Phase II GIS-Based Sediment Quality Database for the St. Louis River Area of Concern (AOC)

Technical Documentation

Prepared – *October 2004* – by:

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Disclaimer

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List of Acronyms and Abbreviations

AOC	Area of Concern
ARDC	Arrowhead Regional Development Commission
As	Arsenic
AVS	Acid Volatile Sulfide
BBL	Blasland, Bouck and Lee, Inc.
BCWLAP	British Columbia Ministry of Water, Land and Air Protection
Be	Beryllium
CAC	Citizens Action Committee
CAS	Chemical Abstracts Service
C-CAP	Coastal Change Analysis Program
Cd	Cadmium
CD	Compact Disk
COPC	Chemical of Potential Concern
CPRD	Coastal Protection and Restoration Division
Cr	Chromium
Cs	Cesium
DDD	1,1-dichloro-2,2-bis(p-chlorophenyl)ethane
DDE	1,1-dichloro-2,2-bis(4-chlorophenyl)ethylene
DDT	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
DQO	Data Quality Objective
DROs	Diesel Range Organics
ERA	Ecological Risk Assessment
ESRI	Environmental Systems Research Institute
FDEP	Florida Department of Environmental Protection
GIS	Geographic Information System
GLNPO	Great Lakes National Program Office
GPS	Global Positioning System
HCDD	Heptachlorodibenzo-*p*-dioxin
HCDF	Heptachlorodibenzofuran
Hg	Mercury
HMW-PAH	High Molecular Weight Polycyclic Aromatic Hydrocarbon
IJC	International Joint Commission
IT	International Technology
LaMP	Lake Superior Lakewide Management Plan
LMW-PAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbon
MARPLOT	Mapping Application for Response, Planning and Local Operational Tasks
MESL	MacDonald Environmental Sciences Ltd.
MN	Minnesota
MN DNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MS	Microsoft
N	Nitrogen
NA	Not Analyzed

NAD	North American Datum
ND	Not Detected
NH_3-N	Ammonia Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
PAH	Polycyclic Aromatic Hydrocarbon
Pb	Lead
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo-*p*-dioxin
PCDF	Polychlorinated Dibenzofuran
PEC	Probable Effect Concentration
PEC-Q	Probable Effect Concentration-Quotient
ppm	parts per million
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
SEH	Short Elliott Hendrickson
SEM	Simultaneously Extracted Metal
SQG	Sediment Quality Guideline
SQL	Structured Query Language
SQT	Sediment Quality Target
SVOC	Semivolatile Organic Compound
TCDD	Tetrachlorodibenzo-*p*-dioxin
TCDF	Tetrachlorodibenzofuran
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalent
TIGER	Topologically Integrated Geographic Encoding and Referencing
TMA	Thermo Analytical
TOC	Total Organic Carbon
U	Undetected
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USS	United States Steel
UTM	Universal Transverse Mercator
UX	Undetected and Detection Limit Not Indicated
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources
WHO	World Health Organization
WI	Wisconsin
WLSSD	Western Lake Superior Sanitary District
X	No Result

Glossary of Terms

Data frame (ArcView 8/9) – In the ArcMap application, a frame on the map that displays layers occupying the same geographic area.

Data validation – An analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

Data verification – The process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements.

Detection limit – Estimates of concentrations at which one can be fairly certain that the compound is present. Concentrations below this limit may not be detected. Concentrations above this limit are almost certainly detected in the analysis.

Detected result – An analytical result that indicates the measured concentration of the analyte.

ESRI ArcView – Environmental Systems Research Institute, Inc. Geographic Information System mapping software.

Export data – To output data and database objects to another database, spreadsheet, or file format so another database, application, or program can use the data or database objects. Data can be exported to a variety of supported databases, programs, and file formats.

Field – An element of a table that contains a specific item of information, such as a chemical name. A field is represented by a column or cell in a data sheet. In some databases, such as Microsoft™ (MS) Structured Query Language (SQL) Server, the term "column" is used instead of the term "field".

Georeference – To establish the relationship between an image coordinate system and a map (x,y) coordinate system.

Import data – To copy data from a text file, spreadsheet, or database table into a MS Access table. The imported data can be used to create a new table, or it can be appended (added) to an existing table with a matching data structure. Database objects from a MS Access database or a MS Access project can also be imported.

Indicators – Measurable features or characteristics of an ecosystem that provide information on the status of the ecosystem as a whole (physical, chemical, or biological).

Key fields – The key fields used to match the data in different tables, and thus provide a unique identifier (e.g., STUDYID, STATIONID, SAMPLEID, and CHEMCODE fields).

Layer (ArcView 8/9) – A collection of similar geographic features, such as rivers, lakes, counties, or cities, in a particular area or place referenced together for display on a map. A layer references geographic data stored in a data source, such as a coverage, and defines how to display it.

Map document (ArcView 8/9) – In the ArcMap application, the disk-based representation of a map. Map documents have a .mxd file extension.

Microsoft™ (MS) Access – An interactive relational database management software application for use with the MS Windows™ operating system.

Project (ArcView 3) – A project is the file in which work in ArcView is stored. A project typically contains all the views, tables, charts, layouts and scripts that you use for a particular ArcView application. These are the components of a project.

Query – A question about the data stored in database tables, or a request to perform an action on the data. A query can bring together data from multiple tables to serve as the source of data for a form, report, or data access page.

Record – A row in the datasheet view of a table, query, or form.

Relational database – A collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled without having to reorganize the database tables.

Statistical power – The ability of a statistical test to detect a true difference between two or more groups.

Table – The fundamental structure of a relational database management system. In MS Access, a table is an object that stores data in records (rows) and fields (columns). The data are usually about a particular category of things.

Transformed data – Data that have been changed from their original form (X values) to a different form ('X' values) to provide "correct" distribution characteristics.

Type I error – The error that occurs if the null hypothesis is rejected when it is actually true ("false positive").

Undetected result – An analytical result that indicates that the analyte was not detected at the reported detection limit.

Unique identifier – A series of fields which, in combination, uniquely identify each sample in the database (i.e., combination of ***STUDYID***, ***STATIONID***, ***SAMPLEID*** fields).

User interface – The collection of controls that you use to interact with a database component. The user interface is comprised of a menu bar, a button bar, a tool bar and a set of popup menus. Each database component has a unique user interface.

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Phase II

The following people comprised the technical team for this phase of the project: Judy Crane (Minnesota Pollution Control Agency; MPCA); Dawn Smorong, Don MacDonald, Leanne Fisher, Shelee Hamilton and Mary Lou Haines (MacDonald Environmental Sciences Ltd.; MESL). Phase II of this project was funded by a grant from the United States Environmental Protection Agency's (USEPA) Great Lakes National Program Office (GLNPO) to the MPCA through grant number GL97540401-2. Brian Fredrickson (MPCA) managed this grant, which had an overall objective of developing a comprehensive sediment management plan for the lower St. Louis River Area of Concern (AOC) (i.e., this Phase II project represented only one task of this broad objective). Scott Cieniawski and Scott Ireland were the successive GLNPO project officers for this grant. In order to make this report more applicable to an overlapping project to develop Phase III of the GIS-based sediment quality database, a small amount of federal funding from this project (through interagency agreement #306-28-06) was utilized in the final stages of report production. This Phase III project was funded in part under the Coastal Zone Management Act, by the National Oceanic and Atmospheric Administration's (NOAA's) Office of Ocean and Coastal Resource Management, in cooperation with Minnesota's Lake Superior Coastal Program. Greg Gross and Pat Carey of the MPCA provided useful supervisory assistance for this project. MESL's work was funded through a professional and technical services contract with the State of Minnesota.

Phase I

This project represented a collaborative effort between the MPCA and MESL, with no-cost assistance provided by NOAA. The technical team members for this phase of the project were as follows: Judy Crane (MPCA); Dawn Smorong, Clara Mackenzie, Don MacDonald, Rebekka Lindskoog, Yvonne Muirhead, Chad Huntington, Leanne Fisher, Mary Lou Haines (MESL); Todd Goeks, Jay Field (NOAA); and, Corinne Severn (Premier Environmental Services, L.L.C, NOAA's consultant). The authors would also like to acknowledge the many

stakeholders that attended the meetings held in Duluth and St. Paul, Minnesota in October 2001. The input of these participants provided valuable information that helped focus the scope and goals of this project. In addition, numerous individuals from city, county, state, and federal agencies, nonprofit groups, consulting firms, private businesses, and the Fond du Lac Band assisted this project by providing either sediment quality data, GIS watershed data for the St. Louis River watershed, or other supporting information; those individuals have been named in the Acknowledgment sections of the accompanying Phase II Help Sections for Database and ArcView Users. Constructive feedback on this project was also provided by the Science Advisory Group on Sediment Quality Assessment. Phase I of this project was funded by a grant from GLNPO to the MPCA through grant number GL97536301-1. Anthony Kizlauskas provided valuable input as the GLNPO project officer for this project. Greg Gross and Marvin Hora of the MPCA provided useful supervisory and management assistance for this project. MESL's work was funded through a professional and technical services contract with the State of Minnesota.

Chapter 1. Introduction

1.1 Background

The St. Louis River constitutes the second largest tributary to Lake Superior. The headwaters begin in northeastern Minnesota (MN), and the lower estuary, which covers an area of approximately 12,000 acres, bisects the border between Duluth, MN and Superior, Wisconsin (WI; MPCA and WDNR 1992). The lower estuary culminates in the Duluth-Superior Harbor, which is one of the largest inland seaports in the world and the most heavily used port in the Great Lakes basin.

The middle and lower portions of the estuary support a variety of industrial, commercial, residential, and recreational activities. In addition, these areas provide essential habitats for aquatic organisms (e.g., walleye) and aquatic-dependent wildlife species (e.g., bald eagle). However, aquatic habitats in some of these areas have been adversely affected by economic development of the St. Louis River over the past 130 years.

In 1987, the St. Louis River was designated as one of 43 Areas of Concern (AOC) in the Great Lakes basin due to degradation of environmental quality conditions in the river and adjoining watershed (IJC 1989). Contaminated sediments contribute to several use impairments in the St. Louis River AOC, including the issuance of fish advisories, restrictions on dredging, and habitat impairments to bottom-feeding organisms. A number of ecosystem health indicators have been selected to support the assessment of sediment quality conditions within the St. Louis River AOC, including sediment chemistry, sediment toxicity, benthic macroinvertebrate community structure, tissue chemistry, the physical characteristics of sediments, and biomarkers in fish (Crane *et al.* 2000). Investigations conducted using data on multiple indicators provide a weight-of-evidence approach for assessing the effects of contaminated sediments on the beneficial uses of this aquatic ecosystem.

As part of the Remedial Action Plan (RAP) process for the St. Louis River AOC, stakeholders identified a need to compile the sediment quality data collected from the St. Louis River in a database format. As a first step, the Arrowhead Regional Development

Commission (ARDC) developed a sediment quality database in 1990 that included all available sediment quality data (31 studies) from the early 1970s to 1990 (ARDC 1990). The sources of these studies included the United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), Minnesota and Wisconsin state agencies, contractors, and university researchers. However, no attempt was made to evaluate quality assurance/quality control (QA/QC) procedures in these studies due to a lack of resources. In addition, accurate locational information was not available for most of these sampling stations so the data could not be plotted on maps based on Geographic Information System (GIS) software.

A matching sediment chemistry and toxicity database was completed in 2000 to support an evaluation of the predictive ability of numerical sediment quality targets (SQTs) in the St. Louis River AOC (Crane *et al.* 2000; 2002a). The Minnesota Pollution Control Agency (MPCA) sought additional funding to expand this Microsoft™ (MS) Access database with a wider range of sediment quality data (e.g., bioaccumulation, fish tissue, and additional sediment chemistry and toxicity data). In October 2000, the MPCA obtained a grant from the USEPA's Great Lakes National Program Office (GLNPO) to develop the first phase of a GIS-based sediment quality database for the St. Louis River AOC and an associated GIS-mapping component [i.e., GIS data were compiled in Environmental Systems Research Institute (ESRI) ArcView 3.2 format]. MacDonald Environmental Sciences Ltd. (MESL) was retained in April 2001 to assist the MPCA with this effort; MESL had developed the previous matching sediment chemistry and toxicity database for the MPCA. A Quality Assurance Project Plan (QAPP) was completed and approved by GLNPO in July 2001 (Crane 2001) so that work could commence on the project. In October 2001, MESL and MPCA staff met with over 60 stakeholders in Duluth and St. Paul to obtain input on the development of this GIS-based database. Stakeholders were asked to identify priority sediment quality indicators, sources of candidate data sets, and key types of GIS data for the St. Louis River watershed (MacDonald *et al.* 2001a). Their input was very useful in producing Phase I of the GIS-based sediment quality database (Smorong and Crane 2003; Smorong *et al.* 2003).

Due to the large amount of sediment quality data that have been collected from the St. Louis River AOC since 1990, funding is being obtained by the MPCA and its collaborators in a phased approach to further the development of the GIS-based sediment quality database. The Duluth office of the MPCA recently changed the scope of GLNPO grant number

GL97540401-2 in order to develop a comprehensive sediment management plan for the lower St. Louis River AOC. Continuation of the GIS-based database (i.e., Phase II) was identified as one task of this grant, for which Judy Crane is the MPCA project manager and Brian Fredrickson is the MPCA grant manager. MESL was retained in September 2003 to complete additional Phase I tasks and to conduct the Phase II updates of the GIS-based database and ArcView 3.2 projects. In addition, MESL was tasked with converting the ArcView 3.2 projects to a version compatible with a more recent version of ESRI's mapping software (i.e., ArcMap 8.3). A QAPP was completed and approved by GLNPO in May 2004 (Crane 2004) so that the Phase II work could begin.

Phase III of the GIS-based sediment quality database was initiated in September 2004 through a grant from Minnesota's Lake Superior Coastal Program to the MPCA (grant/project manager is Judy Crane); MESL has been retained to work on this project. Additional sediment quality data sets from the Minnesota portion of the AOC will be added to the Phase III database. The St. Louis River Citizens Action Committee (CAC), in collaboration with the MPCA and Wisconsin Department of Natural Resources (WDNR), will submit a grant application to the Wisconsin Coastal Management Program in November 2004 to propose conducting Phase IV of the GIS-based sediment quality database. If funded, this project would begin in July 2005 under the project management of Judy Crane (MPCA); additional sediment quality data sets from the Wisconsin portion of the AOC would be added to the database under this proposed phase. In addition, the ArcView 3.2 projects and ArcMap 8.3 map documents would be updated with additional GIS data under the proposed Phase IV project. The expanded database, and associated GIS-mapping component, will support the assessment, preservation, and restoration of the lower St. Louis River AOC and adjoining Lake Superior ecosystems.

1.2 Purpose of the GIS-Based Sediment Quality Database

The purpose of the GIS-based sediment quality database, and the associated GIS-mapping component, is to support the assessment, preservation, and restoration of the lower St. Louis River AOC and adjoining Lake Superior ecosystems. As such, the project team strove to provide an effective system for storing and retrieving information to support analyses of

sediment quality data collected within the St. Louis River AOC. The primary applications of the GIS-based sediment quality database are:

- To standardize the format of the existing data sets so the data are comparable and can be combined for the purposes of data analyses;
- Allow stakeholders to access sediment quality data;
- Allow stakeholders to view the data spatially, along with other GIS-related watershed data;
- Assist stakeholders with implementing the three-phase sediment strategy for the St. Louis River RAP; and,
- Further the goals of the Lake Superior Lakewide Management Plan (LaMP) by tracking the occurrence of critical pollutants.

The objectives of Phase II of the project were to: i) expand the database with additional sediment quality data sets from the federal navigation channels in the Duluth-Superior Harbor and from sites located along the Wisconsin portion of the AOC; ii) incorporate selected GIS watershed data sets into the ArcView 3.2 projects; and, iii) convert the ArcView 3.2 projects to ArcView 8.3 map documents.

1.3 Purpose of the Technical Documentation

This report has been prepared to document the methods and procedures that were used to develop the MS Access 2000 sediment quality database and ArcView 3.2/8.3 GIS maps. As such, this report provides:

- A description of the general structure and contents of the MS Access 2000 sediment quality database;
- A description of the tables that were used to store the various types of data;
- A description of the quality assurance steps that have been undertaken to assure the quality of the underlying data;

- A discussion regarding data treatment options and other data management issues;
- A description of the ArcView 3.2/8.3 GIS maps and the associated data; and,
- A discussion on administrative details relating to distribution of the project Compact Disks (CDs) and access to future updates of the MS Access 2000 database and ArcView 3.2/8.3 GIS maps.

For specific instructions on how to use the database and GIS applications, users should refer to the accompanying Phase II Help Sections for Database and ArcView Users (Smorong and Crane 2004 and Smorong *et al.* 2004).

1.4 Organization of the Technical Documentation

This report is organized into a number of sections to facilitate access to the information associated with the sediment quality database and GIS mapping component, including:

- Introduction (Chapter 1);
- Summary of Phase II updates (Chapter 2);
- Selection of applications and design for the GIS-based sediment quality database (Chapter 3);
- Description of the contents of the GIS-based sediment quality database (Chapter 4);
- Data treatment options in the GIS-based sediment quality database (Chapter 5);
- Special considerations regarding data management (Chapter 6);
- Description of the GIS components of the project (Chapter 7);
- Linking the GIS-based sediment quality database with GIS applications (Chapter 8);
- Administrative details (Chapter 9); and,
- References (Chapter 10).

In addition, a glossary of terms and a list of acronyms are provided at the beginning of this Technical Documentation to define the various scientific terms that are used throughout this document.

1.5 Geographic Scope of the Study Area

The boundaries of the St. Louis River AOC include 72 nautical kilometers from Cloquet, MN to the Duluth, MN and Superior, WI entries to Lake Superior. This transboundary AOC includes a variety of hydrologic regimes ranging from five reservoirs downstream of Cloquet to a 12,000 acre estuary that includes numerous large bays, peninsulas, and islands. These areas support a wide variety of important fish, aquatic invertebrate, avian, and other aquatic-dependent wildlife species (St. Louis River Citizens Action Committee 2002). Just prior to entering Lake Superior at the Duluth Ship Canal and Superior Entry, the river forms a large embayment which is protected by two long sandbars. Two inner spits divide the port into inner and outer harbors. This unique geomorphology has created a natural harbor which has been dredged and modified since the mid-1800s to accommodate shipping traffic and commerce (Walker and Hall 1976). The Duluth-Superior Harbor waterfront is currently 79 km long, with 27 km of dredged channels (Duluth Seaway Port Authority Web site: http://www.duluthport.com/seawayfactsmetric.html).

The Duluth-Superior Harbor is one of the largest inland seaports in the world and the most heavily used port in the Great Lakes basin. Total waterborne commerce in 2002 through the Port of Duluth-Superior reached 39.5 million metric tons, of which the principal cargoes were coal (40%), iron ore (40%), and grain (10%) (Duluth Seaway Port Authority Web site: http://www.duluthport.com/tonnagestats/2001YearEndtonnage.html). Historically, the storage and shipping of taconite, limestone, coal, and iron ore were conducted at various locations within the Duluth-Superior Harbor (Walker and Hall 1976). Historic smelting and manufacturing operations along the harbor have resulted in some of the most contaminated sediment sites in the harbor today [i.e., the Interlake/Duluth Tar and United States Steel (USS) Superfund sites; Schubauer-Berigan and Crane 1997; IT Corporation 1997]. Other areas with elevated concentrations of chemicals of potential concern (COPCs) in the Duluth-Superior Harbor include Hog Island Inlet/Newton Creek in Superior, WI (Redman and

Janisch 1995), as well as several boat slips, areas adjacent to wastewater treatment plants and other areas with historical sources of COPCs (Schubauer-Berigan and Crane 1997; Crane *et al.* 1997; 2002b; Crane 1999).

Chapter 2. Summary of Phase II Updates

This chapter is intended to provide database users with a summary of the changes and additions that have been incorporated into the sediment quality database and GIS mapping applications during Phase II of the project. As such, the additional sediment quality data sets that were appended to the database, and the GIS data sets that were incorporated into the GIS applications, are described. In addition, the conversion of the ArcView 3.2 projects to the newer software version (ArcView 8.3 map documents) is described in terms of the rationale for undertaking the conversion, and the differences that now exist between the two GIS mapping applications.

2.1 Updates to the Sediment Quality Database

A total of 13 new data sets were added to the MS Access 2000 database as part of the Phase II updates. These data sets included sediment quality data from the federal navigation channels in the Duluth-Superior Harbor and from sites located along the Wisconsin side of the St. Louis River AOC. The criteria used for identifying candidate data sets for inclusion in the database are described in more detail in Section 4.2. The criteria used for evaluating data quality and the QA/QC procedures observed while incorporating the new data sets in the sediment quality database are consistent with those used in the Phase I database development effort, and are described in detail in Chapter 4. A listing and brief description of the data sets incorporated into the database as part of the Phase II effort are included in Table 1. This table includes the following information associated with each data set: study reference, location of samples, sediment chemistry analyses conducted, other data types available from the study (i.e., toxicity test, benthic invertebrate community structure, or bioaccumulation test data), year of sample collection, and the total number of samples associated with the study.

