

## **GIS Approach**

### ***Task 1 – Data Conversion***

Dames & Moore will compile and completely inventory all source data involved in this project. This will consist of at least the following sources and formats of data:

- Microsoft Access database for North Carolina existing upland disposal sites locations
- Microsoft Access database for range and tangent locations
- Microstation CADD files of the AIWW Ranges and Tangents outlines and locations
- Microstation CADD files indicating the point location and ID# of dredged disposal sites
- Microstation CADD files indicating beach disposal areas
- Microstation CADD files indicating other navigation projects to be included in the GIS.
- Microstation CADD files indicating offshore disposal areas.
- Map foundation provided by USACE in GIS-ready format
- Aerial Photography in the form of DOQQs to be provided by USACE or acquired on behalf of USACE at additional cost.

Dames & Moore anticipates acquiring additional data in support of this project, although we have not yet determined the specific data needs of this project at this time. Once we have collected all of the relevant data, Dames & Moore will proceed with standardizing and integrating the data for use in the analysis, mapping and scenario building for the project.

### **Data Processing & Standardization**

Each data layer will be imported in the ESRI GIS platform, and registered to the correct coordinate system, projection and horizontal and vertical datum. A QA/QC check of each data layer will ensure that each GIS data layer exactly overlays the others. In order to accomplish this, Dames & Moore will work with the Wilmington District to establish a source document matrix and precedence, so that Dames & Moore can confidently control the quality, accuracy and resulting analysis from the data sources. Once all of the data has been re-projected, registered, and correctly overlain, a data dictionary and metadatabase will be compiled to indicate the process and procedures, and sequence that this task was undertaken. This is important for two reasons a) it is a requirement that this data meet the National Standards for metadata, and since the Wilmington District is going to receive this application interface and maintain all the source data in its respective digital environment (ie. Microstation, MS Access, etc.) then the operational procedures for incorporating and integrating this data into the common GIS

### ***Task 2 – Database Development***

Dames & Moore will process the existing MS Access database and convert them into the Oracle database schema developed by the Wilmington District. This effort is anticipated to be a one-time effort, that once the data from all the sources have been migrated into Oracle, that there will be no expectation to have dynamic, two-way data editing or updating. The original source and the GIS data will be mutually exclusive in their editing and maintenance environments. It is assumed that Dames & Moore will utilize the Wilmington District's Oracle licence on a single project basis.

### **Database Analysis**

The current databases and their respective entity relationships, logical construction will be analyzed and evaluated against current standards such as Oracle, ESRI, FGDC & TSSDS. Any noncompliances will be remedied prior to consolidation and integration within the target Oracle platform and table structure.

### **Database Design**

Dames & Moore will then proceed to build detailed entity relationship diagrams to create the logical and function database designs. This includes the intra and inter-database relationships, and the relationships to the Graphical User Interfaces (GUI) of the GIS and database update screens. Active, live links from the database to the GIS interface will be designed to ensure real-time information is displayed and is available for the users.

### **GIS & Database Interface**

An interactive, customizable database interface will be developed in conjunction with the Wilmington District to ensure that the user requirements and needs are satisfied in the tool. This interface will allow the user to define what information they would like displayed in the GIS, as well as being able to enter new information and edit existing information in a common, user-friendly, intelligent interface. Dames & Moore will build this customized interface in the ArcView GIS environment, and create an extension, as well as customized, pre-determined maps for Wilmington District to begin using immediately upon receipt of delivery

### **Database Population**

Concurrently, Dames & Moore will begin the process of populating and verifying the database contents. This is a critical step in the process, and will require Wilmington District involvement to ensure that the data integrity is satisfactory, and that the results are acceptable. Once the database is populated, this initial phase will not need to be repeated, because the design will then take over as "active" links to the database. Once the system is "live" then the Oracle database and the GIS will work together to maintain the data integrity and data relevance to the individual users.

### ***Task 3 - Building the Base Map***

Dames & Moore will also build a series of GIS-based foundation maps and coverages to begin creating the links to the database as well as provide a basis for any analysis that is to be completed in a spatial context. This includes integrating the DRGs, creating the various point, line and area coverages, populating their respective databases, and ensuring the topology and data integrity is maintained, and that all data is correctly placed in geographic space. This data will be completely integrated into the GIS, and will then be used to help construct the GIS interface and database interface.

### ***Task 4 – Implementation of Standards***

In order to complete the overall project successfully, and provide the Wilmington District with a tool for use in the future, Dames & Moore will document to the extent possible all metadata regarding the information included in the GIS, and we will deliver that to the Wilmington District on an ongoing basis for review and comment, and at the close of the project. These items will include reviewing the data standards of the source data, Federal requirements, QA/QC procedures, and establishing a process for updating, entering, and editing metadata as new or existing data is created or modified. This information will be provided in a searchable database that can be deployed via an internet web browser, or simply on a normal PC client. The standards and processes that are developed as part of this project will be transferred to the Wilmington District at the close of the project.

