RECLAMATION RESEARCH
ENVIRONMENTAL MINE WASTE MANAGEMENT DATABASE

Year one report on Minerals Coordinating Committee Project
Environmental Mine Waste Management Database

30 June 2002

Minnesota Department of Natural Resources
Division of Lands and Minerals
Reclamation Section
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Andrea M. Johnson

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0. EXECUTIVE SUMMARY

Minerals Coordinating Committee (MCC) funding was used to initiate the development of an Environmental Mine Waste Management (EMWM) Database for the Minnesota Department of Natural Resources Lands and Minerals (MN DNR LAM) research data. The objectives of this two-year project include: 1) provide an efficient and user-friendly data management system for the 20 plus years of mine waste drainage quality prediction and mitigation research and 2) provide systematic storage and retrieval of the research data.

This project will benefit the State of Minnesota and the mining industry by allowing more efficient data management and report production, improving security of existing and future data, and increasing the value of this data to the MN DNR, the mining industry, and others interested in the environmentally sound management of mine waste.

A developmental method, created by Advanced Strategies Inc. (1996), was used to create the EMWM Database. Planning, analysis, design, construction and implementation are all phases applied in this method. The initial year of the project was spent on analysis, design, and finally construction of the database in Microsoft Access. This software is readily available to the MN DNR LAM staff, and does not require the extra hardware or extensive technical support required by other programs.

The planning phase of this project involved the project plan, risk management, and project definition sessions and documentation. The majority of the first years time was spent in analysis, identifying and modeling the business requirements of the project. Finally, design and construction of the database tables took place. To date, all tables of the database have been constructed and minor adjustments are being made to the data entry input forms.

Future plans for the EMWM Database include, population of the database with drainage quality prediction and mitigation data, testing of the database, implementation of the database, and training. A final report will be produced prior to June 30, 2003.

1. INTRODUCTION

The Minnesota Department of Natural Resources (MN DNR) is responsible for both encouraging mineral resource development and ensuring that this development does not adversely impact other natural resources. Of particular concern are water resources. Mineral resource development generates large quantities of mine wastes including waste rock, tailings and the mine itself. The quality of drainage from these wastes is variable, ranging from environmentally innocuous to highly acidic drainage with elevated concentrations of trace metals. The extent of mitigation required to prevent adverse impacts on water quality is, therefore, dependent on the quality of drainage.

The present approach to mine permitting requires, prior to mineral resource development,

1. prediction of the quantity and quality of drainage from potential mine wastes
2. based on these predictions, mine waste management plans must be developed to prevent adverse impacts on water quality.

With this information the costs of environmentally sound mine waste management can be factored into the economic analysis of mineral resource development.

The state of Minnesota has spent in excess of three million dollars over the past 25 years studying mine waste drainage quality prediction and environmentally sound mine waste management. The MN DNR Division of Lands and Minerals (LAM) has conducted numerous projects. Some of these are funded internally or through various state programs (Minerals Coordinating Committee, Environmental Cooperative Research). Other studies have been conducted in cooperation with the iron mining industry, U.S. and Canadian base metal mining industries and governmental agencies such as the U.S. Bureau of Mines, U.S. Bureau of Land Management, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and the Western Governors' Association (Lapakko et al. 2001).

These extensive laboratory and field studies include research on:

- mine waste characterization and drainage quality prediction methods
- prediction of drainage quality from taconite mine wastes
- prediction of drainage quality from Duluth Complex mine wastes
- prediction of drainage quality from Archean greenstone mine wastes
- prediction of drainage quality from mine waste rock types in the western U.S.
- mitigative potential of subaqueous mine waste disposal
- mitigative potential of mixing alkaline solids with acid-producing mine waste
- mitigative potential of mine waste encapsulation
- mitigative potential of capping waste rock piles
- mitigative potential of sulfate reduction systems

Prediction of mine waste drainage quality may require long term testing, because mine waste drainage can be neutral for several years and then acidify. Mitigation studies can also be of extended duration in order to assess the effectiveness of techniques that must treat, control or prevent problematic drainage after mine closure. Consequently, more than 20 years of research by the MN DNR LAM has generated an immense amount of data that has been summarized in reports and technical papers.

For many of the MN DNR LAM research projects, data input, compilation, analysis, and tabular and graphical output represents a substantial time commitment. Those responsible for these tasks are often hired temporarily for a specific project or projects. Therefore, having an efficient and user-friendly data management system is a high priority. Furthermore, the voluminous data generated over more than 20 years requires an effective and efficient method for its systematic storage and retrieval.

There are presently several data management systems in use which are adequate, but they are not highly efficient or user friendly. Furthermore, access to and interpretations of stored data are limited by lack of standardized and detailed documentation of data structures. Consequently, it became apparent that a new data management system would greatly improve the capacity to conduct research, as well as communicate and store results.

Due to the availability of sophisticated and user friendly software, the decision was made to create an environmental mine waste management (EMWM) database for the reclamation section of the MN DNR LAM. A proposal for this purpose was submitted to the Minerals Coordinating Committee (MCC) and funding was granted for a two-year project. This report presents progress after the first year of the project.

2. OBJECTIVES

The goal of this project is to create an efficient and user-friendly database for data management of the MN DNR LAM environmental mine waste management research data. This database will also serve as a formal, organized repository for the drainage quality prediction and mitigation research data, and allow for more efficient data manipulation and report preparation.

The ultimate goal of the EMWM database is to correlate drainage quality prediction data (aqueous phase) with solid phase data for use as a prediction tool in environmentally sound mine waste management.

This project will benefit the State of Minnesota and the mining industry by ensuring secure storage of the data generated over the past 25 years, as well as improve the utility and accessibility of those data.

More specific benefits resulting from the creation of a database for the MN DNR's data include:

-more efficient, user-friendly data entry
-more efficient data extraction for manipulation
-more efficient data comparison among experiments
-more efficient data tabulation (set up standard tables)
-documentation of meta data (data descriptions for those who access the data)
-standardization of data (common units/names, detection limits)
-documentation of data change (reruns and value replacements)
-improved security of data storage (multiple person access without change/loss of data)
-improved data organization (data is currently stored in multiple files/locations)
-efficient data retrieval

3. METHODS

The development process of a relational database can be complex, and involve a substantial time commitment. Therefore, detailed planning, along with applying a developmental process or methodology, is crucial to the success of the project.

This project, funded by the Minerals Coordinating Committee, used a method developed by Advanced Strategies, Inc. (1998) to create the EMWM Database. The main structure of this method (planning, analysis, design, construction, and implementation) is commonly used by software engineers in the developmental process.

3.1. Planning

As with any project, proper planning is essential to ensure a successful outcome. A detailed project plan is a necessity for guidance and documentation throughout the development of a project. The project plan helps to identify the activities and resources needed to complete the project.

During the planning phase, roles are assigned such as sponsors and project managers, and a work plan is created estimating project effort, costs and duration.

The planning phase is also where a project definition is created. The project definition provides direction throughout the project, and criteria to measure the project's success. This clearly written statement describes the purposes and boundaries of the project, and initiates the analysis of the business needs of the project.