Database users should also note that the database design was nominally refined during the Phase II project. These refinements consisted primarily of modifications of the database field descriptions (modifications are indicated with an asterisk in Table 2).

2.2 Updates to the GIS Applications

2.2.1 Additional GIS Data Included

The GIS data for the St. Louis River watershed that were compiled in the GIS maps are listed and described in Appendix 1. Ten new data sets were incorporated into the GIS applications as part of the Phase II effort. These data sets are listed and briefly described in Table A1-1. More detailed information about the GIS data sets is provided in Tables A1-2 to A1-11 (the data sets that were incorporated during Phase II of the project are identified in Tables A1-2 through A1-11 with an asterisk in the 'Theme Name' column). Each of these tables provides a summary of the GIS data included in each of the GIS maps. In addition, these tables provide important information about each individual data set, such as details about the data source, how the data were accessed, any errors or problems that have been identified, and where the data and associated metadata are located on project CDs.

2.2.2 Conversion of ArcView 3.2 Projects to ArcMap 8.3 Map Documents

During Phase I of this project, GIS data were compiled into ten ArcView projects (the terminology used to describe an electronic representation of a map) using ESRI's ArcView 3.2 software. Since the completion of the Phase I portion of the project, ESRI has released ArcView 8/9, which is an updated GIS application that is quite different from ArcView 3.x. The ArcView 8/9 software has a new format and new features, with many new tools and options available. Importantly, many of the tasks are executed using methods different from those available in ArcView 3.x. In addition, ArcView 8/9 integrates three applications: ArcCatalog, ArcToolbox (which are new applications), and ArcMap (which is the primary application, and the most similar to ArcView 3.x).

The ArcView 3.2 projects were converted to ArcMap 8.3 map documents, to take advantage of the features offered by the more updated version of ESRI's GIS software. In ArcMap 8/9, 'map documents' (equivalent to the ArcView 3.x 'project') are the files used to store information such as data frames (similar to ArcView 3.x views), graphs, tables, and layouts.

As there are few differences between the two versions, database users can utilize either of the GIS applications to obtain the underlying GIS data.

One difference between the two versions of the GIS applications is the interpretation of the National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center Coastal Change Analysis Program (C-CAP) data that are presented in the Land Use project (the organization of the GIS data into different projects will be described in more detail in Chapter 7 of this report). The Coastal Services Center developed an ArcView extension that allows for the interpretation of land cover and change analysis data (i.e., the C-CAP Legend Handler). Unfortunately, ArcView 8/9 does not support extensions that were developed for ArcView 3.x. So although the C-CAP data are included in the ArcMap 8.3 version, the C-CAP legend handler is not available to assist the user in interpreting the data. For ArcView 8/9 users that have access to the Spatial Analyst extension, the Coastal Services Center is in the process of developing a Data Handler extension that will enhance the users ability to access and manipulate the C-CAP land cover and change analysis data. This tool can be accessed from the following website: www.csc.noaa.gov/crs/. Users who do not have Spatial Analyst may want to check the Coastal Services Center website periodically to check for updates to the Legend Handler extension.

One other difference that should be noted is the creation and use of 'layers' in the ArcMap 8.3 map documents (a layer is similar to a 'theme' in ArcView 3.x; it references geographic data stored in a data source and defines how to display it). To provide background, the ArcView 3.2 projects were specifically designed so that each shapefile would retain its legend properties when added to a view or project. This enables GIS users to create their own maps using the data that were compiled during this project, and retain the legend properties that were generated. This functionality is important because the legend properties define how the data are displayed, which is often critical for the correct interpretation of the data. Unfortunately, certain legend properties (e.g., selected symbols, fills) do not import directly into ArcMap 8/9. For shapefiles for which this occurred, the legends were updated in ArcMap 8.3 and a 'layer' file was saved. The layer file makes it possible for ArcMap 8/9 users to add the theme to a new map document or data frame and retain the legend properties. However, the user should note that there is currently no documentation as to which themes have associated layer files (i.e., the ArcView user will not know that the shapefile legend properties do not display in ArcMap 8.3 until the shapefile is added to a new data frame or

map document). However, the layer files that were created were saved in the same sub-directory as the associated shapefile, which will be obvious when the user is adding data to a data frame.

Chapter 3. Selection of Applications and Design for the GIS-Based Sediment Quality Database

3.1 Introduction

This chapter is intended to provide database users with a description of the selected database application and design of the GIS-based sediment quality database. As such, this chapter includes a detailed discussion of the primary database application (MS Access 2000), as well as information about how to access the secondary database application using the NOAA Query Manager software. In addition, the design of the database is described in terms of the database components (outlines how they are organized), database structure (outlines the content and function of each database component), and database relationships (outlines the connections between database components).

3.2 Selection of Database Applications

A database is a collection of information that is related to a particular subject or purpose. The sediment quality database was designed and populated in a MS Access 2000 relational database based on the software needs of the MPCA and a majority of stakeholders in the St. Louis River AOC.

Using MS Access 2000 as the database application affords many advantages. This application is relatively flexible as the component database tables can be easily exported to other database applications, such as MS Excel (.xls file) and Borland Paradox (.dbf file). In addition, MS Access is widely used and is often the software of choice for beginner and intermediate database users. Many of the database software systems that are designed to handle enormous quantities of data (e.g., Oracle) use MS Access as the user-interface software. Furthermore, in using MS Access, all information can be managed from a single database file (i.e., a .mdb file extension).

Within a database, the data are divided into separate storage containers called tables. MS Access allows users to view, add, and update table data by using forms; to find and retrieve the data of interest by using queries; and, to analyze or print data by using reports. Data are stored in tables (one table for each type of information) and relationships between the tables are defined in order to allow users to bring the data from multiple tables together in a query, form, or report. MS Access allows users to find and retrieve the data that meets specified conditions, including data from multiple tables, by creating queries. A query can also update or delete multiple records at the same time, and perform predefined or custom calculations on the data. MS Access database files can also be modified for interactive internet access, if this functionality is desired.

Using MS Access also presents some challenges to the database user. As mentioned above, the performance of the database decreases if the quantity of data incorporated in the tables is extremely large. Database users must also be forewarned that all changes to the database are permanent and cannot be reversed (e.g., deleting a table, deleting a record, updating information in a cell, etc.). Because of this feature, care must be taken when manipulating the database tables. Caution is also needed when exporting the data into other applications. For example, MS Access and MS Excel often interpret formatted text in slightly different ways, which can result in errors when exporting or importing data (e.g., text formatted as a date in MS Excel is imported into MS Access as a number code). Therefore, it is recommended that checks be conducted after importing/exporting data to ensure that data quality has been maintained. Without incorporating a complex (and restrictive) user interface, it is also necessary for database users to have a good understanding of the database design and field definitions to enable them to design effective queries. For example, if a user is not aware of how undetected data are treated and, as a result, does not include key fields in a query, the query may provide an incorrect answer relative to the database users intentions. For this reason, it is necessary for database users to thoroughly review the supporting documentation prior to designing queries, modifying existing data, and/or adding data to the system.

The sediment quality database was developed in MS Access 2000 format, which is the database format that is available on the project CDs. The database is also available in MS Access '97 format upon request. The data compiled in the MS Access 2000 database can also be accessed in NOAA's St. Louis River Watershed database, which can be viewed using NOAA's Query Manager software. Query Manager provides a menu of flexible, built-in

database queries, and provides seamless linking to two different mapping applications (ArcView 3.x and Mapping Application for Response, Planning and Local Operational Tasks; MARPLOT). The advantage that Query Manager offers is the easy-to-use user interface, which is suitable for users with little or no experience using database software. Although there is some loss of flexibility if complex data analyses are necessary, Query Manager offers a wide range of data queries and provides an excellent way for most users to view and query the data. This Technical Documentation is focused on the development and utilization of the MS Access 2000 version of the database and GIS maps. Chapter 7 of the Phase II Help Section for Database Users (Smorong and Crane 2004) provides an overview of the Query Manager software, as well as guidance for accessing and installing the following products available from NOAA's Office of Restoration and Response: Query Manager software, MARPLOT software, the St. Louis River Watershed database, and tools to link Query Manager and ArcView 3.x [Coastal Protection and Restoration Division (CPRD) tools].

3.3 Database Design

The GIS-based sediment quality database was designed primarily as a data storage system for sediment quality data collected from the St. Louis River AOC. In designing the database structure, the existing sediment quality data were examined to facilitate the identification of data types, key variables, and required database fields. Some of the factors that were considered during the design of the database included:

- The need to retrieve data by chemical class [e.g., metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine pesticides, etc.];
- The need for assuring compatibility with geographic information systems (e.g., ESRI's ArcView 3.2 and ArcMap 8.3 software) to facilitate geographic interpretation of the underlying data;
- The requirement for incorporating ancillary information related to the data (e.g., laboratory qualifier codes, sample dates, sediment descriptions, bibliographic references); and,

- The need for subsequently expanding the database to include other data types (e.g., benthic invertebrate community data, etc.).

The design of the GIS-based sediment quality database was patterned after NOAA's Watershed databases, in which sediment chemistry, sediment toxicity, and tissue chemistry data have been compiled, and which can be viewed using NOAA's Query Manager software. A key component of this design is that each sample is georeferenced to facilitate spatial analyses of the underlying data and presentation of the information on appropriate basemaps (i.e., in ArcView 3.2 or ArcMap 8.3). In order to design a system that most directly met the needs of stakeholders, two meetings were held in October 2001 to garner stakeholder input on a number of data management issues. Stakeholders were asked to describe how they foresee using the database (i.e., the likely ways that they would extract and use the data contained in the database), to identify and prioritize sediment quality indicators, and to identify and prioritize GIS data sets of interest. A comprehensive account of the stakeholder meetings has been compiled in a summary report which is available on the MPCA's Contaminated Sediments Web page at: http://www.pca.state.mn.us/water/sediments/stlouis-stakeholdermtg (MacDonald *et al.* 2001a). Subsequently, the draft database design was reviewed and approved by the MPCA grant and project manager (i.e., Judy Crane) for the Phase I project. Updates to the Phase II database design were approved by the MPCA project manager (Judy Crane).

3.3.1 Description of Database Structure

A detailed description of the database components is provided in Table 2. This table includes a description of the structure and content of each database table, and a description of the information contained in each of the fields (columns) that comprise the tables. To view table descriptions in the database, select the Details icon in the Database window (far right icon in the Database window header), and the table description will be displayed in the Description column. To view field descriptions in the database, see the upper portion of the table in the Design view, or click on a cell in the field of interest and the field description will display in the Status Bar at the bottom of the screen.

3.3.2 Description of Database Relationships

The GIS-based sediment quality database is a relational database. This means that the database consists of several tables that can be linked together (i.e., relationships have been defined) to facilitate retrieval of the data in a wide variety of ways. The purpose of defining relationships is to coordinate the retrieval of information in the different tables. The main advantage of a relational database is that queries, forms, and reports can be created to display information from several tables at once. A relationship works by matching data in key fields (usually a field with the same name in both tables), and these matching fields provide a unique identifier for each data record. Figure 1 shows the database relationships for the database. The key fields that are used to match the data in different tables, and thus provide a unique identifier, are the ***SITEID, STUDYID***, ***STATIONID***, ***SAMPLEID, FIELDREP, LABREP***, and ***CHEMCODE*** fields. These fields were designed to be consistent with fields used in NOAA's Query Manager software.

Chapter 4. Description of the Contents of the GIS-Based Sediment Quality Database

4.1 Introduction

This chapter is intended to provide a description of the contents of the GIS-based sediment quality database that was prepared in MS Access 2000. Accordingly, this chapter includes a description of the criteria used for evaluating data quality, a listing of the data sets incorporated in the sediment quality database (in tabular form), and an outline of the QA/QC procedures observed while developing the sediment quality database. The QAPP for this project (Crane 2004) provided the structure by which the above tasks were implemented.

4.2 Criteria for Evaluating Sediment Quality Data Sets

The purpose of developing and applying screening criteria to candidate data sets was to provide a means of evaluating the quality of the data and assuring general consistency in the information included in the database. In recent years, GLNPO, the United States Geological Survey (USGS), NOAA, MPCA, Florida Department of Environmental Protection (FDEP), British Columbia Ministry of Water, Land, and Air Protection (BCWLAP), MESL, and EVS Consultants developed a database of matching sediment chemistry and sediment toxicity data to support evaluations of the predictive ability of numerical sediment quality guidelines (SQGs) in the Great Lakes basin and elsewhere in North America (Field *et al.* 1999; USEPA 2000; Crane *et al.* 2000; 2002a). In addition, various project-specific databases have been developed to facilitate access to and analysis of data sets to support natural resource damage assessments (NRDAs) and ecological risk assessments (ERAs) at sites with contaminated sediments (MacDonald and Ingersoll 2000; Crane *et al.* 2000; MacDonald *et al.* 2001b; 2001c; Ingersoll *et al.* 2001). The goal of these initiatives was to collect and collate the highest quality data sets for assessing sediment quality conditions at contaminated sites and evaluating numerical SQGs. To assure that the data used in these assessments met the associated data quality objectives (DQOs), all of the candidate data sets were critically

evaluated before inclusion in the database. However, the screening process was also designed to be flexible to assure that professional judgement could also be used when necessary in the evaluation process. In this way, it was possible to include as many data sets as possible and, subsequently, use them to the extent that the data quality and quantity dictated.

The criteria for evaluating candidate data sets were established in consultation with an *ad hoc* Science Advisory Group on Sediment Quality Assessment (which is comprised of representatives of federal, provincial, and state government agencies, consulting firms, and non-governmental organizations located throughout North America and elsewhere worldwide). Subsequently, MESL and the MPCA refined these criteria to specifically apply to data sets that would be incorporated in the GIS-based sediment quality database for the St. Louis River AOC. Appendix 2 provides an outline of the criteria used to evaluate data quality for candidate data sets.

In total, fifty-two candidate data sets were identified for possible inclusion in the sediment quality database (37 for the Phase I project, and 15 for the Phase II project). Benthic invertebrate community data sets were excluded from both Phase I and II of the database development effort due to a lack of funds, as well as the need to coordinate with NOAA staff on the development of new database fields in Query Manager to accommodate these types of data. Judy Crane (MPCA) identified the priority by which MESL staff entered data sets into the database. Data sets were designated as high, medium, and low priority using the following criteria:

High Priority

Phase I

- Data sets by MPCA staff and their consultants for areas throughout the AOC, as well as for data sets collected by the responsible parties for the Interlake/Duluth Tar and USS Superfund sites.

Phase II

- Sediment quality data sets collected by the USACE and their consultants for areas throughout the AOC;
- Data sets collected by WDNR staff and their consultants for Hog Island Inlet and Newton Creek, and the Fraser Shipyard's site; and,

- The study of the Koppers Industries, Inc. facility in Superior, WI conducted by their consultant (BBL).

Medium Priority

Phase I

- Data sets from other groups that were already partly incorporated in the matching sediment chemistry and toxicity database prepared for the St. Louis River AOC (prepared by MESL for the MPCA through GLNPO grant #GL985604-01);
- Data sets from other groups that included mercury data and/or broadened the geographic range of sediment quality data in the database; and,
- Data sets from other groups for hot spot sites located in the Wisconsin portion of the St. Louis River AOC.

Phase II

- Older data sets collected by WDNR staff and their consultants for Hog Island Inlet and Newton Creek; and,
- The study of the Lakehead Pipe Line Company oil tanker loading facility in the Duluth-Superior outer harbor conducted by their consultant (Wenck Associates, Inc.).

Low Priority

Phase I

- Most of the data sets collected on behalf of the USACE in the Duluth-Superior Harbor;
- The Fond du Lac Band's study of reservation lakes near the St. Louis River AOC; and,
- Studies containing benthic invertebrate community data.

The ordering of data sets within each category was also identified by Judy Crane. Tissue residue data for native benthic organisms and fish tissue were designated as a lower priority for inclusion in the sediment quality database due to resource concerns.

4.3 Data Types and Data Sets Incorporated into the GIS-Based Sediment Quality Database

The sediment quality database was primarily populated with the existing sediment quality data for the St. Louis River AOC that were collected during or after 1990. For a detailed description of the data sets that were incorporated in the database during Phase II and Phase I, refer to Tables 1 and 3, respectively. These tables include the following information associated with each data set: study reference, location of samples, sediment chemistry analyses conducted, other data types available from the study (i.e., toxicity test, benthic invertebrate community structure, or bioaccumulation test data), year of sample collection, and the total number of samples associated with the study.

4.4 Database Quality Assurance/Quality Control (QA/QC)

The QAPPs for the two project phases (Crane 2001; 2004) documented the QA/QC procedures used in this project. The data quality screening procedures outlined in Section 4.2 were an important first step in evaluating the quality of the data from various sediment quality studies. During this QA/QC process, the methods used for sample collection, handling, and analysis were scrutinized. Any outstanding data quality issues or questions were resolved by contacting the study authors. Finally, all decisions and assumptions that were made relative to data acceptability and data treatment were approved by either Judy Crane (MPCA) or Don MacDonald (MESL).

To allow for easy accessibility to the results of the data quality screening process, an MS Access 2000 database was designed and populated. This database was developed at the outset of the Phase I project and was designed to capture the following information:

- Study identification codes (e.g., the ***STUDYID***, which is a numerical code assigned to ensure compatibility with NOAA's Query Manager software, and the ***MESL_LIBNO***, which is an alpha-numeric index code that indicates the storage location of the hardcopy report in the MESL library);

- Information about the study (i.e., study reference, key contacts, internal tracking number, data types included);
- Information about the data evaluation process (i.e., the personnel who conducted the data quality evaluation, and the dates that the evaluation was conducted);
- Results relevant to the data quality evaluation criteria for candidate data sets (presented in Appendix 2);
- Decisions made relative to data treatment (e.g., professional judgement decisions, acceptability status, etc.); and,
- Ancillary information about sampling (e.g., collection dates, number of samples collected, whether water depth or soft sediment depth data are available), toxicity testing (e.g., feeding procedures, laboratory name, source of test organisms, etc.), and analytical data (e.g., availability of reported totals, etc.).

As such, this database represents a valuable resource as it allows users to quickly access information about the study and how the data were captured in the database, without having to refer to the study reports. This database also provides the means to standardize the data quality screening procedures, as it provides a clear framework for gathering information and making data treatment decisions. The data quality evaluation database is available upon request by contacting Judy Crane (MPCA) at 651-297-4068 (voice), 651-297-7709 (fax), or judy.crane@pca.state.mn.us (email).

To assure data quality was maintained during the database development process, standardized QA/QC procedures were followed. The first step in the QA/QC process involved verifying the data against the original data source. The specific procedures involved in this step of the process are outlined in Appendix 3 (Data Quality Check Sheet for Sediment Quality Data). Following translation of the data into a database format, the verified data were then further evaluated. This auditing process involved analysis of outliers (i.e., to identify inconsistencies with units) and completeness (i.e., to identify missing samples or missing data); examination of data qualifier fields (i.e., to assure internal consistency); and evaluation of sample identification numbers (i.e., to ensure that data were not duplicated). The data qualifier codes included in the original data files were incorporated into the MS Access 2000 database,

without carrying out further data validation procedures (i.e., the electronic data source files were not scrutinized to further evaluate the accuracy and precision of the underlying data).

Chapter 5. Options for Data Treatment

There are characteristics of sediment quality data (e.g., detection limits) that require database users to make decisions regarding how to handle the information for the purposes of data analyses. It is essential that these decisions are understood and that the implications of these decisions are considered in the design of database queries (e.g., by including criteria to eliminate certain results and/or samples). This chapter reviews the alternatives that are available for treating undetected data, QA/QC samples, acid volatile sulfide (AVS) and simultaneously extracted metal (SEM) results, and non-numerical or zero results. In addition, there is a discussion regarding how chemical names were standardized.

5.1 Treatment of Undetected Data

A number of investigators have evaluated the implications of applying various procedures for estimating the concentrations of contaminants from undetected data (Gaskin *et al.* 1990; Porter and Ward 1991; El-Shaawari and Esterby 1992; Clarke and Brandon 1994; Clarke 1998). While there is no consensus on which data censoring method should be used in various applications, the simplest methods tend to be used most frequently, including deletion of undetected values or substitution of a constant, such as zero, the detection limit, or one-half the detection limit for the undetected values (USACE 1995).

To address the need for guidance on statistical treatment of undetected data, the USACE (USACE 1995; Clarke 1998) conducted a simulation study to assess the performance of 10 methods for censoring data. The results of that investigation indicated that no single data censoring method works best in all situations. Accordingly, the USACE recommended a variety of methods depending on the proportion of the data that requires censoring, the distribution and variance of the data, and the type of data transformation to be applied. For data sets for which a low to moderate proportion of the data require censoring, substitution of the detection limit is generally the preferred method (i.e., to optimize statistical power and control Type I error rates). However, as the proportion of the data that requires censoring and the coefficient of variation of the data increase, statistical power is better maintained by

substituting of one-half the detection limit for the undetected data, particularly for lognormally distributed and transformed data. Substitution of zero or other constants was also recommended in several circumstances. Overall, it was concluded that simple substitution methods work best to maintain power and control error rates in statistical comparisons of chemical concentration data (USACE 1995; Clarke 1998).

