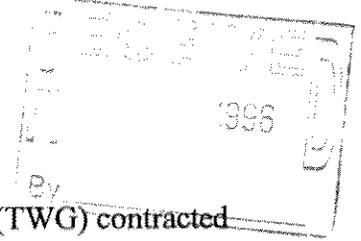


## Abstract



The Klamath River Basin Fisheries Task Force Technical Work Group (TWG) contracted with the Spatial Analysis Lab (SAL) at Humboldt State University, to assemble and develop Geographic Information System (GIS) digital data layers for fisheries restoration planning in the Klamath River Basin. The SAL assisted the Task Force and the TWG in reviewing past restoration efforts and prioritizing ongoing fishery restoration within the Klamath River Basin. Project funding was used to provide map layers, fishery restoration data, and spreadsheets, and to analyze digital map layers in cooperation with federal, state, Native American tribes and other entities involved with restoration efforts in the Klamath River Basin. In addition, this project continued to provide the TWG and its subcommittees with meeting documentation and general support. GIS database efforts were focused on updating and maintaining the Klamath River Basin Fisheries Task Force Restoration Projects GIS Database. Other GIS efforts lent support to subbasin planning and the cooperative microhabitat and flow study work between the National Biological Service and the U.S. Fish and Wildlife Service. In-process spatial analyses include debris torrent mapping and the applications of the Revised Universal Soil Loss Equation (RUSLE) on the landscape level.

Unit Cooperative Agreement No: 14-48-0001-95

***SUBBASIN PLANNING AND  
PROJECT DEVELOPMENT  
96-PC-06***

**A Report to the U.S. Fish and Wildlife Service**

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November 1996

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***BACKGROUND***

The Klamath Act of 1986 (16 U.S.C. 460 *et seq.*) established the Klamath River Basin Conservation Area Restoration Program, a 20-year fishery restoration program for the Klamath River Basin of northern California and southern Oregon (Figure 1). An advisory committee, the Klamath River Basin Fisheries Task Force was established by the Klamath Act to provide guidance in planning and implementing the Restoration Program. The Technical Work Group is comprised of representatives from the Task Force cooperators who provide technical support and make recommendations to decision-makers regarding the biological needs of anadromous fish.

In 1994 the Task Force Technical Work Group (TWG) contracted with the Humboldt State University Foundation (Unit Cooperative Agreement No: 14-0009-1547; Research Work Order No: 38) to assemble and develop Geographic Information System (GIS) digital data layers for fisheries restoration planning in the Klamath River Basin.

After the completion of the Research Work Order 38, the TWG recognized the need for continued GIS technical, logistic and planning support provided by the TWG Research Assistant position. In 1995 the U.S. Fish and Wildlife Service (USFWS) contracted with the Humboldt State University Foundation to continue to provide map layers and fishery restoration data to assist the Task Force and TWG in reviewing past restoration efforts and prioritizing ongoing fishery restoration within the Klamath River Basin.

***INTRODUCTION***

The funding provided through Cooperative Agreement No: 14-48-001-95 was used to continue providing the Task Force and TWG with GIS technical, logistic, and planning general support for FY 1996. Project funding was used to provide map layers, fishery restoration data, and spreadsheets and to analyze digital map layers in cooperation with federal, state, Native American tribes and other entities involved with restoration efforts in the Klamath River Basin. In addition, this project continued to provide the TWG and its subcommittees with meeting documentation and general support.

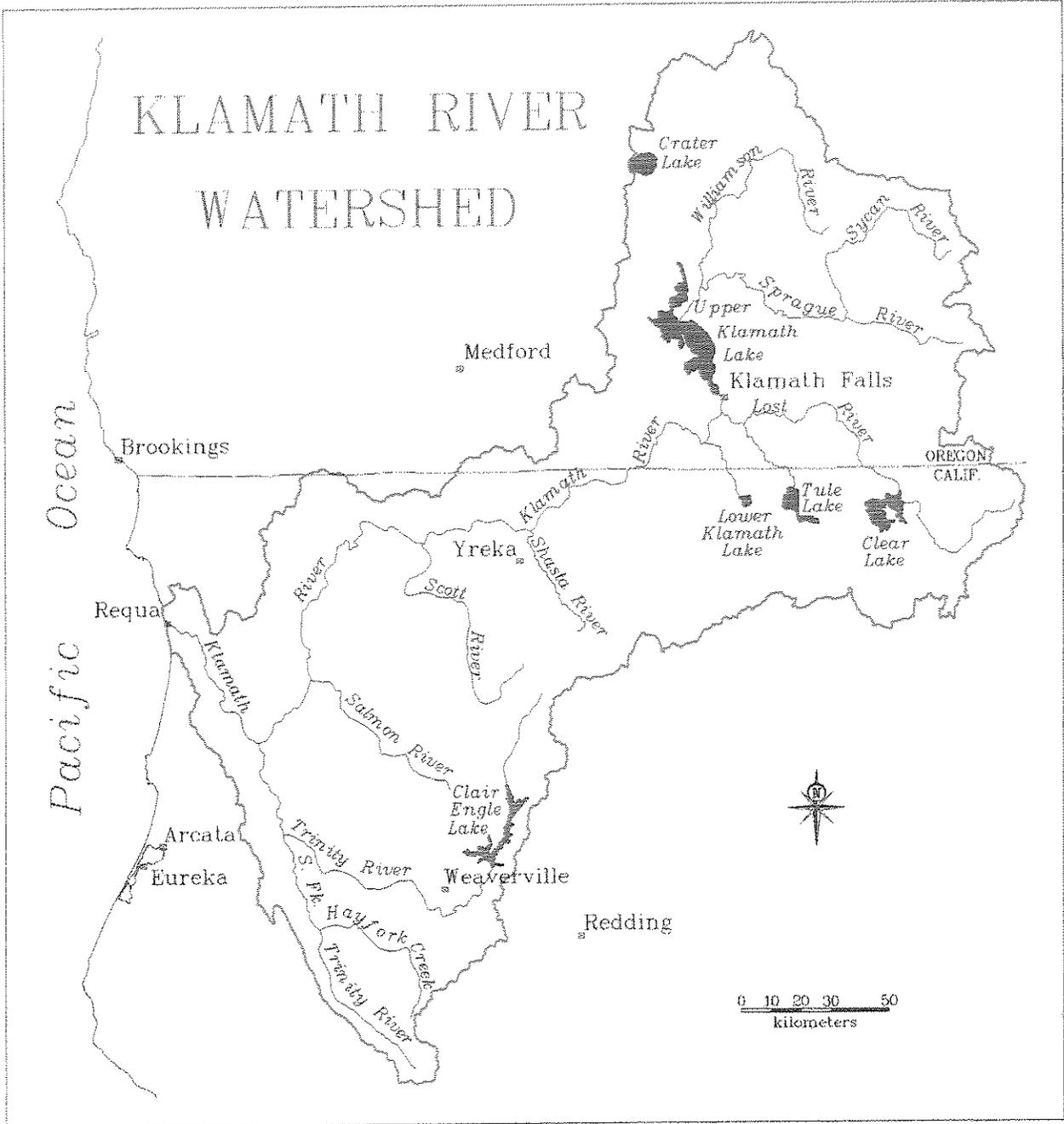


Figure 1. Klamath River Watershed

## ***METHODS AND MATERIALS***

The focus of this project was to support subbasin planning and project development. This was accomplished through ongoing participation and documentation of TWG and its associated subcommittee meetings, activities and decisions.

The following section provides a list of the meetings attended with a brief summary of the purpose of the meeting and issues discussed. Detailed documentation of these meetings are on file at the U.S. Fish and Wildlife Service (USFWS), Klamath River Fish and Wildlife Office (KRFWO) in Yreka.

### **Technical Work Group Meetings:**

- 1. July 25-26, 1995. Rogue Regency Inn, Medford, Oregon.** *Purpose of Meeting:* Update on the status of studies being conducted by the National Biological Service (NBS); Update on the status of the Klamath Project Operational Plan (KPOP); Develop recommendations for Flow Study to Task Force; Recommendation of ranked projects for Fiscal Year (FY) 1996; Develop a subcommittee for review of criteria for ranking of proposals for FY 1997; Discussion of Phase II of Flow Study; TWG role in five year program review.
- 2. October 10-11, 1995. Miners Inn, Yreka, California.** *Purpose of Meeting:* NBS Update on studies and commitments of funding; Updates from Subcommittees on FY 96 funding, reintroduction of anadromous fish into the Upper Basin, microhabitat studies, and cold water refugia; Update on Flow studies including KPOP, Water System Operational Model, Stream Morphology/Sediment Analysis, Water Temperature Pilot Study and Water Quality literature review; Develop recommendations for Flow Studies to Task Force; Provide comments on Draft Memorandum of Understanding (MOU) between the Task Force, NBS, TWG regarding responsibilities of the cooperating parties in the development of Instream Flow Studies; Update from the Request For Proposals (RFP) Subcommittee regarding the evaluation criteria for ranking project proposals.
- 3. February 15-16, 1996. Miners Inn, Yreka, California.** *Purpose of Meeting:* Provide input to NBS Draft Scope of Work for the Water Quality Model Development; Develop recommendations to Task Force on revised RFP for FY 1997; Make recommendations to Task Force regarding the Klamath Project Operational Plan (KPOP); Discuss recommendations presented by the RFP Subcommittee on the revised RFP process; Updates on University of California at Davis Water Quality Studies, Update on North Coast Regional Water Quality Control Board study; Brief update on the FY96 budget for the Klamath River Fish and Wildlife Office; Discussion of Phase II, Instream Flow Water Quality Model lead by NBS.

4. **May 8, 1996. California Department of Fish & Game, Region 1 Headquarters, Redding California.** *Purpose of Meeting:* Provide the TWG with a review of the April 23-24, 1996 Task Force meeting in Klamath Falls, Oregon; Updates on FY96 budgetary shortfalls and how this will effect the Restoration Program and ongoing studies and work; Review of presentation of the Recommended Revisions to the RFP Process to the Task Force; Discuss which RFP recommendations can be incorporated in the FY 1997 RFP; Discuss time frames for development and release of the FY 1997 RFP; Develop and approve revised RFP process schedules for the next three years; Discuss budgetary recommendations for the TF Budget Committee; Develop recommendations to TF Budget Committee for RFP categories (on-the-ground, support services, other projects); Discuss ways to incorporate subbasin objectives and specific language into the RFP.
  
5. **June 6, 1996. Technical Work Group Teleconference.** *Purpose of Teleconference:* To discuss a memorandum from Dr. Marshall Flug (NBS) regarding the development of the Water Quantity Model (WQM) objectives. TWG members discussed some of their concerns regarding the WQM objectives and the direction of this part of the flow studies.
  
6. **August 1, 1996. California Department of Fish & Game Region 1 Headquarters, Redding, California.** *Purpose of Meeting:* Provide TWG members with updates on flow study related work including microhabitat studies, on-going development of the Water Quantity Model (NBS) and water quality studies being conducted by UC Davis. A representative from the U.S. Bureau of Reclamation, Klamath Falls, Oregon Office provided an advisory update regarding the status of the Klamath Project Operational Plan; Information regarding the status of Listing Status of the steelhead and coho salmon was provided by the National Marine Fisheries Service; Organize a Subbasin Plan Development Subcommittee; Planning for September 25-26, 1996 TWG meeting in Yreka to rank project proposals.
  
7. **September 25-26, 1996. California Department of Fish & Game Cantera Program Office, Redding, California.** *Purpose of Meeting:* To discuss and rank FY 1997 project proposals seeking funding from the Restoration Program; To receive updates on the flow study status and the subbasin planning subcommittee; and to review the FY 1997 proposal ranking process.

#### **Request For Proposal (RFP) Subcommittee Meetings:**

1. **August 28, 1995. U.S. Forest Service, Ukonom Ranger District Office, Orleans, California.** *Purpose of Meeting:* Review the RFP process and procedures and develop recommendations for improving them. Discussion topics included: watershed prioritization, need for multiyear project commitments, identification and prioritization of subbasin and basin objectives, annual review and revision of subbasin and basin implementation, establishment of separate ranked project lists and

budgets for non-implementation and implementation categories of projects, development of TF policy guidelines, appropriateness of funding projects, revision of evaluation criteria.

2. **December 10, 1995. U.S. Forest Service, Ukonom Ranger District Office, Orleans, California.** Purpose of Meeting: Continue the work initiated at the last RFP Subcommittee meeting in August, looking forward towards the release of the FY 1997 RFP; Enhance the recommendations discussed at the last subcommittee meeting to draft a Recommended Revision to the RFP Process for the next TF meeting (Appendix A).

#### **Microhabitat Subcommittee Meetings:**

1. **May 16, 1996. U.S. Fish and Wildlife Office, Arcata, California.**  
*Purpose of Meeting:* To explain the National Biological (NBS) Service Quick Response Research Grant Program and how a recently granted funds will be used to conducted micohabitat related studies on the Klamath River. This was an opportunity for TWG members to provide input and direction of microhabitat studies. In addition, the Physical Habitat Simulation (PHABSIM) study reach was identified. Segments and slope subsegments within the study reach were defined later and mapped (Figure 2). Collection of field data methods and essential support studies were also discussed.
2. **June 18, 1996. U.S. Fish and Wildlife Office, Arcata, California.**  
*Purpose of Meeting:* To determine the scope and purpose of the microhabitat subcommittee. There was an update on the NBS/USFWS cooperative microhabitat study. The Habitat Suitability Index Curves and the boundary of the study were also discussed as well as the GIS compatibility of this project. Another topic addressed was some of the specific needs for field data collection to assist with using a GIS for this data in the future.

#### **Klamath River Basin Fisheries Task Force Meetings:**

1. **October, 26-27, 1995. Brookings Oregon.**  
*Purpose of Meeting:* Receive updates on the KPOP, NBS Jurisdictional Analysis and Flow Study direction. TWG Chair presented the TWG recommendations for Instream Flow Study direction including a MOU between the TF, NBS and the USFWS, discretionary funding allocations and the role of the TWG role in the KPOP process. TWG RFP Subcommittee Chair Jud Ellinwood presented a report on the first TWG RFP Subcommittee meeting on the revision to the RFP process and proposal ranking process.