Planning also plays an important role in the project management process by identifying risks and providing tentative solutions for managing these risks.

3.2. Analysis

Detailed analysis in the early stage of the project is crucial to a project's success and may actually save time later in the developmental process.

During the analysis phase, more detail is added to the business requirements, and items are prioritized by those that are needed vs. items that are nice to have. This step is accomplished by group meetings, one-on-one discussions, and sometimes by surveys. The "real world," as it relates to an organizations business, is modeled on paper. This business object model is often referred to as an entity relationship diagram because it includes the entities (objects) and their corresponding relationships to each other. Once the business model is completed, it is converted to conceptual and logical models by adding the data structure and any policy constraints. The new model is referred to as a data structure diagram (DSD).

Another component of the analysis phase is to assess existing data structures and applications. This is the time to determine if the solution to the project requirements already exists, or if one must be built. This process involves a search within the agency for a solution that meets the business requirements of the project. If no solution exists internally, then the search moves to external sources. The final choice is to build a solution from scratch.

Process modeling is also utilized during the analysis phase. This form of analysis uses techniques and instruments to 1) describe the functional process requirements of a system, and 2) emphasize business processes and the data produced by the process.

3.3. Design

In the design phase, the business requirements of the DSD are translated into a solution. The solution, in the form of a physical model, shows the actual architecture of the database tables on paper. Upon completion, the physical model and process models can be handed over to a computer programmer for construction. Applications in the form of screens and report layouts may also be built at this time.

3.4. Construction

Once the physical design has been approved for construction, a decision must be made as to the technology to build it in. The next step is to build the tables using the physical model as a blue print for the construction.

Verification testing is performed throughout the construction phase, and when constructions is complete, a sample set of data is used to test the solution. This testing will show if relationships among tables are correct and ensure that the solution meets the needs of the users. Once the solution is thoroughly tested, it is ready to be implemented.

3.5. Implementation

This is the phase where population of the database takes place. Also, from this point on, maintenance and compaction of the database are essential.

4. PROGRESS TO DATE

4.1. Planning

Project Plan

In August of 2001 the Reclamation and Information Staff (IS) of the MN DNR LAM attended a project planning session for the EMWM Database. The purpose of this meeting was to draft a project plan for the EMWM Database. The project plan acts as a guide to ensure that tasks get done in a timely matter and provide some accountability for these tasks (Appendix 1).

During the project planning meeting, the basic objectives and scope of the project were determined. Next a discussion of the importance of following a method through the database development process was discussed. The decision was made to follow the method developed by Advanced Strategies, Inc. (1998).

The next step was to list the tasks involved in creating the EMWM Database and inventory the resources (staffing and hours) needed for such a project. Some tasks in the original MN MCC work plan were modified according to the needs and resources of the group. A revised work plan was submitted to the MN MCC (Table 1).

The final agenda item for the planning session was to set tentative dates (updated throughout the project) and roles for future meetings (Table 2). The roles of project managers and sponsors were also assigned at this time also.

Risk Assessment

An essential part of project planning, and project management, includes risk assessment. Anytime a substantial amount of resources is invested into a project the risks associated with the project should be addressed.

A meeting was held with the sponsors, project managers and IS staff of the MN DNR LAM in August of 2001 to discuss risk management. A list of potential risks was created along with the impact of each risk to the EMWM Database project, the likelihood of each risk occurring, and how to cope with a risk if it materializes (Appendix 2).

Project Definition

The next step in the planning process was to conduct a project definition session involving everyone associated with the EMWM Database project (from stakeholders to users).

The objectives of a project definition are to:

1. define the purposes and boundaries of the project
2. agree to a common understanding of what the project is and is not
3. deliver a document that provides direction, and criteria to measure the project's success.

Using these objectives, the group identified the focus of the EMWM Database project.

At this time, only non-ferrous projects that are currently in progress (some with 10 years of data) and new experiments will be included in the EMWM Database. Aqueous phase data (drainage quality), solid phase data, and other experimental information from both laboratory and field settings, involving both prediction and mitigation type experiments will be included in the EMWM Database (Appendix 3).

4.2. Analysis

The analysis phase of the project focuses on defining the business requirements/needs (the what) in greater detail, but does not address the solution to these needs. Detailed analysis of the users needs and the information to be stored in the database is essential, or the end product will be useless. Therefore, the initial funding year of the EMWM Database was spent primarily on the analysis portion of the project.

Analysis was initiated by the group during the project planning and project definition meetings. An outline was constructed showing the organizational breakdown of reclamation research related data collected within the Division of Lands and Minerals. It was decided that the focus of the reclamation database would start with the non-ferrous laboratory and field prediction section of the outline. If there was little difference in laboratory and field mitigation methods, this section would also be incorporated into the database. Further discussions included, types of information collected on experiments, how the experiments were conducted, types of information that is tracked, important vs. relevant information (determined by the focus described in the project plan), and eventually uses of the database.

A preliminary business object model, in the form of an entity relationship diagram (ERD), was created in this meeting to reflect the real world business of the MN DNR LAM research (Figure 1). Entity relationship diagrams portray the objects (entities) of the "real world," and their relationships to each other. The group determined if the information in the ERD was true (in the real world), and then determined what information was relevant to the focus of the database. Revisions were made to some sections of the ERD during the meeting, while other topics were put on hold for further discussion.

The next step of the business object modeling was to complete meta data forms for the ERD. The meta data forms included definitions of data (or data about data) that are available to anyone

accessing the database. A single form was completed for each entity represented in the ERD, and included a list of all relationships and attributes (name, data type, definitions) associated with that entity.

A project analyst from the MN DNR LAM attended a four day training session on Business Object Modeling in St. Paul, MN, and another three day training session on Technical Database Modeling. This training provided the information essential to proper modeling and design of the database.

Early in the analysis stage, the group decided to search for a pre-existing database that would parallel the needs of the MN DNR LAM. The U.S. Environmental Protection Agency (EPA) has developed STORET, a database used by many agencies to store and manage their data. While STORET may be used as a standalone database, it also has the ability to download batches of data to an EPA website for accesses to anyone with internet connections. The Minnesota Pollution Control Agency in St. Paul uses STORET and provided a demonstration of the software's capabilities as a database. After viewing the demonstration, it was determined that STORET would not be an option for the storage of the MN DNR's data. STORET is designed primarily for field activities, whereas much of the MN DNR's research is conducted in a laboratory setting. Also, STORET was not ideal for manual input due to the extensive navigation of windows necessary for data input. Finally, STORET was lacking in mineralogy definitions necessary for the solid phase data collected by the MN DNR LAM. A decision was made to develop a database specifically for the needs of the MN DNR LAM.

Many hours were spent on analyses of the MN DNR LAM's data and iteration after iteration of modeling the business needs. Several small and large group discussions and conference calls took place over time to discuss sections of the business object model (Table 3). At each meeting, new and old issues were addressed and the ERD was modified accordingly.

