

Information Management Coordination Project:

Report to TFW Administrative Committee

By

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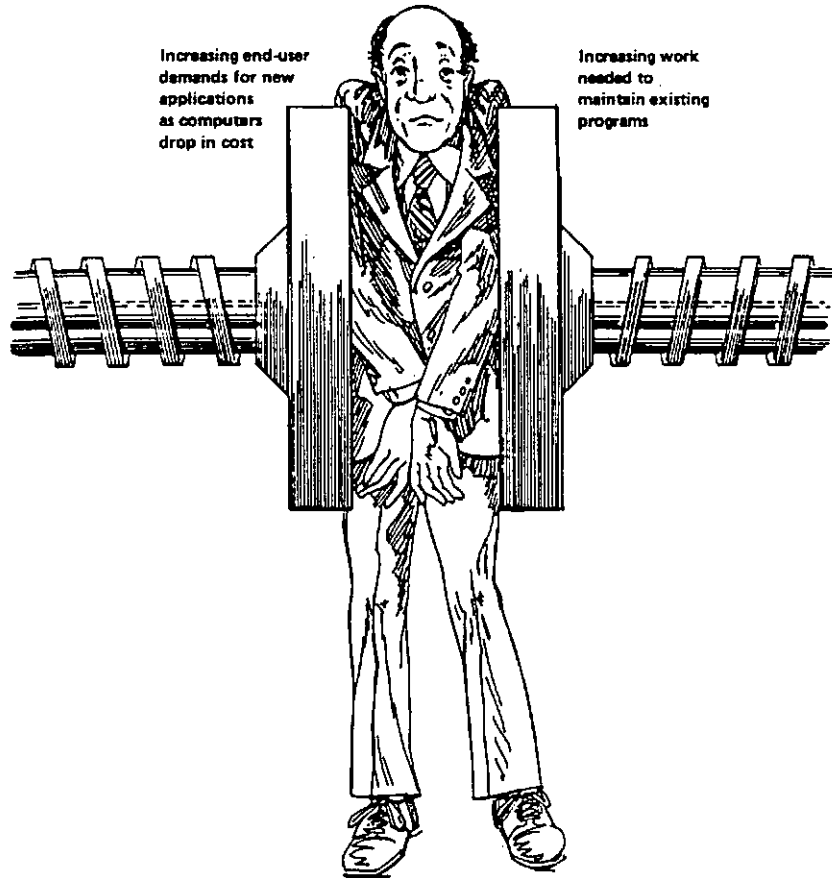


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TIMBER/FISH/WILDLIFE

INFORMATION MANAGEMENT COORDINATION PROJECT

REPORT TO TFW ADMINISTRATIVE COMMITTEE



by

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## DISCLAIMER

The opinions, findings, conclusions, or recommendations expressed in this report/product are those of the authors and do not necessarily reflect the views of any participant in, or committee of, the Timber/Fish/Wildlife Agreement, or the Washington Forest Practices Board, or the Washington Department of Natural Resources, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

TABLE OF CONTENTS

Overview and Summary . . . . . 1  
Introduction . . . . . 3  
Methods. . . . . 5  
Results/Observations . . . . . 5  
Discussion and Recommendations . . . . . 11  
Appendices . . . . . 16

## ACKNOWLEDGEMENTS

This document was prepared under the auspices of the Information Management Committee (IMC) at the direction of the Administrative Committee of the Timber/Fish/Wildlife (TFW) Agreement. The TFW Agreement was reached in 1987 by representatives of the timber industry, state agencies, Indian tribes, and environmental groups with interests in, and responsibilities for, timber, fish, wildlife, and water resources in the State of Washington. It is a unique effort to manage public resources on state and private forest lands of Washington by consensus of constituents and interest groups representing historically disparate interests.

In particular, the authors wish to acknowledge the support and encouragement of the Administrative Committee, the Washington Department of Natural Resources (DNR), and Jack Hulsey, manager of the DNR Division of Forest Practices and Service Forestry. The Washington Department of Wildlife provided in-kind support for the information management coordinator position, and the Cooperative Monitoring, Evaluation, and Research Committee provided funding.

This report was a joint effort by Dan Cantrell, who shared responsibilities for writing and database design, and organizing and entering most of the information into the database; and Peter Haug, who directed the project, helped design the database, and shared the writing and editing responsibilities. The IMC reviewed a draft of the report and made substantial comments, which have been incorporated. Ron Holeman provided assistance entering information into the database, and Dennis McDonald helped with overall review and in developing recommendations.

## OVERVIEW AND SUMMARY

Information management issues throughout the Timber/Fish/Wildlife (TFW) process share many common characteristics. These need to be approached systematically, first to ensure that data and information are of consistently high quality, and second, to facilitate storage, retrieval, and exchange of data and information. This project addresses a need identified by the TFW Information Management Committee (IMC) to develop a directory of data and information generated by, or of interest to, TFW participants, and possibly others outside the TFW community.

The need for managing information relevant to the TFW process has increased and will continue to do so as watershed screening and analysis are implemented. This report (1) reviews and evaluates TFW information and the way it has been handled to date; (2) recommends ways to improve organization, maintenance, and access of TFW data and information; (3) identifies tasks and deliverable items for a comprehensive information management and coordination program within the TFW process, and (4) provides a TFW information database accessible through printed copy or personal computer. The database includes:

- o A master directory of TFW products.
- o A bibliography of reports and other products generated by CMER projects, TFW cooperators, and other TFW activities.
- o A file of annotations about these products.
- o An index to variables measured in research and monitoring projects and to other key words associated with TFW products

The IMC reviewed a draft of this report, and committee comments have been incorporated. Recommendations are summarized on the next page.

## RECOMMENDATIONS

This report, though not comprehensive, illustrates the breadth and scope of data and information associated with TFW. As the TFW process continues, the amount and complexity of this information and data are certain to grow apace. The following recommendations are designed to organize this complexity and provide managers with better information to make decisions quickly.

We therefore recommend that the TFW Administrative Committee and Policy Group:

- o Assign clear responsibility for receiving and keeping TFW products; for maintaining the database of TFW data and information developed in this project; and for refining the information management procedures and database itself to make data and information more accessible to end users.
- o Authorize a full-time information management coordinator position, under the auspices of the IMC, to continue the process begun in this project and expand the ideas presented in this report.
- o Direct IMC to develop a detailed proposal, with budget, to implement the second recommendation above.
- o Recognize and encourage continuing efforts to further the TFW process with more in-kind support and initiatives among TFW participants, and document these efforts through the medium of information management. This study unearthed several such efforts, and we have a sense that several more remain unsung.

Although these recommendations are not exhaustive, they will, if implemented, be a major step forward in providing TFW participants, and others, with data and information necessary to make sound policy and field decisions in managing public resources. Activities, needs, and direction will continue to change as new issues and priorities arise, but the fundamental need of managing data and information about public resources will only grow.

The IMC stands ready to assist in implementing the recommendations and ideas presented in this report.

## INTRODUCTION

The Information Management Committee (IMC) was formed in 1989 as a standing committee of the Administrative Committee (Admin), with the mandate of addressing the following items:

- o Establishing data priorities
- o Coordinating the building of a forest practices information system
- o Coordinating information management beyond the Timber/Fish/Wildlife (TFW) Agreement
- o Developing funding strategies
- o Establishing data standards
- o Coordinating data collection and quality control

The IMC goal is to identify and address TFW information management issues. These issues are discussed in the IMC Workplan of June 1990 (Appendix A).

Since its formation, IMC has become increasingly aware of information sources potentially useful to TFW participants, and the fact that this base of information is growing. IMC's predecessor, the Information Management Steering Committee of the Cooperative Monitoring, Research, and Evaluation (CMER) program, identified these needs in terms of data and information coming from the CMER program. However, it soon became apparent that TFW's information needs go far beyond monitoring and research.

This project addresses a need identified by the IMC to develop a directory of data and information generated by, or of interest to, TFW participants, and possibly others outside the TFW community. This report includes:

- o A partial bibliography of reports and other products generated by CMER projects, TFW cooperators, and other TFW activities.
- o An annotated database of these products and other sources of information relevant to TFW. The database describes each project; lists keywords, and data variables collected with CMER funds; and, for each product, identifies its intent, its subject matter, variables measured (if any), other keywords, resulting data, other information relevant to a potential user.
- o Recommendations for further organizing, maintaining, and accessing TFW data and information.

The IMC reviewed a draft of this report, and committee comments have been incorporated. Objectives, tasks, and deliverable of the project are listed in Figure 1.



### Objectives and Tasks of Project

The objectives of this project are to organize information from TFW projects and other sources of interest to TFW and to begin a process of transferring it to potential users.

Project tasks were to:

1. Review past and ongoing projects of the Cooperative Monitoring, Research, and Evaluation (CMER) program for:
  - o Completed reports, variables being measured, and other products
  - o Projects in progress for the same information, where available
2. Develop a directory of data and information collected by TFW participants or relevant to the TFW Agreement, to include:
  - o A comprehensive list of data sets, with descriptions of what was measured.
  - o A bibliography of reports and other products generated by CMER projects and TFW cooperators.
  - o A brief description of each project's subject matter and its intent, resulting data, methods, and other information relevant to a potential user.
3. Evaluate how well standards and guidelines for data and information management, as set forth in the CMER draft workplan, are being met.
4. Summarize findings in a final report that includes instructions for accessing TFW data and information; present final document to IMC on or before June 30.

### Deliverable

The deliverable product from this project is this report, to include the following.

- o A bibliography of reports and other products generated by CMER projects, TFW cooperators, and other TFW activities
- o An annotated data directory of CMER projects and other sources of information relevant to TFW:
  - Describing data sets collected with CMER funds
  - Describing each project
  - Identifying, for each project,
    - + its intent
    - + its subject matter
    - + variables measured (if any)
    - + its resulting data
    - + other information relevant to a potential user.
- o Recommendations for a loose-leaf "User's Guide to Timber/Fish/Wildlife Data and Information," with protocols for maintenance and periodic updating.
- o Discussions and recommendations about the following other issues of concern identified by IMC:
  - System planning, design, integration, and development
  - Coordination of efforts to avoid unnecessary redundancy and duplication
  - Data security
  - Standards for compatibility, collection, storage, and retrieval of information
  - Standards and criteria for quality and reliability of information
  - Accessibility and ease of use of data and information
  - Distribution and flow of information
  - Transfer and sharing TFW-generated technology among users
  - Inventory of data and information resources inside and outside TFW
  - Budgetary resources for implementing information priorities

Figure 1. Objectives and tasks of the project and deliverable item.

## METHODS

This project was an exercise in gathering and organizing information about TFW projects and their products, and in database modeling and design. From a variety of sources, we assembled documents from throughout the TFW arena, beginning with the TFW Agreement itself. These formed the basis for the database. Time constraints precluded a systematic or exhaustive search for products to be included. Instead, we assembled what was readily available, then tried to incorporate a representative sample of the breadth and types of data and information that could be included in a fully funded project.

While reviewing these products, we developed a list of data items for the database, then designed and built a data model of five files related through the primary key TFWID, a unique identifier assigned to each TFW project. In some cases, TFWID was concatenated with a second key field to identify records uniquely. Although based on data modeling and design principles, the database is not completely normalized, because full normalization requires a substantial amount of programming to link related files. Rather, we opted to produce a first approximation of a useable product within the time available (about three and a half weeks).

This report contains recommendations below for developing the results of this effort into a fully normalized set of related files that can be linked in various ways and accessed more easily by a variety of users.

## RESULTS AND OBSERVATIONS

The results of this project consist of this final report and its database (Appendix B).