# Hydrologic Segments and Slope Subsegments of the Physical Microhabitat Study Area

Klamath River - Iron Gate Dam to Seiad Creek (60.1 miles)

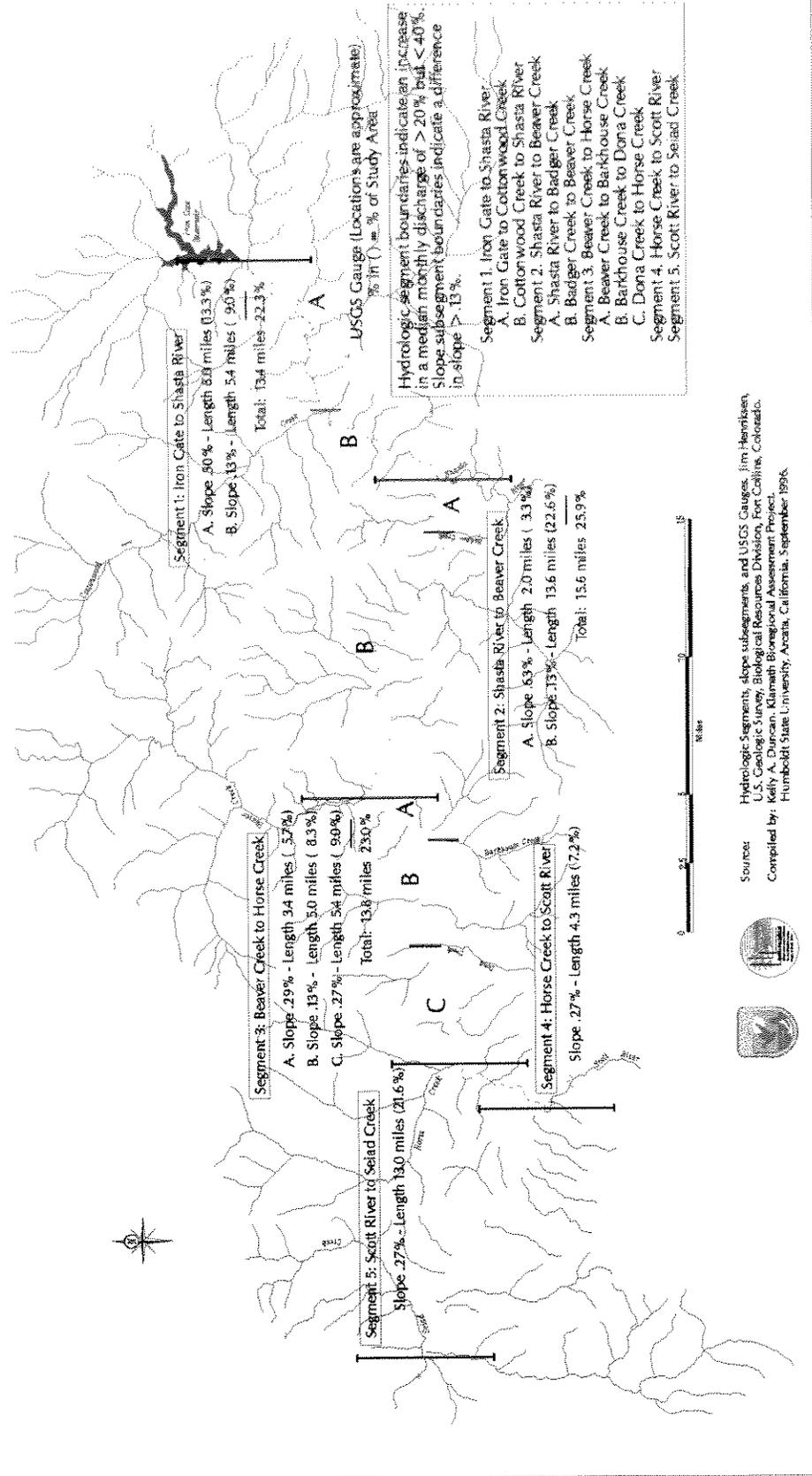


Figure 2. Physical Microhabitat Study Area

2. **April 23-24, 1996. Klamath Falls, Oregon.**

*Purpose of Meeting:* Update on ecosystem restoration issues before Congress, brief status of lake levels, flows and forecasts by the U.S. Bureau of Reclamation; Reports from the CDFG on 1995 river escapement and 1996 abundance forecast; Presentation of the NBS Jurisdictional Analysis; Presentation of TWG RFP Subcommittee Chair on the proposed recommended revisions to the RFP and proposal ranking processes; Present revised RFP schedule and timelines; Discussion of budget shortfall for FY96 projects; Upper Basin Amendment final recommendation; Brief TWG update on Phase II of the Instream Flow Study, Water Quantity Model, and MOU with NBS.

3. **June 4-5, 1996. Humboldt State University, Arcata, California.**

*Purpose of Meeting:* Task Force meeting was hosted by the Departments of Natural Resources Planning and Interpretation and Forestry. Staff support for this meeting was provided under the support of the Subbasin Planning and Project Development (96-PC-06) contract. Agenda items discussed included: a brief update on the status of lake levels, flows and forecasts by the U.S. Bureau of Reclamation; a legislative update from a representative of Congressman Riggs; an update on the FY 1996 Budget from TF Chair Hall; a report on the Mid-Program Review from TF member Wilkinson; Results of the Budget Meeting and recommended Budget Categories for FY 1997; Discussion of the FY 1997 RFP and a look at the priorities and preparation for the October TF meeting; TF discussion and decision regarding the final recommendation to the Upper Basin Amendment; Update by TWG Chair on the status of Phase II of the Instream Flow Study, Water Quantity Model, and agreements with NBS; Discussion regarding hatchery management issues; Update on the status of GIS activities at Humboldt State University.

**GIS and Coordinated Resource Management Planning (CRMP) Meetings:**

1. **October 13, 1995. USFWS Klamath River Fish & Wildlife Office, Yreka, CA**

The purpose of the meeting was to facilitate a GIS scoping session to help identify perceived GIS mapping and analysis needs of CRMP and other cooperators interested in anadromous fisheries restoration. Representatives from the U.S. Fish and Wildlife Service, Klamath National Forest, Humboldt State University GIS Technical Work Group, the Salmon, Scott and Shasta River CRMP programs, College of the Siskiyous and the Siskiyou County Superintendent of Schools Office were active participants in the scoping session. GIS data sets, needs and analysis were discussed. Each participant discussed their GIS needs for their respective areas of interest.

2. Several informal GIS coordination meetings were held with representatives from William M. Kier Associates to identify GIS needs, discuss current GIS data sets and identify cooperators and opportunities to disseminate data sets. Data sets were transferred on several occasions as well as identifying future data requirements and the necessary tasks needed to complete data set revisions and updates.

3. **April 22, 1996. USFWS Klamath River Fish and Wildlife Office, Yreka, CA**  
A meeting was held with cooperators from the Scott and Shasta River CRMP groups to discuss new revisions to the U.S. Environmental Protection Agency (EPA) River Reach Files (Version 3, RF3). CRMP cooperators had identified errors in the classification of hydrologic features in the RF3 data sets and agreed to assist the TWG Research Assistant, in conjunction with the KRIS and William M. Kier and Associates, in updating misclassified and misnamed hydrologic features in their respective subbasins. A series of map and GIS data set revisions improved the quality of the subbasin data sets. Revised data sets were provided to Kier and Associates to be incorporated in the KRIS.
  
4. **May 5, 1996. Siskiyou County Superintendent of Schools Office, Yreka, CA**  
*Purpose of Meeting:* Presented the opportunity to report on the status of on-going projects in the Klamath River Basin in conjunction with 319h Grants administered through the U.S. Fish and Wildlife Service and the North Coast Regional Water Quality Control Board. Cooperators presented their progress to date and discussed opportunities to share information and expertise among all the parties interested restoration work in the basin. Part of the meeting was an update on the status of Phase III of the Klamath Resource Information System (KRIS) being developed by William M. Kier Associates. The TWG Research Assistant was present to inform 319h Grant Program cooperators of the types of GIS data sets and services available from the TWG Research Assistant and the Humboldt State University GIS Technical Work Group.
  
5. **May 10, 1996. U.S. Fish and Wildlife Service Office, Arcata, California.**  
A meeting with USFWS staff was held to discuss the availability of GIS data sets that could assist the staff of the office with planning and consultations. The meeting discussion included the availability of GIS data sets and services that could be available from the HSU GIS Technical Work Group.

## ***RESULTS AND DISCUSSION***

The following section discusses the degree to which the tasks identified in the statement of work have been accomplished and any special problems encountered.

Statement of Work for Restoration Program Work Plan Project 95-PC-06 and identified tasks completed:

Task 1. *Continue to provide GIS research and mapping products authorized by the TWG.*

The TWG Research Assistant continued to provide the TWG with GIS research and mapping products throughout the course of the project including map layers, spreadsheets, and information packets at the direction of the TWG .

GIS map requests were in line with TWG/TF priorities. Many additional subbasin maps were provided to TWG members to assist with subbasin planning efforts (Appendix B). The Water Quantity Model (NBS) was under development this year and the nodes for the model were a big discussion topic for the TWG (Figure 3). Another area that the TWG started working with was water quality. The TWG was interested in compiling the data collection locations for water quality information throughout the basin (Figures 4 and 5).

*Task 2. Continue to provide the TWG with documentation services at TWG meetings.*

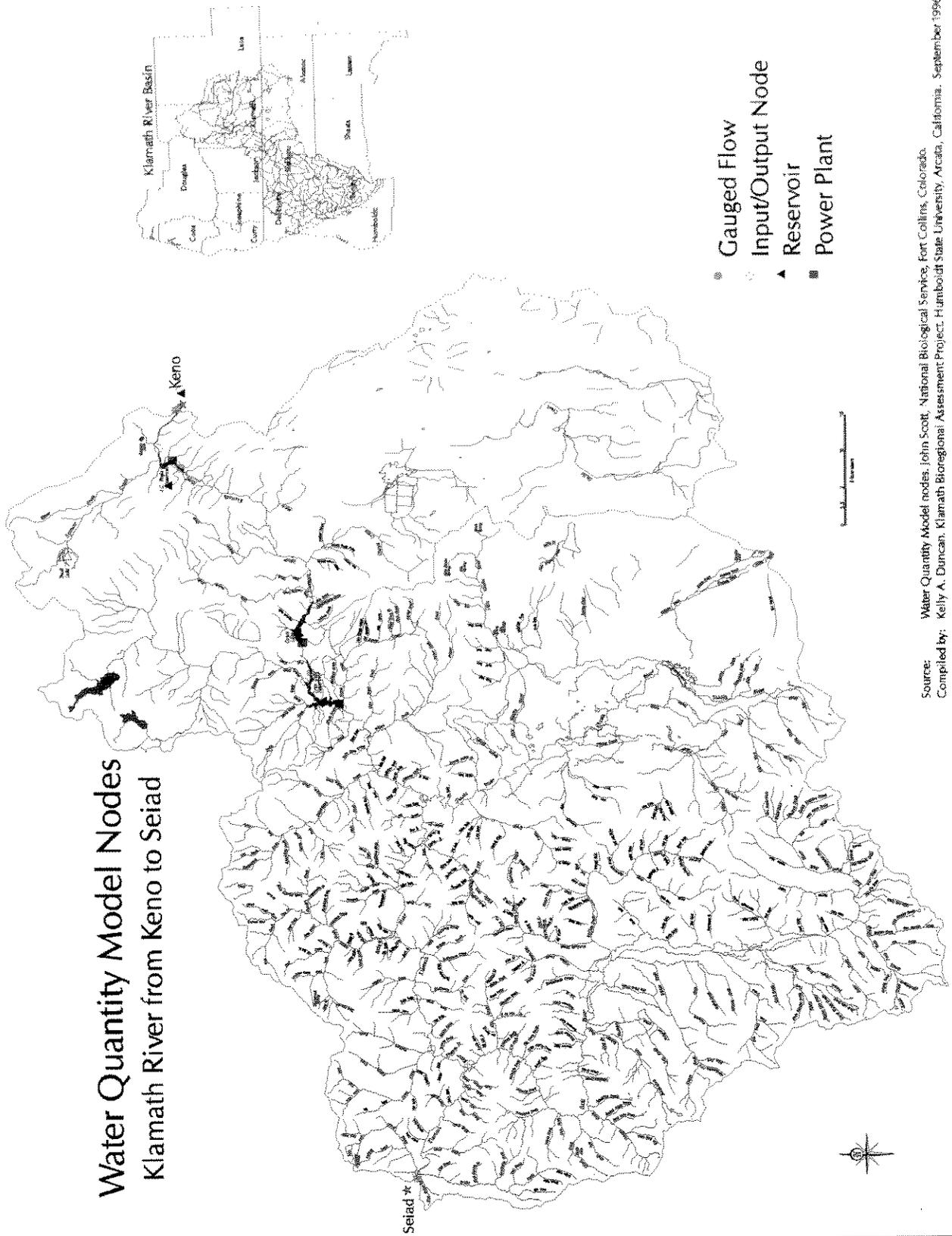
The TWG Research Assistant attended all TWG meetings and several different TWG subcommittee meetings to provide documentation and general support services. The documentation of these TWG meetings played a significant role in recording discussions of critical issues and the development of recommendations and decisions to assist the Task Force in their decision making process. This included the continued development of Phase II of the Instream Flow investigations, and significant changes in the Request For Proposal (RFP) process.

*Task 3. Perform spatial analysis on the limiting factors to anadromous fishery resource recovery.*

There were several impediments to the completion of this task. The TWG Research Assistant asked the TWG what types of information or analysis could be used to identify limiting factors to anadromous fishery resource issues. There were several suggestions regarding what types of information could be useful to the TWG and the Task Force. However, the necessary data is not currently available at the scale that these resource issues need to be addressed. Current GIS capabilities allow for basin level analysis. In many cases this level of information is not site specific enough to answer some of the questions facing resource specialists and decision makers.