Process models were also created during the analysis phase. These models depict the processes of how the MN DNR LAM conducts its research. The process models include detailed processes ranging from how experiments are conducted to data analysis. This information is useful to both the users and programmers, especially for future development.

Finally, the existing data structures containing the current mine waste characterization research data were examined. Detailed lists including the parameters measured and sample units represented were tabulated. These details provided information to the business requirement section and will also be useful when it comes time to populate the database. Some preliminary tests of software compatibility were run at this time, and notes were recorded on problem situations

4.3. Design

During the design phase the business requirements are converted into a solution. The solution is in

the form of a blueprint that will be used in the construction phase.

After extensive analysis and revisions to the business object model, it was converted to conceptual and logical models (Jan to Feb. 2002). The data structure diagram (DSD) representing the conceptual/logical models, adds data structure and policies to the ERD. The DSD (Figure 2) went through many iterations based on input from the group discussions. The final conversion from a logical to a physical model took place in February of 2002. After many iterations, a physical design was approved for construction (Figure 3). In March of 2002 during a group meeting with the project managers and IS staff, a decision was made to build the database in Microsoft Access. This software was chosen because it is readily available to MN DNR staff. Other software options were discussed, and turned down based on lack of proper hardware or technical support.

4.4. Construction

Soon after the March meeting, construction of the database in Microsoft Access began. Tables were built according to the physical model. The aqueous data tables (drainage quality) were built first as the variability among experiments is higher than that of the solid phase data. A few modifications were made to the physical model in order to better meet the user's needs and database constraints. Next, the solids data tables were built. Data input forms were also created for easier, more efficient data entry, including customized forms for the aqueous data by experiment.

Testing was conducted throughout the construction phase, however, more extensive testing will take place along with referential integrity prior to implementation of the EMWM Database.

By June 30th, 2002, the construction of data tables will be complete, with final adjustments to the input forms. Some data has been entered into the EMWM Database, including project information (project name, funding, ...), experiment information (name, methods...), reactor information (type, name/number....).

4.4. Implementation

Initially, the EMWM Database will only be made available to the project managers. Once testing is completed and the current prediction and mitigation data is entered, roll out and training for other users will occur.

5. FUTURE WORK

According to the MN MCC work plan, the EMWM Database project is on schedule for FY 02-03. Once the final adjustments are made to the input forms, a sample set of data will be entered into the database and verification testing will be conducted. Modifications will be made to the database according to the testing results.

Next, data from the current drainage quality prediction experiments will be entered into the database (July 2002 to Jan 2003). Prior to this data entry, some practice with interfacing among software will be needed in order to find the most efficient transfer of data from existing structures to the EMWM Database. Data from the current mitigation experiments will be entered from Jan 2003 to June of 2003. If time permits, applications will be built to run routine queries, calculations, and data tabulation. Also, training of personnel for data entry and manipulation will take place once the drainage quality prediction and mitigation data is entered.

In June of 2003, a final report will be submitted to the Minerals Coordinating Committee.

6. ACKNOWLEDGMENTS

Funding for the EMWM Database project was provided by Minnesota Minerals Coordinating Committee. Participants from the MN DNR Division of Lands and Minerals providing expert advice included: Kim Lapakko, Dave Antonson, Anne Jagunich, Jon Wagner, Jennifer Engstrom, and Paul Eger from the Reclamation section. Dale Cartwright, Perry Canton, Mike Jordan, Jill Bornes, and Larry Swenson provided Information System support. Kim, Dave, and Perry also filled the roles of sponsors, and Dale provided project management support as well as construction of the physical model and input forms.

7. REFERENCES

Advanced Strategies, Inc. 1998. Business Data (Object) Modeling: Emphasizing Entity/Relationship Diagraming. Advanced Strategies, Inc., Atlanta Georgia. p. I-5.

Lapakko, K.A., Antonson, D.A., Leopold, E.M., Berndt, M..E. 2001. Mine Waste Characterization and Drainage Mitigation. Research Summary 2001. MN Department of Natural Resources, Division of Lands and Minerals, St. Paul, MN. 58 p.

Table 1. EMWM Database work plan

MINERALS COORDINATING COMMITTEE
FY 02 - 03 BIENNIAL PROJECT WORK PLANS

Project Name: Environmental Mine Waste Management Data Base				
Proposer: Kim Lapakko			Amount Requested: $46,000/2 yr	
Staff Name	Project Analyst	Anne Jagunich	Dave Antonson	Kim Lapakko
% Time	50	5	5	5

Project Description: During the past 25 years the State of Minnesota has spent in excess of $3 million on research examining the environmentally sound management of mine wastes. Numerous studies have been conducted and reported. Within roughly the last five years, fairly sophisticated data base software has been developed and its application has increased. Development of a data base and entry of existing data will *allow more efficient data management and report production*, ~~not only~~ secure existing and future data, ~~but also~~ *and* increase their value to the MN DNR, the mining industry, and others interested in the environmentally sound management of mine waste.

Project Benefits: The project will benefit the State of Minnesota and the mining industry by ensuring secure storage of data generated over the past 25 years, as well as the utility and accessibility of those data.

Specific Results and Products: By 30 June 2002, the data base will be constructed ~~and data on drainage quality prediction will be entered~~. A status report will be issued at this time. From July 2002 through April 2003, data on *drainage quality prediction and* mitigation *of problematic drainage projects presently in progress* will be entered. A final report describing the contents and application of the data base will be issued at the end of the project.

Action Plan Description (Task List)	Beg. Date	End Date
1. Finalize data base design for drainage quality prediction data	7/1/01	6/30/02
2. Produce interim report	6/1/02	6/30/02
3. Enter prediction data, conduct verification testing	7/1/02	1/1/03
4. Enter mitigation data, conduct verification testing	1/1/03	6/1/03
5. Produce final report	6/1/03	6/30/03

Project Budget: $46,000	Mineral Diversification Funding	Other Funding
Personnel: $43,000	$43,000	0
Travel		
Supplies		
Equipment		
Other (training): $3,000	$3,000	
Other		
Total: $46,000	$46,000	0

Table 2. Time line of EMWM Database tasks (FY 01- FY 02).

Task	# Days to completion	Start date	End date
Planning Meeting	1	8/8/01	8/8/01
Risk Management Meeting	1	8/22/01	8/22/01
Project Definition Meeting	1	8/29/01	8/29/01
Business Data Modeling - ERD	71	10/3/01	1/9/02
Add cardinality to ERD	7	11/1/01	11/7/01
Send ERD to St. Paul IS	1	1/31/02	1/31/02
Revise ERD Documentation	16	1/21/02	2/11/02
Technical Modeling	7	7/15/01	7/23/01
Technical Model Review Period	7	7/23/01	7/31/01
Process Modeling	60	11/9/01	1/31/02
Existing Database - Identify Files	109	10/1/01	2/28/02
Physical Data Model	109	10/1/01	2/28/02
-Existing Database Testing	195	10/1/01	6/28/02
Existing Applications	21	2/19/02	3/19/02
Interface with Systat and MDA database	40	2/4/02	3/29/02
Convert Object Model to Conceptual Model	6	1/15/02	1/22/02
Convert Conceptual Model to Physical Model	14	2/13/02	2/28/02
Choose Software	1	3/2/02	3/2/02
Make Tables	60	1/1/02	3/25/02
Data input and import	86	3/1/02	8/31/02
MCC Interim Report	20	6/3/02	6/28/02

Table 3. Time line of EMWM Database meetings.