### Database Description

The database is structured physically into five related files (Fig. 2):

- o MASTER DIRECTORY
- o BIBLIOGRAPHY
- o ANNOTATIONS
- o KEYWORD INDEX
- o DATA VARIABLES INDEX

Figure 2 illustrates the equivalency of files that are designed to be accessed differently. Although sorted differently, the files in the left and right boxes contain equivalent information. Files in the right box are found in Appendix B. They are hard copies of the bibliography (TFWBIB2.db), the keyword index (KWINDEX2.db), and the data variables index (ENVAR2.db). They are sorted alphabetically for visual access. Equivalent files in the left box

Fields	Field Description	Field Type	Comments
A	Flag to indicate that the Annotations file (ANNOTATE) has been updated	A1	File: DIRECTORY
AUTHORS	Names of document author(s) in standard bibliographic form	A75	File: TFWBIB, linked through TFWID
B	Flag to indicate that the Bibliography file (TFWBIB) has been updated	A1	File: DIRECTORY
CNERID	Unique CNER project code/identifier	A9	File: DIRECTORY
COMMENTS	Annotation: Brief description of project, including subject, intent, method, results, abstract, etc.	A250	File: ANNOTATE, linked through TFWID
CONTACT	Contact name, organization, phone number, physical location, electronic medium for data, etc.	A150	File: DIRECTORY (subdivide field later?)
D	Flag to indicate that the Data Variable file (ENVAR) has been updated	A1	File: DIRECTORY
K	Flag to indicate that the Keyword file (KWINDEX) has been updated	A1	File: DIRECTORY
KEYWORDS	Keywords relating to different projects and documents.	A30	File: KWINDEX, linked through TFWID
OTHERID	Other code assigned/used by another source	A20	File: DIRECTORY
PROJNAME	Name of project (CNER or other type of project)	A110	File: DIRECTORY
PUBDATE	Date of publication/printing of document	A4	File: TFWBIB, linked through TFWID
PUBSRCE	Source or publisher of document; also, where (from whom) is document available.	A100	File: TFWBIB, linked through TFWID
RPTID	Unique report number/publication number	A20	File: DIRECTORY
TFWCOM	TFW committee(s) involved in project	A20	File: DIRECTORY
TFWID	Unique identifier for TFW Information Management Directory	A9*	Link to DIRECTORY, TFWBIB, ANNOTATE, ENVAR, KWINDEX
TITLE	Title of publication/document	A25	File: TFWBIB, linked through TFWID
UNITS	Units of environmental variable used or measured	A75	File: ENVAR, linked through TFWID
V	Flag to indicate that this Keyword (KWINDEX) is also a Variable (ENVAR)	A1	File: KWINDEX, linked through TFWID
VARIABLE	Environmental variable used/measured in research, monitoring, screening, or analysis	A125	File: ENVAR, linked through TFWID

## DIRECTORY.db

Field Name	Field Type
TFWID	A9*
PROJNAME	A110
TFWCOM	A20
CONTACT	A150
RPTID	A20
CNERID	A9
OTHERID	A20
B	A1
A	A1
K	A1
D	A1

## KWINDEX.db

Field Name	Field Type
TFWID	A9*
KEYWORDS	A50*
V	A1

## ENVAR.db

Field Name	Field Type
TFWID	A9*
VARIABLE	A50*
DESCRIPT	A100
UNITS	A75

## TFWBIB.db

Field Name	Field Type
TFWID	A9*
AUTHORS	A75
TITLE	A125
SOURCE	A100
PUBDATE	A4

## ANNOTATE.db

Field Name	Field Type
TFWID	A9*
LINE	A2*
COMMENTS	A250

Figure 2. The top file is a master list of items in the TFW database. rest of the figure lists structures for the five files in the database

are provided on electronic media. They are designed to be viewed, searched, and/or linked via an electronic database manager or viewing software. Files are provided on IBM-compatible floppy disks in ASCII format, although other formats are available as listed below.

The MASTER DIRECTORY is designed to include all TFW-related products: CMER projects and reports; products from the Training, Information, and Education Committee (TIE) and the Field Implementation Committee (FIC); general TFW documents, such as the TFW Agreement itself; and pertinent sources of information outside of TFW proper. Each record in the file is assigned a unique TFWID, which is the relational key to all other files. The complete report or project name is entered along with the associated TFW committee name; a contact name, address, and phone number; and, as appropriate, the TFW report number, CMER project number, and/or 'other' ID number.

The BIBLIOGRAPHY, related to the master directory through the TFWID, contains names of authors, report titles, publishing dates, and repository locations.

The ANNOTATIONS file contains a brief description of each project, including a statement of purpose, goals, intent, and objectives of the project. Again, the link to the directory is through the TFWID.

The KEYWORD INDEX is a list of likely candidates for searches, sorts, or selects of the database. Words chosen for inclusion in the index come from the executive summaries, tables of contents, glossaries, indices, statements of scope, rationale, design, conclusions, and recommendations, as well as the body of the reports themselves. Each keyword is tied back to the project or report via the TFWID. Keywords include all data variables, which are described in more detail in the next file.

The DATA VARIABLE INDEX is a directory of data variables measured. It includes a short description/definition and the unit of measurement used. This is not designed to be as definitive or exhaustive as a data dictionary, which would contain much more specific information about range, method, precision, accuracy, data type, etc. These variables are also related to their respective projects through the TFWID.

The five physical files described above are designed to be linked via the TFWID. They are available in the following electronic formats:

<u>NAME</u>	<u>FILE EXTENSION</u>
1-2-3	.WKS or .WK1
ASCII	.TXT
dBase	.DBF
Paradox	.DB
Pfs:file	.PFS
Quattro	.WKQ
Reflex	.RXD
Symphony	.WRK or .WR1
VisiCalc	.DIF

In addition, many spreadsheet or text viewers available in different utility software can be used to search individual files, or a database language can be used to develop front-end query screens to provide a seamless logical connection among the five data files.

### Examples

Data becomes information when it is accessible and usable. This project is designed to facilitate access to TFW information. The relational database allows creative processing of data, or information about data, to derive new relationships, which then become new information. The database structure is a "skeleton" upon which future enhancements/additions can be hung. This has potential use as a powerful tool for making resource management decisions.

We have provided some examples in Appendix C of ways in which this tool might be used to provide information for decision-makers. One of these, Table 1, illustrates a search on the words "debris" and "sediment." The question, or query, might be posed like this: "What are (or list) all the projects for which debris or sediment are major components?"

### Review of Objectives and Tasks of Project

The objectives of this project (Fig. 1) were to organize information from TFW projects and other sources of interest to TFW and to begin a process of transferring it to potential users. This section describes how project tasks were met.

Task 1. Review past and ongoing projects of the Cooperative Monitoring, Research, and Evaluation (CMER) program for:

- o Completed reports, variables being measured, and other products
- o Projects in progress for the same information, where available

Results: We reviewed 16 of the 26 existing CMER reports. Time did not permit reviewing and entering data for all of them, and some were not easily available.

Task 2. Develop a directory of data and information collected by TFW participants or relevant to the TFW Agreement, to include:

- o A comprehensive list of data sets, with descriptions of what was measured.

Results: From the reports, we extracted a comprehensive list of variables (instead of data sets) measured in CMER projects, the DATA VARIABLE INDEX (filename, ENVAR), cross-referenced by TFWID code to individual projects.

- o A bibliography of reports and other products generated by CMER projects and TFW cooperators.

Results: This is found in the BIBLIOGRAPHY file (filename, TFWBIB).

Table 1. Example query from the TFW database. The selection criteria were:  
 "Select all entries that have the keyword or variable name 'debris' or  
 'sediment'."

Keyword/Variable	V	Description	TFWID	Project Name
capacity modification for debris and sediment flow debris	v	do respondents modify bridge/culvert flow capacity to account for debris and sediment during floods?	TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
debris			TFW000012	Literature Review and Synthesis: Wildlife Use of RMZ's and UMA's by Wildlife - CMERC Projects 2 & 6
debris flow			TFW000013	Effects of Timber Harvest on Rain-On-Snow Run-Off in the Transient Snow Zone of the WA Cascades - Interim Rpt
debris jam			TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
debris jam			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
debris jam			TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution
organic debris			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
organic debris	v		TFW000012	Literature Review and Synthesis: Wildlife Use of RMZ's and UMA's by Wildlife - CMERC Projects 2 & 6
sediment			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
sediment			TFW000013	Effects of Timber Harvest on Rain-On-Snow Run-Off in the Transient Snow Zone of the WA Cascades - Interim Rpt
sediment	v	dominant substrate	TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution
sediment delivery frequency	v	comment on two most important processes	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment delivery magnitude	v	comment on two most important processes	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment delivery process	v	debris torrent or flow/translational or rotational landslide/eroded stream reaches/soil creep/other	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment dynamics	v	observed cause, effect, and duration of timber harvest practices on sedimentation in Type 4&5 Waters	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment storage	v	sediment storage processes/patterns/magnitude/frequency/distribution	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment transport efficiency	v	efficiency is a measure of the percent of sediment moved out per unit per year	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
woody debris	v	large/medium/small based on diameter and length	TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution

- o A brief description of each project's subject matter and its intent, resulting data, methods, and other information relevant to a potential user.

Results: Much of this information is found in the ANNOTATIONS file (filename, ANNOTATIONS), and complementary information is in the MASTER DIRECTORY (filename, DIRECTRY). Access is through the Master Directory or the KEYWORD INDEX to all projects (filename, KWINDEX). Appendix B contains printed copies of the five database files. Not all TFW products that we are aware of have been entered into the database, and there are probably others of which we are not aware.

- Task 3. Evaluate how well standards and guidelines for data and information management, as set forth in the CMER draft workplan, are being met.

Results: The CMER workplan has been undergoing revision for several months, although the substance will probably not change appreciably. Our experience in working with CMER reports, however, indicates that the standards and guidelines for data and information management have not been followed consistently by the various research and monitoring contractors. Further comments and recommendations are found in the "DISCUSSION AND RECOMMENDATIONS" section.

- Task 4. Summarize findings in a final report that includes instructions for accessing TFW data and information; present final document to IMC on or before June 30.

Results: This report was presented in draft form to the Information Management Committee for comment on June 25. Comments were incorporated into the final report.

#### Deliverable

The deliverable product from this project is this report, which addresses the four tasks described above. Discussions and recommendations are found in the next section.

#### DISCUSSION AND RECOMMENDATIONS

Information management issues share many common characteristics. These need to be addressed systematically in order to ensure that data and information are of consistently high quality, and to facilitate storage, retrieval, and exchange of data and information. The need for managing information relevant to the TFW process has increased and will continue to do so as watershed screening and analysis are implemented. This section identifies other possible tasks and deliverable items for a comprehensive information management and coordination program within the TFW process. This project is an early step toward managing TFW data as information.

The IMC workplan establishes priorities for accomplishing the goals of information management (Appendix A, page 2). These are discussed below within the context of issues of concern identified in Fig. 1. These issues can be arranged into four categories: System planning, design, integration, and development; information standards; information dissemination; and budgetary considerations.

#### System planning, design, integration, and development

Two major TFW projects fall into this category: the Geographic Information System (GIS) Hydrography/Transportation Project, and the Forest Practice Applications (FPA) Database. The former has been funded through TFW since 1987, and the latter is poised to begin, pending funding in the biennium beginning July, 1991. Both are housed at DNR.

The Hydrography/Transportation Project: Many information management issues in TFW require baseline data contained in the hydrography (water) and transportation (roads) layers being developed by the DNR. Because of this, TFW is funding development of GIS baseline data layers at a 1:24,000 scale on the DNR's geographic information system. Data are available for some areas of the state. The development of such a large information system raises particular concerns about information characteristics such as priorities, quality control, accessibility, etc. Topics needing specific attention include: field verification of spatial and tabular information, addition of field attributes not currently being coded, quality assurance and control of spatial and attribute data, development of a user interface to allow TFW participants to access these data, and testing how useful these data are in spatial analysis.

Field validation has begun, primarily by DNR on the roads and the Northwest Indian Fisheries Commission on the water. Because this project's original proposed funding was cut by a million dollars, there was no money for field validation. Consequently, DNR and other TFW cooperators are being asked to do this with in-kind efforts.

While DNR offices may have access to these files and the GIS software to process them, procedures for other TFW cooperators have yet to be developed. Special application programming, additional communication devices, and documentation are all potential further needs that TFW must define and secure before these data files can be said to be equally beneficial to all participants. Procedures need to be developed and implemented to allow all TFW users to access, use, update, and correct files.