Data is more readily available in subbasins that have few landowners, like those that are primarily U.S. Forest Service land. In the Salmon River for example, landscape scale factors are being looked at in relation to debris torrent activity and the effect on anadromous fishery resources. This effort is being done at Humboldt State using data produced by the U.S. Forest Service and the Klamath Bioregional Assessment Project and is possible because of the continuity of the data developed. The Shasta River watershed is serving as a pilot study for testing the Revised Universal Soil Loss Equation (RUSLE). These applications can later be applied to the rest of the Klamath River Basin.

# Water Quantity Model Nodes Klamath River from Keno to Seiad



Source: Water Quantity Model nodes, John Scott, National Biological Service, Fort Collins, Colorado.  
 Compiled by: Kelly A. Duncan, Klamath Bioregional Assessment Project, Humboldt State University, Arcata, California, September 1996.

Figure 3. Water Quantity Model Nodes



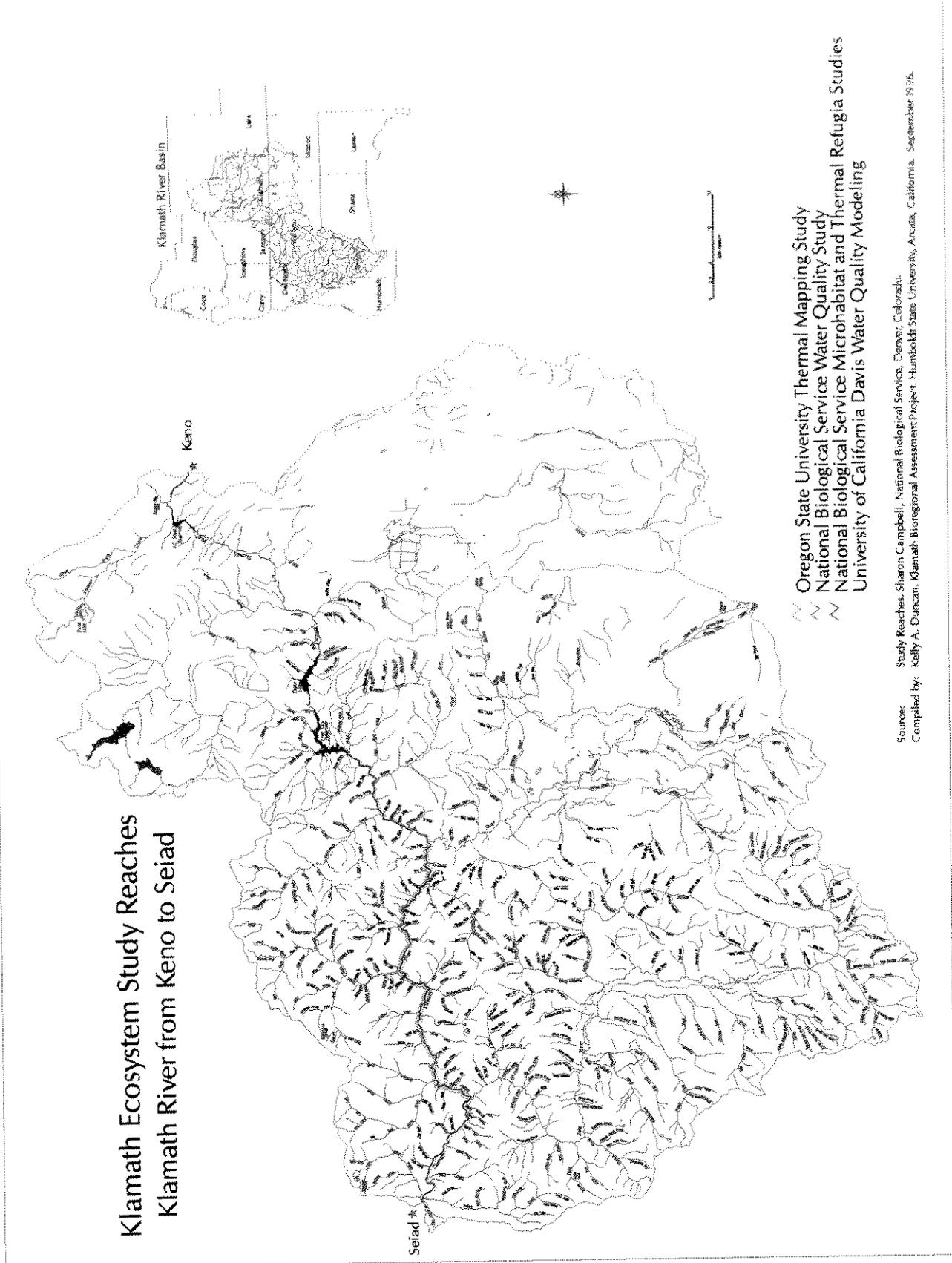


Figure 5. Klamath Ecosystem Study Reaches

Task 4. *Coordinate GIS data collection and dissemination among GIS cooperators in the Klamath Basin.*

Throughout the duration of this project GIS data set transfers were facilitated through cooperative agreements between federal, state agencies, tribal resource departments, and local CRMP efforts. The Klamath Bioregional Assessment Project at Humboldt State kept a record of many of these data transfers (Appendix B).

Task 5. *Facilitate GIS transfers among GIS cooperators and end users, such as subbasin CRMP projects and the Klamath Resource Information System.*

Data transfers among GIS cooperators and end-users were provided in several formats throughout the course of this project. GIS maps were presented to cooperating agencies. Digital GIS data sets were transferred on a variety of magnetic media as well as electronically via the Internet. A comprehensive list of GIS data transfers between the HSU GIS Group and cooperating agencies is provided in Appendix B.

There are still many different levels of technology in use throughout the Klamath Basin. This creates some difficulties with data transfer between users. In one case, the Salmon River Restoration Council people wanted to utilize data from the Klamath National Forest, but they were working on different platforms with different peripherals available to them. Humboldt State assisted with the necessary data conversions to complete the transfer.

Task 6. *Assist Scott and Shasta Coordinated Resource Management Programs with ArcView 2 orientation and training in conjunction with the implementation of the Klamath Resource Information System (KRIS).*

The first step in assisting the Scott and Shasta River CRMP efforts was initiated with a GIS Scoping Session held at the Klamath River Fish and Wildlife Office in Yreka on October 13, 1995. The purpose of this meeting was to bring interested parties together to discuss potential GIS applications in restoration planning. Overall issues discussed included: acquisition and display of site specific data; availability of reference data sets (GIS base layers or coverages); spatial scales and data layers; project specific standards; and GIS design and standards.

In addition, the meeting developed a scope of the different GIS needs of each of the cooperators. Each subbasin cooperator was asked to discuss their perceived need, potential GIS applications, and the types of data sets that would assist them with planning efforts. Each cooperator identified their priorities and discussed the types of analysis and information that they would helpful. Discussion also included potential sources of GIS data and contacts which could provide the

different data sets. Additional information provided included computer hardware requirements needed to run ArcView GIS.

The largest problem incurred with completing Task 6 was providing training to CRMP GIS users. The lack of a training facility with the proper computer hardware and software in the Yreka area made it hard to provide ArcView training. Limited training was provided to John Hamilton of the KRFWO. This consisted of a transfer of GIS data sets from HSU to the KRFWO, explanation of the GIS sets, and ArcView instruction on how to display and query GIS data sets. A visit to the Siskiyou County Resource Conservation District (RCD) Office in Etna, California for a meeting with a representative of the RCD and Scott River CRMP identified the need for additional training after staff had more time to work with the recently delivered KRIS computer system. In order for GIS information to be useful, it falls upon the end users of this technology and information to utilize all the resources available to them.

*Task 7. Assemble additional data sets provided by agencies.*

GIS database development continued to be enhanced with the addition of new and updated agency GIS data sets. Continued cooperation between the HSU GIS Technical Work Group and government agencies has been expanded. The list of GIS cooperators has grown and the amount of data has also increased. Updated GIS data sets that have been acquired include, the California Department of Fish and Game (CDFG) fishery restoration projects data layer containing restoration project information for projects completed between 1982 and 1995.

One of the most significant GIS data sets acquired during the past year was the Klamath Basin Fish Distribution data set developed by the U.S. Forest Service, Klamath National Forest GIS and Fisheries Departments. This data set represents a comprehensive compilation of Klamath River Basin fish species distribution information. This data set will be very important in prioritizing restoration efforts based on current and historic distribution of anadromous fish in the Klamath Basin.

*Task 8. Provide a draft priority list of data rich portions of the basin and identify gaps for TWG review.*

This task is ongoing. The Klamath Bioregional Assessment Project at Humboldt State (of which the TWG Research Assistant has been a part) has put together seamless data sets for the Klamath Basin (Appendix C). During this process, it became apparent that continuous data is not available at a large enough scale to assist with much on-the-ground project work. For landscape scale analysis, however, data is available, at least for the California portion of the basin.

Task 9. *Assist the Task Force and TWG in the identification of anadromous fishery restoration priorities for FY 1997 funding.*

The TWG Research Assistant assisted the TWG in the identification of anadromous fishery restoration priorities through participation with the TWG RFP Subcommittee and subsequent development of the Recommended Revisions to the Request For Proposals (RFP) process. Federal budgetary constraints and shortfalls experienced during FY 1996 demonstrates the need to prioritize restoration efforts.

The need to develop a Basin Strategic Plan and a series of Subbasin Action Plans has been identified and presented to the Task Force. The development of these plans will ensure that restoration efforts will address identified problems of each subbasin as well as setting the framework to implementing these efforts on a consistent basin level.

Task 10. *Focus GIS and analytical fishery restoration efforts on Task Force and TWG priorities.*

GIS and analytical fishery restoration efforts were focused on the updating of the Klamath River Basin Fisheries Task Force Restoration Projects GIS Database to include restoration projects funded in 1996. This included a review and updating of the restoration project database and the addition of new projects being funded by the Task Force and the Jobs-in-the-Woods Program as well as those proposed for Task Force funding (Figures 6 and 7). The locations of the proposed FY 97 projects were used with ArcView during the proposal ranking process.

Task 11. *Provide the TWG with a report summarizing hydrologic and hydrographic GIS data collection efforts conducted by the HSU Foundation.*

Appendix C (see *Streams and Watersheds*) illustrates the larger hydrologic data sets that have been developed for the Klamath Basin (*prefix KB*). Subsets of these are used in subbasin planning efforts for the TWG. The TWG Research Assistant worked with the Scott and Shasta CRMP coordinators to update the EPA River Reach Files (version 3) in order to correct inaccuracies in the original data as well as local changes in ditch information.

A careful examination of the Klamath River subbasin boundaries was done and found that the *Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program* does not represent the main subbasin boundaries in the way that TWG representatives assumed that it did. These boundaries were changed and a proposal to amend the *Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program* will be in front of the Task Force in February 1997.

# Restoration Activities in the Klamath River Basin



Figure 6. Restoration Activities

# U.S. Fish and Wildlife Service Jobs-in-the-Woods Projects Fiscal Years 1995 & 1996

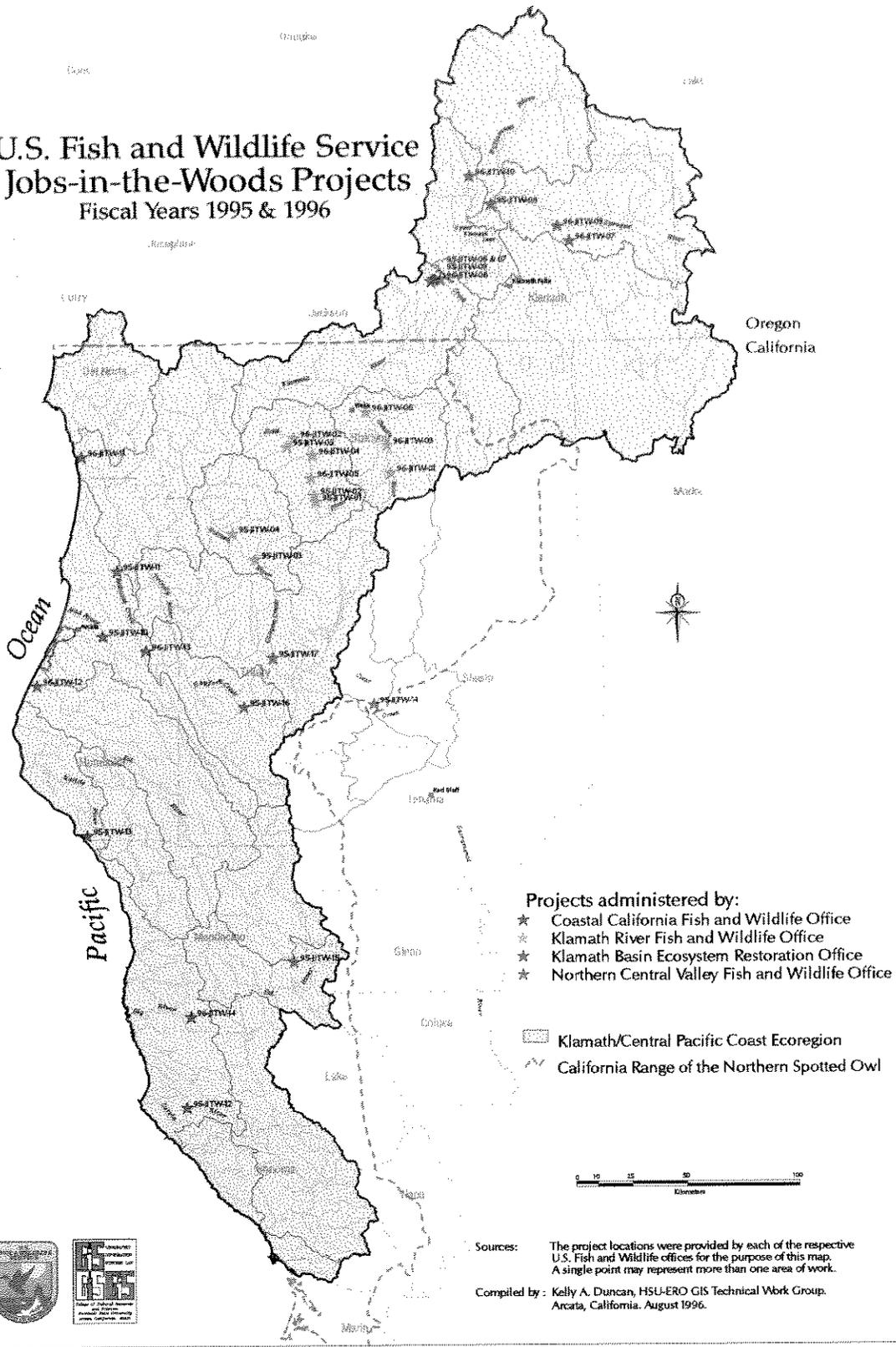


Figure 7. Jobs-in-the-Woods Projects

Task 12. *Assist the TWG in formulation of FY 1997 Fishery Restoration projects.*

The most significant contribution the formulation of the FY 1997 Fishery Restoration projects was the development and subsequent approval by the Task Force, of the Recommended Revisions to the Request For Proposals (RFP) Process document (Appendix A). In addition to the development of the Recommended Revisions to the RFP Process, the TWG Research Assistant assisted in the development of the FY 1997 RFP.

