill.bornes@dnr.state.mn.us) or 651-296-1879.

## Orthophoto and Satellite Data

As with other GIS data sets, there is a difference in types of products needed between statewide, large-area users and local, small-area users.

**ORTHOPHOTOS** Minnesota has been involved in an 8-year effort to produce 1:12,000 Digital Orthophoto Quadrangles (DOQs) with one-meter resolution for the entire state. In the late summer of 1998, this goal was achieved. Minnesota became the second, and by far the largest, state to be completed. The effort was largely funded by the Legislative Commission on Minnesota Resources and the U.S. Geological Survey (USGS) and coordinated by the Land Management Information Center at Minnesota Planning. The Center has received commendations from Governor Arne H. Carlson and the U.S. Geological Survey for its role.

So, what is a DOQ? Here are some definitions:

- An orthophoto is an aerial photo that has been precisely corrected to minimize distortions, such as uneven landscape and camera lens angles, common to regular air photos
- A digital orthophoto is one that is stored as computer data.
- A quarter-quadrangle is the area covered by each image which is one-fourth of the standard area covered by the USGS maps familiar to Minnesota hikers and canoeists.

More information about the digital orthophoto quarter-quadrangle project, called Base Maps for the 1990s, is available at <http://www.lmic.state.mn.us/bmap90/bmap90.htm>. Digital orthophotos are available for Minnesota in two formats:

- The uncompressed data is available for a fee from the U.S. Geological Survey at 573-308-3500 or from the Land Management Information Center at 651-296-1211. The quarter-quad files (about 13 square miles in coverage area) come on 8 mm tape or CD and are each about 45 megabytes.

- A more manageable form of data distribution is JPEG-compressed quarter-quad files grouped by county on CDs. Most Minnesota counties can be purchased from USGS on a single CD for \$32; 13 northern counties require 2 or more disks at \$10 per extra disk (see: <http://www.lmic.state.mn.us/bmap90/doqcd/cdsmap.gif>). A version of the compressed data can be downloaded free via the Internet at the Microsoft Terraserver site (<http://terraserver.microsoft.com>).

Because of the pioneering effort of the state, several regional and local DOQ programs have been completed or are in progress. The Twin Cities Metropolitan Council has produced DOQs similar to the state project for the seven-county metro area. Using 1997 photographs, 2-foot pixel images were created. For information on obtaining the data, contact the Met Council Data Center's new Metro Information Line: 651-602-1888 or look at: <http://metro council.org/metroarea/pubmain.asp>. For more information on the flight, contact Tanya Mayer, (651) 602-1604, E-mail: [tanya.mayer@metc.state.mn.us](mailto:tanya.mayer@metc.state.mn.us).

At the local level, several counties and cities have developed DOQ programs, especially for the highly urbanized areas. For more information, check with your county and city offices.

**SATELLITE DATA** Minnesota has established no centralized production center to help state and local government analyze satellite data. However, several offices were established for internal agency use or as research centers in various state universities. While many of these centers might seek interagency cooperative funding efforts, they are generally not available for other 'production' work. Many private vendors will provide such services for a fee. Known Minnesota government centers with a substantial commitment to satellite data processing are:

U of M, GIS and Remote Sensing Laboratory - The GIS and Remote Sensing Laboratory, a unit of the Department of Forest Resources, is a focal point of research, instruction, and outreach in natural resource applications of remote sensing at the University of Minnesota. The goal of the Laboratory is to research and develop approaches for applying satellite-acquired imagery to inventory and monitor land and water resources in Minnesota. The Laboratory works closely with agencies such as the Department of Natural Resources, Metropolitan Council, Forest Service, and Fish and Wildlife Service. Over the past ten years research sponsored by NASA and led by faculty of the Department of Forest Resources has introduced satellite remote sensing to the Minnesota DNR. The first project demonstrated the potential of multi-date Landsat TM data for change detection in support of forest inventory. More