The current status of this project is summarized in reports numbered TFW000024 and TFW000023 in the database.



The FPA Database: There is considerable demand for access to FPA data. The DNR is presently in the process of developing a computerized FPA data system that will assist with the protection of public resources and support the activities of all organization and entities that interact with the FPA data, by:

- o Reducing costs associated with copying, sorting, and transmitting FPAs between participants.
- o Improving speed and efficiency with which FPA information is shared among participants.
- o Allowing participants to directly access, view, and provide input to a centralized FPA database in real-time mode.
- o Providing participants with the common ability to interactively analyze tabular and spatial FPA data (in concert with any other available databases) consistent with appropriate data security needs.
- o Maintaining an archival record of all FPA data.

The system development process utilized by DNR contains several steps, beginning with a review of the life history ("business scope") of an FPA, which in turn defines the system design, and finishes with the development, testing, and implementation of the system. A feasibility study based on extensive scoping has been approved by the Department of Information Services, and the DNR is awaiting funding. The project is intended to link the GIS with the FPA database when completed. The system is expected to permit electronic retrieval of current and past FPAs by TFW participants who can access the system through computers with modems.

This system is projected to cost nearly \$8,585,000 over five years. This includes maintaining the present system while the new one is being developed. It also includes the value of time expected to be donated each year from other TFW organizations. Further details of this project are described in a feasibility study, database number TFW000026.

#### Information Standards:

A number of concerns have been raised about quality and reliability of information in TFW. These include issues of:

- o Coordination and integration of efforts to avoid unnecessary redundancy and duplication
- o Data security
- o Standards for compatibility, collection, storage, and retrieval of information
- o Standards and criteria for quality and reliability of information

For example, the draft CMER workplan contains guidelines for handling research data, but no quality control procedures are in place for determining how well these guidelines are being followed. The project described by this report is a beginning for creating a data system for TFW projects that provides efficient information storage and retrieval. This is essential to utilizing information as a resource throughout the entire TFW process. It is also

necessary for effecting economies in watershed screening and analysis, as well as in research and monitoring, by allowing integration and standardization of certain data variables.

Standardization of data-variable formats, development of efficient file structures, and establishment of consistent data standards are all prerequisites for successful information management. Selecting a secure central repository, appropriate media, and establishing procedures for submitting data with adequate documentation will ensure the security of the database. Access to information can be facilitated by the development of a central data dictionary and directory, which should be augmented by a data integrity function that checks for share-ability, accessibility, compatibility, and redundancy.

### Information Dissemination

The best organized, most reliable database is of little value unless it is accessible to potential users, and accessibility includes ease of use. The question of information dissemination through the TFW process includes:

- o Accessibility and ease of use of data and information
- o Distribution and flow of information
- o Transfer and sharing TFW-generated technology among users
- o Inventory of data and information resources inside and outside TFW

Accessibility and ease of use of data and information: The reason the research and monitoring program was established during the original TFW negotiations was that little information was available about many controversial issues. It was decided to "go where the truth takes us." Four and a half years later, we have begun down that path. It remains to make that path available to all TFW participants by making information easily available.

The fact that this report includes products from many TFW endeavors illustrates the breadth and scope of information generated by the TFW process. At this writing, this report is the most comprehensive source of such information, and it is very incomplete. Recommendations are included below for providing better access to the rapidly growing array of TFW data and information.

Distribution and Flow of Information: This item and the one above are closely related, the difference being that the above item is passive and this is active. In addition to making information easily available, a certain subset of that information that is used in daily decisions needs to be actively updated and disseminated as it becomes known. Recommendations for doing this are presented below.

Transfer and Sharing TFW-generated Technology Among Users: Many of the research and monitoring have as one objective the development of new technology to improve forest practices or resource protection on the ground. For example, data, information, and technology developed with TFW funds and in-kind support from cooperators reside at the DNR, Department of Wildlife

(WDW), Department of Ecology (Ecology), Department of Fisheries (WDW), the Northwest Indian Fisheries Commission (NWIFC), Weyerhaeuser Company, and many other TFW participants. These technologies need to be provided to all who need them.

Inventory of Data and Information Resources Inside and Outside TFW: This report is a first step in accomplishing this goal, at least within the TFW arena. Much more needs to be done, however. In addition to the TFW committees producing products (Policy Group; Administrative Committee; Field Implementation Committee; Training, Information, and Education Committee; Information Management Committee; as well as CMER and its subcommittees), there are undoubtedly databases, reports, and similar information available from federal natural resource agencies, county planning offices, and similar governmental and private entities.

Budgetary Considerations: A comprehensive information coordination and management program for TFW needs full financial support. The recommendations below outline such a program. Detailed budgetary considerations would be a part of a formal proposal to implement this program.

## RECOMMENDATIONS

This report, though not comprehensive, illustrates the breadth and scope of data and information associated with TFW. As the TFW process continues, the amount and complexity of this information and data are certain to grow apace. The following recommendations are designed to organize this complexity and provide managers with better information to make decisions quickly.

We therefore recommend that Admin and the TFW Policy Group:

- o Assign clear responsibility for receiving and keeping TFW products; for maintaining the database of TFW data and information developed in this project; and for refining the information management procedures and database itself to make data and information more accessible to end users.
- o Authorize a full-time information management coordinator position, under the auspices of the IMC, to continue the process begun in this project and expand the ideas presented in this report.
- o Direct IMC to develop a detailed proposal, with budget, to implement the second recommendation above.
- o Recognize and encourage continuing efforts to further the TFW process with more in-kind support and initiatives among TFW participants, and document these efforts through the medium of information management. This study unearthed several such efforts, and we have a sense that several more remain unsung.

Recommendations for specific tasks to be accomplished by the information management coordinator and IMC are listed here. As the program evolves and develops, these tasks should be revised to adapt and respond to changing needs. Currently these tasks are seen as follows:

1. Modify information management guidelines in the CMER workplan to reflect the data structures developed in this project.
2. Expand the standards and guidelines from the CMER workplan to include and apply to all TFW-generated products, and enforce consistent use of these standards and guidelines for handling all data and information.
3. Develop protocols for entering, maintaining, managing, updating, and disseminating all TFW-generated data and information.
4. Develop standards for compatibility, collection, storage, and retrieval of information; mechanisms for data security; and criteria for quality and reliability of information.
5. As a next step, expand the results of this project to include data dictionaries developed within the TFW process.
6. Develop ways to coordinate and integrate TFW and TFW-related projects to avoid unnecessary redundancy and duplication of effort.
7. Develop a loose-leaf user's guide to TFW data and information, and provide financial support to maintain and disseminate it. This would include a fully normalized relational database with easy-access, user-friendly query screens and report-generating capabilities.
8. Work with DNR to make the GIS layers funded by TFW (hydrography and roads) easily accessible to TFW participants.
9. Incorporate the Watershed Screening and Analysis Project into the TFW database.
10. Incorporate the state Wetlands Classification Project under the auspices of the Department of Ecology into the TFW database.
11. Work with DNR to incorporate the FPA database system as it is developed.

12. Work with WDW to incorporate the Priority Habitats and Species project as it is further developed and refined.
  
13. To the extent feasible and desirable, incorporate data and information from sources outside the TFW arena, but relevant to the TFW process, into the database.

Although these recommendations are not exhaustive, they will, if implemented, be a major step forward in providing TFW participants, and others, with data and information necessary to make sound policy and field decisions in managing public resources. Activities, needs, and direction will continue to change as new issues and priorities arise, but the fundamental need of managing data and information about public resources will only grow.

The IMC stands ready to assist in implementing the recommendations and ideas presented in this report.

#### APPENDICES

The following documents are appended to this report:

- o Appendix A - TFW Information Management Committee Workplan, June 1990
- o Appendix B - TFW Information Database Files
- o Appendix C - Example Queries of the TFW Database

APPENDIX A

Appendix A is the current Information Management Committee Workplan.

## TFW INFORMATION MANAGEMENT COMMITTEE WORKPLAN

June 1990

### INTRODUCTION

The Information Management Committee is a Timber/Fish/Wildlife (TFW) standing committee reporting to the Administrative Committee (Admin). It was formed by Admin at the recommendation of the Ad Hoc Subcommittee on Budget, Organization, Structure, and Priorities in a memo dated 6 October 1989 from Arden Olson, chair of the subcommittee. The subcommittee's rationale and recommendation was as follows:

"Currently there are several Ad Hoc committees and subcommittees involved in working on development of a TFW data base. These include a CMER data subcommittee, G.I.S. subcommittees, and a subcommittee working on the forest practice application data system. It is recommended that the Administrative Committee establish an Information Management standing committee of administrative-type people who can also involve their technical data personnel to resolve all data management issues. Several items need to be addressed by such a subcommittee including establishing data priorities, coordinating building the system, coordinating beyond TFW, such as Department of Information Services, Power Planning Council, etc., and developing funding strategies, establishing data standards, coordinating data collection and quality control."

### GOAL

The Information Management Committee goal is:

To identify and address TFW information management issues.

### INFORMATION MANAGEMENT PRIORITIES: AN OVERVIEW

The IMC has identified the following information management issues, listed in order of priority. These are explained more fully in a following section:

1. Forest Practices Application (FPA) management system
2. GIS hydrography/transportation baseline information
3. Cooperative Monitoring, Evaluation, and Research (CMER) program information management needs
4. Technology transfer: results from CMER projects and others
5. Inventory of data resources (inside and outside TFW)
6. Polls and surveys generated within TFW
7. Storage and retrieval: Selecting data systems for projects and archiving information.
8. Interacting with information management committees outside TFW (Northwest Power Planning Council, Puget Sound Water Quality Authority, etc.)

#### INFORMATION MANAGEMENT COMMITTEE STRUCTURE

The Information Management Committee has two levels of members: administrators and technical staff. It deals with TFW-wide information management questions. These include:

- > Supporting CMER technical steering committees (the old Information Management Steering Committee function).
- > Working to help DNR establish a tabular database, then a GIS map database, for FPAs.
- > Supporting surveys and other types of information collected by the Field Implementation Committee.
- > Coordinating TFW GIS activities.
- > Others as needed.

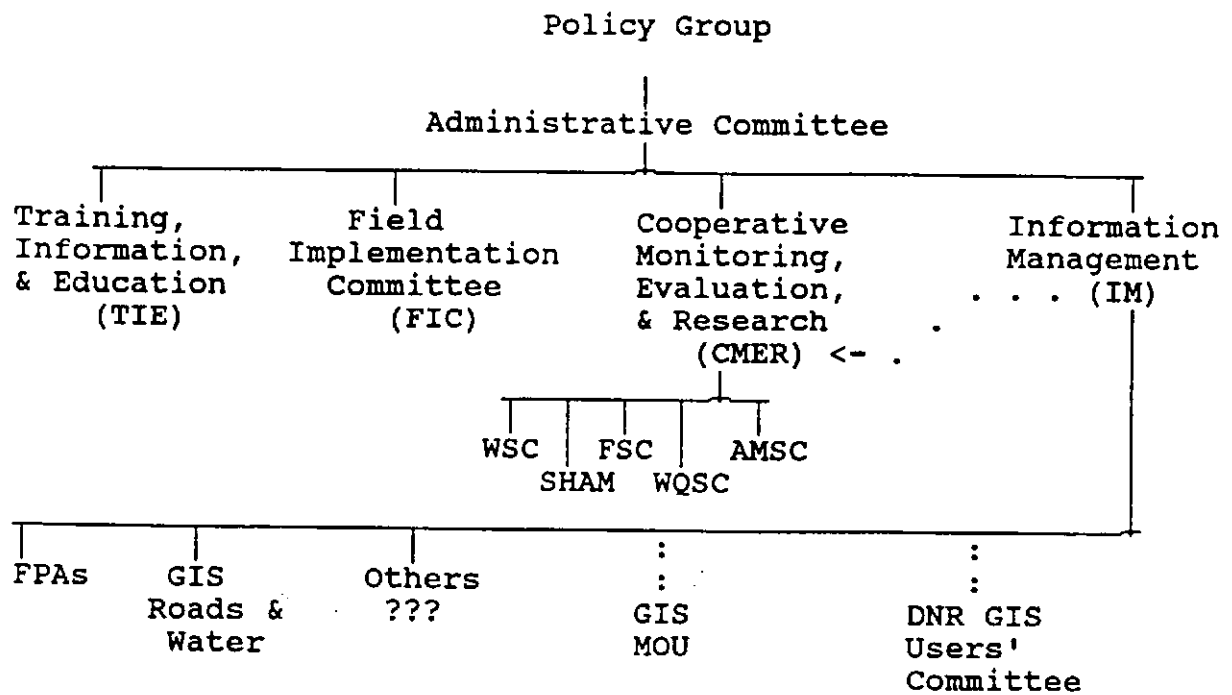
The relationship of Information Management to other TFW committees is diagrammed in Figure 1.