Description of Services  
for  
Development of Geographic Information System  
for that Portion of Atlantic Intracoastal Waterway  
Managed by the Wilmington District, U.S. Army Corps of Engineers

1. Introduction: The project information found in this Description of Services is adapted from the report entitled: Initial Phase Study, Dredged Material Management Plan, Atlantic Intracoastal Waterway, dated December 1999, which was prepared by the Wilmington District U.S. Army Corps of Engineers. This report presents a series of recommendations and implementation strategies for an integrated Dredged Disposal Management Program for the AIWW. The AIWW GIS which will be developed as part of this contract is a critical part of the overall Dredged Material Management Program for the AIWW. In order to understand the complexities of the AIWW and be able to adequately develop a GIS it is necessary understand how the AIWW is managed and operated. The following paragraphs provides a summary of this operation. Further information on the project can be found in the above referenced Management Plan.

A. General Project Information:

(1) The Atlantic Intracoastal Waterway (AIWW) is an important inland navigation route from Norfolk, Virginia to the St. Johns River, Florida. Located roughly parallel to the Atlantic coast, it passes through coastal sounds, estuaries, and marshes. The North Carolina portion of the project provides the state's only north-south commercial navigation thoroughfare, and numerous connecting channels provide access to the Atlantic Ocean through 12 Federally-maintained inlets. The AIWW is utilized by local navigation interests as well as commercial and recreational traffic traveling between Florida and the northeastern United States. Continued viability of the project depends upon channel maintenance to assure that the project depth and width are adequate for safe and efficient navigation on a year-round basis. This maintenance is accomplished through periodic dredging to remove shoals which form in the channel.

(2) The development and maintenance of navigation projects are priority missions of the Corps of Engineers, and these missions contribute directly to national economic development. Effective accomplishment of these missions usually requires dredging to achieve navigable project dimensions sufficient to meet the needs of water transportation. The associated management of dredged material is, therefore, also a priority mission. Each existing and proposed navigation project must have a dredged material management plan that ensures warranted and environmentally acceptable maintenance of the project, and all federally maintained navigation projects must demonstrate sufficient dredged material disposal capacity for a minimum of 20 years.

(3) Corps of Engineers policy requires that the disposal of dredged material associated with the construction or maintenance dredging of navigation projects be accomplished

in the least costly manner that is consistent with sound engineering practice and that meets all Federal environmental standards.

(4) Management of the AIWW is very complex due to its 308-mile length, its variable physical and biological characteristics, its environmental and economic sensitivity to timing of operation and maintenance activities, the large and diverse population affected by its use and maintenance, and the high costs of maintenance in the face of continuous budget reductions. Effective and efficient operation and maintenance requires consideration of a diverse array of issues such as prediction of dredging needs, declining disposal capacity, protection of real estate easements, esthetic criteria for disposal sites, disposal area management, and the environmental impacts of dredging and disposal.

#### B. Description of the Portion of the Waterway Managed by the Wilmington District

(1) The portion of the AIWW project operated and managed by the Wilmington District of the USACE extends from the North Carolina-Virginia state line to Little River Inlet, South Carolina and spans 308 miles. The authorized project provides for a waterway 12 feet deep, with widths varying from 90 feet in land cuts to 300 feet in open waters. Other features related to the project are nine side channels with associated mooring and turning basins, five bridges, and various inlets with paired jetties located at one inlet. Construction of the main channel occurred from 1918 to 1940 and involved the removal of approximately 69.7 million cubic yards of dredged material.

(2) The AIWW in North Carolina is comprised of three major reaches, which are subdivided into sections. The sections are further subdivided into units called ranges or tangents, depending upon location. The project includes a total of 153 such units. The northernmost project reach extends from the Virginia state line to Beaufort, North Carolina, and is 171 miles long. This reach traverses Albemarle and Pamlico Sounds as well as three major land cuts; the North Carolina Cut, the Alligator River-Pungo River Canal, and the Adams Creek-Core Creek Canal. The second major reach extends from Beaufort to the Cape Fear River, and is 104 miles long. It includes one major land cut at Snow's Cut. The third major reach is 33 miles long and extends from the Cape Fear River to Little River Inlet at the South Carolina state line. This southernmost reach is not divided into sections, due to its short length, but is divided into tangents. This reach includes one land cut at tangents 4 and 5 in the area known as Yellow Banks. The two southern reaches generally parallel the Atlantic Ocean shoreline and are separated from it by barrier islands that are interrupted by a number of inlets which connect the AIWW with the ocean.

