Trinity River Restoration Program
Integrated Information Management System

User Needs Assessment
Version 2.0

Prepared by

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November 18, 2004

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Integrated Information Management System

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Prepared for

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1. Introduction

Adaptive management and restoration of the Trinity River requires that reliable scientific information be collected, synthesized and provided to decision makers. The Record of Decision (ROD) recognized this need when it integrated an adaptive environmental assessment and management (AEAM) program into the Trinity River Restoration Program (TRRP).

To make AEAM operational, the TRRP has undertaken the development of a Scientific Framework, to be developed over a 16-month period. This Scientific Framework will provide three critical elements:

1. *conceptual and quantitative models* that make explicit our current understanding of the system, the underlying hypotheses driving the restoration program, and key uncertainties;
2. *rigorous monitoring plans* focused on both reducing the uncertainties most critical to management decisions and clearly evaluating progress towards program goals; and
3. a scientifically defensible, practical *AEAM Framework* and *Integrated Information Management System* to provide rapid feedback from monitored outcomes through databases and models to revised annual management decisions.

As a key part of the Scientific Framework, the Integrated Information Management System (IIMS) is intended to support the Technical Modeling and Analysis Group (TMAG) and other Trinity River Restoration Program scientists in their endeavors to enhance the understanding of ecosystem functions and environmental processes and in identifying and filling critical information gaps. The IIMS will also:

- facilitate integration and sharing of baseline and monitoring data;
- serve as a feature location database for monitoring and analysis;
- provide a tool for ecological and physical modeling; and
- allow visualization of data and simulations to facilitate sound management decisions.

The following report documents the first step in developing the proposed IIMS: identifying the potential users of the system, assessing their information system needs, and outlining the functions the system should perform. The findings and recommendations in this report are based principally upon feedback obtained at meetings on April 15-16, 2004 (in Weaverville) to initiate the development of the Scientific Framework, followed by interviews undertaken with TRRP staff and partners during the week of June 14-18, 2004 (see Appendix for a full list of interview participants).

The report is arranged as follows:

- Section 2 documents the scope of the proposed system, including its objectives, key functions, potential users, inputs and outputs;
- Section 3 provides an overview of the current data holdings of TRRP partner agencies;
- Section 4 outlines the current information technology infrastructure within the TRRP and its partners; and
- Section 5 presents a plan for completing the proposed IIMS.

2. System Scope

2.1 System Objectives

As outlined by TRRP staff, the overall objective of the Integrated Information Management System (IIMS) is to create a comprehensive logical structure to integrate spatial (geographic) and tabular data along with photographs and graphics from a variety of sources. Figure 1 provides an overview of the key components of the IIMS.

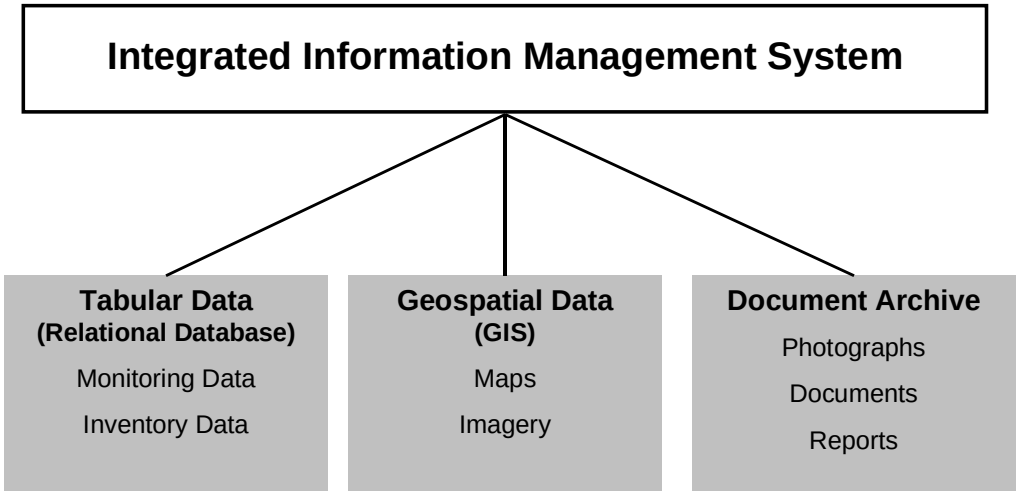

Figure 1: Major components of the Integrated Information Management System.