#### INFORMATION MANAGEMENT ISSUES: A DESCRIPTION

The information management issues, as prioritized above, require some explanation. Some are already being addressed, and others may not be addressed because of resource constraints.

Information management issues share many common characteristics. These need to be addressed systematically in order to ensure that data and information are of consistently high quality, and to facilitate storage, retrieval, and exchange of data and information. The Cooperative Monitoring, Evaluation, and Research (CMER) workplan contains some guidelines for handling research data, but no quality control procedures are yet in place for monitoring how well guidelines are being followed.





Legend:

- | -- Oversight/responsibility
- : -- Coordination/liaison

Figure 1. Timber/Fish/Wildlife committee structure as it relates to the Information Management Committee.

Common characteristics shared by most information management issues include the following for both data and information:

- > Standards for collection, storage, and retrieval
- > Quality control
- > Reliability
- > Accessibility
- > Ease of use
- > Redundancy/duplication
- > Compatibility
- > Priorities
- > Budgetary resources
- > System planning, design, development
- > Coordination
- > Distribution and flow

The rest of this section briefly describes each issue.

#### 1. Forest Practices Application (FPA) management system

There is considerable demand for access to FPA data. The DNR is presently in the process of developing a computerized FPA data system that will assist with the protection of public resources and support the activities of all organization and entities that interact with the FPA data, by:

- > Reducing costs associated with copying, sorting, and transmitting FPAs between participants.
- > Improving speed and efficiency with which FPA information is share among participants.
- > Allowing participants to directly access, view, and provide input to a centralized FPA database in real-time mode.
- > Providing participants with the common ability to interactively analyze tabular and spatial FPA data (in concert with any other available databases) consistent with appropriate data security needs.
- > Maintaining an archival record of all FPA data.

The system development process utilized by DNR consists of several steps, beginning with a review of the life history ("business scope") of an FPA, which in turn defines the system design, and finishes with the development, testing, and implementation of the system.

The FPA task force of the IMC is assisting with this system design process. Task force members attended the scoping session, which involved about 15 persons for seven days. Further involvement by the task force and the committee will include reviewing the scoping report and participating in further system design steps.

## **2. GIS hydrography/transportation baseline information**

Many information management issues in TFW require baseline data contained in the hydrography (water) and transportation (roads) layers being developed by the DNR.

Because of this, TFW is funding development of GIS baseline data layers at a 1:24,000 scale on the DNR's geographic information system. Data are available for some areas of the state. The development of such a large information system raises particular concerns about those information management characteristics listed above (i.e., priorities, quality control, accessibility, etc.)

Topics needing specific attention include: field verification of spatial and tabular information, addition of field attributes not currently being coded, quality assurance and control of spatial and attribute data, development of a user interface to allow TFW participants to access these data, and testing how useful these data are in spatial analysis.

While DNR offices may have access to these files and the GIS software to process them, procedures for other TFW cooperators have yet to be developed. The pending Memorandum of Understanding contracting for DNR system and data use by TFW participants will be just the beginning of getting non-DNR users full access to the data. Special application programming, additional communication devices, and documentation are all potential further needs that TFW must define and secure before these data files can be said to be equally beneficial to all participants. Procedures need to be developed and implemented to allow all TFW users to access, use, update, and correct files.

## **3. Cooperative Monitoring, Evaluation, and Research (CMER) program information management needs**

To work with CMER Steering Committees to identify commonalities among CMER programs and projects and to provide assistance in managing information and data generated by TFW research and monitoring. See also Item 7 below.

## **4. Technology transfer: results from CMER projects and others**

To coordinate with CMER and TFW Field Implementation Committee to transfer research results in a form usable for application in the field, by managers and policy makers. See also Item 7 below.

**5. Inventory of data resources (inside and outside TFW)**

Survey state and federal resource management agencies, universities and other research organizations, and private industry, as well as CMER sources, to catalog information and data relevant to TFW. See also Item 8 below.

**6. Polls and surveys generated within TFW**

Maintain historical results of polls and surveys used to evaluate the effectiveness of TFW. See also Item 7 below.

**7. Storage and retrieval: Selecting data systems for projects and archiving information**

Creating a data system for the CMER projects that allows for efficient storage and retrieval is essential to utilizing information as a resource. Standardization of data format, development of an efficient file structure, and establishment of consistent data standards are all prerequisites for successful information management. Selecting a secure central repository, appropriate media, and establishing procedures for submitting data with adequate documentation will ensure the security of the database. Access to information can be facilitated by the development of a central data dictionary and directory, which should be augmented by a data integrity function that checks for share-ability, accessibility, compatibility, and redundancy.

**8. Interacting with information management committees outside TFW (Northwest Power Planning Council, Puget Sound Water Quality Authority, etc.)**

To discharge its information management mandate, the IMC plans to interact with relevant committees and individuals outside of TFW. To do this, an efficient framework for contacting others needs to be established, perhaps with the assistance of the Washington Department of Information Services. This task is also related to Task 5 above, both inside and outside TFW.

**INFORMATION MANAGEMENT TASK FORCES**

The Information Management Committee currently has two ad hoc task forces, one to assist DNR in completing the FPA database, and a second to develop procedures for adding attributes, updating, and editing the hydrography and transportation GIS layers.

## FPA Task Force

IMC agreed that the FPA database management system is the first priority for committee discussion. The purpose of the FPA task force, which is already under way, is to define requirements for an automated system for reporting and analyzing forest practice application data. Major time commitments will be required by all participants. This automated system will provide access to FPAs by all TFW participants.

Other points about the FPA database are:

- > The database is currently in dBase III Plus on personal computers (PC) in the DNR regions. Although there are problems with this, it will remain on PCs through 1990, with the database moving to the Prime in the Info language by 1991.

- > There will eventually be a new layer in the DNR geographic information system (GIS) containing FPA data.

- > Emphasize improved functionality and efficiency: e.g., forester can now visit more important sites; forester has improved ability to sort and analyze information about FPAs.

- > Use of the Prime for standard analyses will be available for phone costs, but that other custom analyses will cost the normal DNR central processing unit time charges.

## Hydrography/Transportation

The database for the hydro/trans layer was designed by the old GIS Committee. The current task force will produce a methods manual and a users manual, with criteria for including data, quality control, and history. Specific tasks include field verification of data in the system; attribute input by field staff; general quality control/quality assurance issues; future routine update and maintenance procedures; coordination and direction to DNR geographic information system; and applications development, testing, and promotion.

## Cooperative Monitoring, Evaluation, and Research (CMER)

A third task force is being formed for information management issues associated with the CMER program. CMER steering committees have expressed concern about managing and sharing data. Several projects have already run out of funds in the early stages of information management. Good information and data management should provide tools for integrating the CMER data and information, tools that will assist all steering committees in accomplishing their data and information objectives within the CMER program.

Some roles of IMC with respect to CMER are to:

- > Help CMER understand issues of data management.
- > Provide a good description of needs for data management.
- > Inform and educate CMER as to problems and impacts of poor data management, solutions and options to these problems, and how IMC can facilitate these solutions.
- > Set context for CMER committee to make decisions about funding and project integration; make sure the committee understands the need for having rigorous data and information management protocols in place.
- > Set the stage for an eventual funding proposal for information management.
- > Educate general managerial audience on need for good data management.

In summary, the general issue is managing CMER-generated data and information to make it quickly accessible and easily useable to TFW participants. Guidelines for handling CMER data and information in a standardized format for individual projects are written in the CMER workplan, but there is no indication that they are being followed. Furthermore, there remains a need for managing information between and among individual projects in the whole CMER program. This task force is working on ways to facilitate this process.

## APPENDIX B

Appendix B is the TFW database. It consists of five data files:

The MASTER DIRECTORY is designed to include all TFW-related products: CMER projects and reports; products from the Training, Information, and Education Committee (TIE) and the Field Implementation Committee (FIC); general TFW documents, such as the TFW Agreement itself; and pertinent sources of information outside of TFW proper. Each record in the file is assigned a unique TFWID, which is the relational key to all other files. The complete report or project name is entered along with the associated TFW committee name; a contact name, address, and phone number; and, as appropriate, the TFW report number, CMER project number, and/or 'other' ID number.

The BIBLIOGRAPHY, related to the master directory through the TFWID, contains names of authors, report titles, publishing dates, and repository locations.

The ANNOTATIONS file contains a brief description of each project, including a statement of purpose, goals, intent, and objectives of the project. Again, the link to the directory is through the TFWID.

The KEYWORD INDEX is a list of likely candidates for searches, sorts, or selects of the database. Words chosen for inclusion in the index come from the executive summaries, tables of contents, glossaries, indices, statements of scope, rationale, design, conclusions, and recommendations, as well as the body of the reports themselves. Each keyword is tied back to the project or report via the TFWID. Keywords include all data variables, which are described in more detail in the next file.

The DATA VARIABLE INDEX is a directory of data variables measured. It includes a short description/definition and the unit of measurement used. This is not designed to be as definitive or exhaustive as a data dictionary, which would contain much more specific information about range, method, precision, accuracy, data type, etc. These variables are also related to their respective projects through the TFWID.

The five physical files described above are designed to be linked via the TFWID. They are available in the following electronic formats:

<u>NAME</u>	<u>FILE EXTENSION</u>
1-2-3	.WKS or .WK1
ASCII	.TXT
dBase	.DBF
Paradox	.DB
Pfs:file	.PFS
Quattro	.WKQ
Reflex	.RXD
Symphony	.WRK or .WR1
VisiCalc	.DIF