recently the ForNet project (see, <http://www.gis.umn.edu/fornet/>) has fostered the development and application of the Internet as a tool for the delivery of remote sensing and geospatial analysis tools to DNR resource managers. The Laboratory has state-of-the-art workstation-based facilities for digital image processing and analysis. Software systems include ERDAS Imagine and Virtual GIS, ARC/INFO and ArcView, SPlus spatial statistics, and Sybase. The Laboratory has a wide array of input-output devices including digitizers, image scanners, color laser printers, and large format color plotters, and a large array of data storage devices. Contact: Marvin Bauer, Professor, Remote Sensing, Department of Forest Resources, University of Minnesota, 1530 N. Cleveland Avenue, St. Paul, MN 55108, Phone 612-624-3703, Fax 612-625-5212, E-mail [mbauer@forestry.umn.edu](mailto:mbauer@forestry.umn.edu)

MN DNR Forestry - In Grand Rapids, the Remote Sensing Group of DNR Forestry's Resource Assessment Unit handles natural resource applications of aerial and satellite imagery. In addition to supplying air photography of Minnesota forests, the group undertakes a variety of satellite image analysis and custom air photo projects for clients at state, federal and local levels. It maintains the most comprehensive collection of Landsat Thematic Mapper satellite images in the state, and has taken a pioneering role in making images and forest resource data publicly accessible through its ForNet Website at <http://www.ra.dnr.state.mn.us>. Prospective users of Remote Sensing Group services may contact: Bill Befort, DNR Resource Assessment, 413 SE 13th St, Grand Rapids MN 55744, 218-327-4449 x 223, fax 327-4517, e-mail: [bill.befort@dnr.state.mn.us](mailto:bill.befort@dnr.state.mn.us)

Others Other possible sources when looking for air photos, remote sensing and satellite data include the Natural Resources Research Institute (NRRI) in Duluth, the EROS Data Center, St. Cloud State University, Bemidji State University as well as other universities and colleges.

### 1:12,000 Statewide Digital Orthophoto Quads (DOQs)

**Scale or Resolution:** 1:12,000 1-meter pixel

**Agency/Contact:** USGS, Rolla, Mo. 573-308-3500

<http://edcwww.cr.usgs.gov/nsdi/gendoq.htm> or LMIC 651-296-1211

<http://www.lmic.state.mn.us/bmap90/bmap90.htm>.

**Vintage:** photographs from spring of 1991 or 1992

**Description:** Black and white ortho-rectified air photo file covering one-quarter of a USGS 1:24,000 topographic quadrangle map.

**Extent of Coverage:** statewide

**Software/file type:** raster

**Current Funding for Development:** none

**Attribute Data:** 256 grayscale

**Coordinate System:** UTM meters, NAD83

**Fees:** Uncompressed data from LMIC or USGS - set up fee, plus cost per file. Compressed county CDS, \$32 plus \$3.50 S&H for counties from USGS 573-308-3500. Larger counties \$10 more per extra disk.

**Shortcomings:** Age, especially in urban and developing areas

**Data Quality:** National map accuracy standard is  $\pm$  33 feet horizontally.

**Maintenance:** None. A 2003 NAPP flight is scheduled but dependent on state match funding.

### Issues, Needs and Recommendations:

The photo products such as DOQ's are essential products used in the development of nearly all other high priority data development programs (such as land use land cover, parcels, wetlands, hydrology, etc.). Because of this, there is a statewide need to establish a program to replace DOQ's or other equivalent images or products on an ongoing basis.

There is need for more frequent high resolution imagery on a more localized basis for projects and for local and regional government units.

Issues of seasonality (leaf off/on) and types of remote sensing products (black and white, color infrared, multi-spectral) always need to be carefully considered.

To maximize their use and make the most of the government investment, there is a need for someone to keep an accurate and up-to-date inventory of the ever-changing collection of new products.