It is envisioned that the IIMS will serve the following functions:

1. **Repository for TRRP baseline data and monitoring results**. At present there is no program in effect to archive the results of TRRP data collection initiatives — currently each researcher is responsible for their own data management. The IIMS will provide a central and secure repository for TRRP related data, ensuring that all of data collected under the TRRP is accessible and available into the future.
2. **Support for AEAM modeling.** Monitoring data (both historical and future) will be required to develop, test and refine the conceptual and quantitative models produced within the AEAM program. Given their adaptive and interdisciplinary nature, testing and refinement of these models will require a continuously updated set of interdisciplinary monitoring data.
3. **Establishment of data collection standards.** Through the creation of a program database, the IIMS will provide a consistent structure for TRRP data. This will help ensure that data collected by all agencies is consistent in content and format, and meets the ultimate needs of the TRRP.
4. **Support for annual management.** It is critical that TRRP scientists be able to access the data they require for making annual management decisions in a timely manner, especially flow, sediment and vegetation management decisions. At present much of the data for the Trinity River

is scattered amongst different agencies, making it difficult for TRRP staff and other scientists to access the data in a timely manner. The IIMS would bring this data together into a central repository, ensuring that it is available and accessible to TRRP scientists, as required. Each winter and early spring, data and models need to be brought together in an efficient procedure to generate flow schedules and other decisions for the May to July period, fine tuning these decisions based on past observations.

5. **Support for long-term program evaluation.** Finally, the IIMS will provide the necessary multidisciplinary monitoring data required to evaluate the effectiveness of the restoration program over the long-term, including the decadal-scale responses of some ecosystem components.

2.2 Users

Three types of users have been identified for the proposed system: TRRP staff, TRRP partners, and the general public.

1. **TRRP staff**. The principal users of the system will be the staff at the TRRP, particularly the TMAG and Rehabilitation and Implementation Group (RIG). The IIMS will be a repository for all TRRP-related data – it will ensure that data collected for the program is secure and available, regardless of changes in staffing over time; it will also ensure that key data is consistently available to staff in a timely manner for management purposes. At a minimum, TRRP staff felt it was essential that the system contain all of the data collected using program funds.
2. **TRRP partners**. It is envisioned that TRRP partners will also have access to data in the IIMS — as a resource for scientific analysis and management purposes. During interviews with several TRRP partners, concern was expressed regarding the broad distribution of raw data — data that might be misinterpreted without a good understanding of how it was collected. To address this issue, it is likely that access to data in the IIMS will need to be controlled for certain datasets: for example, scientists providing data to the TRRP will always have access to their own raw data, but may only have access to summary data for some of the other datasets. It is also likely that certain datasets will need to be "approved" by the provider before being released for distribution to others.
3. **General public.** Finally, the IIMS may ultimately serve as a tool to disseminate TRRP data to the general public. Once again, it is not likely that all raw data will be distributed to the general public: for certain datasets it is recommended that only summary data be distributed.

In the short-term, the highest priority will be to provide TRRP staff with access to IIMS data — as such, it is recommended that the first phase of the IIMS development (i.e. the current contract) remain focused initially upon meeting the needs of this user group.

2.3 Inputs and Outputs

Consistent with the components outlined in Figure 1, the key inputs to the IIMS will include the following:

- monitoring and inventory data (in tabular format);
- GIS map data; and
- documents and reports.

For Phase 1 of the system, the focus will be on developing the infrastructure required to store only tabular monitoring data – GIS data and document/report archiving will be addressed in Phase 2. As identified at the April 15-16, 2004 meetings in Weaverville, the priority data types to be targeted for inclusion in the IIMS for Phase 1 are as follows:

- streamflow;
- water temperature;
- smolt outmigrant data;
- adult return data;
- sediment data (to be defined); and
- vegetation.

Additional data types will be added in Phase 2, such that eventually all of the data relevant to the program will be accessible through the IIMS. Focusing on a limited number of data types for the first version of the system will ensure that the system does not get overwhelmed with the complexity of many different data types.

With respect to the input data, some of the key features the IIMS should include are as follows:

- the IIMS should be designed to capture both historical and future monitoring data;
- wherever possible, the objective of the IIMS will be to capture and store data in as raw a format as possible, thus providing scientists with as much flexibility as possible in the way the data is analyzed in the future; for many data types it will likely be appropriate to also store data in a more derived (or summarized) format;
- all data entered into the IIMS will be stored with metadata, ensuring that the source and quality of the data can be traced in the future – no data should be allowed in the system without its corresponding metadata; and
- standards should be established for how all data is to be georeferenced within the IIMS.

It is clear from discussions with users that several forms of output will be required, including:

- exported raw data suitable for further analysis (e.g. in Excel format);
- exported GIS data (e.g. shapefile format); and
- summary data reports and maps for key indicators (e.g. PDF format).