TFWID	PROJECT NAME	TFWCOM	CONTACT	RPTID	CMERID	OTHERID	B	A	K	D
TFW000001	Timber/Fish/Wildlife Negotiations	TFW Negotiators	WA Forest Protection Assoc., NW Indian Fisheries Commission, WA Environmental Council, National Audubon Society, state agencies:WDF, WDF, Ecology,				Y	Y	Y	Y
TFW000002	Timber/Fish/Wildlife Primer	TIE, FIC	WA Forest Protection Assoc., NW Indian Fisheries Commission, WA Environmental Council, National Audubon Society, state agencies:WDF, WDF, Ecology,				Y	Y	Y	Y
TFW000003	An Analysis of Program Integration and Development for the TFW/CMER Committee	CMER	Cooperative Monitoring and Research Committee, Jim Rochelle - Chair, WeyCo Technology CTR, Tacoma, WA 98477	TFW-000-89-007	TA-1		Y	Y	Y	Y
TFW000004	Wildlife Use of Managed Forests: A Review	WSC, CMER	National Council of the Paper Industry for Air and Stream Improvement, Inc., West Coast Regional Office	TFW-017-89-004			Y	Y	Y	Y
TFW000006	TFW Wildlife Action Plan	WSC, CMER, Policy	TFW Policy Group; Wildlife Steering Committee - Peter Hawg-Editor, Tim Cullinan-Chair				Y			
TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses	SHANW, CMER	Cogan, Sharpe, Cogan		SH-6		Y	Y	Y	Y
TFW000008	1989 Field Report - Characterization of RNZ's and UMA's with Respect to Wildlife Habitat	WSC, CMER	Carlson, Andy, TFW Biologist, WDW, Habitat Management Division, 600 Capitol Way N, M/S GJ-11, Olympia, WA 98501-1091				Y			
TFW000009	1988 Field Report - Characterization of RNZ's and UMA's with Respect to Wildlife Habitat	WSC, CMER	Armour, Chad, TFW Biologist, WDW, Habitat Management Division, 600 Capitol Way N, M/S GJ-11, Olympia, WA 98501-1091				Y			
TFW000010	1990 Field Procedures Handbook - Characterization of RNZ's and UMA's with Respect to Wildlife Habitat	WSC, CMER	Washington Department of Wildlife, TFW Wildlife Steering Committee, CMER				Y			
TFW000011	1988 Field Procedures Handbook - Characterization of RNZ's and UMA's with Respect to Wildlife Habitat	WSC, CMER	Washington Department of Wildlife, TFW Wildlife Steering Committee, CMER				Y			
TFW000012	Literature Review and Synthesis: Wildlife Use of RNZ's and UMA's by Wildlife - CMERC Projects 2 & 6	CMER	BioSystems Analysis, Inc., 3152 Paradise Drive, Building 39, Tiburon, CA 94920				Y	Y	Y	Y
TFW000013	Effects of Timber Harvest on Rain-On-Snow Run-Off in the Transient Snow Zone of the WA Cascades - Interim Rpt	SHANW, CMER	Harr, R. Dennis, USDA Forest Service, PNW Research Station, College of Forest Resources, UW, Seattle, WA 98195; Coffin, Bengt A.; Cundy, Terrance W.	TFW-18A-89-003	SH-1	PNW 88-593	Y	Y	Y	Y
TFW000015	The Effect of Elevated Holding Temperatures on Adult Spring Chinook Salmon Reproductive Success	FSC, CMER	Berman, Cara H.; Quinn, Thomas P.; Center For Streamside Studies/Fisheries Research Institute, University of Washing, Seattle, WA 98195				Y	Y	Y	Y
TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution	AMSC, CMER	Beechie, T.J.; Sibley, T.B.; Center for Streamside Studies(AR-10) and Fisheries Research Institute(WH-10), University of Washington, Seattle, WA 98504	TFW-16B-89-006	AM-1		Y	Y	Y	Y
TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis	SHANW, CMER	Macdonald, Anne; Ritland, Kerry W.; PTI Environmental Services, 15273 SE 30th Pl, Bellevue, WA 98007	TFW-012-89-002		C883-06	Y	Y	Y	Y
TFW000021	Misqually Resource Management Plan		Warfield, Warren; Department of Natural Resources, PO Box 68, Enumclaw, Wa 98022				Y	Y	Y	Y
TFW000022	Yakima Resource Management Plan		Crooker, Dave; Plum Creek Timber Co. or Divalbiss, Dave				Y	Y	Y	Y
TFW000023	DNR/GIS Transportation Data Entry	IHC	Holeman, Ron; DNR Information Management Div. 1102 South Quince Olympia, Wa. 753-1262			DG14001	Y	Y	Y	Y
TFW000024	DNR/GIS Hydrography Data Entry	IHC	Holeman, Ron; DNR Information Management Div. 1102 South Quince Olympia, Wa. 753-1262			DG14002	Y	Y	Y	Y
TFW000025	The CMER Program Work Plan Note Book for Technical Implementation of the TFW Agreement - May 1990 Draft	CMER	Sullivan, Kate; Turpin, Judy; Haug, Peter; Bernath, Stephen; Knudsen, Pamela; McDonald, Dennis; CMER Committee				Y			



TFWID	AUTHORS	TITLE	SOURCE	PUBDATE
TFW000001	Anonymous	Timber/Fish/Wildlife Agreement: A better future in our woods and streams, Final Report	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1987
TFW000002	Anonymous	Timber/Fish/Wildlife Agreement: Introduction	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	n.d.
TFW000022	Anonymous	Yakima Resource Management Plan	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1990
TFW000009	Armour, Chad	1988 Field Report - Characterization of RMZ's and UMA's with Respect to Wildlife Habitat	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000017	Beechie, T.J.; Sibley, T.H.	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution -	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000015	Berman, Cara H.; Quinn, Thomas P.	The Effect of Elevated Holding Temperatures on Adult Spring Chinook Salmon Reproductive Success	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000012	BioSystems Analysis, Inc.	Literature Review and Synthesis: Wildlife Use of RMZ's and UMA's by Wildlife - CHERC Projects 2 & 6	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000008	Carlson, Andy	1989 Field Report - Characterization of RMZ's and UMA's with Respect to Wildlife Habitat	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1990
TFW000007	Cogan, Sharpe, Cogan	TFW Road Questionnaire - Analysis and Compilation of Responses	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1991
TFW000003	Currie, Jim	An Analysis of Program Integration and Development for the TFW/CHER Committee	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000024	Denkers, D. Scott	Detailed Description for TFW Hydrography GIS Layer	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1991
TFW000023	Denkers, D. Scott	Detailed Description for TFW Transportation GIS Layer	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1991
TFW000013	Harr, R. Dennis; Coffin, Bengt A.; Cundy, Terrance W.	Effects of Timber Harvest on Rain-On-Snow Run-Off in the Transient Snow Zone of the Washington Cascades - Interim	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000018	MacDonald, Anne; Ritland, Kerry W.	Sediment Dynamics in Type 4 and 5 Waters: A Review and Synthesis	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000004	National Council of the Paper Industry for Air and Stream Improvement, Inc.	Wildlife use of Managed Forests in Washington: A Review	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1989
TFW000005	Sullivan, Turpin, Haug, Bernath, Knudsen, McDonald, CHER Subcommittees	The CHER Program Work Plan Notebook for Technical Implementation of the TFW Agreement	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1990
TFW000006	TFW Policy Group, Wildlife Steering Committee, CHER	TFW Wildlife Action Plan	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1990
TFW000021	Washington Department of Natural Resources, et al.	Nisqually Resource Management Plan: Process and Recommendations	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1990
TFW000011	Washington Department of Wildlife, TFW Wildlife Steering Committee, CHER	1988 Field Procedures Handbook - Characterization of RMZ's and UMA's with Respect to Wildlife Habitat	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1988
TFW000010	Washington Department of Wildlife, TFW Wildlife Steering Committee, CHER	1990 Field Procedures Handbook - Characterization of RMZ's and UMA's with Respect to Wildlife Habitat	WA DNR, Forest Practice Div., 1007 S. Washington, MS:EL-03, Olympia 98504; ph.206/753-5315	1990

## TFWID COMMENTS

- TFW000001 The Timber/Fish/Wildlife Agreement among the timber industry, state agencies, Indian tribes, and environmental interests establishes a cooperative way for protecting public resources affected by forest practices on state and private lands in ton. It describes general attributes of the new natural resource management system, forest practices application pathways, management priorities, and components of the management system. Appendices include conflict-resolution ground rules.
- TFW000002 This is a primer written originally at the University of Washington and edited by the Training, Information and Education Committee (TIE)
- TFW000003 This is an analysis of the role and function of CHER within TFW, and how CHER is carrying out it's mission.
- TFW000004 This is a literature review of terrestrial vertebrate wildlife use of managed forests in Washington. The purpose of the review was: a) develop a list of parameters which influence wildlife habitat; b) examine wildlife habitat classification systems; c) develop a study plan for monitoring wildlife. Utilizing the emerging concepts of landscape ecology to focus on wildlife-habitat relationships, the goal is to increase species/habitat diversity through the use of adaptive management techniques.
- TFW000007 This is the result of a questionnaire on forest roads developed by SHAMW in July 1990. It was designed to provide road construction engineers, regulators and other individuals involved with forest roads with an opportunity to provide information TFW cooperators on what's working and not working in the field; additional information needs; suggestions for further research; and identify any needed changes in regulations governing forest roads.
- TFW000012 This is a review of existing literature, both published and unpublished, of wildlife use of Riparian and Upland Management Zones, along with a synthesis of these sources, culminating in a suggested list of variables to be utilized in subsequent field studies, and the rationale for their selection. The intent is to provide the information necessary to help foresters and wildlife biologists better integrate wildlife habitat needs into managed forests through adaptive management.
- TFW000013 A field study is being conducted to determine the effects of forest cover density on rate of water input to soils during rain-on-snow conditions in the transient snow zone of the western Cascades of Washington. The study is in the first year of a two to three year period which will continue at least through the 1989-90 snow season. This is the interim report. If no suitable rain-on-snow events occur in the 1989-90 snow season, measurement will continue through 1990-91.
- TFW000015 While daily and seasonal river temperature fluctuations are natural, logging practices can exaggerate these swings. Acute effects of elevated temperature on fish are well documented. However, information on the effects of long-term exposure to sub-lethal temperatures is scarce. A 2-phase study was designed to investigate the possible link between timber harvesting practices and adult spring chinook salmon reproductive success. The objectives were: a) characterize historic thermal regimes and model likely effects from forest practices; b) determine if temperatures experienced prior to spawning influence reproductive success; c) determine if adult spring chinook salmon can behaviorally regulate their internal temperature. A pilot to assess the effectiveness of the experimental design and methodology was conducted as phase 1.
- TFW000017 The purpose of this research is to evaluate the TFW-AMSC stream classification system with respect to geomorphic and fish habitat variables in the Northwest Cascades ecoregion. The objectives are: evaluate the range and variance of stream conditions; evaluate whether the differences between segment types are statistically significant with respect to channel unit area, percent pool area, or other variables of interest; evaluate the effect of woody debris and other obstructions on habitat

## TFVID COMMENTS

- TFV000017 distribution; and assess the effects of debris torrents on distribution of habitat; assess whether simple length measurements of channel are sufficient to describe the channel unit distribution and rearing space in a stream segment.
- TFV000018 As IFW seeks to balance the preservation of natural resources and maintain a viable timber industry, appropriate management of Type 4 and 5 Waters has become a serious issue. A major link between hillslopes and downstream waters, little is known about sediment and LOD dynamics, and effects of forest practices on these streams. This project reviews existing literature on sedimentation, LOD dynamics, water quality and quantity in both undisturbed forests, and harvested forests. A questionnaire and workshop were used to identify regional characteristics of, and the effect of timber harvest practices on Type 4 and 5 Waters. The ultimate purpose of this project was to determine what information field managers need to employ site-specific management prescriptions on Type 4 and 5 Waters.
- TFV000021 The purpose of the plan is to strive for a balance between managing forest land for commercial timber production and the protection of public resources. Five goals were established, including evaluation of the RMP process. Over 50 recommendations were produced to accomplish the goals. Developing the plan enabled the cooperators to learn more about each other, their concerns, programs, responsibilities and philosophies. The Nisqually RMP cooperators developed a new RMP process that they thought would better serve both landowners and the public. Recommendations for future RNPs is provided.
- TFV000022 The purpose of this effort is to develop and implement a cooperative management process which: identifies resource conflicts and management opportunities; coordinates data collection, evaluation, and cumulative effects assessment; promotes landowner flexibility; meets the resource and use goals of all participants; and has a long-term ecosystem approach.
- TFV000023 When completed, the transportation data layer will contain road, railroad, and other routes existing within townships containing state and private forest lands in the state of Washington. Some federal and tribal lands will also be included.
- TFV000024 The hydrography layer represents an integrated network coverage (polygons and lines) that holds data on water bodies (open waters, lakes, etc.) and watercourses (rivers, streams, canals, etc.). State, private, and some federal and tribal lands are included in the HYDRO layer