Date	Meeting/Activity	Location	Participants	Outcome
8/7/2001	Project Planning Meeting	Hinckley	Reclamation IS Staff	
8/22/2001	Risk Assessment Meeting (small group)	Tele-conference	Reclamation IS Staff	identified risks and determined courses of action
8/29/2001	Project Definition Meeting (large group)	FDLC - Cloquet	Reclamation IS Staff	Project Definition Document
9/19/2001	EMWM Project Update (small group)	Tele-conference	Project Managers IS Staff	project update
10/25/2001	ERD update (small group)	Hibbing	Reclamation	revisions to ERD
10/26/2001	ERD update/prep (small group)	Tele-conference	Project Managers IS Staff	revisions to ERD
10/29/2001	EMWM ERD Meeting (large group)	St. Paul	Reclamation IS Staff	revisions to ERD
11/7/01	EMWM ERD Cardinality (small group)	Hibbing	Reclamation IS Staff	ERD with cardinality
11/29/01	EMWM Project Update (small group)	Hibbing	Project Managers IS Staff	project update and revisions to ERD
12/5/01	EMWM Meeting (small group)	Hibbing	Project Managers Reclamation Staff	follow up with SME's and revisions to ERD

Table 3. Time line of EMWM Database meetings (continued).

Date	Meeting/Activity	Location	Participants	Outcome
1/9/02	EMWM Project Update (small group)	Hibbing	Project Managers IS Staff	project update and final revisions to ERD, convert to DSD
2/13/02	EMWM Project Update (small group)	Hibbing	Project Managers IS Staff	revision's to DSD convert to physical model
3/2/02	EMWM Meeting (large group)	St. Paul	Project Managers IS Staff	follow-up with IS Staff decision on software to use

Figure 1. EMWM Database Business Object Model (ERD)

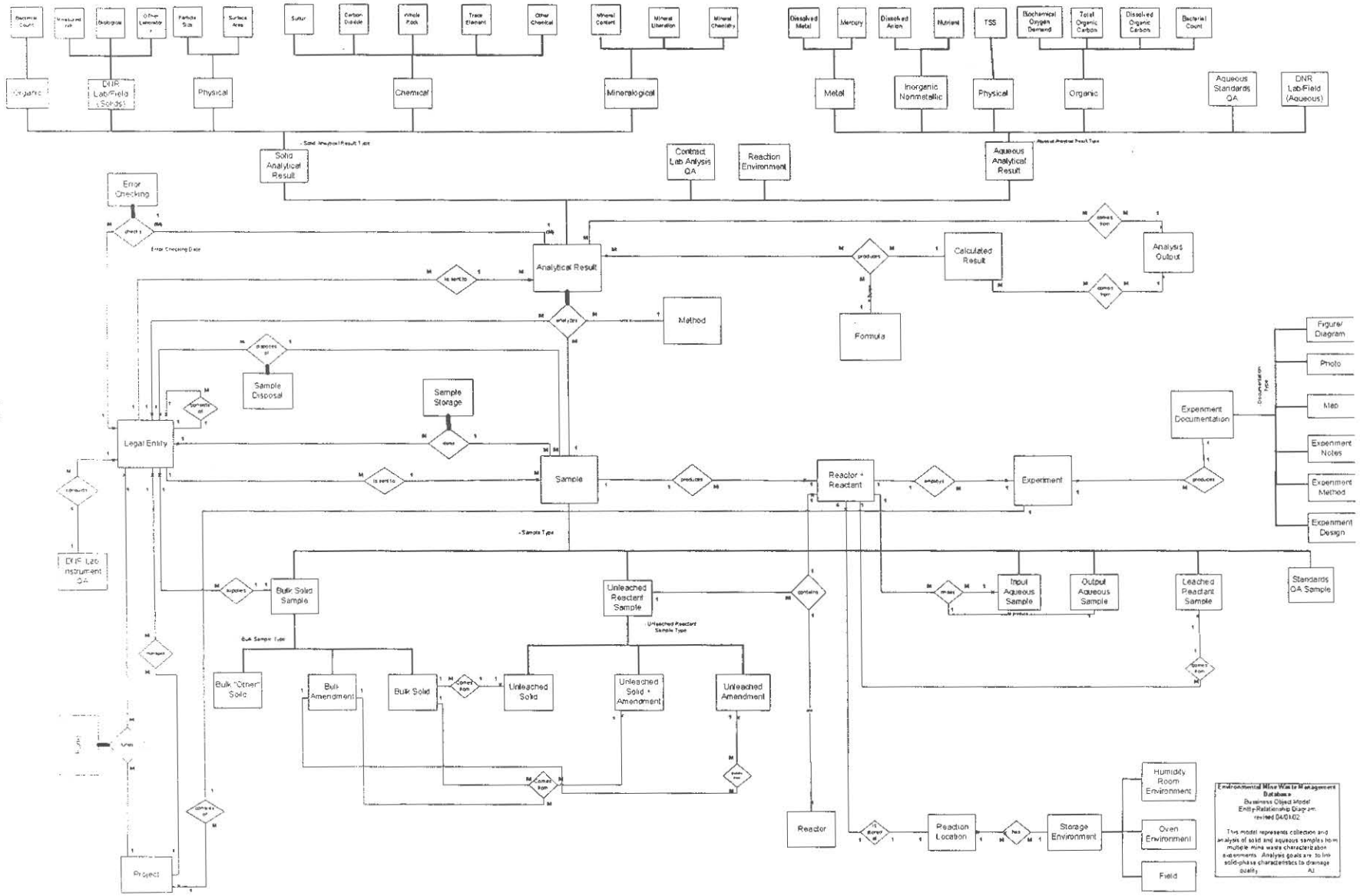


Figure 2. EMWM Database Conceptual/Logical Model (DSD).