#### C. Description of Dredged Disposal Areas Associated with the AIWW

(1) The accumulation of sediment in the AIWW results in the formation of shoals that reduce its depth and/or width causing conditions which may impair safe and economic navigation. For this reason, periodic maintenance dredging is required to restore the authorized dimensions of the waterway. Construction and early maintenance of the AIWW were accomplished primarily with hydraulic pipeline dredges which discharged sediments into open water, into adjacent wetlands, or at upland sites adjacent to the channel. Over time, the resulting disposal areas along the AIWW in North Carolina numbered more than 300. After the National Environmental Policy Act of 1969, concerns over the adverse impacts of dredged material disposal led to the use of diked disposal sites, now called confined disposal facilities or CDFs, as the disposal method of choice. Confinement of dredged material within earthwork dikes facilitates the settlement of solids from the dredging slurry which greatly improves the quality of the effluent released. This, in turn, substantially reduces the adverse impacts of sedimentation on the estuarine environment. The early unconfined sites are no longer actively used for disposal, and today they remain as small islands or estuarine tidal flats. Currently, most dredged material disposal along the AIWW is dependent upon beach disposal, as a beneficial use, and the utilization of approximately 87 active CDFs. Additionally, smaller amounts of dredged material are used beneficially for marsh creation and restoration of colonial waterbird habitat on unconfined disposal islands.

(2) Shoaling problems in the AIWW are most prevalent near ocean inlets and at channel bends. These areas may require maintenance dredging annually, while other reaches less prone to shoaling are dredged less frequently. Due to the presence of 17 connecting ocean inlets, the portion of the AIWW south of Beaufort experiences the heaviest shoaling in North Carolina and accounts for about 90% of the maintenance dredging of the project. The portion of the AIWW north of Beaufort represents over half of its length in North Carolina but requires only about 10% of its maintenance dredging. Its low shoaling rate is due, at least partly, to its location miles inland from the coast and distant from ocean inlets. In addition, this portion includes two areas covering over 50 miles which have never needed dredging because natural water depths satisfy project depth requirements

D. Information regarding the AIWW is extensive, due to its 60+ year history and its large size and complexity. It extends over 300 linear miles; involves more than 20,000 acres of real estate; and has more than 150 geographic segments and more than 300 disposal areas. Its physical and biological characteristics are diverse. Its continual management for navigation requires periodic bathymetric and topographic surveys, updates of aerial photography, and disposal area repairs, as well as annual contract dredging at numerous locations. In addition, environmental compliance documents must be periodically updated to reflect significant modifications in O&M procedures and/or locations. Records are kept regarding details on all these topics. Efficient retrieval of records for inspection and analysis has become an overwhelming task. For this reason, it has become extremely important that data be collected

Description of Services for Development of Geographic Information System for that Portion of Atlantic Intracoastal Waterway Managed by the Wilmington District, U.S. Army Corps of Engineers

and compiled in standardized formats that can be stored and retrieved by computers through database software. Proceeding one step further, linking data to geographic references can make it far more useful. Therefore, computerized data management and the establishment of a Geographic Information System (GIS) for the AIWW have become high priorities for the Wilmington District. These technological improvements are currently being integrated into our office processes.

## 2. Information Provided to the Contractor

A. Microsoft Access® Database (*DISPOSAL.MDB*) which contains information for all known North Carolina AIWW upland disposal sites, both confined and unconfined, and their locations. This data includes information about 314 sites, including all 87 presently active sites, 3 future CDFs in locations which currently have no confined disposal capacity, and all the remnant sites from the days of unconfined disposal. The 224 remaining sites have been categorized as either having potential for development as CDFs or as having no potential for such use, due to their configuration, extent of wetland coverage, extremely small size, or isolated location. It is estimated that 78 remaining sites are potentially usable while 146 sites are not. Development of the 78 sites would entail various levels of cost and difficulty due to physical conditions at the sites as well as the presence of adjacent wetlands which would require mitigation if damaged. This information also contains the coordinate information for the central point of the disposal areas.

B. Microsoft Access® Database (*TANGENTS.MDB*) which contains information about the range and tangents locations including Reach Name, Section Name and Range and Tangent Numbers and a Geographic Code Number.

C. Microstation® CADD maps showing the location and outline of the AIWW Ranges and Tangents.

D. Microstation® CADD maps showing the center point location and identification number of the Dredged Disposal Sites.

E. Microstation® CADD maps showing Beach Disposal Areas

F. Microstation® CADD maps showing Other Navigation Projects which the Wilmington District wants included in the GIS.

G. Microstation® CADD maps showing Off shore Disposal Areas which the Wilmington District wants included in the GIS.

### 3. Implementation Parameters

A. Development of a Wilmington District Corporate Database: The Wilmington District is in the process of developing a District-wide Corporate Database. Different Offices in the District perform operations on projects and need to communicate information about the project to other offices. Better interoperability among software used by different District business processes is required. Interoperability is defined as the ability of software to output information in a format that can be used by other types of software without the loss of relevant information. Since information about these projects must also be available on an ad hoc basis, the project information must be stored in a format and place that can be readily accessed by District personnel using ordinary office software. Additionally, the corporate database resulting from this business information constitutes an important District asset that must be protected and managed carefully.