The TWG Research Assistant was asked to help prepare a Draft Fiscal Year 1997 Request For Proposals for projects seeking funding from the Restoration Program. Working with TWG RFP Subcommittee Chair, the TWG Research Assistant drafted a FY 1997 RFP and presented it to the Task Force at the June 4-5, 1996 meeting at held at Humboldt State University. This Draft RFP incorporated many of the recommended revisions to the RFP process, including the addition of subbasin base maps.

Base maps were provided with the FY 1997 RFP for project proposers to locate the site of proposed projects on a consistent series of subbasin maps. In the past project location information maps have been received on a variety of different scales, formats and levels of detail, making it difficult to geo-reference past restoration projects based on project proposals. Where applicable, project proposers were also asked to provide photographs of the proposed project location. All of this information was used to provide ArcView presentations to TWG members to increase their knowledge of proposals on the table during the ranking process.

Task 13. *Provide a draft final report describing the effectiveness of the fishery restoration program to date for review by the TWG.*

The need to assess the effectiveness of the fishery restoration program was identified as a priority by the Task Force as it enters into the second half of the twenty year Restoration Program. This task was initially identified as part of the Subbasin Planning and Project Development project. At the October 1995 Task Force meeting the TWG Research Assistant presented the Task Force with a summary of dollars spent within current project categories, as well as, subbasin maps showing the location of different categories of projects.

At this Task Force meeting, discussions included the role of Task Force and TWG in a five year program review. The discussion raised concerns over the objectivity of five year and mid-program review conducted by Restoration Program cooperators and contractors. These concerns prompted the Task Force to move towards the development of a RFP to assess the effectiveness of the Restoration Program to be conducted by an independent contractor not currently affiliated with the Program. A Mid-Program Review RFP Subcommittee was assembled

from Task Force members who would on the development of a RFP for a Mid-Program Review.

Several members of the Task Force and the general public expressed concern over the allocation of resources to perform a extensive program review. Several people present at the meeting stated that there are many variables that could affect the abundance of fish stocks in the Klamath, and that it would be hard to ascertain if the efforts of the Restoration Program were responsible to current fish stock levels. Other members of the Task Force stated that we may not have the expertise to assess the effectiveness of the Program.

Task 14. *Provide a final report describing the progress in GIS and database development with a proposed schedule and recommendations on how additional work should proceed.*

GIS base data layers for the Klamath Basin continue to be improved upon. The restoration projects database is growing. In addition to TF funded projects, it now includes Jobs-in-the-Woods projects for 1995 and 1996. Development continues as needed. A method for maintaining the database in the future should be discussed at some point, as well as what other types of projects and information the TWG may wish to have access to when discussing project proposals.

The most significant impediment to the completion of the tasks identified in the statement of work was the federal budgetary problems associated with. Significant delays in the ability of the Task Force and other agencies and entities effected by the 1996 Federal Government shutdowns. These shutdowns severely limited the ability of the Task Force to meet and make critical decisions on the progress of flow related studies, memorandums of understanding, the development of the FY 1997 Request For Proposals.

#### Presentations and Publications

The progress of GIS in support of anadromous fishery restoration planning was presented at the 16<sup>th</sup> Environmental Systems Research Institute Users Conference. At this conference a presentation was made describing the types of GIS applications that the Restoration Program has been utilizing in anadromous fisheries restoration planning in the Klamath River Basin. In addition to the presentation, a technical paper was published in the Proceedings publication (Appendix D).

## ***SUMMARY AND CONCLUSIONS***

The scope of work for GIS support and subbasin planning efforts for the Klamath River Basin Fisheries Task Force Technical Work Group increased dramatically over the past year. Documentation services and base GIS map production continued this year for the TWG. In addition the TWG Research Assistant was very involved in the revisions of the Request for Proposals process and the early stages of the subbasin planning efforts currently underway. GIS efforts were continued, maintaining and updating the restoration projects database. New GIS efforts were started with water quality and water quantity projects in the basin as well as some work with the microhabitat study underway in cooperation with the U.S. Geologic Survey, Biological Resources Division (formerly the National Biological Service).

Future developments need to include a long-term method for storing and maintaining the restoration projects database and other data created specifically for the TWG. Subbasin planning efforts are now one of the TWG's top priorities. Since a Subbasin Planning Coordinator was not decided upon, it will become even more important to fully define the role that the TWG Research Assistant is to play in these efforts over the next year, including where GIS data will be assembled for each subbasin. The TWG Research Assistant position was funded at 80% time for FY 1997. The demands for services are increasingly rapidly, so it will be necessary to have a very strong set of priorities established by the Technical Work Group and a clear overseer to the tasks assigned.

**Ecosystem Parameters II  
FY96 Project Budget Summary**

12/20/96

<i>Accounts (022-0309-)</i>	<i>Alloc.</i>	<i>Expended</i>	<i>Acct. Balance</i>	<i>Notes</i>
111-116 Total Revenue	\$ 50,400			
209-116 Prin. Investigators	\$ 1,900	\$0.00	\$ 1,900.00	
229-116 Salaries	\$ 23,831	\$32,792.50	\$ (8,961.50)	
351-116 ETT	\$ 25	\$10.01	\$ 14.99	
352-116 FICA	\$ 1,968	\$2,128.71	\$ (160.71)	
354-116 Health/Dental	\$ 6,000	\$1,498.19	\$ 4,501.81	
355-116 Worker's Comp.	\$ 1,010	\$451.79	\$ 558.21	
356-116 Unemploy. Insur.	\$ 857	\$390.00	\$ 467.00	
401-116 Supplies/Services	\$ 1,095	\$1,785.31	\$ (690.31)	
461-116 Travel	\$ 2,250	\$3,756.28	\$ (1,506.28)	
805-116 Equipment	\$ 4,890	\$4,452.57 (P90 Gateway)		
(40% of cost/shared with KRBP)		\$2,000.00 (Portable Computer)		
	<i>Equipment Balance</i>		\$ (1,562.57)	
997-116 Indirect Costs	\$ 6,574	\$6,574.00	\$ -	
		<i>Total Available Balance =</i>	\$ (5,439.36)	

## APPENDIX A

## **TF ADOPTED REVISIONS OF THE REQUEST FOR PROPOSALS (RFP) PROCESS**

The Technical Work Group (TWG) has categorized its revisions according to three time frames:

- (1) Revisions that can not be implemented in time to be incorporated into the FY 97 RFP process  
(these revisions are denoted with one asterisk \*).
- (2) Revisions that can not be implemented before the RFP goes out, but can be implemented in FY 97  
(these revisions are denoted with two asterisks\*\*).
- (3) Revisions that can be integrated into FY 97 RFPs  
(these revisions are denoted with three asterisks\*\*\*).

### **I. PLANNING**

#### **\* A. BASIN STRATEGIC PLAN**

The Task Force (TF) should enable and facilitate landscape scale decision-making by approving development of a Basin Strategic Plan by the Technical Work Group. The Basin Strategic Plan will in turn be used to guide development of sub-basin action plans.

1. The Basin Strategic Plan should follow FEMAT Aquatic Conservation Strategy principles.

*Comment:* A benefit will be the standardization of management practices and strategies across public/private land ownership boundaries.

2. The Basin Strategic Plan should:
  - (a) Emphasize the maintenance of biodiversity, not production.
  - (b) Recognize the role of smaller streams that support runs other than fall chinook stocks.
  - (c) Protect and maintain habitat for stocks other than fall chinook.
3. The plan should categorize watersheds in functional terms, using the Forest Ecosystem Management Assessment Team (FEMAT) classification system.

*Comment:* Identification of "key watersheds" will assist planning efforts in protection of these watersheds and fish stocks and guide the allocation of restoration efforts among basin watersheds. Each TWG member could assist in prioritizing watersheds and make

recommendations for their respective geographic domains.

4. The plan should prioritize watersheds based on stock conditions and potential for recovery. The key criteria should be maintenance of biodiversity, not production.

\* B. SUB-BASIN ACTION PLANS:

The TF should approve the development of an action plan for each sub-basin by the Technical Work Group.

1. Plans should be flexible and lend themselves to being annually reviewed and revised as needed through an adaptive management process.

- \*\*\*
2. The TF should continue to fund the TWG Research Assistant who will assist with sub-basin restoration planning in the lower and middle Klamath.

- \*\*
3. The TF should establish deadlines for the completion of sub-basin plans based on a completion rate of two action plans per year. All sub-basins plans should be completed within three years to allow for the implementation of these plans in the final seven years of the Restoration Program.

- \*\*
4. Accelerate development of sub-basin action plans for the lower and mid Klamath sub-basins. These two sub-basins should be given the highest priority.

5. The TF should require the TWG to update action plans annually - identify information and data gaps to see if there is a need to shift priorities.

C. IDENTIFY AND PRIORITIZE BASIN AND SUB-BASIN RESEARCH AND MONITORING NEEDS

The TWG should identify and prioritize research and monitoring needs. Development of a Basin Strategic Plan, Sub-Basin Plans and the Instream Flow Study scoping process will assist in the identification and prioritization of research and monitoring needs.

## II. PROGRAM POLICIES

The Task Force should develop policy direction on the following key issues:

\*\* A. CORE PROGRAMS:

The TF needs to establish a policy regarding the commitment of adequate financial and logistical support for core programs and a policy that requires annual review and prioritization of core program work plans that are coordinated with the annual budget process.

1. The TWG considers only the KRFWO and STRATEGIC PLANNING to be the core programs requiring continuous support and policy direction.
2. It is presumed that the amount of funding for strategic planning will change from year to year. The TWG would propose an annual work plan, estimate costs, specific tasks, and propose annual work priorities; the TF would establish priorities; and the Budget Committee would make funding allocation decisions based on these priorities.

**\*\* B. MULTI-YEAR PROJECTS**

The TF should develop policies regarding the funding, funding conditions and implementation of multi-year projects. CRMP and TWG planning efforts, research, monitoring, education and bio-enhancement projects may be considered to be multi-year projects. The TF should consider making commitments of multi-year funding subject to conditions that ensure annual project work objectives are met.

**\*\*\* C. APPROPRIATENESS OF FUNDING CERTAIN TYPES OF PROJECTS**

The TF should make policy decisions that determine if specific types of projects should or should not be considered for Program funding, and if they do, whether or not there should be limitations imposed on how much funding (i.e., percentage of the total project costs or budget) individual and/or types of projects can be granted, respectively. Specific types of projects that require a TF determination include but are not limited to: construction of fish screens, maintenance of fish screens, construction of irrigation system improvements, and fish harvest management research.

**\*\* D. FUNDING CONDITIONS FOR CERTAIN TYPES OF PROJECTS**

Project funding conditions that ensure long-term commitment to the conservation objectives of the Restoration Program should be developed and implemented by the TF.

1. Options include but are not limited to: matching fund requirements, in-kind contribution requirements, and land and water management agreements which commit cooperators to the long-term use of sound resource stewardship practices, and gradually reducing support for CRMPs to a minimum level.

Examples of project funding conditions: (a) land management practices that ensure the recruitment of large wood debris (LWD) in riparian zones;

(b) monitoring of projects; (c) long-term maintenance agreements for culverts and fish screens paid for with program funds (beyond the end of the Restoration Program in 2006).

### III. RFP: CONTENT AND PROCESS

#### A. ESTABLISH AND MAINTAIN A PUBLIC INVOLVEMENT AND COMMUNICATION LOOP

- \*\*\* 1. The Task Force should direct the TWG to develop a RFP Response Form that will be used to provide project proposers with TWG comments generated at the proposal evaluation meeting. Comments will identify problem areas. The RFP Response Form would be sent to all project proposers with the funding approval/disapproval notification letter sent by the KRFWO.

*Comments:* (a) It is envisioned that the questions raised from the RFP Response Form could be addressed at RFP Development Workshops. (b) Response form could contain comments under each evaluation criteria category, such as scientific validity, or simply provide general comments.

- \*\* 2. The program should offer RFP Development Workshops in each of the sub-basins (excluding the mainstem), to provide proposal writers the opportunity to discuss the development of proposals that meet the objectives and needs of their sub-basins. Workshops should provide information about the RFP Process, grant writing techniques, and information required for proposals. The KRFWO in Yreka, should organize and produce these workshops in cooperation with the area's respective TWG representative.

- \*\* 3. Workshops should also provide the Program, through the KRFWO and TWG, with the opportunity to share other important information with sub-basin cooperators.

#### B. ANNUALLY REVIEW RFP EVALUATION CRITERIA AND REVISE AS NEEDED.

- \*\*\* 1. The Task Force and TWG should cooperatively review the RFP evaluation criteria on an annual basis, and incorporate new program priorities and planning information as needed.
- \*\* 2. The TF should approve a schedule for an annual review and revision of the RFP and its process. The TWG will meet annually for two days in September for the purpose of developing recommendations for the TF to review at their October meeting. The TWG will meet in December

to revisit and finalize recommendations that the TF can adopt at its January meeting.