Specific outputs from the IIMS have not yet been defined – this will require further discussion with potential users. For Phase 1, however, the format of output reports will be driven primarily by the near-term needs of TRRP staff, in particular the annual cycle of monitoring and flow scheduling decisions. The development of the scientific framework, and its associated indicators, will also be a key driver in determining the required IIMS outputs.

3. Existing Data Holdings

As part of the process of identifying the needs of the IIMS, interviews were undertaken with various TRRP partners during the week of June 14-18th, 2004. A key objective of these interviews was to determine the extent of current and future monitoring programs in the Trinity River basin. In all 27 people were interviewed — a full list of interview participants is provided in the Appendix. The following section provides a brief overview of the status of the data collection programs, as determined through these interviews. Note that this review is intended only as a preliminary indication of the availability of possible datasets for the IIMS, and not as a definitive inventory of existing data holdings.

3.1 Hydrology, Sediment and Vegetation Data

Flow data

The USGS, Hoopa Valley Tribe, and DWR all currently operate streamgages on the Trinity River. Data from many of these stations is available for download from the USGS website. Table 1 provides a list of the period of record for those stations. Beginning October 1st, 2004, all gaging stations on the Trinity mainstem will be operated by the USGS.

Table 1: Period of record for historical flow data from USGS gaging stations in the Trinity River basin (does not include recent real-time provisional data). Data provided by the USGS website at http://waterdata.usgs.gov/ca/nwis/sw.

Site #	Station Name	Start Date	End Date
11523200	TRINITY R AB COFFEE C NR TRINITY CTR CA	1-Oct-1957	30-Sep-2003
11523700	COFFEE C NR TRINITY CENTER CA	1-Oct-1910	30-Sep-1966
11524000	TRINITY R NR TRINITY CENTER CA	1-Oct-1910	30-Sep-1913
11525430	JUDGE FRANCIS CARR PH NR FRENCH GULCH CA	1-May-1963	30-Sep-2003
11525500	TRINITY R A LEWISTON CA	1-Oct-1911	30-Sep-2003
11525530	RUSH C NR LEWISTON CA	1-Oct-2002	30-Sep-2003
11525600	GRASS VALLEY C A FAWN LODGE NR LEWISTON CA	17-Nov-1975	30-Sep-2003
11525655	TRINITY R BL LIMEKILN GULCH NR DOUGLAS CITY CA	28-Apr-1981	30-Sep-2003
11525800	WEAVER C NR DOUGLAS CITY CA	1-Oct-1958	30-Sep-1969
11525854	TRINITY R A DOUGLAS CITY CA	1-Oct-2002	30-Sep-2003
11525900	BROWNS C NR DOUGLAS CITY CA	1-Jan-1957	30-Sep-1967
11526000	TRINITY R NR DOUGLAS CITY CA	1-Oct-1943	30-Sep-1951
11526250	TRINITY R A JUNCTION CITY CA	1-Oct-2002	30-Sep-2003
11526500	NF TRINITY R A HELENA CA	1-Oct-1911	30-Sep-1980
11527000	TRINITY R NR BURNT RANCH CA	1-Oct-1931	30-Sep-2003
11527400	NEW R A DENNY CA	1-Oct-1927	30-Sep-1969
11527500	NEW R NR DENNY CA	1-Oct-1927	31-Dec-1928
11528000	TRINITY R NR CHINA FLAT CA	1-Oct-1911	30-Sep-1913
11529800	WILLOW C NR WILLOW C CA	1-Aug-1959	2-Oct-1974
11530000	TRINITY R A HOOPA CA	1-Oct-1911	30-Sep-2003
11530020	SUPPLY C A HOOPA CA	1-Oct-1981	30-Sep-1987

From 1995–1999, McBain & Trush established additional gaging stations at 5 locations along the mainstem and tributaries. From 1997 onwards, these gages have been managed by Graham Matthews — initially for the Hoopa Valley Tribe, and more recently directly for the TRRP office. Graham Matthews currently has a contract to summarize all of the Hoopa Valley Tribe flow data. Beginning October 1st, 2004, all gaging stations on the Trinity mainstem will be operated by the USGS.

Water temperature data

Water temperature data is also available for various locations on the Trinity River. Paul Zedonis of the USFWS has been responsible for managing a series of water temperature probes on the Trinity River. Table 2 provides a list of the period of record for the USFWS quality-checked water temperature data for the Trinity River basin. Data from these probes are stored in an Access database at the USFWS (and managed by Randy Turner); the data from these stations are also available for download from the USFWS (Arcata office) website, and could easily be integrated into the IIMS.