## Transportation BaseMap and Right of Way Data

Mn/DOT BASEMAP - Several changes have occurred regarding the need for a GIS Transportation layer since the survey was taken several years ago. The primary change has been the development of Mn/DOT's BaseMap which was first released in 1995. The BaseMap was created at a scale of 1:24000 and includes several GIS layers related to transportation. The major trunk highways (Interstate, US, MN) as well as the County State Aid Highways (CSAH's) have been developed as routes (ARC/INFO) and all contain a road identifier as part of the attributes attached to each layer. The transportation network is updated on a yearly basis. For more information contact [gisinfo@dot.state.mn.us](mailto:gisinfo@dot.state.mn.us).

There is a project starting soon within Mn/DOT to develop road identifiers for the remaining county, township, and city streets. Through a cooperative effort the transportation data available for the metro area not only includes road or street identifier but address range and direction as well. Several individual counties have also completed or are in the construction stage of county based transportation layers which contain identifier and address information. This is primarily occurring due to the need for Enhanced 911 services.

There have been discussions regarding developing a transportation layer that would provide for standard segmentation/identification for all levels of government, but at this point there has been no implementation. For more information, contact Mike Barnes at (651) 297-5274 or [mike.barnes@dot.state.mn.us](mailto:mike.barnes@dot.state.mn.us).

**RIGHT OF WAYS** Right of Way (ROW) information was another GIS layer identified within the same survey. At this time there has not been a statewide ROW GIS layer developed. Primarily ROW information is being created on a project-by-project basis at all levels of government. Here again several of the individual counties have completed or are working on the development of a GIS parcel layer which, in many cases, contain ROW's as a by-product.

## Utilities

As with many other GIS data sets, there is likely a great divergence between users looking at large areas of geography versus small areas. Statewide or regional data sets commonly are at a scale of 1:100,000 to 1:24,000 with general attribute categories. Local users typically want precise utility locations at sub-meter accuracies or better for

very specific features such as control valves or access points. Also, as with other GIS data, statewide data sets tend to be developed and maintained by state or federal agencies, while precise data sets, where available, tend to be done by county or city governments, or by private organizations. This report will cover the major statewide utility grids and public services - electricity, pipelines, telephone, etc.. It will not cover utilities which are generally locally-based, such as water, sewer or cable systems. For information on this latter category, contact your city hall or county courthouse.

### Mn/DOT BaseMap Data

**Including:** City Streets, County State Aid Highways, Centerline Trunk Highway System, County Roads, Railroads, Highway ramps, Directional Trunk Highway System, Airport runways and Township roads

**Scale:** Primarily 1:24,000

**Agency/Contact:** Minnesota Department of Transportation, Bob Wolbeck, (651) 215-1973 or [bob.wolbeck@dot.state.mn.us](mailto:bob.wolbeck@dot.state.mn.us)

**Vintage:** 1998

**Description:** This data is derived from the Mn/DOT GIS BaseMap which was first released in 1995. The BaseMap was created at a scale of 1:24000 and includes a series of GIS layers related to transportation.

**Extent of Coverage:** Statewide

**Software/file type:** ARC/INFO

**Current Funding for Development:** Continuing

**Attribute Data:** Includes routes, road names, numbers and direction

**Coordinate System:** UTM Zone 15 Extended

**Fees:** Usually nominal fees for CDs but free to government and education. Metro railroad file is available for free download at

<http://lucy.lmic.state.mn.us/metadata/rr.html>.

**Shortcomings:** Shortcomings related to street names in City Street coverage, road name and number for county and township roads.

**Data Quality:**

**Maintenance:** Annual

### Issues, Needs and Recommendations:

The Mn/DOT needs to continue to manage and maintain a digital roads layer and to make it available via CD-ROM and other mechanisms such as the Internet.

There is a need to establish a standard method for linear referencing of transportation data.