The GIS-based sediment quality database was designed so that there are four data treatment options available to the database user for censoring undetected data:

1. Substituting undetected values with one-half the detection limit.

   If this is the desired data treatment option, the data user must consider the ***MESL_C_CALC*** results field in the **ptbl - CHEM** table.

2. Deleting undetected values.

   If this is the desired data treatment option, the data user must consider the ***CONC*** results field in the **ptbl - CHEM** table. In addition, the criteria LIKE "NUM" must be entered in the query design grid for the ***MESL_QUAL_CALC*** field (i.e., only detected results are included in the query results).

3. Substituting undetected values with the detection limit.

   If this is the desired data treatment option, the data user must consider the ***CONC*** results field in the **ptbl - CHEM** table.

4. Excluding undetected values with high detection limits.

   This data treatment option can be used in conjunction with the first and third data treatment options described above. The undetected values with high detection limits [i.e., detection limits greater than the Level II SQTs recommended for use in Minnesota (Crane *et al.* 2000; 2002a)] have been identified in the ***MESL_EXCLUDE HIGH ND*** field in the **ptbl - CHEM** table. As such, the criteria NOT LIKE "X" must be entered in the query design grid for this field to exclude these results.

5.2 Treatment of Data for QA/QC Samples

In a number of studies, additional samples were collected and/or analyzed as part of the quality assurance program (i.e., field replicates, analytical laboratory duplicates). The reasons QA/QC samples are analyzed along with environmental samples is to provide information on the accuracy and precision of the analytical results. Data for field replicate and analytical laboratory duplicate samples were included in the database, although other types of QA/QC samples were not included (e.g., method blanks, matrix blanks, trip blanks, etc.). Field replicate samples (i.e., two or more individual samples collected in close proximity to assess the degree of spatial variability in field samples) are identified in the ***FIELDREP*** field in the **ptbl - SAMPLE** and **ptbl - CHEM** tables. Analytical laboratory duplicates (i.e., one sample that has been split into two sub-samples and analyzed by the laboratory to assess method precision) are identified in the ***MESL_LABDUP_AVG*** field in the **ptbl - CHEM** table. It should be noted that laboratory split samples are NOT entered as unique samples, rather, the results from the two sub-samples have been averaged to support subsequent data analysis.

5.3 Treatment of AVS and SEM Results

In the MS Access 2000 database, the results for SEM have been reported in multiple units to support subsequent data analysis. Results for SEM in the **ptbl - CHEM** table are reported in units of parts per million (ppm). This facilitates including both SEM and total metals in data analysis. The ***MESL_SEMQUAL*** field is populated with "B" to indicate SEM results for samples that also have results for total metals. The purpose of this field is to provide a basis for excluding SEM results for samples that also have results for total metals (i.e., enter the criteria NOT LIKE "B" to only include total metal results for samples that have results for total metals and SEM).

In addition, the SEM results have been included in the **ptbl - AVS and SEM** table in units of µmol/g. This table also includes AVS results reported in units of µmol/g (note that AVS is NOT included in the **ptbl - CHEM** table in units of ppm, as these data are not interpreted on this basis).

5.4 Non-Numerical and Zero Results

There are numerous sediment chemistry results in the database for which either non-numerical (e.g., not reported, missing, not quantified, etc.) or zero results were reported in the original data files. The data treatment decision for zero results was to assume these were undetected results (i.e., "ND" was substituted). The data treatment decision for non-numerical results was to include this information in the database, along with the capacity to exclude these results for the purpose of data analyses. The ***MESL_QUAL_CALC*** field in the **ptbl - CHEM** table allows the user to select criteria to ensure that only numerical results are considered. This field has been populated with "NUM" (detected), "U" (undetected), "UX" (undetected and detection limit not indicated), and "X" (no result). Therefore, when designing queries, enter NOT LIKE "*X*" criteria in the ***MESL_QUAL_CALC*** field to consider only numerical results [note the use of the asterisk (*) as it is a wild card]. However, when counting the sample number with undetected results, the criteria should be such that the "UX" results are included (i.e., NOT LIKE "X", therefore not using the asterisk wild card).

5.5 Standardization of Chemical Names

One of the main challenges associated with compiling several data sets into a database so the data are comparable and can be combined for the purpose of data analyses is standardizing the chemical names used in the individual data sources. Many chemicals typically have several synonyms (e.g., "ammonia" is commonly referred to as ammonia-N, ammonia, ammonia-total, ammonia as N, NH_3-N, etc.). A problem arises because data from each study were generated at different analytical laboratories, each potentially using their own list of chemical names to report the results. There are a variety of systems that provide unique identifiers for chemical substances to provide an unambiguous way to identify a chemical substance when there are many possible systematic, generic, proprietary, or trivial names [e.g., Chemical Abstracts Service (CAS)].

In order to handle the issue of standardizing chemical names in the database, a standard chemical code (i.e., the ***CHEMCODE*** field) was assigned for each chemical name. Assigning

a short code to represent long chemical names also reduces the chance of error in entering long chemical names that must be exact to ensure that related data tables are correctly connected. The **lkp - CHEMDICT** table lists each of the unique chemical codes (i.e., ***CHEMCODE***) and provides the full chemical name and other associated information that is helpful in the evaluation of the data (e.g., chemical classification, standard units of measure, etc.). It is especially important to refer to the ***CHEMNAME*** field in the **lkp - CHEMDICT** table when interpreting particle size data, as the micron size applicable to that CHEMCODE is specified in this field.

Chapter 6. Special Considerations Regarding Data Management

This chapter of the Technical Documentation provides information about special considerations database users should be aware of when querying the database. As such, this chapter reviews the methods used for categorizing sediment samples as surficial or sub-surface, the methods used for calculating totals and other calculated values, the procedures used to adapt certain geographical coordinates, and the methods for recording station identification codes.

6.1 Categorizing Samples as Surficial or Sub-Surface

The **ptbl - SAMPLE** table includes the ***MESL_SURF_SUB*** field, which designates each sample as either a surficial or sub-surface sample. The criteria that have been used to categorize samples on this basis are consistent with the criteria used by NOAA for the St. Louis River Watershed database. Samples considered to be surficial have an upper sampling depth of zero and a lower sampling depth of less than or equal to 30 cm (i.e., 0 to $\leq$30 cm). Samples considered to be sub-surface have an upper sampling depth greater than zero or a lower sampling depth of greater than 30 cm (i.e., >0 cm or $\geq$30 cm). For example, a sample collected at 0-10 cm is categorized as a surficial sample, whereas samples collected at 0-40 cm or 5-10 cm are categorized as sub-surface samples.

6.2 Methods Used to Determine Calculated Values

The **ptbl - CHEM** table includes calculated totals for PAHs, PCBs, and pesticides [i.e., chlordane and 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethanes (DDTs)]. In addition, mean probable effect concentration quotients (PEC-Qs) have been calculated and included in the **ptbl - CHEM** table (using "MeanPEC_Q" as a CHEMCODE), which allows for these results

to be queried along with other chemistry results. In addition, the mean PEC-Qs are incorporated in the **ptbl - Mean PEC-Q** table, which includes more information about the PEC-Qs contributing to the mean. Mean PEC-Qs were calculated to provide an overall measure of chemical contamination and to support an evaluation of the combined effects of multiple contaminants in sediments. The mean PEC-Qs have been shown to provide a reliable basis for classifying sediments as toxic or not toxic in the St. Louis River AOC, in the larger geographical areas of the Great Lakes, and elsewhere in North America (Ingersoll *et al.* 2001; Crane *et al.* 2002a).

The CHEMCODEs that delineate calculated totals can be identified by referring to the records in the **lkp - CHEMDICT** table that have "TOTAL" entered in the ***CHEMCLASS*** field. Additional details regarding the methods for calculating totals and mean PEC-Qs are included in the **ptbl - STUDYNOT** table. The specific procedures used for calculating totals for sediment chemistry data are described below:

- Calculations of total PAHs, total low molecular weight PAHs (LMW-PAHs), and total high molecular weight PAHs (HMW-PAHs) have been calculated and included as results in the MS Access 2000 database, with an indication that these are *calculated totals*. LMW-PAHs are considered to include the following two- and three-ringed substances: naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene. HMW-PAHs are considered to include the following four- and five-ringed substances: fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(a)pyrene and, dibenzo(a,h)anthracene. Total PAHs (tPAH) are considered to be the sum of the LMW-PAHs and HMW-PAHs. Totals reported in the data set were also incorporated, with an indication that they are *reported totals*.
- Calculations of total PCBs have been calculated and included as results in the MS Access 2000 database, with an indication that these are *calculated totals*. If congener and Aroclor results are available, the congener results were used preferentially to calculate totals, and the method that was used in the determination was recorded in the database (i.e., whether congeners or Aroclors were used to determine total PCBs). The reported concentrations of total PCBs were also incorporated, with an indication that they are *reported totals*, and

should be treated as equivalent to the calculated totals regardless of which method was used to determine the concentrations.

- For sediment chemistry data, calculations of total DDTs have been calculated and included as results in the MS Access 2000 database, with an indication that these are *calculated totals*. Sum 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD), Sum 1,1-dichloro-2,2-bis(4-chlorophenyl)ethylene (DDE), and Sum DDT are considered to be the sum of p,p'-DDD and o,p'-DDD, p,p'-DDE and o,p'-DDE, and p,p'-DDT and o,p'-DDT, respectively. Total DDTs are considered to be the sum of Sum DDD, Sum DDE, and Sum DDT. The reported concentrations of tDDTs have also been incorporated, with an indication that they are *reported totals*, and should be treated as equivalent regardless of which method was used to determine the concentrations, provided that the p,p'-isomers of DDT, DDE, and DDD were measured.
- The reported concentrations of polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) should be treated as equivalent regardless of which method was used to determine the concentrations, provided that the most toxic substances were measured [i.e., tetrachlorodibenzo-*p*-dioxin (TCDD), heptachlorodibenzo-*p*-dioxin (HCDD), tetrachlorodibenzofuran (TCDF), heptachlorodibenzofuran (HCDF)]. The World Health Organization (WHO) Toxic Equivalency Factors (TEFs) for humans were used to calculate Toxic Equivalents (TEQ_HH), and the WHO TEFs for fish were used to calculate TEQ_W (Van den Berg *et al.* 1998). TEQs were not calculated for samples that only had results for PCB congeners.
- Mean PEC-Qs were calculated using the methods that were recommended by Ingersoll *et al.* (2001) and outlined in Crane *et al.* (2000; 2002a). Generally, a PEC-Q was first determined for each metal for which a reliable PEC was available (i.e., arsenic, cadmium, chromium, copper, lead, nickel, and zinc). Then, an average PEC-Q for metals was calculated by summing the PEC-Qs of each metal and dividing by the number of metals that were included in the calculation. PEC-Qs were also calculated for total PAHs (based on a subset of the 13 parent LMW- and HMW-PAHs) and total PCBs. Finally, the mean of the average PEC-Q for metals, the PEC-Q for total PAHs, and the PEC-Q for total PCBs was determined for each sediment sample (termed the mean PEC-Q).

6.3 Special Treatment of Toxicity Test Statistical Designations

Statistical significance of toxicity test results were determined using control results. The samples used to determine statistical significance are identified in the ***NEG*** field of the **ptbl - BIOSUMM** table.

In toxicity tests that are designed to evaluate effects on growth and/or reproduction, the sample results were treated as "NA" (not analyzed due to significant mortality) for these endpoints if the survival endpoint was toxic and the magnitude of toxicity was less than 40% survival. This rule was implemented even if the authors reported results and significance determinations for these endpoints.

6.4 Adaptation of Geographical Coordinates

Geographical coordinates were entered in the MS Access 2000 database as they were reported in the original report and/or data files. An indication of how the coordinates were obtained are indicated in the ***MESL_EST_STN*** field in the **ptbl - STATION** table. This information should allow users to assess the degree of confidence they wish to place on individual station locations. For example, some coordinates are very accurate [e.g., obtained using global positioning system (GPS) technology, with post-survey correction], and others are less so (e.g., site locations were estimated using a map from the report).

Subsequently, the accuracy of the station locations was further evaluated by examining whether the geographical coordinates indicated locations that were not within water boundaries. If station locations were substantially outside of the water boundaries indicated by the basemaps utilized for the GIS component of the project, these station locations were estimated by referring to maps in the report and/or detailed site descriptions. This adaptation of the original geographic coordinates was noted in the ***MESL_EST_STN*** field in the **ptbl - STATION** table (e.g., "coordinates adjusted" entered in this field). If station locations were only slightly outside of the water boundaries indicated by the basemaps utilized for the GIS component of the project, these station locations were left in place. The rationale for this

decision was acknowledging that the accuracy of the basemap could also account for the placement of station locations outside the water boundaries.

6.5 Methods for Recording Station Identification Codes

The MS Access 2000 database includes two different fields for recording station identification codes***: STATIONID*** and ***MESL_STATIONID***. The ***STATIONID*** field is limited to only six characters, so often the station identification codes could not be recorded as they originally appeared in the report and/or data files. Therefore, the ***MESL_STATIONID*** field provided the station identification code as it was originally reported in the report and/or data files. In addition, the core depth has been included as a suffix to the original station identification code, where applicable.

Chapter 7. Description of the GIS Components of the Project

This chapter of the Technical Documentation is intended to provide information about the GIS watershed data compiled for the ten accompanying ArcView 3.2 projects and ArcMap 8.3 map documents. As such, this chapter provides details regarding how the GIS data were compiled and organized on the project CDs. In addition, a listing of the data sets included in the GIS maps and the approach used for dealing with known errors in the GIS data are described.

7.1 Methods for Compiling Data

The acquisition of GIS data was focused by the input obtained from stakeholders during the October 2001 meetings in Duluth and St. Paul, MN. In addition, GIS data that were suitable for viewing with ESRI's ArcView software were targeted during the search for candidate data sets. As such, GIS data were obtained:

1. By conducting internet searches for publicly available data;
2. Directly from MPCA staff and stakeholders; and,
3. By digitizing key data sets that were not available from other sources.

This search resulted in a large number of candidate GIS data sets. As such, the data sets were evaluated to filter out the highest quality data sets that would be of greatest use to stakeholders. The following criteria were used to evaluate the GIS data sets:

- The reliability of the data source was assessed;
- The date the data set was generated was determined, and more recently collected data were preferentially selected; and,

- The general quality of the data was assessed and only data sets of high quality were included in the GIS maps.

Finally, the selected GIS data sets were converted to a common projection [i.e., Universal Transverse Mercator (UTM) North American Datum 83 (NAD83) Zone 15].

7.2 Organization of GIS Data

The GIS data were compiled in several different components. A description of each component and how the components relate to each other is included in this section.

7.2.1 ArcView 3.2 Projects and ArcMap 8.3 Map Documents

The GIS data that were compiled have been organized into ArcView 3.2 projects and ArcMap 8.3 map documents (i.e., files in which work in ArcView is stored). The ArcView 3.2 projects are also compatible with other versions of ArcView 3.x. In addition, the ArcMap map documents are compatible with other versions of ArcMap 8.x or 9.x. As mentioned in Section 2.2.2, the ArcView 3.2 projects and ArcMap 8.3 map documents have been developed to be functionally equivalent (i.e., users may access either one or the other GIS application, but do not need to refer to both versions). Accordingly, the remainder of this document will refer to both the ArcView 3.2 projects and the ArcMap 8.3 map documents as 'GIS maps' unless the topic necessitates referring to one or the other specifically.

Nine GIS maps were created for the following themes: contaminated areas, ecological areas, geographic features, hydrology, land use, recreation, USEPA Inland Sensitivity Atlas, water quality, and water use. In addition, a GIS map that included a black and white version of the basemap was created. All of the data sources represented in these ten GIS maps are in the Zone 15 NAD 83 map projection. Users should note that all changes to labeling, theme order, magnification, etc. (i.e., display changes) are saved when the GIS maps are saved. Therefore, it is recommended that users work in a copy of the GIS map files so that the original format and/or display is always available.

7.2.2 Spatial Data

The GIS applications are comprised of spatial data (i.e., geographic data that stores the geometric location of particular features, along with attribute information describing what these features represent). Spatial data are also known as digital map or digital cartographic data. Spatial data are georeferenced to known locations on the Earth's surface. Spatial data accurately records geographic locations by employing a specific coordinate system, unit of measurement, and map projection. The GIS maps included on the project CDs include the following types of spatial data: image data (aerial photographs and scanned USGS topographic maps), shapefiles, and layers.

7.2.3 Accessory Information

An ArcView extension prepared by NOAA has been included on project CD #1 (see Section 4.1.2 in the Phase II Help Section for ArcView Users for installation instructions). The C-CAP Legend Handler extension allows users to manipulate the display of NOAA's C-CAP land cover and change data in ArcView 3.x. The C-CAP land cover and change data can be viewed in the Land Use project. This image data set has associated metadata and instructions for effectively using the C-CAP Legend Handler [included on project CD #1, in the same sub-directory as the associated shapefile (i.e., "C:\STLR_GIS Project\Shapefiles")].

7.2.4 Basemap of the St. Louis River AOC

Three different basemaps (i.e., a planning level set of data) were compiled in each of the ten GIS maps. Each GIS map includes three views of different basemaps. The view named "Orthophotos" includes digital orthographic aerial photographs (image data); the view named "Quad maps" includes USGS digital orthographic topographic maps (image data); and, the remaining view (the main view) includes a basemap comprised of several basic line and polygon shapefiles. Note that the image files are large and slow down ArcView's refresh rate substantially. As such, users are afforded quick access to each of the three basemaps, as any or all of the orthophotos or quad maps can be incorporated into the main view (i.e., the view that contains the feature geographic data). For specific instructions on how to do this see Section 3.1.4 of the Phase II Help Section for ArcView Users (Smorong *et al.* 2004).

7.2.5 Theme Metadata

Metadata are data that describes spatial data. A metadata file describes the spatial dataset in terms of who created it, for what purpose it was created, and when it was created. The metadata file will also provide an indication of data quality, history, and availability.

When metadata were available for spatial data, this information was included on project CD #1, in the same sub-directory as the associated shapefile or image data (i.e., **C:\STLR_GIS Project\Shapefiles**).

7.3 GIS Data Included

The watershed GIS data included in the ten GIS maps are listed and described in Appendix 1. Table A1-1 provides a summary of the GIS data that were incorporated into the various GIS maps as part of the Phase II effort. More detailed information about the GIS data sets have been incorporated into Tables A1-2 to A1-11 (the data sets that were incorporated during Phase II of the project are identified in Tables A1-2 through A1-11 with an asterisk in the 'Theme Name' column). These tables provide important information about each individual data set, such as details about the data source, how the data were accessed, any errors or problems that have been identified, and where the data and associated metadata are located on the project CDs.

7.4 Approach Used for Dealing with Known Errors in the GIS Data

7.4.1 Errors in Attribute Data

In the process of compiling the GIS maps, a number of errors in the source data were identified. Users should be aware that identifying and correcting errors in the GIS data were not identified as a work plan task for this phase of the project. As such, even though GIS

data from reliable data sources were preferentially included (e.g., USGS, USEPA, state agencies), there are some known inaccuracies in the GIS data. Users should also be aware that the metadata were current as to the time period the GIS information was assembled by the source agencies. The notable inaccuracies in the GIS data are listed below:

- Contaminated Areas project; Contaminated Sediment Hot Spots theme: the boundaries indicated are estimates and should not be construed as an estimation of the area requiring sediment remediation;
- Contaminated Areas project; Superfund Sites theme: the boundaries indicated are estimates and should not be construed as an estimation of the area requiring sediment remediation;
- Contaminated Areas project; Air Emissions (MN) theme: the Potlatch facility was bought out several years ago by Sappi;
- Ecological Areas project; MN DNR Important Habitat Sites theme: the location of some of the sites are inaccurate (e.g., Interstate Island is shown at the end of Rices Point instead of on Interstate Island; the Bong Bridge site is shown at Erie Pier; Hog Island is shown in Allouez Bay);
- Hydrology project; Land Areas of the St. Louis River theme: some land areas such as Rices Point, Clough Island, Interstate Island, and Hearding Island are not included in this theme;
- Hydrology project; Water bodies of the St. Louis River theme: this theme does not include the reservoirs, Superior Bay is shown to extend too far over to Duluth, and Allouez Bay is cut off;
- Hydrology project; MN Watersheds theme: the watershed designated as Keene Creek in the attribute table is not located near Keene Creek, which drains into the Interlake/Duluth Tar Superfund site; and,
- USEPA Inland Sensitivity Atlas project: this project is a stand alone product available from the USEPA. It has been included on the project CD as it was available from the source agency, with the exception of some data layers originating from the WDNR that were deemed to be proprietary. The Inland Sensitivity Atlas used a different basemap than was used for the other projects included on the project CDs, which excludes many boat slips in the outer harbor.