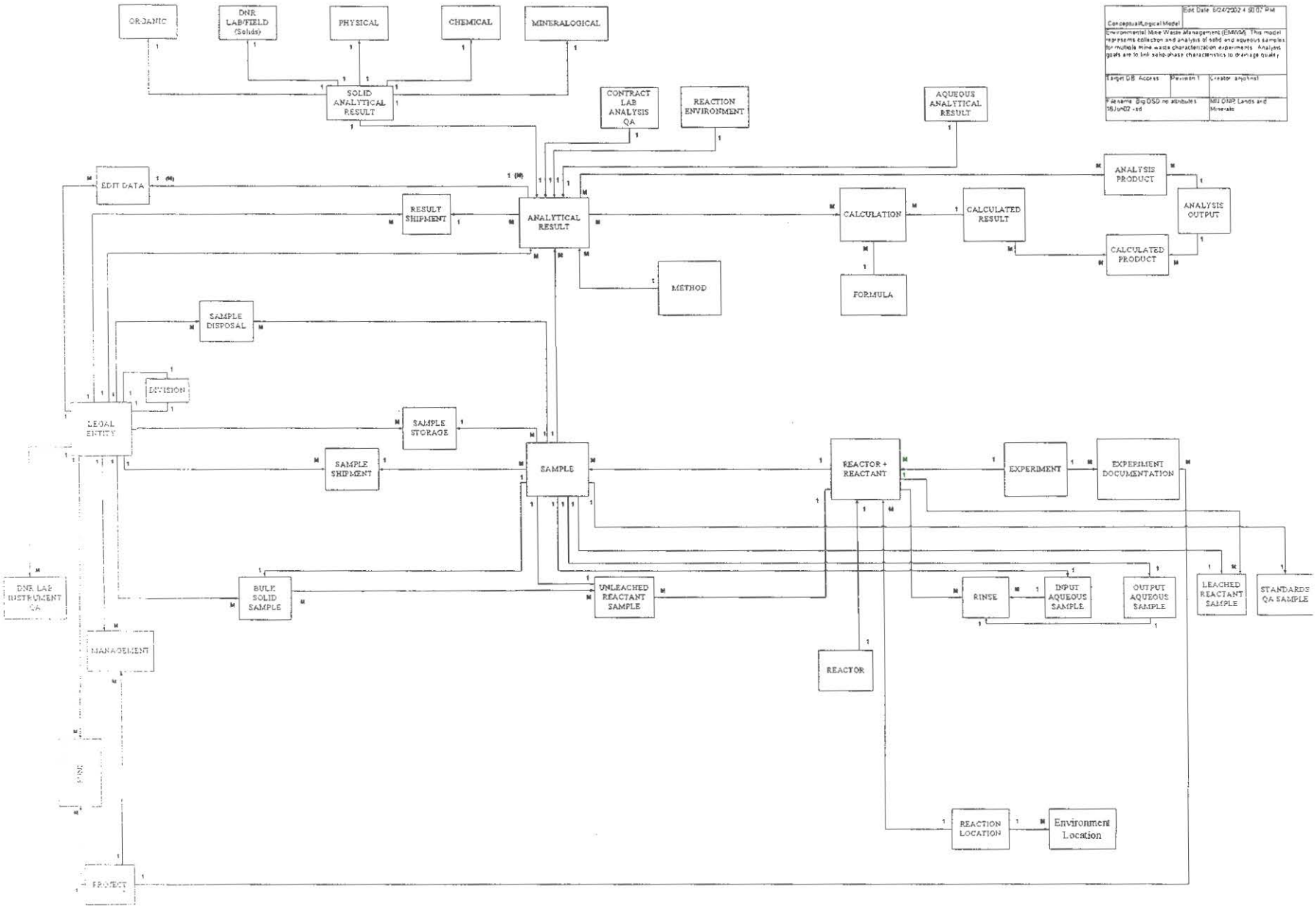
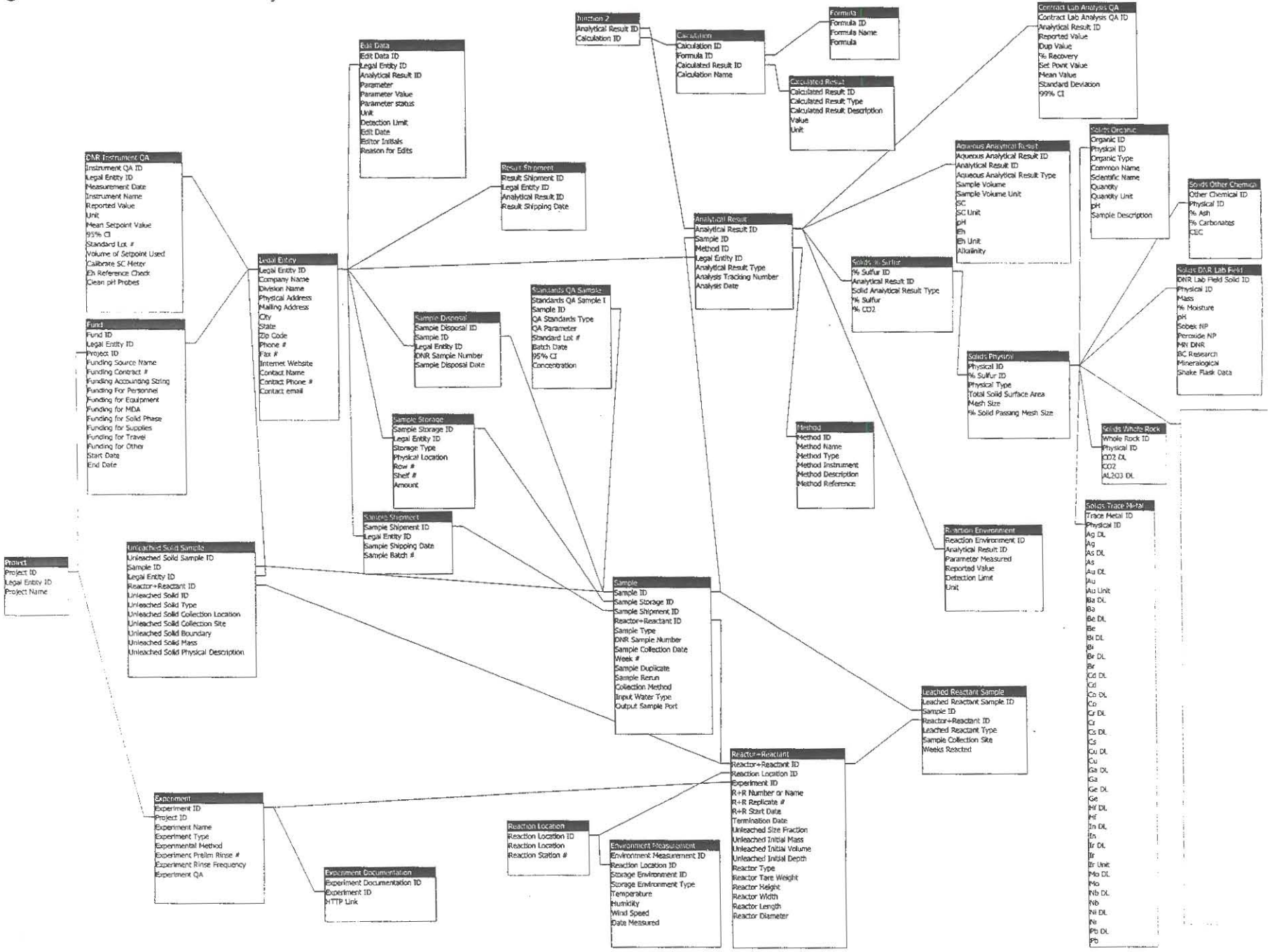


Figure 3. EMWM Database Physical Model



APPENDIX 1

EMWM DATABASE
PROJECT PLANNING MEETING AND DOCUMENTATION

Meeting notes: **Environmental Mine Waste Management Database Planning Mtg**

Date:7 August 2001

Attendees:

Mike Jordan, Jill Bornes, Kat Stafford, Larry Swenson, Perry Canton, Dave Antonson, Anne Jagunich, Dale Cartwright, Andrea Johnson

Agenda:

1. Project Plan
   - Tasks
   - Resources Needed
     - Number of staff involved
     - Hours and Time Line
2. Setup Project Definition Session
   - Attendees
   - Preliminary Discussion on Project
3. Project Lead
   - Responsibilities (Plan , Organize, Control, Lead)
   - Reporting Functions (when and to whom)

Project Plan (revised)

Analysis:

Project Definition:

- Pains
- Pleasures
- Stakeholders
- Hopes
- Intentions
- Consequences of Doing nothing
- Values
- Focus Statement
  - Breadth (includes/postpone/excludes, from/until)
  - Scope of Integration
  - Perspective
  - Detail
  - Universality
  - Elevator Intentions

Business Object Model (Business Driven, User Centric)
- Information Needs (Rules, Policies, Processes, Security Needs)
- ERD (Entities, Relationships, Attributes)
  - Flexible
  - Stable
  - Navigable
  - Capable of answering unanticipated questions (Normalized)

Business Process Modeling
- DFD (Data Flow Diagram)

Event Modeling

Location Analysis

Risk Assessment

Change Management

Existing Data Structures and Applications
- Interface to Systat and Word Processing / Report Generation
- What do you want to do with the data?
- Are there business processes you want to automate?
- Report generator

Design:

Data Base
- Conceptual, Logical, Physical (iterative process) (data naming conventions)

Application
- Import Screens
- Input Screens (views, forms)
- Date entry (domains)
- Screen mock-ups
- Output / Reports (queries, Word merges for reports, etc)
- Data Cleansing Routines (validation, adding values)
- Analysis Routines (repetitive analysis)
- Menus
- Documentation Screens (help)
- Build in Proofing (produce graph to see anomalies)
- Document input rules for data entry (ppm, ppb, <dl, set point blanks)

Construction:
Data Base Selection / Application Tool Selection (needs vs resources)

Code generation

Validation (of code)

Sample data set

Testing of database

Implementation / Rollout:

Installation (Locations, Staff)

Testing

Training

Back-up

Production, Maintenance and Support:
Populate Data Base

Maintenance and compaction

Evaluation / Assessment:

Note: Develop staffing and time frames for the above tasks. Documentation occurs at all phases.

Setup Project Definition Session

To Do List:

1.) Set Date for Project definition meeting (Dale Cartwright)
Write email to attendees (Dale Cartwright)
Plan meeting: location, time, date (Mike Jordan, Jill Bornes, Andrea Johnson)
Prepare project definition forms (Mike Jordan)

2.) Set Date for ERD Validation (Andrea Johnson- following project def mtg & revised ERD)
Prepare summary of existing ERD (Andrea Johnson, Perry Canton)
Prepare entity relationship forms (Andrea Johnson, Perry Canton)
Risk Assessment (Perry Canton)
Attendees: Mike J., Andrea J., Dale C., Dave A., Kim L.

3.) Write-up new Project Plan (Andrea Johnson, Perry Canton)

4.) Get Model from Department of Agriculture.

5.) Give MCC a copy of Project Definition and revised Work Plan Misc.

Dave: check with Marty to see if we have to treat work plan "as is" (one year for prediction and one year for mitigation), or if we can spend more time on design phase including both and mitigation.

Andrea: work on updating ERD and corresponding entity/attribute lists. Also, review data files for computer version, content, units, negative values, less than detection limits. Document....

Future meeting topics, dates and team members

Meeting Topic	**Tentative Date**	
Project Definition	end of Aug., early Sept. 2001	
ERD	mid to end Sept. 2001	
Risk Assessment	end of Aug. 2001	
Existing Data Structure & Applications	Oct. to Dec. 2001	
Design	Model	Construction
Database		
Input Screens		
Import Screens		
Output/Reports		
Analysis		

Roles for Project Definition meeting

SME's: Kim Lapakko, Dave Antonson, Anne Jagunich, Jon Wagner, Jennifer Engstrom, John Folman, Andrea Johnson, Mike Berndt, Paul Eger
Recording Analysts: Perry Canton, Larry Swenson
Facilitators: Mike Jordan, Jill Bornes
Observer: Dale Cartwright
Customers: data output personnel, data input personnel

Project Leads and Roles

Sponsor - Candidates: Kim, Dave, Arlo, Marty, Perry

-someone who has an interest in the project and is willing to go to most of the meetings.
-May end up having a main sponsor and a satellite sponsor
-most likely a manager.
-provides direction
-makes decisions when tradeoffs involved
-controls resources (staff time, etc..)

Project Manager(s) - Dale Cartwright, Andrea Johnson

-make the specific plan
-maintain plan:
    update
    track progress
    make decisions on what happens
-good communication:
    sponsors, team members, clients
-maintain project definition:
    scope and product
    ideas coordinated
-may or may not be responsible for risk management, keep track of risks, make lists/good documentation
-dual role (1 reclamation, 1 IS)
-people report to them about phases of project (diff people may manage tasks)
-person may be a risk if also a developer due to time commitment

Activity/Task Managers

-communicate with people performing tasks and report progress to project manager

Work Roles - to be determined later
Analyst
Developer
Tester
Documenter
SME's (subject matter experts) - Reclamation staff
Coach - informal/advice

Other Discussion topics

- discussed importance of following a method

- discussed setting up a project plan
  allows task to get done in a timely manner
  provides accountability

- agreed that MCC work plan for FY 02 - 03 actually describes two projects:
  1. Formal data repository
  2. Data management tasks

APPENDIX 2

EMWM DATABASE
RISK MANAGEMENT DOCUMENTATION

Environmental Mine Waste Management Database
Risk Management Meeting
August 22, 2001

Attendees: Dale Cartwright, Andrea Johnson, Dave Anstonson, Kim Lapakko, Mike Jordan, Perry Canton

Agenda

1. Risk Management
    1. List each risk
    2. Qualify each risk as to its potential impact and likelihood
    3. Designate a transition indicator for each risk to tell you that the risk is beginning to materialize
    4. Set in advance how you plan to cope with each risk should it begin to materialize
    5. Develop process to discover new risks

2. Risk Containment:
    Discuss nature of the risk, extent of damage, and its likelihood

3. Risk Mitigation:
    Actions you take to reduce the impact of a risk should it materialize

Risk Assessment List

A. 1. Staffing - loss of key staff
    2. impact depends on the staff missing, not likely
    3.desk empty
    4. extend time (revised proposal to MCC), if Dale, replace with someone from St. Paul

B 1. Work priorities change
    2. Andrea's schedule no change, this project high on priority for IS staff
    3. not meeting deadlines of time line
    4. Limit dependencies (inter) work between modules

C. 1. Strike
    2. impact dependent on length of time
    3. no one working
    4. time line pushed back, or cut back on parts of database, focus on design work rather than input forms and views