- \*\*\* 3. The TWG should randomly select groups of proposals for evaluation.
- \*\*\* 4. The TF and TWG should reevaluate how proposals are grouped for evaluation. The TWG should evaluate project proposals by category rather than by sub-basin for Fiscal Year 1997 on a one year trial basis.
- \*\*\* 5. The TF and TWG should replace the existing proposal categories with the three proposed in Section IV (C) - Annual Budget Development.
- \*\*\* 6. The TWG should evaluate and rank projects within categories.
- \*\*\* 7. The TF should adopt the policy that proposals that do not meet the "Goals and Policies" of the RFP (one of the current evaluation criteria) will not be considered for funding.

*Comment:* This will reduce the number of proposals to be reviewed and evaluated and allow the TF to redistribute the criteria's 20 points among other criteria that have more diagnostic value.

- \*\*\* 8. The TF Budget Committee should propose and the TF approve funding levels for categories of projects before the projects are evaluated by the TWG.
- \*\*\* 9. The TF should require project proposers to provide detailed project location and site maps and before and after project photographs of proposed project sites. The projects will be used to document and assess restoration activities.
- \*\*\* 10. The TF should authorize the TWG Research Assistant to develop a series of five sub-basin base maps to be used by project proposers to provide locations for proposed projects. The TWG Research Assistant should also describe additional information required from project proposers regarding detailed project site maps using standard 1:24,000 scale USGS Topographic Maps that will be incorporated into the RFP.
- \*\*\* 11. The TF should approve the proposed Fiscal Year 1997 Evaluation Criteria shown on page 6 (the FY 96 Criteria are shown for comparative purposes).

TECHNICAL WORK GROUP RANKING CRITERIA  
REVISED FOR FY96

<u>Criteria:</u>	<u>Maximum points</u>
1. Employment of target groups	10
2. Contribution to Restoration Program goals and policies	20
3. Benefits to priority fish species and stocks	10
4. Ability of the proposer to successfully implement the proposed project	10
5. Scientific validity, technical quality, development of new concepts or information	20
6. Conforms to sub-basin objectives	10
7. Cost effectiveness; including: pricing, resource benefits/costs, and leveraging of funds -- willingness of the proposer to contribute funds or in-kind goods/services	<u>20</u>
	<b>Total 100</b>

TECHNICAL WORK GROUP EVALUATION CRITERIA  
REVISED FOR FY97

<u>Criteria</u>	<u>Maximum points</u>
1. Employment of target groups	10
2. Benefits to priority fish species and stocks	10
3. Ability of the proposer to successfully implement the proposed project	10
4. Scientific validity and technical quality, (+ 5 points from FY96)	25
5. Conforms to sub-basin objectives (+ 15 points from FY96)	25
6. Cost effectiveness; including: pricing, resource benefits/costs, development of matching funds and willingness of the proposer to contribute funds or in-kind goods/services	<u>20</u>
	<b>Total 100</b>

Proposals must contribute to the goals and policies of the Restoration Program to be considered for funding. These requirement applies to all project proposals. ( *The 20 points given to this criteria will be redistributed to other criteria* ).

*The redistribution of the criteria points (an additional 5 points added to scientific validity and 15 additional points to criteria, conforms to sub-basin objectives) would place a greater emphasis (50% of total points possible) on a proposals scientific validity and compliance with sub-basin objectives.*

#### IV. ANNUAL BUDGET DEVELOPMENT

- \*\*\* A. The TF should annually adopt programmatic spending priorities at their October meeting.
- \*\*\* B. The Budget Committee should define levels of funding (i.e., set spending caps) for categories of projects consistent with TF budget priorities after the October TF meeting, but prior to the January TF meeting.
- \*\*\* C. The TF should define new categories of projects/work based on function. The TWG recommends that projects should be categorized as follows:
  - Category 1: Education, habitat protection and restoration construction, and artificial propagation projects
  - Category 2: Support Projects (CRMP);
  - Category 3: Collectively all other projects (includes research, monitoring and assessment projects).

**GENERAL COMMENTS:** A cap on category spending coupled with evaluating and ranking projects within categories will make category proposals more competitive. Policy changes will make the program more efficient. We need to acknowledge what can and can't be accomplished, set restoration programmatic priorities and allocate sufficient funds based on these priorities. There is also an immediate need to estimate how much money must be spent to implement high priority projects in order to identify programmatic funding shortfalls and to justify continued support and funding for fishery restoration efforts in the Klamath River Basin beyond the completion of the Restoration Program in 2006.

## APPENDIX B

Humboldt State University  
 Natural Resources Planning & Interpretation Department  
 Forestry Department  
 Arcata, California 95521

HSU GIS Lab (707) 826-5417  
 fax (707) 826-4145

**Klamath Bioregional Assessment Project at Humboldt State University**

Klamath GIS Project Data Transfer Log				
Date	To:	From:	Description	media format
11/22/94	Robert Rohde Karuk Tribe of California Orleans, CA 95556 (916) 627-3446	HSU GIS TWG Rob Beachler, Gordon Bonser	1972-MSS Satellite Imagery 1988-MSS Satellite Imagery Klamath Prov. GIS coverages	transferred on Bernoulli disk to Karuk Tribe GIS computer.
1/29/95	Tim Veale Trinity NRC PO Box 1414 Weaverville, CA	HSU GIS TWG Rob Beachler, Gordon Bonser	Trinity & S. Fork Trinity HUC boundaries, and RF3 hydrology. Color raster/vector overlay map of Salmon River HUC. 1988 MSS image/RF3 hydro data	(5) 3.5" floppy DXF format for AutoCAD (1) 8.5"x11" color map
2/7/95	Dr. Terry Waddle, NBS John Bartholow, NBS 4512 McMurry Ave. Fort Collins, CO 80525 (303) 226-9230	HSU GIS TWG, KRBFTF TWG	Complete set of HSU GIS TWG maps. Given to NBS for Phase 1 Scoping Report for the Klamath River Flow Assessment	(6) D-sized paper maps presented to NBS at Feb. 6-8 KRBFTF--TWG meeting in Redding, CA
	Yvonne Everett Hayfork GIS Group Hayfork, CA	HSU GIS TWG Rob Beachler	Klamath Province GIS Data Sets land ownership, hydrology, roads, Klamath counties	(1) 250 MG Tape pcARC/INFO coverages
2/10/95	Twila Browning Klamath NF Goosenest Ranger Dist. MacDoel, CA (916) 398-4391	HSU GIS TWG Gordon Bonser	Classified imagery of Schonchin Butte Quad--1988 TM imagery	(4) 3.5" floppy disks Idrisi format
3/10/95	Twila Browning Klamath NF Goosenest Ranger Dist. MacDoel, CA (916) 398-4391	HSU GIS TWG Gordon Bonser	Classified imagery of Bonita Butte Quad--1988 TM imagery	(4) 3.5" floppy disks Idrisi format
3/11/95	Pat Higgins, Dr. Jan Durkson Klamath Resource Info. System (KRIS)	HSU GIS TWG Rob Beachler	Full set of Klamath Province GIS data sets	(1) 250 MG Tape pcARC/INFO coverages
3/11/95	Pat Higgins/Jan Durkson Klamath Resource Info. System (KRIS) Wm. M. Kier & Assc.	HSU GIS TWG	Scott Valley GIS data sets from KRIS project (from at Teale DC). scottav.zip file (54 MG file) S. Frk Trinity SPOT Imagery	(1) Bernoulli disk detailed Scott Valley GIS data set prepared at Teale DC (Sac.) for KRIS
3/16/95	Dr. John Ritter O.I.T./NASA Visiting. Sci. 3201 Campus Drive Klamath Falls, OR 97063 (503) 885-1495	HSU GIS TWG Rob Beachler	Complete hard copy set of Klamath Province GIS maps	(7) D-sized paper maps
3/16/95	Klamath Basin Ecosystem Restoration Office (ERO) 6600 Washburn Way Klamath Falls, OR 97063	HSU GIS TWG Rob Beachler	Complete set of Klamath Prov. GIS maps.	(8) D & E-sized paper maps

Date	To:	From:	Description	media format
3/29/95	Al Olson	HSU TWG	Klamath River Basin Boundary	(1) 3.5" floppy
	Klamath Ntl. Forest 1312 Fairlane Rd. Yreka, CA 96039	Rob Beachler	Master Quad Index	ARC/INFO export file mailed to Al Olson
	HSU GIS TWG Rob Beachler	Paul Veisze Spatial Data Coord CDFG Sac. CA (916) 323-1667	CDFG fishery restoration project locations (1983-1992)	emailed to S. Carlson IP ARC/INFO export file w/ assoc. meta-data
	HSU GIS TWG	Mike Tuffly GIS Analyst CDFG-Heritage D (916) 753-0522	CALWATER 1.0 CA Planning Watersheds Source: CDF	emailed to S. Carlson IP ARC/INFO export file unix compressed (.z)
4/4/95	Klamath Basin Ecosystem Restoration Office (ERO) 6600 Washburn Way Klamath Falls, OR 97063 (503) 885-8481	HSU GIS TWG Rob Beachler	Complete set of Klamath Prov. GIS data sets: land ownership, hydro (RF3), roads, mine pts., hydrologic units code (HUC) bnd etc.	transferred using 150 MG Bernoulli disk.
4/5/95	Twila Browning USFS-Klamath NF Gooseneck Ranger Dist. MacDoel, CA (916)398-4391	HSU GIS TWG Gordon Bonser	Refined classification of Bonita Butte imagery	(2) 3.5" floppy diskettes
4/6/95	Wedge Watkins BLM-Wood River Area 2795 Anderson Bldg 25 Klamath Falls, OR 97063 (503)885-4110	HSU GIS TWG Rob Beachler	ArcView 2 Klamath River Basin and Klamath Counties Map	(1) 8.5"x11" map created at KBERO
4/9/95	Sharon Campbell, NBS 4512 McMurry Ave. Fort Collins, CO 80525 (303) 226-9230	HSU GIS TWG Steve Carlson Rob Beachler	Klamath Prov. Federal Lands map showing acreage by category	(1) 8.5"x11" map faxed to S. Campbell
4/13/95	Jerry Bird USFWS Arcata, CA 95521	HSU TWG Rob Beachler	HSU GIS TWG maps: land admin., master quad index, Klamath counties, regional setting	(4) D-sized maps
	HSU GIS TWG	Carl Almquist USBM Spokane, WA	USBM Mine Location Database clipped to the KLPROV 3 cover.	emailed to C. Almquist
5/19/95	Dr. Ron Garrett & Akimi Young Klamath Basin ERO 600 Washburn Way Klamath Falls, OR	HSU GIS TWG Rob Beachler	Klamath River Watershed map with specific water bodies as per ERO request.	(8) 8.5"x11"; (2) 2"x2.25" Map: color, b/w & trans.; smaller ver. for letterhead
5/21/95	Tryg Sletteland Sierra Club Legal Defense Fund 705 Second Ave, Suite 203 Seattle, WA 98195	HSU GIS TWG Rob Beachler	Klamath River Watershed Map with Link River & Iron Gate Dams	(3) 8.5"x11" Maps: color, b/w, transparency
5/21/95	Ellen Chu Univ. of Washington Environmental Services FM-12 Seattle, WA 98104	HSU GIS TWG Rob Beachler	Klamath River Watershed Map with Link River & Iron Gate Dams	(2) 8.5"x11" Maps: color & b/w

Date	To:	From:	Description	media format
5/28/95	Tom Lupo CDFG	HSU GIS TWG Larry Fox Steve Carlson	GIS Coverages	sent by email and downloaded onto (1) 250 MG tape
8/8/95	Mike Furness USFS-Watershed Analysis Center	Larry Fox Kelly Duncan	Eel River Watershed Color Comp. Image, Eel River Physiographic map	(2) hard copy maps
8/25/95	Jan Dirksen William Kier Assoc. K.R.I.S. Project	Gordon Bonser	TIFF Files of Scott & Shasta River sub-basins	Bernoulli disk by mail
8/25/95	Twyla Browning USFS-Klamath NF Gooseneast Ranger Dist.	Gordon Bonser	25 Image quads of distinct and three threshold classification images	hard copy maps mailed to Gooseneast Ranger Dist. Office
9/26/95	HSU GIS Group Dr. Larry Fox	Tom Lupo CDFG	Northern Spotted Owl and Marbled Murrelet GIS coverages	sent via internet, downloaded to floppy disk A/I export file format
Oct-95	Mike Evenson Natural Resources PO Box 191, Redway CA 95560 (707) 923-2979	Kelly Duncan	Klamath Geographic Domains, Eel River Physiographic maps	hard copy maps
11/2/95	Cliff McMillan Klamath County Board of Commissioners 409 Pine St., Suite 200 Klamath Falls, Or 97601	Rob Beachler Kelly Duncan	Series of Upper Klamath Sub-Basins showing watershed	(6) hard copy maps
12/15/95	Jim Villeponteaux Salmon River Restoration Council Rt 4, Box 325 Sawyers Bar, CA 96027	Kelly Duncan Rob Beachler	Salmon River Watershed Roads 1:100,000 scale	(1) QIC-80 250 MB tape
1/4/96	Karen Gaffney Circuit Riders Prod. 9619 Old Redwood Hwy. Windsor, CA 95492	Gordon Bonser	Ownership, streams, roads and 3 band imagery of the Navarro River region	(10) 3.5" floppy disks
Jan-96	B. Davis Bureau of Reclamation	Mike Neuman	Klamath Project Operations Plan Orientation Map	hardcopy maps
1/15/96	Ron Beitel USFWS-Region 1 GIS Analyst	David Ramirez	Complete transfer of all HSU GIS coverages to USFWS-Region 1 Office	(1) 8 mm tape
1/25/96	Mike Martischang GIS Coordinator Six Rivers NF Eureka, CA	Kelly Duncan	Complete transfer of all HSU GIS coverages to USFS, Six Rivers NF, Supervisors Office	(1) 8 mm tape
2/5/96	Janine Steinback Cooperative Projects Coord. Strategic Planning Program The Resources Agency PO Box 944246 Sacramento, CA 94244	Rob Beachler	Klamath Task Force Restoration Projects Map, KZ Physiographic map, Geographic Domains map	(3) hard copy maps Phone: (916) 654-1885 Fax: (916) 227-2672