**ELECTRICAL TRANSMISSION LINES** While several sources of this data are available, none are of the detail of other statewide datasets documented in this report. The Mid-Continent Area Power Pool (MAPP) produces very generalized transmission lines maps of the Upper Midwest. The CAD drawing availability is unknown. In addition, some transmission lines appear on Mn/DOT's County Highway Maps, but the accuracy and currency is not at the top of Mn/DOT's priority list. (In fact this layer was removed from BaseMap97 and later). It is also known that many of the state's major power companies are developing internal GIS systems. It might be a recommendation of the Committee that someone attempt to build such a cover from the various existing data producers.

**PIPELINES** In 1995, the Minnesota Office of Pipeline Safety contracted with LMIC to develop a small-scale statewide database providing a general overview of the gas and liquid pipelines. The goal was to produce a comprehensive map of the pipelines, maintained in digital format using GIS software. Data was collected from Mn/DOT County Highway maps and updated information from the files of OPS, USGS 1:100,000 quad maps and other sources. Pipelines were generally not mapped within the corporate boundaries of cities. Because data sources were at various levels of detail and accuracy, mapping should be limited to scales of 1:100,000 or smaller. For information on the availability of this data set, contact Charles Kenow, Office of Pipeline Safety, 651-296-9638.

**TELEPHONE SERVICE AREAS** Working with the Minnesota Department of Public Service, LMIC has developed a statewide data file and map of the more than 700 telephone exchange service areas. For information on the map and digital files available from LMIC, see: <http://www.lmic.state.mn.us/projects/telecom.html> or call LMIC. Counties are required to submit maps to DPS showing the exchange areas, which are then approved by the Minnesota Public Utilities Commission. LMIC worked with the Department of Public Service to ensure the accuracy of the data portrayed on this state file. The file is intended to provide only an overview of telephone exchanges in Minnesota and should not be used for detailed site analysis or be construed as final. The published map is not an 'official' telephone exchange service area map. To view official maps of particular exchanges, please call the Minnesota Department of Public Service at 651-296-5120.

## Hydrography

Lakes and stream digital map data continues to evolve: from its beginnings as an item called "water orientation" in the

old MLMIS 40 acre raster data base; to the "stick figure" River Kilometer Index (RKI) delineation in the early 80's that was based on a combination of 7.5 and 15 minute quadrangle maps; to the Mn/DOT BaseMap Hydrography layers in the mid 90's; to the National Hydrography Dataset, which will probably not become fully available until the new millennium. Descriptions of recent efforts follow:

**Mn/DOT BASEMAP HYDROGRAPHY LAYER** During the 1990's the Minnesota Department of Transportation (Mn/DOT) produced a 1:24,000 BaseMap Dataset, featuring layers such as roads, airports, political boundaries, and hydrography. Mn/DOT originally produced these layers as graphics files to support their County Highway Map production program, then later expanded the use of the transportation layers in GIS for their road management responsibilities. For more information, contact [gisinfo@dot.state.mn.us](mailto:gisinfo@dot.state.mn.us). Mn/DOT plans to update the road information continually, and has invited the water management agencies to take the basic hydrography linework and to use and enhance it as necessary. Since the Mn/DOT BaseMap hydrography layers represent the best linework available, water management agencies are using these files as a base to create a more robust 1:24,000 layer to support their activities.

The BaseMap hydrography data set consists of three separate data layers: intermittent streams, perennial streams, and hydrography polygonal features (including polygon river features, lakes, and wetlands). The polygonal feature file is still an arc file with no polygon topology. When the polygon feature file is built as a polygon cover, many of the polygons are not entirely closed, meaning that lakes are

### Issues, Needs and Recommendations:

There is a need for 1:24,000 or larger scale GIS databases for major utilities, including pipelines, transmission lines and corridors, and railroads.

There is a growing number of point and line features especially those related to evolving technology (such as fiber, cable, cellular phones) and more traditional point features such as TV and microwave towers that would be of interest to GIS users. Though much of this is considered to be proprietary data, the availability of this kind of data needs to be evaluated.