In addition, fewer marinas are identified in this project, as compared to the Recreation project (marinas theme). Also, part of the Minnesota state boundary is erroneously shown in Wisconsin.

Users should be aware of the following error in ArcView 3.x software: if two projects are opened in a row ***without*** closing out of ArcView completely, you may receive an error message (e.g., "Illegal Instruction!" or "Segmentation violation!"). Closing and re-opening ArcView resolves this problem.

7.4.2 Modifying the Basemap

The shapefile obtained from the MPCA that delineated the water boundaries for the lower St. Louis River AOC did not have associated metadata and is inaccurate when viewed at larger scales. This discrepancy is evident when comparing the water boundary shapefile to the orthographic aerial photographs and/or topographic maps. There were insufficient resources available to re-digitize a shapefile for the lower St. Louis River water boundaries. However, this shapefile was modified during the process of evaluating the accuracy of the geographical coordinates for station locations (see Section 6.4 for additional details). When station locations appeared to be falling outside the water boundaries (i.e., on land), the water boundary shapefile was compared to the orthographic aerial photograph to determine whether the geographic coordinate of the station location was inaccurate, or if the water boundary shapefile was inaccurate. If the latter situation existed, the water boundary shapefile was edited to match the aerial photograph for the section of the shoreline adjacent to the station location.

Chapter 8. Linking the GIS-Based Sediment Quality Database with GIS Applications

Linking the database with a GIS application provides a foundation for viewing and interpreting the underlying data on a spatial basis. The MS Access 2000 version of the sediment quality database can be accessed and imported into any of the GIS maps using ArcView's Structured Query Language (SQL) connection feature or ArcCatalog to establish a database connection to ArcMap. These features allow users to query a database and to store the returned records in the GIS application. For detailed instructions for linking the sediment quality database to the GIS applications, refer to Chapter 5 of the Phase II Help Section for ArcView Users (Smorong *et al.* 2004).

Query results obtained using NOAA's Query Manager software can be accessed and imported into ArcView 3.x by using GIS tools developed by NOAA (i.e., CPRD tools; at this time, NOAA has not produced tools to directly link the Query Manager software with ArcView 8/9). These GIS tools are available at no cost from NOAA's Office of Restoration and Response Web page, and are accompanied by detailed instructions for installation and use. For more detailed instructions for accessing NOAA's CPRD tools, refer to Chapter 7 of the Phase II Help Section for Database Users (Smorong and Crane 2004).

Query results obtained using NOAA's Query Manager software can also be imported into MARPLOT software. MARPLOT is a mapping software that uses Topologically Integrated Geographic Encoding and Referencing (TIGER) maps for viewing the data spatially. This software is less flexible than ArcView 3.x, and only users that do not have the ArcView 3.x software available should select this option for spatially viewing the data. The MARPLOT software is available at no cost from NOAA's Office of Restoration and Response Web page, and are accompanied by detailed instructions for installation and use. For more detailed instructions for accessing the MARPLOT software, refer to the Phase II Help Section for Database Users (Smorong and Crane 2004).

Chapter 9. Administrative Details

This chapter of the Technical Documentation will provide an explanation of administrative details (distribution, updates, notices) and plans for future database updates.

9.1 Distribution of the MS Access 2000 Sediment Quality Database and GIS Components via Project CDs

The MS Access 2000 sediment quality database and accompanying GIS maps will be available on a set of project CDs that will be distributed to interested MPCA staff and stakeholders. The Phase II project CDs will include the following files and information:

- Phase II MS Access 2000 sediment quality database;
- Phase II Help Section for Database Users;
- Phase II ArcView 3.2 projects and ArcMap 8.3 map documents of GIS watershed data; and,
- Phase II Help Section for ArcView Users.

A notice of the availability of the project CDs will be posted on the MPCA's Contaminated Sediment Web page at: http://www.pca.state.mn.us/water/sediments/data.html and http://www.pca.state.mn.us/water/sediments/studies-stlouis.html#assessment.

The database and GIS files available on the project CDs will not be downloadable from the MPCA Web page due to security concerns. Instead, users will be directed to obtain the Phase II project CDs from Judy Crane at: Environmental Analysis and Outcomes Division, MPCA, 520 Lafayette Rd. N., St. Paul, MN 55155-4194, ph: 651-297-4068, fax: 651-297-7709, e-mail: judy.crane@pca.state.mn.us.

9.2 Distribution of the Database via NOAA's Office of Restoration and Response

The following products are available at no cost from NOAA's Office of Restoration and Response Web page: (http://response.restoration.noaa.gov/cpr/watershed/watershedtools.html):

- Query Manager 2.5 software (data delivery application that offers a menu of flexible, built-in database queries);
- MARPLOT 3.3 software (a mapping application that can be seamlessly linked to display query results from Query Manager software; this software is best used by people lacking ArcView 3.x);
- NOAA's CPRD Tools (a collection of GIS tools created for ArcView 3.x to assist with the development and analysis of spatial data); and,
- The St. Louis River Watershed database.

Each of these applications is accompanied by detailed instructions for installation and use. Users should note the following details regarding NOAA's St. Louis River Watershed database:

- The Watershed database will be updated in late 2004 or early 2005 to incorporate all of the data included in the Phase I MS Access 2000 sediment quality database for the St. Louis River AOC. Inclusion of updated versions of the GIS-based sediment quality database in future updates of NOAA's Watershed database for the St. Louis River will depend on NOAA's financial resources;
- The data sets that are unique to the NOAA St. Louis River Watershed database (i.e., not included in the MS Access 2000 database) have not undergone the same data evaluation procedures as the data sets incorporated in the Phase I MS Access 2000 database; and,

- Users should be aware that there are other minor differences between the NOAA Watershed database and the MS Access 2000 sediment quality database, for example:
  - Any field prefixed by "MESL_" in the MS Access 2000 database is not included in NOAA's database;
  - Field replicate samples are treated differently; and,
  - Mean PEC-Qs are calculated on-the-fly, using different methods than were used to calculate the mean PEC-Qs in the Access 2000 database [Query Manager users may still access the mean PEC-Qs as they were calculated by MESL using USEPA (2000) methods, as these results have been included as a substance in the MESL Query Manager database (under the 'Other' chemical class)]. NOAA is planning to update the procedure for calculating mean PEC-Qs to make the results comparable to those obtained using the USEPA (2000) procedure.

9.3 Access to Database Updates

At the time of publishing this document, Phase III of the GIS-based sediment quality database had been initiated (September 2004) and funding sources were actively being sought from the Wisconsin Coastal Management Program to continue with Phase IV. Notices of project updates will be posted on the MPCA's Contaminated Sediment Web page at: http://www.pca.state.mn.us/water/sediments/data.html and http://www.pca.state.mn.us/water/sediments/studies-stlouis.html#assessment. Notices will also be distributed via e-mail or regular mail to all interested MPCA staff and stakeholders.

Under the "Data and Maps" section of NOAA's Office of Restoration and Response Web page (http://response.restoration.noaa.gov/cpr/watershed/watershedtools.html), the date of the most recent database update is provided (users should reference this Web page periodically for future updates).

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Table 1. Summary of Data Sets Incorporated in the GIS-Based Sediment Quality Database for the St. Louis River Area of Concern during Phase II of the Project.

Reference	Location	Sediment Chemistry	Toxicity Test Data	Benthic Data	Bioaccu-mulation Data	Sampling Year(s)	Total Number of Samples
Altech Environmental Services, Inc. (2002); ASci Corp. (2002)	Federal Navigation Channels	Metals, Hg, PAHs, PCBs, Pesticides, SVOCs, Ammonia, Oil & Grease, Cyanide, TOC	Yes	No	No	2002	8
Baxter (2002); ASci Corp. (2001a,b)	Nemadji Shoals	Metals, Hg, PCBs, Ammonia, Oil & Grease, Cyanide, TOC, Particle size	Yes	No	No	2001	11
BBL (2000a,b)	Koppers Industries, Inc.	PAHs, Pentachlorophenol, TCDDs, TCDFs, TOC, Particle Size, Radioisotopes (^{137}Cs, ^{210}Pb, ^{7}Be)	No	Yes	No	1999	191
Redman and Janisch (1995)	Newton Creek/Hog Island Inlet	Cr, Pb, Hg, PAHs, DROs, Oil & Grease, Ammonia, TOC, Particle Size	Yes	Yes	No	1993, 1994	247
SEH Inc. (2003a)	Hog Island Inlet, Newton Creek Segment L, Loons Foot Landing, and West Bearskin Lake	Metals, Hg, PAHs, VOCs, SVOCs, TOC, DROs, SEM, AVS, Particle Size, Oil & Grease	Yes	Yes	No	2002	23
SEH Inc. (2003b)	Newton Creek Segments B and C	Cd, Cr, Cr^{6+}, Pb, Hg, PAHs, VOCs, AVS, SEM Metals, TOC, Particle Size	No	No	No	2002	15
TMA (1996)	Duluth-Superior Harbor	Metals, Hg, PCBs, Pesticides, Ammonia, Cyanide, TOC, Oil & Grease, Particle Size	Yes	Yes	Yes	1995	8
USACE DACW35-91-D-0001 Delivery order 40	Nemadji Shoals and Lakehead Sites	Metals, Hg, PAHs, PCBs, Pesticides, TCDD, Oil & Grease, VOCs, SVOCs, Ammonia, Cyanide, TOC, Particle Size	No	No	No	1992	8

Table 1. Summary of Data Sets Incorporated in the GIS-Based Sediment Quality Database for the St. Louis River Area of Concern during Phase II of the Project.

Reference	Location	Sediment Chemistry	Toxicity Test Data	Benthic Data	Bioaccu-mulation Data	Sampling Year(s)	Total Number of Samples
USACE DACW35-93-D-0005 Delivery order 16	Duluth-Superior Cross Channel	Metals, Hg, PAHs, PCBs, Pesticides, Ammonia, Cyanide, TOC, Oil & Grease, Particle Size	No	No	No	1993	8
USACE DACW35-93-D-0005 Delivery order 29	Duluth-Superior Harbor	Metals, Hg, PAHs, PCBs, Pesticides, Ammonia, Cyanide, TOC, Oil & Grease, Particle Size	No	No	No	1994, 1995	56
USACE DACW35-93-D-0005 Delivery order 36	Duluth-Superior Harbor (Deep Hole)	Metals, Hg, PAHs, PCBs, Ammonia, Particle Size	No	Yes	No	1994	16
USACE DACW35-95-D-0002 Delivery order 28	Duluth Entrance Channel	Metals, Hg, PAHs, PCBs, Pesticides, Ammonia, Cyanide, TOC, Oil & Grease, Particle Size	No	No	No	1995	5
WDNR (2003a)	Fraser Shipyards	Metals, Hg, PAHs, PCBs, Pesticides, VOCs, SVOCs, Cyanide	No	No	No	2002	16

AVS = acid volatile sulfides; Be = beryllium; Cd = cadmium; Cr = chromium; Cr^{6+} = hexavalent chromium; Cs = cesium; DRO = diesel range organics; Hg = mercury; PAH = polycyclic aromatic hydrocarbons; Pb = lead; PCB = polychlorinated biphenyls; SEM = simultaneously extractable metals; SVOC = semivolatile organic compounds; TCDD = tetrachlorodibenzo-*p* -dioxins; TCDF = tetrachlorodibenzofurans; TOC = total organic carbon; and, VOC = volatile organic compounds.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
lkp - CHEMDICT[1]	**NA**	**NA**	**Chemical dictionary (only included chemicals represented in the ptbl - CHEM table).**
CHEMCODE	Text	10	Chemical code (defined in lkp - chemdict).
CHEMNAME	Text	45	Chemical name.
CHEMCLASS	Text	8	Chemical class.*
CATEGORY	Text	8	Query Manager field (not populated).
SUBCATGY	Text	10	Query Manager field (not populated).
CHEMTOTAL	Text	10	Query Manager field (not populated).
MOLWT	Number	8	Molecular weight of chemical.
CASNUM	Text	24	Chemical abstract services number.
UNITS	Text	6	Units of chemical concentration.
WA_UNITS	Text	6	Query Manager field (not populated).
EDITDATE2	Text	8	Query Manager field (not populated).
EDITBY	Text	15	Query Manager field (not populated).
EDITDATE	Date/Time	8	Query Manager field (not populated).
MESL_synonym	Text	150	Synonym for chemical name.
MESL_syn2	Text	150	Synonym for chemical name.
MESL_syn3	Text	150	Synonym for chemical name.
lkp - QUALIFY	**NA**	**NA**	**Lookup table for sediment chemistry qualifiers (QUALCODE).**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
QUALCODE	Text	5	Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field).
QUALIFIERS	Text	30	Qualifier code for concentration value, as designated in report.
DESCRIPT	Text	80	Description of the meaning of the qualifier, as indicated in the original report or data file.
MESL_LIBNO	Text	50	MESL - library number.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
lkp - SPECIES	**NA**	**NA**	**Lookup table for tissue samples species type (SPP).**
SPP	Text	5	Species code.
COMMONNAME	Text	25	Common name.
SCIENTIFIC	Text	40	Scientific name.
GROUP	Text	25	Query Manager field (not populated).
EDITDATE2	Text	8	Query Manager field (not populated).
EDITBY	Text	15	Query Manager field (not populated).
EDITDATE	Date/Time	8	Query Manager field (not populated).
MESL_COMMENT	Text	50	MESL - comments.
lkp - SQC	**NA**	**NA**	**Sediment Quality Criteria: Level I and Level II SQTs (Crane *et al.* 2000) and SQGs (WDNR 2003b).***
SQCCODE	Text	10	Code for Sediment Quality Criteria (see lkp - Sqcdict for a description of the codes).
CHEMCODE	Text	10	Chemical code (defined in lkp - chemdict).
CONC	Number	8	Chemical concentration.
UNITS	Text	6	Units SQC is reported in.*
NORM	Text	2	Indicates measurement basis SQC are reported in.
MESL_chemical name	Text	50	MESL - chemical name.
MESL_units	Text	50	MESL - units.
MESL_comment	Text	100	MESL - comments.
lkp - Sqcdict	**NA**	**NA**	**Lookup table for Sediment Quality Criteria references (SQCCODE).**
SQCCODE	Text	10	Code for Sediment Quality Criteria.
SQCDESCR	Text	90	Description of the SQCCODE.
YEAR	Text	4	Year of publishing for study reporting the sediment quality criteria.
AUTHORS	Text	160	Authors for study reporting the sediment quality criteria.
TITLE	Text	160	Title of the study reporting the sediment quality criteria.
SOURCE	Text	160	Source (location) for study reporting the sediment quality criteria.
COMMENT	Text	160	Comments.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
lkp - SQCPAIRS	**NA**	**NA**	**Lookup table for identifying Sediment Quality Criteria pairs.**
PAIRNAME	Text	50	High and low Sediment Quality Criteria (how Query Manager will reference the pair).
SQCLOW	Text	10	SQCCODE of low Sediment Quality Criteria.
SQCHIGH	Text	10	SQCCODE of high Sediment Quality Criteria.
LOW NAME	Text	8	Low Sediment Quality Criteria (how Query Manager will reference the SQC).
HIGH NAME	Text	8	High Sediment Quality Criteria (how Query Manager will reference the SQC).
SORT ORDER	Number	2	Query Manager field (did not populate).
lkp - TESTDICT	**NA**	**NA**	**Lookup table for toxicity test dictionary (TESTID).**
TESTID	Text	12	Code describing the bioassay.
MEDIUM	Text	15	Medium used in toxicity test (e.g., bulk sediment or pore water).
MEDCODE	Text	2	Code used to indicate medium used in toxicity test.
GROUP	Text	20	Group of organism used in toxicity test (e.g., bacteria or amphipod).
ALTGROUP	Text	20	Group of organism used in toxicity test - alternate.
SPECIES	Text	40	Species used in toxicity test.
SPPCODE	Text	3	Code used to indicate species used in toxicity test.
LHS	Text	10	Life stage of organism used in toxicity test.
LHSCODE	Text	1	Code used to indicate life stage of organism used in toxicity test.
ENDPOINT	Text	30	Endpoint of toxicity test (e.g., growth or survival).
ENDCODE	Text	2	Code used to indicate endpoint of toxicity test.
DURATION	Text	10	Duration of toxicity test.
DURCODE	Text	4	Code used to indicate duration of toxicity test.
HABITAT	Text	2	Query Manager field (not populated).
EDITDATE	Date/Time	8	Query Manager field (not populated).
EDITDATE2	Text	8	Query Manager field (not populated).
EDITBY	Text	15	Query Manager field (not populated).
lkp - TISSQUAL	**NA**	**NA**	**Lookup table for tissue chemistry qualifiers (QUALCODE).**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
lkp - TISSQUAL (cont.)			
QUALCODE	Text	5	Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field).
QUALIFIERS	Text	30	Qualifier code for concentration value, as designated in report.
DESCRIPT	Text	80	Description of the meaning of the qualifier, as indicated in the original report or data file.
MESL_LIBNO	Text	50	MESL - library number.
lkp - TISSTYPE	**NA**	**NA**	**Lookup table for tissue sample tissue types (TISSCODE).**
TISSCODE	Text	6	Tissue type code.
DESCRIPT	Text	50	Description of tissue type.
EDITDATE	Date/Time	8	Query Manager field (not populated).
EDITDATE2	Text	8	Query Manager field (not populated).
EDITBY	Text	15	Query Manager field (not populated).
ptbl - AVS_SEM	**NA**	**NA**	**Sediment chemistry results for Acid Volatile Sulfides and Simultaneously Extracted Metals (units of µmol/g).**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	6	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
LABREP	Text	2	This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results).
CHEMCODE	Text	10	Chemical code (defined in lkp - CHEMDICT).
QUALCODE	Text	5	Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field).
CONC	Number	8	Chemical concentration (dry weight basis).
UNITS	Text	6	Units of chemical concentration.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - AVS_SEM (cont.)			
MEASBASIS	Text	2	Measurement basis - dry weight (DW).
MISSINGVAL	Yes/No	1	'Yes' indicates a missing value (i.e., not reported, not sampled, lost, etc; -9 entered in CONC field).
MESL_LIBNO	Text	20	MESL - library number.
MESL_STATIONID	Text	50	MESL - station ID (retains the Station ID code as it appears in the original datafiles and/or reports).
MESL_UNITS	Text	7	MESL - units of concentration value.
MESL_QUAL_CALC	Text	10	MESL - qualifier code for concentration value - used for calculation purposes (NUM - value, U - less than detect value; X - do not include in calculations).
MESL_semqual	Text	50	MESL - qualifier code to indicate whether to use SEM metal conc. or total metal conc. (B entered in this field indicates that both are measured, therefore do not use the SEM result).
MESL_C_TXT	Text	50	MESL - concentration value represented in a text field (nondetected results include a "<").
MESL_LABDUP_AVG	Yes/No	1	MESL - indicates if results for laboratory duplicate samples were averaged.*
MESL_C_CALC	Number	8	MESL - concentration value represented in a number field (nondetected results included as 1/2 the detection limit).
MESL_EXCLUDE HIGH ND	Text	50	MESL - X entered in this field indicates a nondetected result with a detection limit greater than the Level II SQT.
MESL_comment	Text	250	MESL - comments.
ptbl - BIOSUMM	**NA**	**NA**	**Sediment toxicity test and bioaccumulation test results.**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	6	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
TESTID	Text	12	Code describing the bioassay (see lkp - TESTDICT table for a description of the codes).
GROUP	Text	2	Query Manager field (did not populate).
SERIES	Text	2	Associates control sample results with test results.
EFFECTVAL	Number	8	Toxicity test result (e.g., percent survival).