TFWID	KEYWORDS	V
TFW000007	50-year flood level	V
TFW000021	CMER	
TFW000018	DNR region	V
TFW000001	FPA	
TFW000002	FPA	
TFW000004	GIS	
TFW000021	GIS	
TFW000022	GIS	
TFW000023	GIS	
TFW000024	GIS	
TFW000004	HEP	
TFW000004	HSI	
TFW000024	HYDRO	
TFW000001	ID team	
TFW000002	ID team	
TFW000003	ID team	
TFW000018	LOD	V
TFW000021	NWI	
TFW000022	NWI	
TFW000021	Natural Heritage Program	
TFW000007	OHW	
TFW000004	PATREC	
TFW000001	RMP	
TFW000002	RMP	
TFW000001	RMZ	
TFW000002	RMZ	
TFW000012	RMZ	
TFW000013	RMZ	
TFW000001	T&E	
TFW000004	T&E	
TFW000001	UMA	
TFW000002	UMA	
TFW000012	UMA	
TFW000004	WHR	
TFW000024	WRIA	
TFW000007	abandoned road	
TFW000007	abandoned road mitigation techniques	V
TFW000007	active miles maintained	V
TFW000007	active road	
TFW000001	adaptive management	
TFW000002	adaptive management	
TFW000003	adaptive management	
TFW000004	adaptive management	
TFW000015	adaptive management	
TFW000021	adaptive management	
TFW000003	administration	
TFW000004	afforestation	V
TFW000013	air temperature	
TFW000004	ambient temperature	V
TFW000021	anadromous fish	
TFW000007	annual miles built	V

TFWID	KEYWORDS	V
TFW000012	aquatic zone	V
TFW000002	archeological/cultural heritage	
TFW000004	area model	
TFW000007	armored overflow	
TFW000017	bank full depth	V
TFW000017	bank full width	V
TFW000018	bankfull width	V
TFW000004	basal area	V
TFW000017	basin area	
TFW000017	bedrock geology	
TFW000015	behavior	
TFW000012	biogeographic location	V
TFW000018	bioturbation	
TFW000007	blown-out culverts	V
TFW000007	bridges	
TFW000003	budget	
TFW000018	buffering	
TFW000018	burning	V
TFW000012	canopy	
TFW000013	canopy	
TFW000012	canopy closure	V
TFW000004	canopy cover	V
TFW000004	canopy height	V
TFW000007	capacity increase design/effectiveness	V
TFW000007	capacity modification for debris and sediment flow	V
TFW000004	carrying capacity	
TFW000017	cascade	
TFW000004	cavity availability	V
TFW000004	cavity height	V
TFW000004	cavity permanence	V
TFW000004	cavity size	V
TFW000017	channel	V
TFW000017	channel area	
TFW000018	channel recovery	V
TFW000017	channel stability	
TFW000021	channel stability	
TFW000018	channel topography	V
TFW000007	channel width	
TFW000013	clearcut	
TFW000012	cliffs	V
TFW000003	communication	
TFW000012	connectivity	V
TFW000003	consensus	
TFW000018	constituency	V
TFW000003	contract	
TFW000003	cooperation	
TFW000003	coordination	
TFW000004	cover type	
TFW000004	cover/forage ratio	V
TFW000007	cross-drain	
TFW000007	cross-drain discharge points	V
TFW000007	cross-drain size/type	V

TFWID	KEYWORDS	V
TFW000007	cross-drain spacing	V
TFW000022	cultural resource	
TFW000001	cultural/archeological resources	
TFW000007	culvert	
TFW000007	culvert design	V
TFW000007	culvert size	V
TFW000001	cumulative effects	
TFW000003	cumulative effects	
TFW000013	cumulative effects	
TFW000021	cumulative effects	
TFW000001	data	
TFW000013	date	V
TFW000015	date	V
TFW000015	date of arrival	V
TFW000015	date of development to eyed stage	V
TFW000015	date of egg take	V
TFW000012	debris	
TFW000013	debris	
TFW000018	debris flow	
TFW000007	debris jam	
TFW000017	debris jam	
TFW000012	dependent species	
TFW000007	design flow	
TFW000007	design-flow determinants	V
TFW000007	design-flow recurrence interval	V
TFW000007	discharge point	
TFW000004	distance to cover	V
TFW000004	distance to edge	V
TFW000004	distance to water	V
TFW000004	distribution	
TFW000001	diversity	
TFW000002	diversity	
TFW000004	diversity	
TFW000012	dominant vegetation	V
TFW000004	downed logs	V
TFW000007	downspout	
TFW000007	downstream risk reduction	V
TFW000018	dry ravel	
TFW000018	earthflow	
TFW000018	ecoregion	V
TFW000001	ecosystem	
TFW000012	ecosystem	
TFW000004	edge	V
TFW000012	edge contrast	V
TFW000012	edge length	V
TFW000015	egg mortality (number and %)	V
TFW000015	egg volume	V
TFW000015	egg weight	V
TFW000012	elevation	V
TFW000013	elevation	
TFW000007	employer	V
TFW000022	endangered species	

TFWID	KEYWORDS	V
TFW000007	forest roads	
TFW000022	forest roads	
TFW000018	forest type	V
TFW000004	fragmentation	V
TFW000012	fragmentation	V
TFW000004	geographic information system (see GIS)	
TFW000012	geographic location	V
TFW000018	geology	V
TFW000018	glaciation	V
TFW000017	glide	
TFW000003	goals	
TFW000007	grates	
TFW000022	grazing	
TFW000004	guild	
TFW000012	guild	
TFW000001	habitat	
TFW000002	habitat	
TFW000007	habitat	
TFW000012	habitat diversity	
TFW000022	habitat enhancement	
TFW000004	habitat evaluation process (see HEP)	
TFW000022	habitat protection	
TFW000012	habitat size	
TFW000004	habitat structure	V
TFW000004	habitat suitability index (see HSI)	
TFW000022	harvest	
TFW000018	harvest method	V
TFW000007	headwaters	
TFW000018	headwaters	
TFW000018	herbicides	
TFW000021	hiding cover	
TFW000021	high quality wetlands	
TFW000018	hillslope topography	V
TFW000004	hole size	V
TFW000013	hour	V
TFW000004	human disturbance	V
TFW000013	humidity	
TFW000022	hydrography	
TFW000003	implementation	
TFW000007	inactive miles maintained	V
TFW000007	inactive road	
TFW000015	incubation	
TFW000015	incubation water - PH	V
TFW000015	incubation water - dissolved oxygen	V
TFW000015	incubation water temperature - average	V
TFW000015	incubation water temperature - high	V
TFW000015	incubation water temperature - low	V
TFW000004	indicator species	
TFW000012	indicator species	
TFW000001	information	
TFW000007	innovative road construction/maintenance	V
TFW000018	insecticides	

TFWID	KEYWORDS	V
TFW000001	interdisciplinary team (see ID team)	
TFW000004	interspersion	
TFW000004	isolation	V
TFW000012	isolation	V
TFW000004	juxtaposition	
TFW000012	juxtaposition	
TFW000004	landscape ecology	
TFW000022	landscape pattern	
TFW000007	landslide	
TFW000013	landslide	
TFW000007	landslide frequency and distribution	V
TFW000004	landtyping	
TFW000004	litter cover	V
TFW000007	log culverts	V
TFW000017	low flow discharge	
TFW000004	managed forest	
TFW000007	mass movement	
TFW000018	mass wasting	
TFW000021	mass wasting	
TFW000013	mean air temperature	V
TFW000013	mean relative humidity	V
TFW000013	mean shortwave radiation	V
TFW000013	mean windspeed	V
TFW000017	measured unit depth	V
TFW000017	measured unit length	V
TFW000017	measured unit width	V
TFW000004	metapopulation	
TFW000003	methodology	
TFW000004	mid-story cover	V
TFW000015	migration	
TFW000007	minor stream-crossing considerations	V
TFW000004	moisture conditions	V
TFW000001	monitoring	
TFW000002	monitoring	
TFW000003	monitoring	
TFW000012	monitoring	
TFW000007	monitoring abandoned/orphaned/inactive roads	V
TFW000013	month	V
TFW000015	mortality rate	
TFW000004	mosaic	
TFW000021	native fish	
TFW000021	natural production (fish)	
TFW000002	negotiations	
TFW000004	nest availability	V
TFW000004	nitrogen availability	V
TFW000022	non-industrial landowners	
TFW000021	noncompatible land use	
TFW000015	number of adult arrivals	V
TFW000015	number of arrivals (m/f)	V
TFW000015	number of days from eyed stage to first hatch	V
TFW000015	number of days from first hatch to complete hatch	V
TFW000015	number of eggs	V



6/29/91

Standard Report

TFWID	KEYWORDS	
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TFW000015	number of fish spawned (m/f)	V
TFW000015	number of mortalities (m/f)	V
TFW000003	objectives	
TFW000012	obligate species	
TFW000018	obstruction	
TFW000017	obstructions	
TFW000022	old growth forest	
TFW000007	ordinary high water (see OHW)	
TFW000007	organic debris	
TFW000012	organic debris	V
TFW000007	orphaned road	
TFW000001	orphaned roads	
TFW000004	patch	
TFW000004	patch diversity	V
TFW000012	patch size	V
TFW000004	pattern recognition model (see PATREC)	
TFW000004	perch availability	V
TFW000012	persistence	
TFW000002	planning	
TFW000003	planning	
TFW000022	plant communities	
TFW000002	policy	
TFW000003	policy	
TFW000017	pool	
TFW000004	population sinks	
TFW000013	precipitation	V
TFW000002	predictability	
TFW000022	preharvest review	
TFW000004	presence of hardwoods	V
TFW000003	priorities	
TFW000001	priority issues	
TFW000002	priority issues	
TFW000003	process	
TFW000003	program integration	
TFW000001	public resources	
TFW000002	public resources	
TFW000015	radio telemetry	
TFW000013	rainfall	
TFW000018	rainfall	
TFW000017	rapid	
TFW000017	raw bank length	V
TFW000022	red light threshold	
TFW000007	region	V
TFW000003	regulation	
TFW000007	relationship between culvert size and road life	V
TFW000015	reproduction	
TFW000001	research	
TFW000002	research	
TFW000003	research	
TFW000012	research	
TFW000001	resource management plan (see RMP)	
TFW000022	resource recovery	

TFWID	KEYWORDS	V
TFW000003	responsibility	
TFW000017	riffle	
TFW000007	rip-rap	
TFW000002	riparian	
TFW000017	riparian	V
TFW000021	riparian leave area	
TFW000021	riparian management area	
TFW000001	riparian management zone (see RMZ)	
TFW000012	riparian zone width	V
TFW000004	risk analysis	
TFW000001	risk assessment	
TFW000015	river	
TFW000023	road	
TFW000023	road activity status	
TFW000007	road construction	
TFW000018	road construction	V
TFW000022	road crossing	
TFW000022	road density	
TFW000021	road location	
TFW000007	road maintenance	
TFW000018	road maintenance	V
TFW000021	road management	
TFW000007	road prism	
TFW000007	road prism protection	V
TFW000013	runoff	
TFW000018	runoff generation	V
TFW000015	salmon	
TFW000004	sapling cover	V
TFW000003	scope	
TFW000007	sediment	
TFW000013	sediment	
TFW000017	sediment	V
TFW000018	sediment delivery frequency	V
TFW000018	sediment delivery magnitude	V
TFW000018	sediment delivery process	V
TFW000018	sediment dynamics	V
TFW000018	sediment storage	V
TFW000018	sediment transport efficiency	V
TFW000004	sensitive	
TFW000021	set asides	
TFW000015	shading	
TFW000004	shrub density	V
TFW000007	sidecast	
TFW000021	sivicultural	
TFW000013	slope stability	
TFW000007	slope stability/instability	
TFW000007	slumping of cut bank	V
TFW000018	slumps	
TFW000001	snag	
TFW000022	snag	
TFW000004	snag availability	V
TFW000004	snag condition	V