D. 1. Staff Training
2. should be minimal
3. unfamiliar with database software,
4. set aside time for training

E. 1. Software Change
2. could have large impact
3. loss of software license...
4. keep current on state's decision to change software, have plan for change in

F. 1. Reports or other projects conflicting
2. could have large impact
3. progress slow, not meeting deadlines
4. better time management, delegate responsibilities

G. 1. SME's Availability
2. impact could be large
3. SME's unavailable for meetings, or one-on-one
4. set aside small blocks of time for discussion and testing

H. 1. Change Management
2. could have large impact
3.
4. define what we are building and expectations so no surprises part way through project

I. 1. Excessive Planning
2. could have large impact
3. failing to reach deadlines according to time line
4. good project management to keep on task, prioritize tasks

APPENDIX 3

PROJECT DEFINITION DOCUMENT

Environmental Mine Waste Management Database Project

Project Definition Document

August 2001

Table of Contents

Participants List

Environmental Mine Waste Management:

Initials	Name	Project Definition Role	EMWM Database Project Role
DA	Dave Antonson	Expert	Sponsor
AJA	Anne Jagunich	Expert	
AJO	Andrea Johnson	Expert	Project Manager
KL	Kim Lapakko	Expert	Sponsor
JW	Jon Wagner	Expert	

Support Staff

JB	Jill Bornes	Facilitator	
PC	Perry Canton	Recording Analyst	Sponsor
DC	Dale Cartwright	Observer	Project Manager
MJ	Mike Jordan	Facilitator	
LS	Larry Swenson	Recording Analyst	Developer

Additional EMWM Project-Related Staff Not Attending

PE	Paul Eger		Sponsor
JE	Jennifer Engstrom		
JF	John Folman		

Meeting Objectives

Define the purposes and boundaries of the project

Agree to a common understanding and commitment to what the project is and is not

Deliver a document that will provide:
direction through the project; and,
criteria to determine whether the project is successful.

Wants and Needs

Wants and needs are things we do not do now, cannot do, cannot do well, or could do better Wants and needs are used to help us determine the specific intentions of the project. This was a structured brainstorm activity later related with intentions and evaluated to determine whether the particular items are in or out of scope for the project.

#	Wants & Needs	Source	Intention #	I/O
1	Report formats - have standard reports/graphs where changes and modifications can be kept to a minimum	JW	14	I
2	Produce reports and quality graphs in 1 step (more easily)	AJA	16	I
3	Easily dump raw data into Systat, Quattro or Excel	DA	15	I
4	Easily access tables or data generated by a certain solid, including any analysis or any tests. Easy searching for solid phase data. (Currently in WP)	AJA	16	I
5	Easy way top get historical data into new database from WordPerfect documents and other formats, including paper to digital and software conversion.	AJA	17	I
6	Get Department of Agriculture data into the database electronically. (The conversion routine is in scope for this project, but the Agriculture data is scope of integration for this project.)	DA	15	O
7	Database to efficiently store, tabulate, calculate, and graph data collected.	KL	1	I
8	Easily tabulate data collected (make tables)	KL	1	I
9	Easily calculate data collected	KL	1,2,13	I
10	Easily make graphs from data collected	KL	1,13,11	I

11	Easily retrieve data on Kim's demand	JW	14	I
12	Standard nomenclature for data files, tables, units (ppm), project names	JW	9	I
13	Way to know if data has been checked for errors by parameter documentation, who did the checking, and when	JW	18	I
14	Documentation of written reports contained in the database	AJA	1	I
15	Database and application must incorporate mitigation and historical data	DA	1	I
16	Calculate missing values (averages).	JW	13,11	I
17	Distinguish between calculated and actual data (i.e., ph data measured vs. calculated) (metadata?)	JW	20	I
18	Convert sample dates to linear time scale	JW	13	I
19	Make date/time conversion standardized	JW	9	I
20	Identify detection units/limits for each parameter	JW	21	I
21	Ability to correct "less than" values to determine numeric values. Also unit conversions (ppb, ppm, mg/l...etc.).	KL	21	I
22	Provide appropriate output for BLM and other contractors	KL	15	I
23	Provide training on use of database application such as importing, queries, reports, exporting, structure...	DA	22	I
24	User-friendly applications for data input and output	AJA	15	I
25	Identify customizable formulas.	JW	23	I
26	Custom views of experiments and projects	AJO	24	I
27	Keep track of physical locations of existing samples	KL	1	I
28	How much of a sample is available? Description of samples. Solid phase only.	JW	1	I
29	Track the chain of custody for Ag samples	AJA	1	I
30	Quality assurance information; e.g., department of Ag.	KL, DA, AJA	1	I
31	Checking data (error checking). Data ranges.	KL	19	I
32	Accommodate re-runs	AJA	25	I
33	(Context) Accommodate both aqueous and solid phase data.[This need is now an assumption of the project - both data types will be accommodated within the scope of this project.]	KL	2	I
34	Accommodate anomalous data	All	19,25	I

35	Track, store, and view photos, maps, memos, figures and other images	AJA	1	I
36	Access and print graphics and/or text from a report or experiment or access and print an entire report or experiment.	AJO	26	I
37	Keep information about related documents (Literature reviews and papyrus references)	KL	1	I
38	Backups and data safety	JW	27	I
39	Security - access to database. Transaction tracking?	AJO	27	I
40	Storing metadata	KL	1	I
41	Be able to accurately describe detail information about parameters (ex. digits/characters)	JW	1,9	I
42	Perfect graphing package	AJO	???	I
43	Place to capture lab notes and time line (status and history tracking)	KL	???	I

Don't Change

These are aspects of the current way of doing EMWM work that we would not want to change.

#	Don't Change	Source
1	Dept of Ag does analyses	AJA
2	Like having individual control of data. Not "too many hands in the pot"	JW
3	Specific people can change/edit/check data, but all can view data	JW
4	Freedom to use software of choice	AJO
5	Competent people doing the work (in a timely manner)	KL

Intentions

Intentions are the purposes or reasons that we are doing a project and the results that are expected from the effort. The intentions answer the question of "what" we want an application to do and why we are making this effort but not how it should be done.

The intentions are not sorted in order of priority or any other sequence. They are derived from the wants and needs identified earlier.

#	Intention
1	Create a formal, organized repository for EMWM information, including: reports; metadata; photos; maps; data; text; sample locations; solid sample quantity, literature reviews; papyrus references...etc.
2-8	*Candidate intentions 2-8 were replaced by intention 13 but may be relevant for the purpose of establishing a more detailed understanding...*
2	*Tabulate all necessary tabulations*
3	*Make concentration vs. time graphs*
4	*Calculate cumulative mass release*
5	*Tabulate cumulative mass release/time (covered in (2) above)*
6	*Graph cumulative mass release/time*
7	*Determine release rates (linear regression and averaging)*
8	*Convert rates of release to mineral dissolution*
9	Standardize nomenclature, including time format
10	Provide improved accurate parameter descriptions
11	Calculate missing values
12	Capture Department of Agriculture data easily
13	Easily calculate tabulate graph and summarize statistics for EMWM data (captures items 2-8 above)
14	Standardize design formats for reports; including graphs, tables, etc...
15	Easily import and export data to other software, including exchanges with BLM and Department of Agriculture
16	Easily search and retrieve data on specific solids and other stuff.
17	Import historical data (convert non-electronic paper formats to digital)
18	Document error checking

19	Check data for errors
20	Distinguish between calculated and actual data (is this metadata?? If so, what kind?))
21	Collect, store and convert detection limits
22	Train people to use the database and application
23	(Provide the ability to) Customize formulas for calculation
24	Provide customized views of data
25	Accommodate, identify, document re-runs & anomalous data. Which (identify & document) value will be used for calculations.
26	Print data, analysis, and graphs for reports and store reports. See #1 for information about items contained in reports.
27	Secure and back up the data
28	Look for and find "perfect" graphic ability
29	Create a place for lab notes and time line

Values

Tradeoffs and judgments that guide or balance project results.