The District-wide Corporate Database is being implemented concurrently with this project. It is intended that this Corporate Database will use Oracle ® with ARC/SDE® 8 to establish an instance of a common database, to run on the Oracle® server in the District Headquarters after completion of the lab development work. The approach to populate this common database will use ARC/Info® 8 with ARC/SDE® 8 to create and manage a geodatabase. The pilot implementation will be programmed in Visual Basic to provide easily accessible user interfacing for common data input and query tasks. More complex tasks such as spatial analysis will be performed in ArcInfo® 8 directly.

B. AIWW GIS Interface with Existing Data: It is intended that the AIWW GIS will be used by an interdisciplinary team of individuals who are responsible for the various aspects of management of the AIWW. Data will be accessed by geographic location (coordinate pairs) or by AIWW features (tangent and range numbers and disposal area numbers). It is intended that data currently being collected electronically will continue to be collected using the same method and programs that are currently being used, with minimal changes. This means that data from a variety sources and from various database and spreadsheet programs must be compatible for use in the system. Currently data is being produced in Microsoft Excel 97® spreadsheets, Microsoft Access 97® databases, Microstation 95® CADD drawings, ARC/View® 3.01 Shape files, ARC/Info® 7.0 Coverages, and Dbase® databases. Implementation of the AIWW GIS will not involve changing the way people currently electronically track their data. However, individuals who currently track data by hand will be encouraged to track their data electronically using Microsoft Access® or Microsoft Excel®, as appropriate. Access directly to the GIS until the District upgrades to ARC/Info® 8 and ARC/View® 3.2 will be accomplished using ARC/Info® 7.00 based on Windows NT® 4.00 and ARC/View® 3.01 GIS software. It is intended that the primary mechanism for accessing data will be using the AIWW features (tangent and range numbers, disposal area numbers, and milemarkers).

Description of Services for Development of Geographic Information System for that Portion of Atlantic Intracoastal Waterway Managed by the Wilmington District, U.S. Army Corps of Engineers

C. AIWW GIS Interface with the Corporate Database: Mapping produced under this contract shall be completed in ARC/Info® 8, or in a format that can be easily used by ARC/Info® 8. Attribute tables will be produced in Oracle® 8. or in a format that can be easily used by Oracle® 8.

D. Horizontal Datum and Coordinate System: The required datum for all geographic coding and mapping will be the North American Datum 1983 (NAD 83). The coordinate system to be used for this work is North Carolina State Plane Coordinate System..

E. Vertical Control: Local Dredging Datum is used for hydrographic data. National Geodetic Vertical Datum 1929 (NGVD 29) is used for upland disposal areas.

F. Units of Measure: The primary units of measure for the AIWW GIS will be United States Measurement Units (miles, feet, tenths of feet, etc.), however attributes tables will contain fields for metric system measurement units (kilometers, meters, centimeters, etc) and will have the ability to convert United States Units to their metric equivalents.

G. Levels of Accuracy: All mapping will be done at a scale equal to or larger than 1:24,000.

4. Request for Proposals: The contractor shall prepare a technical proposal for this work which will describe in detail the methods which are to be used to accomplish the work. The contractor shall also describe the proposed deviations from this scope of work which may result in a more efficient or more usable end product.

5. Partnering: Completion of the AIWW GIS will be a complex and evolving process that will require constant communication between the contractor and the Government. In order to most effectively accomplish this work, the Government is willing to form a cohesive partnership with the Contractor. This partnership would strive to draw on the strengths of each organization in an effort to achieve a quality project done right the first time, within budget and on schedule. This partnership would be bilateral in make-up, and participation would be totally voluntary.

## 6. Description of Services

A. The contractor shall build a base map for the AIWW which includes the following information:

Description of Services for Development of Geographic Information System for that Portion of Atlantic Intracoastal Waterway Managed by the Wilmington District, U.S. Army Corps of Engineers

(1) Centerline of the entire AIWW from the Virginia/North Carolina border to the North Carolina/South Carolina border (Little River, South Carolina) (including approved side channels)

(2) Polygon coverages representing the Channel Prisms of the AIWW Channel

(3) Point Coverage representing the milemarkers on the AIWW.

(4) Point Coverage representing the center point location of all dredged disposal areas both active and inactive identified by the New Disposal Area Numbers found in Table 4 of the Dredged Disposal Management Plan, Atlantic Intracoastal Waterway.

(5) Polygon coverages representing all of the active and potentially active upland dredged disposal areas identified by the New Disposal Area Numbers found in Table 4 of the Dredged Material Management Plan, Atlantic Intracoastal Waterway and beach disposal areas. These polygons should be constructed using information from the latest aerial photography available or as built drawings, if available

(6) Polygons representing other authorized Federal Navigation Projects managed by the Wilmington District (Government Provided list of projects)

(7) A base map of the entire study area which will be used as the "cookie cutter" for clipping statewide and regional databases. The coastal boundary of this map will extend for fifteen miles offshore. The western boundary shall be the aggregate of the westernmost county lines of the following list of counties. This map will include all of the following counties

(8) Polygon representing the Counties found in Table 2

Table 2 List of Counties Included in the Study Area

Beaufort	Bladen	Brunswick	Camden	Carteret
Craven	Currituck	Columbus	Dare	Duplin
Hyde	Jones	New Hanover	Onslow	Pamlico
Pasquotank	Pender	Perquimans	Tyrrell	Washington

(9) USGS 7 1/2 Minute Quadrangle Maps (\*.DRG) clipped files contractor provided for use as a background for all study area mapping required under the terms of paragraph 6A(8) above.