Date	To:	From:	Description	media format
2/9/96	Mark Buettner Bureau of Reclamation	Mike Neuman	Upper Klamath Lake Fish Project Radio Telemetry Locations Water Quality Relationships	(50) hardcopy maps
2/14/96	Jim Villeponteaux Salmon R. Restor. Coun Rt 4, Box 325 Sawyers Bar, CA 96027	Kelly Duncan	Full transfer of Klamath NF GIS coverages converted from 8 mm tape to QIC-80 format	(2) QIC-80 tapes
2/14/96	Gary Black Siskiyou Resource Conservation District Etna, CA	Rob Beachler	Scott River Hydrology, ownership map,	(2) hard copy maps
2/15/96	Mike Deas UC Davis, Dept. of Civil & Env. Engineering University of California Davis, CA 95616	Rob Beachler	Maps of the Middle Klamath and Shasta River Basin: ownership, hydrology, lakes, physiography	(4) hard copy maps  (916) 753-6386
2/15/96	Marshall Flug National Biological Serv. 4512 McMurray Ave. Fort Collins, CO 80525	Rob Beachler	Maps of the Klamath River and & major sub-basins: ownership, hydrology, lakes, physiography Upper Klamath Basin Landsat	(8) hard copy maps
2/15/96	Mike Rode C.D.F.G. 3 N. Old Stage Rd. Mt. Shasta, CA 96067	Rob Beachler	Maps of Shasta River sub-basin and Mt. Shasta Landsat image map	(2) hard copy maps
2/15/96	John Hamilton USFWS-KRFFWO PO Box 1006 Yreka, CA 96097	Rob Beachler	Series of new sub-basin maps: ownership, streams, lakes; Upper Klamath sub-basin Landsat map	(8) hard copy maps
2/15/96	Tom Shaw USFWS, CCFWO 1125 16th St., Room 209 Arcata, CA 95521 (707) 822-7201	Rob Beachler	Map of Lower Klamath River sub-basin map	(1) hard copy map
2/15/96	Dan Gale Yurok Tribal Fisheries 15900 Hwy 101 Klamath, CA 95548	Rob Beachler	Map of Lower Klamath River sub-basin map	(1) hard copy map
3/7/96	Water users	Mike Neuman	Klamath Basin Lakes	
3/8/96	Steve Lewis KBERO	Mike Neuman	Klamath Falls Wetlands	
3/20/96	Kent Manual City of Redding, Planning Dept. 760 Parkview Ave. Redding, CA 96001	Gordon Bonser	Full vegetation calssification of Redding area- DXF format to import into AUTOCAD	(1) QIC-80 250 tape
3/25/96	Bob Klamt N. Coast Regional Water Quality Control Board 5550 Skylane Blvd. Santa Rosa, CA	Gordon Bonser	All vector layers for Russian R., imagery and preliminary class. of Russian River	(1) 8 mm tape

Date	To:	From:	Description	media format
3/13/96	Jim Villeponteaux Salmon R. Restor. Coun Rt 4, Box 325 Sawyers Bar, CA 96027	Kelly Duncan	DEM and Timber layers from Klamath NF	(1) QIC-80 250 MB tape
3/19/96	Karen Lee Klamath Tribes of OR PO Box 436 Chiloquin, OR 97624	Rob Beachler	Landsat scenes	(2) 8 mm tapes
3/25/96	Shane Romsos HSU Wildlife Dept. Dr. Golightly (707) 826-3952	Rob Beachler	Data conversion and transfer of landuse maps for Newport Coyete Project	transferred 8 mm tape to (4) 3.5" floppy disks
3/19/96	Karen Lee Klamath Tribes of OR PO Box 436 Chiloquin, OR 97624 (541) 783-2095	Rob Beachler	(2) Landsat scenes, watershed boundaries, Oregon land admin. Public Land Survey coverages	(2) 8 mm tapes
4/22/96	Twila Browning Klamath NF, Goosenest Ranger District	Gordon Bonser	Final classification of Goosenest AMA and accuracy assessment plots. Hard copy maps, 8 mm tape, cover letter, ascii text files for accuracy assess. w/ GPS	(3) hard copy maps; (1) 8 mm tape with text files
4/22/96	Dave Webb Shasta R. CRMP Coord. PO Box 277 Mt. Shasta, CA 96067	Rob Beachler	Second round of EPA R. Reach File field verification of stream networks, names and classes.	(2) hard copy maps (1) N. Shasta R. (1) S. Shasta R.
4/22/96	Gary Black Scott River, Resource Conservation District 444 Main St. Etna, CA	Rob Beachler	Second round of EPA R. Reach File field verification of stream networks, names and classes.	(2) hard copy maps (1) N. Scott R. (1) S. Scott R.
4/25/96	Greg Goldsmith USFWS, CCFWO 1125 16th St., Room 209 Arcata, CA 95521	Rob Buntz	Landsat Map: Late Sucessional Reserves map for Marbled Murrelet Critical Habitat consultation Happy Camp, CA area	(1) hard copy map
4/29/96	Mike Neuman Klamath Basin ERO 6600 Washburn Way Klamath Falls, OR	Rob Beachler	Northern Spotted Owl, Marbled Murrelet coverages	(2) A/I export coverages transferred by FTP
4/29/96	Pat Higgins William Kier Assoc. K.R.I.S. Project	Rob Beachler	Scott and Shasta River updated hydrology, lakes, ditches, precip. coverages	(2) 3.5" floppy diskettes
5/18/96	Steve Lewis KBERO	Rob Beachler Georgia Trehey	For Regional Managers meeting in support of ecosystem mgmt.	(15) hardcopy maps *Federal Expressed
5/22/96	Pam Halstead Fortuna High School	Georgia Trehey	Clipped Eel River Watershed Maps	(2) hardcopy maps -mailed
5/23/96	Rixanne Welren Coastal Land Trust	Georgia Trehey	6 clipped coverages and 1 - 3 band image	(1) QIC-80 250 MB tape
6/12/96	Pam Halstead Fortuna High School	Georgia Trehey	Eel River Watershed (unclipped)	(2) hardcopy maps -mailed

Date	To:	From:	Description	media format
6/12/96	Alan Franklin Spotted Owl Study	Georgia Trehey	11 clipped stream and road coverages; Grid file and 3 band .lan file	(2) 3.5" floppy disks
6/13/96	USFS Winema NF Andy Peavey	Rob Buntz	Preliminary Classification and raw TM (.lan) of upper basin	(1) 8mm tape and FHR description
6/15/96	USFS Klamath NF Goosenest RD	Gordon Bonser	Final Classification - Goosenest	(1) 8mm tape (60) quad maps
6/20/96	California Dept. of Fish and Game	Darian LaBrie	Accuracy Assessment Quads	(2) paper maps
6/24/96	Ken Vance-Borland Oregon Forestry Sciences Lab	Kelly Duncan	Digital files of 1:100,000 roads, cities, and 1:500,000 streams for California	ftp to their public directory
7/9/96	Fruit Growers Supply Co.	Gordon Bonser	Preliminary Classification of their area (1/4 scene) and Landsat .lan file	
7/15/96	California Dept. of Fish and Game - Dave Smith	Darian LaBrie	Raw/Unsupervised quads	(4) hardcopy paper maps
7/15/96	Bruce Halsted - USFWS Arcata Office	Steve Carlson	Preliminary gridcomposite maps for Murrelet and Owl Data Points	(2) hardcopy paper maps
7/23/96	Pam Halstead Fortuna High School	Georgia Trehey	6 band .lan file of Fortuna and Hydesville 1:24,000 quads Clipped roads coverage Clipped streams coverage Clipped quad boundary coverage	(1) QIC-80 250 MB tape
8/7/96	Greg Goldsmith USFWS/Arcata	Kelly Duncan	Export file of subwatershed boundaries kzsubwsd.e00	Ftp to National Park Service site (ftp.nps.gov)
8/8/96	Fruit Growers Supply Co.	Gordon Bonser	Final Classification	
8/16/96	Sharon Campbell National Biological Service Denver, CO	Kelly Duncan	Draft Klamath River water quality base maps	(3) hardcopy paper maps
8/19/96	Karen Lee Klamath Tribes Chiloquin, OR	Georgia Trehey	Landsat full scenes - 6 band 44-30, 45-30, 45-32, 46-31 .img files	(1) 8mm tape
8/19/96	Colin Brooks Hopland Research and Extension Center Hopland, CA	Georgia Trehey	Landsat Full Scenes 45-33, 45-32, 6 bands; ArcInfo Grid Files	(1) 8 mm tape
8/20/96	Diane Knox	Georgia Trehey	Grid Files, polygon coverages of 7.5' quads from classified images	ftp data
8/23/96	Jim Henriksen National Biological Service Colorado Springs, CO	Kelly Duncan	Draft: Klamath River Microhabitat Study Area maps	(1) hardcopy paper
8/23/96	Paula Golightly USFWS - Arcata Office	Kelly Duncan	USFWS Jobs-in-the-Woods maps	(5) large paper maps (26) small paper maps
8/23/96	John Hamilton USFWS - Yreka Office	Kelly Duncan	USFWS Jobs-in-the-Woods map	(1) large paper map

Date	To:	From:	Description	media format
9/5/96	Sharon Campbell National Biological Service Denver, CO	Kelly Duncan	Klamath River Microhabitat Study Area Map	(1) paper map
9/6/96	Tom Shaw USFWS - Arcata Office	Kelly Duncan	Klamath River Microhabitat Study Area Map	(1) paper map
9/11/96	Ron Garrett KBERO	Georgia Trehey Kelly Duncan	McArthur/Tulelake & Cedarville/Alturas (100k) (Landsat: Classified, Raw, and Elk Habitat) Economic Zone Physiographic Maps	(6) maps total - 1 set for each area (3) large and (2) small paper maps
9/12/96	John Hamilton/Ron Iverson USFWS - Yreka Office	Kelly Duncan	Restoration Activities in the Klamath River Basin - map for the "5 Chairs" Meeting	(2) paper maps
Sep-96	Colin Brooks Hopland Research and Extension Center Hopland, CA	Georgia Trehey	CD-ROM Files Directory	(1) 8mm tape
9/20/96	Terry Weist California Dept. of Fish and Game	Georgia Trehey	ArcView Project - derived from Classified Imagery	ftp
10/01/96	Dianne Osborne	Georgia Trehey	Classified imagery, (7) 100k quads, matching 100k quad boundary coverage	(1) 8mm tape
10/08/96	Karen Kovacs CDFG - Eureka	Georgia Trehey	Unsupervised classified 7.5 quads (2) Lord Ellis Summit, Bull Creek	(2) harcopy maps