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - BIOSUMM (cont.)			
SIGEFFECT	Yes/No	1	Toxic (-1) or Not toxic (0).
NEG	Yes/No	1	Negative control sample? Yes (-1) or No (0).
REF	Yes/No	1	Reference sample? Yes (-1) or No (0).
STAT	Yes/No	1	Identifies sample used to determine significance (T/NT) - ND results (i.e., growth endpoint not measured because of low survival) from SOT database added as NOT TOXIC.
SIG_ORIGIN	Text	50	Original significance designations - from QM database.
CTRLADJ	Number	8	Control adjusted result (test result/control result*100).
TOXCODE	Text	1	Query Manager field (did not populate).
MESL_LIBNO	Text	50	MESL - library number.
MESL_STATIONID	Text	50	MESL - Station ID (retains the Station ID code as it appears in the original datafiles and/or reports).
MESL_TOXIC	Text	2	Toxic (T), Not toxic (NT), or ND (growth endpoint not measured because of low survival).
MESL_comment	Text	250	MESL - comments.
ptbl - CHEM	**NA**	**NA**	**Chemistry results for sediment samples.***
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	6	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
LABREP	Text	2	This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results).
CHEMCODE	Text	10	Chemical code (defined in lkp - CHEMDICT).
QUALCODE	Text	5	Qualifier code for concentration value, modified to be compatible with Query Manager (all ND data has a "U" in this field).
CONC	Number	8	Chemical concentration (dry weight basis)
UNITS	Text	6	Units of chemical concentration.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - CHEM (cont.)			
MEASBASIS	Text	2	Measurement basis - dry weight (DW).
MISSINGVAL	Yes/No	1	'Yes' indicates a missing value (i.e., not reported, not sampled, lost, etc; -9 entered in CONC field).
MESL_LIBNO	Text	20	MESL - library number.
MESL_STATIONID	Text	50	MESL - station ID (retains the Station ID code as it appears in the original datafiles and/or reports).
MESL_UNITS	Text	7	MESL - units of concentration value.
MESL_QUAL_CALC	Text	10	MESL - qualifier code for concentration value - used for calculation purposes (NUM - value, U - less than detect value; X - do not include in calculations).
MESL_semqual	Text	50	MESL - qualifier code to indicate whether to use SEM metal conc. or total metal conc. (B entered in this field indicates that both are measured, therefore do not use the SEM result).
MESL_C_TXT	Text	50	MESL - concentration value represented in a text field (nondetected results include a "<").
MESL_LABDUP_AVG	Yes/No	1	MESL - indicates if results for laboratory duplicate samples were averaged.*
MESL_C_CALC	Number	8	MESL - concentration value represented in a number field (nondetected results included as 1/2 the detection limit).
MESL_EXCLUDE HIGH ND	Text	50	MESL - X entered in this field indicates a nondetected result with a detection limit greater than the Level II SQT.
MESL_comment	Text	250	MESL - comments.
ptbl - CHEMTISS	**NA**	**NA**	**Chemistry results for tissue samples.***
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	10	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
LABREP	Text	2	Not populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results).
CHEMCODE	Text	10	Chemical code (defined in lkp - chemdict)

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - CHEMTISS (cont.)			
CONC	Number	8	Chemical concentration (wet weight basis).
QUALCODE	Text	5	Qualifier code for concentration value, as designated in report (see lkp_TISSQUAL table for a description of the codes).
UNITS	Text	6	Units of chemical concentration.
MEASBASIS	Text	2	Measurement basis - wet weight (WW).
MISSINGVAL	Yes/No	1	'Yes' indicates a missing value (i.e., not reported, not sampled, lost, etc; -9 entered in CONC field).
MESL_LIBNO	Text	20	MESL - library number.
MESL_STATIONID	Text	50	MESL - Station ID (retains the Station ID code as it appears in the original datafiles and/or reports).
MESL_UNITS	Text	7	MESL - units of concentration value.
MESL_QUAL_CALC	Text	10	MESL - qualifier code for concentration value - used for calculation purposes (NUM - value, U - less than detect value; X - do not include in calculations; UX - less than MDL, detection limit not known).
MESL_comment	Text	250	MESL - comments.
MESL_CONC_TXT	Text	50	MESL - concentration value represented in a text field (nondetected results include a "<").*
MESL_LABREP_AVG	Yes/No	1	MESL - indicates if results for laboratory duplicate samples were averaged.*
ptbl - Mean PEC-Q	**NA**	**NA**	**Mean Probable Effect Concentration-Quotients (Mean PEC-Q). NOT A QUERY MANAGER TABLE.**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	6	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
LABREP	Text	2	This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results).

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - Mean PEC-Q (cont.)			
PECQ met	Number	8	PEC quotient for metals.
PECQ pah	Number	8	PEC quotient for PAHs.
PECQ pcb	Number	8	PEC quotient for PCBs.
MeanPECQ	Number	8	Mean PEC quotient (as calculated).
MeanPECQ (3 sf)	Number	8	Mean PEC quotient (3 significant figures).
ptbl - SAMPLE	**NA**	**NA**	**Sediment sample information.***
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	6	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
LABREP	Text	2	This field will not be populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results).
UDEPTH	Number	8	Upper sampling depth (cm).
LDEPTH	Double	8	Lower sampling depth (cm).
SAMPDATE	Text	8	Sample date (YYYYMMDD).
SAMPTIME	Text	5	Sample time.
TOC	Number	8	Total organic carbon (%).
PCTFINES	Number	8	Percent fines (sand + clay), the micron diameter used to define PCTFINES is <53 μm, unless otherwise noted in the MESL_comments field.*
UAN_PW	Number	8	Unionized ammonia in pore water.
H2S_PW	Number	8	Hydrogen sulfide in pore water.
EXSAMPID	Text	15	Original station ID reported in study or data file.
MESL_LIBNO	Text	50	MESL - library number.
MESL_STATIONID	Text	50	MESL - station ID (retains the Station ID code as it appears in the original datafiles and/or reports).
MESL_Mean PEC-Q	Number	8	MESL - Mean PEC-Q (3 significant figures).

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - SAMPLE (cont.)			
MESL_MATCH	Text	50	MESL - indicates if the sample has matching sediment chemistry and toxicity data.
MESL_WATERDEPTH	Text	50	MESL - water depth at the point of sediment sampling (m). NR = not reported.*
MESL_SOFTDEPTH	Text	50	MESL - soft sediment depth (m). NR = not reported.*
MESL_SEDDESC	Text	255	MESL - sediment description (have included the sediment description if this data was available electronically). NA = not available.*
MESL_SURF_SUB	Text	50	MESL - indicates if the sample is designated as surficial or sub-surface, according to NOAA's Query Manager rules. NA indicates that the sampling depth was not specified.*
MESL_comments	Text	255	MESL - comments.
ptbl - SITE	**NA**	**NA**	**Query Manager table.**
SITEID	Text	4	Site ID code (from Query Manager).
SITENAME	Text	40	
EPAREGION	Number	2	
COUNTY	Text	25	
STATE	Text	2	
CERCLIS	Text	12	
REACH	Text	8	
REACHSEG	Text	11	
LATITUDE	Number	8	
LONGITUDE	Number	8	
WATERSHED	Text	20	
ptbl - SMPTISS	**NA**	**NA**	**Tissue sample information.**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	10	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - SMPTISS (cont.)			
SAMPLEID	Text	2	Sample ID code.
FIELDREP	Text	2	Identifies field replicate samples (samples collected in close proximity).
LABREP	Text	2	Not populated (lab dups will be averaged and the MESL_LABREP_AVG field identifies these averaged results).
SAMPDATE	Text	8	Date sample collected (YYYYMMDD).
SAMPTIME	Text	5	Time sample collected.
SPECIES	Text	5	Species from which the tissue sample was collected (see the lkp_SPECIES table for a description of the codes).
SPP	Text	5	Species code (see the lkp_SPECIES table for a description of the codes).
TISSUE	Text	30	Tissue type analyzed (see the lkp_TISSTYPE table for a description of the codes).
TISSCODE	Text	6	Tissue type code (see the lkp_TISSTYPE table for a description of the codes).
LIFESTAGE	Text	1	Lifestage of the organism at the time of sampling (not populated).
NOINCOMP	Number	2	Number of individuals in a composite sample.
LENGTH	Number	8	Length (cm) of individual organisms collected for tissue analysis.
WEIGHT	Number	8	Weight of individual organisms collected for tissue analysis (not populated).
SEX	Text	1	Sex of individual organisms collected for tissue analysis (not populated).
AGE	Number	2	Age of individual organisms collected for tissue analysis (not populated).
PCTLIPID	Number	8	Percent lipids (%).
EXSAMPID	Text	15	Query Manager field (not populated).
MESL_LIBNO	Text	50	MESL - library number.
MESL_STATIONID	Text	50	MESL - Station ID (retains the Station ID code as it appears in the original datafiles and/or reports).
MESL_COMMENT	Text	255	MESL - comments.
ptbl - STATION	**NA**	**NA**	**Station information (sediment and tissue samples).**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STATIONID	Text	6	Station ID code (this is the MESL_STATIONID, unless it exceeded 6 characters, then the QM_STATIONID was substituted).

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - STATION (cont.)			
AREA	Text	50	Waterbody (corresponds with 'DB_AREA' theme in GIS projects).
LOCDESC	Text	50	Reach (corresponds with 'Location Description' theme in GIS projects).
EST_STN	Text	50	Code indicating how the geographic coordinates were obtained (R = reported; P = plotted in GIS based on a map from the report; E = estimated using site descriptions from report; U = unknown).
LATITUDE	Number	8	Geographical coordinates (decimal degrees).
LONGITUDE	Number	8	Geographical coordinates (decimal degrees).
X-coord	Text	50	Geographical coordinates (UTM Zone 15 NAD83 datum).
Y-coord	Text	50	Geographical coordinates (UTM Zone 15 NAD83 datum).
MESL_LIBNO	Text	50	MESL - library number.
MESL_EST_STN	Text	50	MESL - description of how the geographic coordinates were obtained.*
MESL_CORELENGTH	Text	50	MESL - core length (units are in meters). Note that this field has only been populated when the information has been readily available (electronic format).
MESL_Habitat class	Text	50	MESL - relevant to REMAP studies only (STUDYID 04 & 06). Codes: 1 = Shallow area; 2 = Channel; 3 = Reservoir.
MESL_LOCDESC2	Text	50	MESL - additional station location descriptions.
MESL_COMMENTS	Text	150	MESL - comments.
ptbl - STUDY	**NA**	**NA**	**Study names and the types of data associated with each study.**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
STUDYNAME	Text	40	Study name.
CONTACT	Text	40	Contact person/agency.
SEDCHEM	Yes/No	1	Indicates if the study has surficial sediment chemistry data incorporated in the database.
SEDTOX	Yes/No	1	Indicates if the study has sediment toxicity data incorporated in the database.
SUBSURF	Yes/No	1	Indicates if the study has sub-surface sediment chemistry data incorporated in the database.
LABACCUM	Yes/No	1	Indicates if the study has bioaccumulation test data incorporated in the database.

Table 2. Detailed Description of Database Components (asterisks indicate changes from the Phase I database design).

TABLE NAME / Field Name	Data Type	Field Size	TABLE DESCRIPTION / Field Description
ptbl - STUDY (cont.)			
TISSCHEM	Yes/No	1	Indicates if the study has tissue chemistry data incorporated in the database.
Location/Sampling Year	Text	40	Location and sampling year.
MESL_LIBNO	Text	50	MESL - library number.
ptbl - STUDYNOT	**NA**	**NA**	**Study notes.**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
NOTES	Memo	-	Notes.
MESL_LIBNO	Text	50	MESL - library number.
ptbl - STUDYREF	**NA**	**NA**	**Bibliographic references for each study.**
SITEID	Text	4	Site ID code (from Query Manager).
STUDYID	Text	2	Study ID code.
YEAR	Text	4	Publish year for report.
AUTHORS	Text	160	Authors of the report.
TITLE	Text	160	Title of the report.
SOURCE	Text	160	Source (locations).
STUDYCOMM	Text	160	Comments.
MESL_LIBNO	Text	50	MESL - library number.

[1]Note that the following fields have been removed from this version of the database: MESL_casno and MESL_update.

Table 3. Summary of Data Sets Incorporated in the GIS-Based Sediment Quality Database for the St. Louis River Area of Concern during Phase I of the Project.

Reference	Location	Sediment Chemistry	Toxicity Test Data	Benthic Data	Bioaccu-mulation Data	Sampling Years	Total Number of Samples
Ankley *et al.* (1994)	Duluth-Superior Harbor	PAHs, TOC	Yes	No	No	1994	5
AScI Corporation (1999)	Duluth-Superior Harbor	Hg, PAHs, PCBs, TOC (Tissue - Hg, PAHs, PCBs)	Yes	No	Yes	1999	17
Crane (1999)	Slip C, Duluth Harbor	Hg, Pb, PAHs, PCBs, TOC, Particle Size	No	No	No	1997	51
Crane *et al.* (2002b)	Minnesota Slip, Duluth Harbor	Metals, Hg, PAHs, PCBs, AVS, SEM, TOC, Particle Size	Yes	No	No	1999	103
Crane *et al.* (1997)	Duluth-Superior Harbor	SEM Metals, AVS, As, Pb, Hg, TCDDs, TCDFs, PAHs, PCBs, Ammonia, TOC, Particle Size	Yes	Yes	No	1994	224
ENSR (1996)	Upper St. Louis River; Thomson and Forbay Reservoirs	Hg, Methyl Hg	No	No	No	1995	56
IT Corporation (1997)	Interlake/Duluth Tar Superfund Site	SEM Metals, AVS, PAHs, TOC, Metals, Hg, Ammonia, Particle Size	Yes	Yes	No	1996	16
King (2001)	Lower St. Louis River Estuary	Total chlorinated bornanes/bornenes, cis- and trans-chlordane, cis- and trans-nonachlor	No	No	No	1999	44
MPCA (unpublished data); Crane (1997)	USX and Interlake/Duluth Tar Superfund Sites	Metals, Hg, PAHs, Cyanide, TOC, Phenol	Yes	No	No	1993	4
MPCA (1997a); Breneman *et al*. (2000)	St. Louis River AOC	SEM Metals, AVS, Hg, PAHs, TOC, Particle Size	Yes	Yes	No	1995	165

Table 3. Summary of Data Sets Incorporated in the GIS-Based Sediment Quality Database for the St. Louis River Area of Concern during Phase I of the Project.

Reference	Location	Sediment Chemistry	Toxicity Test Data	Benthic Data	Bioaccu-mulation Data	Sampling Years	Total Number of Samples
MPCA (1997b)	St. Louis River AOC	SEM Metals, AVS, Hg, PAHs, TOC, Particle Size	Yes	Yes	No	1996	34
MPCA (unpublished data)	Minnesota Slip, Duluth Harbor	Hg, Pb, PAHs, TOC	No	No	No	1998	9
MPCA (unpublished data)	Dakota Pier Boat Slip, Duluth Harbor	Metals, Hg, PAHs, Ammonia, Cyanide, Sulfate, TOC	No	No	No	1999	8
MPCA (unpublished data)	Vicinity of WLSSD and Forbay Reservoir	Toxaphene	No	No	No	1996	10
Oliaei *et al* . (2002)	Vicinity of WLSSD	PBDEs, TOC	No	No	No	2001	1
Schubauer-Berigan and Crane (1996)	Thomson, Forbay, Fond du Lac Reservoirs	Hg, PCBs, TCDD	Yes	No	Yes (fish tissue)	1992, 1993	217
Schubauer-Berigan and Crane (1997)	Duluth-Superior Harbor	Metals, Hg, PAHs, PCBs, TCDDs, TCDFs, Pesticides, Ammonia, TOC	Yes	No	No	1993	210
Smith *et al.* (1992)	Allouez Bay, WLSSD, others	Metals, total PCB, total PAH, Particle size	Yes	No	Yes (fish tissue)	1992	5
URS Corporation (2002)	USS Superfund Site	Metals, Cyanide, Percent solids	No	No	No	2002	20
Wenck Associates (1995)	Lakehead Pipe Line (North of Hog Island Inlet)	Metals, Hg, DROs, PAHs, Oil & Grease, Ammonia, TOC, Percent Solids	Yes	No	No	1995	2

As = Arsenic; AVS = acid volatile sulfides; DRO = diesel range organics; Hg = mercury; PAH = polycyclic aromatic hydrocarbons; Pb = lead; PBDE = polybrominated diphenyl ethers; PCB = polychlorinated biphenyls; SEM = simultaneously extractable metals; TCDD = tetrachlorodibenzo-*p* -dioxins; TCDF = tetrachlorodibenzofurans; and, TOC = total organic carbon.

Figure 1. Diagram showing the relationships between database components.

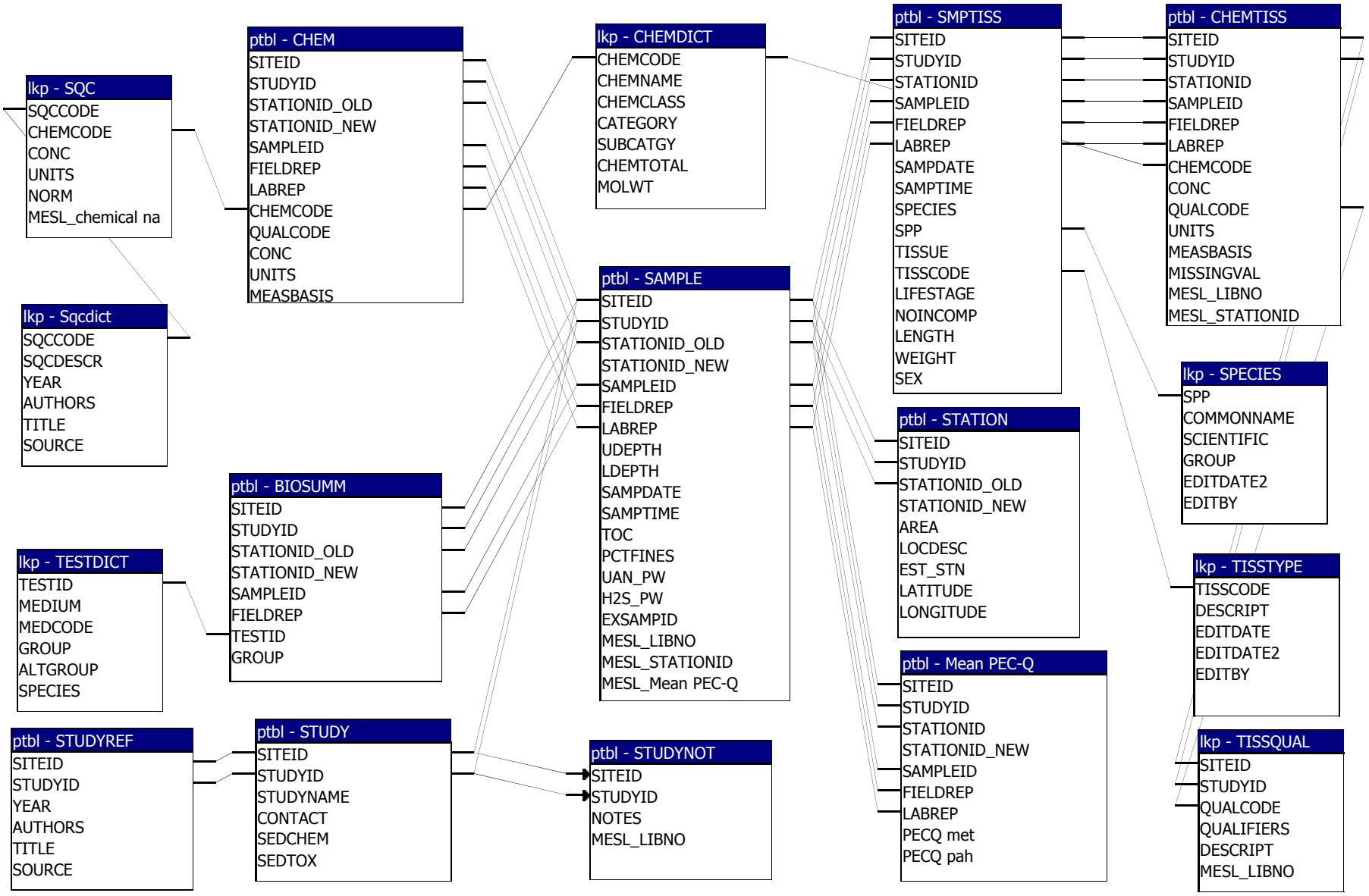

Table A1-1. Summary of Data Sets Compiled during Phase II of the Project.

Project	Table that Includes Summary Information	Data Category	Theme Name	Data Description
Ecological Areas	Table A1-3	Managed Areas	Douglas County Endangered Resources (by Township)	Presence of one or more occurrences of rare or natural communities that have been reported only at the township level (of the Public Land Survey referencing system; a township is comprised of 36 Sections).
Ecological Areas	Table A1-3	Managed Areas	Douglas County Endangered Resources (by Section)	Presence of one or more occurrences of rare or natural communities that have been reported at the section level (of the Public Land Survey referencing system; a section equals one square mile).
Geographic Features	Table A1-4	Geography	Geographical Names (WI)	Names of all places, features, and areas which appear on the USGS 7.5-minute quadrangle map series (from the National Geographic Names Data Base).
Hydrology	Table A1-5	Lakes	USGS DLG Lakes and Wetlands (Carlton County)	1:100,000 scale hydrography (lakes only) derived from USGS Digital Line Graph's (DLG's) of the same scale.
Hydrology	Table A1-5	Streams/Rivers	USGS DLG MN Streams (Carlton County)	1:100,000 scale hydrography (rivers and streams only) derived from USGS Digital Line Graph's (DLG's) of the same scale.
Land Use	Table A1-6	Land Cover/Use	Future Land Use	Future land use by the City of Superior. They will use this map to rework their zoning and land use codes.
Land Use	Table A1-6	Land Cover/Use	Harbor Shoreline - 1861	Representation of Superior Port harbor shoreline in 1861.

Table A1-1. Summary of Data Sets Compiled during Phase II of the Project.

Project	Table that Includes Summary Information	Data Category	Theme Name	Data Description
Land Use	Table A1-6	Land Cover/Use	Harbor - 1861	Representation of Superior Port harbor in 1861.
Land Use	Table A1-6	Roads/Rails	DOT Roads (Carlton County)	This data set contains roadway centerlines for roads found on the USGS 1:24,000 mapping series. Those roadways that are Interstate, Trunk Highway, or CSAH (county state/aid Highway) are current through the 2000 construction season.
Recreation	Table A1-7	Recreation	Bike Routes (Duluth and Superior)	Identifies off-road trails and on-street signed bike routes in Duluth and Hermantown and other recommended unsigned on-street routes throughout the Twin Ports area.