Description of Services for Development of Geographic Information System for that Portion of Atlantic Intracoastal Waterway Managed by the Wilmington District, U.S. Army Corps of Engineers

(10) Aerial Photography of the AIWW channel will be provided for uses as a background.

B. Attribute tables for the following coverages:

(1) AIWW Channel Centerlines Coverage

(2) AIWW Milemarker Point Coverage

(3) AIWW Channel Prisms Coverage, using ranges and tangents of the AIWW, as identified by the **RTC\_CODE** found in the *TANGENTS.MDB* database (paragraph 2A above).

(4) AIWW Disposal Area Point Coverage, using the **DA\_CODE** found in the *DISPOSAL.MDB* database (paragraph 2A above).

(5) AIWW Active and Potentially Active Disposal Area Polygon Coverage, using the **DA\_CODE** found in the *DISPOSAL.MDB* database (paragraph 2A above).

7. Deliverables: All work under the terms of this contract must be accomplished and submitted in final form to the Wilmington District not later than July 1, 2000. Draft copies of all work need to be submitted for review and comment by June 1, 2000.

8. Points of Contact:

A. GIS Information: Richard H. Lewis, (910) 251-4755

B. CADD Information: Jim Jacaruso (910) 251-4064

Description of Services for Development of Geographic Information System for that Portion of Atlantic Intracoastal Waterway Managed by the Wilmington District, U.S. Army Corps of Engineers

### Appendix A: Range/Tangent/Channel Code (RTC\_Code)

**Range/Tangent/Channel Code (RTC\_Code):** It is proposed that this code be composed of three alpha characters representing the project followed by, four number designator representing the channel number. For the AIWW this number would be based on the Geo Code column of Table 3 of the DMMP. The currently used reach, section and tangent numbers found in this table will be retained as aliases for the RTC\_Code. The project name code is proposed as follows:

<b>Project</b>	<b>Code</b>
(1) Atlantic Intracoastal Waterway	AIW
(2) Morehead City Harbor	MCH
(3) Wilmington Harbor	WHB
(4) Manteo-Shallowbag Bay	MSB

**Examples:**

**EXAMPLE 1:** The AIWW Virginia - Beaufort Reach, Alligator - Pungo Land Cut Range 1: would be represented by **RTC\_Code: AIW\_0041**

**EXAMPLE 2:** The AIWW Virginia - Beaufort Reach, Adams - Core Creek Cut Section, Range C: would be represented by **RTC\_Code: AIW\_0061**

**EXAMPLE 3:** The AIWW Beaufort - Cape Fear River Reach, Section V, Tangent 4a: would be represented by **RTC\_Code: AIW\_0118**

**EXAMPLE 4:** The AIWW Cape Fear River - South Carolina Reach, Tangent 1: would be represented by **RTC\_Code: AIW\_0124**

Description of Services for Development of Geographic Information System for that Portion of Atlantic Intracoastal Waterway Managed by the Wilmington District, U.S. Army Corps of Engineers

**Appendix B: Disposal Area Code (DA\_Code)**

**Disposal Area Code (DA\_Code):** It is proposed that this code be composed of three alpha characters representing the project followed by a one Alpha character code describing the disposal area type followed by a four number designator representing the disposal area number. For the AIWW, this number would be based on the New Disposal Area Number column of Table 4 of the DMMP. The currently used "old" disposal area numbers found in this table will be retained as an alias for the new numbers. The project name code is proposed as follows:

<b>Project</b>	<b>Code</b>
(1) Atlantic Intracoastal Waterway	AIW
(2) Morehead City Harbor	MCH
(3) Wilmington Harbor	WHB
(4) Manteo-Shallowbag Bay	MSB

The disposal type code is proposed as follows:

<b>Disposal Type</b>	<b>Code</b>
(1) Beach	B
(2) Control of Effluent	C
(3) Littoral Zone	L
(4) Ocean Dumping	O
(5) Upland	U
(6) Miscellaneous/Other	M

Examples:

**EXAMPLE 1:** The AIWW Virginia - Beaufort Reach, North Landing R. Section, Range 3, DA 270 would be represented by **DA\_Code: AIW\_U\_0001**

**EXAMPLE 2:** The AIWW Beaufort - Cape Fear River Reach, Section I, Tangent AA DA 246: would be represented by **DA\_Code: AIW\_U\_0036**

**EXAMPLE 3:** The AIWW Cape Fear River - South Carolina Reach, Tangent 1: DA25E would be represented by **DA\_Code: AIW\_U\_0281**

**EXAMPLE 4** Wilmington Harbor Ocean Dredged Material Disposal Site (ODMDS)

Would be represented by **DA\_Code: WHB\_O\_0001**

## GIS COVERAGES

## ORACLE DATABASE TABLES

**CHANNEL (ArcInfo Polygon)**  
 @RTC\_CODE (Primary Key)

Fk- For Archinfo coverages this is the Primary Key. The Archinfo coverage can be linked to any Oracle table that contains an RTC\_CODE.