## APPENDIX C

Appendix C  
 COVERAGE LOG  
 12/20/96 10:09

Coverage Category	Cover Name	Geographic Extent	Nominal Scale	Resolution	Topology	Initial Analyst	Current Analyst	Status	Currency	Source 1	Source 2
boundary	kbbnd	basin	100000	0	polygon	Carlson	Ramirez	complete	6/22/96	CALWATER	HUCs-OR
boundary	kebnd	ecoregion	100000	0	polygon	Carlson	Ramirez	complete	6/22/96	CALWATER	HUCs-OR
boundary	klbbnd	lower basin(IG)	100000	0	polygon	Carlson	Ramirez	complete	6/22/96	CALWATER	HUCs-OR
boundary	kpbnnd	province	100000	0	polygon	Carlson	Ramirez	complete	6/22/96	CALWATER	HUCs-OR
boundary	kpstbdy	province	100000	0	line	Ramirez		complete	10/23/96		
boundary	kubbnd	upper basin(IG)	100000	0	polygon	Carlson	Ramirez	complete	6/22/96	CALWATER	HUCs-OR
boundary	kzbnnd	economic	100000	0	polygon	Carlson	Ramirez	complete	6/22/96	CALWATER	HUCs-OR
boundary	kzstbdy	economic/OR-CA bdy	100000	0	line	Ramirez		complete	10/23/96		
boundary	statebnd	california/oregon	2000000	0	line	Carlson		complete	9/1/94	ArcUSA	
cities	kzcity_pt	california	2000000	0	point			complete?	9/1/94	ArcUSA	
cities	nca_city	n. california	100000	0	polygon		Kinison	processing	9/16/96	Teale	
cities	orcacity	california/oregon	2000000	0	point	Carlson		complete	9/1/94	ArcUSA	
cities	orcityu	oregon	100000	0	polygon			?		OR St. Service Ctr?	
counties	kpcounty	province	100000	0	polygon	Carlson		complete	9/1/94	ArcUSA	
counties	kzcounty	economic	2000000	0	polygon	Carlson	Ramirez	complete	6/23/96	ArcUSA	
counties	orcacnty	california/oregon	2000000	0	polygon	Carlson		complete	9/1/94	ArcUSA	
dems	eastdems.tar.Z	economic	250000	90	point	Duncan	Duncan	complete	8/14/96	USGS	
dems	westdems.tar.Z	economic	250000	90	point	Duncan	Duncan	complete	8/14/96	USGS	
grids	kb_lat	california/oregon	250000	92	grid	Duncan	Duncan	complete	8/14/96	USGS	
grids	kp_lat	province	250000	90	point	Duncan	Duncan	complete	8/16/96	USGS	
grids	kz_lat	economic	250000	90	point	Duncan	Duncan	complete	8/15/96	USGS	
lakes	kblak100	basin	100000		polygon	Beachler	LaBrie	processing	9/17/96		
lakes	kblakes	basin	2000000	0	polygon	Ramirez		complete	9/15/96	ArcUSA	
lakes	kplakes	province	2000000	0	polygon	Ramirez		complete	9/16/96	ArcUSA	
lakes	kzlake	economic	2000000	0	polygon	Ramirez		complete	9/16/96	ArcUSA	
mines	camining	california	999999	0	point	Carlson		complete	9/1/94	USBM	
mines	kpmine	province	999999	0	point	Carlson	Ramirez	updating	1/1/96	USBM	
mines	kzmine	economic	999999		point	Ramirez		complete	1/1/96	USBM	
mines	ormining	oregon	999999	0	point	Carlson		complete	9/1/94	USBM	
mines	placer	province	999999	0	point	Ramirez		complete	1/1/96	USBM	
ownership	dfglands_utm	california	100000	0	polygon	Duncan		incomplete		CDFG	
ownership	karukbnd	california	100000	0	polygon	Beachler		incomplete			
ownership	kzcaown	california	100000	0	polygon	Duncan	Duncan	complete?	10/31/96	Teale	
ownership	kzorown	oregon	100000	0	polygon	Duncan	Duncan	complete	10/31/96	Def. Wildlife	
ownership	kzown	economic	100000		polygon	Duncan	Duncan	complete?	10/31/96	Teale	Def.Wildlife
ownership	yurokbnd	california	100000	0	polygon	Beachler		incomplete			
quad index	or_q24k_utm	oregon	24000	0	polygon	Buntz		complete	8/15/96	OR St. Serv	
quad index	ca_q24k_utm	california	24000	0	polygon	Buntz		complete	6/16/96	Veisze	
quad index	kp_q100	province	999999	0	polygon	Harmon		complete	9/1/94	GIS Group	
quad index	kp_q24	province	100000	0	polygon	Harmon		complete	9/1/94	GIS Group	
quad index	kp_q250	province	999999	0	polygon	Harmon		complete	9/1/94	GIS Group	
quad index	tm_quads	special	0	0	polygon	Buntz		complete			
roads	kzcalrds	CA/economic	100000	0	line	Ramirez	Ramirez	in progress	10/1/96	Teale	
roads	kzcaltrl	CA/economic	100000	0	line	Ramirez	Ramirez	in progress	10/1/96	Teale	
roads	kzorroad	OR/economic	100000	0	line	Ramirez	Ramirez	in progress	10/1/96	OR St. Serv	
roads	kzroads	economic	100000	0	line	Ramirez	Ramirez	in progress	10/12/96	OR St. Serv	Teale
roads	orcards2m	california/oregon	2000000	0	line	Carlson		complete	9/1/94	ArcUSA	
roads	orrdsutm	oregon	100000	0	line	Ramirez		complete			
roads	casoildata.tar	california	250000	0		Ramirez		complete		STATSGO	
soils	cast_utm	california	250000	0	polygon	Carlson	Duncan	complete	6/20/96	CDFG	
soils	kzsoils	economic	250000	0	polygon	Ramirez	Ramirez	processing	7/15/96	CDFG	Donavin
soils	orsoildata.tar	oregon	250000	0		Ramirez		complete		STATSGO	
soils	orst_utm	oregon	250000	0	polygon	Carlson	Duncan	complete	6/20/96	CDFG	
spectral	tm94_4430.img	special	100000	30	grid	Fox	Bonser	processing	7/17/94	EOSAT	NASA
spectral	tm94_4431.img	special	100000	30	grid	Fox	Bonser	processing	7/17/94	EOSAT	NASA
spectral	tm94_4432.img	special	100000	30	grid	Fox	Bonser	processing	7/17/94	EOSAT	NASA
spectral	tm94_4530.img	special	100000	30	grid	Fox	Bonser	processing	8/9/94	EOSAT	NASA
spectral	tm94_4531.img	special	100000	30	grid	Fox	Buntz	processing	7/8/94	EOSAT	NASA
spectral	tm94_4532.img	special	100000	30	grid	Fox	Buntz	processing	6/22/94	EOSAT	NASA
spectral	tm94_4533.img	special	100000	30	grid	Fox	Buntz	processing	6/22/94	EOSAT	NASA
spectral	tm94_4631.img	special	100000	30	grid	Fox	Buntz	processing	7/15/94	EOSAT	NASA
spectral	tm94_4632.img	special	100000	30	grid	Fox	Trehey	processing	7/15/94	EOSAT	NASA
streams	kbhyd500	basin	500000	0	line	no one...		complete?		Teale? and ?	
streams	kbstm100	basin	100000	0	line	Duncan		complete		Teale	OR St. Serv.
streams	kpriver	province	2000000	0	line	Carlson	Ramirez	complete	7/18/96	ArcUSA	
streams	kzhyd100	CA/economic	100000	0	line	Duncan	Duncan	in progress	10/12/96	Teale	
streams	kzorstms	OR/economic	100000	0	line	Duncan	Duncan	in progress	10/12/96	OR St. Serv	
streams	kzriver	economic	2000000	0	line	Ramirez	Ramirez	complete	7/10/96	ArcUSA	
streams	kzstm100	economic	100000	0	line	Duncan		complete		Teale	OR St. Serv.
te_species	ca_nso_bdy	california	0	0		Duncan			8/15/96	CDFG	
te_species	mamu_u	california	0	0	point					USFWS/Arcata	
te_species	nso_prov	california	0	0		Duncan			8/15/96	CDFG	
te_species	nso_u	california	0	0	point					USFWS/Arcata	
tools	biglogo		0	0	polygon	Carlson		complete	7/15/96		
tools	blmlogo		0	0	polygon	Buntz	Buntz	in progress	10/12/96	BLM	

Coverage Category	Cover Name	Geographic Extent	Nominal Scale	Reco-lydon	Topology	Initial Analyst	Current Analyst	Status	Currency	Source 1	Source 2
tools	dflogo		0	0	polygon	Buntz	Buntz	in progress	10/12/95	BLM	
tools	fslogoblk		0	0	polygon			complete	7/15/95		
tools	fslogogr		0	0	polygon			complete	7/15/95		
tools	fwslgo		0	0	polygon			complete	7/15/95		
tools	krbtflgo		0	0	polygon	Beachler	Beachler	in progress	10/12/95	KRBT <sup>2</sup>	
tools	krislgo		0	0	polygon	Buntz	Buntz	in progress	10/12/95	KRIS	
tools	north		0	0	polygon			complete	7/15/95		
tools	smalllgo		0	0	polygon	Carlson		complete	7/15/95		
watersheds	*huc	subbasins	100000	0	polygon	Beachler	Duncan	complete			
watersheds	caerwahd	california/oregon	100000	0	polygon	Carlson	Ramirez	complete	6/22/95	CALWATER	HUCs-OR
watersheds	huc500ku	oregon	600000	0	polygon	Ramirez		complete	9/1/94	Oregon	
watersheds	huca	california	100000	0	polygon	Carlson		complete	9/1/94	CDFG	
watersheds	kbsubwsd	basin	100000	0	polygon	Ramirez	Ramirez	complete	6/30/95	CALWATER	HUCs-OR
watersheds	kesubwsd	ecoregion	100000	0	polygon	Ramirez	Ramirez	complete	6/30/95	CALWATER	HUCs-OR
watersheds	kpsubwsd	province	100000	0	polygon	Ramirez	Ramirez	complete	6/30/95	CALWATER	HUCs-OR
watersheds	kzsubwsd	economic	100000	0	polygon	Ramirez	Ramirez	complete	6/30/95	CALWATER	HUCs-OR
watersheds	master	economic	100000	0	polygon	Ramirez		complete	6/22/95	CALWATER	OR St. Serv
wetlands	nwi?		0	0			Bonser				

## APPENDIX D

Robert E. Beachler

## **Hydrologic and Hydrographic Database Design in Support of Anadromous Fisheries Restoration Planning**

### **Abstract**

The Klamath Act of 1986 established the Klamath River Basin Conservation Area Restoration Program, a 20-year fishery restoration program for the Klamath River Basin of southern Oregon and northern California (Figure 1). An advisory committee, the Klamath River Basin Fisheries Task Force was established by the Klamath Act to provide guidance in planning and implementing the Restoration Program. The 14-member Task Force is directed to assist the Secretary of the Interior in creating and implementing the Restoration Program and to coordinate federal, state and local government or private anadromous fish restoration projects within the area.

In 1994 the Task Force Technical Work Group contracted with the Humboldt State University Foundation to assemble and develop Geographic Information System (GIS) digital data layers in support of anadromous fisheries restoration planning in the Klamath River Basin. In cooperation with federal, state, county, local agencies and Native American tribes, hydrologic and hydrographic databases and coverages are compiled, reviewed and analyzed to produce thematic GIS products to support the Task Force's decision making process.

The purpose of this paper is to describe existing and potential applications of GIS in support of anadromous fisheries restoration planning. This paper discusses the issues associated with the compilation and development of regional watershed data sets, data availability and integration. The U.S. Environmental Protection Agency, EPA River Reach Files, version 3 (RF3) data sets are serving as the baseline hydrology layer and have been used to reference past fishery restoration projects and proposed projects seeking funding. A variety of planning areas and scales requires different levels of evaluation for hydrologic sub-basin planning units and watershed boundary delineation. To help prioritize fishery restoration planning efforts it is important to assess what types of projects have been funded in the past, their locations and to document the success or failure of these projects. Identifying the locations of the different types of restoration projects assists decision makers in evaluating the potential of effectiveness of future projects.

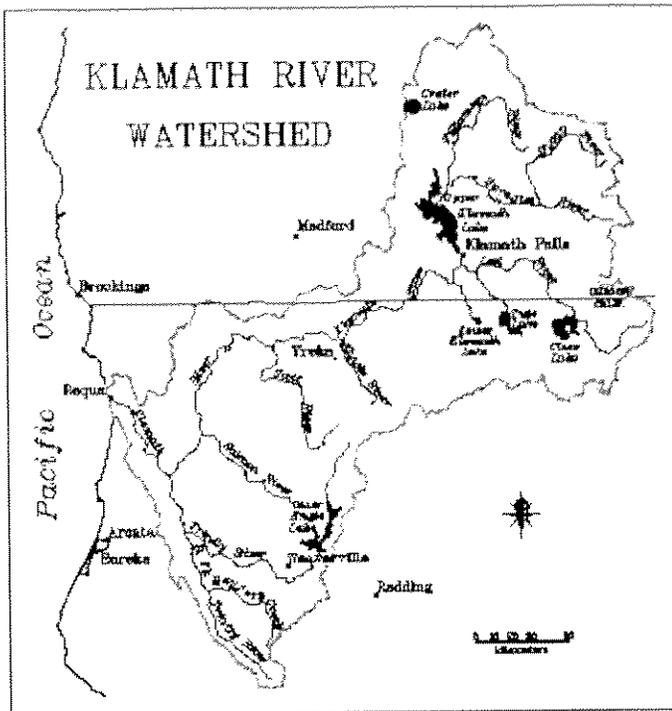


Figure 1

## GIS in Support of Anadromous Fisheries Restoration Planning

After an initial orientation to the capabilities of GIS in fisheries restoration planning, there was interest among Technical Work Group members to have past restoration projects funded by the Task Force georeferenced and displayed on a map. To help prioritize fishery restoration efforts it is useful to assess what types of projects have been funded in the past and where they are located. Once we determine where the different types of restoration efforts have occurred, we will be able to assess the potential effectiveness of future projects.

In cooperation with staff from the U.S. Fish and Wildlife Service (USFWS), Klamath River Fish & Wildlife Office (KRFWO) in Yreka, California, project information was used to assign a location, or georeference point, to specific restoration projects. Along with the actual point location, an accompanying data base was integrated into the restoration data layer. Restoration projects were placed into six categories: (1) Education, (2) Habitat Protection, (3) Habitat Restoration, (4) Fish Population Protection, (5) Fish Population Restoration, and (6) Planning and Coordination. Other projects undertaken by other agencies were then added to the database. The California Department of Fish & Game (CDFG), Inland Fisheries Division, has provided a fisheries restoration projects data layer of CDFG-funded projects within the Klamath Basin.

In addition to georeferencing past restoration efforts, a data layer of restoration projects submitted for Task Force funding during Fiscal Year 1996 was developed. This layer depicted the type of proposed project and its approximate location within the Klamath River Watershed and respective sub-basins. These maps allow resource specialists and decision makers to graphically compare locations and types of past restoration projects with proposed projects to help prioritize restoration efforts and funding. Future endeavors will continue to build upon restoration data layers, including the incorporation of US Forest Service projects, USFWS Partners for Wildlife projects and Klamath Basin Ecosystem Restoration Office

projects. Planned additions to the restoration data layer include digital images of proposed restoration project locations and post-restoration results.

## **Sub-Basin Restoration Prioritization**

The Restoration Program is in the process of performing a mid-program review which will re-evaluate the effectiveness of the program. As part of this mid-program review, the Restoration Program's GIS data layers and data bases are being used to assess what types of restoration projects have been completed. Through data base queries, restoration dollars are accounted for within each of the restoration programs categories (Education, Fish Population Protection, Fish Population Restoration, Habitat Protection, Habitat Restoration, and Planning and Coordination).

As part of reassessing where to allocate restoration dollars, these data bases has illustrated the need for expanded and continuing planning and coordination of restoration efforts. For example, in the Lower Klamath River sub-basin approximately 1.7 million dollars have been spent on fish population protection/restoration, and habitat protection/restoration between 1987-1995. During this same time frame there has not been any funds allocated towards planning and coordination. This demonstrates the need to develop specific *sub-basin action plans* that address the specific resource restoration issues of each sub-basin.

## **Anadromous Fish Species Occurrence and Distribution**

In cooperation with the Klamath National Forest Fisheries and GIS departments, fish species distribution data layers have been acquired and will be used to help prioritize fish population protection and restoration efforts. These data layers represent the historic range of fish species as well as current distribution. These data layers will become pivotal with the potential listing of certain fish stocks under the both federal and state threatened and endangered species acts.

These data layers allows fisheries resource specialists to identify current distribution of the anadromous fish species and compare with historic ranges. This information can be used to assess habitat loss and distribution patterns. Identification of anadromous fish species distribution will assist resource managers in the protection of key watersheds that currently support viable fish populations. Adoption of the philosophy of *Protecting the best, and Restoring the Rest* will assist in the prioritization of restoration efforts.