Table 2: Period of record for historical water temperature data collected and quality checked by the USFWS since 2001 (does not include 2004 data). Data provided by the USFWS website at http://arcata.fws.gov/fisheries/db/krbwt/01to03/krbwt01to03_menu.asp.

Site #	Station Name	Start Date	End Date
TR	Trinity River near mouth	25-Apr-02	05-Aug-03
WLC	Willow Creek Screw Trap Site	21-Nov-02	21-Nov-03
SF	South Fork Trinity River	06-Nov-02	08-Oct-03
TSF	Trinity River above South Fork	06-Nov-02	08-Oct-03
BRN	Burnt Ranch at Transfer Station	02-Jul-03	08-Oct-03
BFC	Big French Creek	06-Nov-02	08-Oct-03
TBF	Trinity River above Big French Creek	06-Nov-02	08-Oct-03
NFT	North Fork Trinity River	02-Jul-02	08-Oct-03
CNY	Canyon Creek	06-Nov-02	08-Oct-03
TCN	Trinity River above Canyon Creek	02-Jul-02	08-Oct-03
DGC	Douglas City	06-Nov-02	08-Oct-03
RSH	Rush Creek	07-Nov-02	08-Oct-03
TRC	Trinity River above Rush Creek	07-Nov-02	08-Oct-03
CFC	Coffee Creek	07-Nov-02	08-Oct-03
STF	Stuart Fork	07-Nov-02	08-Oct-03
SWF	Swift Creek	07-Nov-02	18-Sep-03

Data collected prior to 2002 is also available from the USFWS in spreadsheet format. In addition to the water temperature data collected by the USFWS, additional water temperature measurements have been recorded by the Bureau of Reclamation at some of gaging stations (as described under *Flow data* above) – however the quality of these additional historical data is unknown, and much data may require additional quality checking before it can be used. The US Forest Service also has some water temperature data for smaller tributaries.

Sediment transport data

Various forms of sediment data exist for the Trinity River – details regarding the extent of these data, however, were not captured during the interviews for this report. Graham Matthews is currently working to consolidate all of this data for the TRRP by December, 2004, at which point it should be available for inclusion in the IIMS - a decision will need to be made by the TRRP as to which specific data items should be included in the first version of the database.

The types of data that currently exist include the following:

- sediment transport data (suspended load and bedload);
- sediment budgets;
- coarse sediment augmentation;
- bulk samples;
- pebble counts;
- mark rock experiments;
- scour core experiments;
- Helly-Smith experiments;
- basket experiments.

Landform and vegetation data

Additional sources of landform and vegetation information include:

- topographic maps (as TIN and contours) – this includes both a Digital Elevation Model (USGS product at 20m contour interval for the entire river), and local Digital Terrain Models (produced at a much finer resolution for each rehabilitation site);
- aerial photographs – the most recent complete set was flown in 2001 from Lewiston to the North Fork - 1 ft topography also exists to go with it; past aerial photos exist for 1999, 1997, 1989, 1974, 1961 and 1944 (2001 and 1944 datasets are available in digital format);
- riparian vegetation mapping – completed in 2003 (and based upon the 2001 aerial photographs); and
- cross sections.

Additional water quality data

In addition to water temperature, turbidity and dissolved oxygen have also been measured on the Trinity River. Mary Borzi at the Bureau of Reclamation is responsible for these data.

Highwater mark data. Curtis Anderson at the California Department of Water Resources has measured highwater mark data (as x,y,z point locations for various flows) for different locations on the Trinity River.

3.2 Fish Data

Outmigrant data

Rotary screw trap data, recording downstream migrants, exists for several locations on the Trinity River. The USFWS has been operating a trap at Willow Creek since 1990; the Yurok Tribe added a second trap at this same location in 2002. In addition, the Hoopa Valley Tribe has been operating a trap at Junction City since 1997 (prior to that the trap was operated by USFWS), and a second trap at the North Fork since 2003. Mark-recapture data to determine trap efficiency has been recorded at these traps since 2002. Finally, the US Forest Service (USFS) have been operating traps on tributaries of the Trinity.

Raw data collected since 1992 by the USFWS and Yurok Tribe at the Willow Creek rotary screw trap have been entered into an Access database; the database is currently being managed by Bill Pinnix at the USFWS Arcata office.

Adult returns

Adult return data (including carcass surveys) are currently collected and managed by Wade Sinnen at the Arcata office of the California Department of Fish & Game. Return data has been collected since 1977; all of the raw return data since 1986 have been entered into a dBase database. Annual reports summarizing the data are produced each year.