*MAP*

**CH\_LOCATION**  
 @RTCCODE  
 @REACH\_CODE  
 @SECTION  
 @CHANNEL  
 @LANDMARK

1: Many

Many:1

**CH\_SURVEY\_EVENT**  
 @RTC\_CODE  
 @CH\_SURVEY\_EVENT\_ID  
 @SURVEY\_VESSEL  
 @DATE\_SURVEY  
 @VOLUME  
 @RSURFILE  
 @DGN  
 @MIN  
 @RIS  
 @MARK

1: Many

Fk- For Archinfo coverages this is the Primary Key. The Archinfo coverages can be linked to any Oracle table that contains a DA\_CODE.

**INACTIVE\_DA (ArcInfo Point)**  
 @DA\_CODE (Primary Key)

**ACTIVE\_DA (ArcInfo Polygon)**  
 @DA\_CODE (Primary Key)

**BEACH\_DA (ArcInfo Line)**  
 @DA\_CODE (Primary Key)

**DA\_LOCATION**  
 @DA\_CODE  
 @NEW\_DA\_NUM  
 @OLD\_DA\_NUM  
 @COUNTRY  
 @REACH  
 @SECTION  
 @LANDMARK  
 @HESUMMER

1:1

1:1

1:1

**CH\_DREDGE\_EVENT**  
 @EVENT\_EVENT\_ID  
 @DATE\_CODE  
 @DRE\_NAME  
 @DATE\_COMPLETE  
 @NUM\_DAYS  
 @EXTRACTION  
 @DPS\_CODE

Many:1

1: Many (RTC\_CODE:ORIGIN\_RTCCODE)

**CH\_DREDGE\_VESSEL**  
 @DRIG\_NAME  
 @DRIG\_OWNER  
 @DRIG\_TYPE  
 @RAMP\_HP  
 @DISCHARGE  
 @BUDGET\_CAP  
 @HOPPER\_CAP  
 @MAX\_DRIG\_DEPTH  
 @MIN\_DRIG\_DEPTH

1: Many

**DA\_DISPOSAL\_EVENT**  
 @DISP\_EVENT\_ID  
 @ORIGIN\_RTC\_CODE  
 @DRIG\_NAME  
 @DA\_CODE  
 @CY  
 @DATE  
 @ORIGIN\_DA\_CODE

1: Many (DA\_CODE:DA\_CODE)

1: Many (DA\_CODE:ORIGIN\_DA\_CODE)

**DA\_SURVEY\_EVENT**  
 @DA\_CODE  
 @DA\_SURVEY\_EVENT\_ID  
 @SURVEY  
 @DATE\_SURVEY  
 @SURF\_CAP  
 @DASURL\_FILE  
 @DTM\_FILE

1: Many

PK- Primary Key - The Unique Identifying Key for every record in a table. This cannot be a null(empty) value.  
 FK-Foreign Key - Identifying Key in the Child Table that references the corresponding Primary Key in a Parent Table.  
 Parent Table - The table that contains the Primary Key.  
 Child Table - The table(s) that contain the Foreign Key.  
 Cascade Delete - If a record containing a Primary Key has been deleted in the Parent Table, then corresponding records in the Child Tables containing referenced Foreign Keys will also be deleted.

Referential Integrity - When a common field relates two tables, we define a PRIMARY KEY constraint on the field in the Parent Table, and define a FOREIGN KEY constraint on the field in the Child Table to maintain the validity of the relationship between the two tables. In the USACE GIS database design, this implies that a record cannot be entered in a Child Table if the FOREIGN KEY does not already exist as a PRIMARY KEY in the Parent Table. Also a PRIMARY KEY in a Parent Table cannot be deleted until the corresponding FOREIGN KEYS in the Child Tables have been deleted.

Assumptions by Dames and Moore:

We intend to enforce Referential Integrity for all relationships in the Oracle database. The Cascade Delete option has not been provided in the USACE GIS to minimize user error. This option can be provided if required by the client. All Primary Keys will be unique. All Primary Keys and Foreign Keys cannot have null (empty) values. Dames and Moore will be populating the CH\_LOCATION, DA\_LOCATION, CH\_DREDGE\_VESSEL, and CH\_DREDGE\_EVENT tables with the data that has been provided by the USACE. We have not received data for the CH\_DREDGE\_EVENT table and require data from the client to populate this table. The rest of the tables will be populated/modulated by the USACE using the Visual Basic form provided by Dames and Moore and by text files prepared and loaded by USACE Oracle staff.