MN = Minnesota; WI = Wisconsin

Table A1-2. Summary of Data Sets Compiled for the Contaminated Areas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Contaminated Areas	Contaminated Sediment Hot Spots	Location of hot spot sites (i.e., areas of high sediment contaminant concentrations).	MPCA (Crane *et al.* 1997)	Crane *et al.* 1997	Shapefile created by MESL	hotspots.shp	Contaminated_Areas\Hotspots	NA	YES
	Superfund Sites	Location of CERCLA Superfund Sites.	MPCA	IT Corp. 1997; URS Corp. 2002	Shapefile created by MESL	superfund.shp	Contaminated_Areas\ Superfund_Sites	NA	YES
Facilities/ Point Sources	Location of Feedlots (MN)	Location of feedlots.	--	MPCA	GIS data sent by MPCA (Tad Schindler)	feedlots.shp	Contamination_Points\ Feedlots	Users have no basis for interpreting attribute data (GIS data provides location data only).	NO
	Hazardous Waste Generators (MN)	In Minnesota, commercial entities that produce any amount of hazardous waste are regulated as hazardous-waste "generators" with requirements that depend upon the amount of waste they produce.	MPCA	MPCA	GIS data sent by MPCA (Tad Schindler)	hwgen.shp	Contamination_Points\ Hazardous_Waste_Generators	Users have no basis for interpreting attribute data (e.g., Type, Size and LCM fields). Refer to www.pca.state.mn.us/programs/bau_p.html for more information about the program.[1]	NO
	Industrial Facilities	Industrial Facilities Discharge Sites - these sites are industrial or municipal point sources discharging to surface waters.	USEPA/Office of Water/OST	USEPA 2003	BASINS website	ifdgood.shp	Contamination_Points\ Industrial_Facilities	Users will need to refer to the metadata file to interpret the field names in the attribute table.	YES

Table A1-2. Summary of Data Sets Compiled for the Contaminated Areas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Facilities/ Point Sources (cont.)	Landfills (MN)	Location, type, and status of landfill sites.	--	MPCA	GIS data sent by MPCA (Tad Schindler)	landfills.shp	Contamination_Points\ Landfills	Users have no basis for interpreting attribute data in the 'Rank' field.	NO
	Leaking Underground Storage Tanks (MN)	Location and status of LUSTs.	--	MPCA	GIS data sent by MPCA (Tad Schindler)	lust.shp	Contamination_Points\ Leaking_Underground_Storage_Sites	Users have no basis for interpreting attribute data in the 'LCM' field.	NO
	Oil Storage Facilities (# of oil tanks)	Location, contact information and product type/volume of oil storage facilities.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	fixed oil storage facilities_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES
	Permit Compliance System	USEPA-regulated facilities listed in the USEPA Envirofacts Permit Compliance System (PCS) database.	USEPA	USEPA 2003	BASINS website	permitcomp_final_utm.shp	Contamination_Points\ Permit_Compliance_System	Users have no basis for interpreting attribute data in several fields because metadata does not provide code descriptions (GIS data provides location and facility names only; Envirofacts database can be referenced for code descriptions).	YES
	Pipelines	Locations and routes of pipelines carrying crude oil or refined oil products.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	pipelines_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES

Table A1-2. Summary of Data Sets Compiled for the Contaminated Areas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Facilities/ Point Sources (cont.)	Resource Conservation and Recovery Information	USEPA-regulated facilities listed in the USEPA Envirofacts Resource Conservation and Recovery Information System (RCRIS; a system in which information is provided by generators, transporters, treaters, storers, and disposers of hazardous waste to state environmental agencies).	USEPA	USEPA 2003	BASINS website	rcris_final_utm .shp	Contamination_Points\ Resource_Conservation_and_ Recovery_Information	Users have no basis for interpreting attribute data in several fields because metadata does not provide code descriptions (GIS data provides location and facility names only; Envirofacts database can be referenced for code descriptions).	YES
	Toxic Release Inventory Sites	USEPA-regulated facilities listed in theToxic Release Inventory System (TRIS).	USEPA	USEPA 2003	BASINS website	tri_final_utm.s hp	Contamination_Points\ Toxic_Release_Inventory_Site	Users have no basis for interpreting attribute data in several fields because metadata does not provide code descriptions (GIS data provides location and facility names only; Envirofacts database can be referenced for code descriptions).	YES
	Salvage Yards (MN)	Location, licensing information, facility descriptions and inspection information for salvage yards.	--	MPCA	GIS data sent by MPCA (Tad Schindler)	salvage.shp	Contamination_Points\ Salvage_Yards	Users have no basis for interpreting attribute data in several of the fields (i.e., ps_lic, dism_cov).	NO

Table A1-2. Summary of Data Sets Compiled for the Contaminated Areas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Discharges/ Emissions	Air Emissions (MN)	Location and names of facilities with air emissions, and contaminant concentrations in air emissions.	MPCA (data obtained from Chun Yi Wu)	MPCA 1999	Shapefile created by MESL	airemissions.shp	Contamination_Points\ Air_Emissions	Users to note that the units of contaminant concentrations in air emissions are lbs.	YES

BASINS = Better Assessment Science Integrating Point and Nonpoint Sources; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; GIS = Geographic Information System; LUST = Leaking Underground Storage Tanks; MESL = MacDonald Environmental Sciences Ltd.; MN = Minnesota; MPCA = Minnesota Pollution Control Agency; NA = Not Applicable; OST = Office of Science and Technology; PCS = Permit Compliance System; RCRIS = Resource Conservation and Recovery Information System; TRIS = Toxic Release Inventory System; USEPA = United States Environmental Protection Agency.

[1]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-3. Summary of Data Sets Compiled for the Ecological Areas GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Ecological Sites	Environmentally Sensitive Areas[1]	Special places meritting spill protection (areas not publically managed, with no special designation).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	envirosensres_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Habitat Sites	Location of sites of important habitat in the Lake Superior Basin, mapped as part of the Lake Superior Binational Program.	MN DNR	UMN and NRRI 2003	Lake Superior Decision Support Project website	habitatsites_utm.shp	Ecological_Areas_and_Classification\ Habitat_Sites	Users will need to refer to the metadata file to interpret the field names in the attribute table. Link to file referred to in the metadata file doesn't work.	YES
Lower St. Louis River Habitat Plan	Lower St. Louis River Habitat Plan Aquatic Habitat	Aquatic habitat types within the Lower St. Louis River, from the Fond du Lac Dam to the Duluth and Superior entries to Lake Superior (established by the MN DNR and the WI DNR).	Community GIS Services, Inc.	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	aquatic_habitat.shp	Lower_STLR_Habitat_Plan\ Aquatic_Habitats	NA	YES
	Lower St. Louis River Habitat Plan Plant Communities	Plant community types within a quarter mile buffer of the Lower St. Louis River, from the Fond du Lac Dam to the Duluth and Superior entries to Lake Superior (established by the MN DNR, the WI DNR, and CGIS).	Community GIS Services, Inc.	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	plant_communities.shp	Lower_STLR_Habitat_Plan\ Plant_Communities	NA	YES

Table A1-3. Summary of Data Sets Compiled for the Ecological Areas GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Lower St. Louis River Habitat Plan (cont.)	Lower St. Louis River Habitat Plan Project Area	Project area of St. Louis River.	--	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	project_area.shp	Lower_STLR_Habitat_Plan\Project_Area	NA	NO
Managed Areas	Managed Areas[1]	Boundaries of federal, state, regional and private lands with special ecological, natural, or recreational value, that are uniquely vulnerable to oil spills (mapped for the Western Lake Superior Inland Sensitivity Atlas).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	managed resource areas_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	MN DNR Scientific and Nat. Areas	Location of Scientific and Natural Areas (SNAs) delineated under the SNA Program (MN DNR).	MN DNR - Scientific and Natural Areas Program	MDNR 2003a	Minnesota DNR GIS Data Deli website	snaxxpymn.shp	Ecological_Areas_and_Classification\MN_DNR_Scientific_and_Natural_Areas	NA	YES
	Douglas County Endangered Resources (by Township)*	Presence of one or more occurrences of rare or natural communities that have been reported only at the township level (of the Public Land Survey referencing system; a township is comprised of 36 Sections).	WI DNR - Bureau of Endangered Resources (Natural Heritage Inventory)	WDNR 2004	WDNR Natural Heritage Inventory County Maps website	douglas_co_twp_utm.shp	Ecological_Areas_and_Classification\WI_DNR_NHI	Users note that PDF versions of maps can be accessed at http://dnr.wi.gov/org/land/er/workinglists/mapsbycounty.htm[2]	YES

Table A1-3. Summary of Data Sets Compiled for the Ecological Areas GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Managed Areas (cont.)	Douglas County Endangered Resources (by Section)*	Presence of one or more occurrences of rare or natural communities that have been reported at the section level (of the Public Land Survey referencing system; a section equals one square mile).	WI DNR - Bureau of Endangered Resources (Natural Heritage Inventory)	WDNR 2004	WDNR Natural Heritage Inventory County Maps website	douglas_co_section_utm.shp	Ecological_Areas_and_Classification\WI_DNR_NHI	Users note that PDF versions of maps can be accessed at http://dnr.wi.gov/org/land/er/workinglists/mapsbycounty.htm[2]	YES
Vegetation	PLS Presettlement Vegetation (MN)	General location of bearing trees used in conjunction with the original Public Land Survey (PLS; 1908) and information on vegetation type information.	MN DNR - Section of Wildlife - Minnesota County Biological Survey	MDNR 2003a	Minnesota DNR GIS Data Deli website	pls_veg.shp	Ecological_Areas_and_Classification\PLS Corners with Presettlement Vegetation Info	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[2]	YES
Mussel Distribution	USGS Zebra Mussel Distribution (1989-1998)	Compilation of reports of confirmed zebra mussel sightings in the United States from 1988 to the present (from a variety of federal, State, and municipal agencies, public utilities, universities, engineering and private consultant firms).	USGS, Florida Caribbean Science Center	USGS 2003a	The National Atlas of the USA website	zebra_mussels.shp	Ecological_Areas_and_Classification\Zebra_Mussel_Distribution	NA	YES

Table A1-3. Summary of Data Sets Compiled for the Ecological Areas GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Mussel Distribution (cont.)	MN DNR Mussel Sites 1991, 2000, 2002	Location of state- and/or federally-listed mussels.	MN DNR - Natural Heritage Program	MPCA	GIS data sent by MPCA (Judy Crane via Sarah Hoffman)	stl_musselsites_1991.shp; stl_musselsites_2000.shp; stl_musselsites_2002.shp	Ecological_Areas_and_Classification\Mussels	It is unclear what these data represent, based on the current information and metadata available. Refer to http://www.dnr.state.mn.us/ecological_services/nhnrp/mussel_survey/index.html for more information about the data.[2]	YES

ATV = All Terrain Vehicle; CAC = Citizens Action Committee; CD = Compact Disc; CGIS = Community GIS Services, Inc.; DNR = Department of Natural Resources; GIS = Geographic Information System; MN = Minnesota; MPCA = Minnesota Pollution Control Agency; NA = Not Applicable; NRRI = Natural Resources Research Institute; PLS = Public Land Survey; SNAs = Scientific and Natural Areas; UMN = University of Minnesota; USA = United States of America; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey; WI = Wisconsin; WWW = World Wide Web.

[1]These shapefiles only contain natural heritage data from Minnesota DNR. Wisconsin DNR natural heritage information was not included at the request of the Wisconsin DNR.

[2]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-4. Summary of Data Sets Compiled for the Geographic Features GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Geography	Geographical Names (MN)	Names of all places, features, and areas which appear on the USGS 7.5-minute quadrangle map series (from the National Geographic Names Data Base).	USGS	MDNR 2003a	Minnesota DNR GIS Data Deli website	geonames.shp	Geographic Features\Geography	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	Geographical Names (WI)*	Names of all places, features, and areas which appear on the USGS 7.5-minute quadrangle map series (from the National Geographic Names Data Base).	USGS Geographic Names Information System (GNIS)	USGS 2004	USGS GNIS website	geographic_names_wi_utm.shp	Geographic Features\Geography	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
Landforms	Landforms (MN)	Geomorphology data describing a wide variety of conditions related to surficial geology.	University of Minnesota-Duluth Geology Department; MN Geological Survey, MN DNR	MDNR 2003a	Minnesota DNR GIS Data Deli website	landforms.shp	Geographic Features\Landforms	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
Soils	Soils	State Soil Geographic (STATSGO) database: digital general soil association map developed by the National Cooperative Soil Survey.	USEPA	USEPA 2003	BASINS website	statsgo_utm.shp	Geographic Features\Soils	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

BASINS = Better Assessment Science Integrating Point and Nonpoint Sources; DNR = Department of Natural Resources; GIS = Geographic Information System; HTML = HyperText Markup Language; MN = Minnesota; NA = Not Applicable; STATSGO = State Soil Geographic Database; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey.

[1]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-5. Summary of Data Sets Compiled for the Hydrology GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Hydrologic Units	USGS Hydrologic Management Units	Hydrologic Units (USGS Office of Water Data Coordination), which includes the list descriptions and name of region, subregion, accounting units, and cataloging unit.	Steeves, Peter and Douglas Nebert	USGS 2003b	Water Resources of the United States website	huc04_250K_utm.shp	Hydrology\Hydrologic_Units	NA	YES
Lakes	MN DNR Lakes	MN DNR 24,000K Lakes (medium scale lake polygons derived from the National Wetlands Inventory (NWI) polygons and MNDOT Basemap lake delineations, integrated with the DNR 24K Streams Layer).	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	dnrlkpymaj03.shp	Hydrology\Lakes\DNR_24K_Lakes	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	USGS DLG Lakes and Wetlands (MN)	1:100,000 scale hydrography (lakes only) derived from USGS Digital Line Graph's (DLG's) of the same scale.	USGS	MDNR 2003a	Minnesota DNR GIS Data Deli website	dlglkpystlo.shp	Hydrology\Lakes\DLG_Lakes_and_Wetlands_Polygons	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	USGS DLG Lakes and Wetlands (Carlton County)*	1:100,000 scale hydrography (lakes only) derived from USGS Digital Line Graph's (DLG's) of the same scale.	USGS	MDNR 2003a	Minnesota DNR GIS Data Deli website	dlglkpycarl.shp	Hydrology\Lakes\DLG_Lakes_and_Wetlands_Polygons\dlglkpycarl	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

Table A1-5. Summary of Data Sets Compiled for the Hydrology GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Streams/Rivers	Duluth Trout Streams	Designated trout streams of Duluth (as reported by Duluthstreams.org).	MESL	DuluthStreams 2003	Shapefile created by MESL	dulutroutstreams.shp	Hydrology\Streams_Rivers\Duluth Trout Streams	NA	YES
	Land Areas of the St. Louis River	Location of islands, points, etc. (to support the navigation of vessels).	NOAA, National Ocean Service, Office of Coast Survey	NOAA 2003a	Electronic Navigational Charts Download website	land_region_polygon_utm.shp	Hydrology\Streams_Rivers\Land Areas…	Users have no basis for interpreting attribute data because metadata does not define the information contained in the attribute fields (GIS data provides location data only). Metadata for this data is unreliable (see readme file).	YES
	USGS DLG MN Streams (extra coverage)	1:100,000 scale hydrography (rivers and streams only) derived from USGS DLG's of the same scale.	USGS	MDNR 2003a	Minnesota DNR GIS Data Deli website	dlgstlnstlo.shp	Hydrology\Streams_Rivers\DLG_Streams_MN	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	USGS DLG MN Streams (Carlton County)*	1:100,000 scale hydrography (rivers and streams only) derived from USGS Digital Line Graph's (DLG's) of the same scale.	USGS	MDNR 2003a	Minnesota DNR GIS Data Deli website	dlgstlncarl.shp	Hydrology\Streams_Rivers\DLG_Streams_MN	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	MN and WI Streams	Location of small to medium size streams (ESRI shapefile).	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	streams_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES

Table A1-5. Summary of Data Sets Compiled for the Hydrology GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Streams/Rivers (cont.)	Trout Streams and Resource Waters	Special designated resource areas that are uniquely vulnerable to oil spills (mapped for the Western Lake Superior Inland Sensitivity Atlas).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	special designated resource areas_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES
	Water Bodies of the St. Louis River	Location of bays, lakes, etc. (to support the navigation of vessels).	NOAA, National Ocean Service, Office of Coast Survey	NOAA 2003a	Electronic Navigational Charts Download website	water_area_utm.shp	Hydrology\Streams_Rivers\Water_Areas_St. Louis River	Users have no basis for interpreting attribute data because metadata does not define the information contained in the attribute fields (GIS data provides location data only). Metadata for this data is unreliable (see readme file).	YES
Watersheds	WI Watersheds	Watersheds of WI.	--	WDNR 2003	WI DNR FTP site	wiwatsheds.shp	Hydrology\Watersheds\Watersheds_WI	NA	YES
	MN Watersheds	Statewide minor watershed delineations with major/minor watershed identifiers and names for provinces, major watersheds, and basins.	MN DNR - Division of Waters	MDNR 2003a	Minnesota DNR GIS Data Deli website	mnwatersheds.shp	Hydrology\Watersheds\Watersheds_MN	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	FEMA Floodways (MN)	Federal Emergency Management Agency (FEMA) floodways [Q3 Flood Data derived from the Flood Insurance Rate Maps (FIRMs)].	Federal Emergency Management Agency (FEMA)	MDNR 2003a	Minnesota DNR GIS Data Deli website	femafloodways.shp	Hydrology\Watersheds\FEMA_Floodways	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

Table A1-5. Summary of Data Sets Compiled for the Hydrology GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Water Boundaries (St. Louis River)	St. Louis River Depths	Water depths (to support the navigation of vessels).	NOAA, National Ocean Service, Office of Coast Survey	NOAA 2003a	Electronic Navigational Charts Download website	depth_area_polygon_utm.shp	Hydrology\St._Louis_River_Boundaries\Depths_Polygon	Users have no basis for interpreting attribute data in some of the fields (e.g., prim, grup, river, ruin) because metadata does not define the information contained in the attribute fields. There is no information available concerning how depth data was obtained and what datum it is relative to. Data presentation assumes that "Drval1" represents water depth and is more relevant than "Drval2". Metadata for this data is unreliable (see readme file).	YES
	St. Louis River Outline	Boundary of St. Louis River (line).	--	MPCA	GIS data sent by MPCA (Judy Crane)	stlouidl_utm.shp	Hydrology\St._Louis_River_Boundaries\River_Outline	NA	NO
Wetlands (Water Features)	National Wetlands Inventory - Lines	Linear wetland features (including selected streams, ditches, and narrow wetland bodies) mapped as part of the National Wetlands Inventory (NWI).	MN - Division of Waters	MDNR 2003a	Minnesota DNR GIS Data Deli website	nwilines.shp	Hydrology\National_Wetlands_Inventory_Lines	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

Table A1-5. Summary of Data Sets Compiled for the Hydrology GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Wetlands (Water Features; cont.)	National Wetlands Inventory - Points	Wetland point features (typically wetlands that are too small to be as area features at the data scale) mapped as part of the National Wetlands Inventory (NWI).	MN - Division of Waters	MDNR 2003a	Minnesota DNR GIS Data Deli website	nwipoints.shp	Hydrology\National_Wetlands_Inventory_Points	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	National Wetlands Inventory - Polygons	Wetland area features mapped as part of the National Wetlands Inventory (NWI).	MN - Division of Waters	MDNR 2003a	Minnesota DNR GIS Data Deli website	nwipolys.shp	Hydrology\National_Wetlands_Inventory_Polygons	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

DLG = Digital Line Graph; DNR = Department of Natural Resources; ESRI = Environmental Systems Research Institute; FEMA = Federal Emergency Management Agency; FIRMs = Flood Insurance Rate Maps; ftp = File Transfer Protocol; GIS = Geographic Information System; HTML = HyperText Markup Language; MESL = MacDonald Environmental Sciences Ltd.; MIS = Management Information Services; MN = Minnesota; MNDOT = Minnesota Department of Transportation; MPCA = Minnesota Pollution Control Agency; NA = Not Applicable; NOAA = National Oceanic and Atmospheric Administration; NWI = National Wetlands Inventory; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey; WI = Wisconsin; WWW = World Wide Web.