TFWID	KEYWORDS	V
TFW000004	snag/tree size	V
TFW000012	snags	V
TFW000013	snow collector outflow	V
TFW000013	snowmelt	
TFW000018	snowmelt	
TFW000013	snowpack	
TFW000007	soil composition	
TFW000018	soil creep	
TFW000004	soil moisture	V
TFW000018	soil texture	V
TFW000018	soil thickness	V
TFW000013	soils	
TFW000004	spatial diversity	
TFW000004	spatial statistics	
TFW000004	spatial variation	
TFW000015	spawning	
TFW000002	species	
TFW000012	species richness	V
TFW000004	stand	
TFW000004	stand age	V
TFW000004	stand area	V
TFW000013	standard deviation of air temperature	V
TFW000013	standard deviation of windspeed	V
TFW000002	state agencies	
TFW000021	state endangered species	
TFW000021	state monitor species	
TFW000021	state sensitive species	
TFW000021	state threatened species	
TFW000004	stem density	V
TFW000015	stream	
TFW000024	stream	
TFW000007	stream crossing	
TFW000007	stream gradient	
TFW000012	stream gradient	V
TFW000017	stream gradient	V
TFW000021	stream numbering system	
TFW000012	stream order	V
TFW000017	stream order	V
TFW000017	stream sequence	V
TFW000012	stream shading	V
TFW000017	stream type	V
TFW000017	stream unit	V
TFW000012	stream width	V
TFW000007	stream-crossing siting criteria	V
TFW000012	streambank stability	V
TFW000013	streamflow	
TFW000022	streamside vegetation	
TFW000004	successional stage	
TFW000012	successional stage	V
TFW000017	surficial geology	
TFW000015	survival/mortality per lot	V
TFW000012	talus	V

TFWID	KEYWORDS	
TFW000015	temperature	V
TFW000015	temperature - average maximum	V
TFW000015	temperature - average minimum	V
TFW000015	temperature - monthly high	V
TFW000015	temperature - monthly low	V
TFW000007	temporary crossing criteria	V
TFW000007	temporary road	
TFW000007	temporary road percentage	V
TFW000007	tension cracks	V
TFW000021	thermal cover	
TFW000015	thermal regime	
TFW000001	threatened and endangered species (see T&E)	
TFW000018	timber harvest period	V
TFW000018	timber harvest practices	V
TFW000001	timber industry	
TFW000002	timber industry	
TFW000022	timber supply	
TFW000018	title	V
TFW000021	transient snow zone	
TFW000022	transportation	
TFW000023	transportation	
TFW000004	tree condition	V
TFW000004	tree density	V
TFW000004	tree height	V
TFW000004	tree size	V
TFW000004	tree species	V
TFW000002	tribes	
TFW000004	ultimate factor	
TFW000018	undisturbed area	V
TFW000021	unstable slopes	
TFW000021	upland management area	
TFW000001	upland management area (see UMA)	
TFW000012	vegetation	V
TFW000017	vegetation	
TFW000018	vegetation	
TFW000004	vegetation cover	V
TFW000022	vegetative diversity	
TFW000021	vegetative screening	
TFW000012	vertical structural diversity	V
TFW000021	water appropriations	
TFW000015	water depth	
TFW000012	water permanence	V
TFW000002	water quality	
TFW000007	water quality	V
TFW000018	water quality	V
TFW000021	water quality	
TFW000018	water quantity	V
TFW000021	water quantity	
TFW000021	water rights	
TFW000012	water type	V
TFW000021	water type system	
TFW000004	watershed	

6/29/91

Standard Report

TFWID	KEYWORDS	V
TFW000018	watershed	
TFW000022	watershed	
TFW000022	wetland	
TFW000021	wetland cultural features	
TFW000021	wetland management zones	
TFW000001	wetlands	
TFW000002	wetlands	
TFW000001	wildlife	
TFW000002	wildlife	
TFW000021	wildlife	
TFW000021	wildlife habitat protection	
TFW000004	wildlife-habitat relationships (see WHR)	
TFW000013	wind	
TFW000013	wind azimuth	V
TFW000017	woody debris	V
TFW000022	woody debris	
TFW000018	yarding practice	V
TFW000022	yellow light threshold	

TFWID	VARIABLE	DESCRIPT	UNITS
TFW000007	50-year flood level	determination of 50-year flood level	
TFW000018	DRR region	DNR region	
TFW000024	EPA river reach number	EPA number to uniquely identify a watercourse to the reach and subreach level	
TFW000018	LOD	observed delivery or redistribution of large organic debris on Type 4 & 5 Waters from harvesting	
TFW000021	LOD	tree parts larger than 4 inches in diameter and longer than 6 feet	
TFW000024	WRIA code	state water resource inventory area identifier	
TFW000024	WRIA stream ID	unique state water course identifier	
TFW000007	abandoned road mitigation techniques	with planned road abandonment, stream crossing design and subsequent protection of public resources	
TFW000007	active miles maintained	number of miles of active road maintained	miles
TFW000004	afforestation	I have no idea	
TFW000021	age class	age grouping of timber stands	years
TFW000004	ambient temperature	? the average temperature?, the range of temperature?, the current temperature?	degrees celsius/fahrenheit
TFW000007	annual miles built	number of miles of new road built annually	miles
TFW000012	aquatic zone		
TFW000021	asset value	value of a forest resource	dollars
TFW000017	bank full depth	bank full depth (visual)	meters
TFW000017	bank full width	bank full width (visual)	meters
TFW000018	bankfull width	ordinary high water (OHW) mark, usually accompanied by a change in vegetation	
TFW000004	basal area	I don't know	?
TFW000012	biogeographic location		
TFW000007	blown-out culverts	methods to evaluate and deal with blown-out culverts	
TFW000018	burning	prescribed/accidental	
TFW000012	canopy closure		
TFW000004	canopy cover	degree to which canopy blots out the sky	?
TFW000004	canopy height	height above ground where you encounter branches with leaves/needles which create a 'canopy'	feet/meters
TFW000007	capacity increase design/effectiveness	methods to increase flow capacity to accommodate debris passage, and measurement of effectiveness	
TFW000007	capacity modification for debris and sediment flow	do respondents modify bridge/culvert flow capacity to account for debris and sediment during floods?	y/n
TFW000004	cavity availability	determination of whether snags are hollowed to accommodate wildlife	?
TFW000004	cavity height	height above ground to cavity opening	feet/meters
TFW000004	cavity permanence	determination of whether the cavity is likely to survive/persist over time	
TFW000004	cavity size	area within a snag available to wildlife	?
TFW000017	channel	comments on channel units	
TFW000022	channel morphology		
TFW000018	channel recovery	Type 4 & 5 Waters recovery time from floods, landslides, other extreme events	
TFW000018	channel topography	for both Type 4 & 5 Waters, steep/moderate/gentle/other	
TFW000012	cliffs		
TFW000021	coarse woody debris	large down logs and root wads	
TFW000012	connectivity		
TFW000018	constituency	employer/agency/organization	
TFW000004	cover/forage ratio	? ratio of protective cover to open area for foraging?	ratio
TFW000007	cross-drain discharge points	criteria for determining cross-drain discharge points	
TFW000007	cross-drain size/type	cross-drain types (culvert, water bar, drivable dip, other) and diameter	
TFW000007	cross-drain spacing	effectiveness of various guidelines to determine cross-drain spacing (FPB manual, DOF, USFS, etc.)	
TFW000007	culvert design	designed for headwater depth? sediment passage? fish passage? debris passage? other?	
TFW000007	culvert size	culvert size determined by design flood? channel width? culverts downstream? basin area? other?	
TFW000013	date	day of the month	
TFW000015	date	date	
TFW000015	date of arrival	arrival date of spring chinook salmon	
TFW000015	date of development to eyed stage	date of development to eyed stage	
TFW000015	date of egg take	date of egg take by lot	
TFW000007	design-flow determinants	'tools' for fish-bearing streams to determine design-flow (formulae, methods, publications, etc.)	

TFWID	VARIABLE	DESCRIPT	UNITS
TFW000007	design-flow recurrence interval	recurrence intervals of 10, 25, 50, or 100 years; or some other interval?	years
TFW000004	distance to cover	? distance to cover from nesting area?	feet/meters
TFW000004	distance to edge	distance to differing habitat zone/stands	feet/meters
TFW000004	distance to water	distance from primary habitat area to potable water	feet/meters
TFW000012	dominant vegetation		
TFW000004	downed logs	fallen trees on forest floor	
TFW000007	downstream risk reduction	effectiveness of programs to reduce risk downstream	
TFW000018	ecoregion	adapted and simplified from EPA map based on topography, geology and climate	
TFW000004	edge	border area between stands	feet/meters
TFW000012	edge contrast		
TFW000012	edge length		
TFW000015	egg mortality (number and %)	number and percent of egg mortality	
TFW000015	egg volume	volume @ 10 eggs/20 ml distilled water	milliliter (ml)
TFW000015	egg weight	weight per 10 eggs	not specified
TFW000012	elevation		
TFW000007	employer	agency or company	
TFW000007	erosion protection for fill	effectiveness of protection methods for fill	
TFW000017	estimated unit depth	estimated depth of stream unit	meters
TFW000017	estimated unit length	estimated length of stream unit	meters
TFW000017	estimated unit width	estimated width of stream unit	meters
TFW000007	experience	how long has respondent worked on forest roads?	years
TFW000018	experience	number of years of experience	
TFW000007	expertise	area of specialty	
TFW000018	expertise	area of expertise	
TFW000007	failure of ditch drainage	methods to evaluate and deal with failure of ditch drainage	
TFW000007	fish habitat	protection of fish habitat by various mitigation techniques	
TFW000007	fish passage considerations	effectiveness of various design tools and guidelines (FPB,DOF,USFS,etc.)	
TFW000021	flexibility	ability to capture market peaks and withhold products during slumps	options
TFW000018	flooding duration	short/moderate/long	
TFW000018	flooding frequency	frequent/moderate/infrequent	
TFW000018	flooding magnitude	overbank/to valley sides/across valley	
TFW000004	foliage density	relative measurement of how "open" or "crowded" the habitat area is with plant growth	percent
TFW000004	food availability	availability of appropriate food source in the local vicinity	
TFW000004	foraging substrate	the dominant soil/foilage in the foraging area	
TFW000007	forest practices rules regarding roads	effectiveness of forest practices rules in addressing forest road issues; strengths; weaknesses	
TFW000018	forest type	dominant species, followed by major non-climax species	
TFW000004	fragmentation	degree to which similar habitat characteristics are dispersed throughout the landscape	percent
TFW000012	fragmentation		
TFW000012	geographic location		
TFW000018	geology	volcanic/metamorphic/granite/sedimentary/other	
TFW000018	glaciation	continental/alpine/unglaciated/other	
TFW000004	habitat structure	characterization of physical habitat	
TFW000018	harvest method	clearcut/selective cut/partial cut/other	
TFW000018	hillslope topography	steep, moderate, etc.	
TFW000004	hole size	diameter of cavity opening	inches/centimeters
TFW000013	hour	hour of the day using the 24-hour clock	
TFW000004	human disturbance	measurement of amount and degree of human intrusion into the habitat area	
TFW000024	hydrologic unit number	number set up by USGS dividing the United States into a hierarchy of hydrologic units	USGS region, subregion, accounting unit, cataloging unit
TFW000007	inactive miles maintained	number of miles of inactive road maintained	miles
TFW000015	incubation water - PH	PH of incubation trough water	
TFW000015	incubation water - dissolved oxygen	dissolved oxygen in incubation trough water	milligrams/milliliter (mg/ml)
TFW000015	incubation water temperature - average	average incubation trough water temperature	degrees C