Much of the largest scale utility data is very local in nature or is project specific. Developers should be encouraged to document this data and to make it available to others that may have a use or need.

missing because they do not appear as closed polygons. For Mn/DOT County Highway Map production purposes this does not matter; but for water data users it is extremely important. It must also be noted that the original BaseMap linework was captured over a period of several years, and that the data capture rules changed over time. Initially, MnDOT captured only features on the 1:24,000 quad map that appeared on the existing County Highway Map Series, whereas later they began to capture every hydrographic feature appearing on the quad. This results in the level of detail on the files varying across the state. There is no river or lake identification number on the files.

#### DNR 1:24,000 HYDROGRAPHY LAYER IMPROVEMENT

Driven by the need of the DNR-Fisheries Section for improved digital basemaps for trout stream management, in 1996 the DNR GIS group began looking at the Mn/DOT BaseMap hydrography layers as a base to create an integrated hydrography dataset which included both rivers and lakes.

Initial pilot work was concentrated in trout stream areas (200 quads in southeastern, north central, and northeastern Minnesota). The purpose of the pilot was to produce a hydrography layer which was an accurate representation of streams on the 1:24,000 base map, had accurate feature coding, contained connectivity through lakes and flowpaths through rivers represented as polygons, and identified all trout streams. Going beyond quads with trout streams, with current financial commitments from DNR, MPCA, and Metropolitan Council Environmental Services, all areas of the state with the exception of the Minnesota River Basin will be completed by the end of 1999. Some of this work is being contracted out to the Spatial Analysis Research Center (SARC) at St. Cloud State University and to BRW, Inc. (The Water Resources Center at Mankato State University is just finishing a parallel effort to upgrade the MnDOT BaseMap Hydrography work for the Minnesota River Basin. This project is discussed under #3). As the enhanced 1:24,000 hydrography is completed, it is being distributed by 1:24,000 map sheet through the DNR Data Deli: <http://deli.dnr.state.mn.us>. Metadata is also available at that site. For more information, contact Robert Maki, DNR-MIS, at (651) 297-2329 or [robert.maki@dnr.state.mn.us](mailto:robert.maki@dnr.state.mn.us).

Initially DNR used the Mn/DOT BaseMap hydrography layers (perennial and intermittent streams and polygon features) for all features. After further investigation by DNR it was determined that the National Wetlands Inventory dataset showed a more consistent capture of lakes and other polygonal information than did the Mn/DOT BaseMap. At that point, DNR decided that in building the new 1:24,000 hydrography layer, they would use the rivers and streams from the Mn/DOT BaseMap files and use the

National Wetlands Inventory file for lakes and other Protected Waters. NWI would also be used for riverine polygons, while Mn/DOT BaseMap would be used for single-line stream traces.

The current phase of work is sufficient to meet the immediate needs of the DNR Fisheries' trout stream program, which has sponsored much of the work. The DNR recognizes that there is more work that needs to be done to make a fully functional hydrography dataset, including:

- Adding connectivity through all wetlands. A set of decision rules has been developed to guide the digitizers in making connectivity decisions.
- Adding river identifiers.
- Adding river flow direction.
- Adding some means of dealing with mileposting or linear referencing (or, at least, coming to an understanding of how to accommodate these within the system being created).
- Using the NWI layer and NWI coding scheme to "collapse" the NWI layer into a lake/wetland layer which would serve to identify DNR 'Protected Waters'.
- Adding DNR-Waters lake numbers to all numbered lakes and wetlands.

This next phase of river layer development will depend on the data structure definition work which is being done by the Governor's Council on Geographic Information Hydrography Committee. The lake layer development work (sections e. and f. above) are in progress at DNR-Waters. For information about the Governor's Council Hydrography Committee activities, contact Susanne Maeder, LMIC, at (651) 297-4986, [susanne.maeder@mnplan.state.mn.us](mailto:susanne.maeder@mnplan.state.mn.us).