## **Future GIS Applications in Anadromous Fisheries Restoration Planning**

The utility of GIS-related products and the general support provided by the GIS analyst generated interest by the Task Force for continuing support of GIS efforts. Fiscal Year 1995 discretionary planning funds have been allocated to provide the Task Force and Technical Work Group (TWG) with a full-time GIS Analyst. A cooperative agreement between the USFWS and the Humboldt State University Foundation served as the funding mechanism to continue and enhance the GIS capabilities of the Task Force and TWG.

The objectives of the cooperative agreement are to provide map layers, fishery restoration data, spreadsheets and other products that assist the Task Force and TWG in reviewing past restoration efforts and prioritizing ongoing fishery restoration within the Klamath River Basin. The GIS Analyst continues to work with the Task Force, TWG and the USFWS Klamath River Fish & Wildlife Office in analyzing and disseminating information related to Klamath River Basin fish habitat and fish restoration projects.

In the Restoration Program's fiscal year 1996, Request for Proposals (RFP), the RFP asked project

proposers to include a map of the proposed project location. This request resulted in a variety of different types of project maps with different sources and scales being submitted with the completed proposal. This made the referencing of the proposed projects difficult, and in many instances generalized point locations were assigned to projects. Project maps ranged enlarged photocopies of USGS quad maps to generalized small scale maps.

It became apparent that in order to consistently represent fishery restoration project locations, it would be necessary to develop a series of standardized sub-basin maps that will be included with future Restoration Program Request for Proposals. As part of developing these series of base maps, the EPA River Reach Files (RF3) will serve as a 1:100,000 base hydrology layer to reference project locations. These base maps include hydrologic sub-basin boundaries, annotated sub-basin hydrologic stream networks and a 7.5 minute USGS 1:24,000 quad index. The base maps also provide instructions for project proposers when assigning proposed project locations.

For projects that are linear in nature, such as cattle exclusionary fencing and riparian vegetation enhancement projects, proposed project reaches are highlighted on the base map. In addition to referencing proposed project locations on the 1:100,000 scale base maps, project proposers are asked to provide a more detailed site map based on standard 1:24,000 USGS quad maps.

### **EPA River Reach Files, Version 3 (RF3-Alpha)**

The RF3 program is being developed by EPA's Office of Water to provide a nationally consistent database to promote compatibility for national, regional, and state reporting requirements such as those found in 305(b) and other sections of the Clean Water Act (McKay et al., 1994). In support of EPA's objective of restoring and maintaining the quality of the nation's waters, numerous environmental studies have been undertaken that rely upon flow estimates. Typical studies include waste load allocations, water quality trends, impact of discharges on water intake sites, and designated use studies. The EPA is currently developing flow estimation procedures which will utilize RF3 data sets. A work group was formed in 1992 to study the issues associated with the development of flow estimates for RF3 and to develop a preliminary plan and resource requirements for making such estimates (Bondelid et al., 1992).

The official release of RF3 by the EPA is expected in the fall of 1996. In the meantime, public agencies have been given permission to utilize the data while procedures are being developed to manage RF3 updates on a national scale.

The basic building block of the EPA River Reach File is the **reach**, a distinctly identified lineal stream feature. A reach may be either: (1) the linear hydrographic feature between two stream confluence's, or (2) a unique hydrographic feature as denoted by the source data (e.g., USGS Digital Line Graphs). The distinction between these two definitions is that the first reach type is normally connected hydrologically with other reaches, while the second reach type is an isolated feature. Reaches are given a unique reach address (RF3RCHID). The RF3RCHID, is a string of numbers composed of three concatenated fields, CU-SEG-MI where

CU	=	the USGS Cataloging Unit
SEG	=	the stream SEGment, and
MI	=	the Marker Index (Veisze, 1994).

Codes are also assigned to indicate subfeatures such as intermittent streams, canals/ditches, rapids, water bodies and wide rivers. Most hydrologically connected reaches are called transport reaches while others are referred to as start reaches (headwaters) or simply as non-transport reaches.

The initial step was to acquire river reach data sets from cooperating agencies. The California Department of Fish & Game, Inland Fisheries Division and the Oregon State Service Center for Geographic Information Systems (SSCGIS) provided data sets for their respective states.

**California Reach Files.** The RF3-Alpha compilation is being done on a cataloging unit (watershed) basis. The present California RF3 was derived from 1:100,000 USGS Digital Line Graphs (DLGs) of streams (Figure 2), as reprocessed and archived by California's Teale Data Center GIS Lab in ARC/INFO format. After importing the files into the HSU GIS Technical Work Group database, the coverages were projected into a Universal Transverse Mercator (UTM) map projection based on NAD27 datum.

**Oregon Reach Files.** The hydrologic data sets provided by the Oregon SSCGIS and USGS Water Resources Division are not part of the EPA's RF3 program. The data sets for Oregon, the Pacific Northwest River (PNW) Reach Files, do not share the same structure with the California RF3 data sets. The PNW files are a georeferenced river reach data base at 1:100,000 scale which are encoded with US EPA Enhanced Reach File (RF2) reach codes. The line work came from the same USGS DLGs but they were compiled in a completely different manner. Combined with EPA STORET reach identifiers the PNW River Reach files are an integral hydrologic component in a regional Northwest Environmental Data Base, an ongoing effort by federal and state agencies to compile reach-specific information on rivers in Oregon, Idaho, Washington and western Montana (Fisher, 1993).

An on-going priority of the broader HSU-GIS Technical Work Group program is to create a seamless GIS river reach data layer for the entire Klamath River Basin and Klamath Economic Zones. The disparate structures of the two reach file data sets will require the development of common attributes, codes and structures in order to be incorporated into a seamless reach file data layer.



Figure 2

## Hydrologic Unit Boundary Data Layers

Developing a hydrologic and hydrographic data base to support anadromous fisheries restoration planning requires the delineation of watershed boundaries. A variety of planning areas and scales required evaluation of different hydrologic unit or watershed boundary schema.

Hydrologic Unit Code (HUC) coverages provided by the California Department of Fish & Game, Inland Fisheries Division provided general watershed boundary delineation at the 1:250,000 scale. This HUC layer has been adopted by CDFG to provide statewide watershed unit boundaries. This coverage has been modified by the HSU-GIS Group to correlate with the 1:100,000 EPA RF3 data.

The California Department of Forestry & Fire Protection (CDF) has developed a much more detailed watershed data layer. CALWATER 1.0-California Planning Watersheds, has been developed and maintained by the CDF's Strategic Planning Program to aid state forestry programs and help in timber harvest planning. The associated database includes such attributes as: (1) State Water Quality Control Board region number; (2) State Water Quality Control Board hydrologic unit; (3) State Water Quality Control Board hydrologic area; (4) State Water Quality Control Board subarea and (5) watershed name. The planning watersheds have also been grouped into one or more planning watersheds up to approximately 50,000 acres and further subdivided into planning watershed units between 3,000 and 10,000 acres.

The Oregon SCCGIS and the Oregon Department of Fish & Wildlife provided watershed data layers at the

1:500,000 and 1:24,000 scales. These data sets were used to help identify and delineate watershed boundaries for the Oregon portion of the Klamath River Basin. For most practical purposes we employed the 1:24,000 scale hydrologic unit code boundary layer.

A hybrid watershed boundary coverage was developed using CALWATER and Oregon 1:24,000 data layers. This hybrid watershed layer merged the two different data layers to provide the best possible basin-wide watershed layer with the existing GIS data sets (Figure 3). CALWATER was also used as a background coverage to provide updates to existing USGS cataloging unit sub-basins. Watershed sub-basin areas were calculated on a cataloging unit basis. Table 1 presents sub-basin areas in acres and hectares and allows resource managers to compare watershed planning areas within the basin.

**TABLE 1**

USGS Cataloging Unit	Name	HA	Acres
18010201	Williamson	378,191	934,509
18010202	Sprague	416,764	1,029,823
18010203	Upper Klamath Lake	188,146	464,908
18010204	Lost	779,572	1,926,322
18010205	Butte	156,227	386,036
18010206	Upper Klamath	366,929	906,681
18010207	Shasta	205,779	508,479
18010208	Scott	210,688	520,610
18010209	Lower Klamath	398,506	984,708
18010210	Salmon	194,325	480,177
18010211	Trinity	527,419	1,303,252
18010212	South Fork Trinity	240,750	594,893
	Total	4,063,296	10,040,398

## Klamath River Basin HYDROLOGIC SUB-BASINS

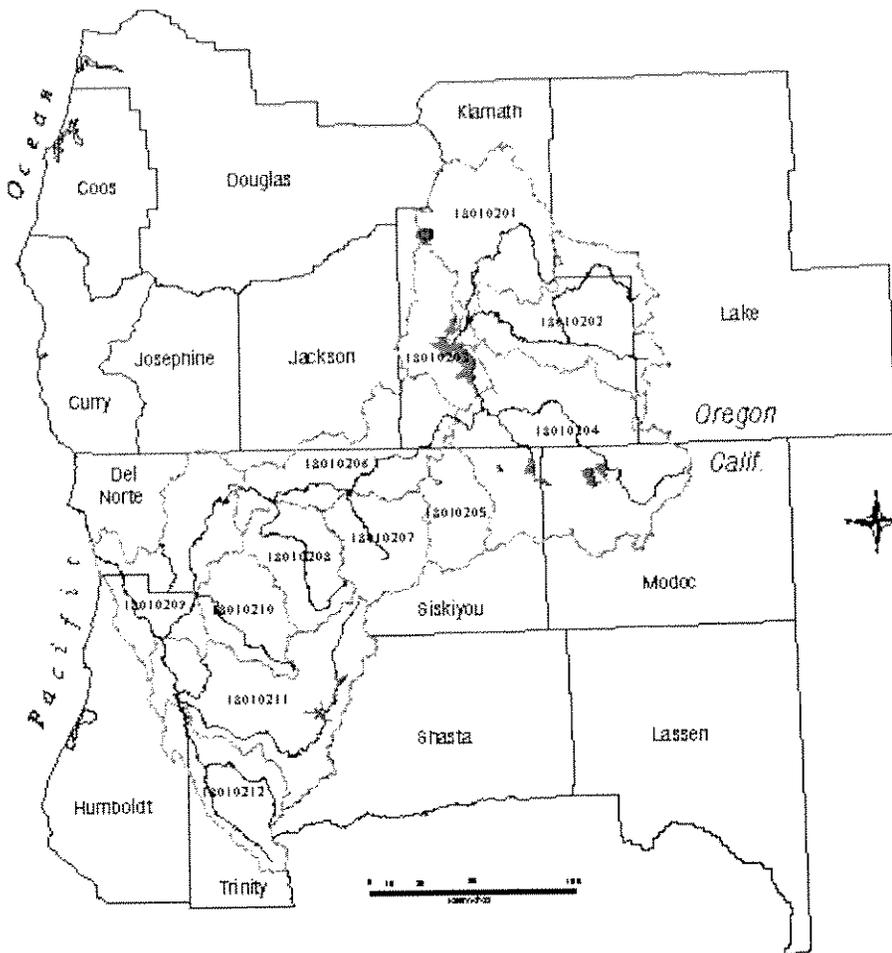


Figure 3

### Land Administration and Ownership Data Layers

A 1:100,000 land administration and ownership data layer was created to delineate land administration boundaries of federal and state agencies, Native American tribes, local agencies, or private owners. Detailed sub-basin maps have been compiled from US EPA River Reach Files (RF3), hydrologic unit code boundaries, and land administration layers. These maps are used to identify perennial, and intermittent streams, canals/ditches and land ownership patterns within sub-basins.

### GIS Coordination and Cooperation

Continued coordination and cooperation in the acquisition and dissemination of geographic information continues to enhance the decision making process and the evolution of GIS in fisheries restoration planning. GIS is empowering local grass roots restoration efforts through Coordinated Resource Management Planning (CRMP) efforts in several sub-basins of the Klamath Basin. GIS orientation workshops and limited training are also being offered to agency personnel and CRMP groups.

Data transfers are facilitated through a series of cooperative agreements and memorandums of understanding between cooperating entities. Data is transferred on a variety of media, including electronically via file transfer protocol (FTP) and the World Wide Web (WWW).

Through the course of these ongoing cooperative mapping efforts, coordination and data transfers has been facilitated by GIS coordinators at CDFG Inland Fisheries Division, Klamath and Six Rivers National Forests, US EPA Region IX River Reach/STORET program, California Department of Forestry & Fire Protection Strategic Planning Program, and Oregon State Service Center for Geographic Information Systems and the U.S. Fish and Wildlife Service. Contact was also made with Horizon Systems Corporation, private contractors working with EPA on the national RF3 data base development and implementation.

In addition to these state and federal contacts, the foundation for continued data coordination with non-governmental organizations and programs, such as the Klamath Resource Information System (KRIS) and CRMP sub-basin efforts has expanded. Local knowledge from CRMP coordinators and Resource Conservation District personnel are being utilized to review existing data layers for completeness and accuracy.

*User needs assessments* have occurred on several occasions and have provided the opportunity to identify data needs, gaps, hardware and software requirements and expanded coordination. The need for detailed site specific information continues to drive the data collection and cooperation towards finer resolution data sets. Continued GIS data coordination is expanding with new cooperators entering into the collaborative mapping efforts in the Klamath River Basin. Incorporation of additional data sets and map layers is an ongoing process. Current efforts are at the 1:100,000 scale with future efforts expanding to incorporate basin wide 1:24,000 scale information.

### **Klamath Basin GIS Technical Work Group at Humboldt State University**

The Klamath Basin Ecosystem Restoration Office/Humboldt State University GIS Technical Work Group (ERO/HSU-GIS Group) at Humboldt State University was established to support the Klamath Basin Ecosystem Restoration Office's mission of holistic resource management for the Klamath hydrobasin. The GIS Facility will produce and make available to all cooperators, regional, "seamless" geographic information. The primary task of the facility will be to develop a hierarchical earth registration network, register existing GIS data layers into that network, produce missing GIS data layers, and integrate both existing data and new data into seamless GIS products. The data development work is phased at three scales: 1:100,000, 1:24,000 and 1:12,000.

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