[1]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-6. Summary of Data Sets Compiled for the Land Use GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Harbor Facilities	Harbor Facilities	Industrial harbor facilities (to support the navigation of vessels).	NOAA, National Ocean Service, Office of Coast Survey	NOAA 2003a	Electronic Navigational Charts Download website	harbor_facilities_points_utm.shp	Land_Use_Information\Harbor_Facilities	Users have no basis for interpreting attribute data in several fields because metadata does not define the information contained in the attribute fields (GIS data provides location and facility names only). Metadata for this data is unreliable (see readme file).	YES
Land Cover/Use	General Land Use/Cover	Land Cover/Use (Duluth Area).	USEPA/Office of Water/OST	USEPA 2003	BASINS website	l_dulumn_utm.shp	Land_Use_Information\Lands_Cover_and_Use\Land Cover_Use (Duluth Area)	NA	YES
	Land Ownership	Public/private ownership as designated by NRRI (includes a breakdown of public ownership by agency, and also includes private industrial forest holdings).	Natural Resources Research Institute	UMN and NRRI 2003	Lake Superior Decision Support Project website	landown_utm.shp	Land_Use_Information\Lands_Cover_and_Use\Public_Private_Ownerships	NA	YES
	Land Use 1800s	Industrial land use along the lower St. Louis River for the pre-industrial time period.	Community GIS Services, Inc.	Kellner *et al.* 1999	St. Louis River Historic Reconstruction Project	grid1800s.shp	Land_Use_Information\Lands_Cover_and_Use\Property_Ownership_and_Land_Use\Grid 1800s	Datum is NAD27 so is not aligned with the basemap.	YES

Table A1-6. Summary of Data Sets Compiled for the Land Use GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Land Cover/Use (cont.)	Land Use 1950s	Industrial land use along the lower St. Louis River for the industrial time period.	Community GIS Services, Inc.	Kellner *et al.* 1999	St. Louis River Historic Reconstruction Project	grid1950s.shp	Land_Use_Information\Lands_Cover_and_Use\Property_Ownership_and_Land_Use\Grid 1950s	Datum is NAD27 so is not aligned with the basemap.	YES
	Land Use 1980s	Industrial land use along the lower St. Louis River for the post-industrial time period.	Community GIS Services, Inc.	Kellner *et al.* 1999	St. Louis River Historic Reconstruction Project	grid1980s.shp	Land_Use_Information\Lands_Cover_and_Use\Property_Ownership_and_Land_Use\Grid 1980s	Datum is NAD27 so is not aligned with the basemap.	YES
	Mines	Known mining operations, mineral deposits/occurrences and processing plants [derived from the Mineral Availability System (MAS)/Mineral Industry Location System (MILS)].	USEPA/Office of Water/OST	USEPA 2003	BASINS website	mines_utm.shp	Land_Use_Information\Lands_Cover_and_Use\Minerals_Mines	NA	YES
	Future Land Use*	Future land use by the City of Superior. They will use this map to rework their zoning and land use codes.	Arrowhead Regional Development Commission (ARDC)	Duluth-Superior Metropolitan Interstate Committee 2003a	GIS data sent by ARDC (Andrew Hayden)	future_land_use_403.shp	Land_Use_Information\Lands_Cover_and_Use\Future_Land_Use	The Superior Port Land Use Plan (June 2003) is available to download at http://www.ardc.org/library/plans/mic/supportland03.pdf[1]	YES

Table A1-6. Summary of Data Sets Compiled for the Land Use GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Land Cover/Use (cont.)	Harbor Shoreline - 1861*	Representation of Superior Port harbor shoreline in 1861.	Arrowhead Regional Development Commission (ARDC)	Duluth-Superior Metropolitan Interstate Committee 2003a	GIS data sent by ARDC (Andrew Hayden)	harbor1861.shp	Land_Use_Information\Lands_Cover_and_Use\1861_Harbor	The Superior Port Land Use Plan (June 2003) is available to download at http://www.ardc.org/library/plans/mic/supportland03.pdf[1]	YES
	Harbor - 1861*	Representation of Superior Port harbor in 1861.	Arrowhead Regional Development Commission (ARDC)	Duluth-Superior Metropolitan Interstate Committee 2003a	GIS data sent by ARDC (Andrew Hayden)	1861_poly2.shp	Land_Use_Information\Lands_Cover_and_Use\1861_Harbor	The Superior Port Land Use Plan (June 2003) is available to download at http://www.ardc.org/library/plans/mic/supportland03.pdf[1]	YES
NOAA C-CAP Data	C-CAP Land Cover 1995	Dataset consists of a 1995-era Landsat 7 Thematic Mapper scene which was analyzed according to the Coastal Change Analysis Program (C-CAP) protocol to determine land cover.	NOAA Coastal Services Center/Coastal Change Analysis Program (C-CAP)	NOAA 2003b	CD - NOAA C-CAP Data, MN DNR GAP Veg Data	ccaplu95.img	Land_Use_Information\ccap_nad83	Users should note that files with ".metadata" extensions can be viewed using Wordpad.	YES
	C-CAP Land Cover 2000	Dataset consists of a 2000-era Landsat 7 Thematic Mapper scene which was analyzed according to the Coastal Change Analysis Program (C-CAP) protocol to determine land cover.	NOAA Coastal Services Center/Coastal Change Analysis Program (C-CAP)	NOAA 2003b	CD - NOAA C-CAP Data, MN DNR GAP Veg Data	ccaplu00.img	Land_Use_Information\ccap_nad83	Metadata not available for this dataset, but it is reasonable to assume that the metadata file provided for the 1995 data set generally applies to the 2000 data set.	NO

Table A1-6. Summary of Data Sets Compiled for the Land Use GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
NOAA C-CAP Data (cont.)	C-CAP Land Cover Change 1995-2000	This data is a change analysis of 1995 C-CAP land cover and 2000 C-CAP land cover for the Great Lakes Region of the U.S.	NOAA Coastal Services Center/Coastal Change Analysis Program (C-CAP)	NOAA 2003b	CD - NOAA C-CAP Data, MN DNR GAP Veg Data	ccaplu95-00.img	Land_Use_Information\ccap_nad83	Users should note that files with ".metadata" extensions can be viewed using Wordpad.	YES
Tribal Interests	Tribal Lands and Inter	Native Reservations MN.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	tribal interests_t	USEPA_Inland_Sensitivity_Atlas	NA	
Roads/Rails	State Forest Roads (MN)	Roads administered by the Commissioner of Natural Resources to provide access to lands administered by the Division of Forestry.	MN DNR - Division of Forestry	MDNR 2003a	Minnesota DNR GIS Data Deli	stfrdlnmn.shp	Land_Use_Information\Roads\State_Forest_Roads	NA	YES
	Interstate Trunk Highways (MN)	Includes Interstate, US trunk highway, and Minnesota trunk highway system highway centerlines.	MN Department of Transportation, Survey and Mapping	MDNR 2003a	Minnesota DNR GIS Data Deli	interstatetrunkhwy.shp	Land_Use_Information\Roads\Interstate_Trunk_Highways	NA	YES
	County State Aid Roads (MN)	County state-aid highway (CSAH) is a category of highways based on funding designation.	MN Department of Transportation, Survey and Mapping	MDNR 2003a	Minnesota DNR GIS Data Deli	county_state_aid.shp	Land_Use_Information\Roads\County_State_Aid_Highways	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

Table A1-6. Summary of Data Sets Compiled for the Land Use GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Roads/Rails (cont.)	DOT Roads (St. Louis County)	This data set contains roadway centerlines for roads found on the USGS 1:24,000 mapping series. Those roadways that are Interstate, Trunk Highway, or CSAH (county state/aid Highway) are current through the 2000 construction season.	MN Department of Transportation, Survey and Mapping	MDNR 2003a	Minnesota DNR GIS Data Deli	dotroads.shp	Land_Use_Information\Roads\ DOT_Roads	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	DOT Roads (Carlton County)*	This data set contains roadway centerlines for roads found on the USGS 1:24,000 mapping series. Those roadways that are Interstate, Trunk Highway, or CSAH (county state/aid Highway) are current through the 2000 construction season.	MN Department of Transportation, Survey and Mapping	MDNR 2003a	Minnesota DNR GIS Data Deli	dotrdlncarl.shp	Land_Use_Information\Roads\ DOT_Roads	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES

BASINS = Better Assessment Science Integrating Point and Nonpoint Sources; C-CAP = Coastal Change Analysis Program; CD = Compact Disc; CSAH = County State-Aid Highway; DLG = Digital Line Graph; DNR = Department of Natural Resources; DOT = Department of Transportation; GAP = Gap Analysis Project; GIS = Geographic Information System; HTML = HyperText Markup Language; MAS = Mineral Availability System; MESL = MacDonald Environmental Sciences Ltd.; MILS = Mineral Industry Location System; MIS = Management Information Services; MN = Minnesota; NA = Not Applicable; NAD27 = North American Datum of 1927; NOAA = National Oceanic and Atmospheric Administration; NRRI = Natural Resources Research Institute; NWI = National Wetlands Inventory; OST = Office of Science and Technology; UMN = University of Minnesota; US = United States; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey; Veg = Vegetation; WI = Wisconsin.

[1]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-7. Summary of Data Sets Compiled for the Recreation GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Recreation	MN DNR ATV Trails	DNR managed ATV trails.	MN DNR	MDNR 2003b	MN DNR FTP site	trl_giaatvln3.shp	Recreation\DNR_ATV_trails	Users have no basis for interpreting attribute data because metadata does not define the information contained in the attribute fields (GIS data provides location data only).	YES
	MN DNR Snowmobile Trails	Location of snowmobile trails in Minnesota, regardless of funding source.	MN DNR	MDNR 2003b	MN DNR FTP site	trl_snomblln3.shp	Recreation\Snowmobile_Trails	NA	YES
	MN DNR State Trails	State trails DNR maintained by MN DNR Division of Trails and Waterways.	MN DNR	MDNR 2003b	MN DNR FTP site	trl_stateln3.shp	Recreation\DNR_State_Trails	NA	YES
	Jay Cooke State Park Trails	Location of state park trails.	MN DNR	MDNR 2003b	MN DNR FTP site	trl_stprkln4.shp	Recreation\Jay_Cooke_State_Park_Trails	Users have no basis for interpreting attribute data in several fields (e.g., trail_use, trail_src, surface) because metadata does not define the information contained in the attribute fields (GIS data provides location and names only).	YES
	Marinas	Location of local marina facilities for the purpose of response to potential oil spill situations.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	marinas_utm_rev.shp	Water_Use_Information\Recreation\Marinas	Users should note that original WLS EPA Inland Sensitivity Atlas shapefile was updated to include 3 additional marinas (as per request of Judy Crane, MPCA).	YES

Table A1-7. Summary of Data Sets Compiled for the Recreation GIS Maps (asterisks in the 'Theme Name' column indicate data sets that were incorporated during Phase II of the project).

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Recreation (cont.)	Bike Routes (Duluth and Superior)*	Identifies off-road trails and on-street signed bike routes in Duluth and Hermantown and other recommended unsigned on-street routes throughout the Twin Ports area.	Arrowhead Regional Development Commission (ARDC)	Duluth-Superior Metropolitan Interstate Committee 2003b	GIS data sent by ARDC (Andrew Hayden)	Duluth_Superior_Bikeroutes.shp	Land_Use_Information\Lands_Cover_and_Use\Bike_Routes	More information is available at http://www.ardc.org/mic/bikemap/[1]	YES
	Recreational Areas of St. Louis River	Location of recreational areas around the St. Louis River Area of Concern.	Hedberg Map/visitduluth.com	Duluth Convention and Visitors Bureau 2003	Shapefile created by MESL	rec areas.shp	Recreation\Recreational_Areas	NA	YES
	Water Access Sites	Location of water access sites around the St. Louis River Area of Concern.	MN DNR	MDNR 2003b	MN DNR FTP site	shor_waspt3.shp	Recreation\Water_Access_Sites	NA	YES
	Wisconsin Trails (all types)	Location of proposed and existing trails in Wisconsin.	WI DNR - Bureau of Parks and Recreation	WDNR 2003	WI DNR FTP site	trails.shp	Recreation\WI Trails	NA	YES

ATV = All Terrain Vehicle; DNR = Department of Natural Resources; GIS = Geographic Information System; MESL = MacDonald Environmental Sciences Ltd.; MN = Minnesota; NA = Not Applicable; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey; Veg = Vegetation; WI = Wisconsin, WLS = Western Lake Superior.

[1]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-8. Summary of Data Sets Compiled for the USEPA Inland Sensitivity Atlas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
USEPA Inland Sensitivity Atlas	Dams	Locations of non-navigational dam sites (public water supply, power generation, flood control, irrigation and recreation).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	dams_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Fixed Oil Storage Facilities (# of oil tanks)	Fixed facilities store quantities of oil in above- or below- ground storage tanks with a storage capacity of 42,000 gallons or more.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	fixed oil storage facilities_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Water Intakes	Local water intake facilities (for the purpose of effective response to potential oil spill situations).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	water_intakes_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Marinas	Location of local marina facilities (for the purpose of response to potential oil spill situations).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	marinas_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Boat Access	Local boat ramp access facilities (for quick and effective notification and response to potential oil spill situations).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	boat access_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES

Table A1-8. Summary of Data Sets Compiled for the USEPA Inland Sensitivity Atlas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
USEPA Inland Sensitivity Atlas (cont.)	Shoreline Sensitivity	Sensitivity to coastal environments and wildlife to spilled oil (Lake Superior).	NOAA, Office of Ocean Resources Conservation and Assessment	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	shoreline sensitivity_utm .shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Special Designated Resource Areas	Areas of environmental significance not actively managed by any federal, state, regional or private agency.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	special designated resource areas_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Sensitive Species[1]	Sensitive biological resources that are potentially at risk during a spill.	Inland Waterways Spill Response Mapping Project	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	sensitive species_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Environmentally Sensitive Resource Areas[1]	Special places meritting spill protection (areas not publically managed, with no special designation).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	envirosenres_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Tribal Lands and Interests	Boundaries of land and water areas that are of specific tribal interest.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	tribal interests_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES

Table A1-8. Summary of Data Sets Compiled for the USEPA Inland Sensitivity Atlas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
USEPA Inland Sensitivity Atlas (cont.)	Managed Resource Areas[1]	Boundaries of federal, state, regional and private lands with special ecological, natural, or recreational value, that are uniquely vulnerable to oil spills (mapped for the Western Lake Superior Inland Sensitivity Atlas).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	managed resource areas_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Major Water Features	Major water features.	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	major water features_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Rails	Railway system at the 1:100,000 scale.	Bureau of Transportation Statistics	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	rails_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Pipelines	Locations and routes of pipelines carrying crude oil or refined oil products.	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	pipelines_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES
	Streams	Small to medium size streams extracted from the standard Geographic Data Technology line water layer and includes only Fcc codes H10 and H11.	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	streams_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	YES

Table A1-8. Summary of Data Sets Compiled for the USEPA Inland Sensitivity Atlas GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
USEPA Inland Sensitivity Atlas (cont.)	Roads	Interstate, U.S., and state highways and other major thoroughfares.	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	roads_utm.shp	USEPA_Inland_Sensitivity_Atlas	Edited Bong Memorial Bridge to match quad map (was considerably off).	YES
	1_25 000 Quad Index	The index to tiles data set depicts the extents to which data are mapped.	Inland Waterways Spill Response Mapping Project	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	1_250000_index_utm.shp	USEPA_Inland_Sensitivity_Atlas	Users note that the image files (i.e., orthoquads) for which these indexes relate to are not included in the dataset.	YES
	1_100 000 Quad Index	The index to tiles data set depicts the extents to which data are mapped.	Inland Waterways Spill Response Mapping Project	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	1_100000_index_utm.shp	USEPA_Inland_Sensitivity_Atlas	Users note that the image files (i.e., orthoquads) for which these indexes relate to are not included in the dataset.	YES
	Great Lakes Boundary	Great Lakes Boundary.	--	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	great lakes boundaries_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	NO
	County Boundaries	County Boundaries.	--	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	county boundaries_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	NO
	State Boundaries	State Boundary.	--	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	state_boundaries_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	NO

ESRI = Environmental Systems Research Institute; GIS = Geographic Information System; NA = Not Applicable; NOAA = National Oceanic and Atmospheric Administration;
USEPA = United States Environmental Protection Agency.

1 These shapefiles only contain natural heritage data from Minnesota DNR. Wisconsin DNR natural heritage information was not included at the request of the Wisconsin DNR.

Table A1-9. Summary of Data Sets Compiled for the Water Quality GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Clean Water Act Assessments	305b - Aquatic Life Use Assessments (MN)	Aquatic Life Use Support Assessments (Clean Water Act 305b).	--	MPCA	GIS data sent by MPCA (Tad Schindler)	305b_aql00.shp	Water_Quality\Clean_Water_Act_Assessments\Aquatic_Life_Use_Support_Assessments	Attribute table does not adequately describe meaning of data. Users would have to research State 305b program to interpret data.	NO
	305b - Swimming Use Support Assessments (MN)	Swimming Use Support Assessments (Clean Water Act 305b).	--	MPCA	GIS data sent by MPCA (Tad Schindler)	305b_swim00.shp	Water_Quality\Clean_Water_Act_Assessments\Swimming_Use_Support_Assessments	Attribute table does not adequately describe meaning of data. Users would have to research State 305b program to interpret data.	NO
	TMDL - Impaired Waters (MN Lakes)	Impaired Waters - Lakes (Clean Water Act Section 303d).	--	MPCA 2003	TMDL and Minnesota's Waterways website	tmdl02_lakes.shp	Water_Quality\Clean_Water_Act_Assessments\Impaired_Waters	Attribute table does not adequately describe meaning of data. Users would have to research TMDL program to interpret data.	NO
	TMDL - Impaired Waters (MN Streams)	Impaired Water - Streams (Clean Water Act 303d).	--	MPCA 2003	TMDL and Minnesota's Waterways website	tmdl02_streams.shp	Water_Quality\Clean_Water_Act_Assessments\Impaired_Waters	Attribute table does not adequately describe meaning of data. Users would have to research TMDL program to interpret data.	NO
Hydrology	MN and WI Streams	Location of small to medium size streams (ESRI shapefile).	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	Streams_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES

Table A1-9. Summary of Data Sets Compiled for the Water Quality GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Hydrology (cont.)	MN DNR Lakes	MN DNR 24,000K Lakes (medium scale lake polygons derived from the National Wetlands Inventory (NWI) polygons and MnDOT Basemap lake delineations, integrated with the DNR 24K Streams Layer).	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	dnrlkpymaj03.shp	Hydrology\Lakes\DNR_24K_Lakes	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
	USGS DLG Lakes and Wetlands (MN)	1:100,000 scale hydrography (lakes only) derived from USGS Digital Line Graph's (DLG's) of the same scale.	USGS	MDNR 2003a	Minnesota DNR GIS Data Deli website	dlglkpystlo.shp	Hydrology\Lakes\DLG_Lakes_and_Wetlands_Polygons	Users note that codes can be accessed on WWW through the metadata file (See Section 5 - HTML Table on the website).[1]	YES
Miscellaneous Water Quality	Bacteria Monitoring Stations	Location of selected water quality monitoring stations that monitor for 10 bacteria-related parameters.	USEPA Office of Water/OST	USEPA 2003	BASINS website	bacstations.shp	Water_Quality\Bacteria Monitoring Stations	Users have no basis for interpreting codes reported in attribute table (metadata file does not define coding system). Theme has 12 additional dbf files (based on 4 year increments) of bacteria data, as well as a parameter table. Users will have to join these tables to the shapefile.	YES
	Drinking Water Supply	Location of water treatment plants.	--	USEPA 2003	BASINS website	drinkwatersupply.shp	Water_Quality\Drinking Water Supply	Meta data is not available for this dataset. Users have no basis for interpreting several fields in the attribute table (e.g., TMP_B, STCO, TYPE).	NO

Table A1-9. Summary of Data Sets Compiled for the Water Quality GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available?
Miscellaneous Water Quality (cont.)	Gage Sites	Inventory of surface water gaging station data including 7-Q-10 low and monthly stream flow.	USEPA Office of Water/OST	USEPA 2003	BASINS website	gage.shp	Water_Quality\Gage Sites	NA	YES
	Milestone Monitoring Sites (MN)	Minnesota Milestone Monitoring Sites.	--	MPCA	GIS data sent by MPCA (Tad Schindler)	milestone_sites.shp	Water_Quality\Minnesota Milestone Monitoring Sites	See associated files saved in the same sub-directory as the shapefiles for more information regarding this data set; no metadata.	NO
	Water Quality Monitoring	Location of water quality monitoring sites.	USEPA Office of Water/OST	USEPA 2003	BASINS website	wqmonitoring.shp	Water_Quality\Water Quality Monitoring	Theme has 12 additional dbf files (based on 4 year increments) with statistical summaries of water quality stations, as well as a parameter table. Users will have to join these tables to the shapefile.	YES
	Water Quality Stations	USEPA's STORET Water Quality Observation Data.	USEPA Office of Water/OST	USEPA 2003	BASINS website	waterqualitystations.shp	Water_Quality\Water Quality Stations and Observations	Theme has one additional dbf file containing raw data measurements for stations. User will have to join this table to the shapefile.	YES
	Water Intakes	Local water intake facilities (for the purpose of effective response to potential oil spill situations).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	water_intakes_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES

BASINS = Better Assessment Science Integrating Point and Nonpoint Sources; CD = Compact Disc; DLG = Digital Line Graph; DNR = Department of Natural Resources; GIS = Geographic Information System;
MIS = Management Information Services; MN = Minnesota; MnDOT = Minnesota Department of Transportation; MPCA = Minnesota Pollution Control Agency; NA = Not Applicable;
NWI = National Wetlands Inventory; OST = Office of Science and Technology; STORET = Storage and Retrieval; TMDL = Total Maximum Daily Load;
USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey; WI = Wisconsin, WWW = World Wide Web.