Habitat suitability

Microhabitat data has been collected for the Trinity River under 2 projects: one project for biological monitoring (at channel rehabilitation sites only) and a second project to develop inputs suitable for SALMOD. For the biological monitoring project, preconstruction habitat data has been recorded at 6 sites for a range of flows; this work has been done by the USFWS, Hoopa Valley Tribe and the Yurok Tribe. For the SALMOD project, habitat data has been collected for 2003 and 2004 by the USFWS and the Yurok Tribe. While the plan is to eventually cover all of the upper 40 miles of the Trinity River, to-date data have been collected from Lewiston Dam to Junction City.

The USFWS has developed an Access database to store data for both of these projects. Key contacts for these data are Charlie Chamberlain (USFWS) and Tim Heyden (Yurok Tribe). Mike Cumanan (USFWS) is responsible for administering the Access database.

Spawning/Redd surveys

Since 2001, spawning/redd survey results collected by the USFWS have been stored in an Access database; earlier data likely exists in Excel format. Hoopa Valley Tribe also collects some survey data. David Hines (USFWS) is responsible for administering the Access database.

3.3 Wildlife

Bird Data

The current sampling program for Trinity River bird data was started in 2002 by scientists at the Redwood Sciences Laboratory. Four major types of data are currently being collected for the Trinity River: area searches, banding, float surveys and point counts. In addition to sampling locations on the Trinity mainstem, additional data for the South Fork have also been recorded since 2002; some mainstem data from the early 1990s also exists. All of the data collected since 2002 are been entered into a series of Access databases, which are administered by Linda Long; associated GIS data (e.g. area search polygons) are managed by Bill Hogoboom.

Herpetology Data

Herpetology data exists for the Trinity River from 1990-97, and then again from 2003 onwards. Data has been collected in the Upper Trinity River; some additional data has also been collected in the South Fork (mainstem and tributaries), which could potentially serve as control data for the Upper Trinity. As part of a sampling program initiated in the early 1990's, two focal species were identified: yellow legged frog and western pond turtle – as such, most of the herpetological data is focused upon these 2 species. Sampling on the entire herpetological community was done in the early 1990's; this sampling program was repeated in 2003 (using time constraint surveys). At present herpetological data relevant to the Trinity River is stored in miscellaneous formats at the Redwood Sciences Laboratory. Don Ashton and Becky Howard have agreed to begin compiling this data into an Access database shortly, and are planning to have the data loaded into the newly created Access database sometime within the next year.

4. Existing Information Technology Infrastructure

The following section provides an overview of the current Information Technology infrastructure that exists with the TRRP and other associated agencies.

4.1 Tabular Data

The partner agencies interviewed for this report store their monitoring data in a variety of formats. For tabular data, several agencies have begun using Microsoft Access — this includes the USFWS, Redwood Sciences Lab and Yurok Tribe. The California Department of Fish & Game stores their adult return data in a dBase database format — an older desktop database format that can readily be imported into Microsoft Access. Other tabular data is generally stored in Excel or Text format.

At present none of the partners interviewed for this report were using enterprise-level database products to store their data (such as Oracle or SQL Server), although likely the larger data collection agencies – such as the USGS, Bureau of Reclamation (BOR) and California Department of Water Resources – are using such products. In general these larger agencies have developed export routines for their databases to provide their data in text format.

4.2 Spatial Data

Spatial data collected by the various partner agencies are also stored in a variety of formats. The standard for GIS data at the BOR is ArcGIS format using a UTM NAD83 projection (vertical datum of NAVD88). The bird group at the Redwood Sciences Lab are also using ArcGIS, but with UTM NAD29 – they adopted this alternative datum to conform to the BOR standard in place at the start of their data collection program, which the BOR has since changed. The standard used by the California Department of Water Resources is AutoCAD format with State Plane Coordinates; this is also the standard followed by McBain & Trush for the majority of their GIS data.

Each of the partner agencies have also adopted a range of standards for georeferencing their monitoring data. Several are now using GPS to georeference their location measurements, although the projection in which the GPS coordinates are recorded will vary from agency to agency. In addition, several agencies continue to use river mile/km for recording some sampling locations. There are several different river centerlines used for recording these locations, each starting at a different location and following a slightly different trajectory.

While it is possible with current GIS technology to convert data from one GIS projection/format to another, or from one river mile location to another, it does require time and effort to do so — this will become an important issue once the data collected by various agencies is brought together for any sort of interdisciplinary analysis. Establishing a common standard for TRRP GIS data storage and georeferencing is something that several of the interviewees suggested would be a valuable contribution of the IIMS.