**Entity and Attribute definitions:** Please provide any input regarding our definition of attributes for all entities (tables) and incorporation of any checks, constraints and default values for these attributes. Currently, only the RTC\_CODE and DA\_CODE columns have been set to upper case and no other constraints have been enforced. A default value of 'Estimate' is set to the SUR\_NAME attribute in the DA\_SURVEY\_EVENT entity. All Primary Keys will be Unique and all Primary Keys and Foreign Keys cannot have null (empty) values.

Dames and Moore will populate the CH\_LOCATION, DA\_LOCATION, CH\_DREDGE\_VESSEL and CH\_DREDGE\_EVENT tables with the data that has been provided by the USACE. We have not received data for the CH\_DREDGE\_EVENT table and require data from the client to populate this table. It is understood that the rest of the tables will be populated/updated by the USACE using the Visual Basic form provided by Dames and Moore and by text files prepared by the USACE Oracle staff.

**Entity : CH\_LOCATION**

The table that stores the Location Information for the Channels. Dames and Moore will populate this table with the data that has been provided by the USACE.

Attributes		Description	Notes	Attribute Definitions			
				Data Type	Length	Decimal Places	Key
RTC_CODE	The Unique ID for a Channel Range/Tangent.  This will serve as the primary key in the Oracle database to link to the GIS coverage and related Oracle tables.  Set to covert all characters to upper case.	Available and complete for the 153 Ranges and Tangents.  Need further instructions from client regarding the Connecting Channels using Common Disposal Areas. Need RTC codes/GeoCodes for Connecting Channels using Common Disposal Areas. Currently, the Connecting Channels have not been incorporated.		VARCHAR2 (Oracle character data type)	20	NA	Primary Key
GEO_CODE	The Geo Code for a range/tangent as defined by the DMMP tables.	Same as above.		INTEGER	5	0	-
REACH	The AIWW Reach for a range/tangent as defined by the DMMP tables.	AIW_0123 has a null value.		VARCHAR2	50	NA	-
SECTION	The AIWW Section for a range/tangent as defined by the DMMP tables (3 and 5) and Excel spreadsheets.	Range/Tangent 0124-AIW_0153 have "NA".		VARCHAR2	50	NA	-
CHANNEL	Range or Tangent codes as assigned in the DMMP tables (3 and 5) and Excel spreadsheets.			VARCHAR2	20	NA	-
LANDMARK	Geographic Vicinity as assigned in the DMMP tables (3 and 5).			VARCHAR2	50	NA	-

**Entity : CH\_DREDGE\_VESSEL**

This table records information for each dredge vessel. Dames and Moore will populate this table with the data that has been provided by the USACE in the Dredge Vessel Information table in the dredge.mdb Access database.

Attributes	Description	Notes	Attribute Definitions			
			Data Type	Length	Decimal Places	Key
DRG_NAME	The name of the dredge vessel. This is the Primary Key(Unique) for table CH_DREDGE_VESSEL	Set to covert all characters to upper case.	VARCHAR2	100	NA	Primary Key
DRG_OWNER	Dredge Vessel Owner		VARCHAR2	150	NA	-
DRG_TYPE	Dredge Classification		VARCHAR2	100	NA	-
PUMP_HP	Pump Horsepower		INTEGER	8	0	-
DISCHARGE	Pipe Diameter in Inches		INTEGER	3	0	-
BUCKET_CAP	Bucket Capacity in CY		INTEGER	4	0	-
HOPPER_CAP	Hopper Capacity in CY		INTEGER	8	0	-
MAX_DRG_DEPTH	Maximum Dredging Depth in Feet		INTEGER	6	0	-
MIN_DRG_DEPTH	Minimum Dredging Depth in Feet		INTEGER	6	0	-

**Entity : CH\_DREDGE\_EVENT**

This table records all discrete dredging events. Dames and Moore will populate this table with the data that has been provided by the USACE. We have not received data for the CH\_DREDGE\_EVENT table (the Dredge Event table in the dredge.mdb Access database contains no records) and require data from the client to populate this table.

Attributes	Description	Notes	Attribute Definitions			
			Data Type	Length	Decimal Places	Key
DREDGE_EVENT_ID	This is the Unique Primary Key generated by Oracle for the CH_DREDGE_EVENT table.		INTEGER	6	0	Primary Key
RTC_CODE	The ID for a Channel Range/Tangent. This is a foreign key that references to CH_LOCATION.RTC_CODE in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Foreign Key
DRG_NAME	The name of the dredge vessel. This is a foreign key that references to CH_DREDGE_VESSEL.DRG_NAME in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	100	NA	Foreign Key
CY	Average Volume /Event in 1,000 CY		INTEGER	6	0	-
DATE_COMPLETE	Date Event Completed		DATE	NA	0	-
NUM_DAYS	Dredge Event Duration		INTEGER	5	0	-
CONTRACTOR	Contractor Name		VARCHAR2	150	NA	-
DA_CODE	Disposal Area Code. This is a foreign key that references to DA_LOCATION.DA_CODE in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Foreign Key

**Entity : CH\_SURVEY\_EVENT**

The Survey Event for a Range/Channel/Tangent. This table will be populated by the USACE.