[1]The web link indicated was active at the time this project was completed. Since web site addresses are subject to change and information may be updated over time, it is recommended that users download accessory information as soon as possible.

Table A1-10. Summary of Data Sets Compiled for the Water Use GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Dams	Dams	Location of dams as well as age of the dam, number of people living downstream, and some inspection information.	USEPA Office of Water/OST	USEPA 2003	BASINS website	dam_utm.shp	Water_Use_Information\Dams	Some coding is used in the attribute data table that is not defined in the metadata file.	YES
Dredging	Dredging Depths	Dredging Area Outline.	NOAA, National Ocean Service, Office of Coast Survey	NOAA 2003a	Electronic Navigational Charts Download website	Dredged_area_utm.shp	Water_Use_Information\Dredging	Users have no basis for interpreting attribute data in several fields because metadata does not define the information contained in the attribute fields. Metadata for this data is unreliable (see readme file). Assuming units are meters.	YES
Harbor Facilities	Harbor Facility Points	Harbor Facilites (Industrial) around St. Louis River.	NOAA, National Ocean Service, Office of Coast Survey	NOAA 2003a	Electronic Navigational Charts Download website	harbor_facilities_points_utm.shp	Water_Use_Information\Harbor_Facilities	Users have no basis for interpreting attribute data in several fields because metadata does not define the information contained in the attribute fields. Metadata for this data is unreliable (see readme file).	YES
Hydrology	MN and WI Streams	Location of small to medium size streams (ESRI shapefile).	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	Streams_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES

Table A1-10. Summary of Data Sets Compiled for the Water Use GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Industry	Industrial Water Use	Location of facilities with water appropriation permits.	MN DNR	MDNR 2003c	Water Use - Water Appropriations Permit Program website	swuds.shp	Water_Use_Information\Industry	NA	YES
Navigation	Navigable Waterway Nodes	Navigable Waterway Nodes (Navigation Points; nodes may represent physical entities such as river confluences, ports/facilities, and intermodal terminals, USACE nodes, or may be inserted for analytical purposes).	Vanderbilt Engineering Center for Transportation Operations and Research, Vanderbuilt University	USBTS 2003	Bureau of Transportation Statistics Geographic Information Services website	waternd_utm.shp	Water_Use_Information\Navigation\Navigable Waterway Nodes	NA	YES
	Navigable Waterway Network	Navigable Waterway Network (Navigation Routes; a comprehensive network database of the nation's navigable waterways).	Vanderbilt Engineering Center for Transportation Operations and Research, Vanderbuilt University	USBTS 2003	Bureau of Transportation Statistics Geographic Information Services website	nav_water-utm.shp	Water_Use_Information\Navigation\Navigable Waterway Network	NA	YES
Public Use	Fish Consumption Advisory Areas	Areas for which Fish Consumption Advisories are issued.	MN Department of Health	MDH 2003	Environmental Health in MN website	fishadvis_update.shp	Water_Use_Information\Public_Use\Fishing_Advisories	NA	YES

Table A1-10. Summary of Data Sets Compiled for the Water Use GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Public Use (cont.)	Marinas	Location of local marina facilities (for the purpose of response to potential oil spill situations).	Great Lakes Commission	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	marinas_utm_rev.shp	Water_Use_Information\Public_Use\Marinas	Users should note that original WLS EPA Inland Sensitivity Atlas shapefile was updated to include 3 additional marinas (as per request of Judy Crane, MPCA).	YES
	Prohibited Areas	Prohibited Areas (Swimming Advisories).	St. Louis River Citizens Action Committee	SLRCAC 2001	Shapefile created by MESL	prohibited_areas.shp	Water_Use_Information\Public_Use\Prohibited_Areas	NA	YES

BASINS = Better Assessment Science Integrating Point and Nonpoint Sources; DNR = Department of Natural Resources; ESRI = Environmental Systems Research Institute; GIS = Geographic Information System; MN = Minnesota; MPCA = Minnesota Pollution Control Agency; NA = Not Applicable; OST = Office of Science and Technology; USACE = United States Army Corps of Engineers; USEPA = United States Environmental Protection Agency; WI = Wisconsin, WLS = Western Lake Superior.

Table A1-11. Summary of Data Sets Compiled for the Basemap Features for the Black and White GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
BASEMAP									
Roads	Main Roads	Interstate, U.S., and state highways and other major thoroughfares.	ESRI	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	roads_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA	YES
	Road Labels	Labels for major roads in AOC.	ESRI	NA	Shapefile created by MESL	road_Labels.shp	USEPA_Inland_Sensitivity_Atlas	NA	NO
Rails	Rails	Railroads.	Bureau of Transportation Statistics	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	rails_utm.shp	USEPA_Inland_Sensitivity_Atlas	Ownership is delineated with codes (code descriptions not provided in metadata; GIS data provides locations only).	YES
Urban Areas	Major Towns	Major towns of the St. Louis River AOC	MPCA (J. Crane)	NA	Shapefile created by MESL	towns.shp	Land_Use_Information\Urban_Areas	NA	NO
Reach/Water Body Boundaries	DB_AREA	Waterbody Boundaries for St. Louis River AOC	MPCA (J. Crane)	NA	Shapefile created by MESL	water_body_bounds_utm.shp	Hydrology\Reach_Water_Body_Boundaries	NA	NO
	Location Description	Reach Boundaries for St. Louis River AOC.	MPCA (J. Crane)	NA	Shapefile created by MESL	reach_bounds_utm.shp	Hydrology\Reach_Water_Body_Boundaries	NA	NO
Water Boundaries (St. Louis River)	St. Louis River	Boundary of St. Louis River (polygon).	--	MPCA	GIS data sent by MPCA (Judy Crane)	Shp_pol_utm_update.shp	Hydrology\St._Louis_River_Boundaries\River_Polygon	NA	NO

Table A1-11. Summary of Data Sets Compiled for the Basemap Features for the Black and White GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Stateline	MN/WI State Line	State Line between MN and WI.	--	NA	Shapefile created by MESL	stateline.shp	Land_Use_Information\Stateline	NA	NO
Counties	County Boundaries	Counties boundaries for MN and WI.	--	MPCA	GIS data sent by MPCA (Judy Crane)	Counties_utm.shp	Land_Use_Information\Counties	NA	NO
	County Mask	extra county coverage for MN and WI.	--	NA	Shapefile created by MESL	county_mask.shp	Land_Use_Information\Counties	NA	NO
	Great Lakes Boundary	Great Lakes Boundary.	--	USEPA 2000	Western Lake Superior USEPA Inland Sensitivity Atlas	great lakes boundaries_utm.shp	USEPA_Inland_Sensitivity_Atlas	NA (presenting data as it is distributed by USEPA)	NO
QUADS/ORTHOPHOTOS									
Topographic Quad Maps	Adolph.tif	quad -- Adolph.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Adolph.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	Duluth.tif	quad -- Duluth.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Duluth.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	Duluth_hghts.tif	quad -- Duluth Heights.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Duluth_hghts.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES

Table A1-11. Summary of Data Sets Compiled for the Basemap Features for the Black and White GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Topographic Quad Maps (cont.)	Esko.tif	quad -- Esko.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Esko.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	Lakewood.tif	quad - Lakewood.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Lakewood.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	Parkland.tif	quad -- Parkland.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Parkland.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	Superior.tif	quad -- Superior.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	Superior.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	W_duluth.tif	quad -- West Duluth.	USGS and MN DNR	SLRCAC 2002	CD - Lower St. Louis River Habitat Plan	W_duluth.tif	Land Use Information\Quads and Orthophotos\Quads	NA	YES
	Quad Index	Q024k directory - Quad Index.	USGS and MN DNR	MDNR 2003b	MN DNR FTP site	indx_q024kpy4 .shp	Land Use Information\Quads and Orthophotos\Quads	NA	YES
Orthophotos	Doq03imq2139.tif	orthophoto -- Saginaw.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2139. tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2140.tif	orthophoto --Adolph.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2140. tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES

Table A1-11. Summary of Data Sets Compiled for the Basemap Features for the Black and White GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Orthophotos (cont.)	Doq03imq2141.tif	orthophoto -- Duluth Heights.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2141.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2142.tif	orthophoto -- Duluth.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2142.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2143.tif	orthophoto -- Lakewood.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2143.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2239.tif	orthophoto -- Cloquet.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2239.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2240.tif	orthophoto -- Esko.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2240.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2241.tif	orthophoto -- West Duluth.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2241.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2242.tif	orthophoto -- Superior.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2242.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES
	Doq03imq2339.tif	orthophoto -- Wrenshall.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2339.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES

Table A1-11. Summary of Data Sets Compiled for the Basemap Features for the Black and White GIS Maps.

Data Category	Theme Name	Data Description	Data Originator	Acquired From	Acquisition Details	File Name	Location of GIS data C:\STLR_GIS Project\Shapefiles\.....	Notes	Metadata available ?
Orthophotos (cont.)	Doq03imq2340.tif	orthophoto -- Frogner.	MN DNR - MIS Bureau	MDNR 2003a	Minnesota DNR GIS Data Deli website	doq03imq2340.tif	Land Use Information\Quads and Orthophotos\Orthophotos	NA	YES

AOC = Area of Concern; BASINS = Better Assessment Science Integrating Point and Nonpoint Sources; CD = Compact Disc; DNR = Department of Natural Resources; FTP = File Transfer Protocol; GIS = Geographic Information System; MESL = MacDonald Environmental Sciences Ltd.; MIS = Management Information Services; MN = Minnesota; NA = Not Applicable; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey; WI = Wisconsin.

Appendix 1. Summary of Data Compiled for the Various GIS Maps that Accompany the GIS-Based Sediment Quality Database for the St. Louis River AOC

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Appendix 2. Screening Criteria for Evaluating Candidate Data Sets for the GIS-Based Sediment Quality Database for the St. Louis River Area of Concern (AOC)

MacDonald Environmental Sciences Ltd. (MESL) are working collaboratively with the Minnesota Pollution Control Agency (MPCA) and the National Oceanic and Atmospheric Administration (NOAA) to develop a GIS-based sediment quality database (GISSED) for the St. Louis River Area of Concern (AOC). When completed, the GISSED database will include sediment quality data collected since 1990 by various state, federal, tribal, and private groups. The database is being coupled with GIS information to generate visual techniques for presenting complex data in an understandable format for lay audiences, MPCA staff, and stakeholders. The database will be comprised of whole sediment data, sediment toxicity and bioaccumulation data, and tissue chemistry data. Although benthic invertebrate community data, pore water chemistry data, pore water toxicity data (except for Microtox® tests), and plant toxicity data (e.g., cattail and wild rice seed germination and growth) will not be included in this phase of the GISSED database, the availability of these types of data will be noted on the screening sheets. The following screening criteria are intended to provide a means of evaluating candidate data sets and assuring general consistency in the information included in the database. However, the screening criteria are not necessarily recommended for applications beyond their intended purpose.

A. Criteria for Evaluating Data Set Acceptability

General

1. Samples must be located within the St. Louis River AOC. Sediment quality data collected from the St. Louis River and its tributaries upstream of the AOC, from nearby reference lakes, and from outside the harbor area in Lake Superior may be considered for incorporation in future updates of the GISSED database.

2. Data sets which include sediment quality data generated from dilution series of bulk sediments (i.e., elutriate tests) are not acceptable for incorporation into the database because there is too little connection between the chemistry and laboratory toxicity data. However, data from the 100% dilution series are acceptable to include in the GISSED database.

3. Data sets should include the location of sediment sampling sites, preferably by georeference coordinates (i.e., longitude and latitude). Otherwise, the georeference coordinates can be estimated using GIS software and maps of the sample site locations. Data sets for which sample locations cannot be georeferenced should be qualitatively described as to the waterbody and reach (e.g., Hog Island Inlet) within the St. Louis River AOC.

4. Acceptable procedures for collecting, handling and storing samples must be employed. If standard procedures (i.e., those developed by ASTM or USEPA) are not utilized, the alternative methods must be clearly stated and may be evaluated using best professional judgement. The rationale for decisions regarding procedure acceptability must be documented.

5. Any sediment horizon (i.e., surficial sediments, cored sediment sections, etc.) can be used to assess sediment toxicity, bioaccumulation, and/or chemical indicators.

Sediment/Tissue Chemistry

6. The sediment and/or tissue chemical analytical methods used in the study must be reported, must meet minimum data quality requirements/objectives, and detection limits must be reported. Data quality is considered acceptable if the author has stated that QA/QC procedures were followed and data quality objectives were met. If the author has not stated this clearly, data quality may be evaluated using various protocols and best professional judgement. The rationale for decisions regarding data acceptability must be documented.

7. Data acceptability for sediment and/or tissue chemistry data must be further assessed by screening laboratory qualifier codes after all data have been incorporated. Each result is categorized as detected, undetected, undetected (detection limit not specified), and unacceptable.

8. Sediment or tissue chemistry data that were generated using screening methods [e.g., X-ray fluorescence for metals; laser induced fluorescence (LIF) or other fluorometric screening methods for PAHs; immunoassay method for PCBs, etc.] are not acceptable for inclusion in the GISSED database.

9. Concentrations of SEM metals (e.g., Cd, Cu, Pb, Ni, and Zn) may be included in the database, although data on the concentrations of total metals (i.e., strong acid digestion) are preferred.

Toxicity/Bioaccumulation

10. Acceptable environmental conditions must be maintained throughout the toxicity/bioaccumulation tests (as defined in the protocols for the toxicity/bioaccumulation test). Consequently, the temperature, pH, alkalinity, hardness, conductivity, and DO of the overlying water should have been measured during the test. Acceptable conditions are considered to be achieved if the author states that standard methods were employed and that acceptable environmental conditions were maintained in the bioassay chambers. Alternatively, if the authors have not explicitly assessed the overlying water quality conditions, and the raw overlying water quality data is provided in the report, the data should be assessed for acceptable conditions. Subsequently, any toxicity/bioaccumulation results associated with environmental conditions outside the acceptable ranges should be flagged.

11. The responses of the test organisms exposed to negative controls must be reported and be within acceptable limits (i.e., as defined in ASTM or USEPA test methods). For toxicity/bioaccumulation tests for which a negative control sediment is not available, then the selected field reference sediment must be shown to be functionally-equivalent to a negative control sediment, as indicated by non-toxicity (as defined by acceptable control sample criteria), concentrations of measured contaminants in matching sediment samples should not exceed their respective Level I SQTs, and the particle size distribution and TOC levels should be similar to that in the basin area under investigation.

12. Standard toxicity/bioaccumulation test laboratory procedures must be employed. If procedures other than those developed by ASTM or USEPA are utilized, the acceptability of the test procedure may be evaluated using best professional judgement. Preference will be given to novel test procedures that have been published in the peer-reviewed literature. The rationale for decisions regarding procedure acceptability must be documented.

13. Sediment samples must not be frozen prior to biological testing.

14. Sediment samples must be designated as toxic or non-toxic based on statistical comparisons with the negative control or a suitable reference site (see #11 for a definition of what constitutes a suitable reference site). Results from the negative control and/or reference samples must be included in the database. The USEPA's decision tree for statistical analysis of survival, growth, and reproduction data subjected to hypothesis testing should be used for evaluating sediment toxicity data (USEPA 2000). Significant difference ($p<0.05$) in toxicity/bioaccumulation test results from test samples compared to negative control or reference samples must be

determined using a pair-wise 1-tailed statistical test.

15. Data sets generated using organic extracts may be included in the database (e.g., Microtox®), provided they are available with other toxicity data. Microtox® and Mutatox® data are not being targeted for inclusion in the database because the linkage between the toxicity data and effects on sediment-dwelling organisms is tenuous.

Suggested Guidance Documents

ASTM (American Society for Testing and Materials). 1996. 1996 Annual Book of Standards. Water and environmental technology. Volume 11.05. Biological effects and environmental fate; biotechnology; pesticides. West Conshohocken, Pennsylvania.

ASTM (American Society for Testing and Materials). 1997. Standard test methods for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates. E1706-95b. In Annual Book of Standards, Vol 11.05, Philadelphia, Pennsylvania: pp.1138-1220.

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Appendix 3. Data Quality Check Sheet for SEDIMENT QUALITY DATA for the GIS-Based Sediment Quality Database for the St. Louis River Area of Concern

STUDY NAME/STUDYID: _____

DATA ENTRY/TRANSLATION DATE: _____

QA/QC DATE: _____

MS EXCEL FILE NAME: _____

MS ACCESS FILE NAME: _____

STEP #2 QA/QC CHECKS FOR TRANSLATED DATA COMPLETED:

Name of Reviewer #1 (print): _____ Initials/Date:_____

Name of Reviewer #2 (print): _____ Initials/Date:_____

STEP #3 QA/QC CHECKS FOR MANUALLY-ENTERED DATA COMPLETED:

Name of Reviewer #1 (print): _____ Initials/Date:_____

Name of Reviewer #2 (print): _____ Initials/Date:_____

Initial and date to verify that changes incorporated: _____

Initial and date to verify that QA checks were recorded in the master file (MASTER_QA_SUMMARY.xls):_____

Step #1: DOCUMENTATION

The following information must be in MPCA's possession prior to entering data into the GIS-based database. Verify that the proper documentation is available.

MPCA Approved QAPP or SAP _____

Copy of the Laboratory Data Report Package _____
(either electronic or hard copy).

Post-Sampling QA/QC Audit Checklists _____

Name of Reviewer (print): _____ Initials/Date:_____

Step #2: QA/QC PROCEDURES FOR VERIFYING TRANSLATED DATA

The following steps are required as part of the QA/QC check of the data **translation** process, ***after*** data have been translated from spreadsheet format into MS Access format.

1. Use a random number generator to select x stations and y chemicals to check (determine x and y to ensure that at least 10% of the data are checked). **This ensures that all data for a chemical and/or station were not excluded in the translation process.**

2. One person reads the information from a printed copy of the original data file or hardcopy: site number, chemical name, analysis result, units, and qualifiers.

3. Another person verifies the information by putting a checkmark on a hardcopy.

4. If any errors are encountered, the reason for the error is investigated. Usually the error is associated with:
    1. A shift in the data (across or down or both). In this case the data are re-translated and datachecking would start from step 1, or
    2. An omission of a chemical or station or both. In this case the missing data are added and the datachecking process starts from step 1, *ensuring that the missing data are included as part of the datachecking step,* or
    3. Data fields have been truncated. In this case the data are re-translated and datachecking would start from step 1, or
    4. There are problems with the assigned data type (i.e., text vs. values; double number field vs. single number field). In this case the compatibility with the data types is resolved and tested, to ensure that the translated data represents exactly what was in the original data file. Then the data are re-translated and datachecking would start from step 1.

5. The hardcopy of the signed and dated datachecking sheets and the completed Data Quality Checksheet are retained on file for an indefinite time period.

6. An electronic list is maintained of the QA/QC checks conducted. Any errors and subsequent changes made are recorded in this list. This list is maintained in a MESL sub-directory that has an on-site and off-site back-up.

Note: It is not necessary to outline procedures for incorporating changes (i.e., steps b to e in the procedures for verifying manually entered data), because there is a very low likelihood of generating the kinds of random errors that occur when manually entering data.

Step #3: QA/QC PROCEDURES FOR VERIFYING MANUALLY ENTERED DATA

The following steps are required as part of the QA/QC check of the **data entry** process, after data have been manually entered in spreadsheet or MS Access. Each cell that has manually entered data or information will be 100% verified.

1. One person reads the information from a printed copy of the original data file or hardcopy. This will include, at a minimum: site number, chemical name, analysis result, units, and qualifiers. Information entered in other fields that may be entered globally (e.g., DW or WW basis) do not have to be checked for each record.

2. Another person verifies the information by putting a checkmark on a hardcopy. Required corrections are recorded CLEARLY and NEATLY on the hardcopy

3. If any errors are encountered, the reason for the error is investigated. If the error is systemic, the data entry person corrects the errors and prints another hardcopy before datachecking resumes.

4. One person incorporates the corrections into the data file.

5. Another person checks that the corrections have been correctly incorporated, indicating this with a different colored checkmark on the hardcopy. This person also signs and dates the hardcopy (indicating changes have been incorporated).

6. The hardcopy of the signed and dated datachecking sheets and the completed Data Quality Checksheet are retained on file for an indefinite time period.

7. An electronic list is maintained of the QA/QC checks conducted. Any errors and subsequent changes made are recorded in this list. This list is maintained in a MESL sub-directory that has an on-site and off-site back-up.

8. All data sets should be double-checked to ensure that changes were incorporated and the Data Quality Checksheet should be signed and dated to confirm that this step was completed.