4.3 Bureau of Reclamation

The TRRP office is currently supported by the Bureau of Reclamation (USBR) Information Technology support group, based in Shasta Lake. Currently the USBR has a number of IT standards in place for application development: for example, only Oracle is supported for enterprise database applications on USBR servers, while ArcGIS is the standard for GIS applications. In addition, the USBR has standards for such things as GIS data projections, metadata, etc.

Some of the key questions raised by the BOR IT staff with respect to the proposed IIMS included the following:

- Would the system be considered a BOR IT asset? If yes, then for legal purposes there are a number of BOR IT standards to which the system must adhere.
- Who will be responsible for administering the database? If the long-term responsibility for administering the system rests with the BOR, then the system should be developed using BOR supported technologies to ensure that BOR staff are able to support it in the future.
- Will the system reside on a BOR server? If yes, then a number of additional standards and procedures must be followed to ensure the security of the BOR network. If not, then there would likely be more flexibility in the hardware/software environment for the IIMS.

5. Project Plan

This section of the report provides a plan for moving forward with the proposed Integrated Information Management System.

As outlined at the meeting in Weaverville on April 15th, 2004, development of the IIMS has been divided into two phases:

- *Phase 1* will produce a prototype for the relational database portion of the IIMS — this phase is scheduled for completion by March 2005;
- *Phase 2*, which is scheduled for completion by December 2005, will then finalize the relational database and develop a prototype for the GIS and document archiving portions of the system.

Consistent with standard approaches to system development, we have outlined 7 stages that we propose that the TRRP follows in developing their proposed IIMS (Figure 2). Note that stages 1 and 2 of Figure 3 have already been completed.

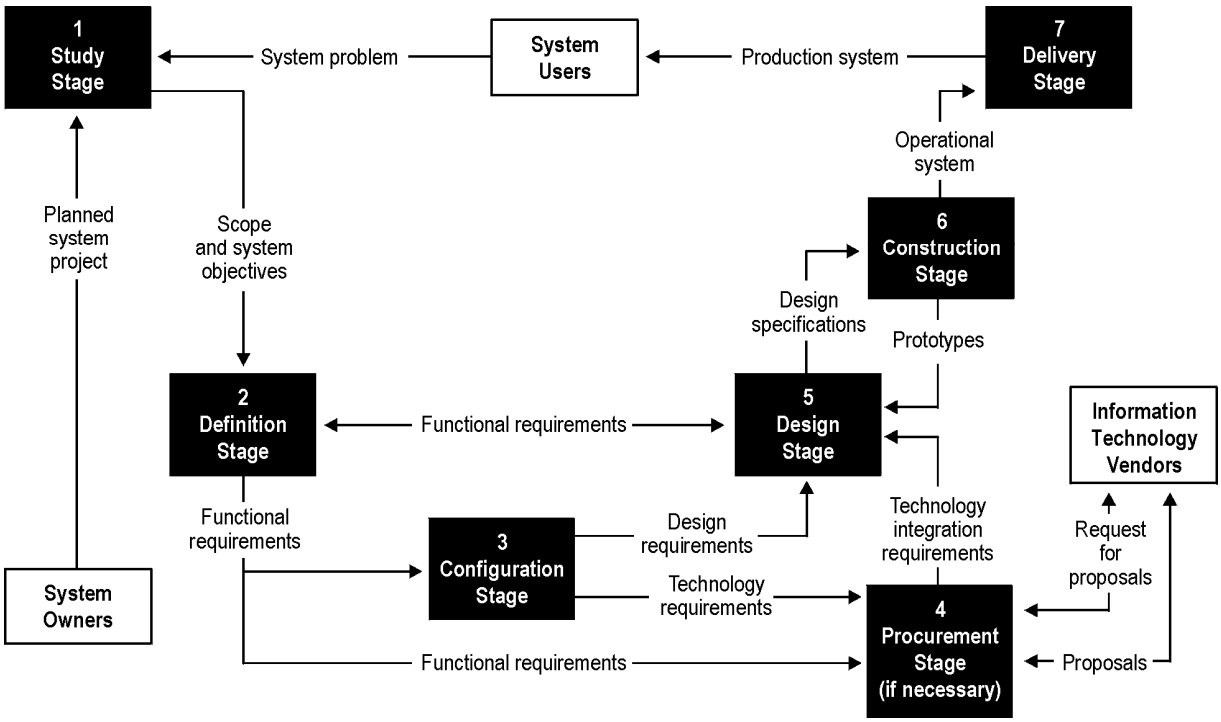

Figure 2: Development stages for the Integrated Information Management System. Arrows represent major deliverables of the stages, which then may serve as inputs to a subsequent stage. Phase 1 of this project includes stages 1-6 and their associated deliverables. Adapted from Whitten and Bentley (1998)[1].