#	Values	Source
rank		
1	Ease of use (intuitive)	all
1	Efficiency (minimum clicks)	AJA, JW
1	Time to completion/Delivery for project (usable)	KL
1	Organization/consistency	AJO
* De facto	Accuracy (has to be accomplished)	KL
	Visual quality of output (consistent)	all

Stakeholders

Anyone who may impact or be impacted by this project.

#	Emphasized	Stakeholder	Source
1	X	Us Us Us (Reclamation staff)	
2		Arlo Knoll	
3		Minerals Coordinating Committee	
4		Lands & Minerals Division	
5		Mining Industry	
6		Bureau of Land Management	
7		Environmental Protection Agency	
8		Contractors	

Focus Statement

The focus statement defines the domain of the enterprise (EMWM) that will be the focus, or main concentration, of the project. In this case it consists of 4 parts: breadth, scope of integration, depth and universality.

Breadth: *clarifies the boundaries of the project.*

(From/Until)

#	**Breadth: Our interest extends from...until...**
from	Beginning of current, running experiments and new experiments
until	the end of experiments. Never get rid of the data--possibly archive

(Include/ Exclude)

#	**Breadth: Includes / Excludes**	**Inc/Exc**
1	Includes aqueous and solids	Incl.
2	Includes predictions and mitigation	Incl.
3	Includes laboratory and field data/experiments (not actually in field)	Incl.
4	Includes data already collected	Incl.
5	Excludes electronic monitoring in real-time	Excl.
6	Excludes taconite research (vegetation, in-pit)	Excl.
7	Excludes collection/inclusion of historical raw data	Excl.
8	Includes citations of publications presenting historical data	Incl.

Scope of Integration: *describes other business elements that this project should be compatible with or coordinated with.*

#	Scope of Integration
1	Historical raw data
2	In-Pit disposal - taconite
3	Vegetation data
4	Prediction data from other sources like U of Utah BLM study
5	MDA data - electronic file for input (transfer). We want a disk.

Depth: *Describes how much detail about EMWM must be explored and documented to be able to create the desired products.*

Full Detail - Detail sufficient to implement and use solutions.

Universality: *describes how generic and/or flexible the solution must be. The more generic or flexible the solution, the more rigorous we need to be in gathering requirements.*

#	Universality: Geo-Political	Source
1	Hibbing	
2	St. Paul	
#	**Factors Driving Project/Change**	**Source**
1	Scientific advances	KL
2	Sources of funding	AJA
3	New/Unforseen/Incompatible experiment	KL/AJO/DC
	Time Frame	
	Stable: 2 years	
	Extensible: 5 years	
	Assertable Life Span: 8 years	

Project Context

Context is information that we have gathered about the project that is important to understand and document but does not fit the formal structure of the project definition. Context may describe project constraints like time and budget, background information, candidate solutions, issues that need to be raised or kept in mind as the project proceeds, or information about business processes or events that need to be investigated and documented through formal procedures in later project phases. The context list should be revisited regularly during the course of the project, and may justifiably serve as a stand-alone document or as an addition to planning and tracking documents.

#	Context
1	Dave A. talked to Marty about changes to original project proposal to MCC. Changes include: • creating only one database instead of two, one for mitigation and one for prediction • task list change to work on database in the first year, then applications in the second • clarify that the goal is to capture current and future data, with the idea that historical information may be added later. Marty said these changes sounded reasonable and that we should write up the proposed changes and submit them to MCC. A modified version of the project definition document may be what is sent to MCC.
2	Keep in mind that the project definition can change down the road. The important thing is to know whether it is a change. (MJ)
3	Jon W. asked whether the project purpose is to develop something that is for use by the division or for use by outside clients. Everyone agreed that the database and applications will be used by the division to help create reports.
4	It is not reasonable to have a standard format for all reports. Written reports need text, graphs and tables. (JW)
5	Department of Agriculture is creating data that needs to go into this project's database.
6	(?) Will probably want to know which data has been checked for errors, which is anomalous by parameter, and who did the checking.
7	Need to come up with what is historical data, what data will go into this [system]. Has not been decided.
8	Keep in mind how much can be accomplished in two years and what the trade offs might be.
9	May want climate data from other sources.
10	Right now people have to manually convert PPM (parts per million) to PPB (parts per billion) from Department of Ag.
11	Because of department conversion to Microsoft Office, should convert current Quattro Pro files to Excel and Word Perfect to Word.
12	Applications should report back what is used to calculate output.

13	One situation to deal with will be conversion/dumping Systat files into a database and getting data from database into Systat.
14	Want to retain values of both original and re-run data.
15	(?) Solid phase descriptors. Relationship between the aqueous and solids used in tests.
16	Want to have photos, maps, memos, figures, drawings, etc. stored in database. Should be retrievable for reports and presentations.
17	Whoever makes corrections to data set has to know status of data set.
18	Only certain people can (and should be able to) enter data.
19	Want to be able to accurately describe what the parameter is. Move into Systat.
20	When referring to calculations or database, we are referring to both aqueous and solid phase.
21	There is uncertainty about which graphing packages are available and how they can be used with the new system/database.
22	Want minimum clicks to move between screens.
23	Scope of integration does not mean developing an interface or connection.
24	This application is not being used for getting money from stakeholders.
25	Use a small data set to verify and test applications

WorkWork Schedule (Agenda)
EMWM Project Definition
8/29/2001

Time	Task
9:30	Sit; Introductory Comments
9:35	Sponsor Comments
9:40	Project Briefing
9:45	Meeting Objectives
9:50	Introductions/Tasks
10:00	EMWM Needs
10:30	Break
10:40	EMWM Needs Continued
11:20	Pleasures with the Current Way of Doing Things/Don't Change
11:30	Lunch
12:30	Intentions/Confirm Intentions
1:15	Values/Tradeoffs
1:30	Breadth (Includes/Excludes, From/To)
1:55	Depth
2:00	Break
2:10	Scope of Integration (Other Business Systems or Initiatives)
2:20	Stakeholders
2:30	Universality (Geographic-Factors Driving Change-Time Frame)
2:40	Confirm EMWM Needs/Intentions: In or Out of Scope
3:10	Review Meeting Objectives
3:20	Next Tasks
	Debrief