MANKATO STATE UNIVERSITY 1:24,000 HYDROGRAPHY LAYER IMPROVEMENT The Water Resources Center at Mankato State University has just completed a parallel effort to improve the BaseMap hydrography linework for the Minnesota River Basin. This work was done as part of the creation of a 'Minnesota River Basin Data Center.' The work involved adding connectivity, adding feature coding and feature names, and digitizing features from the 1:24,000 quad maps that were not on the BaseMap files. River and lake linework from this effort is available for online download from the Minnesota River Basin Data Center web site: <http://mrdbc.mankato.msus.edu/gis/indexgis.html>. For information about this effort, contact Cis Berg at [cecelia.berg@mankato.msus.edu](mailto:cecelia.berg@mankato.msus.edu) or John Rongstad at

[john.rongstad@mankato.msus.edu](mailto:john.rongstad@mankato.msus.edu) . The Water Resources Center phone number is (507) 389-1820. The Governor's Council Hydrography Committee is interested in reformatting this dataset for consistency with the DNR Hydrography improvement effort (#2).

**NATIONAL HYDROGRAPHY DATASET (NHD)** The National Hydrography Dataset is the culmination of recent cooperative efforts of USEPA and the U.S. Geological Survey (USGS). It combines the best of the USEPA Reach File Version 3 (RF3) and the USGS Digital Line Graph (DLG) hydrography files: hydrologic ordering, hydrologic navigation for modeling applications, and a unique identifier (reach code) for surface water features from RF3; and the spatial accuracy and comprehensiveness of DLG 1:100,000 hydrography. More information about the NHD program can be found at: <http://nhd.usgs.gov> . The local USGS contact for the NHD program is Ron Wencl, USGS National Mapping Division, (612) 783-3207, [rwenc1@usgs.gov](mailto:rwenc1@usgs.gov).

The Minnesota Pollution Control Agency (MPCA) has worked with the U.S. Environmental Protection Agency (USEPA) in the initial phase of the NHD development process for all Minnesota NHD data. This work involves examining the 1:100,000 scale dataset created by an automated merging of DLG (Digital Line Graph) linework and RF3 (Reach File 3) attributes, identifying unconnected segments and connecting them, checking flow direction, and verifying that features are in the correct cataloging unit.

USGS and EPA are implementing the NHD model and creating a nationwide dataset at 1:100,000, and are interested in finding cooperators to build 1:24,000 NHD layers. MPCA, as a primary user of the Reach File system in Minnesota is interested in improving the NHD dataset to the 1:24,000 level. The Governor's Council Hydrography Committee is looking at the NHD model as a way of adding capabilities to the current level of 1:24,000 enhancement work. MPCA is funding the conversion by USGS of 8 cataloging units (DNR major watersheds) of state 1:24,000 hydrography data into the NHD format.

**WATERSHEDS** Watershed delineations are an important component for many natural resource investigations, including engineering analyses and water planning, water quality and lake management studies. Major and minor watersheds were delineated and grid-cell-coded by the DNR for the entire state during the late-1970's. In 1993, a scanned version of the watersheds was developed in a true vector format. Major updates by Mankato State University (13 south-central counties) and the U.S. Geological Survey (remainder of the Minnesota River Basin) were incorporated into the 1995 watershed file. A new version will be available, based on DNR linework updates, in the fall of

1999. The statewide GIS watershed coverage includes major watersheds (81), minor watersheds (approximately 5600) and limited subwatershed delineations, located at major tributary confluences and USGS gaging stations. The delineations to date have been made based on height-of-land divides, and do not reflect drainage patterns as affected by stormwater drainage systems in urban areas.

The watershed coverage is updated periodically to reflect improved information and changes to drainage patterns. DNR-Waters has assumed the responsibility for maintaining and updating the major and minor watershed GIS coverage. Proposed updates are accepted from outside the department. In 1997-98, the Governor's Council Hydrography Committee established a procedure and guidelines for the update of major and minor watershed boundaries. Periodic changes to these guidelines are expected as experience is gained as to the quantity and quality of proposed updates.