[1] **Whitten, J. and L. Bentley.** 1998. Systems Analysis and Design Methods - 4th ed. Published by McGraw-Hill 724 pp.

5.1 Proposed Tasks for Phase 1

Given the findings from the user needs assessment, the following section outlines the tasks remaining to complete Phase 1.

Task 1: Identify alternative design options *(by August 31st, 2004)*

The next step in developing the IIMS will involve defining alternative design options. This will include:

- hardware and software technologies for the system;
- system architecture (e.g. what are the various components of the IIMS? How will they interact?);
- administrative procedures (e.g. who will administer the IIMS? How will it be updated?); and
- priority data to be entered into the prototype system.

Feedback to-date on the design of the system suggests that the first prototype for the database should be kept as technologically simple as possible (e.g. using Microsoft Access as the software platform). Priority should be given to directing resources towards data compilation in the early stages of the project – once the relevant data has been compiled, then resources can be directed towards more sophisticated technologies for storing and accessing the data.

Task 2: Compare and evaluate design options *(by September 15th, 2004)*

After defining a range of alternative design options, each option will be evaluated according to a set of feasibility criteria, grouped according to the following four categories:

- *Technical feasibility* – Is the solution technically practical? How will it integrate into the existing Information Technology infrastructure?
- *Operational feasibility* – Will the solution fulfill the user's requirements? Is it likely to meet the system objectives (as defined in the scoping stage)? Does the technical expertise exist to support the solution?
- *Economic feasibility* – Is the solution cost-effective?
- *Schedule feasibility* – Can the solution be designed and implemented within an acceptable time period?

For each of these categories, we propose to meet with TRRP staff to develop more specific criteria for this project, and to rate these criteria according to their relative importance. Some sample criteria are listed in Table 3.

Table 3. Sample feasibility criteria for evaluating alternative design options.

Category	Criteria
Technical	• Performance of system (given anticipated size of system and the number and location of users) • Interoperability of components, including auxiliary tools and GIS (e.g., spatial and attribute data) • Compatibility with existing and planned infrastructure • Degree to which technology is proven • Anticipated lifespan of technology • Scalability of system • Security of system
Operational	• Degree to which system objectives will be met • Ease of use of system, including the desire/capacity of key users to use it • Ability to incorporate both fish/aquatic and terrestrial/riparian data • Ability to integrate with existing and planned databases and models • Ability to integrate GIS capability • Ability to access and integrate external data (including GIS) • Quality control of data provided • Availability of support (internally, regionally) • Vendor stability
Economic	• Total cost of ownership • Initial development costs • Ongoing support and maintenance costs
Schedule	• Time required to develop prototype • Time required for initial system deployment • Ability to phase-in future functionality

Task 3: Prepare draft design and technical requirements *(by October 15th, 2004)*

Having decided on the target solution (in Task 2), we will then proceed with development of the design for the system. The key deliverable for this task will be the *design requirements* and *technology requirements* for the target solution.

The *design requirements* will include recommendations for the following:

- application architecture for the system, including major components, their functions, and relationships between them;
- relationship between the system and other databases/systems;
- estimated size of the database;
- administration and support requirements for the system;
- data to be included in the first prototype, including recommendations for data standards (e.g. for georeferencing, metadata, etc.)

The *technology requirements* will include:

- recommendations for any new hardware and software to be acquired or purchased in order to implement the recommended design;
- recommendations for any additional support requirements associated with hardware and software acquisitions.

A meeting will be held with TRRP staff to review the draft design and technology requirements in detail.

Task 4: Prepare design specifications *(by November 30th, 2004)*

The design of the IIMS prototype will involve designing both the software technology and data model components that together will represent the prototype database deliverable. The technology component involves building a Microsoft Access template database that can input, store and output, the TRRP data. The data model component involves identifying those data layers that will be stored in the database and defining the properties and relationships of each layer.

Identify Potential Data Layers

ESSA will develop a preliminary list of data layers for consideration in the IIMS. Two sources will be used for this exercise: The Record Of Decision (ROD) and the IIMS User Needs Assessment. The preliminary list will be circulated to the scientific leads of each subsystem to capture any potential data layers that have been overlooked.

Prioritize Potential Layers

ESSA will work with key TMAG members (Doug Schleusner, Rod Whittler and Andreas Krause) to prioritize the proposed data layers and identify those that fall in or out of scope for the IIMS prototype. ESSA has developed a weighting matrix to facilitate this process.