TFWID	VARIABLE	DESCRIPT	UNITS
TFW000015	incubation water temperature - high	high incubation trough water temperature	degrees C
TFW000015	incubation water temperature - low	low incubation trough water temperature	degrees C
TFW000007	innovative road construction/maintenance	description of innovative or particularly effective road construction and maintenance techniques	
TFW000021	investment	amount put into a tiaberstand to get a return	dollars
TFW000004	isolation	degree to which specific habitat characteristics are isolated, or 'islands'	percent
TFW000012	isolation		
TFW000007	landslide frequency and distribution	percentage subject to mass movement; causes; effects; age of roads; frequency; mitigation techniques	
TFW000004	litter cover	availability of litter on forest floor	
TFW000007	log culverts	methods to evaluate and deal with log culverts	
TFW000013	mean air temperature	mean air temperature	degrees C
TFW000013	mean relative humidity	mean relative humidity	percent
TFW000013	mean shortwave radiation	mean shortwave radiation	watts/square meter
TFW000013	mean windspeed	mean windspeed	meters/second
TFW000017	measured unit depth	measured depth of stream unit	meters
TFW000017	measured unit length	measured length of stream unit	meters
TFW000017	measured unit width	measured width of stream unit	meters
TFW000004	mid-story cover	availability of cover in the middle branches, above the lowermost canopy	
TFW000007	minor stream-crossing considerations	for crossing headwaters and side streams: how many? failure types/causes? repair frequency? design?	
TFW000004	moisture conditions	characterization of moisture throughout habitat (e.g. stream, saturated ground, parched, etc.)	
TFW000007	monitoring abandoned/orphaned/inactive roads	programs to identify drainage or stability problems with abandoned, orphaned or inactive roads	
TFW000013	month	numeric representation of the month of the year	
TFW000021	nephelometric turbidity units	optical properties of water that causes light to be scattered and absorbed , not in a straight line	
TFW000004	nest availability	availability of existing nesting sites, or areas suitable for nesting	
TFW000004	nitrogen availability	?	
TFW000015	number of adult arrivals	number of adult arrivals	
TFW000015	number of arrivals (m/f)	number of male and female arrivals	
TFW000015	number of days from eyed stage to first hatch	number of days from eyed stage to first hatch by lot	
TFW000015	number of days from first hatch to complete hatch	number of days from first hatch to complete hatch by lot by cup	
TFW000015	number of eggs	total number of eggs	
TFW000015	number of fish spawned (m/f)	number of male and female fish spawned	
TFW000015	number of mortalities (m/f)	number of male and female mortalities	
TFW000012	organic debris		
TFW000004	patch diversity	ratio of patches with different habitat characteristics	percent
TFW000012	patch size		
TFW000004	perch availability	availability of areas appropriate for viewing the habitat area (territorial view)	
TFW000013	precipitation	precipitation	millimeters (mm)
TFW000004	presence of hardwoods	determination of the significant presence or absence of hardwood trees within the habitat area	
TFW000017	raw bank length	estimated length of raw banks and bank material in unit (for left/right banks)	?
TFW000007	region	area of Washington state in which surveyed roads are located	
TFW000007	relationship between culvert size and road life	downsizing culverts based on the length of time a temporary road will be in place	
TFW000017	riparian	general characterization of riparian zone	
TFW000012	riparian zone width		
TFW000023	road activity status code	WAC 222-24-050 status of active, inactive, or abandoned road	
TFW000023	road class code	generalized USGS road classification code	
TFW000018	road construction	when built, where located, # landings, road length, construction practices	
TFW000018	road maintenance	well/poorly maintained, orphaned, abandoned	
TFW000023	road maintenance program	DNR program responsible for construction or maintenance	
TFW000007	road prism protection	effectiveness of various methods in protecting road prism from erosion	
TFW000023	road surface type	paved, unpaved, or unknown	
TFW000023	road user program	DNR program using road	
TFW000018	runoff generation	sources/causes of runoff	
TFW000004	sapling cover	? how many saplings are on the site as a ratio?	?



TFWID	VARIABLE	DESCRIPT	UNITS
TFW000017	sediment	dominant substrate	
TFW000021	sediment	percent fines in spawning gravels less than 0.85mm in size	%%
TFW000022	sediment		
TFW000018	sediment delivery frequency	comment on two most important processes	
TFW000018	sediment delivery magnitude	comment on two most important processes	
TFW000018	sediment delivery process	debris torrent or flow/translational or rotational landslide/eroded stream reaches/soil creep/other	
TFW000018	sediment dynamics	observed cause, effect, and duration of timber harvest practices on sedimentation in Type 445 Waters	
TFW000018	sediment storage	sediment storage processes/patterns/magnitude/frequency/distribution	
TFW000018	sediment transport efficiency	efficiency is a measure of the percent of sediment moved out per unit per year	percent
TFW000021	seral stage	successional stages in a forest stand including the climax or final stage	
TFW000004	shrub density	relative abundance of shrubs throughout the habitat area	
TFW000007	slumping of cut bank	methods to evaluate and deal with slumping of cut bank	
TFW000021	snag	large standing dead tree	
TFW000004	snag availability	relative abundance of snags within the habitat area	?
TFW000004	snag condition	condition of snags relative to suitability for habitat (e.g. for cavity-nesting birds)	
TFW000004	snag/tree size	measurement of standing dead tree diameter at breast height	inches/centimeters
TFW000012	snags		
TFW000013	snow collector outflow	snow collector outflow	millimeters (mm)
TFW000004	soil moisture	measurement of relative moisture in soil	?
TFW000018	soil texture	sandy, loose, coarse grained/silty/clay, cohesive, fine grained/other	
TFW000018	soil thickness	thick/thin/moderate	
TFW000012	species richness		
TFW000004	stand age	age of forest stand	years
TFW000004	stand area	spatial measurement of stand size	square feet/meters
TFW000013	standard deviation of air temperature	standard deviation of air temperature	degrees C
TFW000013	standard deviation of windspeed	standard deviation of windspeed	meters/second
TFW000004	stem density	relative abundance of branches, sub-branches (stems) within the stories	?
TFW000021	stream flow	water level of streams	
TFW000024	stream flow periodicity	identifies flow characteristics of a stream segment due to seasonal or meteorological conditions	
TFW000012	stream gradient		
TFW000017	stream gradient	relative incline	degrees
TFW000024	stream name	name of stream, river, or other linear watercourse	
TFW000012	stream order		
TFW000017	stream order	relative stream ranking	
TFW000017	stream sequence	main, side or off channel	
TFW000012	stream shading	temperature	
TFW000021	stream temperature	stream temperature	
TFW000017	stream type	pool/riffle/glide	
TFW000017	stream unit	unit identification	
TFW000012	stream width		
TFW000007	stream-crossing siting criteria	effectiveness of siting stream-crossings to protect roads, water quality and fish habitat	
TFW000012	streambank stability		
TFW000012	successional stage		
TFW000021	survival of emergence	percentage of fish which survived from deposition in the gravel as a fertilized egg to a fingerling	percent
TFW000015	survival/mortality per lot	egg lot survival and mortality through hatch	percent
TFW000012	talus		
TFW000015	temperature - average maximum	average maximum temperature	degrees C
TFW000015	temperature - average minimum	average minimum temperature	degrees C
TFW000015	temperature - monthly high	monthly high temperature	degrees C
TFW000015	temperature - monthly low	monthly low temperature	degrees C
TFW000007	temporary crossing criteria	determination of siting and effectiveness of temporary crossings	
TFW000007	temporary road percentage	percentage of all roads within respondents area slated to be abandoned	percent

TFWID	VARIABLE	DESCRIPT	UNITS
TFW000007	tension cracks	methods to evaluate and deal with tension cracks	
TFW000018	timber harvest period	most recent past peak harvest years in current rotation	
TFW000018	timber harvest practices	effectiveness of change to forest practice regulation in protecting Type 4&5 Waters from disturbance	
TFW000018	title	job title	
TFW000023	township code	four digit township code used in DNRGIS	
TFW000023	transportation input method	method of spatial data entry for a transportation route segment	
TFW000023	transportation route ID	commonly used transportation route identifier (I-5, SR20)	
TFW000023	transportation route name	full textual name of transportation route	
TFW000023	transportation route type	type of transportation route (road, railroad, trail, ferry crossing)	
TFW000004	tree condition	characteristics of tree health	
TFW000004	tree density	relative abundance of tree dispersal throughout the habitat area	?
TFW000004	tree height	overall height of tree	feet/meters
TFW000004	tree size	measurement of tree diameters at breast height (dbh)	inches/centimeters
TFW000004	tree species	precise identification of tree types	
TFW000018	undisturbed area	percentage of region undisturbed or minimally disturbed by timber harvest or related activities	percent
TFW000012	vegetation	submergent/emergent	
TFW000004	vegetation cover	characteristics of vegetation types	
TFW000012	vertical structural diversity		
TFW000024	water body name	name of lake, wetland, or other open water body	
TFW000024	water body type	type of water polygon, USGS DLG hydrographic classification codes are used	
TFW000012	water permanence		
TFW000007	water quality	protection of water quality by various mitigation techniques	
TFW000018	water quality	observed cause, effect, and duration of timber harvest practices on water quality in Type 4&5 Waters	
TFW000018	water quantity	observed cause/effect/duration on amount/timing of runoff from harvest practices on Type 4&5 Waters	
TFW000012	water type		
TFW000024	water type code	WAC 222-16-030 classification of stream, lake, etc.	
TFW000021	wetlands	lands transitional between terrestrial and aquatic systems where water table is at/near the surface	
TFW000013	wind azimuth	wind azimuth	degrees
TFW000017	woody debris	large/medium/small based on diameter and length	
TFW000018	yarding practice	tractor,skidder/shovel/high lead cable/helicopter,ballon/other	

## APPENDIX C

Appendix C contains three examples of queries that were performed on the TFW database.

Selection criteria for the first query were:

"Select all entries that have keyword or variable names of 'patch' or 'edge'."

Selection criteria for the second query were:

"Select all entries that have keyword or variable names of 'abandoned' and 'road'."

Selection criteria for the third query were:

"Select all entries that have keyword or variable names of 'debris' or 'sediment'."

Keyword/Variable	V	Description	TFWID	Project Name
distance to edge	v	distance to differing habitat zone/stands	TFW000004	Wildlife Use of Managed Forests: A Review
edge	v	border area between stands	TFW000004	Wildlife Use of Managed Forests: A Review
edge contrast	v		TFW000012	Literature Review and Synthesis: Wildlife Use of RNZ's and UMA's by Wildlife - CMERC Projects 2 & 6
edge length	v		TFW000012	Literature Review and Synthesis: Wildlife Use of RNZ's and UMA's by Wildlife - CMERC Projects 2 & 6
patch			TFW000004	Wildlife Use of Managed Forests: A Review
patch diversity	v	ratio of patches with different habitat characteristics	TFW000004	Wildlife Use of Managed Forests: A Review
patch size	v		TFW000012	Literature Review and Synthesis: Wildlife Use of RNZ's and UMA's by Wildlife - CMERC Projects 2 & 6

Keyword/Variable	V	Description	TFWID	Project Name
abandoned road			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
abandoned road mitigation techniques	v	with planned road abandonment, stream crossing design and subsequent protection of public resources	TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
monitoring abandoned/orphaned/inactive	v	programs to identify drainage or stability problems with abandoned, orphaned or inactive roads	TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses

Keyword/Variable	V	Description	TFWID	Project Name
capacity modification for debris and sediment flow debris	v	do respondents modify bridge/culvert flow capacity to account for debris and sediment during floods?	TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
debris			TFW000012	Literature Review and Synthesis: Wildlife Use of RMZ's and UMA's by Wildlife - CMERC Projects 2 & 6
debris flow			TFW000013	Effects of Timber Harvest on Rain-On-Snow Run-Off in the Transient Snow Zone of the WA Cascades - Interim Rpt
debris jam			TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
debris jam			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
debris jam			TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution
organic debris			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
organic debris	v		TFW000012	Literature Review and Synthesis: Wildlife Use of RMZ's and UMA's by Wildlife - CMERC Projects 2 & 6
sediment			TFW000007	TFW Road Questionnaire - Analysis and Compilation of Responses
sediment			TFW000013	Effects of Timber Harvest on Rain-On-Snow Run-Off in the Transient Snow Zone of the WA Cascades - Interim Rpt
sediment	v	dominant substrate	TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution
sediment delivery frequency	v	comment on two most important processes	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment delivery magnitude	v	comment on two most important processes	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment delivery process	v	debris torrent or flow/translational or rotational landslide/eroded stream reaches/soil creep/other	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment dynamics	v	observed cause, effect, and duration of timber harvest practices on sedimentation in Type 4&5 Waters	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment storage	v	sediment storage processes/patterns/magnitude/frequency/distribution	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
sediment transport efficiency	v	efficiency is a measure of the percent of sediment moved out per unit per year	TFW000018	Sediment Dynamics in Type 4 and 5 Waters: A review and Synthesis
woody debris	v	large/medium/small based on diameter and length	TFW000017	Evaluation of the TFW Stream Classification System: Stratification of Physical Habitat Area and Distribution