Typical updates will generally fall within one of the following three categories:

- Obvious error corrections based on redelineation using USGS 7.5-minute topographic maps. An example would include a delineation that followed the valley line, not the ridgeline. Corrections will generally not be made to the statewide coverage in instances where the quad map does not provide conclusive evidence of the actual drainage pattern and the re-delineation of the watershed divide is strictly an interpretation of the user.
- Redelineation based on more detailed data sources, including 2-foot contour topographic maps, public drainage system plans and/or field surveys and site visits.
- Physical changes to the landscape not reflected on the current quad maps. An example would be outlets constructed to previously landlocked basins, such as Lake Pulaski in Wright County.

The primary source of updates will be generated by the DNR and by the USGS with their continuing development of *Physical Characteristics of Stream Subbasins* reports. Additional watershed delineation updates are expected from other federal, state and local governmental agencies, universities, and private consultants.

Proposed delineation updates should be submitted to DNR-Waters, 500 Lafayette Road, St. Paul, Minnesota, 55155-4032. DNR-Waters staff will review the supporting documentation for completeness and accuracy and incorporate the requested changes as appropriate. The USGS and/or the Natural Resources Conservation Service will be contacted should a second opinion be desired.

Mankato State University and USGS will be contacted as appropriate with proposed updates to their existing study areas. Acknowledgment of the requested watershed delineation and final resolution will be provided. All proposals for watershed updates should include:

- a. A redelineation on USGS 7.5' quad – an original copy of the quad map is preferred, not a reproduction.
- b. A narrative discussion of how redelineation was made and the source of additional information. A form is available that can be used for this purpose.
- c. Additional supporting documentation (maps, drainage plans, field surveys or site visit reports) can also be provided. Digital update files can be submitted.

For more information, contact Jim Solstad, DNR-Waters, at (651) 297-3851, [jim.solstad@dnr.state.mn.us](mailto:jim.solstad@dnr.state.mn.us) or Glenn Radde, DNR-Waters, at (651) 297-4950, [glenn.radde@dnr.state.mn.us](mailto:glenn.radde@dnr.state.mn.us). Metadata and data are available at DNR's Data Deli: <http://deli.dnr.state.mn.us>.

**LAKESHEDS** Both DNR and the Metropolitan Council have initiatives underway to define and automate lakesheds. DNR and Met Council have coordinated their activities and have developed a common approach to delineating new lakesheds. The approach is based on the development of a hydrologically correct DEM followed by an automated delineation. The completion of the DEM product requires a stream network coverage and a lake polygon coverage. Therefore, these products will also become available through this project. The Met Council is developing the stream network coverage in a fashion that is consistent with the DNR's efforts to develop 1:24,000 stream data. The end products of all this should be an integrated set of coverages

#### Issues, Needs and Recommendations:

There is a need to establish a hydrologic data model for use throughout the state. This model should be capable of handling and being populated with the best existing data at local and state levels.

There is a need to complete building improved hydro layers that have the needed connectivity and directionality and that will work with the evolving hydrologic data model.

There is a need to determine how to store lakeshed and watershed information: whether the information for both can be stored in the same file, and, if not, how the two files can be managed such that coincident boundaries are coincident in the two files.

for streams, lakes, and lakeshed boundaries, as well as a hydrologically correct DEM. These data products should be complete for the metro area before the end of 1999. It will take much longer to develop the products statewide. For more information, contact Jim Solstad, DNR-Waters, at (651) 297-3851, [jim.solstad@dnr.state.mn.us](mailto:jim.solstad@dnr.state.mn.us) or Steve Kloiber, Metropolitan Council, at (651) 602-1056, [steve.kloiber@metc.state.mn.us](mailto:steve.kloiber@metc.state.mn.us).