Define Prototype Data

ESSA systems ecologists will work with the scientific leads of each subsystem to define the attributes of each data layer including:

- Data type
- Precision
- Metadata
- Temporal Frequency
- Temporal Extent
- Source

Client Signoff Data Definition Document

ESSA will collect the definitions of each data layer into a Data Definition Document for approval by the client. Following signoff, changes to the data definitions (especially the addition of new data layers) will only be permitted by consensual agreement by both the client and ESSA.

Develop Data Collection Plan

ESSA will take the Data Definition Document and plan how it intends to request and collect the individual data layers. Some data are available for download on the Internet while members of the TMAG will provide other layers. A concise plan is required to ensure that no data are overlooked or that either party assumes the other is collecting a particular dataset.

Request Data For Prototype

ESSA systems ecologists will contact the data providers both by email and telephone to request the data. A finite window of time will be specified for the provision of data, during which time ESSA will be available to answer questions and support issues presented by the data providers.

Task 7.4.7 Receive, Archive and QA Data

ESSA will perform an initial quality control of each data layer as it is received. The data provider will be contacted if there are perceived problems with the data.

Task 5: Develop system prototype *(by March 31st, 2005)*

The technical requirements gathered in the User Needs Assessment combined with the data requirements gathered in Task 5 will be used to design the IIMS prototype database.

Agree IIMS Infrastructure Standards

The technology platform and data standards for the database will be defined and documented to ensure they are clearly understood. This is important to ensure consistency and compatibility for future enhancements to the IIMS.

Database Data Model

ESSA will develop the database data model based on the data layers defined in the Data Definition Document. The data model will be robust, scalable, transparent and self-documented.

Database Design (Technical Architecture)

The core database technical architecture will be designed in accordance with the infrastructure standards laid out in Task 7.5.1. The data model and database design will be combined into an overall IIMS Design Document that will be delivered to the client in person by ESSA. As part of this trip, ESSA will guide the client through a review of the design and incorporate any feedback agreed by both parties.

Prototype Database Build

ESSA will build the database based on the design document signed off by the client in Task 7.5.3. The build will include all features of the database template, including, tables, queries, reports, forms and import/export features. Once the build is complete, the database will be populated with the data provided by the client.

User Guide

ESSA will develop a brief, high level User Guide to help those downloading the IIMS prototype get started. The User Guide will not be exhaustive – rather it will focus on helping people find the data they are looking for. This document will be key to the acceptance and buy-in of end users who want to download the database and start being productive quickly.

TRRP Web Site Integration

ESSA is currently hosting a basic web site that brings together materials associated with the TMAG effort within the TRRP. The prototype database will be hosted on this site where it will be available to those possessing the password. Instructions will be provided online describing how to download and start using the database.

Prototype Database Testing

The prototype database will be tested by ESSA and then provided to the client for User Acceptance Testing. Upon completion of testing, the client signoff will confirm acceptance of the prototype.

Prototype Database Release

ESSA will make the prototype database available on the TRRP web site. Notification of the release will be made to members of the TMAG.

5.2 Proposed Tasks for Phase 2

Upon completion of Phase 1, the following tasks are proposed for Phase 2 of the IIMS development:

- refinements to the relational database component;
- refinements to the data entry templates;
- system documentation;
- TRRP deployment of the relational database component of the IIMS;
- design and specifications for the spatial data and document archive components of the IIMS; and
- prototype of all three IIMS components running jointly in a TRRP test environment (tabular database, spatial database, document archive).

Appendix
Interview Participants for User Needs Assessment

Interview Date/Time	Name	Agency
June 15 10:30-12:30	Don Ashton, Becky Howard	Redwood Sciences Lab
June 15 13:00-17:00	John Bair	McBain & Trush
June 15 17:00-17:30	Scott McBain	McBain & Trush
June 16 09:00-11:30	David Hines, Charlie Chamberlain, Bill Pinnix, Mike Cumanan	U.S. Fish & Wildlife Service
	Joel Green, Erik Logan	Hoopa Valley Tribe
	Tim Heyden	Yurok Tribe
June 16 11:30-12:30	Paul Zedonis	U.S. Fish and Wildlife Service
June 16 13:00-14:30	Wade Sinnen	California Dept of Fish & Game
June 16 15:00-17:00	C.J. Ralph, Sherri, Pablo Herrera, Linda Long, Bill Hogoboom	Redwood Sciences Lab
June 17 8:30-10:30	Jay Glase, Bill Brock	TRRP Office
June 17 10:30-12:30	Andreas Klause	TRRP Office
June 17 14:00-16:00	Doug Schleusner, Bill Brock	TRRP Office
	John MacGillivray, Chris Arden	Bureau of Reclamation Information Technology