Attributes	Description	Notes	Attribute Definitions			
			Data Type	Length	Decimal Places	Key
CH_SURV_EVENT_ID	This is the Unique Primary Key generated by Oracle for the CH_SURVEY_EVENT table.		INTEGER	6	0	Primary Key
RTC_CODE	RTC Dredged. This is a foreign key that references to CH_LOCATION.RTC_CODE in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Foreign Key
SURVEY_VESSEL	The name of the Survey Vessel		VARCHAR2	100	NA	-
DATE_SURVEY	Date of Survey		DATE	NA	NA	-
VOLUME	Volume Dredged		INTEGER	15	0	-
RSUR_FILE	Survey DGN File Name		VARCHAR2	150	NA	-

**Entity : DA\_LOCATION**

This table will store location information for the Disposal Areas. Dames and Moore will populate this table with the data that has been provided by the USACE. No data has been provided by the USACE for the MILEMARKER item.

Attributes	Description	Notes	Attribute Definitions			
			Data Type	Length	Decimal Places	Key
DA_CODE	The Unique DA code for a Disposal Area as defined by the DMMP table 4.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Primary Key
NEW_DA_NUM	New Disposal Area Number as defined by the DMMP table 4.		VARCHAR2	6	NA	-
OLD_DA_NUM	Old Disposal Area Number as defined by the DMMP table 4.		VARCHAR2	6	NA	-
COUNTY	County as defined by the DMMP table 4.		VARCHAR2	50	NA	-
REACH	The AIWW Reach for a range/tangent as defined by the DMMP tables		VARCHAR2	50	NA	-
SECTION	The AIWW Section for a range/tangent as defined by the DMMP tables.		VARCHAR2	50	NA	-
CHANNEL	Range or Tangent codes as assigned in the DMMP tables 3 and 5.		VARCHAR2	20	NA	-
LANDMARK	Geographic Vicinity as assigned in the DMMP tables and Excel spreadsheets.		VARCHAR2	50	NA	-
MILEMARKER	The milemarker for the Disposal Area. <b>This information is not available with Dames and Moore and is to be provided by the USACE.</b>		DECIMAL	6	2	-

**Entity : DA DISPOSAL\_EVENT**

The table that records Disposal Events. This table will be populated by the USACE.

Attributes	Description	Notes	Attribute Definitions			
			Data Type	Length	Decimal Places	Key
DISP_EVENT_ID	This is the Unique Primary Key generated by Oracle for the DA DISPOSAL_EVENT table.		INTEGER	6	0	Primary Key
ORIGIN_RTC_CODE	Material's Origin RTC_CODE. This is a foreign key that references to CH_LOCATION.RTC_CODE in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Foreign Key
DRG_NAME	The name of the dredge vessel. This is a foreign key that references to CH_DREDGE_VESSEL.DRG_NAME in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	100	NA	Foreign Key
DA_CODE	DA code for a Disposal Area. This is a foreign key that references to DA_LOCATION.DA_CODE in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Foreign Key
CY	Cubic Yards placed in Disposal Area		INTEGER	15	0	-
DATE	Date Material Placed		DATE	0	0	-
ORIGIN_DA_CODE	Material's Origin DA_CODE. This is a foreign key that references to DA_LOCATION.DA_CODE in a 1:Many relationship.	Set to covert all characters to upper case.	VARCHAR2	20	NA	Foreign Key

**Entity : DA SURVEY\_EVENT**

This table will record Survey Events for a Disposal Area. This table will be populated by the USACE.

Attributes	Description	Notes	Attribute Definitions			
			Data Type	Length	Decimal Places	Key
DA_SURV_EVENT_ID	This is the Unique Primary Key generated by Oracle for the DA_SURVEY_EVENT table.		INTEGER	6	0	Primary Key
DA_CODE	DA code for a Disposal Area. This is a foreign key that references to DA_LOCATION.DA_CODE in a 1:Many relationship.		VARCHAR2	20	NA	Foreign Key
SUR_NAME	Surveyor Name (input 'Estimate' if not surveyed). 'Estimate' is set as the default value.		VARCHAR2	100	NA	-
DATE_SURVEY	Date of Survey		DATE	NA	NA	-
SUR_CAP	Surveyed Capacity		INTEGER	15	0	-
DASUR_FILE	File Name of Survey Data		VARCHAR2	100	NA	-
DTM_FILE	Digital Terrain Model File Name		VARCHAR2	100	NA	-