## Well Information

The Minnesota Geological Survey (MGS) and Minnesota Department of Health (MDH) continue to improve the County Well Index (CWI). CWI is both a database and a software tool for entering, storing, and querying tabular well data. CWI can house basic well descriptive and well construction information, as well as stratigraphy, water level, and minimal water chemistry information. CWI is populated primarily with information from the Water Well Driller Log form, which is submitted to MDH for each new well constructed.

County Well Index has been rewritten in Microsoft Access. The dbf versions of the CWI files are more ArcView compatible than the original CWI format files. Information on all new MDH Water Well Driller Log forms submitted to MDH (although not the complete well log) is entered into the County Well Index by MGS. In addition, verification of well locations and coding of geology is done as a work step in the creation of County Geologic Atlases and Regional Hydrogeologic Assessments. Therefore, in those areas of the state for which those products exist, the well information tends to be more complete and better located.

MGS digitizes locations for any wells, which have been field-located. In addition, LMIC and MGS have in the past incorporated non-digitized well locations into the GIS coverage, by calculating a point location based on PLS locations reported by well drillers on the Water Well Driller Log form. Full state GIS point coverages of well information were created in 1992 and 1997. A feature-level attribute identifies the location accuracy of the individual well point.

The newest version of a well GIS point file is based on entries in County Well Index as of December 1998. This information is stored as two statewide coverages: one consists of all points that have been field-verified and digitized, or surveyed, or located via GPS by MGS; the second consists of all calculated well point locations. Two files were created in order to accentuate the difference in location accuracy between the two sets of data. The main index file from County Well Index, which includes

information on location, ownership, use, status, depth, aquifer (if available) and other summary features of the well, is also provided. The state well point location coverages with the associated index file are available online at LMIC. The full County Well Index software and county data files are available from the Minnesota Geological Survey.

Ongoing work by MGS and DNR to create county geologic atlases and regional hydrogeologic assessments results in continual improvements to the database. MDH is now sending well inspectors out with GPS equipment, so that a certain percentage of wells start out with good locations, although getting this information into CWI is still an issue. Projects at LMIC and elsewhere have provided assistance to help correct errors in CWI and digitize wells associated with specific projects.

**Issues, Needs and Recommendations:**

There is the continued need to improve the location quality of well and water data using tools such as GPS.

There is a need to make the dataset more complete by incorporating non-represented wells from other data sources, including local updates to CWI.

There is a need to improve well attribute information, especially stratigraphy information. This is done through the ongoing DNR/MGS County Atlas/Regional Assessment programs and similar activities.

Putting wells data onto the Internet is encouraged.

CWI does not represent ALL wells in the state: the requirement for reporting wells to MDH began with the implementation of the Water well Construction Code in 1974: therefore many older wells are not represented. Reporting by drillers in response to the code has been incomplete, although compliance is improving over time. Information reported varies in quality. CWI at this point in time is the most complete source of information on known wells within the state. As such it provides the backbone for state integration efforts related to ground water. Other agencies maintain well-related datasets: in some cases not all wells in these datasets are in CWI. The Minnesota Unique Well Number on the Water Well Driller Log form is the unique identifier which serves to tie together all information about a well within the state.

CWI initially accommodated storage of only bacteria and nitrate information. MDH is rewriting the Water Chemistry section of CWI to make it more robust and able to accommodate storage of more water chemistry information.

Information about the full County Well Index software can be obtained from Tim Wahl, Minnesota Geological Survey, (612) 627-4802, [tewahl@maroon.tc.umn.edu](mailto:tewahl@maroon.tc.umn.edu). Online information, including frequently asked questions, is available at: <http://128.101.142.76/mgs/cwi.html>. Information about the well GIS point coverages including access to online download, is available from the metadata at: <http://lucy.lmic.state.mn.us/metadata/wwpt.html> and <http://lucy.lmic.state.mn.us/metadata/wwptcalc.html>. For further information, contact Susanne Maeder, LMIC, at (612) 297-4986, [susanne.maeder@mnplan.state.mn.us](mailto:susanne.maeder@mnplan.state.mn.us).